International Energy Agency

Russia 2014

Energy Policies Beyond IEA Countries

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INTERNATIONAL ENERGY AGENCY

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- Secure member countries' access to reliable and ample supplies of all forms of energy; in particular, through maintaining effective emergency response capabilities in case of oil supply disruptions.
- Promote sustainable energy policies that spur economic growth and environmental protection in a global context – particularly in terms of reducing greenhouse-gas emissions that contribute to climate change.
- Improve transparency of international markets through collection and analysis of energy data.
- Support global collaboration on energy technology to secure future energy supplies and mitigate their environmental impact, including through improved energy efficiency and development and deployment of low-carbon technologies.
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1. EXECUTIVE SUMMARY AND KEY RECOMMENDATIONS

EXECUTIVE SUMMARY

Since the last energy policy review of Russia conducted by the International Energy Agency (IEA) in 2002, there have been major developments especially in the sectors of hydrocarbon production, processing, exports and distribution. Investments in the upstream oil and gas sector have enabled Russia to maintain its position as one of the most important energy players globally, continuing its essential role in global energy supply. Crude oil and especially condensate production have reached historical highs against the backdrop of increasing global oil prices, higher investment and technology upgrades. New oil production centres were developed in East Siberia, and major crude oil exports to Asia, primarily to the People's Republic of China – where demand for Russian oil is increasing – have started. As refineries are being modernised and capacities expanded, production of oil products has increased and fuel quality has been improving to meet growing domestic demand. These changes have also supported Russia's economic growth during this period, its economic and energy sector modernisation and its own energy supply security.

Gas production and distribution have been diversified, with legacy production increasingly replaced with new production areas and fields. Companies other than Gazprom, in particular Novatek and increasingly also Rosneft, have expanded gas production, obtained access to the gas transmission system, taken significant shares in the wholesale gas market and consolidated their assets through acquisitions. Gazprom is playing a key role in Europe's gas supply and has expanded its gas exports to Europe over the past ten years and developed new gas export infrastructure. Russian companies are now preparing to supply more gas to the booming Asian markets, including in partnership with foreign companies following the partial liberalisation of liquefied natural gas (LNG) exports. The government has adopted an important package of oil and gas tax reforms aimed at unlocking the development of Russia's next generation of hard-to-recover and frontier hydrocarbon resources. The IEA welcomes the progress made in the liberalisation of the gas market, especially the most recent partial liberalisation of LNG exports.

However, in spite of record high liquids production (close to 11 million barrels per day) and oil price levels (about USD 110 per barrel for the Urals), Russia's oil and gas sectors are no longer sufficient to ensure steady and robust economic growth as the economy has slowed since the end of 2012 to growth levels of around 1.5%. In order to maintain oil production and export volumes at the current historically high levels, Russia will need to develop new resources, maximise the remaining potential at existing brownfields, make the transport sector more efficient, and develop gas use for transport.

The power sector has also undergone profound reforms, which have enabled it to successfully liberalise, to attract investments to progressively replace ageing infrastructure and meet growing demand. The IEA supports further efforts aimed at completing the liberalisation of the power market. Infrastructure in the electricity and heat sectors is ageing and needs rapid replacement and modernisation: This poses risks to the country's energy security (especially for heat and power supplies), as well as its competitiveness and well-being.

Tackling the challenge of reforming district heating systems is complex but an essential step to foster security of heat supply and attract investments in the modernisation of ageing generation and transmission infrastructure, as well as to support investments in electricity and heat co-generation.[1] Regulatory preparations are underway, but changes have been insufficient in past years in order to address the challenges.

Overall, energy markets in the area of gas, electricity and heat could be more efficient and deliver better quality, prices and service to end users.

The energy intensity of the Russian economy has improved since the 2000s but is still about two times higher than average IEA levels and has been slightly increasing in past years. Russia's energy-intensive goods are facing increasing global competition in domestic and export markets, especially since regulated wholesale gas prices have been raised to a level close to USD 100 per 1 000 cubic metres, as electricity prices have increased and as energy efficiency investments in the industrial sector, but also in the residential sector, have not occurred at the required pace. Russia has started to develop a policy and regulatory framework to unleash its substantial energy efficiency potential – a key potential driver of economic modernisation and sustainable growth, provided that large-scale deployment is achieved. The IEA particularly commends Russia for having started to consider ambitious and comprehensive demand-side management policies, especially with the introduction of energy efficiency legislation. Nonetheless, these much-needed policy and legislative measures have not delivered in a timely fashion and stated objectives are not on track to be met. A strong and effective energy efficiency policy would foster the competitiveness of the Russian economy, help diversify economic activity, increase energy exports and enhance energy supply security. The modernisation of the Russian economy and energy sector depends to a large extent on energy efficiency deployment as the potential is huge in the industrial, residential, transport sectors and especially in the district heating and power generation sectors. In most of these areas, it can be achieved at relatively low cost.

Finally, the carbon intensity of the Russian economy, measured as carbon dioxide (CO_2) emissions per real gross domestic product (GDP), is 60% higher than the average of IEA member countries. As the government has recognised, there is much scope to limit CO_2 emissions, yet a comprehensive and effective strategy combining climate and energy policy will need to be developed and implemented as Russia is likely to be negatively affected by climate change. Developing renewable energy sources in Russia can foster sustainable economic growth and energy security, especially in remote regions. Energy efficiency would also be a pillar of an effort to reduce and even stop the growth in greenhouse gas emissions.

While a number of policies and measures aimed at modernising the energy sector and increasing its efficiency and sustainability are being developed or implemented, further reforms are needed. Russia's energy policies remain at a turning point, on both the supply and demand sides, and with regard to their role in the economy. The current economic slowdown in Russia offers a reminder of the need to implement economic and

1. Co-generation refers to the combined production of heat and power.

energy policy reforms, and for energy policies to promote the competitiveness and modernisation of the Russian economy. Russia now has an opportunity to accelerate current efforts and turn the entire energy sector, in addition to the oil and gas pillars, into a driver of robust and sustained economic growth. Yet addressing all these challenges will require large investments in a range of USD 100 billion per year over the next 20 years, mainly from private domestic and foreign sources. Installing a political, regulatory, fiscal and legal environment that is conducive to investments will be essential if Russia is to rapidly modernise its energy sector.

REFORMS TO FOSTER INVESTMENTS INTO INFRASTRUCTURE AND ENERGY EFFICIENCY

Greater energy efficiency would be a winner for the Russian economy, as the current energy inefficiency throughout the energy sector and overall economy is an obstacle to sustainable and robust GDP growth. Moreover, ageing infrastructure, in particular in the areas of electricity and district heating, requires urgent investments. Four key steps could help foster investments to modernise assets and improve energy efficiency.

Regulated tariff levels, subsidies and cross-subsidies

Regulated prices remain in place mainly for the wholesale industrial gas market and for the heat, gas and electricity retail markets. In gas, the regulated wholesale gas price is close to market levels, or even perhaps above the market level in areas close to production locations, given that independent suppliers sell gas with a profit margin at slightly lower prices. Yet in distant areas, the regulated wholesale gas price may not allow all supply costs to be recouped, and Gazprom remains the sole supplier. In the retail market, gas supplies to the residential sector are not attractive to independent companies due to low tariff levels. In the heating sector, the tariff/price formation methodologies, tariff levels and duration of regulated tariffs are often blocking much-needed modernisation investments.

Progressively raising regulated tariffs for the residential sector to incentivise energy efficiency investments, adopting tariff conditions that foster modernisation investments in the heat supply chain, and fostering competition in the wholesale gas market across the entire gas grid, are needed steps. The government's recent decision to freeze regulated tariff increases may have limited a loss in competitiveness in the short term and inflation, but is sending the wrong signal for energy efficiency and is likely to slow down infrastructure investments as well as end-use energy efficiency investments. If competitiveness of Russian industry is the challenge, the government should focus on measures to cut the underlying production costs. Moreover, cross-subsidies remain in the heat, electricity and gas sectors. These need to be removed, and the government is preparing such steps in the area of heat and electricity co-generation. The removal of remaining subsidies and cross-subsidies are key to eliminating market distortions and to letting market mechanisms become drivers of economic and consumer behaviour changes.

De-linkage of social and energy policy and inclusion of strong quality of service requirements

The government should de-link social and energy policy and liberalise, in particular, retail electricity and gas tariffs, while protecting the most vulnerable consumers with separate social transfers. This step could be achieved progressively but would send the right signals to suppliers and end users. In addition to social transfers, end users could benefit from consumption-based billing and thus be able to lower their consumption and the impact of bills, especially if there are programmes to improve the energy efficiency of buildings. At the same time, quality of service requirements should be expanded and enforced to raise consumer confidence and incentivise investments by energy providers, in particular in the heat sector. There should also be penalties for non-payments.

As the Russian economy modernises, quality of supplies, freedom to choose suppliers at the retail level, and consumer involvement, will become increasingly important, especially in the areas of district heating and power distribution.

Metering in the district heating sector

There is a good record in the deployment of meters in the electricity sector, yet a major obstacle to investments into the heat supply chain remains the insufficient deployment of heat meters in the residential sector. While apartment-level meters would be too expensive and technically challenging to deploy in old buildings, the rapid and quick countrywide deployment of building-level automated metering and regulation substations is an essential condition to create the right framework conditions for investments in district heating infrastructure. This would also allow consumption-based billing and improve the quality of heat supply, while providing incentives to reduce losses along the heat supply chain.

Access to finance and fiscal incentives

Access to finance remains a major challenge. Federal budget funding for energy efficiency or district heating modernisation remains insufficient. Private banks have not yet developed services tailored to energy efficiency investments in the industrial sector or the residential sector. Finally, a state fund that would provide affordable credits to municipalities, regional governments and homeowners, as well as offer guarantees, is seen as a possible efficient tool that could fill market gaps in this key area.

In parallel, a predictable fiscal framework that is easy to understand and has strong incentives known and understood by all relevant stakeholders, is another important factor that could facilitate investments in energy efficiency and infrastructure modernisation, in particular in the residential and industrial sectors.

FOCUS ON EFFECTIVE REGULATION AND IMPLEMENTATION

Streamlining and co-ordinating policies, strengthening priorities, and focusing on implementation would help to quickly unleash Russia's enormous energy efficiency potential and reap much greater economic and social benefits.

Russia over past years has a good track record of passing appropriate framework legislation, such as on energy efficiency or the heat sector, yet a major challenge is to turn targets and objectives into reality. As in many countries, policy co-ordination among the numerous ministries involved, as well as implementation of policies, legislation and regulation, are often a challenge: Dozens of sub-laws and regulatory acts need to be prepared, voted on and co-ordinated; the information needs to be made available; and implementation needs to be monitored and controlled, which requires human and institutional capacities to do so. In the area of energy efficiency or district heating, there are co-ordination challenges at the federal level and between the federal and regional/local levels, as well as challenges pertaining to knowledge- and capacity-building at the regional and local levels. Key stakeholders need to be empowered, to know what their opportunities, challenges and options are and how best to develop and implement the most appropriate strategies.

There are also cases of unpredictable frameworks with frequent changes in objectives, and contradictory and missing regulation and sub-regulation. Last but not least, there is often an insufficient focus on implementation, monitoring and enforcement, in particular in the area of energy efficiency in the residential and public sector.

MORE EFFICIENT MARKETS

Accelerating the needed modernisation will also require continuing to foster the efficiency of energy markets by further encouraging competition and transparency. On the institutional side, the Federal Anti-monopoly Service needs to be further empowered, especially to monitor the situation in the retail oil market as well as in the electricity and gas sectors, particularly for issues related to access to infrastructure and consumer protection. Regional Energy Commissions need to have the required capacity and authority to fully fulfil their responsibilities and should be fully transparent and accountable, such as in setting heat tariffs. Compliance and competition oversight need to be further fostered, and overall, the government should consider the benefits of encouraging further privatisations and reducing the dominance of state-controlled companies. They tend to be less efficient than private actors per se and impede competition and efficiency in markets. At minimum, strengthening public audits, fostering accountability, and corporate governance of state companies, but also of private companies in the market, would be required to incentivise them to work fully efficiently.

An efficient gas market is essential for the efficiency of the power market, which is largely reliant on gas-fired power generation. The gas market would benefit from fully free, fair and efficient access to the gas transmission infrastructure and from fair competition between Gazprom and independents.

In the power sector, in order to successfully complete the liberalisation process, Russia will need to consolidate the electricity market reforms. This includes the completion of governance and the retail market reforms and the creation of a fully competitive wholesale energy and capacity market. More competition in the wholesale and retail markets is a key prerequisite to unlocking investments for the modernisation of assets, in particular of Russia’s large fleet of co-generation plants.

DEVELOPING THE MOST COST-EFFICIENT OIL AND GAS RESOURCES AND ADJUSTING EXPORT STRATEGIES

Russia’s oil production and exports are likely to decrease in the long term due to a combination of lower liquids production and higher consumption of domestic products.

Several steps could be taken to maintain liquids production at current high levels over the long term, thus avoiding a decline driven by the depletion of West Siberian brownfields. These steps include: developing tight oil; enhanced oil recovery (EOR); and new greenfields in East Siberia, the Far East and the Arctic, onshore and offshore. Among these options, EOR appears to be a step to which the government is giving the least required attention.

To attract the necessary level of investments in the upstream, the government needs further flexibility and adaptability in regard to the tax reform packages already adopted. A progressive move towards profit-based taxation merits serious consideration. Regulation framing the participation of foreign companies in joint ventures should be further streamlined to reduce risks and facilitate credit and risk taking, and access to production areas of small and medium-sized companies should be supported.

In order to keep oil and oil product exports at high levels, which is in the interest of the state budget and is important for the global oil supply balance, the government should further encourage the use of gas for the transportation sector, in particular for public transportation, rail transportation and trucks.

Finally, Russia has a golden opportunity to develop pipeline gas and LNG exports, in particular to the Asia Pacific markets where gas demand growth is the strongest, as Russia's resources are well located. Overall, success in developing gas exports to Asia will depend on developing the most cost-effective projects in a timely and reliable manner. The government, in co-ordination with companies should consider likely commercial and fiscal benefits, in terms of higher market shares, higher corporate revenues and budget revenues from taxation, from adjusting the gas pricing mechanisms in long-term contracts.

KEY RECOMMENDATIONS

The government of the Russian Federation should:

- ☐ *Consider a set of policy adjustments and reforms to foster investments in energy infrastructure and energy efficiency, including: the immediate removal of cross-subsidies and progressive removal of subsidies; the full deployment of meters in the heat sector; better access to finance and appropriate fiscal incentives; focus on quality of energy supply service; and a de-linkage of social policy from energy policy.*
- ☐ *Focus on effective regulation and implementation of legislation and regulation, through swifter institutional co-ordination and empowerment at the federal level and between the federal and regional/local levels, through monitoring and enforcement strategies.*
- ☐ *Promote more efficient energy markets, in particular the gas, oil and electricity markets, through greater competition and market-based pricing, strengthened corporate governance standards and transparency of markets.*
- ☐ *Ensure the development of Russia's most cost-efficient oil and gas resources, in particular through EOR, and take steps to maximise the oil and gas export potential, including the accelerated development of gas for the transportation sector and commercial export strategy adjustments.*

PART I
POLICY ANALYSIS

Figure 2.1 Map of Russia

Note: km = kilometre.

This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

2. GENERAL ENERGY POLICY

Key data (2012 provisional)

Total energy production: 1 331.8 Mtoe (natural gas 40.6%, oil 39.1%, coal 15.1%, nuclear 3.5%, hydro 1.1%, biofuels and waste 0.6%), +27.3% since 2002

TPES: 747.4 Mtoe (natural gas 51.8%, oil 21.8%, coal 17.3%, nuclear 6.2%, hydro 1.9%, biofuels and waste 1%, geothermal 0.1%), +20% since 2002

TPES per capita: 5.2 toe, +21.4% since 2002

TPES per real GDP: 0.34 toe/USD 1 000 GDP PPP, -23.6% since 2002

Electricity generation: 1 069.3 TWh (natural gas 49.1%, nuclear 16.6%, coal 15.7%, hydro 15.5%, oil 2.6%, biofuels and waste 0.3%, geothermal 0.1%), +20.2% since 2002

Electricity and heat generation per capita: 19.9 kWh, +9.3% since 2002

Electricity generation per capita: 7 300 kWh

COUNTRY OVERVIEW

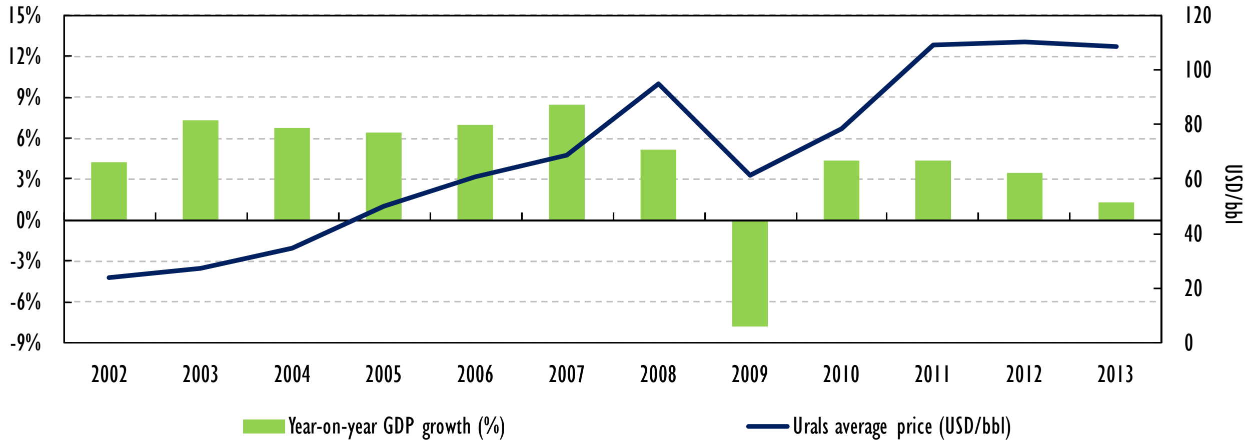
POLITICAL AND ECONOMIC OVERVIEW

The energy sector is a pillar of the economy

Russia experienced a decade in the 2000s of almost uninterrupted strong economic growth figures – the Russian economy grew 4.7% on average in the period 2001-12, including 6.6% in the period 2001-08. However, the economy slowed down to 1.3% annual growth in 2013 despite continued very high Ural oil price levels close to USD 110 per barrel (USD/bbl). This has underlined the existence of fundamental obstacles to growth requiring structural economic reforms, as the increase in oil prices and production is no longer driving economic growth as in previous years (see Figure 2.2).

This situation has pointed to the fact that projections made by the government after the global financial and economic crises of a 5% sustained gross domestic product (GDP) growth over the current decade are very unlikely to be fulfilled. In autumn 2013, the government acknowledged that average growth for the period 2014-30 would likely be around 2.8% per year. Forecasts for 2014 and 2015 from leading international economic and financial organisations (shown in Table 2.1) highlight that the economy is unlikely to get back to pre-crisis levels. Instead, future growth levels are likely to be close to the average of member countries of the Organisation of Economic Co-operation and Development (OECD) average, even though Russia is an emerging, resource-rich economy. Structural reasons for the economic slowdown and short-term and long-term macroeconomic challenges to bring Russia back on a sustainable and robust path of economic growth are extensively investigated by the OECD *Economic Survey: Russian Federation 2013*,[1] alongside a discussion of policy measures taken by the government to address this situation.

Figure 2.2 Russia's GDP growth and average Ural prices, 2002-13



Sources: Russian Central Bank, www.cbr.ru; Rosstat, www.gks.ru.

Table 2.1 GDP growth projections for Russia by leading international organisations and the Russian Central Bank in early 2014 for the period 2014-15

	2014	2015
OECD	0.5%	1.8%
International Monetary Fund	0.2%	1%
World Bank	1.1%	1.3%
Russian Central Bank	1.5% to 1.8%	1.7% to 2%

Sources: OECD, www.oecd.org/newsroom/global-economy-strengthening-but-significant-risks-remain.htm; IMF, www.imf.org/external/np/ms/2014/043014a.htm; World Bank, www.worldbank.org/en/news/press-release/2014/03/26/russian-economic-report-31; Russian Central Bank, www.cbr.ru.

The slowdown in economic growth levels has different explanatory factors such as insufficient labour and capital productivity, the challenging investment and business climate, population trends, an insufficient level of economic diversification, insufficient public sector efficiency, and large capital outflow.[2] But a number of key challenges come directly from the energy sector, which plays a key role in the economy.

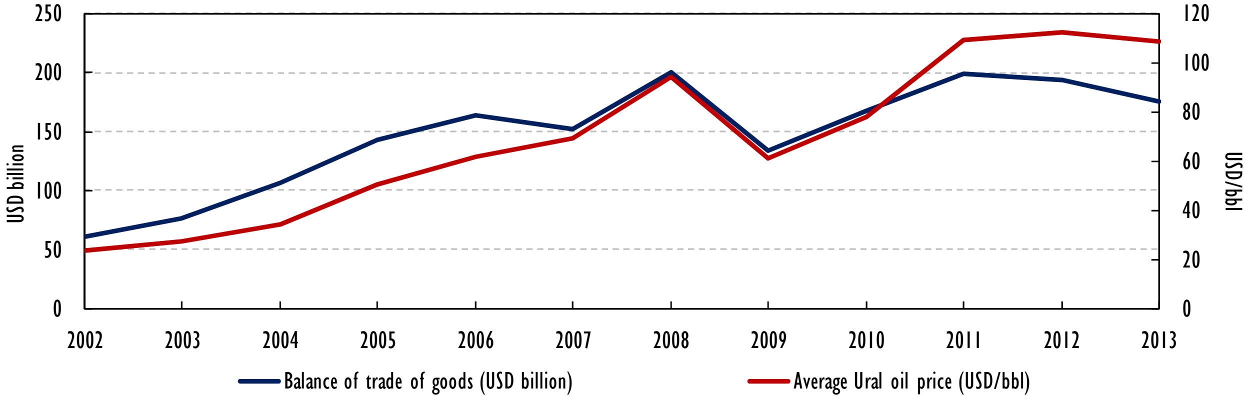
The share of energy export revenues in total exports was 70% in 2012 (61% from European Union [EU] member states alone – but the Asia Pacific is set to take a growing share). As shown in Figure 2.3, there is a strong correlation between the trend in average Urals oil prices and the Russian trade balance, which reflects the dominance of oil exports in Russia's total exports. Over the past three years, against the backdrop of higher imports, such as of consumer goods, the surplus in the trade balance has slightly decreased amid high oil prices. In 2012, 50.2% of total budget revenues originated mostly from the oil sector and to a lesser extent from the gas sector (through the

1. OECD (2014), *OECD Economic Surveys: Russian Federation 2013*, OECD Publishing, Paris.

2. IMF (2013), "Russian Federation 2013 Article IV Consultation", IMF Country Report No. 13/310, www.imf.org/external/pubs/ft/scr/2013/cr13310.pdf.

collection of the mineral extraction tax (MET), different excise taxes and the export tax). This number is especially high when the oil price is high and the Russian rouble weakens versus the United States (US) dollar, which has been the case since early 2014. Russia's oil and gas sector represented 20% of GDP in 2012.[3] Back in 2000, the oil sector contributed an estimated 8% of Russia's GDP and 35% of its foreign trade earnings in 2000, and supplied some 20% to 25% of federal budget revenues.[4]

Figure 2.3 Russia's trade balance and its correlation with the oil price, 2002-13



Sources: Rosstat, www.gks.ru; Russian Central Bank, www.cbr.ru.

In the long term, budget revenues from the oil sector may decrease from today's levels due to a combination of factors: Russia cannot rely on a continued upward trend in oil prices as seen in past years; Russia's oil production could decrease by 10% by 2030 from today's levels, and exports by about 20%; and replacing a large part of the legacy oil production with new resources that are more expensive to develop will require major tax breaks which are to a large extent in place. Gas sector revenues may increase as production and exports are likely to increase and because there is a potential to increase the MET further, alongside an opportunity to tax the growing liquids-rich gas production. Yet the share of gas in total energy sector revenues remains small compared with oil, and in gas, tax concessions have already been given, such as on liquefied natural gas (LNG) exports from Yamal. This picture might be only partially offset by higher oil prices or curtailing current tax breaks and holidays. Against this backdrop, it is essential that Russia pursue its economic modernisation effort in order to gain more tax revenues from economic activities other than oil and gas. This is needed to enable the government to give the required flexibility and incentives on upstream and export taxation to develop these resources.

The current economic situation will also have a major impact on the Russian energy markets in terms of energy consumption and production levels, and also points to specific economic and energy sector challenges that will need to be addressed. This highlights that enhancing sustainable economic growth is the most important medium-term policy challenge, and that energy policy reforms and economic modernisation efforts are closely interrelated, inasmuch as one cannot succeed without the other being successful.

3. Depending on the methodology used, this figure could be even higher.

4. IEA (2002), *Russia Energy Survey 2002*, OECD/IEA, Paris, www.iea.org/publications/freepublications/publication/russia_energy_survey.pdf.

Russia can turn today's obstacles to economic growth, which stem from inefficient energy consumption and energy market inefficiencies, into tomorrow's opportunities and solutions for sustainable economic growth. Key conditions include: fostering economic competitiveness and economic diversification in unleashing the country's energy efficiency potential, in particular the regions' potential for energy efficiency and energy modernisation investments; attracting private investments in energy infrastructure that will fuel energy security and economic growth; promoting the development of the most competitive oil and gas resources so that tax collection and production levels can be sustained; and fostering competition in markets. The impressive achievements – in particular in the oil, gas, coal and power sectors outlined below – would need to be sustained and complemented by similar strong and sustained commitment to energy demand-side management.

RUSSIA'S CURRENT ENERGY POLICIES

Institutions

According to the Constitution of the Russian Federation, the president is the highest political decision maker taking the key strategic energy policy decisions. His administration also supervises large contracts involving Russian state companies.

The Prime Minister is responsible for the development of energy and environmental policy and its implementation, and is supported in that role by deputy prime ministers in charge of the economy and energy sector who are responsible for supervising and co-ordinating the implementation of energy policies. The prime minister nominates key representatives of the government to the board and audit committees of state companies. He also nominates the heads of Russian state companies.

The Ministry of Energy of the Russian Federation[5] develops and implements policies in oil and gas, energy efficiency/district heating systems of large cities, coal, power generation and renewables, and also controls the Federal Grid Company's investment programmes. The Russian Energy Agency (REA)[6] under the Ministry of Energy was established in December 2009 to support the implementation of the programme to improve energy efficiency and reduce the intensity of the economy by 2020. It has many regional branches and provides information-sharing, capacity-building, policy co-ordination at local level and expertise.

Other ministries of the Russian Federation are involved in making energy policy:

- The Ministry of Finance[7] is responsible for upstream and hydrocarbon export taxation, as well as corporate taxation.
- The Ministry of Economic Development[8] plays a leading policy role in the area of energy efficiency, and socio-economic and energy forecasting. It also co-ordinates work on the energy technology /innovation/technology platforms.
- The Ministry of Industry and Trade[9] is responsible for energy efficiency in industry.

5. www.minenergo.gov.ru.

6. http://rosenergo.gov.ru/.

7. www.minfin.ru/en/.

8. www.economy.gov.ru.

9. www.minpromtorg.gov.ru/eng.

- The Ministry of Construction, Housing and Utilities, which has taken over key functions from the Ministry of Regional Development, is responsible for issues regarding construction, architecture and municipal services, including in the sphere of district heating.[10]
- The Ministry of Transport[11] handles energy efficiency in the transport sector and fuel quality.
- The Ministry of Natural Resources and Environment[12] deals with: regulation of the use of natural resources, including subsoil; licensing and compliance procedures and oversight via the Federal Subsoil Resources Management Agency (Rosnedra); upstream regulation; environmental regulation and monitoring of the environment and resources via the Federal Service for Supervision of Natural Resources, the Federal Agency for Water Resources, the Federal Service for Hydrometeorology and Environmental Monitoring and the Federal Agency for Forestry; and climate change.
- The Ministry of Education, Sciences and Technologies[13] is responsible for policies in the sphere of education and technical and scientific areas, including innovation policies for the energy sector.

Another energy policy-making institution is the Presidential Commission for Strategic Development of the Fuel and Energy Sector and Environment Safety. It consists of representatives from major oil, gas and electricity companies, as well as key ministers, the heads of ministerial institutions and of the national energy market's regulatory authorities. As such, it has a co-ordination and policy impulse function and mainly focuses on energy supply issues of strategic importance.

In addition, there is the Government Commission on the Fuel and Energy Complex, the Reserve Replacement and Improving the Economy's Energy Efficiency, chaired by the deputy prime minister in charge of the energy sector. It has a role of operational management and co-ordination of federal executive bodies in different fields such as agriculture, transport, energy and environmental protection. It deals mainly with operational issues.

The state Duma votes on legislation in the field of energy and has several relevant committees:[14] the Committee on Environmental Protection; the Committee on Energy; the Committee on Natural Resources; and the Committee on Housing and Municipal Economy.

A number of regulatory bodies also play an important role. Among them:

- The Federal Tariff Service (FTS)[15] of the Russian Federation sets transportation tariffs, and transmission and distribution tariffs for electricity. At the regional level, the FTS sets limits for the electricity tariffs; it sets the transportation tariff for gas; it sets the wholesale tariff for natural gas to the industrial and power sector. Tariffs of residential and municipal customers for electricity are established on a local basis by Regional Energy Commissions, based on the framework determined by the FTS.

10. www.minregion.ru/eng/.

11. www.mintrans.ru/.

12. www.mnr.gov.ru/english/.

13. http://минобрнауки.рф/static/ministry_eng.html.

14. www.duma.gov.ru/structure/committees/.

15. www.fstrf.ru/eng.

- The Federal Anti-monopoly Service (FAS) of the Russian Federation[16] is responsible for competition monitoring and control.
- The Federal Service for Environmental, Technological and Nuclear Oversight, Rostekhnadzor,[17] is responsible for regulation and safety oversight in the nuclear, mining, industry and hydro sectors.
- The Federal Service for State Statistics (Rosstat) is responsible for data collection and preparing a yearly energy balance.[18]

At the regional level,[19] regional governments play an important role – such as developing regional energy programmes and energy efficiency policies. Regional Energy Commissions, typically composed of a staff of five to ten people, set tariffs for heat and gas within the framework of the FTS. Finally, municipalities are in charge of developing municipal heat schemes in cities with fewer than 500 000 inhabitants and often manage the local district heating systems.

Last but not least, the Russian Academy of Sciences, the Analytical Center under the government, the central fuel dispatching centre (CDU TEK), and the REA are public institutions that provide analytical work on Russian and global energy market developments.

Key current energy policy objectives

In the 2009 Energy Strategy to 2030[20] and in subsequent medium-term policy programmes, the government has outlined a number of fundamental policy objectives for the energy sector. The most recent comprehensive medium-term energy policy document is the Decree No. 512 on a Governmental programme of the Russian Federation "On Energy Efficiency and the Development of Energy", developed by the Ministry of Energy and approved on 3 April 2013. An update of this programme was being prepared in 2014.[21]

These aim at strengthening Russia's energy supply security, at expanding its role as global energy supplier, and at ensuring affordable, competitive and increasingly sustainable energy supply and consumption in Russia. Overall, key sector-specific objectives include:

- the increase of gas production by about 30% by 2030 and of gas exports – mainly to take a 15% share of global LNG markets by 2030, with LNG export projects oriented towards the Asia Pacific market
- the slight increase in oil production from current levels with the development of frontier and hard-to-recover resources, and the increase in crude exports to the Asia Pacific markets and overall, the increase in oil products versus crude oil
- the development of the use of gas for the transportation sector

16. http://en.fas.gov.ru/.

17. www.gosnadzor.ru/.

18. www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/en/main/.

19. The Russian 1993 constitution establishes the federal nature of the Russian state, consisting of 21 Republics, 9 territories, 47 regions, 4 autonomous districts and 2 cities of federal importance, Moscow and St. Petersburg.

20. Government of the Russian Federation (2009), *Energy Strategy of Russia for the period up to 2030*, approved by Decree No. 1715-r of the government of the Russian Federation dated 13 November 2009, www.energystrategy.ru/projects/docs/ES-2030_(Eng).pdf.

21. http://minenergo.gov.ru/upload/iblock/afc/afc90b96ec0fef29f2ededabb6a4a131.pdf; http://government.ru/en/news/1174.

- the reduction of the energy intensity of the economy by 40% by 2020 from the 2007 level
- the development of renewables up to 4.5% of the power generation mix by 2020 – mainly of solar, wind and small hydro
- the increase in the number of nuclear power units and plants and lifetime expansion
- the development of coal production and exports
- ensuring the security, reliability and affordability of electricity supplies and attracting investments in power generation and district heating systems
- a reduction in greenhouse gas (GHG) emissions by 393 million tonnes (Mt) by 2020
- a greater innovation effort with spending on research and development to amount to 3% of the revenue of companies implementing innovative development programmes by 2020.

Overview of recent energy policy developments

The section below provides an overview of policy reforms and measures, by sector, introduced by the government and highlights that important policy and legislative effort and prioritising is already under way. The different chapters of this review then provide a more detailed policy analysis of these measures and an assessment of their implementation and impact.

- Exposure of public finance to oil price volatility: A new budget rule was introduced in July 2012 to limit public finance's exposure to oil price volatility. The 2013 budget is part of a three-year plan and was calculated on the basis of the average oil price over the previous five years. For the preparation of budgets for the next years, this period will gradually be extended so as to include the average oil price over the past ten years by 2018. If the market oil price exceeds the reference oil price in the budget, the additional revenue is channelled into the Reserve Fund. As soon as the Reserve Fund reaches 7% of GDP (it stood at about 4% of GDP in mid-2013), additional revenues can be channelled into the National Welfare Fund (aimed at co-financing the pension savings of Russians) to support budget expenditures or the pension fund. These additional revenues may also be used in part to finance infrastructure projects. If oil prices drop below the reference oil price, the government can draw on the Reserve Fund to cover the fiscal deficit. As a consequence, the cautious 2013 budget was based on an oil price of USD 91/bbl as the budget break-even price and assumed an average barrel price of USD 97/bbl.
- Energy strategy: The government in 2013 issued a tender for the preparation of a new Energy Strategy for the period until 2035 which is to replace the current Energy Strategy to 2030 adopted in November 2009. A number of research centres are involved in its preparation, and the draft is currently in the status of discussion among stakeholders. The government plans to assess the draft in October 2014. A 25-page concept note on the new Energy Strategy to 2035 was published on the website of the Ministry of Energy on 23 January 2013 and a second version on 27 February 2014.[22] Indeed, the current strategy dating back to 2009 did not take fully into account the key changes that have occurred in the Russian and global energy markets since then.

22. http://minenergo.gov.ru/documents/razrabotka/17481.html.

- Oil and gas: Key recent policies include the determination of an increasing number of resources as being of federal strategic importance as well as the definition of strategic companies where foreign participation is limited;[23] the development of oil and gas exports from Russia's Far East; an unprecedented tax reform package aimed at reducing the tax burden for frontier and "hard-to-recover" resources; a legal framework for a partial liberalisation of LNG exports; higher fuel standards and support for the modernisation of refineries; measures aimed at almost totally cutting gas flaring by 2016; important progress in third-party access to the gas transmission infrastructure; exploration efforts involving foreign companies for Arctic and tight oil resources; and last but not least, a drive to promote natural gas in the transportation sector.
- Energy efficiency: The June 2008 Presidential Decree No. 889 "On Measures to Raise Energy Efficiency and Foster Environmental Stability in Russia's Economy", and its related legislation passed in 2009 (Law 261 and related amendments) implies a very ambitious target to reduce energy intensity of GDP by 40% by 2020 versus 2007. Specific policy measures were enacted for the period 2013-20 to advance this objective.[24] Moreover, on 17 October 2013, the government passed an updated decree on approving the procedure to develop, implement and evaluate the effectiveness of the state programme of Russia, which sets a framework for assessing the efficiency of governmental programmes and which was expected to lead to adjustments in the energy efficiency policy measures in place.[25]
- District heating: The government has established a new legal framework following the adoption of the heat law in 2010 and is currently streamlining tariff methodologies and regulatory efforts to attract private investments in modernising this ageing and inefficient infrastructure.
- Electricity: After a decade of efforts made to reform and liberalise the Russian electricity sector with unbundling of electricity networks and generation, the privatisation of generation assets and the creation of the wholesale energy and capacity market, the reform process reached a crucial point in 2013. Discussions are ongoing over the future direction of the electricity market reforms, and the government is currently focusing on reforms of the heat sector in order to stimulate modernisation of co-generation[26] plants. Other policy efforts focus on phasing out cross-subsidisation, and improving the efficiency of electricity grid investment as well as the payment discipline of consumers.
- Renewables: The government has developed a support scheme for power generation from solar, wind and small hydro for the wholesale market, has been developing mechanisms to support the deployment of renewables in the retail market, and also aims at fostering the deployment of renewable off-grid solutions for power generation in remote areas.
- Coal: The government is supporting infrastructure investments in removing some transport bottlenecks and promoting a move towards safer, cleaner and more efficient coal generation and consumption and aims at achieving higher exports.

23. According to amendments to the Russian federal law On the Sub-soil, these contain recoverable oil reserves of no less than 70 Mt and contain gas reserves of no less than 50 billion cubic metres (bcm); the federal law On Strategic Investment requires a foreign investor to obtain the prior approval of a governmental commission chaired by the prime minister for any ownership-taking in a strategic company as defined in the law.

24. http://minenergo.gov.ru/upload/iblock/afc/afc90b96ec0fef29f2ededabb6a4a131.pdf (accessed on 14 December 2014); http://government.ru/en/news/1174.

25. www.economy.gov.ru/wps/wcm/connect/economylib4/mer/activity/sections/GovPrograms/doc20131028_4.

26. Co-generation refers to the combined production of heat and power.

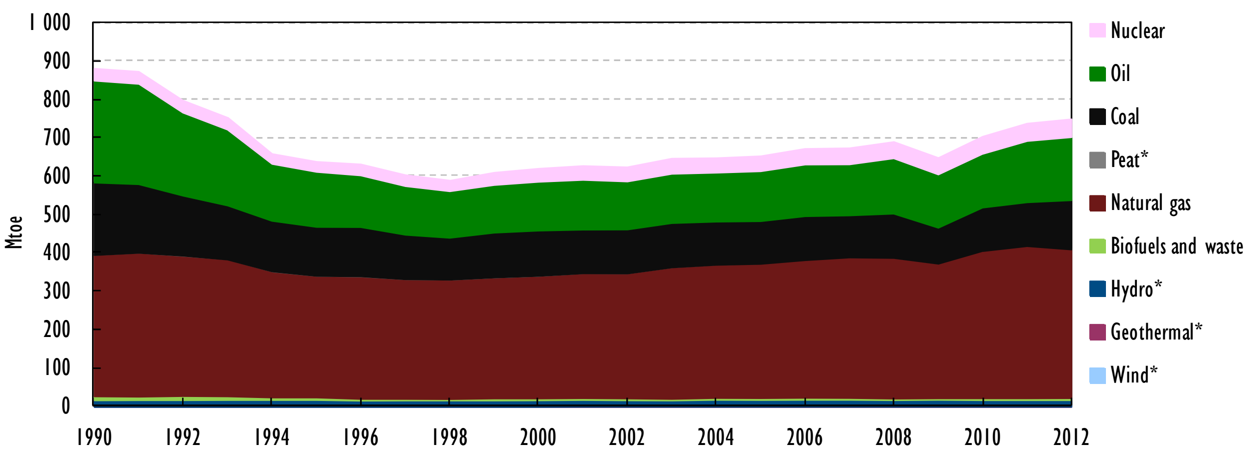
- Nuclear: The government is supporting the role of nuclear in the Russian energy mix, and has ordered safety inspections and upgrades following the Fukushima accident.
- Climate change mitigation: The government has set targets to reduce carbon dioxide (CO_2) emissions, and there are signs of a growing awareness of climate change risks. On 30 September 2013, the Russian president issued a decree requesting the government to develop measures that would facilitate GHG emission reductions to the level of no more than 75% of the 1990 emissions by 2020. The government in April 2014 issued a corresponding decree, which also envisages yearly reports on progress made to meet this target.
- Energy technology research and deployment: The government has developed a policy and institutional framework to spur innovation including in the energy sector and a number of research clusters and innovation platforms, also focusing on the energy sector.

ENERGY SECTOR ACHIEVEMENTS AND DEVELOPMENTS

ENERGY CONSUMPTION TRENDS

Total primary energy supply (TPES)[27] in Russia was 747.4 million tonnes of oil equivalent (Mtoe) in 2012 (Figure 2.4). Natural gas, oil and coal account for more than 91% of TPES (natural gas 51.8%, oil 21.8% and coal 17.3%), with nuclear at 6.2%, hydro at 1.9%, biofuels and waste at 1%, and geothermal at 0.1%. The structure of Russia's energy supply varies across the country: Gas is mostly used in the European part of Russia, and coal and hydro in the eastern part of Russia, for example.

Figure 2.4 Russia's TPES, 1990-2012



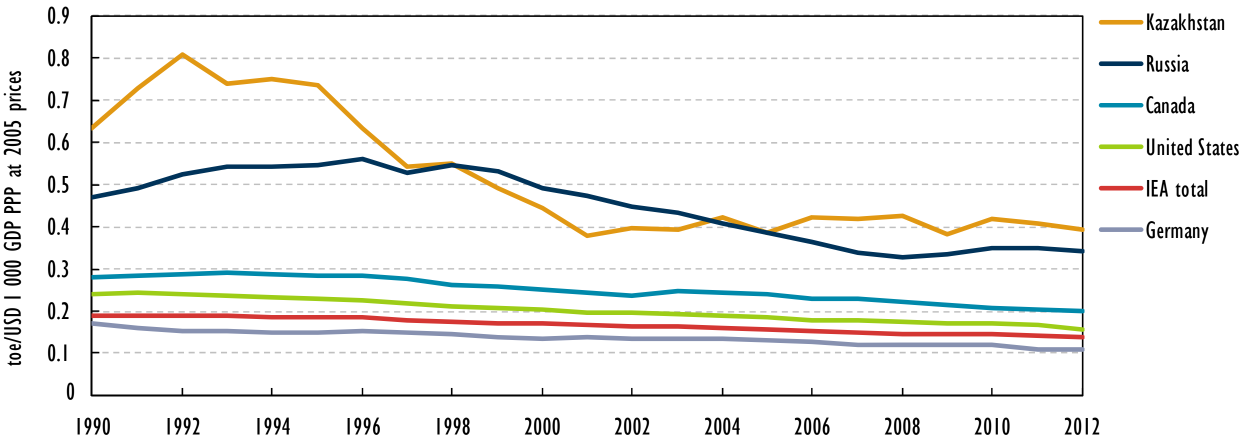
Note: Data for 2012 are provisional.

* Negligible.

Source: IEA (2013), *Energy Statistics of Non-OECD Countries*, OECD/IEA, Paris.

27. TPES is made of indigenous production + imports - exports - international marine bunkers - international aviation bunkers ± stock changes.

Figure 2.5 TPES/GDP (energy intensity) in Russia, Kazakhstan and selected IEA member countries in comparison, 1990-2012



Notes: toe/USD 1 000 GDP PPP = tonnes of oil-equivalent per one thousand US dollars of gross domestic product at purchasing price parity; IEA = International Energy Agency. Data for 2012 are provisional.

Sources: IEA (2013), *Energy Statistics of Non-OECD Countries*, OECD/IEA, Paris; IEA (2013), *Energy Statistics of OECD Countries*, OECD/IEA, Paris.

Russia's energy intensity has declined by 23.6% since 2002 (Figure 2.5). Indeed, between 2000 and 2009, GDP grew by more than 50% while energy demand increased at a much slower pace (Figure 2.4). This partly resulted from the fact that economic output shifted towards less energy-intensive sectors following structural changes in the economy and that GDP growth levels have been much higher than the increase in TPES levels. Yet this trend has been reversed since 2008 with energy intensity increasing again.

FOSSIL FUEL PRODUCTION AND EXPORTS: A NEW ERA FOR RUSSIA

The IEA last conducted an energy policy review of Russia in 2002[28] and since then, Russia's energy sectors and policies have entered into a new era. In many respects, changes that occurred in Russia's energy markets and policies since then are impressive in their scale, in their acknowledgment of the need for greater sustainability and in terms of Russia's growing contribution to global energy security.

Since the 2002 review, Russia has strengthened its position as the world's largest resource-holding country. Reserves have been expanding over the 2000s as exploration activity has increased and been successful: Russia has the world's largest gas reserves and the world's third-largest coal reserves, and its oil reserves are among the top ten in global rankings. The government in 2013 decided to lift the secrecy over Russia's oil and gas reserves and change the Soviet-era reserve classification system and bring it close to international standards (see Box 5.1 in the Natural Gas Chapter for an overview of the gas reserve classification system). When implemented, this could lead to some downward revision that is likely to be compensated in the coming years through results from increased exploration activity. The Ministry of Energy forecasts that RUB 1 175 billion (EUR 27 billion)[29] is to be invested in the period 2013-20 in exploration activities, which

28. IEA (2002), *Russia Energy Survey 2002*, OECD/IEA, Paris, www.iea.org/publications/freepublications/publication/russia_energy_survey.pdf (accessed 12 February 2014).

29. The average currency conversion rate retained for this review, in Russian rouble (RUB) to US dollar (USD) and to euro (EUR), is 1 USD/RUB = 33; 1 EUR/RUB = 43.

would mark a significant increase compared with previous years. The Ministry of Natural Resources is indeed putting pressure on companies to fulfil the exploration activity commitment contained in their licences. Overall, yearly hydrocarbon reserves additions have been exceeding production over the past years and RUB 170 billion (EUR 3.9 billion) was invested in 2013.[30]

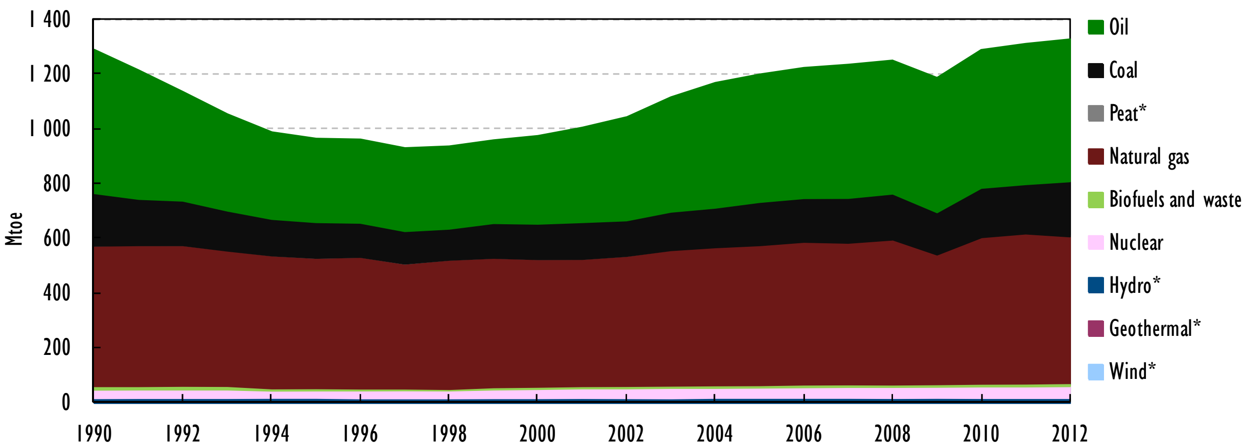
According to the current Russian classification of hydrocarbon reserves, total "ABC1" natural gas reserves (proven and probable, see Box 5.1) as of January 2013 were 49 trillion cubic metres (tcm), an increase of 2.2 tcm since January 2001. The *Oil and Gas Journal* has a similar account with 47.79 tcm as of 1 January 2013, about a quarter of the world's total proven reserves and the first among gas resource-holding countries.

Russia's oil reserves as of January 2013 stood at 18 billion tonnes (Bt) in the proven and probable (ABC1) categories (about +25% versus 2000), and 10.9 Bt under the inferred (C2) category. According to the most recent assessment from the World Energy Council, as of the end of 2011, Russia had 8.184 Bt of oil reserves or 60 billion barrels (bbl) – a comparably lower figure yet with a similar ranking, number seventh largest in the world.[31] This would mark a 15% increase over 2000 estimates. The *Oil and Gas Journal* puts reserves at 80 billion bbl.

As for coal, by January 2013, Russia had 194.7 Bt of discovered reserves (Russian classification ABC1) and 160 Bt according to the German Federal Institute for Geosciences and Natural Resources, almost unchanged since 2000.

Russia's total energy production level has been increasing since 2002 to surpass the 1990 level so that Russia is one of the world's largest energy producers, with the total production of 1 314.9 Mtoe in 2011. In addition, Russia is the world's largest exporter of energy with 572 Mtoe energy exports in 2011. The increase in fossil fuel production since the early 2000s has considerably strengthened Russia's predominant role as a global energy supplier.

Figure 2.6 Energy production by source, 1990-2012



Note: Data for 2012 are provisional.

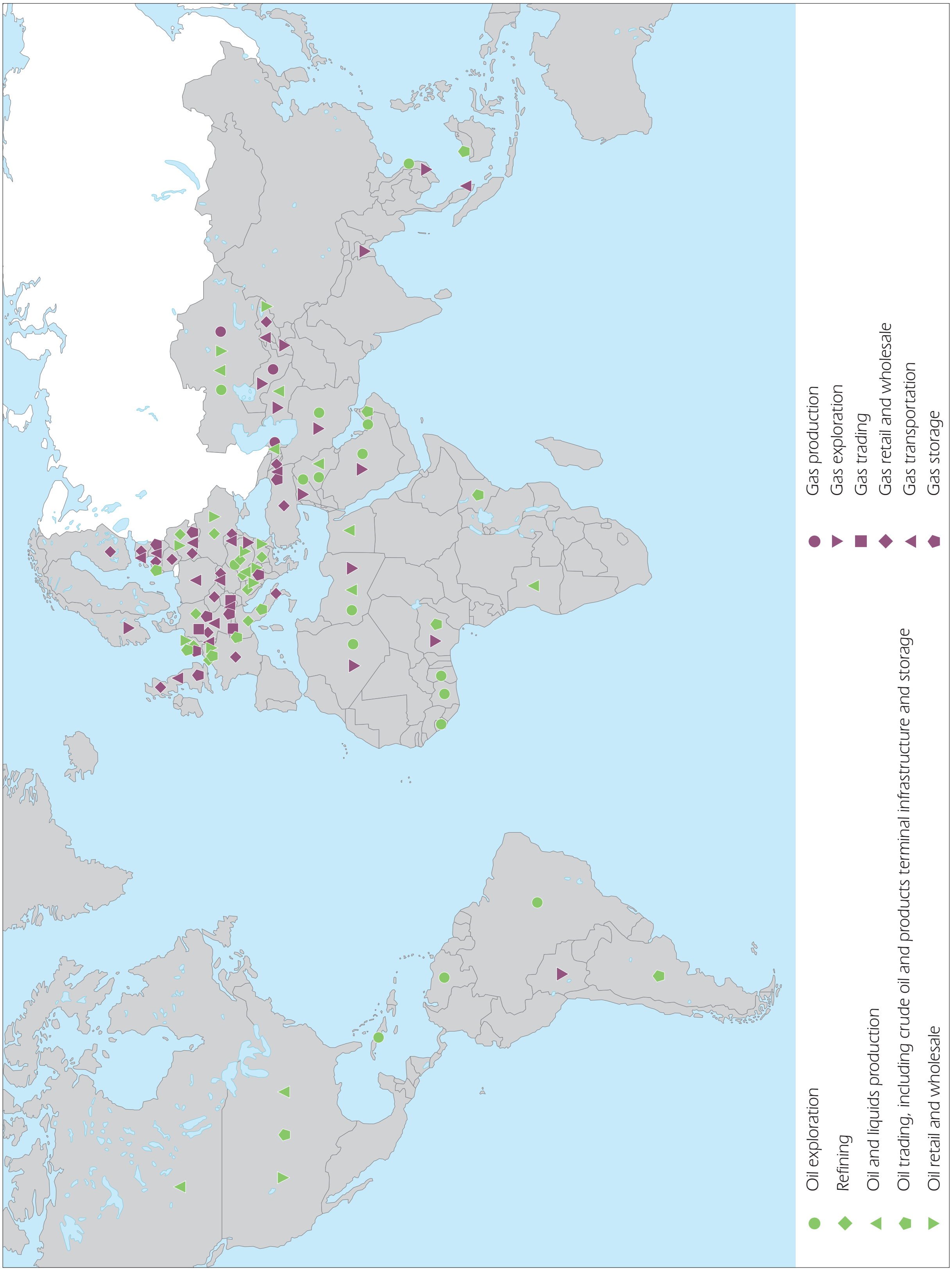
* Negligible.

Source: IEA (2013), *Energy Statistics of Non-OECD Countries*, OECD/IEA, Paris.

30. Interfax (2014), "Interview: No time to relax where the shelf is concerned, says Russian resources minister", interview with Sergei Donskoi, Minister of Natural Resources, Russia & CIS Energy Newswire, 12 February 2014, p. 1, Moscow.

31. www.worldenergy.org/wp-content/uploads/2013/09/WER_2013_2_Oil.pdf.

Figure 2.7 Main oil and gas activities in foreign countries of Russia's companies (as of end 2013)



This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

Sources: Annual Reports from Gazprom, Rosneft, Lukoil, and Surgutneftegaz.

Russia ranked second in the world behind the United States in terms of annual gas production in 2012 (+12.8% since 2002). A key development has been the commissioning of Bovanenkovo on the Yamal peninsula; Russia's 2012 gas production represented about 19% of the world's total production that year.

Russia was the world's second-largest total liquids producer in 2012, behind Saudi Arabia and ahead of the United States. Liquids production has been on the rise since the mid-1990s, with output increasing by 67% since 2000 and passing 11 million barrels per day (mb/d) in December 2013, averaging 10.87 mb/d that year. Russia's total liquids production thus represents about 12% of the world's production in 2013. This figure could be even higher, considering the fact that the global figure includes refinery gain, and some of that refinery gain occurred in Russia. Remarkably, Russia's total liquids output is more than 50% higher than projections from the main provisions of the Energy Strategy to 2020 dating back to November 2000, which highlights the extent to which the increase in Russia's oil production was not expected at the turn of the century.

Russia is among the top ten hard coal producers in the world, ranking sixth-highest behind the People's Republic of China, the United States, India, Indonesia and Australia in 2012. Production of hard coal reached 276.5 Mt in 2012, as well as 77.8 Mt of lignite. The production of hard coal has increased by 69.1% since 2000.

These production levels have been achieved against the backdrop of increasing global oil prices, growing investments, and increasing regulated domestic prices for gas, heat and electricity. Higher production, exports, and oil and gas prices have also enabled the government to increase the taxation levels of the oil and gas sectors. This has fuelled GDP growth over the 2000s alongside federal budget spending increases.

This increase in oil and gas exports, which has made a decisive contribution to the security of the global energy supply, has followed major infrastructure investments in oil and gas pipelines as well as ports, both in the European and Asian markets. Russia has also become a LNG exporting country as the Sakhalin-2 plant was commissioned in 2009, and a number of projects are being developed that will increase its share in LNG trade in the medium and, especially, longer term. Whereas Gazprom is the monopoly pipeline exporter for gas, non-Gazprom companies will take a growing share in Russia's future LNG exports following legislative changes adopted in 2013 that have given Rosneft and Novatek the right to export LNG from their current projects.

Russian companies, in particular state-controlled companies, dominate the upstream oil and gas production segment as foreign companies so far have had a marginal role, with the exception of the TNK-BP joint venture. A few production sharing agreements were signed in the 1990s and are producing, but this framework has not been used since then. Some foreign oil companies have entered oil or gas exploration or production agreements in recent years via joint ventures for offshore oil and gas as well as tight oil resource development, but these are not yet producing. In particular, they help provide technologies and expertise to unlock frontier or hard-to-recover resources and finance exploration activities. Some foreign companies, though, have become important shareholders in Russian companies: Total in Novatek (19.4% share) and BP in Rosneft (19.75%). A recent trend points to a growing concentration and state control over Russia's oil production with Rosneft becoming a giant state-controlled company and only Lukoil and Surgutneftegas left as major private producers. Back in 2002, about 80% of Russia's liquids production came from private companies, whereas by the end of 2013, the number was down to just over 50%. Russia's gas production is increasingly less dominated by state-controlled

Gazprom as Novatek has largely increased production in recent years, and as Rosneft is likely to follow a similar trend. Nonetheless, the bulk of gas production will still come from state-controlled companies in the future. Finally, there has been a spectacular technological upgrade in Russia's oil production over the past ten years, which, accompanied by increasing prices, has contributed to the increase in output.

At the same time, Russia's leading oil and gas companies have also expanded their activities in the upstream, midstream and downstream oil and gas segments abroad (Figure 2.7). Lukoil has been the most active company, producing 5.6 Mt of oil abroad in 2012 and setting up a Dubai-based dedicated headquarters, followed by GazpromNeft, which produced 1.7 Mt. Total foreign oil production by Russian companies was about 7.5 Mt by the end of 2012, mainly in the Former Soviet Union (FSU) area. Gas production abroad now represents about 8 bcm, mainly by Lukoil in Uzbekistan, and is likely to increase to about 25 bcm to 30 bcm by 2020. Russian oil companies Lukoil and GazpromNeft have very promising oil exploration and production projects, especially in Iraq.

Venezuela could become a key future production country for Rosneft and GazpromNeft. Vietnam also holds potential for future offshore oil and gas production by Russian companies. Against this backdrop, Russian companies' foreign oil production could increase to 25 million tonnes per year (Mt/yr) to 40 Mt/yr per year by 2020. Lukoil and Rosneft also have refinery and retail assets in Europe, and Rosneft is preparing to enter the refinery segment in Asia. GazpromNeft has recently been developing its activities in southeastern Europe in the refinery and retail segments. Gazprom has a very strong presence in Europe and FSU countries, its key export markets, especially after the full takeover of Wingas, and is further expanding its storage and gas transportation capacities. Russian companies are now increasingly active in exploration activity in Latin America, Africa and Asia, but also to a lesser extent in North America, where Rosneft benefits from project stakes following agreements with ExxonMobil, as well as in Norway's offshore. Only in a few cases are Russian companies operators of projects.

NOTABLE ACHIEVEMENTS IN POWER SECTOR REFORMS, IMPORTANT STEPS IN GAS MARKET REFORMS

Over the past years, Russia has conducted a successful restructuring and liberalisation of the electricity sector. The pace and results of the reforms are impressive and include the multi-billion-dollar privatisation of the electricity generation assets of Inter RAO (over USD 30 billion according to various estimates); the liberalisation of the wholesale market, including the creation of a day-ahead spot market and capacity market; the unbundling of generation/supply and network activities; the introduction of regulatory asset base (RAB) regulation; and investments in new modern combined-cycle gas turbines (CCGTs). The sector has also attracted major foreign investments, such as by Enel, E.ON and Fortum.

The challenge is to continue on this path with clear sequences and long-term planning, and to further promote competition in markets. Indeed, fostering Russia's economic competitiveness and productivity requires efficient gas and power markets, which are closely interrelated.

The gas market has also undergone significant changes over the past years as Novatek and Rosneft have largely increased their domestic gas supplies to the industrial sector, following important improvements in access to the pipeline infrastructure, the right to sell gas at non-regulated prices and higher production. However, competition remains limited in many regions where Gazprom remains the dominant, if not sole, supplier.

ENERGY POLICY CHALLENGES AND OPPORTUNITIES

THE ENERGY INEFFICIENCY OF THE ECONOMY REMAINS A KEY CHALLENGE

The improvement in Russia's energy intensity over the 2000s appears to be masking the fact that there has not been large progress in increasing the energy efficiency of the economy, in particular the residential and industrial sectors. Indeed, to a large extent, the improving energy intensity also reflects the fact that Russia has benefited from increasing oil and gas export revenues during this period, which have fuelled GDP growth. Thus, Russia has been able to make more revenues out of the same energy consumption and related economic output rather than more economic output and revenues based on similar or even possibly reduced energy usage.

Box 2.1 Reductions in energy intensity do not necessarily reflect reduction in energy use in absolute terms

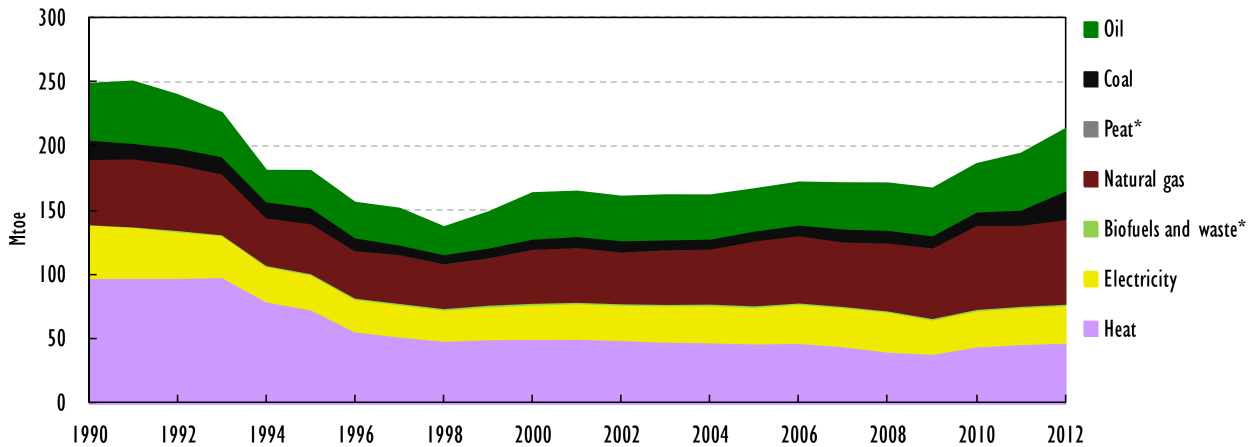
While changes in energy intensity are frequently used to reflect progress in terms of energy efficiency, it can be a misleading indicator. As energy intensity is based on the ratio of energy use per monetary unit of GDP, use of it tends to overstate the extent to which energy efficiency improvements have occurred in the economy. In cases when the economy is growing faster than energy consumption – when the GDP denominator is growing faster than the energy numerator – energy intensity falls. But in a recession, GDP tends to fall faster than energy consumption, and so the energy intensity ratio rises. This would be true even if there were no change in energy efficiency.

As a consequence, the energy intensity indicator does not help to map and track progress in the energy efficiency of Russia's industries, for example. It cannot verify improvements in energy efficiency. Targets in terms of absolute reduction of energy demand would better enable Russia to plan how energy efficiency measures will contribute to freeing up energy resources for export and support the role of energy efficiency in reducing the need for new energy generation capacity.

The amount of energy required to produce a unit of GDP (in purchasing power parity terms) is, in Russia, still about two times higher than the IEA average, which highlights that despite structural changes, historically embedded inefficiencies have yet to be overcome. A comparison of Russia's energy intensity with Canada, an IEA member country that shares a similar climate, is also an oil and gas producer and exporter, and is also industrialised, shows that it is nearly two times higher (Figure 2.5). Russia's energy intensity is also more than two times higher than that of Germany. This comparison in absolute terms is of course tricky, as economic situations and GDP structures are very different; however, a more striking indicator is to compare these trends and their development. Indeed, Canada has seen strong economic growth over past years, but flat, and even slightly decreasing, energy intensity. This is even more marked in the case of Germany. Conversely, Russia has seen an increase in energy intensity in recent years. Indeed, Russia's energy-intensive industries are comparably inefficient as they have relied for too long on low energy prices and comfortable market conditions, and as a result lack modernisation. Energy consumption in the power and heat generation, buildings, and transport sectors is also inefficient.

Indeed, Figure 2.5 shows the rate of increases in TPES since 2010 is above pre-crisis levels though economic growth has been slower than pre-crisis levels. This trend is also highlighted in Figure 2.8 showing the total final consumption (TFC) in the industrial sector by source. The trend since the end of 2009 shows an increase that is explained by the fact that industrial output has been increasing since the crisis, yet also indicates that if energy efficiency in the industrial sector had improved, this trend would have been much lower, if not flat. Against this backdrop, changes in energy intensity of the Russian economy tend to reflect structural changes outside economic factors and do not highlight the inertia of older energy-using buildings and industry processes. Energy intensity is not the most suitable indicator to measure improvements and challenges.

Figure 2.8 TFC in the industrial sector, 1990-2012



Notes: includes non-energy use. Data for 2012 are provisional.

* Negligible.

Source: IEA (2013), *Energy Statistics of Non-OECD Countries*, OECD/IEA, Paris.

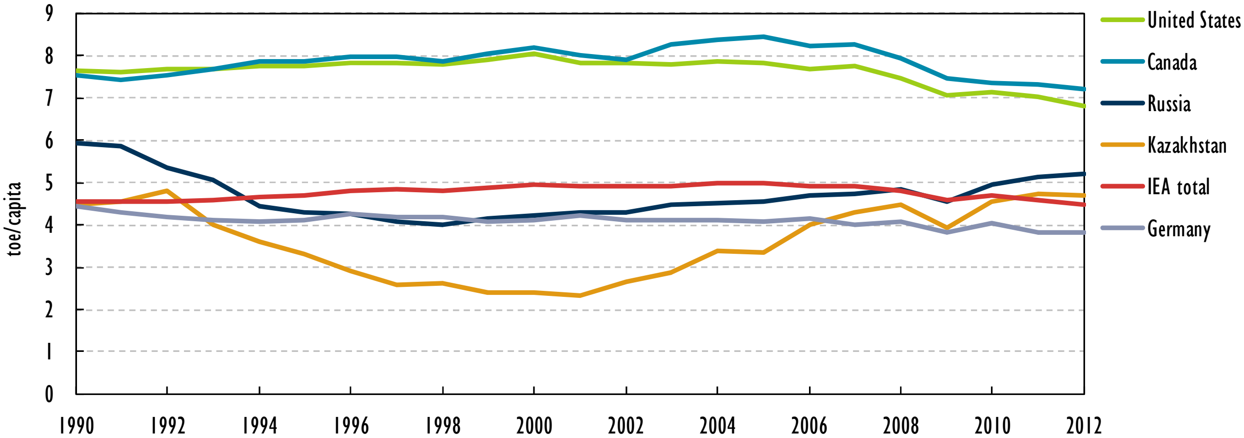
It is important to note that Russia has a very particular geography with specific climate conditions. Russia is the largest country in the world with often very harsh winters, which has a major impact on energy use. The country's population and infrastructure are denser in the European part of the country than in the East Siberian part.[32] Its economy is also heavily industrialised. In these circumstances, centralised district heating and secure and affordable power, gas and diesel supplies play a vital economic and social role. This leads not only to energy-intensive space and industrial heating processes, but also to specific policy challenges: to design markets, transmission infrastructures and generation infrastructure that can cover, as much as possible, this territory, and to develop affordable, reliable and sustainable off-grid solutions for remote areas.

Figure 2.9 also confirms the trend that Russia's energy efficiency does not seem to improve. Major economies such as the United States, Germany and Canada experience a decline in energy intensity per capita, and so do average IEA member countries. Nonetheless,

32. Total population is 143.6 million inhabitants by mid-2013 according to Rosstat. About 80% of its population lives in the European part of the country. Average population density is 22.8 persons per square kilometre (persons/km^2) and varies from 28.6 persons/km^2 in the European part to 2.4 persons/km^2 in the Asian part. Overall, about three-quarters of the population live in urban areas. See www.gks.ru/bgd/free/B13_00/IssWWW.exe/Stg/dk10/8-0.htm; www.minregion.ru/statparam/48/; www.gks.ru/free_doc/new_site/perepis2010/croc/perepis_itogi1612.htm; www.gks.ru/bgd/regl/b12_12/IssWWW.exe/stg/d01/07-15.htm.

Russia sees quite a sharp increase in recent years, and this trend has been observed since the 2000s. Of course, the Russian economy has been growing at a fast pace, yet the increase in energy intensity should have been much milder, or even null, had the economy become much more efficient.

Figure 2.9 Comparison of TPES/capita, 1990-2012, Russia, Kazakhstan and a selection of IEA member countries

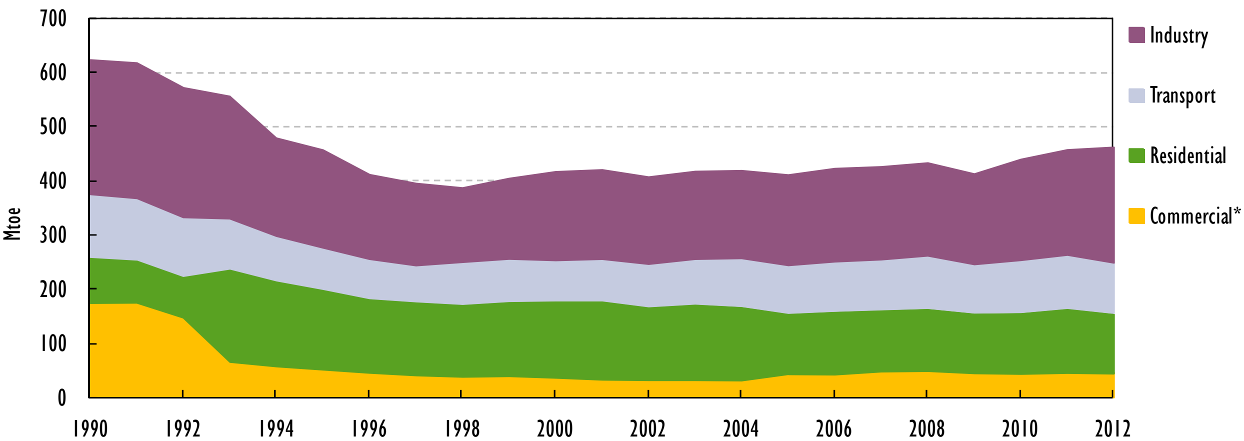


Notes: toe/capita = tonnes of oil-equivalent per capita. Data for 2012 are provisional.

Source: IEA (2013), *Energy Statistics of Non-OECD Countries*, OECD/IEA, Paris.

TFC of energy[33] in Russia was 463.1 Mtoe in 2012 (Figure 2.10). TFC is dominated by the industry sector, which accounted for 213.8 Mtoe or 46.2%. Energy consumption in industry has increased by 32.5% since 2002, growing at a faster rate than TFC, which increased by 13.4% since then.

Figure 2.10 TFC, 1990-2012



Note: Data for 2012 are provisional.

* *Commercial* includes commercial and public service, agriculture, fishing and forestry.

Source: IEA (2013), *Energy Statistics of Non-OECD Countries*, OECD/IEA, Paris.

33. TPES is the consumption/supply of primary energy only, i.e. gas, coal, crude oil, etc., and is the balance of production, imports, exports and stock changes. TFC is the final consumption of energy products, i.e. electricity, heat, gas, oil products, etc., so direct consumption by final consumers.

Residential energy use represents 23.6% of TFC, and transport represents 20.2%. However, final consumption in the residential sector has declined since 2002, decreasing by 18.4%. Conversely, consumption of oil and gas in the transport sector has increased by 18.8% over the same period. As such, the share of TFC by households has fallen from 32.8% in 2002 while the share of transport has risen from 19.3%. Commercial and public services energy use represents 10.1% of TFC, and this sector has seen the fastest growth in consumption since 2002, increasing by 35.8%.

Against this backdrop, Russia in 2013 was the world's fourth-largest CO_2 emitter and the world's fourth-largest oil consumer.

Russia's ongoing high energy inefficiency is limiting the competitiveness of its economy. Russia is a member of the World Trade Organization (WTO), which has increased the exposure of Russian industry to global competition: This will be a driver of modernisation yet requires investments to reduce energy consumption and energy input costs. Indeed, there are other industrialised countries in the world which benefit from similar energy price levels than Russia: For example, wholesale gas prices are at similar levels in Russia and in the United States. Improving energy efficiency in energy-intensive industries and buildings could further foster economic growth, create markets for services and technologies, stimulate the development of the small and medium-sized enterprise sector, improve industrial competitiveness, foster regional development, diversify the economy, and contribute to budget revenues. The challenge is thus to attract the necessary investments and have a policy, regulatory and economic framework that is conducive to prioritising and implementing energy efficiency investments. Resisting price increases for the residential sector is an obstacle to building upgrades and reducing wasteful consumption.

In particular, low energy efficiency in buildings is a barrier to moving prices to cost-recovery prices and, vice versa, regulated prices below market levels are a barrier to energy efficiency investments. As long as end-use consumption in buildings is highly inefficient and remains to a large extent unmetered (especially heat), it is socially and politically difficult to raise regulated prices to market levels. The challenge is to progressively move prices to full cost-recovery levels (especially for gas, heat and power supplied to households) and end cross-subsidies (between heat and power generation, between power generation and transmission) while implementing energy efficiency policies – such as minimum mandatory upgrade requirement – and deploying meters in order to limit the financial impact on end consumers. Another challenge is also to disconnect social policies and transfers from energy policy and to provide differentiated financial transfers to the most vulnerable consumers. Moreover, a challenge is to create the right regulatory framework must be created in terms of property rights of buildings and apartments to foster investments in energy efficiency upgrades of buildings and more efficient heat distribution and consumption. Building-level sub-meters and regulators need to be rapidly deployed countrywide and building envelope upgrades need to be conducted. Apartment owners need to have incentives to make window upgrades, for example. This also requires appropriate fiscal and/or financial incentives to foster investments in energy efficiency. Finally, building upgrades need to be synchronised with district heating modernisation projects to avoid overcapacities and optimise the district heating systems.

NEW CHALLENGES AND UNCERTAINTIES FROM GLOBAL OIL AND GAS MARKET DEVELOPMENTS

Russia's energy policies are increasingly affected by developments in the global economic and energy markets. Policy makers and companies are facing strategic uncertainties when assessing these developments and their short-, medium- and long-term implications.

Oil sector challenges

When looking ten years back, the pace of increases in oil production is very unlikely to be further duplicated in the future, and the growth in oil prices that has accompanied these changes is also not likely to be repeated again. This comes at a time when Russia needs to develop the next generation of oil resources to replace depleting legacy brownfield production, and also needs to continue investing in enhanced oil recovery (EOR) to limit this depletion. These resources, especially hard-to-recover and offshore oil resources, will be more expensive to develop and require a balanced and adapted taxation system, alongside targeted corporate strategies and close cost oversight. Moreover, the continued growth in global oil prices as seen in the 2000s is unlikely to be repeated in the medium term. Some major upward but especially downward fluctuations are possible so that policy makers and oil companies in Russia need to carefully plan budgets and investments.

Gas sector challenges

Gazprom is facing a challenge to adapt to changing market conditions in Europe, and Russian companies will also need to address market challenges when expanding gas exports beyond Europe in the booming Asia Pacific region in order to turn Russia from a regional gas exporter into a global gas exporter.

In particular, the North American unconventional oil and gas revolution already has a number of consequences for Russia's energy markets and export strategies and will further do so.

For gas, Russia has a golden opportunity to export large volumes of gas to the Asian markets, but challenges include the United States' switch to becoming an LNG exporter that will compete with additional upcoming Russian LNG projects especially in the Asia Pacific region. Indeed, the fact that the United States would not become an LNG importer has already contributed, alongside the project's economics, to calling a project such as Shtockman into question. Another challenge is the impact on European gas demand as increasing coal production in Australia, Indonesia, China and also Russia makes cheap coal available for import to Europe, where it is cheaper to use for power generation.[34] And one additional challenge is the future potential impact on gas pricing as a number of LNG projects from the United States have signed long-term contracts based on Henry Hub indexation mostly with Asian buyers. This may increase pressure to reduce the strict oil indexation in long-term contracts for pipeline or LNG exports to Europe and to Asia and include alternatives. In particular, there is a growing competition among future LNG suppliers in the booming Asia Pacific markets, with a number of LNG projects from Australia and the United States to be commissioned in the medium term and East Africa and Canada in the longer term. Russia's LNG drive is not too late as some of these liquefaction projects may be delayed and as LNG production in other producing countries may decrease. However, the successful development of Russia's LNG projects will depend on their ability to be cost-competitive, and designed efficiently and on time. Indeed, some key factors may affect Russia's LNG exports to Asian gas markets in the longer term, including price elasticity of gas demand with the competition of cheaper coal and other LNG suppliers; China's ability to increase domestic gas production and slow the increase of its future LNG or pipeline import needs; and overall economic growth levels in the region.

34. IEA (2013), *Medium-Term Coal Market Report 2013*, OECD/IEA, Paris.

The way LNG is commercialised may also change, possibly becoming more flexible in regard to take-or-pay obligations and a shorter duration of contracts, as well as greater swap and re-export operations. In the long term, the difference in prices among the United States, European and Asian gas markets is likely to slightly narrow, with Asia still expected to keep a premium.[35]

Overall, in gas, Gazprom enjoys a strong position in most European markets. Regulatory and particularly market changes in Europe affect Gazprom's operations in these markets and require adaptation to new market and regulatory conditions as well as dialogue with the European Commission when appropriate.[36] The EU gas markets have undergone significant regulatory changes following the removal of destination clauses from most long-term contracts, and the implementation of the Third Energy Package and its provisions aimed at fostering gas-to-gas competition and creating a single gas market where companies and consumers benefit from free and fair competition. The Third Energy Package also has implications on access to pipeline or storage capacities or ownership structures of infrastructure. Some frictional issues have appeared, such as DG Competition opening proceedings against Gazprom for a possible breach of EU antitrust rules,[37] unbundling issues in Lithuania and disagreements over the regulatory regime applicable to pipelines on the EU territory. At the same time, European gas markets are facing fundamental economic challenges: Consumption is unlikely to increase to levels seen in 2006 over the medium term. Gas demand is affected by factors including low GDP growth, competition from coal, and renewables benefiting from subsidies for power generation as oil indexation contributes to making gas less competitive with alternatives for power generation. Gas hubs are developing their liquidity. Average Gazprom export prices to European markets grew in the 2000s, following a similar trend as export volumes, but since 2009, these are much more volatile. Gazprom in some European markets will also face increasing competition from new suppliers and alternative energy sources by 2018-20. In general, it is likely that natural gas prices will converge in the European Union and today's large spreads between individual countries will further erode. There is also an uncertainty over future climate policies globally and in Europe in particular, which could affect the role of gas in the global and European energy mix, especially related to the carbon price levels, which are currently very low and support coal consumption. Another uncertainty comes from the development of wind and solar, and in particular the pace at which offshore wind costs will decrease.

Yet Gazprom has opportunities to consolidate market shares, as highlighted by its 2013 high sales volumes of 161.5 bcm in Europe[38] versus 139 bcm in 2012 and 130 bcm in 2000. Factors that support Gazprom's position as a supplier to Europe include: the uncertainties in North Africa which impact gas exports to Europe from that region, the large combustion plant directive that will enter into force by 2015, the retreat from nuclear in Germany and the planned phase-out in Belgium and Switzerland in the longer term, the fact that shale gas development in Europe is likely to remain limited, high LNG prices in Asia that divert LNG supplies away from Europe, and an anticipated progressive

35. IEA (2013), *Medium-Term Coal Market Report 2013*, OECD/IEA, Paris; IEA (2013), *World Energy Outlook 2013*, OECD/IEA, Paris.

36. For an overview of Gazprom's positions and proposals related to the Third Energy Package, see different speeches and presentations from Gazprom's management available at: www.gazpromexport.ru/en/presscenter/speech/.

37. Note: As put forward by DG Competition, "An opening of proceedings does not prejudge the outcome of the investigation; it only means that the Commission will treat the case as a matter of priority". See: http://europa.eu/rapid/press-release_IP-12-937_en.htm.

38. For Gazprom, Europe means EU member states + Turkey + Balkans - the Baltic States.

decline in Europe's domestic production, especially following the decision by the Dutch government to reduce output of the Groningen field. Moreover, price adjustments in long-term contracts, agreed with most European utilities, helped support higher sales volumes in 2013. As a consequence, Gazprom's exports to Europe are likely to remain in a range of 153 bcm to 167 bcm in the medium term, but they are unlikely to grow beyond.

THE NEED FOR INVESTMENTS IN THE AGEING INFRASTRUCTURE

Russia's ageing energy sector infrastructure is in need of massive and rapid investment in the next 15 years. These investments in conservation/energy efficiency, power and heat generation and transmission, and upstream oil and gas, alongside transportation and export infrastructure, should be continued and fostered to reach the necessary levels. The 2009 Energy Strategy to 2030 estimated that investments in the amount of USD 2.4 trillion to USD 2.8 trillion until 2030 at constant prices of the year 2007 would be needed. The modernisation of power generation, transmission and generation infrastructure alone requires USD 355 billion to USD 554 billion for generation and between USD 217 billion and USD 334 billion for networks, with the IEA making a similar estimate.[39] Indeed, a third of existing capacity needs to be decommissioned, and almost the equivalent of the 2008 installed capacity could be additionally needed. More private and foreign investments will be needed in Russia's upstream oil and gas sectors given the huge capital and technological needs. The Institute for Energy Studies of the Russian Academy of Sciences has similar projections: It estimates that over the period 2010-20, about USD 100 billion per year (USD/yr) will be needed in energy sector investments. This is 45% more than annual capital investment spending for modernisation over the period 2006-10, which was around USD 70 billion/yr.[40]

In particular, the investment needs are urgent in the district heating segment. About 80% of Russian boilers are over 30 years old, 20% over 50 years old and 29% of the heat distribution system is considered in critical condition and needs to be replaced. In total, heat losses (leakage, wasteful use) in the entire supply chain can reach up to 60%, versus an average of 20% in OECD systems.

In the power sector, almost two-thirds of Russian thermal power plants are more than 30 years old and average between 50 years and 60 years old. The bulk of nuclear capacity reaches the end of its lifetime in the coming years, which will require investments in lifetime expansion and safety upgrades as well as construction of new units in order to realise plans to increase total nuclear generation capacity. Moreover, 78% of hydropower plants are in need of refurbishment. The upgrading and decommissioning of old co-generation plants and related networks, amid rising maintenance and repair costs, have become a pressing concern for generation adequacy. There is also an urgent need for the modernisation of the grid infrastructure, and investment in interconnection between energy systems, notably to reinforce the weak links between Europe and Urals and Siberia and to link the currently isolated energy system in the Far East and the north of Russia as well as make connections to Asian markets.

The government needs to further facilitate private Russian investment in this regard, but also foreign investments, which will be essential to achieve this modernisation. The challenge is thus to develop a consistent and predictable taxation and regulatory framework and attractive economic and regulatory conditions to draw the required level of private and foreign investments.

39. IEA (2011), *World Energy Outlook 2011*, OECD/IEA, Paris.

40. Russian Academy of Sciences (2013), *Presentation to the IEA, Institute for Energy Studies*, July, Moscow.

STRONG MARKET DOMINANCE OF STATE-CONTROLLED COMPANIES IN OIL AND GAS

IEA experience shows that well-functioning, efficient and sustainable energy markets require a combination of both regulatory and economic incentives, which need to be closely and carefully balanced and co-ordinated. However, there is no clear response as to whether state companies should be predominant or not to ensure effective resource development and usage. In emerging economies, national oil companies tend to be state-controlled and play a dominant role. In Russia, the revival of oil production in the period 1999-2004 was driven mostly by key private companies Yukos, Sibneft, Surgut and Lukoil, whereas the responsibility of maintaining Russia's oil production at current levels in the long run now increasingly lies on state company Rosneft. The IEA constituency, which has no emerging economies among its member countries, includes a number of important oil-and-gas-producing countries with different models. The United States has no state-controlled companies involved in the upstream sector, and a large number of independent companies have ensured the boom in oil production on the back of clear and fair regulation. In Norway, Statoil is 67% owned by the state and is listed on the Oslo stock exchange. Though the majority is owned by the Norwegian state, the company is treated the same as any other private company present on the Norwegian continental shelf. Norway has in recent years seen a strong increase in exploration and production from private companies. For example, Lukoil, which cannot operate in the Russian Arctic or Barents sections, holds licences in the Norwegian Barents section. Overall, in IEA member countries, there is also significant state ownership, especially in transmission infrastructure in Europe.

Key features of the Russian energy policy model appear to be the combination of state concentration of the oil and gas sectors, a limited price liberalisation in most sectors, and an overall limited competition in markets. The price liberalisation process started over the past five years with substantial increases in regulated gas tariffs for the industrial sector adopted every year, but has been largely stalled since 2013. Partial or total privatisation of major state-controlled companies was envisaged, yet initial plans have been revised to a large extent. Large state-controlled companies that often operate in an integrated model such as Gazprom, Rosneft, Rosatom, Rushydro and Inter RAO have, in some cases, strengthened their positions in markets over recent years and are poised to continue to dominate Russia's energy sector.[41] The challenge is to ensure high dividends for the state, a competitive market with no abuse of the dominant position, efficient management of state companies and adequate investments. Russian state-controlled companies also play a social role, such as in developing regions or supporting major federal projects. Examples from the United States and Norway share the following elements: clear, credible, transparent and predictable regulation; high corporate governance standards; full market transparency; and liberalised markets.

41. The government plans to reduce the stake held by Rosneftegaz in Rosneft to 50% plus one share before 2016, according to the updated privatisation programme for 2014-16 approved by the government, yet this could be delayed and may only partially be implemented. State-controlled energy holding Rosneftegaz now owns 69.5% of Rosneft. Following the TNK-BP takeover by Rosneft, BP is another key shareholder in Rosneft, controlling a 19.75% interest. The new plan also envisions reducing the state-controlled interest in oil producer Zarubezhneft to 90% by 2016 from the current 100%, and to 50% plus one share until 2020. The new programme kept the government's earlier plans to reduce the state-controlled stake in Transneft, Russia's national oil pipeline monopoly, to 75% plus one share by 2016, from 78.1% currently. See Platts (2013), "Russian Rosneft to remain under state control until 2016", 28 June.

ASSESSMENT

This overview has highlighted the tremendous changes that Russia's energy sectors have undergone and that have largely benefited Russia's economic growth and development alongside global energy supply security. The Russian government has acknowledged that its economy and energy sector face key challenges, but also opportunities, and aims to address them through its modernisation and economic diversification strategy. Over the past few years, the Russian government and leading companies have already taken important and relevant steps and policy measures to address the challenges facing Russia's economy and energy sector in a clear sign that the government is aware of them and is measuring their importance and the need for policy adaptation.

Additional progress, however, is needed, in particular to improve energy efficiency in the building, industrial and transport sectors, alongside attracting more investments in the power generation and district heating sectors. Now is the time to increase efforts to avoid missing existing opportunities, and the following steps could be taken in priority.

NEW ENERGY STRATEGY

Updated and comprehensive energy strategy focusing on sustainable and robust economic growth

In recent years, Russian and global energy markets have undergone significant changes against the backdrop of the economic and financial crises, increased global competition, societal demands, the impact of climate policies, technological innovation, and the evolving global energy supply and demand picture. There have been enormous developments in the shale gas and tight oil sectors. All these factors increase uncertainties over future price levels and market developments, and further impact trade and investments in gas, oil and coal. As a consequence, energy importers and exporters such as Russia face uncertainties and new opportunities. It is timely therefore that in 2013 and 2014, Russia is examining these challenges and is articulating an updated Energy Strategy to 2035 as well as a longer-term-vision document to 2050, with determination to reinforce the current reforms. The work on both documents provides an opportunity to strengthen governance of the energy sector and design a long-term consistent and coherent energy policy that focuses on implementation and monitoring at federal and regional levels.

In developing these strategies, the government should ensure a framework that reflects the interdependences among the energy sectors (e.g. district heating, energy efficiency, renewables); which includes all relevant stakeholders at federal, regional and local levels, consumers and producers and market regulators; and which clearly articulates policy on:

- Rapid progress in energy efficiency in the residential and industrial sectors, and related measures that could bring these results.
- The potential for EOR and unconventional oil developments.
- The opportunities and challenges from Arctic and frontier hydrocarbon production versus traditional production.
- The projects, sequencing and conditions that would allow the successful increase of oil and gas exports to the Asia Pacific markets.

- Enhancement of competition and efficient functioning of energy markets.
- Encouragement of technological innovation as Russia develops policy objectives in this area but would need a more streamlined and targeted approach that would more strongly involve public and private companies.
- Mitigation of environmental and climate impacts in unleashing the full energy efficiency potential in buildings, industry and transport.
- Analysis of the cost and benefits of unleashing Russia's potential for biomass and waste-to-energy, and what political regulatory steps would need to be taken.
- Importantly, the implementation, monitoring and enforcement of these polices in all regions; and the CO_2 impact of these upgraded policies.
- Sound energy data collection and projections, including demand-side developments, e.g. the area of energy efficiency, not least to avoid overcapacity investments in the power and gas sectors. In particular, the strategy should rely on revised and realistic GDP growth assumptions which, alongside energy efficiency, should determine the consumption patterns especially in the gas and power sectors. Future policy targets would need to be carefully weighted to give predictable signals to markets and avoid a trend to either delay or cancel objectives, as has been the case in areas such as renewable deployment, energy efficiency and district heating.

The new energy strategy in particular should also focus on how Russia could best adapt and reinforce education and professional skills in identifying specific needs stemming from the efforts to modernise the energy sector. Indeed, deploying energy efficiency on a large scale; developing new oil and gas resources, such as offshore; building more nuclear units and expanding their lifetime; moving to clean coal technologies; and developing innovations for off-grid renewable power installations, for example, will require very specific human skills and knowledge that so far have not been sufficiently widespread in Russia. This will require fostering efforts for preparing a new generation of engineers, project managers and technicians who will be able to work in these sectors with state-of-the-art knowledge, expertise and technologies. Innovations will need to be oriented towards the most cost-competitive segments, universities and companies should be further encouraged to work together, and the state should identify and fill gaps in learning, such as in energy efficiency for example.

Realistic update of future energy production and consumption trends

Sound data and projections about the future development of Russia's energy markets are essential to inform and guide energy policies. The development of Russia's TPES and TFC will depend on a variety of factors, including revised GDP growth levels and their impact on demand for gas and electricity, the evolution of the structure of the economy, average oil prices, life extension of nuclear power plants, the deployment level of renewables, the use of gas in the transport sector, the deployment of energy efficiency in the buildings and industrial sectors, and the liberalisation of regulated prices. In particular, there could be a lower increase of gas consumption due to lower use for power generation following the replacement of the ageing thermal capacities with modern CCGTs and a slower increase in power consumption, and the maintenance of a significant share of nuclear and hydro in the power generation mix. Another factor is the lower use of gas for district heating systems as modernisation efforts kick in by 2018 and meters are deployed. Finally, households should also limit their gas consumption, if not slightly reduce it, when regulated prices increase and meters are deployed; the industrial sector may consume more gas as output increases, yet the increase could be limited, if not offset, by gains in energy efficiency.

CENTRAL ROLE FOR ENERGY EFFICIENCY AND CO_2 EMISSIONS LIMITATION

The Russian economy has much to lose if the view prevails that the wealth of its fossil resources and the predominant interest to produce and supply more fossil fuel resources to the market make it affordable to keep energy efficiency deployment at a lower priority. In particular for gas, heat and power consumption, higher efficiency would lead to higher competitiveness and potentially, higher exports and thus higher output; it could help to free up resources for opening new domestic markets, such as gas for transportation, as well as exports and reduce investment needs; it would foster a healthy domestic competition which would reduce costs. The government in 2008 developed a very ambitious and almost historical energy efficiency policy, and a number of key legislative and regulatory acts have been adopted, which to a large extent are in line with the IEA *25 Energy Efficiency Recommendations.*[42] The potential is large in the buildings, power generation, industry and transport sectors, yet facilitating energy efficiency improvements in the power generation and industry sectors has the potential to deliver the quickest. Yet large-scale and effective implementation has failed to materialise so far and energy efficiency is losing momentum. This comes at a time when energy efficiency should enjoy a strategic priority as it can deliver sustained economic growth and foster the competitiveness of energy-intensive industries, trigger the needed modernisation investments, and even reduce the total energy system investment needs, such as in the upstream gas or power generation segments. Last but not least, it will limit the increase in CO_2 emissions – as Russia is one of the world's largest CO_2 emitters and is getting back on a path of increase. Indeed, CO_2 emissions in Russia could well increase further if this issue is insufficiently addressed and if current policy objectives are not effectively met. A comprehensive CO_2 limitation policy could also be a powerful tool for modernising ageing infrastructure, such as in the electricity sector. A number of climate mitigation policies could also be beneficial for the economy, such as EOR, deployment of clean coal technologies, energy efficiency and a greater use of biomass for example. However, the current policy to support the deployment of renewable energy sources in Russia does not include biomass and its initial objectives are unlikely to be met due to regulatory constraints. Russia is not immune to climate change, and its frontier onshore oil and gas production is sensitive to milder temperatures.

In devoting greater efforts and support to demand-side policies, Russia will be much better equipped to face the new challenges that have emerged from its growing exposure to globalisation, while also addressing the huge challenge of refurbishing its ageing and inefficient energy infrastructure.

The government should stick to its ambitious targets – while developing another benchmark different from energy intensity – and set up a strategic institutional co-ordination framework supervised at the highest governmental level in charge of accelerating the implementation of measures, streamlining those that have not delivered, and in particular, making policy co-ordination among ministries and federal agencies, regions and municipalities more efficient. Policy monitoring and evaluation should also be implemented in order to make quick and effective adjustments where and when needed. Regions need to be sufficiently resourced to fulfil their role and obligations, especially in terms of energy efficiency programmes.

42. www.iea.org/publications/freepublications/publication/name,3782,en.html.

The focus should be on the buildings sector, power and heat generation, and the industry sector. Conditions need to be deployed so that energy service companies (ESCOs) expand their activities in line with energy audit results, in particular in the industrial and heat sectors – Russia should be one of the most dynamic markets in the world in this regard yet only a few projects have materialised. Price signals have to be in place, alongside adequate, predictable and effective fiscal and regulatory measures that are conducive to investments, but also contract sanctity and rule of law. The private banking sector also needs to be closely involved to provide adapted instruments to finance these investments.

Improving the efficiency of buildings requires developing an effective policy package to ensure the renovation of the existing building stock and the construction of very efficient buildings. Upgrades of old apartment buildings are not happening at the scale required and progress is too slow. Modern constructions alongside product labelling could benefit from stricter standards and enforcement. The regulation needs to be streamlined and enforced and incentives provided, such as through fiscal or financial instruments – affordable credits from state banks, for example. Developing harmonised energy efficiency indicators to guide policies and monitor progress is essential, as sound and harmonised data are missing to support policy making, alongside sharing information and knowledge.[43] Energy efficiency investments in district heating systems will also be essential and will require a co-ordinated, systems-based approach that includes generation, transmission, metering and building envelopes.

MODERNISING DISTRICT HEATING SYSTEMS TO IMPROVE SOCIAL WELL-BEING AND SUPPORT THE POWER MARKET REFORMS

Russia's heating sector is facing a massive and urgent need of modernisation, and the more this is postponed, the more overwhelming and unmanageable the challenge will be, which will jeopardise the country's energy, social and economic security. Centralised district heating systems are also increasingly facing the challenge of disconnections, especially as end-user prices have been increasing whereas the low quality of service has not improved. The heat sector reform has overlapping implications: It can support co-generation, foster investments in energy efficiency in the residential sector and free up gas resources for other uses, such as transportation or exports, given that large volumes of gas are wasted every year in inefficient systems. The government has started adjusting the regulatory framework to facilitate this modernisation, and several further major steps are needed to foster the modernisation investments in the district heating systems:

- A new market organisation, with the creation of single heat supply organisations that would supply heat to end users and take responsibility for quality of supply and modernisation. This would also turn the district heating sector more efficient and more transparent.
- The removal of remaining cross-subsidies, in particular for co-generation.
- Synchronised modernisation efforts in the areas of heat generation, transmission, metering and end consumption, including consideration of the benefits in some cases from stand-alone heat supply systems, is essential to make heat supply systems more reliable, efficient and affordable.

43. Trudeau, N. and I. Murray (2011), "Development of Energy Efficiency Indicators in Russia", *IEA Energy Papers*, No. 2011/01, OECD/IEA, Paris, www.iea.org/publications/freepublications/publication/Russia_En_Eff_Ind.pdf.

- The deployment of energy service contracts.
- The deployment of building-level metering and regulation substations for old buildings and a move to consumption-based billing.
- Further quality components in the end tariff, to help to limit disconnections, to encourage payment for services, and to put pressure on heat generation and distribution companies to make investments, as the implementation of a system to fill and support complaints alongside a definition of fines for failing to meet specific heat quality supply standards would indeed push the single heat supply organisations to undertake investments.
- Greater financial support from the federal level to modernisation, especially of municipally owned systems, and effective concession schemes to incentivise private investments.
- An extended validity period of tariff methodologies and levels to at least ten years to recoup large investments.
- For tariff regulation and methodologies, ensuring that cost-plus tariff setting is quickly replaced with the individual stand-alone boiler benchmarking which is currently being developed. The RAB methodology could also be used and implemented where appropriate.
- And development of renewables for district heating, such as biomass.

COMPLETING THE ELECTRICITY WHOLESALE AND RETAIL MARKET REFORMS TO FOSTER COMPETITION AND ATTRACT INVESTMENTS

Over the past decade, Russia has implemented fundamental electricity market reforms with the transition to a liberal model at its heart. Key achievements of market liberalisation include unbundling, investment in new capacity thanks to the privatisation of generation, and the creation of a functioning wholesale electricity and capacity market for European Russia, the Urals and Siberia. Reforms are planned to be completed with the full liberalisation of the wholesale and retail markets by 2015. The reform process is now in a critical phase. As Russia is preparing further steps in the electricity market reform, an increasing uncertainty over the model and path to follow risks undermining confidence of market participants. The government currently concentrates on the heat sector reform to stimulate modernisation and investments into co-generation plants and remove remaining cross-subsidies. Russia has yet to determine a roadmap for the completion of the electricity wholesale and retail market reforms up to 2015.

The electricity sector is fundamental to sustainable economic growth and a key driver of the Russian economy. The IEA *Russian Electricity Sector Reform Update 2013*[44] and the analysis of this review strongly support the completion of the successful liberalisation process on which Russia has embarked, including the creation of fully competitive wholesale energy and capacity and retail markets, the phase-out of price regulation and a progressive move to cost-reflective pricing. The privatisation and introduction of a capacity market has led to an increase of generation capacity. The priority should be to streamline reforms and stabilise the market design, in particular by reforming the capacity mechanisms into a fully functioning and more competitive capacity market.

44. www.iea.org/publications/insights/RussianElectricityReform2013Update_FINAL_WEB.pdf.

The modernisation of Russia's electricity generation and networks will require large-scale investment in the coming decade. Growth in electricity demand, however, has been slowing down (due to lower GDP growth), making the climate for investment more difficult. While a capacity market might still be needed to support investment in the modernisation, as adequacy improves, its necessity will decrease.

Strong progress and achievements so far in the reform of the power market risk being undermined by frequent government intervention, changing the rules and market outcomes. It is important not to backtrack on more competition, and an action plan to progressively liberalise the markets and finalise the wholesale market reform is urgently needed. On the retail side, a priority should be encouraging energy efficiency, the free choice of supplier, and ensuring quality and security of supply.

In order to be successful, the electricity market reforms also need to be accompanied by a movement towards a competitive and efficient natural gas market with fully liberalised prices at a wholesale gas exchange, enhanced competition and continued progress in third-party access to infrastructure.

In this regard, maintaining a diversity of companies and stakeholders, fair rules and non-discrimination, as well as strong competition oversight by an independent and powerful regulator, in particular by the FAS, is a necessity.

RECOMMENDATIONS

The government of the Russian Federation should:

- ☐ *Develop a new, comprehensive and realistic Energy Strategy to 2035 that fully reflects the developments in global and Russian domestic energy markets, the changing economic situation, the conditions to maintain high liquids production and exports, and the potential for sustainable and robust economic growth building on accelerated and large deployment of energy efficiency and renewables.*
- ☐ *Ensure that energy efficiency is implemented as a strategic economic policy priority in the industrial and residential sectors and take the appropriate regulatory and policy steps to strengthen fiscal, financial and tariff signals and incentives; develop the ESCO market, regulatory constraints and standards to ensure swift and large-scale deployment; and ensure wide monitoring and enforcement.*
- ☐ *Ensure that the modernisation of district heating systems happens rapidly on a large scale through adopting the necessary institutional, regulatory and tariff frameworks that are needed to attract the required level of investment in generation and supply while co-ordinating with end users to avoid overcapacity, improve payment discipline and raise consumer satisfaction.*
- ☐ *Complete the electricity market reforms by setting out a clear timetable for achieving the long-term objective of fully liberalised energy wholesale and competitive retail markets. In particular, fostering the development of a competitive capacity market to reward existing and new generation investment after the end of the capacity contracts based on a competitive capacity selection to allow for transparency, non-discrimination and flexibility to adjust to different supply/demand adequacy needs.*

3. ENERGY EFFICIENCY

Key data (2012 provisional)

TPES per capita: 5.2 toe (IEA average: 4.5 toe), +21.4% since 2002

Energy intensity: 0.34 toe/USD 1 000 GDP PPP (IEA average: 0.14 toe/USD 1 000 GDP PPP), -23.6% since 2002

TFC by source: 463.1 Mtoe (natural gas 27.7%, heat 26.7%, oil 25.7%, electricity 13.7%, coal 5.6%, biofuels and waste 0.6%), +13.4% since 2002

TFC by sector: industry 46.2%, residential 23.6%, transport 20.2%, commercial and public services 10.1%

OVERVIEW

Russia is the fourth-largest primary energy consumer after the People's Republic of China, the United States and India. The amount of energy required to produce a unit of gross domestic product (GDP) (in purchasing power parity [PPP] terms) is, in Russia, still over two times higher than the International Energy Agency (IEA) average, which highlights that despite structural changes, historically embedded inefficiencies have yet to be overcome. Russia has huge potential for energy efficiency with a technical potential of roughly 260 million tonnes of oil equivalent (Mtoe), that is about 30% to 35% of total primary energy supply (TPES), and according to the government, a realistic potential of approximately 195 Mtoe by 2020 or 20% of the current TPES. Russia's ability to realise this potential over the coming decades will shape its energy balance, and influence upstream, power generation and heat sector investment needs, industrial competitiveness, and the availability of energy resources for export. Progress in energy efficiency deployment is also instrumental in mitigating the impact of increasing energy costs for the population. Energy efficiency can facilitate a transition to cost-reflective pricing by enabling investments in modernising generation, transmission and distribution to lower costs to consumers. Energy efficiency can greatly contribute to greenhouse gas reduction and is a key pillar in Russian efforts to mitigate climate change.

The presidential decree of 4 June 2008 No. 889, On Certain Measures Aimed at Enhancing Energy and Environmental Efficiency of the Russian Economy, set the ambitious target of decreasing the energy intensity of Russia's GDP by no less than 40% by 2020 (from 2007). Since then, Russia has made progress in establishing a legislative and policy framework for promoting energy efficiency. The governmental programme of Russia "On Energy Efficiency and the Development of Energy developed by the Ministry of Energy and approved by the government of Russia on 3 April 2013[1] sets a number of specific measures to decrease the energy intensity of Russia's GDP by 13.5% by 2020 from 2007.

1. http://minenergo.gov.ru/upload/iblock/afc/afc90b96ec0fef29f2ededabb6a4a131.pdf; http://government.ru/en/news/1174.

The government is preparing an assessment of the effectiveness of existing legislation and is planning measures to improve existing policy instruments.

However, considerable additional efforts will be needed over the coming years to ensure that the set target is met. So far, progress in reaping the manifold benefits from energy efficiency is lagging behind due to a lack of effective implementation and realisation of the existing policy and regulatory framework. While some energy-intensive industries have started modernising their capital stock to remain competitive, there remains a large scope to unleash the potential through all parts of the energy system and end-use sectors. Among final consumers, savings potentials are large in the residential, public service, manufacturing industry and energy sectors. In particular, there are also significant energy savings opportunities in the power and heat sectors.

There is a clear opportunity to make energy efficiency a driving force in the modernisation of the Russian economy. Five aspects identified in this review will be fundamental in improving the energy efficiency of the Russian economy: price signals; effective legislation and regulation; capacity-building and best-practice sharing; improved data collection; and access to financing. In particular, by ensuring long-term public investment policies for energy efficiency innovation and implementation, energy efficiency can become one of the most attractive areas for private investment. Strong public policies can ensure the necessary conditions to stimulate the development of a national market for goods and services related to energy efficiency. This would also create preconditions needed to develop business opportunities related to the export of such goods and services to neighbouring countries and beyond.

FINAL ENERGY USE

FINAL CONSUMPTION BY SECTOR

Total final consumption (TFC) was 463.1 Mtoe in 2012 in Russia, which is the highest level of energy consumption in Europe. Since the start of the 21st century, Russia's TFC has been increasing steadily, except in 2009 due to the global financial and economic crisis, and in 2012 had increased by 13.4% since 2002. Before 1999, the level of consumption was consistently falling, decreasing from a high of 625 Mtoe TFC in 1990.

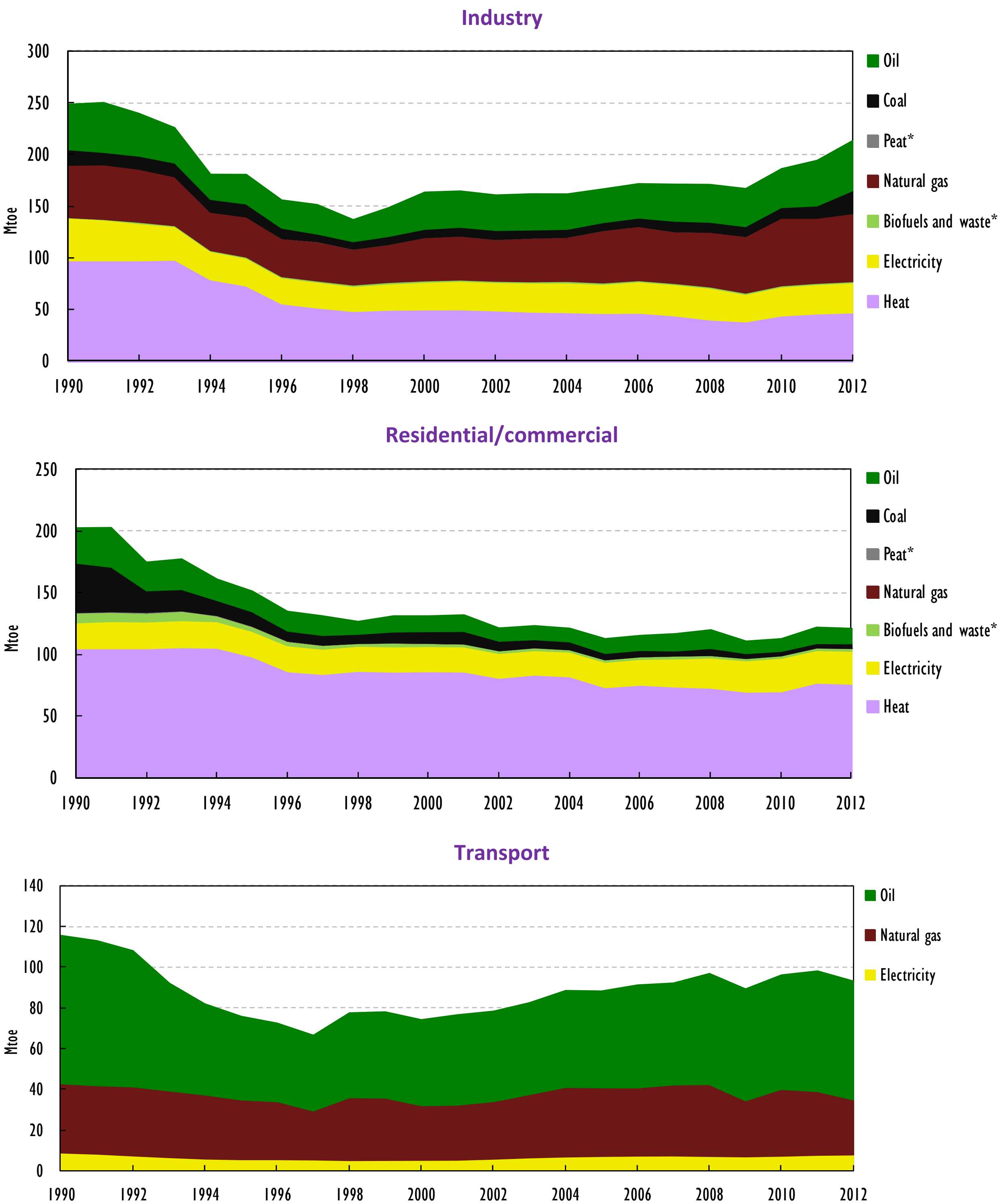
As shown in Figure 3.1, TFC is dominated by the industry sector, followed by the residential/commercial sector and the transport sector.

The industry sector consumes the largest share of final energy, amounting to 213.8 Mtoe in 2012, or 46.2% of TFC. Consumption in this sector has increased at a faster rate compared with TFC, with its share up from 39.5% of TFC in 2002.

The residential sector consumed 109.2 Mtoe in 2012, reaching 23.6% of TFC. The share of residential consumption in total consumption has fallen from a peak of 34.2% in 2001. Overall consumption of energy by the residential sector has fallen by 18.4% since 2002. Most of the energy in the residential sector is used for space and water heating.

Transport accounted for 20.2% of TFC in 2012 and has experienced a surge in energy consumption since 2002, increasing by 18.8%. As such, its share has increased from 19.3% in 2002, while still having the fifth-lowest share of transport in energy consumption compared with IEA member countries, behind Finland, Turkey, the Republic of Korea and the Netherlands.

Figure 3.1 TFC by sector and by source, 1990-2012



Note: Data for 2012 are provisional.

* Negligible.

Source: IEA (2013), *Energy Statistics of Non-OECD Countries*, OECD/IEA, Paris.

Commercial and public services represented 10.1% of TFC, up from 8.4% in 2002. The level of energy consumption in this sector has increased by 35.8% since 2002; however, Russia still has the lowest share of services in TFC compared with other IEA member countries.

Natural gas, heat and oil account for more than 80% of final energy consumed in Russia. Natural gas represents 27.7% and is used in all sectors, including a significant portion in transport (29% of all fuels used). Heat represents 26.7% of TFC and is mainly used for residential and commercial buildings. Oil accounts for 25.7% of TFC and is the main fuel in transport. Electricity represents 13.7% of the final consumption while coal and biofuels are less significant. Since 2002, natural gas and oil have increased their penetration, mainly at the cost of coal and heat.

ENERGY INTENSITY

Energy intensity, measured as the ratio of TPES to real GDP, was 0.34 tonnes of oil-equivalent per USD 1 000 GDP PPP in 2012. This important issue has already been discussed in the General Energy Policy chapter, and illustrated in Figures 2.5 and 2.9. In summary, IEA data show that this level of energy intensity is the highest compared with IEA member countries. However, energy supply per GDP in Russia has been declining since the beginning of the century, by 23.6% since 2002, and Russia has very specific climate conditions which need to be considered in this regard. The average IEA intensity has declined over the same period, albeit at a slower rate of 16.6%. The reasons for this spectacular trend in Russia lies largely not with energy efficiency investments, but rather with structural changes in the economy: a decline of energy-intensive manufacturing and the development of the service sector, increased imports of energy-intensive goods, and closures of inefficient industries. Last but not least, over past years, Russia's energy intensity has been increasing again.

INSTITUTIONS

Strategic decisions pertaining to energy efficiency are made by the president and the government. The Ministry of Energy shapes policy in the sphere of energy efficiency. The Ministry of Economic Development, the Ministry of Industry and Trade, and the Ministry of Transport also play a role in their respective areas. In November 2013, a new ministry was set up – the Ministry of Construction, Housing and Utilities, which has taken over key responsibilities in the field of energy efficiency in terms of new constructions and major renovations from the Ministry of Regional Development. The functions and personnel of the Federal Agency for Construction and Communal Services (ZHKH GosStroy) which was set up under the Ministry of Regional Development in May 2012 to develop building standards and co-ordinate the construction of public buildings, have been partly transferred to this newly established ministry. It will also take over key responsibilities in the area of heating and energy efficiency in buildings.

On the development and implementation of solutions in the field of new technologies and innovation, including energy saving and energy efficiency, the advisory body to the president of Russia, which is the Council for the Economic Modernisation and Innovative Development, has significant impact.

Regional and municipal authorities are charged with ensuring the implementation of state policy and programmes in the field of energy efficiency in the corresponding federal subjects of the Russian Federation and the municipality. Each region has been tasked with developing and adopting a regional programme on energy saving and energy efficiency. The budget is provided for the attraction of investments in energy efficiency in the regions that develop related programmes. The government provides grants for regions to implement energy efficiency projects. Grant distribution is based on a system of competition where regions submit projects, and the best projects receive grants. The Ministry of Energy selects regions and checks applications for grants from the federal budget, and oversees the budget distribution to the extent provided by state programmes and the budget law (about RUB 5 billion), and calculates the levels of co-financing of expenditure commitments by subjects of Russia on the implementation of programmes by means of grant. Regional governments also provide grants for each project and provide assistance, so that the projects can attract private investment. There is an increased interest in regions for these subsidies; there are, however, regions that lack necessary capacity to participate in this system. There are some regions and municipalities that have taken on a leading role in the area of energy efficiency, for example, Tomsk region, Kaliningrad Oblast and the Republic of Tatarstan. At the same time there is a lack of effective mechanisms to stimulate the transfer of best practices and knowledge to other regions.

The establishment of a co-ordinating multi-level energy efficiency governance system (federal-regional-municipal levels) has not yet taken place.

The Russian Energy Agency (REA) under the Ministry of Energy was established to have a pivotal role in ensuring progress in accelerating the implementation of energy efficiency at the federal and regional level. This important function would require having stronger human and financial capacities. There is an energy efficiency information system designed to provide information on legislation and best practices, yet it still needs to be developed and deployed.

POLICIES AND MEASURES

LEGISLATION AND POLICIES

As of 2008, the government started to take comprehensive and ambitious policy measures to tackle Russia's energy efficiency challenges. The presidential decree of June 2008 aimed to decrease the energy intensity of Russia's GDP by 40% by 2020, with 2007 as a basis.

The current Energy Strategy to 2030 determines objectives and goals of the Russian energy sector's long-term development, its priorities and guidelines, as well as mechanisms of the state energy policy to ensure the realisation of stated objectives. It includes state energy policy requirements and guidelines. The strategy sets a target of a 56% reduction in energy intensity for 2030 (compared with 2005) to be accomplished in three stages: The first is a major overhaul of the energy sector; the second emphasises efficiency gains through new technology within the fuel and energy sectors; and the third stresses economy-wide energy efficiency. The current Energy Strategy is now being revised and in 2014 work is expected on a new Energy Strategy to 2035, as well as a separate document with projections until 2050.

The government's new programme On Energy Efficiency and Development of Energy Sector for the period until 2020 approved in April 2013 has a sub-programme on energy efficiency which defines policy support measures to achieve only a 13.5% decrease of energy intensity by 2020. The remaining 26.5% in energy intensity reduction is to be achieved through the influence of other factors, mainly expected structural changes in the economy. *De facto*, this implies that achieving the remainder by 2020 is not backed by targeted policies and that the 40% target, while still valid, is postponed. It foresees the development of a Financing Energy Agency, which will be tasked with attracting private capital in energy efficiency projects, although at the time of writing the exact functioning and responsibilities of this agency were still being worked out.

The federal law dated on 23 November 2009 No. 261-FZ, On Energy Saving and Energy Efficiency Increase, creates a framework for a legal basis for the implementation of energy efficiency measures. Subsequently, supplementary regulatory acts were developed and adopted in the period 2009-12. There are currently more than 70 regulatory acts in effect. However, as these have been developed in a very short time frame, there is a need for amendments to remove interpretability and contradictions. In some areas, for instance building energy codes, key legislation is still lacking. Ministries and agencies are understaffed, leading to bottlenecks in the development of the legislative acts needed to accelerate implementation of energy efficiency measures. There are plans to adopt further laws and regulation during 2014.

There have been recent efforts to pass regulatory adjustments and additions in order to correct gaps and problems identified. However, the still-incomplete legal basis and time lags in the approval of regulatory acts, as well as the insufficient focus on implementation, have led to slow deployment of energy efficiency projects. The complexity of the regulatory basis including state decrees, orders, laws, by-laws and amendments, as well as regional legislation, is also deterring investments and hindering the implementation of energy efficiency projects.

The Russian energy efficiency targets are ambitious, yet the 40% target by 2020 is highly unlikely to be met. The government would need to clarify what targets its policies are realistically pursuing by 2020 and 2030 and especially assess what policy adjustments are needed to achieve them, on the basis of the experience of the past five years. Without a proper regulatory framework that ensures the financial viability of energy efficiency investments, energy efficiency policy will remain largely declarative and aspirational. There is a need to accelerate the development of normative and legal acts, to spur effective implementation of the federal law on energy saving including through the creation of economic incentives.

The Federal law “On Energy Saving and Energy Efficiency Increase” (FZ-261) adopted in 2009 does not establish the necessary parameters to determine the energy efficiency of the economy. The main target – to reduce the energy intensity of GDP – is not a suitable indicator to assess the impact on the production and consumption of energy resources. Instead Russia should consider targeting an energy reduction in absolute terms.[2] While an initial focus on state-funded organisations is understandable as these organisations are well-placed to initially take on a leading role in energy efficiency, the public sector accounts for only 12% of energy demand. Further efforts in other sectors are warranted.

During the past year, the government has worked on addressing identified shortcomings and committed to establishing an effective framework for the implementation of energy

2. Further information on sector-specific indicators of relevance to Russia can be found in Trudeau, N. and I. Murray (2011), "Development of Energy Efficiency Indicators in Russia", *IEA Energy Papers*, No. 2011/01, OECD/IEA, Paris, www.iea.org/publications/freepublications/publication/Russia_En_Eff_Ind.pdf.

efficiency policies. There is a time lag in the approval of regulatory acts, which has resulted in slower implementation than planned. The quality and timeliness of the necessary legislative amendments, their implementation, the development of new or enhanced mechanisms and instruments, and support to regional authorities will play a large role in Russia's progress towards achieving its energy efficiency targets.

REGIONAL AND LOCAL GOVERNMENTS

Regional and local governments play an important role in promoting implementation of energy efficiency and in ensuring compliance to regulation. Further capacity-building and resources are needed to enable these entities to effectively implement this role. Further steps should be taken to ensure that municipalities have sustained capacity and resourcing to continuously engage in the promotion of energy efficiency.

The government has made significant efforts in encouraging regional and local governments to work to improve energy efficiency. It plays a key role in ensuring that regional and local governments have the capacity, expertise and incentives to plan and implement energy efficiency measures and in improving co-ordination among federal, regional and municipal efforts. Areas requiring particular attention include improving regional and municipal energy-saving and energy efficiency plans to ensure that these are evidence-based effective instruments to drive energy efficiency implementation; capacity-building for regions unable to access the performance-based subsidies; the creation of stronger incentives for budget-funded organisations; and the active use of energy service contracts at the regional and municipal levels e.g. ensuring that reduced expenses due to energy savings result in the opportunity to reinvest in further projects.

The energy efficiency information system provides an excellent platform to enable the exchange of experience and learning including guidelines, best practices and case studies, and the REA and its regional offices can be effective instruments to deliver needed capacity-building, information and technical guidance.

INDUSTRY

The industry sector consumes the largest share of final energy in Russia, amounting to 194.8 Mtoe in 2011, or 42.5% of TFC. The main industrial energy users are producers of iron and steel (29%), chemicals (23%), non-metallic minerals such as cement (12%), and non-ferrous metals such as aluminium (5%).[3]

There are no mandatory energy efficiency targets for industry. One of the principal initial energy efficiency programmes covering public utilities and private and public companies is a mandatory system of energy audits.[4] However, implementation of the audits is lagging. In principle, failure to comply with the mandatory energy audit requirements can lead to an administrative fine in the amount of RUB 10 000 (USD 300) to RUB 15 000 (USD 450) for physical persons and from RUB 50 000 (USD 1 500) to RUB 200 000 (USD 6 000) for legal entities. Yet in 2012 only 10% of the mandatory audit reports were received by the Ministry

3. IEA (2011), *World Energy Outlook 2011*, OECD/IEA, Paris.

4. Entities subject to mandatory energy audits are covered in Federal Law dated 23 November 2009 No. 261-FZ. Coverage includes large consumers (with an energy expenditure exceeding RUB 10 million per year (USD 330 000 per year [USD/yr]); public unities; state and local governmental bodies; organisations with state or municipality interest; and organisations engaged in "regulated activities".

of Energy, and only 1% were deemed to be of an adequate quality, although the law has set a framework for energy audit organisations. Of the institutions covered, less than 50% of the planned audits have been carried out. Currently, audits are expensive, leading to a situation where organisations do not have sufficient resources to cover costs for implementing energy efficiency opportunities identified during the audits. Work is under way to improve the system, and outcomes of ongoing discussions are expected by mid-2014. As shown in the Box 3.1, examples from China, for example, highlight that significant and quick progress can be achieved through targeted and comprehensive programmes.

Box 3.1 Targeting energy-intensive industry: China Top 1,000 and Top 10,000 Programme

The Top 1,000 Energy-Consuming Enterprises Programme, which targeted the largest 1,000 enterprises in China, successfully achieved and surpassed its energy-saving target of 100 million tonnes of coal-equivalent (Mtce) during the 11th Five-Year Plan (FYP) with reported savings of just over 150 Mtce. During the 11th FYP, the Top 1,000 Programme was gradually expanded at the local level. Provinces established energy conservation programmes to cover smaller enterprises in the local "Double-Hundred" programmes or provincial "Top 1,000" programmes. This built the foundation for expanding the Top 1,000 programme to the Top 10,000 Programme under the 12th FYP.

The Top 10,000 Programme aims to cover two-thirds of China's total energy consumption, or 15 000 industrial enterprises that use more than 10 000 tonnes of coal-equivalent per year (tce/yr), and around 160 large transportation enterprises (such as large shipping companies), and public buildings that use more than 5 000 tce/yr. The total number of enterprises covered by this programme reaches around 17 000. The target of the Top 10,000 Programme is an absolute energy-saving target of 250 Mtce by 2015.

The key elements of the Top 10,000 Programme include: establishment of energy conservation working groups in enterprises; implementation of the target responsibility and accounting system, allocating targets to companies, plants and workshops; conducting energy audits and developing energy conservation plans; implementation of energy audit systems; conducting energy efficiency benchmarking; establishment of energy management systems; expansion of the energy managers training pilots; implementation of an energy utilisation reporting system; continuation of phasing out of backwards technologies; acceleration of energy conservation retrofits by allocating special funding for annual retrofits and cooperating with energy service companies (ESCOs); improvement of energy measurement and measuring instruments; encouraging companies to build energy management and control centres and to use automation and IT; and establishment of energy conservation incentive mechanisms.

Source: IEA (2013), *Energy Efficiency: Market Trends and Medium-Term Prospects*, OECD/IEA, Paris.

As of 1 January 2012, Russian taxpayers subject to corporate property tax are entitled to a three-year exemption for newly introduced high energy efficiency assets.[5] The government also provides a capital allowance for approved energy efficient fixed assets for corporate profit tax purposes. The capital allowance amount can be doubled for certain assets. Investments in energy efficient equipment also qualify for accelerated depreciation at twice the standard rate for profits tax purposes. To date, the tax credit has been utilised only to a limited degree due to a lack of information and insufficient tax incentives.

5. According to a list on what assets are covered in accordance with Decree of the Russian government No. 562 of 12 July 2011.

There are more than 6 million registered small and medium-sized enterprises (SMEs) in Russia. Currently, there are no measures dedicated to improving energy efficiency in SMEs such as subsidised audits, training and capacity-building, and measures to promote access to financing.

Energy efficiency investments are also constrained due to weak investment attractiveness of the Russian manufacturing sector (especially non-energy sectors), which is associated with a relatively poor investment climate in the country and a lack of competition in various domestic goods and services markets.

Rising energy prices have not triggered significant investments in energy efficiency and have in some cases led to deterioration of competitiveness.

The still very limited ESCO activities are primarily focused on public buildings and a market for industrial energy efficiency services is yet to be developed. This should be a strong priority given the large potential in Russia, and success seen in Germany for example could be well replicated in Russia (see Box 3.2).

BUILDING SECTOR

The residential sector consumed energy equivalent to 117.5 Mtoe in 2011, reaching 25.6% of TFC. Commercial and public services represented 10.4% of TFC, up from 9.3% in 2000. The building stock includes over 3.2 billion square metres (m^2) of residential buildings with more than 125 million m^2 constructed since 2010. There are significant energy savings potentials in the building sector. Deep energy efficiency renovation in multistorey residential buildings could reduce energy consumption of these buildings by 50%.

Russia has made progress in creating the conditions needed towards a more efficient building stock. There is a system for classifying buildings according to their energy efficiency, but further work is needed to develop the classification methodology, norms for certification and compliance mechanisms. Legislation on this might be developed by in 2014. An essential aspect will be to have the necessary human resources and regulatory powers to monitor and enforce compliance.

Current building standards date back from 2000. Some cities including Moscow, St Petersburg and Omsk have adopted more stringent requirements. Work is ongoing in developing new national building energy codes, which is an opportunity to align with international best practices.[6] Smooth implementation of the new code will require capacity-building and training of the construction sector. There are several other key challenges that remain to be tackled. In the residential sector's existing building stock, which is dominated by multifamily buildings, progress is stalled by lack of properly functioning homeowner associations. Currently, it is not mandatory to join a homeowner association and only 10% of residential housing stock has homeowner associations.

In line with the law FZ-261, public buildings are subject to energy audits; however, there are no obligations to invest in identified energy efficiency opportunities. There is also scope to improve methodologies for verification required for energy efficiency audits of buildings.

Currently 40% of the customer base is equipped with meters. These are needed to enable residents to accelerate the installation of heat, gas and water meters at building

6. IEA (2013), *Policy Pathways: Modernising Building Energy Codes*, OECD/IEA, Paris, www.iea.org/publications/freepublications/publication/name,42535,en.html.

level and preferably, where possible, in particular in new constructions, at apartment level, and access financing to invest in energy efficiency measures, including ones that are implemented on the basis of energy service contracts (see Chapter "District Heating").

Russia is currently planning strong measures to improve the state of the existing housing stock, a significant share of which is in urgent need of capital repairs,[7] which is a good opportunity to implement deep energy efficiency retrofits and ensure that these buildings meet high energy efficiency standards. The federal programme sets annual building renovation rates of 4% per year for public buildings and 2% for residential, but implementation and compliance checking need further improvement.

There are currently no policies in place to promote passive or zero-energy buildings, and only a few pilot projects are currently taking place in some regions.

Box 3.2 Towards integrated policy approaches to promote energy efficiency in the building sector: The multifaceted German policy framework

Russia is well-placed to utilise lessons learned from international best practices to improve the efficiency of the building sector. There are numerous examples to draw from – for instance, the approach used in Germany. Germany's energy-saving programme is based on three pillars:

- A clear legal framework and tight regulation at the national level, requiring energy efficiency upgrades to buildings and increased use of renewable energy sources among electricity providers.
- Strong financial incentives through subsidies and loans to reduce energy consumption in the building sector at all levels of government. At the national level, these are provided via a public investment bank sponsored by the German government.
- Information, promotion and behaviour change, working through regional and local bodies, developing enforceable standards through Energy Performance Certificates, and supporting model projects all over Germany. Public investment bank to leverage investments in energy efficiency.

In support of the energy savings programme, the public investment bank Kreditanstalt für Wiederaufbau (KfW) provides promotional programmes to target homeowners, private builders, landlords and housing companies. The bank promotes the construction of new energy efficient homes and the energy efficient refurbishment of older residential buildings in particular with grants or loans at favourable conditions. Results:

- Since 2006, KfW has provided more than EUR 50 billion in loans and subsidies within the context of various programmes to promote energy-related modernisation and energy efficient new buildings. To date, 3 million homes have been modernised in order to reduce their energy consumption or built to be energy efficient.
- By 2010 KfW had financed the rehabilitation, to high energy efficiency standards, of 9 million pre-1979 housing units. Between 2006 and 2009, KfW programmes retrofitted 1 million existing homes with energy efficient products, and approximately 400 000 highly energy efficient new homes were built, directly generating approximately 250 000 jobs per year, largely in the construction and supply chain.

7. According to Rosstat, 100 million m^2 are in urgent need of repair. Estimates indicate that the required funding for these repairs is in the region of RUB 30 trillion.

Box 3.2 Towards integrated policy approaches to promote energy efficiency in the building sector: the multifaceted German policy framework (continued)

- Energy efficiency in new buildings has doubled from 2002 to 2009, reducing calculated energy use from 120 kilowatt hours per square metre per year (kWh/m^2/yr) to 60 kWh/m^2/yr, while renovation has reduced it to approximately 80 kWh/m^2/yr in existing buildings.
- It is estimated that every euro of subsidy has leveraged EUR 9 in loans and private investment, with a leverage ratio of 1:10 for the KfW programmes and 1:12.5 for the Market Incentive Programme.
- KfW energy-saving programmes from 2006 to 2009 have saved heating costs in the region of EUR 1 billion per year.

The construction investment and employment effect that were created have had a dual impact on public budgets. On the revenue side, additional contributions and taxes paid by the companies and employees amounted to EUR 5.4 billion.

New jobs in the sector also reduced public expenditure on unemployment and social benefits. Cost savings resulting from declining unemployment provided the public authorities with additional funds of up to EUR 1.8 billion. Together, the additional revenue and reduced costs add up to as much as EUR 7.2 billion in income for the public accounts. In 2010, the EUR 1.4 billion from budget funds leveraged EUR 5 billion back into the treasury for each public euro invested.

APPLIANCES, LIGHTING AND EQUIPMENT

Russia has standards and labels for a number of appliances and is moving towards alignment with European Union requirements. The Russian labelling scheme was designed on the basis of the existing European energy efficiency labelling scheme. Energy classes of devices are, just as in the European Union, marked by Latin characters from A to G. The most energy effective appliances correspond to the first "A" class; the most energy-consuming corresponds to the last "G" class.

The current list of products subject to energy labelling is still relatively narrow, excluding electric kettles, coffee machines, irons, vacuum cleaners, gas ovens, audio equipment, computers, and many other household and office devices, which account for a significant proportion of total energy demand of the building sector.

Currently, there are no regulations to limit standby power consumption and promote power management. For many products, the introduction of energy labels is delayed for almost two years. Verification and compliance mechanisms are not fully developed and data are currently not collected on the average energy efficiency class of sold appliances.

Efforts have been undertaken to phase out inefficient lightbulbs. Since 1 January 2013, federal law No. 261-FZ dated 23 November 2009 prohibits the production, importation and sales of incandescent bulbs of 100 watts (W) or more, as well as the purchase of incandescent bulbs of any capacity used for lighting for government or municipal needs. To counter this regulation, some entrepreneurs have started producing and selling 99 W bulbs.

The illegal sale of goods is punishable by an administrative fine, yet these need to be enforced to be deterrent. Another challenge here is the need to harmonise these standards within the Custom Unions, as inefficient lightbulbs may well be imported and sold from other Custom Union countries. The law also admits the possibility of introducing a ban on the trade of incandescent bulbs 75 W and more in Russia, and from 1 January 2014, 25 W or more. However, these rules have not been adopted, and the timing of their application is not yet defined.

TRANSPORT

Transport accounted for 20.2% of TFC in 2012 and has experienced a surge in energy consumption since 2002, increasing by 18.8%. Fuel consumption of the transport sector, particularly road-based transport, is on the increase.

The governmental programme On Energy Efficiency and the Development of Energy developed by the Ministry of Energy and approved by the government on 3 April 2013[8] envisages a range of measures to address transport efficiency. Indicators have been developed for the transport sector including: specific energy consumption in gas and oil pipelines and railroads; light-duty vehicle fuel efficiency; share of hybrid light-duty vehicles; and growth in per capita public passenger transportation turnover.[9]

Currently, there are no mandatory fuel efficiency or carbon emission standards for light-duty vehicles nor are there policies to promote eco-driving. Data collection efforts on energy consumption within the transport sector need to be enhanced to support the identified indicators and support the development of policies in this area.

There are plans to transition towards a larger share of gas-based transport systems.

Box 3.3 Towards a gas-based transport system in Russia

On 13 May 2013, Prime Minister Dmitry Medvedev signed a decree prepared by the Ministry of Energy to transition towards more sustainable transport systems. The decree includes an order to develop a set of legal, economic and organisational measures by the state to support the production, release into circulation and sales of motor vehicles and agricultural equipment that are fuelled by natural gas, and to create fuelling and service infrastructure, statistical systems and technical regulations for natural gas as a motor fuel.

The Ministries of Industry and Trade, Regional Development, Transport and Energy are charged with the task of submitting to the government by 1 January 2014 a set of measures aimed at creating the conditions in Russia to achieve the following targets for natural gas as a fuel for road transport, public transport and road utility:

- in cities with populations of more than 1 million people, up to 50% of the total number of pieces of equipment
- in cities with a population of over 300 000 people, up to 30%
- in cities and towns with a population of over 100 000 people, up to 10%.

Implementation to these levels is proposed for completion by 2020.

8. http://minenergo.gov.ru/upload/iblock/afc/afc90b96ec0fef29f2ededabb6a4a131.pdf (accessed 14 December 2013); http://government.ru/en/news/1174.

9. Government Resolution No. 2446-r, dated 27 December 2010, on adopting the federal programme “Energy Conservation and Energy Efficiency Until 2020”, www.rg.ru/2011/01/25/energosberejenie-site-dok.html.

ENERGY PROVIDERS

The heat and power sector has been characterised by a lack of investment since the 1990s. The evolving and changing approach to the design of the power system and market is deterring investments. Russia still has a comparatively high share of low-efficiency power plants. More than 40% of thermal power plants are more than 40 years old (compared with 28% in the United States, 22% in Europe and 12% in Japan). Average efficiency for coal plants in Russia is 34.9%, and 38.3% for gas-fired plants (compared with 45% of efficient coal plants and 58% for modern combined-cycle gas turbine plants in the Organisation for Economic Development and Co-operation [OECD]). Progress is being made particularly in thermal power plant efficiency in Russia – but there are significant opportunities to increase energy efficiency. Energy providers are subject to mandatory energy audits (see Section "Industry").

Russia has the largest use of district heating systems in the world (1.6 billion gigacalories per year, supplying over 70% of population). About 70% of the district heating infrastructure needs replacement or maintenance. The biggest challenge for modernising Russia's district heating sector is the lack of cost-reflective pricing: Tariff revenues do not cover the full costs of district heating, and costs are established on a yearly basis. For end consumers, tariffs are still based on square metre or per person, not actual consumption, thereby limiting incentives to reduce losses. There are opportunities to cut auxiliary consumption and transmission losses. Efforts are under way to attract investments, but there has been poor progress so far and a lack of commercial incentives is a critical limit to progress (see Chapter "District Heating").

Apart from improving supply-side energy efficiency, there is a role for energy providers in stimulating end-use energy efficiency. The IEA has estimated that globally, in 2011, energy providers spent almost USD 12 billion on energy-saving activities. Most of these investments are from state and provincial efforts in North America, where some energy providers spend up to 3% of their revenue in improving demand-side energy efficiency. While there is a clear role for regulatory efforts to stimulate energy provider activities in this area, there are examples of where energy providers have used the delivery of energy efficiency services to create business opportunities.[10] Currently in Russia, a white certificate system is under consideration.

FUNDING AND FINANCING

To finance the work towards achieving the set energy savings targets, in its most recent budget, the federal government's energy efficiency programme allocated 0.9% from total projects' financing needs, and envisaged that 8.9% would be covered by regional and municipal budgets. The rest needs to be financed from the private sector.

Most recent figures indicate that to achieve set energy efficiency targets over the period 2013-20, RUB 53.9 billion (USD 1.6 billion) are allocated from the federal budget and RUB 562.3 billion (USD 17 billion) from regional budgets, and that the private sector should invest RUB 5.7 trillion (USD 172 billion).

In 2013, the Ministry of Energy had an energy efficiency budget of RUB 7 billion (USD 212 million), of which RUB 5 billion (USD 165 million) was dedicated to energy efficiency programmes in 27 regions. This means that in 2013, allocated resources from the federal

10. Heffner, G. et al. (2013), "Energy Provider-Delivered Energy Efficiency: A Global Stock-taking Based on Case Studies", *IEA Energy Papers*, No. 2013/02, OECD/IEA, Paris, www.iea.org/publications/insights/EnergyProviderDeliveredEnergyEfficiency_WEB.pdf.

budget were just under the level of annual funds envisaged in the government's energy efficiency programme. Private sector investment, which should amount to about USD 24 billion/yr, has not been fulfilled according to experts' estimates.

Russia has a number of energy efficiency financing instruments. However, a key remaining constraint to energy efficiency policy implementation in Russia is the lack of long-term and affordable financing mechanisms. Russian capital markets are still relatively non-responsive to energy efficiency opportunities.

ESCOs and energy performance contracting could be key instruments in enabling the implementation of energy efficiency projects.

As mentioned in the industry section above, despite efforts to stimulate the development of ESCO-delivered energy efficiency, the ESCO market has not taken off. Important parts of the ESCO chain are missing, in particular the engagement from finance institutions.

Prices for electricity, gas and heating play a crucial role in the attractiveness of energy efficiency projects and energy performance contracting, as they largely determine the payback period and final profits. Many energy efficiency measures have long payback periods, and investors require greater clarity regarding the development of energy prices. While energy prices have been increasing, the current system of a high fixed fee for transmission and distribution rather than costs reflective of units used does not create strong incentives for energy efficiency. There is also an opportunity to phase out subsidised electricity, heat and gas prices thereby creating stronger incentives to invest in energy efficiency.

Box 3.4 Emerging ESCO activities in Russia

Despite remaining challenges, ESCO activities are under way in Russia with approximately 30 companies providing some form of energy services. Apart from the need to establish an enabling framework, financial institutions need to become more active in this area. Currently, most ESCO projects are financed either through ESCOs' own funds and direct loans to customers, or by the customers themselves. Russian banks rarely provide direct loan financing for energy efficiency projects of ESCOs. There are, however, banks that offer financial leasing contracts.

The Federal Energy Service Company was created in 2011 to help improve conditions for the ESCO market. In addition, developing an Energy Credit Agency (ECA) would well complement this effort. The ECA would provide securities (certificates) to ESCOs complying with the established criteria with typical energy service contracts as collateral. It is planned that such certificates would be effective instruments for attracting capital from the market. There is also work in progress on creating an Energy Finance Agency.

Despite the existing barriers, some promising results are already being seen. For example, FENICE RUS LLC is a Russian energy service pioneer that has developed energy service contracts that allow the partners to organise a common control of the level of performance and promote a benefit-sharing mechanism to guarantee a return on investment in favour of industrial customers. It has to date enabled investments in energy efficient technologies and processes across a range of industries. Projects include the modernisation of compressed air systems with projected annual reductions of electricity demand up to 40%, heating system optimisation with savings up to 20% of thermal energy, and lighting system improvements that reduce energy demand for lighting by a factor of six.

International organisations are actively engaged in promoting access to energy efficiency finance. For instance, the European Bank of Reconstruction and Development is lending RUB 1.7 billion to UniCredit Leasing Russia to finance new leases to energy efficiency projects. The programme focuses particularly on SMEs in industry and agriculture. The International Finance Corporation's Russia Sustainable Energy Finance Programme works across Russia to encourage investments in energy efficiency projects. The project helps financial institutions and companies to assess modernisation projects, and provides long-term credit to banks to enable energy efficiency loans. To date the programme has facilitated financing for 200 projects worth more than USD 185 million, of which USD 142 million was the volume of loans disbursed by the Russian banks. The Nordic Investment Bank has launched a long-term funding programme aimed at improving energy efficiency in the industrial and district heating sectors in Russia. To date EUR 60 million has been earmarked for on-lending to projects. The Nordic Environment Finance Corporation offers small-scale financing for energy-saving measures in municipally owned buildings such as schools, day care centres, hospitals and sports facilities in Russian municipalities.

ASSESSMENT

The IEA welcomes the unprecedented attention and policy measures of recent years aimed at tapping Russia's energy efficiency potential. Against the backdrop of Russia's accession to the World Trade Organization (WTO) and a period of slower economic growth, the current ongoing energy policy discussion, which is still dominated by supply-side aspects, would benefit from an increased focus on the role energy efficiency can play in fostering sustainable and strong economic growth. Reducing domestic natural gas, heat and power consumption in buildings and industry would allow Russian industry to improve its competitiveness and create new business opportunities in the area of the provision of energy efficiency services and goods. More energy resources for exports could also be freed up. It is also essential to explore to what extent demand reduction through energy efficiency can be a more cost-effective proposition than relying only on investments in new capacity. Russia's energy efficiency policies currently in place offer a strong basis to unleash investments if current and additional regulatory and policy support measures are streamlined and implemented.

INDUSTRY

Rising domestic electricity and gas prices will reduce the competitiveness of Russian industry if energy efficiency efforts are not accelerated. International experience shows that there are barriers to industrial energy efficiency, and increasing energy prices alone are insufficient to ensure the implementation of all cost-effective energy efficiency measures. The government can play an important role in providing necessary supporting measures such as access to technical advisers, capacity-building, training and providing incentives particularly for SMEs.

Moving forward, the programme on mandatory energy audits could be transformed into a more effective instrument for energy efficiency implementation. This would require differentiated audits, more extensive training of auditors and stricter certification requirements, constraining the costs of audits, and establishing mechanisms to implement identified opportunities by facilitating the creation of bankable energy efficiency projects and linking up the programme with mandatory targets and suitable financial instruments.

There are many international best practices in the development of energy management programmes from industry ranging from voluntary agreements to mandatory programmes.[11]

BUILDINGS

According to international experience, effective buildings sector packages include increasingly stringent performance-based codes for new buildings; mandatory energy efficiency renovation requirements; sustainable financing mechanisms; and effective compliance mechanisms.

The government should complement and streamline legislation and regulation regarding energy efficiency requirements for buildings, both new constructions and the existing building stock. More stringent minimum energy performance standards for buildings, appliances and equipment are essential. Optimally these would be performance-based and build on international best practices.[12]

Programmes to improve the efficiency of the existing building stock need to be developed. While transitioning towards successively more stringent regulation has raised concerns within the construction industry, as shown by experiences in other countries, energy efficiency opens up new business opportunities for these sectors. Energy efficient buildings and retrofits will stimulate the development of new business opportunities for the producers of construction and building materials and equipment.

The motivation for homeowners to engage in energy efficiency will continue to be weak as long as heat is not billed on actual usage. Accelerating the deployment of meters and consumption-based billing needs to be a priority, as does the establishment of tenants' associations or other entities that can access financing for energy efficiency retrofits and investments. Further efforts are needed to create incentives, and raise awareness and capacity for inhabitants to take steps to improve the energy efficiency of their residences.

The process of ensuring a more efficient building sector should go hand in hand with modernisation efforts in district heating systems (see Chapter "District Heating").

APPLIANCES AND EQUIPMENT

There is scope to expand the coverage of minimum energy performance requirements for appliances and equipment and labels, and to enhance compliance through improved verification and enforcement mechanisms and make further efforts in raising awareness about and stimulating demand for high-efficiency products.

TRANSPORT

Key actions in the area of road-based transport should include establishing mandatory fuel efficiency standards for light-duty vehicles and heavy-duty vehicles with the aim of successively increasing efficiency, measures aimed at ensuring proper inflation levels of tyres, and promotion of eco-driving.

Russia has further opportunities to enhance transport energy efficiency through supporting modal shifts to more efficient forms of transport; for example, through scaling up public transport systems and promoting efficient modes of freight transport. Further efforts in the

11. IEA/IIP (2012), *Energy Management Programmes for Industry – Gaining through Saving*, OECD/IEA, Paris.

12. IEA (2013), *Policy Pathways: Modernising Building Energy Codes*, OECD/IEA, Paris.

area of integrated transport planning would contribute to fuel efficiency by optimisation of traffic flows and reducing congestion. Russia could also consider implementing schemes to speed up the renewal of the car fleet.

FUNDING AND FINANCING

Energy efficiency in Russia is slowed by the lack of long-term financial capital. There is also a need for concerted measures to stimulate investments in energy efficiency as well as for integrated policy packages to address market imperfections and barriers. Russia must ensure favourable conditions for energy efficiency investments and for the development of financial mechanisms.

While there is an interest from market players, the necessary legal and administrative framework to enable the development of a viable market for energy services is still insufficient. Necessary measures include enabling effective federal, regional and municipal organisation guarantees, adjusting public tendering requirements, and standardised methods for calculation and verification of savings. Another key constraint are the current regulations on utility services, which prevent ESCOs from developing profitable business. A further challenge to tackle is to scale up and improve the quality of energy auditor training and certification. Access to financing for energy efficiency projects could be stimulated through low-interest loans and revolving loan funds.[13]

An important starting point is accelerating the development of a market for energy services. International experience shows that policies play a key role in creating framework conditions needed for ESCO market development, which should be a key priority.

DATA AND INFORMATION

Russia is expanding its data collection efforts, including gathering valuable data through its energy efficiency programmes. In accordance with Federal Law No. 382-FZ of 3 December 2011, On the State Information System of the Fuel and Energy Complex, a system was established to provide state bodies, organisations and citizens with information about the condition and prognosis of the developments within the fuel and energy complex (FEC). The FEC refers to the mining and processing of various fuels and to electric power production. The FEC also comprises industries engaged in the production, transportation or processing of primary energy resources such as oil, gas or coal.[14] In accordance with the federal law of 23 November 2009, No. 261-FZ On Energy Saving and Energy Efficiency Improvements and on Amendments to Certain Legislative Acts of the Russian Federation (revised 10 July 2012, No. 109-FZ), the state information system in the field of energy conservation and energy efficiency was established. However, remaining gaps in energy data are hindering the development, monitoring and evaluation of policies. Similar to most other countries, there is scope for improving end-use data and use of standardised energy efficiency indicators for monitoring progress. Further efforts are warranted, particularly in the collection of residential and public sector energy consumption on both a national, and a regional level. An important further step is ensuring that data collected from various sources can

13. A revolving loan fund is a source of money from which loans are made for multiple projects. The central fund is replenished as individual projects pay back their loans, creating the opportunity to issue other loans to new projects.

14. www.rg.ru/2011/12/06tek-system-dok.html.

subsequently be used to improve energy efficiency plans, inform the policy-making process and track implementation progress.[15]

The energy efficiency information system managed by the REA provides an excellent platform that could be expanded to enable the exchange of experience and learning by including guidelines, best practices and case studies to replicate effective measures, progressive practices and the best technical solutions.

RECOMMENDATIONS

The government of the Russian Federation should:

- *Ensure that energy efficiency is implemented as a strategic economic policy priority in the industrial and residential sectors to maintain the competitiveness of the economy and facilitate the move to market level prices:*
  - *maintain ambitious targets*
  - *provide the necessary federal budget support to attain them.*
- *Expand its current audit requirements for industry into an energy management programme for industry that includes targets, reporting requirements, incentives and support. The government should also develop specific measures targeting light industry and SMEs.*
- *Continue work on developing a comprehensive package to improve the energy efficiency of buildings through:*
  - *mandatory energy renovation of the existing building stock and the enforcement of stringent performance-based energy requirements for new buildings*
  - *stimulation of the establishment of homeowner associations*
  - *deploying product energy labelling and consumption-based billing*
  - *demonstration of leadership by large-scale energy efficiency improvements and renovations of the public sector buildings.*
- *Continue work on governance, co-ordination and the development of a legal and regulatory framework particularly with a focus on developing effective enforcement and compliance mechanisms, improving co-ordination among federal, regional and municipal levels and ensuring that the REA has the resources and capacity to drive the implementation of energy efficiency across all sectors.*
- *Stimulate the further development of mechanisms for energy efficiency financing including removing legal and institutional barriers and fostering the framework for the development of the ESCO market and energy performance contracting.*
- *Scale up efforts in collection and analysis of energy end-use data including the development of a co-ordinated system of data collection for energy efficiency indicators. Measure and report actual progress in implementation of energy efficiency policies.*

15. Trudeau, N. and I. Murray (2011), "Development of Energy Efficiency Indicators in Russia", *IEA Energy Papers*, No. 2011/01, OECD/IEA, Paris, www.iea.org/publications/freepublications/publication/Russia_En_Eff_Ind.pdf.

4. CLIMATE CHANGE

Key data (2012 provisional)

Total GHG emissions (2011, excluding LULUCF): 2 320.8 $MtCO_2$-eq, -30.8% since 1990

2008-12 target: annual GHG emissions equal to the 1990 level

New voluntary target for 2020: reduce GHG emissions to 75% of 1990 levels

CO_2 emissions from fuel combustion: 1 693.6 $MtCO_2$, -22.2% since 1990

Emissions by fuel: natural gas 51.2%, coal 27%, oil 20.7%, other 1.1%

Emissions by sector: electricity and heat generation 57%, manufacturing and construction 17.6%, transport 13.8%, residential 5.7%, other energy 3.8%, commercial 2.1%

Carbon intensity: 0.78 t CO_2/USD 1 000 GDP PPP (IEA average: 0.5 t CO_2/USD 1 000 GDP PPP)

OVERVIEW

Russia is one of the world's largest carbon dioxide (CO_2) emitters. Russia is an Annex I country of the United Nations Framework Convention on Climate Change (UNFCCC) and Annex B party of the Kyoto Protocol (it had a quantified emissions reduction target for the first commitment period between 2008 and 2012). Under the Kyoto Protocol, Russia committed to keeping its greenhouse gas (GHG) emissions at the 1990 level. This target was met with a 30% margin due to the significant changes in the structure of the Russian economy since 1990. Yet Russian emissions have been growing in the last decade, albeit slowly. Recently Russia made the decision not to participate in the second commitment period of the Kyoto Protocol. Russia is focusing on a new global agreement expected in 2015 that would enter into force in 2020, and would call for the same legal status of commitments for all large emitters regardless of their Annex I or non-Annex I status.

Russia has developed a broad, high-level legal framework to address climate issues related to its participation in the UNFCCC. It is now in the process of developing supporting regulations and action plans. On 30 September 2013, the president issued Decree No. 752, On Greenhouse Gas Emissions Reduction, requesting the government to facilitate GHG emissions reductions to the levels of no more than 75% of the 1990 emissions levels; the government is currently working on developing concrete provisions and plans of action to achieve this objective. Russia also conducts regular analysis of climate change impacts on its ecosystems and economy. While it is expected that global warming may have some positive impacts on the Russian economy through increased agricultural productivity and reduced demand for heating, recent studies also point to possible severe negative impacts that will manifest themselves in extreme weather events and permafrost melting, affecting energy infrastructure.

Russia is also pursuing ambitious energy policy goals of improving energy efficiency, increasing the share of renewable energy and modernising its energy sector, which, if implemented, could bring significant GHG emissions reductions. However, efforts to integrate climate and energy policy objectives into a coherent energy and climate policy package are still very limited. This lack of harmonisation of climate and energy policy objectives may impede the implementation of some measures that become economical if the benefit of reducing GHG emissions is included in the cost-benefit analysis. Failure to facilitate and account for GHG emissions reductions through the implementation of energy policies also hinders short-term recognition of Russia as a determined player in global climate mitigation, and in the long term creates obstacles for competitive decarbonisation of Russia's economy. Russia would thus benefit domestically and internationally from harmonising climate and energy objectives and developing a comprehensive climate and energy package with clear goals, accountability, coherent policy tools, and incentive and compliance instruments.

As the legal framework for addressing climate change in Russia continues to develop, there is an opportunity to fill some of the gaps and make necessary linkages to improve stringency and effectiveness of the climate-energy interface.

TARGETS AND OBJECTIVES

On 30 September 2013, the Russian president issued decree No. 752, On Greenhouse Gas Emissions Reduction, requesting the government to develop measures that would facilitate GHG emissions reductions to the levels of no more than 75% of the 1990 emissions by 2020.[1] This objective was then confirmed in a governmental decree No. 504 dated April 2014, which also requires yearly reports to be prepared on progress made to reach this target.[2] This target does not specify whether land use, land-use change and forestry (LULUCF) will be included in the calculations. Some analysis shows that Russian sinks can absorb around 20% of the 1990 level of GHG emissions.[3] Given this magnitude of potential alterations of the target, more clarity is needed on what it encompasses.

Earlier in March 2013, the government had adopted the Prognosis of Socio-economic Development by 2030 that included indicators of anticipated GHG emissions. The long-term prognosis expects an increase of GHG emissions between 2013 and 2020, peaking at 75% of 1990 levels and then declining to 70% of 1990 levels by 2030 (which would correspond to today's levels of GHG emissions in Russia).

As for the scenarios for the energy sector's GHG emissions, the government is working with three groups of scenarios that provide a range of outlooks for the future GHG emissions in relation to policies and measures implemented by the government. The first family of scenarios (no action) is based on the assumption that in the absence of any policy measures to accelerate changes, energy consumption and carbon intensity of gross domestic product (GDP) will change slowly, at rates similar to those observed in the past. Scenarios of the second family (with measures) suggest some reductions in GHG emissions that will be tied to the implementation of policies and measures to

1. Previously, in 2009 Russia announced its economy-wide emissions reduction target by 2020 under the Copenhagen Accord. The target is to reduce total GHG emissions by a range of 15% and 25% relative to the 1990 level of emissions by 2020. The range of the target of Russia depends on the following conditions: (a) appropriate accounting of the potential of the Russia's forestry sector in the context of its contribution to meeting the obligations of anthropogenic emissions reductions; and (b) the undertaking by all major emitters of legally binding obligations to reduce anthropogenic GHG emissions.

2. www.pravo.gov.ru/laws/acts/27/534852451088.html.

3. Kokorin A and A.Korppoo (2013), *Russia's Post-Kyoto Climate Policy*, Fridtjof Nansens Institute.

modernise the Russian economy, improve energy efficiency, further develop nuclear and renewable energy, and other relevant strategies adopted in recent years. For most of these second family scenarios the upper boundary of the range passes through the value of 2.02 billion tonnes of carbon dioxide-equivalent ($BtCO_2$-eq), corresponding almost exactly to 75% of the total emissions of 1990, (2.03 $BtCO_2$-eq). Scenarios of the third family (with additional measures) suggest implementation of specific policies to limit GHG emissions, such as a carbon tax or a GHG emissions trading system, deployment of carbon capture and storage (CCS), an accelerated transformation of the fuel balance of the electricity sector, and measures applied to road transport in connection with the introduction of stringent emission targets, etc. The value of additional reductions, compared with scenarios of the second family, greatly depends on the degree of rigidity and timing of additional measures.[4]

Table 4.1 GHG emissions ($BtCO_2$-eq)

		2010	2015	2020	2030
No action	Ranges		2.05-2.12	2.27-2.42	2.72-3.02
	Forecast	1.82	2.08	2.35	2.87
	% in relation to 1990	67.2	76.8	86.5	105.9
With measures	Ranges		1.88-1.92	1.93-2.02	2.04-2.22
	Forecast	1.82	1.90	1.98	2.13
	% in relation to 1990	67.2	70.0	72.9	78.6
With additional measures	Ranges		1.82-1.84	1.82-1.86	1.82-1.89
	Forecast	1.82	1.83	1.84	1.86
	% in relation to 1990	67.2	67.5	67.9	68.5

Source: Ministry of National Resources and Environment of the Russian Federation (2013), Sixth National Communication of Russia to the UNFCCC, Moscow.

Russia has recently set a number of important strategic goals for the development of the energy sector, such as the goal to improve energy intensity of GDP by 40% of 2007 levels by 2020 and the goal to bring the share of renewable sources (besides large hydropower) in the primary energy supply to 4.5% by 2020. While it seems unlikely that these goals could be achieved by 2020 (see the "Renewables" and "Energy Efficiency" chapters), moving towards their attainment would have important implications for national GHG emissions reductions. For example, the state programme Energy Efficiency and Energy Sector Development, adopted by the government in April 2013, anticipates a GHG emissions reduction of 393 million tonnes of carbon dioxide-equivalent per year ($MtCO_2$-eq/yr) by 2020 as a result of its implementation. This would correspond to around 20% annual reduction in energy sector GHG emissions.

Thus, to capture GHG effects of these and other sectoral goals and supporting policies, provisions are needed to calculate the associated GHG emissions reductions and monitor actual implementation of these policies. Setting long-term sectoral goals, including on GHG emissions, encourages investments in the relevant infrastructure (e.g. energy supply,

4. Sixth National Communication of Russian Federation to the UNFCCC, 2013, https://unfccc.int/files/national_reports/annex_i_natcom/submitted_natcom/application/pdf/6nc_rus_final.pdf.

transport, energy demand). To avoid locking in emissions for several decades, long-term climate mitigation objectives have to be taken into account when sectoral energy goals are defined.

ENERGY-RELATED CO_2 EMISSIONS

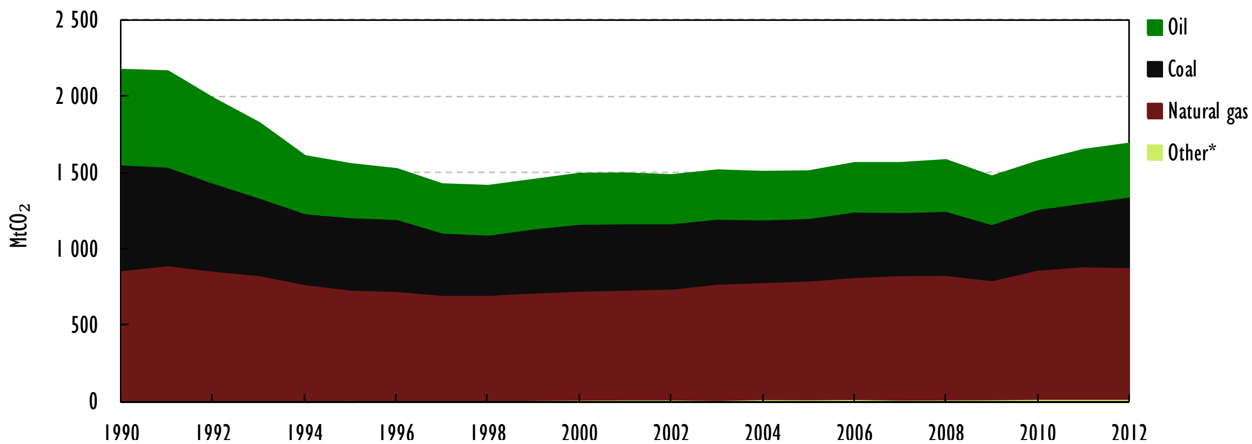
SOURCES OF CO_2 EMISSIONS

The energy sector is the largest contributor of anthropogenic GHG emissions in Russia. In 1990, its contribution in CO_2-equivalent without accounting for LULUCF was 81%; in 2011, it grew to 82.7%.

Energy-related CO_2 emissions in Russia amounted to 1 693.6 million tonnes (Mt) in 2012. This is 2.4% higher compared to the year prior, and 14.6% higher than in 2009. CO_2 emissions from fuel combustion have been on an upward trend since the late 1990s, increasing on average by 1.3% annually from 2002 to 2012 (13.9% in total).

The majority of the CO_2 emissions are from natural gas, which accounts for 51.2% of total energy-related emissions. Slightly more than a quarter of the emissions are from coal (27%) and the remainder is emitted from oil use (20.7%). Just over 1% is from other fuels including industrial waste. CO_2 emissions from coal have increased by 8.4% in total since 2002, while emissions from natural gas have increase by 18.7%, and oil emissions have risen by 9.5%.

Figure 4.1 CO_2 emissions by fuel, 1990-2012



Note: Data for 2012 are provisional.

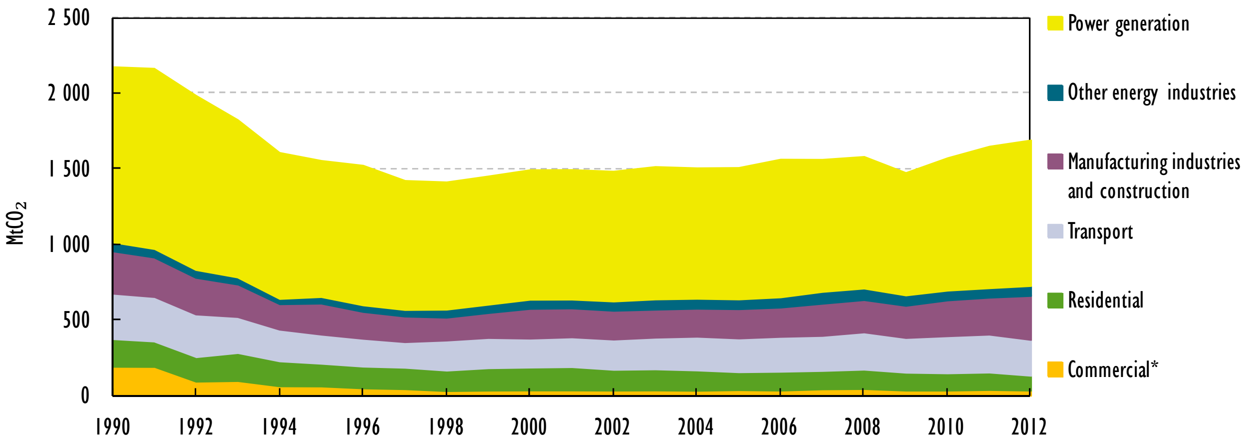
* *Other* includes industrial waste and non-renewable municipal waste; negligible.

Source: IEA (2013), *CO_2 Emissions from Fuel Combustion*, OECD/IEA, Paris.

Power generation is the largest emitter of CO_2, accounting for 57% of the total CO_2 emissions from the energy sector. Total emissions in this sub-sector have increased by 12% since 2002, which is slightly slower than the overall increase in CO_2 emissions. Manufacturing and construction account for 17.6%, and transport emits another 13.8%. The residential sector represents 5.7% of CO_2 emissions, followed by other energy industries at 3.8% and the commercial and public services sector at 2.1%.

Over the past decade from 2002 to 2012, the level of emissions from the residential sector has declined by 28.7%, while emissions from the manufacturing sector have increased by 50.5% and from the transport sector by 19.1%.

Figure 4.2 CO_2 emissions by sector, 1990-2012



Note: Data for 2012 are provisional.

* *Commercial* includes emissions from commercial and public services, agriculture/forestry, and fishing.

Source: IEA (2013), *CO_2 Emissions from Fuel Combustion*, OECD/IEA, Paris.

Methane emissions represent 20.1% of the GHG emissions from the energy sector, after CO_2 (79.5%); nitrous oxide emissions contribute a small share of 0.4%.[5] In 2011, methane emissions totalled 371.1 Mt (371 112.79 gigagrammes) of CO_2-eq, which is 3.3% above the 1990 levels. The largest part of these emissions comes from oil and gas production. Methane emissions related to oil and gas production, including fugitive emissions, grew by 18% between 2000 and 2011 due to increased production of oil and gas.

CARBON INTENSITY

Carbon intensity, measured as CO_2 emissions per real GDP, was 0.78 tonnes of CO_2 per USD 1 000 of gross domestic product at purchasing power parity (t CO_2/USD 1 000 GDP PPP) in 2012. Russia had the highest level when compared with member countries of the International Energy Agency (IEA), followed by Australia at 0.48 t CO_2/USD 1 000 GDP PPP. Similar to other IEA member countries, the level of carbon intensity in Russia has been decreasing, down by 27.5% since 2002. Since 2008, there has been a slight increase in emissions per GDP, mainly due to a modest recovery in economic growth.

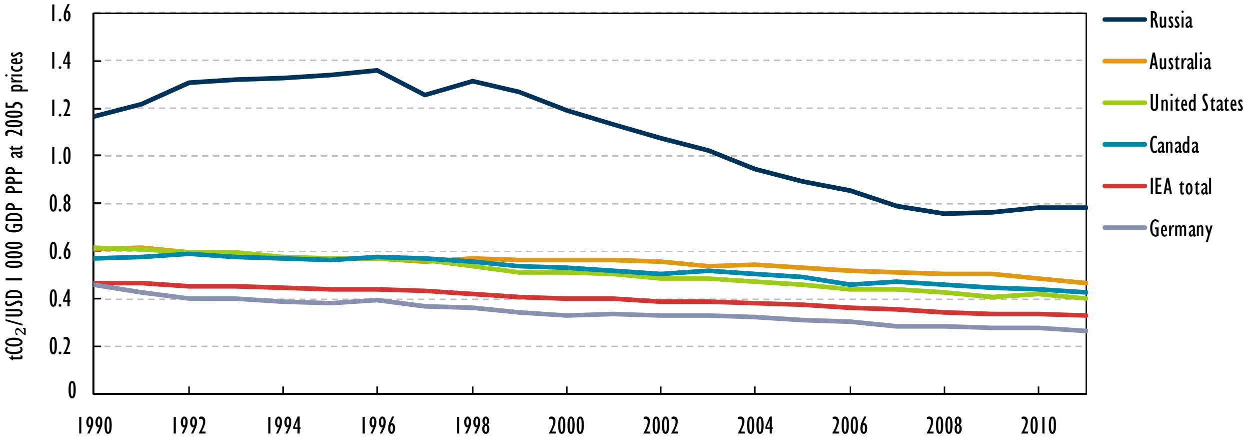
High carbon intensity is determined by high energy intensity (energy use per unit of GDP) of the Russian economy and dominance of fossil fuels in the energy mix. The energy intensity of Russia is two times greater than the average of IEA member countries and the highest among the BRICS countries (Brazil, Russia, India, the People's Republic of China and South Africa). Even when taking into account Russia's climate conditions, the energy intensity indicator should be a maximum of 25% to 30% higher than that of European countries. The current situation may be explained by the structure of the national economy, the use of outdated technological equipment and the lack of strong environmental policy.[6]

5. National Report on Inventories for 1990-2011 of Russia to the UNFCCC.

6. Piskulova, N. (2012), *Resource Efficiency Gains and Green Growth Perspectives in Russia*, Friedrich Ebert Stiftung.

The ambitious energy efficiency goals as well as the objective to build up the share of renewable energy in the primary energy supply, and aspirational goals to increase the share of nuclear energy, if achieved, will lead to decreased carbon intensity of the Russian economy. Projected economic growth accompanied by increased energy consumption would avoid causing an increase in GHG emissions if it could be coupled with lowered carbon intensity. These assumptions are probably taken into account in Russia's estimations of GHG emissions in 2030 that are projected to be at today's levels. In addition, Russia has already managed to decouple its high economic growth from GHG emissions – between 1998 and 2010 Russia's GDP grew by 87.4%, while CO_2 emissions increased by 8.6% during the same time frame.[7]

Figure 4.3 Energy-related CO_2 emissions per GDP in Russia and selected IEA member countries, 1990-2011



Source: IEA (2013), *CO_2 Emissions from Fuel Combustion*, OECD/IEA, Paris.

INSTITUTIONS

National climate policy formulation is guided by a group of ministries. Overall responsibility for climate change policy making lies with the Ministry of Natural Resources and Environment and the Ministry of Economic Development of the Russian Federation. The Ministry of Economic Development assumed responsibility for the preparation of emissions projections of Russia, which also serve as the basis for defining national GHG targets for 2020 and beyond. The Russian Federal Service for Hydrometeorology and Monitoring of the Environment is responsible for all issues related to Russia's participation in the UNFCCC and its Kyoto Protocol. The Commission on Climate and Sustainable Development under the administration of the president supports intergovernmental co-operation in policy implementation.

A number of national institutions are involved in analysing and promoting climate change policy implementation, such as the Ministry of Foreign Affairs and the Federal Forestry Agency under the Ministry of Environment. Several business associations, such as Delovaya Rossiya and the Russian Union of Industrialists and Entrepreneurs, as well as non-governmental organisations (WWF Russia, Russian Socio-Ecological Union, Greenpeace, Ecodefence, Bellona) also take active part in climate policy discussions and related analytical work. Several research institutions (such as, for example, the Centre for Energy

7. Bashmakov, I and A. Myshak, (2012), *Factors Determining Energy-related GHG Emissions in Russia: 1990-2050*, Center for Energy Efficiency, Moscow.

Efficiency, the Main Geophysical Observatory and the Higher School of Economics, and the Energy Research Institute of the Russian Academy of Science) provide analytical support to the government and also conducts independent studies on climate change issues, including scenario development, evaluation of policy measures, etc.

POLICIES AND MEASURES

STRATEGIES AND REGULATORY FRAMEWORK

Russia has adopted long-term governmental strategy and legislation on climate change. The Climate Doctrine of the Russian Federation for the period until 2020 (CDRF 2009) is a key document that guides climate policy. It officially acknowledges the threat of global warming to the country's security and sets tasks for formulating climate policy.

The CDRF 2009 outlines the framework for the contemporary climate policy in Russia and sets long-term policy objectives. These objectives focus on four priority areas related to scientific and research work: climate change, adaptation, mitigation and participation in international initiatives. The doctrine represents a framework cross-cutting strategy that is intended to be supported by a number of sectoral policies and programmes.

Several high-level strategic documents that guide developments in the energy, industrial and transport sectors may support the implementation of the CDRF 2009. They include the decree on Certain Measures to Increase Energy and Ecological Efficiency of the Russian Economy (2008), the federal law On Energy Saving and Energy Efficiency of the Russian Federation (2009), the decree On the Main Directions of State Policy in Improving Energy Efficiency of the Electric Power Industry Based on Renewable Energy Sources until 2020 (2009), State Energy Saving and Energy Efficiency Improvement Programme Until 2020 (2010), Draft Transport Strategy of the Russian Federation to 2030 (2012), the state programme Energy Efficiency and Energy Sector Development (April 2013), and the prognosis Long-Term Socio-economic Development Until 2020 (March 2013). The State Programme No. 2446 on Energy and Energy Efficiency for the Period up to 2020, approved by the government in 2010, assumes that a set of measures would reduce GHG emissions by 673.5 million tonnes of carbon dioxide-equivalent ($MtCO_2$-eq) from 2011 to 2015, and by 2 436 $MtCO_2$-eq during the entire implementation period (2011-20). Another new Governmental programme of the Russian Federation "On Energy Efficiency and the Development of Energy", developed by the Ministry of Energy and approved on 3 April 2013, includes a GHG goal of reducing emissions by 393 $MtCO_2$-eq by 2020.

However, many of these strategies do not include GHG emissions reductions as main or even associated objectives; they also do not facilitate accounting and reporting of associated emissions reductions. Objectives and policy approaches outlined by these documents should be checked against climate policy objectives and vice versa to secure a coherent and consistent national energy-climate strategy.

In 2011, the government adopted the Comprehensive Action Plan (CAP) for Implementing the Russian Federation's Climate Doctrine for the Period until 2020, which translated the CDRF 2009 into practical implementation steps in relation to its priority areas. CAP also defines the roles and responsibilities of the ministries and agencies involved in its implementation. It contains provisions for co-operation among agencies, and includes relevant arrangements for monitoring of the implementation. In this context, it is important to ensure that newly developed sectoral strategies and policies mentioned above are formally linked to the CAP and its implementation.

The CAP also warns about climate change impacts on Russia and suggests that they will manifest themselves in the form of increased frequency and intensity of meteorological phenomena such as floods, winter melts, storms and droughts, with potentially severe impacts for agricultural production and housing, but also for oil pipelines and pumping facilities in the north, leading to possible disruptions of hydrocarbon exports. Adaptation to climate change so far has been considered for Russian forests, and some location-specific measures have also been suggested for the most vulnerable areas (e.g. permafrost zone).

DOMESTIC MEASURES

There are no climate-specific domestic policy measures that would purposely facilitate reductions of GHG emissions, although this situation may change in the near future. The Ministry of Economic Development is leading stakeholder consultations on possible economic instruments to address GHG emissions, including a possibility of setting up a domestic emissions trading scheme. While these discussions are important and necessary steps in policy designing, they still have not led to any official proposals. According to the presidential decree No. 752 from 30 September 2013 On Greenhouse Gas Emission Reductions,[8] the government is obliged to prepare by 30 March 2014 indicators for sectoral emissions reduction contributions as well as an action plan for the implementation of specific measures that would facilitate these reductions. The government is currently developing the plan of action that would include a set of measures to facilitate emissions reductions specified by the decree. It is anticipated that the plan of action will include such suggestions as development of concepts for GHG emissions reporting at the company level; development of GHG emissions performance requirements for companies; drafting of relevant laws, regulations, technical guidelines, building scenarios for GHG emissions and emissions reduction potential; development of sectoral indicators of GHG emissions reductions; implementing pilot projects on GHG emissions reductions; and others. Once these provisions are translated into policies and tools with implementation schedules as well as incentive and enforcement mechanisms, they will constitute a functional policy framework for GHG emission reductions in Russia.

One important step in implementing climate goals would be the development of a company-level GHG accounting system. Such a system would provide detailed information on emissions and their trends from the major stationary sources of GHG emissions in Russia. It would be an important prerequisite for setting up a domestic carbon pricing system for GHG emissions control, be it a domestic carbon market or a carbon tax.

There are several energy policy measures that could facilitate substantial GHG emissions reductions if successfully implemented. As highlighted earlier in this section, policies to promote energy efficiency and renewable energy sources (RES) as well as other relevant strategic priorities for the energy sector are so far the only policy drivers for GHG emissions reductions in Russia. In addition, they also have potential to deliver multiple co-benefits to the economy and society, such as a reduction in air pollution or a decrease in the energy consumption and related energy bills of households, public buildings and industry.

8. This decree sets the goal of 75% GHG emissions reductions by 2020 from 1990 levels.

Phase-out of ageing infrastructure and assets

The governmental order No. 398 demanding the development of a set of measures on transitioning from old and inefficient technologies to new, modern and best available technologies could also facilitate the necessary modernisation of the Russian economy and the energy sector in particular. The proposed set of measures that includes, among others, provisions for the development of related regulations, technical requirements, financing, roadmaps for modern technologies integration and pilot project implementation, could facilitate an effective transition if they are clear, targeted, developed in consultation with the industry and made available in the near future. It is also important to envisage incentives for companies to adopt new technologies.

The reform of the Russian electricity market, launched in 2003, is expected to have a substantial impact on Russia's energy sector. Investments in efficiency improvements and replacement of outdated infrastructure with new and efficient capacity will determine the success of these reforms. Environmental performance of the sector will also improve as a result of these investments.

Improved efficiency of the energy sector would lead to reduced carbon intensity as well as reductions in other pollutants. As plants age and become less efficient, the relative amount of CO_2 emitted increases; other pollutants such as particulate matter (PM), nitrogen oxides ($NO_{x)}$ and sulphur dioxide (SO_2) also increase. Setting stringent air quality requirements would force old power plants to either invest in upgrading or close down if rehabilitation work is too expensive in relation to the remaining productivity of the plant. Retirement of old and inefficient plants would reduce overall air pollution and CO_2 emissions if these plants are then replaced with more efficient and/or lower carbon fuelled plants. Rehabilitation of a plant to improve performance will also reduce air pollution as well as the CO_2 emission rate, especially if the rehabilitation process involves a significant improvement in the energy efficiency of the plant. This is also the case of the district heating sector, where the heat generation infrastructure is ageing and would operate in a more efficient way if modernised. Modernising transmission networks would also reduce heat losses in the supply chain (see Chapter on "District Heating").

Upgrading an outdated capacity may be a particular problem in rapidly growing economies where there is already an energy deficit or in economies where there has been a lack of investments in new modern capacity. The option of removing a plant for upgrading is not tempting to most operators, especially when there is an uncertainty of final cost and time-out period. In order to minimise risk and "surprises", the shutdown period must be well planned in advance and all eventualities considered.[9]

The excess of outdated capacity is a problem and it will persist as long as there are factors in favour of extending the life of existing plants. Environmental regulations that impose tighter emissions standards on newer facilities give older facilities an operating cost advantage over new plants. Introducing emissions performance standards for existing plants would facilitate gradual decommissioning and improvement of the efficiency of the power sector. This can be done according to an agreed schedule that would incorporate gradual tightening of requirements and appropriate time intervals, so that companies are given enough time to make decisions and necessary improvements. One option could also be to allow some plants to run for a certain number of hours per year (partial functioning), and that by a decided date either be ready to shut down or comply with stringent requirements.

9. Sloss, L. L. (2011), *Impact of Emissions Legislation on Coal-Fired Power Plants*, CCC/145, London.

Energy efficiency and renewable energy

The legal framework to promote energy efficiency can bring substantial reductions in CO_2 emissions if effectively implemented. The IEA estimated that if Russia used energy as efficiently as comparable member countries of the Organisation for Economic Development and Co-operation (OECD) in each sector of the economy in 2008, it could have achieved an annual CO_2 savings of 325 Mt from gas, 71 Mt from oil and 124 Mt from coal or around 1/3 of total CO_2 emissions in 2008.[10]

Legislative and regulatory provisions with the aim of increasing the production of electricity from RES could also facilitate CO_2 emission reductions. According to International Finance Corporation calculations, if 4.5% of electricity in Russia could be produced with RES in 2020, this could bring a GHG emission reduction of approximately 18 $MtCO_2$/yr.

Higher associated gas utilisation

Another example comes from fugitive and flared emissions from upstream oil and gas production. During upstream oil production, a large amount of associated gas is either flared or escapes as fugitive emissions. Methane is a highly potent GHG; its warming potential is much higher than that of CO_2. The rate of utilisation of associated gas produced by oil companies improved between 2002 and 2010, with the amount of gas produced (and not flared) by oil companies increasing, both in absolute terms and when considered relative to oil production. The numbers reported for utilisation of associated gas vary between 50% and 95%, depending on the companies, with an average around 75%, but some scepticism has been expressed concerning these values since more than 50% of the flares do not have meters. The government has taken resolute steps to bring the utilisation level of associated gas to 95% which, if achieved, would have a major impact on emissions reduction (see Chapter "Natural Gas"). The government should follow through with this policy implementation and encourage comprehensive monitoring, reporting and compliance with the rule.

Transport sector

Within the energy sector, road transport is the fastest-growing sub-sector in terms of energy consumption driven by the growing number of private cars at the expense of public transport. According to Rosstat, the number of privately owned passenger vehicles increased from less than 20 million in 2000 to over 31 million in 2009 (from less than 10 million in 1991). Emissions from road transport will continue to grow in the future, as private car ownership is still far below the levels in most developed countries, albeit the progressive modernisation of the car fleet may lead to some efficiency improvements.

In June 2012, the President of the Russian Federation required the government to adopt a set of measures to facilitate an enhanced use of gas as motor fuel. Following this order, the government issued a decree on 13 May 2013, No. 767 that calls for the creation of a plan of action in this regard. The decree calls on the relevant ministries (including the Ministry of Energy) to suggest regulations by 1 December 2013 that would facilitate the use of gas as motor fuel, including natural gas. This includes setting requirements and a subsidy scheme, tax differentiation, facilitative infrastructure, statistical support and regular reporting. In terms of specific requirements, the decree calls for all relevant ministries

10. IEA (2010), *Clean Coal Centre*, www.iea-coal.org.uk/site/2010/home.

to develop by 1 January 2014 a set of measures that would bring the level of use of gas in all public motor transport and all city transport services by 2020 to the following requirements:

- in cities with a population of more than 1 million people, up to 50% of all units
- in cities with a population of more than 300 000 people, up to 30% of all units
- in cities with a population of more than 100 000 people, up to 10% of all units.

There are currently around 100 000 natural gas vehicles in Russia and 250 compressed natural gas (CNG) filling stations. Gazprom is supporting a steady expansion of the CNG infrastructure and this is expected to boost natural gas use in road transportation by an average rate of 13% per year.[11]

Other measures that focus on developing a non-road transport infrastructure are mentioned in the Draft Transport Strategy to 2030 and should be further evaluated and seriously considered. Russia has an extensive railroad infrastructure as well as the established public transport tradition. The improvement and expansion of railroad and other public transport could reduce local and GHG pollution if a substantial number of cars could be taken off the road. Improved and expanded electric and gas-fuelled public transportation in cities together with increased restrictions on private vehicles (e.g. through limited parking in city centres but improved parking on city edges near public transportation hubs) would not only reduce emissions but improve congestion and mobility in cities.

CCS technologies

CCS may become a necessary component of the Russian energy sector under aggressive climate objectives in the long term. This technology can help reduce emissions from the power sector and industrial sectors such as steel, cement, refineries, gas production, and pulp and paper. However, so far CCS has not been seriously considered by the Russian policy makers. This technology is not well understood and analysed in Russia, although some research and development work has been done in Russia to understand CO_2 capture technologies (mainly by the All-Russia Thermal Engineering Institute), and potential for CO_2 storage. A small pilot CCS project in the Kuzbass coal region is being developed. The goal of the project is to capture CO_2 from the mine boiler and store it in unmineable coal seams. In addition, there has been some technical and analytical research on CCS opportunities in Russia. The Russian technology platform on clean power considered CCS as a long-term option and made progress in getting support from various stakeholders involved in this process. It would be important to continue these discussions in Russia and build on the knowledge and understanding developed so far. It would also be beneficial for relevant Russian experts, government and industry decision makers to participate in international discussions on CCS as well as joint research projects.

UNFCCC MARKET MECHANISMS

Russia ratified the UNFCCC on 4 November 1994, and in 2004 joined the Kyoto Protocol to the UNFCCC. The Federal Law on ratification was signed by the President of the Russian Federation on 4 November 2004.

As an Annex I country of the UNFCCC and Annex B party of the Kyoto Protocol, Russia is eligible for joint implementation (JI) and international emissions trading mechanisms

11. IEA (2011), *World Energy Outlook 2011*, OECD/IEA, Paris.

under the Kyoto Protocol. However, Russia significantly underutilised these market opportunities in attracting foreign and domestic investments in decarbonisation measures.

Russia has managed to host a substantial number of JI projects, but the scale of emission reduction units (ERUs) sold and revenues channelled into the economy is far below the initial expectations. The government took a long time to prepare adequate procedures to utilise JI opportunities. Until 2011, the system was highly bureaucratised and a competitive mechanism for selecting projects was overly sluggish. In September 2011, the government issued resolution No. 780, On Measures for Realisation of the Article 6 of the Kyoto Protocol to the UNFCCC. At that time significant changes were introduced and the JI mechanism started operating effectively. Sberbank was appointed as the project operator. A total of 150 applications have been submitted for approval with a total volume of 381.3 $MtCO_2$-eq of emissions reductions. As of October 2012, 108 projects had been approved, earning Russian corporations about USD 600 million. The Russian registry of carbon units has been fully operational since March 2008. It is also linked to the international transaction log. The government stopped approving JI projects in May 2012 because the limit set by Government decree No. 780 of a maximum of 300 Mt of ERUs that can be transferred as part of the implementation of Article 6 of the Kyoto Protocol was exceeded. Despite losing several years and probably substantial amounts of carbon investments, Russia still played a dominant role in the market of JI projects. The future of JI in Russia is uncertain given that Russia has refused to participate in the second phase of the Kyoto Protocol and it is still not clear what market mechanisms will be available in a new climate agreement that is currently under negotiations. Russia may be interested in negotiating market-based instruments in the future agreement that would be appropriate for Russian conditions and could also be implemented by using the already established infrastructure and legal provisions.

JI has certainly provided Russian businesses with an opportunity to implement climate-friendly projects, and has raised awareness regarding climate, emissions reductions and energy efficiency. JI projects involved 250 Russian companies. Although there are no mandatory requirements on the way to spend the revenues from JI projects, participants in such projects must submit an investment declaration on plans to invest such revenues in environmental and energy efficiency projects.

IMPACTS OF CLIMATE CHANGE ON THE ENERGY SECTOR AND ADAPTATION MEASURES

Observations show that the intensity of warming in a considerable part of the territory of Russia exceeds the average global intensity. Over the past 100 years, the average surface temperature in Russia has increased by about 1.3 degrees Celsius (°C), compared with less than 0.8°C in the world as a whole.[12] The overwhelming proportion of this warming has occurred in the last few decades. Observation data show that average warming in Russia between 1976 and 2012 was 0.43°C per ten years while global temperature was growing at a rate of 0.17°C per ten years.[13] According to most climate models this trend will continue in the future.

12. RosHydromet (2012), *Climate Change Assessment Report*, Moscow.

13. Ministry of National Resources and Environment of the Russian Federation (2013), Sixth National Communication of Russia to the UNFCCC, Moscow.

The increased surface temperatures have already affected energy consumption in the central part of Russia, especially during winter months when the trend of a decreasing heating demand compared to historic levels has been observed. For example, a comparison was made between the situation in December 2010 when the monthly temperature was within the norm (-11.9°C) and December 2011 when the average monthly temperature in the European part of Russia exceeded the average temperature by 5.4°C. The reduction of energy consumption in December 2011 in this part of Russia amounted to 1.8% in comparison with the similar period of 2010. Estimates show that relative change in heat consumption value in large regions of Russia could impact the total energy consumption by 20% on average, compared with the present level.[14]

The expected reduction of power consumption for building heating prevails on the largest part of the territory of Russia, according to scenarios. An increase in summer power consumption was also observed during the last 20 years. For example, a significant growth in power demand is recorded in the Southern region (about 150 cooling degree days per ten years) and has been linked to climate conditions. Today the growth of actual power consumption in the summer period is constrained by the low income of the population, but this situation is already changing. These shifts in historical levels of energy demand should be considered in estimates of power consumption in the long term (up to 2050). They should also be taken into account when updated building standards are being developed.

Some assessment of climate change impacts and potential adaptation measures for various geographic regions and economic sectors of Russia have been developed by RosHydromet.[15] Other studies have been carried out for specific cities or by energy companies that anticipate risks to their activities from climate change impacts. Several studies conducted in Russian cities, including Moscow and Tver, evaluated impacts of heat waves and long periods of extremely hot weather. They concluded that the frequency and severity of heat waves have increased over the past decade. These studies detected some negative consequences for morbidity and mortality in some groups of the population and suggested that the risks for vulnerable groups of the population will grow in the 21st century.

Some of these studies were initiated after a dramatic and unprecedented heat wave affected the central European part of Russia in 2010. The summer of 2010 was the hottest on record in Russia: In the European part of Russia and the southern Urals the variation from average summer temperatures was over 6°C (RosHydromet, 2011). The damage to productivity from the hot weather in 2010 was around RUB 250 billion to RUB 280 billion, or 0.6% of GDP. While not quite as hot, 2011 continued the run of summers well above trend temperatures.

One of the negative effects of climate change on the Russian economy and living standards will be caused by permafrost melting. In the second half of the 20th century, especially in the last quarter, many sections of the permafrost zone experienced increased temperature of the upper layer of the permafrost, and in some regions there was an increase in the depth of seasonal permafrost thawing.[16] Permafrost currently covers 63%

14. Voeykov Main Geo-physical Observatory (2013), *Final report on the project influence of climate change on energy production and consumption in Russia*.

15. Federal Service on Hydrometeorology and Monitoring of the Environment (RosHydromet) (2012), *Methods of assessment of climate change impacts on physical and biological systems*, Moscow.

16. Ministry of National Resources and Environment of the Russian Federation (2013), Sixth National Communication of Russia to the UNFCCC, Moscow.

of the territory of Russia, but over the next 25 to 30 years this area is expected to be reduced by 10% to 18%,[17] adversely affecting buildings, transportation facilities, and oil and gas infrastructure. There are already reports of an increase in accidents related to pipeline networks in permafrost regions.[18] In addition, drilling infrastructure has also been affected. It was estimated that permafrost melting and its impacts on the conditions for drilling holes and recovery led to 10% to 20% losses of productivity.[19]

ASSESSMENT

Russia is one of the world's largest CO_2 emitters, and its emissions have been growing in the last decade, albeit slowly, due to economic expansion that has been occurring since early 2000. Its aspiration to modernise the economy and improve efficiency of its energy sector offers an opportunity to reduce GHG emissions while pursuing economic development objectives. Many of the energy policy objectives currently in place could effectively limit the future increase of CO_2 emissions, if implemented. Russia has also introduced specific climate change targets and policy objectives and continues developing supporting legislation. Given the opportunities for cost-effective emissions reductions, including co-benefits for the local economy and society, Russia should consider taking a more leading role in the global effort to reach a new international agreement and move towards decarbonisation.

Effective implementation of already-defined energy policy objectives, supported by a proper accounting of associated GHG emissions reductions, would be an important step in Russia's contribution to reducing GHG emissions. Implementation of energy efficiency objectives should be a priority for Russian policy makers as it will have multiple benefits, from reduced energy costs to improved air quality and reduction of GHG emissions. Further engagement in a long-term strategic approach to addressing climate and energy concerns through a coherent policy package would position Russia as a strong international player in the global effort to address climate change.

Additional regulatory and institutional arrangements are needed to effectively harmonise energy and climate strategies. The empowerment of leading ministries including the Ministry of Energy, with responsibilities for policy implementation, is needed, and it seems that Russia is moving in this direction. Another issue of concern is the limited human resources capacity within the relevant ministries to deal with climate issues.

For Russia as everywhere in the world, ambitious, clear and long-term GHG emissions reduction objectives and related policies are needed to provide incentives and long-term certainty for businesses to invest in new low-carbon technologies. Carbon pricing (through emissions trading or carbon taxes) is considered to be the cornerstone of an effective climate policy. While Russia is moving towards a domestic carbon pricing system, it needs to be aware that it may take a couple of years for such a system to start operating even once it is already in place. Further developing a clear plan of action in this respect and setting a date for implementation would provide certainty to companies and create conditions for their decision making on cost-effective ways of implementation and

17. Federal Service on Hydrometeorology and Monitoring of the Environment (RosHydromet) (2012), *Methods of assessment of climate change impacts on physical and biological systems*, Moscow.

18. O. Anisimov, A. Velichko, P. Demchenko, A. Eliseev, I. Mokhov, V. Nechaev, (2002), "Effect of Climate Change on Permafrost in the Past, Present and Future," *Atmospheric and Oceanic Physics*, 38 (1).

19. Federal Service on Hydrometeorology and Monitoring of the Environment (RosHydromet) (2012), *Methods of assessment of climate change impacts on physical and biological systems*, Moscow.

compliance. Two special groups within the government were created to analyse an opportunity for the use of a national carbon market as a stimulus for GHG emissions reductions. Important discussions on carbon market options for Russia are now going on at a high level. The timing is ripe to transform this interest and stakeholder consultations into concrete policy proposals and actions. The first step in this direction should include the establishment of a company-level GHG reporting system.

However, given market and non-market barriers that sometimes prevent markets from working efficiently as well as the need for innovation and deployment of new non-commercial technologies, supplemental policies are needed. Additional policies – for example those that target innovation and offer support for investments in new low-carbon technologies – should also be considered. Russian Environment Ministry policy makers may also consider more stringent air pollution regulations for power plants (for mercury, SO_2, NO_x and PM) that could also facilitate a shift to more efficient, less carbon-intensive power production. A whole set of energy efficiency policies are being developed in Russia; these policies are described in the Energy Efficiency chapter. Efforts should be made to facilitate their implementation.

Transportation is a growing source of emissions, affecting air quality in cities and producing climate-related GHG emissions. While localised actions to address emissions from transport take place, Russia could benefit from more comprehensive policies in this area including the use of gas or biofuels in transportation as well as expansion and improvement of non-road public transportation in cities.

A reduction in gas flaring and fugitive emissions from upstream oil and gas production offers a short-term opportunity for GHG emissions reductions and business opportunities for the use of the associated gas. Implementation of policies to reduce fugitive and flared emissions should be another area of priority for the government. It has already taken important toward this goal. Assessments of GHG benefits should also be carried out.

Some assessments of the potential impacts of climate change on the Russian energy sector and in particular on its infrastructure are under way. There is a growing awareness of economic impacts (including costs of distraction caused by extreme weather events) of climate change on various sectors of the Russian economy, including on the energy sector. However, a more systematic approach to such assessments and integration of their conclusions into policy making is needed. Making the energy sector climate-resilient by anticipating future changes will benefit the Russian economy in the long term.

RECOMMENDATIONS

The government of the Russian Federation should:

- ☐ *Consider a more prominent role in global efforts on decarbonisation and GHG emissions reductions.*
- ☐ *Harmonise climate change and energy strategies and encourage specified GHG emissions reductions through appropriate energy and environmental policies. Evaluate opportunities for structural changes to address climate change, such as for example, replacing old coal power plants with new high-efficiency coal-fired power plants that are CCS-ready.*
- ☐ *Encourage implementation of measures related to energy efficiency and RES as defined by the government and document associated GHG emissions reduction.*

- *Encourage implementation of measures to facilitate the use of gas in transportation, starting from public transport. Consider policies, including favourable tariffs, to encourage rail transport expansion for goods transportation.*
- *Ensure full implementation of regulations addressing the reduction of methane emissions from upstream oil infrastructure; expand these regulations to incentivise use of coal mine methane.*

PART II
SECTOR ANALYSIS

5. NATURAL GAS

Key data (2012)

Production:* 654.4 bcm, +12% since 2002

Imports:* 33 bcm

Total exports:* 219 bcm, +13% since 2002

Share of natural gas: 51.8% of TPES and 49.1% of electricity generation

Inland consumption: power generation 62.5%, industry 17.3%, residential 8.2%, transport 7%, other transformations 4.4%, commercial 0.7%

* Source: Gazprom data.

OVERVIEW

Russia's gas sector has undergone major transformations in the upstream, midstream and downstream segments over the past five years that have enhanced the long-term reliability of gas supplies in Russia and to European countries and beyond. Gazprom is successfully managing the transition from operating the legacy gas fields to one based on new greenfields – primarily Bovanenkovo. Independent companies have rapidly increased their share of domestic gas production, in particular Novatek. Gas production is moving to the Yamal area, as well as to the Yakutsk and Irkutsk centres in the longer term, and liquids-rich gas and deeper gas layers are increasingly produced.

Russian companies have the capacity to produce much more gas than domestic and foreign markets can absorb. The domestic gas pipeline network has been partially modernised and expanded, and the export pipeline infrastructure, with Nord Stream, has been developed to foster the security of Russian gas exports to key European markets. Russia also started exporting liquefied natural gas (LNG) from the Sakhalin plant in the Far East, which could become another major production centre in future, supplying Asian markets. A number of new LNG projects, more or less advanced, will increase the share of Russia in global LNG trade in the medium to long term.

The downstream market is also transforming from a monopoly to an oligopoly for supply and distribution. Regulated wholesale prices have been rising in past years, and independent companies are increasing their market share in benefiting from free tariff setting, lower upstream taxation and improved access to the pipeline system. This has been accompanied by important regulatory changes which need to be further continued and streamlined to develop a more competitive, transparent and efficient gas market that can support the competitiveness of the economy.

In addition, Russia now needs to ensure the success of its strategy aimed at opening new gas export outlets to the booming Asia Pacific region and take the appropriate steps to benefit from this golden opportunity.

SUPPLY

Russia holds the world's largest gas reserves and is the world's second gas producer after the United States. In 2012, domestic production was 654.4 billion cubic metres (bcm) and reached almost 670 bcm in 2013. The share of associated petroleum gas in 2012 is 8.4% of the total and in constant increase, from 42.6 bcm in 2005 to 54.7 bcm in 2012. Peak daily gas production was reached at the end of 2011, with 2.1 bcm per day.

Gazprom, a state-controlled company,[1] is Russia's largest producer with 487 bcm of gas in 2012 (down by 5% from 2011), 487.4 bcm of gas in 2013 extracted from 127 fields and 7 226 existing gas production wells.[2] Gazprom's production in 2012 reached its second-lowest level in the past ten years at a time when Gazprom launched its super-giant Bovanenkovo field and increased plateau production from the Zapolyarnoye field. Indeed at the same time, Gazprom reduced imports of Central Asian gas, purchases of gas from independent companies and its legacy fields continued to post a progressive decline in output. Production was flat in 2013 at 487.4 bcm. In autumn-winter 2012/13, the company's maximum daily gas production was 1 658 bcm (+50 million cubic metres [mcm] year-on-year). Gazprom's production capacity in 2014 is 600 billion cubic metres per year (bcm/yr). Reasons for Gazprom producing below its potential in more detail in the subsequent sections and - include: no increase in overall export volumes, no increase in domestic gas consumption, steady imports from Central Asia and the Caspian since 2010, and growing competition from independents on the domestic market.

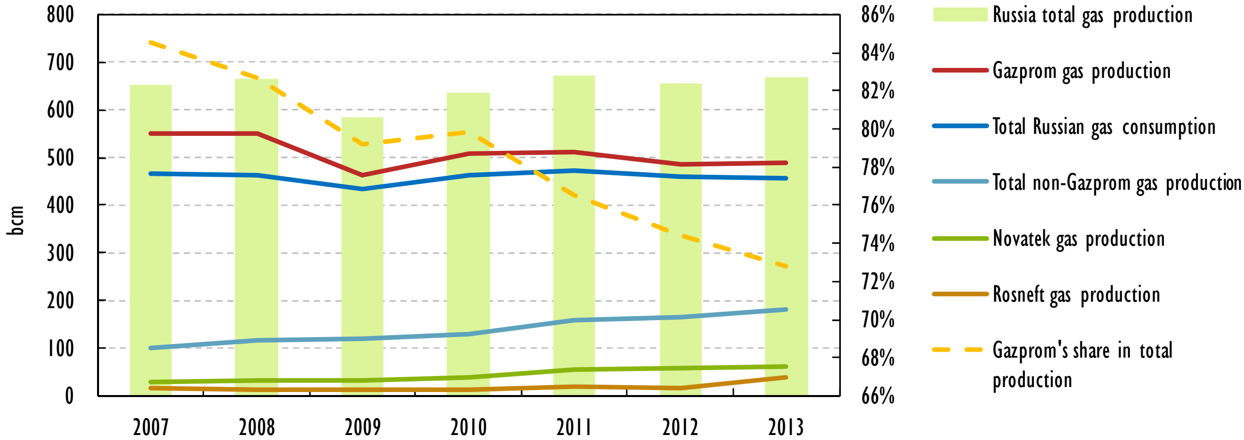
Whereas Gazprom remains by far Russia's leading producer, its share in total production has been steadily decreasing over recent years. Three companies represent the bulk of Russia's production: Gazprom (73.1%), followed by Novatek (12.6%) and Rosneft (5%). Indeed, the share of non-Gazprom production from so-called "independent" producers – this is how these companies are referred to in the Russian official regulations – has been constantly increasing, mainly driven by Novatek. As a consequence, the share of Gazprom in total production has declined from about 83.3% in 2007 to 73% in 2013. Reasons include lower domestic demand and lower exports to Ukraine, its commercial strategy, and higher production from independents benefiting from a more favourable tax and regulatory environment, such as the right to sell gas at non-regulated prices.

Combined production from independent producers Novatek, Rosneft, Lukoil, Surgutneftegaz, Russneft, Tatneft and Bashneft (ranked by order of production level and excluding production from joint ventures involving Gazprom and foreign companies) dropped by 5% to 128.6 bcm (about 19% of Russian gas production) in 2012, in line with the decline from Gazprom production that year. This is nonetheless a considerable increase over 2005 levels (79 bcm or 12.3% of Russian production). When considering the overall difference between Russia's total production and Gazprom's production, which also includes gas produced at joint ventures with foreign companies, it appears that the difference passed another record in 2012 at 167.4 bcm, up from 104 bcm in 2007 – a 62% increase. The trend continued in 2013, with non-Gazprom production increasing to 182 bcm.

1. In September 2013, the state controlled 50.01% of the company through Rosneftegaz (10.97%); the Russian Federal Property Agency (Rosimuschestvo) (38.373%); and Rosgazifikatsiya, a company in which Rosimuschestvo owns 74.55%, has 0.889% (the state's effective share in this block being 0.662%). Another 25.86% of Gazprom's shares are traded as depositary receipts as of 8 July 2013. Gazprom subsidiaries own 3.1% of the company's shares.

2. Gazprom (2013), Annual Report 2012, www.gazprom.com/investors/reports/2012/.

Figure 5.1 Gas production by leading Russian gas companies, 2007-13



Sources: Ministry of Energy of the Russian Federation; Gazprom Annual Reports, www.gazprom.com; Novatek Annual Reports, www.novatek.com.tw/ir/AnnualReport.asp; Rosneft Annual Reports, www.rosneft.com/Investors/results_and_presentations/annual_reports/; IEA calculations.

In total, there were about 260 gas-producing companies operating in Russia on 1 January 2013, including 8 vertically integrated oil companies, 113 oil companies, 14 companies affiliated with Gazprom, 2 affiliated with Novatek, 128 independent companies and 3 companies operating within the framework of Production sharing agreements (PSAs). Some foreign companies are active within joint ventures: SeverEnergia, initially a joint venture among GazpromNeft, Novatek, Enel and ENI (in autumn 2013, Enel sold its stake to Rosneft, and ENI sold its stake to Novatek and GazpromNeft, and subsequently Rosneft and Novatek made an asset swap – Novatek's stakes in Sibneftegaz in exchange for Rosneft's stakes in SeverEnergia – so that Novatek ended up controlling a 59.8% of SeverEnergia), started producing 1.8 bcm in 2012 at the Sumburgskoye field, which is the first to be developed. Production reached 5 bcm in 2013 as a second gas treatment train was put in operation in December 2012. Novatek in March 2014 then announced it had sold further stakes to GazpromNeft, bringing its ownership to 50%. The third train of the Samburgskoye field is to be launched in 2014, which will enable ramping up production at the field to 7 bcm per annum. SeverEnergia holds a number of additional licences in the Urengoyskoye area (Yaro-Yakhinskiy, Severo-Chaselskiy and Yevo-Yakhinskiy) that will further increase production: production will start at the Urengoyskoye and Yaro-Yakhinskoye fields in 2014, which have overall production capacity of more than 21 bcm per year. Total annual production could be as much as about 35 bcm by 2017 (on top of 145 000 barrels per day of gas condensate).

The Yuzhno-Russkoe field in the Yamal-Nenets Autonomous District (YNAD), developed by a joint venture among Gazprom, E.ON and Wintershall, may well produce 5 bcm to 8 bcm more than the current 25 bcm following the success of a pilot project to tap complex Turonian gas deposits.

Some small gas companies are successfully operating small fields with about 130 bcm of ABC1 reserves in total (such as JKX, Eurotek (Repsol, Alliance) and Severnet Urengoi. There are still a number of unlicensed oil and gas fields with over 100 bcm of ABC-1 reserves, and barriers to their development include some high sulphur content or organisation challenges when teaming up with local company.

As noted earlier, Novatek experienced the largest increase in production among independent producers over the past ten years, almost tripling output from 20.9 bcm in 2004 to over 60 bcm in 2013. This increase came from bringing new fields online (such as Yurkharovskoye phase 2) and expansion of its gas processing capacities, but also acquisition of assets: notably in 2010, a controlling stake in Sibneftegaz (swapped later on), in 2012, a 49% stake in Nortgas, and in 2013, the consolidation of stakes in SeverEnergia and Nortgas. As a consequence, the production growth is not entirely related to Novatek's initial fields and resources. Nortgas, a 50-50 joint venture between Novatek and Gazprom, holds the licence for the Severo-Urengoyskoye gas condensate field located in the YNAD, which produced about 3.5 bcm in 2013 and is likely to produce about 10 bcm in 2014 as a total of 18 wells will be in operation, alongside the Purovsky gas processing plant. The company more than doubled its proven reserves from 2008 to 2012, to 1.75 trillion cubic metres (tcm).

Following the merger with TNK-BP, Rosneft posted higher gas production levels (16.39 bcm in 2012, 38.17 bcm in 2013), mostly associated gas.[3] Rosneft's production potential from associated gas, some new greenfields and continued acquisition of assets drives its strong ambitions to enter the domestic gas production and export segments. The company is poised to become a significant gas producer over the current decade. In 2013, Rosneft gradually acquired 100% of Itera, a significant independent gas producer with declining production (12.7 bcm in 2011) but with a larger end-consumer portfolio (23 bcm marketed in 2011). Rosneft also acquired gas production assets from Alrosa and took control of Sibneftegas. Rosneft will be developing gas production from the Kynsko-Chaselskiy group of fields and especially from the Kharampur gas field in West Siberia (YNAD) set to start in 2016 with some 8 bcm, with an expected yearly plateau production of 20 bcm in the longer term. In addition, as Rosneft's oil production grows and as the company is compelled to comply with stricter gas flaring reduction targets, so will its marketable associated gas production, as Rosneft is actively pursuing projects aimed at processing associated gas, such as at its Vankor oil field.

Following its acquisition of TNK-BP, Rosneft is also building on TNK-BP's own plans set out in 2011 to produce 35 bcm of gas by 2020, up from 13.2 bcm of mostly associated gas in 2012. Indeed, TNK-BP was working to maximise associated gas utilisation and its subsidiary Rospan International holds licences to develop two gas and condensate fields in YNAD, Vostochno-Urengoiskoe and Novo-Urengoiskoe. Rospan, which produced 3.5 bcm in 2012, is currently developing the deep gas reserves of the Valangin and Achimov formations in these fields. According to TNK-BP, work was under way for the Phase 1 ramp-up to 8.5 bcm by late 2016 and to 16 bcm by 2020.

CURRENT KEY PRODUCTION IN REGIONS AND BY FIELDS

West Siberia, and in particular Nadym-Pur-Taz in YNAD are Russia's key gas production regions. Indeed, the Yamal peninsula holds 27% of gas reserves in Russia (11 tcm). The YNAD represents 80% of Gazprom's production and contains more than 50% of its reserves. Production from Gazprom Dobycha Yamburg fields slightly decreased in 2012 to 196 bcm (from 203 bcm in 2011). The Urengoy oil, gas and condensate fields, Gazprom's key super-giant production field containing dry gas in its Cenomanian reservoirs, has been in operation since 1978. Gazprom's giant Zapolyarnoye field, which has been producing since 2001, reached a plateau level higher than initially planned at 112 bcm of gas in 2012 and 130 bcm in 2013.[4]

3. www.rosneft.com/news/pressrelease/04022014.html.

4. Discovered in 1965. The overall Zapolyarnoye gas field's reserves account for 3.3 tcm, of which 2.6 tcm lie in the Cenomanian layers and 735 bcm in the Valanginian layers.

On the Yamal peninsula, Gazprom's giant Bovanenkovo gas field with estimated reserves of 4.9 tcm of gas started operations in October 2012. It is aimed at offsetting declining production in the traditional big three gas production areas (Urengoy, Yamburg, Medvezhe). Gazprom plans to spend another 25% of its capital expenditure (CAPEX) in the period 2013-20 to complete this megaproject. In 2012, gas production in Bovanenkovo was 4.9 bcm. In 2013, it was 22.8 bcm and in 2014, gas production is expected to reach 40.8 bcm. After 2017 it will reach the full capacity at 115 bcm, when 775 wells are expected to be operational and, finally, 140 bcm at a later stage – these targets may be revised in light of the development of demand in Russia and abroad, and in light of the production decline at traditional fields. The Bovanenkovo field's opening came later than initially expected (2011), which was opportune, given lower demand following the global economic and financial crises. In the longer term, this additional gas can help offset the expected decline in legacy fields (believed to be about 60% depleted on average as for the Cenomanian layers) and offer a source of production growth, should consumption increase in the coming years.

Finally, in the Far East, gas production currently reaches about 28 bcm; the largest source is Sakhalin feeding the LNG plant.

NEW LOCATIONS, NEW RESOURCES

Reserves of state-controlled Gazprom for the categories A+B+C1 amounted to 35.1 tcm as of January 2013, accounting for 72% of Russian gas reserves. In 2013, state-controlled Rosneft reported that it held 6.1 tcm of A+B+C1 gas reserves – these reserves would appear to be lower when using the classification of the Petroleum Resources Management System (PRMS). For example, Rosneft has 1.3 tcm of reserves under this classification.[5]

Box 5.1 Russia's system of reserve classification, recent changes and comparison with international standards

The Russian hydrocarbon reserves classification is specifically based on the analysis of geological parameters. While Russian oil and gas companies have been increasingly reporting under the Western accounting standards on reserves (the PRMS classification or the United States [US] Securities and Exchange Commission rules), estimates from Russian government and academic institutes generally use the Russian system of reserves classification dating back to Soviet times.

Currently, Russian mining companies assessing hydrocarbon reserves use "temporary classification of prospective and probable oil and combustible gases reserves filed" (order of Ministry of Natural Resources of Russia dated 7 February 2001, No. 126).

The current classification of hydrocarbon reserves, by the level of study, includes the following categories: A, B and C1, and preliminary inferred – C2.

"A" are reserves that have been fully ascertained through drilling and production. "B" are reserves that have been established through pilot drilling. "C1" are estimates for established fields, based on the obtained commercial flows of oil or gas, including parts that may not have been drilled and tested yet, but for which geophysical information is available. "C2" represents preliminary estimates based on data on geological and geophysical studies (geological work).

5. www.rosneft.com/Upstream/Reserves/.

Box 5.1 Russia's system of reserve classification, recent changes and comparison with international standards (continued)

Oil and gas resources are also categorised in terms of their degree of validity: advanced category C3, and forecast D1, D1 and D2.

Quantitative assessment of the resources is conducted on the basis of studies in the oil and gas region areas by geological and geophysical methods, or studies of new layers of deposits that are not opened until the drilling.

From 2005 to 2013, the Federal Agency for Subsoil Use (Rosnedra) worked to change the current Russian classification with the Russian oil and gas companies.

As a result, Rosnedra will create a new classification, according to the Decree of the Ministry of Natural Resources and Ecology of the Russian Federation from 1 November 2013, No. 477, which is expected to be implemented in 2016. According to the new classification, reserves could be classified depending on the degree of industrial development and geological knowledge: A (developed, drilled), B1 (developed, undrilled, explored), B2 (developed, undrilled, estimated), C1 (proven) and C2 (inferred).

The category A includes drilled deposits with production wells developed in accordance with the approved project documents.

The category B1 includes undrilled deposits with production wells, the development of which is planned in accordance with the approved project documents, and deposits were test drillings have been performed leading to commercial flows of oil or gas.

The category B2 includes undrilled deposits; their development is planned in accordance with the approved project documents, and seismic studies are justified on the basis of data of geological and geophysical studies and testing of individual wells.

The category C1 stands for deposits where no commercial development has taken place and no test wells have been drilled, and where estimations are done on the basis of geophysical and geotechnical studies.

The category C2 includes deposits, the presence of which is justified by these geological and geophysical studies and testing of individual wells during drilling.

There is no unique correspondence between the Russian classification and the PRMS one. But in general, industry experts assume that A, B and C1 reserves ("ABC1") lie in between proven and proven and probable; C1 and part of C2 correspond to probable and possible reserves technically recoverable. C1 and C2 are typically technically recoverable, not necessarily economically recoverable. A and B, as they are based on an approved development plan, are normally technically and economically recoverable. For gas, Russian assessments traditionally assumed a recovery coefficient of 1 (i.e. recoverable gas is 100%), a reason for the PRMS estimates to be smaller than "ABC1" values.

Russia's gas production sector is undergoing major changes that will be amplified in the coming decade. The centre of gravity of production has already started moving from Gazprom's traditional West Siberian top three fields, Yamburg, Urengoy and Medvezhe, to new resources in the Nadym-Pur-Taz, Yamal peninsula and Gydan peninsula, East Siberia, the Kara Sea, and the Far East. Gazprom forecasts that production from its current fields will decline by about 25% until 2020 and by 75% until 2030. As an illustration, the same West Siberian fields that were operated by Gazprom in 2010 and producing about 470 bcm are expected by Gazprom to dramatically see production fall to just above 100 bcm by 2030.[6] At the same time, Gazprom will further ramp up production from Bovanenkovo in the medium term. A number of new fields are likely to be commissioned in the medium term on the Yamal peninsula, in particular Novatek's South Tambei field, and Gazprom's Kharosovskoe and Kruzenshtern fields. Some additional production is also expected to come from deeper reservoirs at existing West Siberian fields, which will slow down the depletion of these fields. Finally, a number of smaller projects on existing production fields are set to provide some higher production. This is the case for the development of Achimov deep deposits at existing fields in the Nadym-Pur-Taz region. The YNAD is thus projected to remain the main gas production region in the coming years.

In the long term, other strategic production regions will be the Arctic shelf (Barents Sea, Kara Sea), and Eastern Siberia and the Far East (Sakhalin offshore and Sea of Okhotsk).

Arctic/Barents offshore

Russia is also a key Arctic country holding about 76.3 billion tonnes of oil equivalent (Btoe), with recoverable reserves estimated to be 9.6 Btoe. The gas reserves, estimated at 21.4 tcm, largely exceed the oil reserves estimated in the region. According to Rosnedra, reserves in the Barents Basin include 2.2 billion tonnes of oil and 1.2 tcm of natural gas. Nonetheless, oil reserves, especially in the Kara Sea, are likely to receive priority as they require less expensive infrastructure to be developed and exported.

Recent amendments to the Federal law No. 2395-1 "On Subsoil" in 2008 state that only companies with over 50% of state ownership and over five years of experience in marine exploration are allowed participate in auctions for licences on the continental shelf in Russia's Arctic regions. This means that no private companies are given access to these areas, in spite of Lukoil for example having extensive offshore experience (Korchagina field in the Caspian, for example) and conducting exploration activities in the Norwegian Barents Sea. Private companies have access within boundaries of internal seas and territorial seas – such as the Caspian, Azov and Black Seas. As a consequence, 80% of licences in the Arctic have already been attributed to Gazprom and Rosneft.

Arctic shelf exploration activities were advanced in 2012 and 2013 in line with the General Scheme for the Development of the Oil Industry in Russia until 2020. Rosneft and Gazprom were awarded a number of licensing rights for exploration, and expanded their geological surveys to assess this area's reserves. Following a recognition that Russian companies would need foreign partners for the successful development of these challenging resources, a number of independent oil companies (IOCs) entered into agreements establishing in most cases foreign-registered joint ventures with Rosneft on exploration of several licensing blocks located in the Kara, Barents and Okhotsk Seas, as well as the Black Sea. While the Russian company holds the licence, these agreements generally involve a shareholder agreement of 33.33% for the foreign company in the joint ventures, a commitment by the foreign company to finance exploration activities in line with licence obligations, and also to develop joint technologies.

IOCs teaming up with these two Russian state-controlled companies have to operate on a risk service basis and cannot own the licence. Indeed, under the current schemes developed for exploration works in the Arctic shelf, IOCs are minority shareholders in foreign-registered joint ventures in which Russian state companies Rosneft and Gazprom are majority

6. Gazprom Investor Presentation (2013), www.gazprom.com/investors/events-presentations/investor-day-feb-2013/.

shareholders. Foreign companies have insisted on foreign joint ventures to be established to benefit from greater legal security, and Russian companies and their foreign partners have established complex contractual frameworks to overcome gaps and uncertainties in the Russian legislation. As such, there is room to further clarify the Russian legislation and regulatory framework to facilitate these partnerships between foreign and Russian companies.

Should gas or oil finds be made and the decision taken to move to a production phase, then the Russian partner would generally reimburse its share of exploration costs. These agreements also involve a reciprocal equity agreement for some projects that these IOCs develop abroad, for example in North America, North Africa and the North Sea, allowing Rosneft to gain expertise and develop internationally, while also giving foreign partners an opportunity to gauge this co-operation. Such asset swap-type agreements are supported by the government and others could follow. As a consequence, these initial exploration activities involving foreign IOCs could open the way for a second wave of international partnerships under a new risk-sharing agreement model, following a first phase in the mid-1990s using PSAs where initially Russian companies were minority stakeholders. So far, this risk service model has been agreed by interested foreign companies and offers a sound approach to this joint development of resources, given that Russia is very clear that it does not want licences to be owned by foreign companies and rejects any return to PSAs. Licences are held by the Russian state company, and the foreign company can undertake exploration without the licence on behalf of the Russian state company. Yet the key challenge is now to ensure that an effective legislative and regulatory framework is in place to guarantee that the foreign company participation is not terminated after a discovery, to define the role of an operator and to accommodate the fact that the licence is strictly owned by a Russian company as well as that a robust framework is in place that protects minority rights of foreign partners.

Table 5.1 Licences distributed as of the end of 2013 for Russia's offshore blocks, including Arctic, Black Sea and Azov Sea (as of 31 December 2013)

	Licences attributed	Number of further applications pending
Gazprom	36	13
Rosneft	46	13
Other independents	38	

Source: Ministry of Natural Resources and Environment of the Russian Federation, www.mnr.gov.ru/.

The government has provided a number of fiscal incentives to foster exploration activities in the offshore Arctic, including: unlimited exemptions from the mineral extraction tax (MET), export tax exemption (yet with limitations, until 2042 for Arctic resources), and property tax and amortisation holidays (see Table 5.2). For the Yamal LNG project – an onshore project – the government has provided a MET exemption for up to 250 bcm of cumulative production and an unlimited export duty exemption.

In the concept note on the Energy Strategy to 2035, which was published in January 2014,[7] the government set the ambitious goal of increasing Arctic offshore production to 10% of total gas production in 2035. Achieving this objective would depend on production and transportation costs, especially if through LNG, and thus on the government's fiscal incentives.

7. http://minenergo.gov.ru/documents/razrabotka/17481.html.

Table 5.2 Key offshore exploration projects linking Gazprom and Rosneft with foreign companies

Foreign partner	Licence areas (number)	Offshore blocks	Comment/structure of the deal
Gasprom			
Total	1	Shtokman	Discovered in 1988 and located about 600 kilometres (km) off Murmansk, the Shtokman gas and condensate field is believed to hold 3.8 tcm of gas and 53.4 million tonnes (Mt) of gas condensate. In 2013, the project's development was postponed to after 2020 or even later as initial partners Gazprom, Total and Statoil did not take a final investment decision (FID) about challenges related to project design and costs. Statoil then left the project. According to Gazprom, field development would be divided into three phases. Phase 1 would allow for respective annual production of 23.7 bcm of gas, and Phase 2 would allow 47.4 bcm. The field is to reach its design capacity of 71.1 bcm/yr through implementing Phase 3 at a later stage.*
Gazprom (50%+1), Royal Dutch Shell (50%-1), Mitsui (12.5%), Mitsubishi (10%).	1	Sakhalin-2	This project is based on Russia's first PSA (1994, when Gazprom acquired a shareholding of 50%+1 share in Sakhalin Energy, the operator, in April 2007). It is Russia's first offshore and LNG project, with gas being sold by Gazprom to the Asia Pacific region under some swap schemes with its foreign partners. Sakhalin-2 recoverable hydrocarbon reserves amount to over 600 bcm of gas and 170 Mt of oil and condensate. The platforms, 13 km to 16 km off Sakhalin Island, stand in water up to 50 metres (m) deep in the Sea of Okhotsk. The LNG plant started to work in February 2009 and the first Sakhalin-2 LNG cargo arrived in Japan's Tokyo Bay in April 2009. Under an agreement signed with Shell Energy Europe over a total of 22 bcm, Gazprom puts at Shell's disposal gas at the border of Poland and Germany and in return, sells Shell's stake of LNG to markets. One of the options for further development is to add a third LNG export train.
Rosneft			
ExxonMobil	11	The licence blocks include Vostochno-Cibirsky-1 and Yuzhno-Chukotsky blocks in Chukchi Sea, Ust' Oleneksky, Ust' Lensky and Anisinsko-Novosibirsky blocks in Laptev Sea and Severo-Karsky block in the Kara Sea.	In return for obtaining the right to conduct exploration activities in these areas (agreements have different legal status and validity though at this stage and may not all be firm), ExxonMobil envisions that Neftegaz America Shelf LP (Neftegaz), an indirect independent subsidiary of Rosneft, will acquire 30% interest in 20 deepwater exploration blocks in the Gulf of Mexico held by ExxonMobil; in a separate Heads of Agreement, Rosneft (or its affiliate) has an opportunity to acquire a 25% interest in the Point Thomson Unit which covers the project of developing a remote natural gas and condensate field on Alaska's North Slope. It is estimated that Point Thomson contains approximately 25% of the known gas resource base in Alaska's North Slope.
Statoil	4	The Kashevarovsky, Lisyansky and Magadan-1 licences are in the Sea of Okhotsk north of the Sakhalin Island, and the Perseevsky licence is in the Central Barents Sea.	The license requirements include drilling of six exploration wells in the period from 2016 to 2021. Statoil will carry the expenses of exploration activities required to determine commercial value of the licences. The three Arctic licence areas cover a territory of 79 000 square kilometres (km^2).
ENI	3	The Fedynsky block (38 000 km^2) is located in the ice-free part of the Barents Sea. The Central Barents block (16 000 km^2) borders Fedynsky from the north. The Western Chernomorsky block is in the Black Sea.	ENI has reportedly started 2-D seismic surveys and a first well.

INPEX	2	Offshore blocks Magadan-2 and Magadan-3 in the Russian section of the Sea of Okhotsk.	A Memorandum of Understanding (MoU) was signed in May 2013: INPEX was granted exclusive rights to negotiate towards a final agreement, expected by the end of 2013; INPEX would reimburse the licensed blocks' development expenses incurred by Rosneft, as well as 33.3% of a one-off payment made by the Russian company during the course of licence acquisition. Furthermore, the agreement provides for non-recurrent bonuses to be paid by INPEX to Rosneft for each commercial oil and gas discovery proportionally with its stake in the project; both firms plan to set up a joint venture to explore the offshore blocks.
CNPC	3	These blocks are located in the Barents and Pechora Seas (West Prinovozemelsky, Yuzhno-Russky and Medynsko-Varandeisky) as well as onshore blocks in Irkutsk Region, Krasnoyarsk Territory and YNAD.	Preliminary agreements were signed in March 2013. Some of these areas have never been explored before and are thus quite unknown.
Petrovietnam		Blocks would be located in the Pechora Sea.	The parties also signed a MoU over Rosneft's potential acquisition of a stake in the PSA for the Block 15-1/05 offshore Vietnam.

* www.gazprom.com/about/production/projects/deposits/shp/.

Sources: company information: Total www.total.fr/; Gazprom www.gazprom.com/; ExxonMobil http://corporate.exxonmobil.com/en/; Statoil www.statoil.com/; ENI www.eni.com/en_IT/home.page; CNPC http://classic.cnpc.com.cn/en/; Petrovietnam http://english.pvn.vn/.

Further exploration and development drilling activity is needed in order to enable production in upcoming decades, and companies still have a long way to go in ensuring that resource extraction can be economically viable, and occur safely while protecting sensitive Arctic ecosystems. Russian government has started to address issues, related to protecting sensitive arctic ecosystems. It is considered in Strategy of development of Arctic zone and ensuring national security for the period up to 2020.

Developing possible Arctic resources will bring key environmental and technological challenges given the very harsh environment, with offshore drilling from platforms surrounded by ice and very low temperatures. Water depth is not a major issue given that most of the resource is in shallow water, yet sea bottom pipelines are possible but can be at risk from iceberg migration paths. This will bring massive logistical and infrastructure challenges – special pipelines, hundreds of specialised platforms and support ships, dozens of seismic vessels, and infrastructure for thousand of workers will need to be developed and/or operated in this harsh environment.

Any major environmental accident is likely to call many projects into questions. This is why developing a very robust security and environmental protection framework is key, alongside ensuring that the most advanced and relevant technologies are employed. Gazprom, together with Norwegian partners, has actively participated in the Barents 2020 project to safeguard petroleum activities in the Barents Sea. Rosneft, together with ExxonMobil, have established an Arctic Research Center in Saint Petersburg, which focuses, among other things, on key technologies for shelf development, such as drilling rigs, offshore ice-resistant platforms and subsea systems for treatment and transportation. Rosneft and some of its foreign partners such as ENI and Statoil are also committing to preserve the environment based on a Declaration on the Russian Arctic Shelf Environment Protection.

The Arctic has enormous potential to help address future energy needs, but that potential can be realised only if the environmental and technical challenges of Arctic resources are addressed with a very high premium on maintaining exemplary standards for their development from day one. Any accident could have a devastating impact on sensitive

Arctic ecosystems; any misstep by industry could postpone Arctic resource development for decades. There will be no margin for error. The Arctic is thus a region where economic activities will lead to strong interdependences and will require strong co-operation among all stakeholders. Increased co-operation on the “High North” through bodies such as the Arctic Council or Barents Euro-Arctic Co-operation will be essential to developing and maintaining the international governance standards necessary to guarantee that commercial opportunities opening up in the Arctic are pursued in an environmentally sensitive fashion. Against this backdrop, developing these Arctic resources is thus a still uncertain prospect. It will require not only recoverable resources to be found, but also regulatory and legislative clarifications.

Box 5.2 Addressing transportation, safety and environmental challenges in the Arctic

The oil and gas industry is accustomed to operating under all kinds of conditions. But there are unique challenges associated with the Arctic. One of them is that of providing search-and-rescue capabilities in remote locations under extreme weather and climate conditions (often with limited visibility). The region presents massive navigational challenges due to icebergs, which require frequently changing routes and relying on assistance from icebreakers.

An accident is always a possibility: What to do if something goes wrong? Most of the Arctic so far cannot be subject to rescue operations by helicopter because distances are too long and there are no rescue bases installed. Helicopters can embark with additional oil tanks to fly longer distances, but at the expense of their capacity to embark material and passengers. Ice and distances pose key challenges for oil spill containment and remediation (little availability of equipment at short notice; slow biological degradation).

A short drilling season also increases the risks: If a blowout occurs towards the end of the drilling season, there is no time to drill a relief well until the following year. Finally, the lack of complete and reliable satellite coverage for navigation and communication is another challenge that needs to be addressed.

A key facilitator of Arctic oil and gas projects would be the possibility of oil and gas transportation via the Northern Sea route to reduce the travelled distance and time by one-third between Atlantic and Pacific basins – down to about 26 days and 9 000 km compared to about 38 to 42 days through the Suez Canal, with estimated average cost savings of USD 1 million for a large cargo. This is increasingly being discussed (for example, across the northern route in the Russian Arctic and through the Bering Strait, avoiding the Suez Canal for Asia-Europe trade) as hundreds of ships already take this route every year, often accompanied by icebreakers. The Yamal LNG project has further supported this discussion. On 7 November 2012, Gazprom Marketing & Trading’s LNG cargo carrier ”Ob River” left Hammerfest, to ship the first Arctic LNG from the Snohvit gas field on a spot basis, and reached Tobata in Japan 29 days later. Novatek in 2012 reportedly supplied 487 000 tonnes (t) of stable gas condensate to the People’s Republic of China with the northern route.

Box 5.2 Addressing transportation, safety and environmental challenges in the Arctic (continued)

Although ice is melting at a rapid pace, the development of major, regular and large traffic of oil or gas tankers, even in summer, cannot be expected before 2030 as insurance companies will want to minimise risks and only a limited number of special ships are current being built by leading shipping companies, such as for Yamal LNG. In 2013, cargo transit via the Northern Sea route represented about 1.2 Mt. Insurance costs are reportedly still too high to allow for the opening of a new major trade route, and properly assessing risk for insurance prices will be complex. Ensuring timely delivery of transported goods will also be challenging. In addition, such traffic requires assistance of icebreakers, which makes the route expensive, even if convoys of ships are organised, and would require the development of a large icebreaker fleet, unless reinforced ice-class vessels are in operation, as will be the case for Yamal LNG. It raises the same questions of search-and-rescue and accident containment as for exploration/production activities. An accident involving a diesel ship already occurred in 2013. The Russian tanker Nordvik carrying 5 000 t of diesel bumped into an iceberg in the Kara Sea in early September, and it took one week to provide rescue and support. Reportedly, no diesel leak occurred. The International Maritime Organisation is working on a polar code that could be implemented in 2015 – which is needed to define and harmonise safety and navigation standards – and the Arctic Council is also doing important work on environmental safety. Thus in the medium term, only coal, minerals such as nickel and container cargo trading might increase over this route, as they represent less danger to the environment.

Sources: Interfax, Russia & CIS Oil and Gas Weekly Reports, 2013.

East Siberia and the Far East

In line with the decree by the Energy Ministry approving the state-run development programme for an integrated system for gas production, transportation and supply in East Siberia and the Far East with the possible exports to the markets in China and other Asia Pacific regions (Eastern Gas Programme) dating back to 27 September 2007, Gazprom was appointed by the government as the co-ordinator of the programme aimed at raising gas production and commencing exports from the region.

In the medium term (until 2018), production is likely to increase in a relatively limited way, but in the longer term, the production increase is likely to be much higher. Gazprom has committed to developing the Sakhalin continental shelf, Kovykta (Irkutsk production centre) and Chayanda oil, gas and condensate fields (Yakutia production centre), estimating the continental shelf gas reserves at 0.8 tcm, Kovykta's at 1.5 tcm and Chayanda's at 1.3 tcm. Exploration works is being carried out. This gas production is meant for Russia's domestic market and the Asia Pacific region.

Gazprom announced that it will develop Chayanda first, estimating its cost at USD 13.7 billion and plateau production at 25 bcm in 2021 (plus 1.5 Mt of oil production in 2027 at plateau). In October 2012, the Gazprom Management Committee adopted the FID on the investment rationale for the Chayanda field pre-development, transmission and processing of gas, with the field to be commissioned in 2017. Yet this date has been further pushed back to no earlier than 2019[8] – which is likely to incur some further delays.

8. Gazprom Investor Presentation (2013), www.gazprom.com/investors/events-presentations/investor-day-feb-2013/.

Kovykta could produce up to 35 bcm/yr at plateau level. Gazprom recently announced that gas production will start in Kovykta in 2024. Field operator LLC Gazprom Dabycha Irkutsk recently announced that it would start operation on the field during the third quarter of 2016.

Both fields will require expensive gas treatment and helium treatment/storage facilities. Prioritising Chayanda over Kovykta makes sense because it is closer to export market outlets, because Russia and China agreed to use the "eastern route". This helium-rich gas from both fields is to be treated at the Belogorsk gas processing plant to be constructed by Gazprom.

Sakhalin

More production is also expected to come from the Sakhalin province, which produced 27.6 bcm of gas in 2012. In particular, additional production is expected to come from Sakhalin-1[9] and Sakhalin-3 fields are likely to enable substantial incremental production only in the longer term after 2017. Gazprom holds licences for three offshore blocks within the Sakhalin-3 project: Kirinsky, Ayashsky and Vostochno-Odoptinsky. Total gas reserves of these blocks are estimated by Gazprom at about 1.5 tcm. The Kirinskoye field (90 m depth), currently believed to hold 162.5 bcm, is Gazprom's priority, and could produce 5.5 bcm/yr.

This field would be Gazprom's first 100% self-developed offshore project. Gazprom also discovered the large Yuzhno-Kirinskoye field within the Kirinsky block in 2010, with estimated reserves of 160.9 bcm more than preliminary estimated 403.1 bcm. Peak annual production from Sakhalin-3 is currently projected at about 16 bcm to 20 bcm, but could be larger. In the short to medium term, Gazprom plans to perform seismic works and continue drilling about 20 exploration wells within the Sakhalin 3 project, in particular in the Kirinskoye field in 2013 in view of starting to produce up to 2 bcm by 2015.

Production at Yuzhno-Kirinskoye is set to start no earlier than 2019 and should reach a peak of 16 bcm by 2023-24, but there is the possibility of incurring some delays, related to the oil discovery in this field. Produced gas from these fields is planned to be delivered to the onshore processing facility via undersea connecting pipelines and shipped onwards via the Sakhalin-Khabarovsk-Vladivostok gas transmission system (GTS).

It is also noteworthy that Rosneft, in addition to its participation in Sakhalin-1, possesses a number of licences and made important gas finds: For example, the Veninsky block in Sakhalin-3 that is soon to be developed together with Sinopec contains 33.7 bcm of gas reserves. Rosneft is planning to build its own LNG liquefaction plant to bring its future gas production to markets, basically using its Sakhalin-1 gas (see next section).

To bring Sakhalin gas to regional markets and prepare for future exports, Gazprom also built the 1 350 km Sakhalin-Khabarovsk-Vladivostok pipeline, which will ultimately be able to carry up to 30 bcm of gas to Vladivostok region. Current throughput capacity of this pipeline is 6 bcm to 6.5 bcm/yr, with about 2.2 bcm transported.[10]

9. This project is Russia's second PSA signed in 1996 and involves Rosneft (20%), ExxonMobil (30%, operator), Sodeco (30%) and ONGC (20%). Very small volumes of associated gas are produced from this project, currently partly re-injected or supplied to consumers in Khabarovsk territory. In the future, the project, believed to hold 485 bcm of gas reserves, could produce more gas if opportunities to commercialise this gas exist. www.sakhalin-1.com.

10. Interfax, 24 January 2014.

Associated gas/reduction of flaring

Gas flaring in Russia has been a long-time issue and has recently been more resolutely addressed by the government, which has set strong targets to reduce flaring and high fines to spur investments in reducing flaring. This involves a system of penalty payments by companies on the basis of their emissions, and which also promotes investments into projects to use the associated gas.

This stricter approach nonetheless comes after targets and timelines have been delayed repeatedly. Indeed, decree No. 7 from 8 January 2009, On Measures to Reduce Air Pollution from Products of Associated Gas Flaring, set the target not to flare more than 5% of the associated gas by 2012 and established a procedure of fines for this purpose, yet this target has been postponed to 2016.

The exact amount of gas being flared is uncertain, as more than 50% of the flares do not have meters. Based on satellite data, the Global Gas Flaring Reduction Partnership estimated that the volume of gas flared in 2010 in Russia was 35.2 bcm, marking a 17 bcm decrease since 2007.

Yet data showed that in 2011, the amount of gas flared increased by another 1.8 bcm instead of being further reduced.[11] Official Russia data is lower at 17 bcm of gas flared in 2012, out of a total of 71.8 bcm of associated gas production.[12] Whatever the exact figure, it is difficult to assess as metering is not always available. Most experts agree that flaring remains a major problem in Russia that so far has not been addressed.

The current objective is to reduce gas flaring to 5% of associated gas production by 2016. Gazprom, for example, had a 70% average utilisation level in 2012, including 65.7% for GazpromNeft.[13] Most oil companies including Rosneft, but reportedly excluding Tatneft and Surgutneftegaz, are reportedly still a long way from complying with a level of utilisation over 70%. A key obstacle for greater utilisation is the lack of metering, alongside infrastructure to collect and treat the gas or power generation facilities to monetise the gas, for example.

Since the beginning of 2013, the fee for flaring associated gas has gone up sharply. On 8 November 2012, the government passed a decree approving a new formula for calculating pollution fees related to associated gas flaring. The coefficient used in the formula for calculating payments in 2013 would strongly increase from 4.5 to 12, and from 12 to 25 in 2014 for gas flared in excess of the 5% limit, with fees thus increasing by around three times in 2013 and six times in 2014 compared with the 2012 level. At the same time, associated gas has priority access to the gas transportation system, as enshrined in the Law on Gas Supply, and unmetered associated gas flaring leads to massive standardised fines. Fines for associated gas flaring are in a range of USD 500 million per year (USD/yr) to USD 600 million/yr, according to the Ministry of Natural Resources and Environment, about USD 13 million per billion cubic metres (USD/bcm) to USD 16 million/bcm.

11. Based on data from the World Bank-led Global Gas Flaring Reduction partnership and satellite monitoring of the National Oceanic and Atmospheric Administration (NOOA). See http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTOGMC/EXTGGFR/0,,contentMDK:22137498~menuPK:3077311~pagePK:64168445~piPK:64168309~theSitePK:578069,00.html; WWF/KPMG (2011), *Associated gas utilisation in Russia: issues and prospects*, Annual Report Issue 3, Moscow.

12. Interfax (2013), "Russia needs to supply own petrochemical products - Putin", News Headlines, 15 October 2013, www.interfax.com/newsinf.asp?id=451261.

13. Gazprom (2014), Annual Report 2013, www.gazprom.com/.

The newly introduced regulation has also addressed gaps in the previous 2009 regulation, which was not detailed enough. Fines are regularly attributed by the federal environmental watchdog for underutilisation of associated petroleum gas at the level stipulated in licence agreements or the law.

The regulation envisages a grace period for new fields, or greenfields, where the requirements to utilise 95% of the associated gas produced will not apply during the initial stage.

In order to foster the utilisation of associated gas and reduce flaring, and as part of some import-substitution policy effort, the government is also encouraging the development of Russia's petrochemical industry near oilfields with associated gas production in order to benefit from this feedstock. An example is Sibur's USD 2 billion Tobolsk-Polymer plant commissioned in 2013 and producing polypropylene. It should use about 5 bcm of associated gas per year. Rosneft is also developing similar projects in Russia's Far East. Another example is the construction of the Yuzhno-Priobsky gas processing plant by GazpromNeft and Sibur, which is to be operational in 2015.

Overall, these additional measures, if fully implemented, should lead to a faster decrease of associated gas flaring in Russia in the coming years.

Unconventional gas

According to the US Energy Information Administration, as of 2013, Russia's technically recoverable shale gas resources were 285 trillion cubic feet (approximately 8 tcm) and Russia holds the ninth position in the world, with about 4% of the world's technically recoverable shale gas resources.[14] Gazprom's Scientific & Research Institute of Natural Gases and Gas Technologies (VNIIGAZ) estimates that Russia's unconventional gas reserves might be 680 tcm, including shale, sandstone and coalbed methane (CBM).[15] This is 2.5 times more than conventional reserves, which are already the world's largest. Among them, probable CBM resources in Russia are estimated at around 84 tcm. The most promising fields are located in the north of East Siberia.

At this moment, Russia's priority lies in developing its very large conventional (including deeper layers of liquids-rich gas) and offshore gas resources; and unconventional gas reserves have not come into sight. In Russia, it is widely accepted that gas extracted from shale costs several times more than gas recovered by traditional means, and that shale gas will cause huge environmental-related costs. The president and other high-ranking government officials, alongside Gazprom, have refrained from supporting the development of Russia's shale gas potential. Nonetheless, some experts argue that the development of some of the unconventional gas resources could be cheaper, because some of them could be located much closer to consumption places and save transportation costs.

Although Gazprom started a trial development of CBM resources in 2010, unconventional gas production in Russia remains at the negligible level – 4 bcm/yr. In order to develop unconventional gas in Russia, studies on feasibility and profitability; strong political support, including tax incentives; and foreign companies' state-of-the-art technologies and expertise would be needed. Some pilot projects would deserve to be developed, though, especially for areas which are not connected to the gas transmission infrastructure – yet that would require having at least the road infrastructure in place, alongside qualified manpower, as well as potential consumption sources near the extraction places.

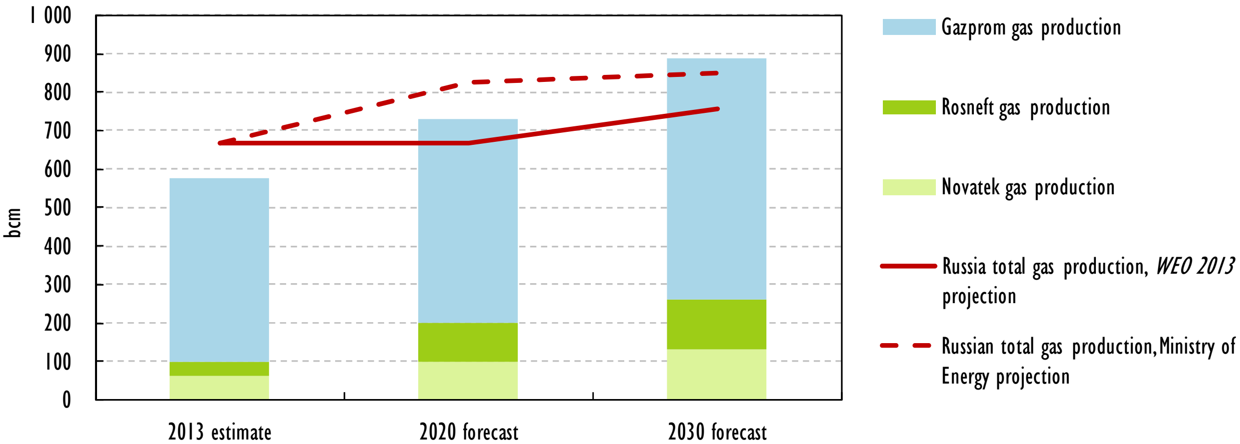
14. www.eia.gov/analysis/studies/worldshalegas/.

15. www.bloomberg.com/news/2012-12-24/russia-may-hold-680-trillion-cubic-meters-of-unconventional-gas.html.

Production outlook

Overall, Gazprom plans for only small production growth in the short to medium term, and in the short term, its production is likely to even be flat. This downward revision of initial production growth numbers cannot be seen in isolation, from the stagnation of demand on the Russian and foreign markets and from increasing competition on the Russian market. Gazprom plans to produce about 530 bcm by 2020,[16] while independents also have ambitions of production growth in a market where demand is unlikely to pick up sharply. Over the period 2014-20, independent producers are likely to increase production by about 40 bcm of already contracted gas, which could require Gazprom to be the swing supplier and possibly keep output flat or even reduce it unless there is a substantial growth in exports to Europe and in domestic consumption.[17]

Figure 5.2 Outlook for Russia's gas production until 2030



Sources: IEA (2013), *World Energy Outlook 2013*, OECD/IEA, Paris; Gazprom Investor Presentation 2013; Novatek and Rosneft company information; IEA estimates; Ministry of Energy projections.

By 2020, both Novatek and Rosneft aim to produce 100 bcm, mostly due to the development of additional fields and resources in the case of Novatek, and due to further acquisition of companies and assets for Rosneft. The share of Gazprom in total production is thus likely to continue its trend of decline. The 2009 *Energy Strategy for the period to 2030* foresaw that by 2020, Russia's gas production would be in a range of 803 bcm to 837 bcm, and by 2030, in a range of 885 bcm to 940 bcm. In January 2013, the Ministry of Economic Development published a long-term projection for Russia's economic development to 2030, foreseeing a slightly lower gas output at 783 bcm by 2020 and 870 bcm by 2030.[18] The Ministry of Energy has a more bullish forecast, envisaging production of 826 bcm by 2020.[19] There is no doubt that given its gas reserves and ongoing project developments, Russia and its companies have the full potential to reach these production targets. Yet it

16. www.gazprom.com/f/posts/34/453539/2013-02-08-investor-day.pdf.

17. Sberbank Investment Research (2013), *Russian Oil and Gas – Two portraits in oil,* October, Moscow.

18. Ministry of Economic Development. Projection of long-term socio-economic development of the Russian Federation for the period to 2030. January 2013, Moscow (Прогноз долгосрочного социально-экономического развития Российской Федерации на период до 2030 года); partly www.economy.gov.ru/minec/activity/sections/macro/prognoz/doc20130218_09 (accessed 14 March 2013).

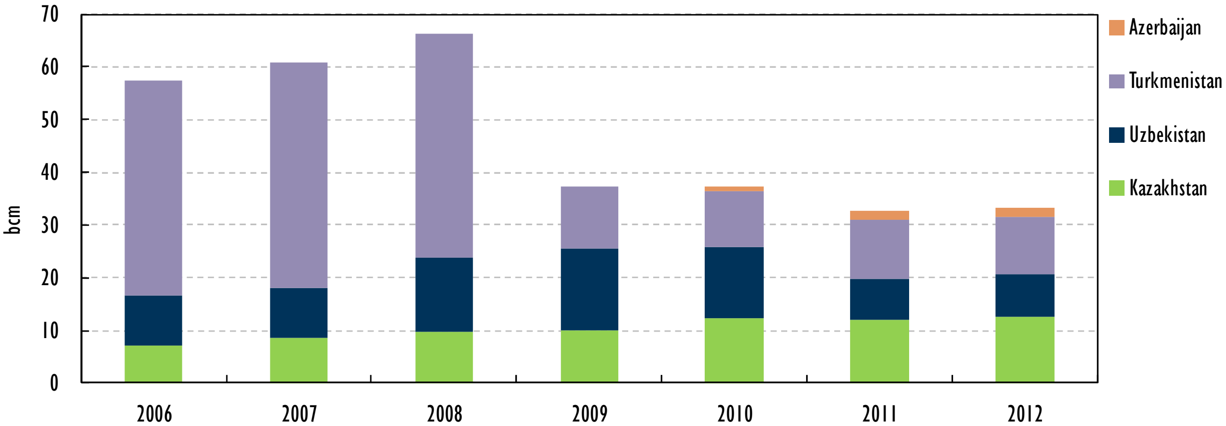
19. Interfax Russia & CIS Oil and Gas Weekly, 15 January 2014.

is not a given that Russia will be able to find enough domestic and foreign consumers to buy all this gas, so these production forecasts are likely to be revised downwards as they will need to reflect development in consumption markets. As a consequence, the International Energy Agency (IEA) *World Energy Outlook 2013* (*WEO 2013*) envisages that production will reach 667 bcm by 2020, 692 bcm by 2025 and 757 bcm by 2030.[20]

IMPORTS

Gazprom and its affiliated companies have been importing gas from Central Asian and Caspian countries for many years. However, since the 2009 crises, import volumes have decreased and plateaued at a level of about 31 bcm/yr. These imports used to complement Russia's gas production to meet the growing domestic and foreign demand for gas when Russian production was not sufficient. In addition, these import pipelines are well-placed to supply parts of Russia's southeast. Finally, these gas purchases allowed Gazprom to ship part of this gas in the transit regime to European markets, thus avoiding having to pay the Russian MET and the export tax. With the higher gas prices charged to customers in the Former Soviet Union (FSU) area, which has reduced consumption of Russian gas, especially in Ukraine; the economic crisis since 2009 that has contributed to reducing domestic and foreign gas demand; the growth in Russia's own production and potential; and the higher tariffs charged by Central Asian suppliers, the level of imports has decreased, in particular from Turkmenistan and Uzbekistan.

Figure 5.3 Gazprom's imports of gas, 2006-12



Source: Gazprom.

DEMAND

Russia is the world's second-largest gas consumer after the United States, with 459.4 bcm in 2012.[21] Historical data show that over the 2000s, gas consumption steadily and rapidly increased at a pace of 2.3% per year for the period 2000-07, before slowing down to 0.3% per year in the period 2007-12. The rapid expansion of demand in the first half of the 2000s was related to the growth in power generation, as well as the growth in industrial consumption following stronger industrial output.

20. IEA (2013), *World Energy Outlook 2013*, OECD/IEA, Paris.

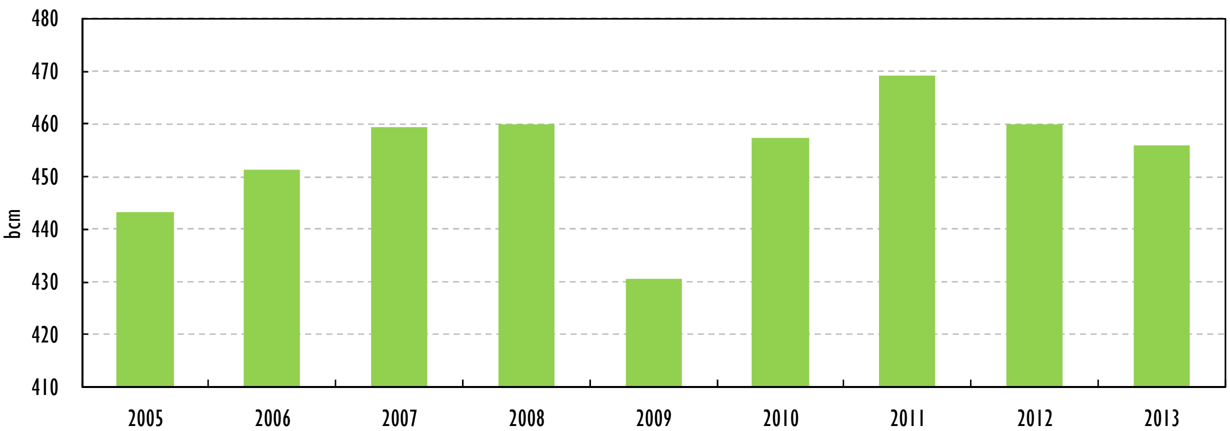
21. www.minenergo.gov.ru/activity/statistic/17135.html.

Over past years, demand for electricity from gas-fired power generation has also increased in a few regions, driven by major infrastructure projects. This is notably the case in the Leningrad region where the Primorsk port was built as well as in the Sakhalin region where a major LNG plant was constructed, but also in the Yamal region where upstream gas projects were developed; similar development occurred in the Tyumen region and the Moscow oblast. This has thus contributed to a sharp increase in gas consumption, but only temporarily and in a geographically limited scope. Calculations from Troyka Dialogue show that when these four regions are not accounted for, average annual growth in Russia was only 0.5% in the period 2004-11.[22]

After the economic and financial crises, Russia faced lower growth in gross domestic product and power demand which has impacted the level of gas consumption. In addition, more efficient combined-cycle gas turbines (CCGTs) have been put in operation, and industrial demand has been sluggish. As a consequence, gas consumption in 2012 fell by 13 bcm from 473 bcm in 2011. Preliminary data from the Central Dispatching Department of the Fuel and Energy Complex for 2013 suggest that this trend is continuing, with a further slight decline in gas consumption of 2.5% mainly due to lower industrial demand for gas and power (power consumption was down 2.6 bcm to 163.17 bcm) but also mild weather in December.[23]

Preliminary data from the Ministry of Energy suggest a slightly lower decline of 0.7% at 456.2 bcm.[24] Overall, yearly gas demand levels to a large extent depend on the weather, and in particular how cold and how long the winters are, and on industrial production, but also to a growing extent on how hot the summers are as there is a growing number of air-conditioning systems in operation across the country.

Figure 5.4 Russia's domestic gas consumption, 2005-13



Sources: Ministry of Energy of the Russian Federation; CDU TEK.

In the 2009 *Energy Strategy to 2030*, the government projected that gas demand would increase sharply by about 280 bcm by 2020 and be in a range of 712 bcm to 743 bcm by 2020. Yet calculations by the Energy Research Institute of the Russian Academy of Sciences

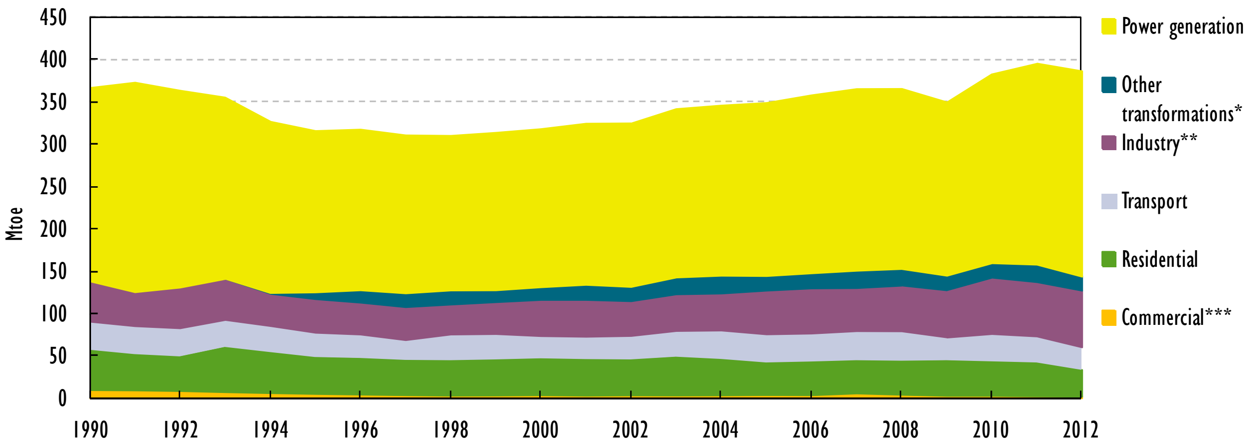
22. Sberbank Investment Research (2012), "Russian Oil and Gas: The Blushing Bride", Moscow.

23. Interfax, 24 January 2014.

24. www.minenergo.gov.ru/activity/statistic/17359.html.

show that, in the best-case scenario, demand could increase by only 40 bcm by then and reach 471 bcm by 2020, implying a 1.12% annual growth.[25]

Figure 5.5 Natural gas supply by sector, 1990-2012



Notes: Mtoe = million tonnes of oil-equivalent. Data for 2012 are provisional. Total primary energy supply (TPES) by consuming sector.

* *Other transformations* includes other transformation and energy sector consumption.

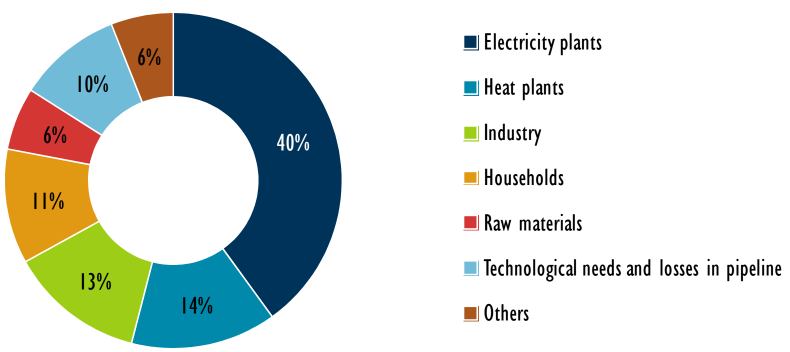
** *Industry* includes non-energy use.

*** *Commercial* includes commercial, public services, agriculture/ forestry, fishing and other final consumption.

Source: IEA (2013), *Energy Balances of Non-OECD Countries*, OECD/IEA, Paris.

Key features behind of this slow demand growth are higher domestic regulated gas prices, energy efficiency deployment in the residential and industrial sectors, industrial restructuring, low growth in industrial output and in power demand, modern CCGTs commissioned in replacement of old plants, and nuclear unit commissioning (see Chapter "Nuclear Energy"). Against this backdrop, the *WEO 2013* also sees gas demand growing very slowly, to 493 bcm in 2020 and 523 bcm in 2030.

Figure 5.6 Natural gas consumption by sector, 2012



Sources: Rosstat, www.gks.ru/; Energy Research Institute of the Russian Academy of Sciences, www.eriras.ru/eng.

25. Makarov A., L. Grigoriev, T. Mitrova (eds.) (2013), *World and Russian Energy Outlook up to 2040,* Energy Research Institute of the Russian Academy of Sciences, analytic centre under the government of the Russian Federation, Moscow.

About 40% of Russia's gas consumption – 190 bcm – comes from the power sector, to supply Russia's large fleet of thermal power plants. IEA projections envisage a flat demand from the power sector until 2030, mostly due to investments in modernising the existing capital stock and lower electricity demand growth. Russia's district heating systems and boilers consume about 67 bcm and represent about 14% of Russia's total gas consumption. The industrial sector, mainly the chemical industry, but also to a lesser extent the metallurgy industry, consume about 62 bcm and represent 13% of total demand. Gazprom states that the GTS consumes about 40 bcm to 45 bcm of gas per year (40.9 bcm in 2012). Residential consumers represent only 11% of consumption. Gazprom as of 1 January 2013 was distributing gas in 69 Russian regions, and spent RUB 37 billion in 2012 (USD 1 billion) to lay 3 400 km of new pipelines to further connect 54 000 new apartments and 473 boiler plants to the gas transmission grid. Gazprom states that in the period of 2005-12 the average penetration level of natural gas increased from 53.3% to 64.4%, including from 60% to 70% in cities and from 34.8% to 53.1% in rural areas.[26] Gazprom Mezhregiongaz concludes gasification contracts with regional authorities and develops master gas supply and gasification schemes and proposals. Regions in turn need to prepare consumer infrastructure – construction of distribution networks, boiler plant switchover to natural gas, household preparation and enforcement of timely payments for supplied gas.

More recently, the government has prioritised the development of gas use for the transportation sector. Decree No. 767 from 13 May 2013, On the Regulation of the Increase of Gas Use in the Sector of Motor Fuel, has given a framework for this development. During the Soviet period in the 1970s, approximately 1 million cars and trucks were fuelled by gas. Decree No. 767 calls for the development of gas use for the transportation sector, in particular for trains and road transport – cars, public buses and trucks, as well as for agriculture. This includes propane, butane, compressed natural gas (CNG) and compressed LNG products. It commits to installing gas filling stations. The Ministry of Transport is envisaging a plan with subsidies to the agriculture and public transportation sectors. Various estimates put additional gas consumption by the transportation sector in a range of 2.5 bcm or 3 bcm to 7 bcm by 2020 from almost none today.

Gazprom is a front runner in the development of a natural gas vehicle (NGV) fuel market and it created a specialised company, Gazprom Gazomotornoye Toplivo LLC, in 2012. It has also teamed up with truck maker Kamaz. The objective is to expand the number of NGV filling station networks in Russia and increase the numbers of NGVs. Proposals for the development of NGV fuel infrastructure were made to 69 regions of Russia participating in the gasification programme. As of the beginning of 2013, Russia had 246 NGV filling stations (including 210 stations operated by Gazprom). In addition, there were 90 000 CNG vehicles, and 390 mcm of CNG were sold (including 348 mcm by Gazprom). Gazprom Gazomotornoye Toplivo LLC intends to invest RUB 1 billion (USD 30 million) in adding NGV filling points at GazpromNeft's existing network of stations in 2013. Gazprom is in particular targeting the municipal, passenger and freight transport segments.

26. Gazprom (2013) Annual Report 2012, www.gazprom.com/f/posts/77/194006/annual-report-2012-eng.pdf.

GAS TRANSMISSION SYSTEM

PIPELINES

Gazprom is the owner and monopoly operator of Russia's unified GTS. Gazprom has 17 specialised gas transmission subsidiaries that manage regional transportation and distribution systems. As of the end of 2012, the total length of trunk pipelines and distribution pipelines owned by Gazprom and its gas transportation subsidiaries in Russia was 168 300 km. The GTS includes 222 compressor stations with 3 738 gas compressor units with the total capacity of 43 870 megawatts. Of the total transmission lines, 42 600 km are less than 20 years old, 98 000 are between 21 and 40 years old, and 27 000 km are over 40 years old. Gazprom overhauls about 2 400 km of pipelines per year. In 2012, 16 technical failures at trunk gas pipelines reportedly occurred, i.e. 0.091 failures per 1 000 km.

Over the past years, Gazprom has devoted a big share of its CAPEX to building very large amounts of new gas pipeline systems inside Russia to link up new production centres in Yamal as well as new export infrastructure, in particular Nord Stream. This includes the Gryazovets-Vyborg trunk gas pipeline, and the Bovanenkovo-Ukhta pipeline reached full design capacity of 28.5 bcm.

In 2012, the GTS handled a total of 683.26 bcm. The average gas transportation distance for the domestic market is 2 785 km and 3 430 km for exports.[27]

STORAGE INFRASTRUCTURE

Russia's very large underground storage capacities play an essential role for ensuring the security of supplies in case of failure or accident, especially during the heating season, when consumption peaks often both on the domestic market and on the export markets. The capacity to ramp up daily production and transport gas on several parts of the pipeline system is limited due to technical constraints and the very long transportation distances as gas travels slowly.

As of 31 December 2012, Russia's 25 underground sites (17 in depleted gas fields and 8 in aquifers) had a storage capacity of 68.16 bcm, a slight increase versus 2011-12. For the 2012/13 heating season, Gazprom stored 44.1 bcm of gas and ejected 66.2 bcm. Gazprom claims that during the period of peak load, the network of underground storages ensures about 20% of gas supply to Russian consumers and exports, and in the days of quick freeze, this figure reaches 30%. During maximum gas withdrawal season in 2012/13 the share of gas supplies from the storage facilities in Russia reached 38.3%. A record withdrawal of 0.725 bcm was reportedly achieved on 31 January 2014.

The January 2012 cold wave that affected Europe, including Russia, showcased both the crucial importance of Russia's underground storage sites and the need to further increase storage capacities in Russia and to a lesser extent in Europe, where there are often quite large capacities available. Gazprom started investing in capacity expansion of gas storage facilities. Since the 2004/05 season, the maximum daily volume of gas ejection was increased by 15%.

In 2012 gas storage capacity increased by 1 bcm, and in 2013 Gazprom commissioned the Kaliningrad underground storage facility.[28] Two other facilities are being built in Russia

27. Gas State Programme.

28. The underground storage facility will have a full-scale working capacity of 800 mcm, a third of the Kaliningrad region's annual requirement of 2.2 bcm. Maximum daily productivity is 12 mcm, or way above the region's peak consumption of 8 mcm in the winter.

at the moment. At the same time, Gazprom is expanding its storage infrastructure in the European Union markets, with a goal of reaching 5 bcm by 2015 (in the Netherlands, the United Kingdom and the Czech Republic). For the 2013/14 season Gazprom committed to increase its own gas storage capacities in Russia from 66.28 bcm to 69.01 bcm. Gazprom plans to increase daily capacity of gas storage withdrawal to up to 819.6 mcm for the 2015/16 season. This is particularly important since gas imports from the Caspian and Central Asia in winter can be partly interrupted, as was the case in January 2014.

MARKET STRUCTURE, REGULATION AND REFORM

WHOLESALE MARKET

Access to infrastructure

Gazprom has been required by the Federal Law on Gas Supply in the Russian Federation, which sets the terms and conditions for granting access to transmission capacity of the GTS, to grant access to independents to its systems or deny access only on a reasonable basis. Independent producers' access to its pipeline system has *de facto* ended the monopoly of Gazprom on using the GTS. In 2012, gas transportation services via Gazprom's GTS in Russia were provided to 25 independent companies.[29] Overall, this is effectively working, which marks a major step towards a more competitive market.

Yet Gazprom continues to be the owner and operator of the GTS and thus has a key influence on this process. In accordance with the Federal law dated 31 March 1999 No. 69-FZ, On Gas Supply in the Russian Federation, and the government decree dated 14 July 1997 No. 858, On Ensuring Access for Independent Organisations to the Gas Transportation System of Gazprom, Gazprom provides access to its gas pipelines to independent companies in case there is spare capacity in the GTS from the connection zone to the gas collection zone in the proposed delivery period if they have a contract with buyers, and the gas meets the technical standards.

The access to free capacity is available for suppliers of dry gas and of associated gas. A preferential right to conclude gas supply contracts is given to suppliers of state or municipal needs, and public and social needs of households.

Against this backdrop, Gazprom can refuse transportation services, such as for technical reasons, and prioritises its own supplies. The regulation does not organise competitive bidding for capacities or a transparent mechanism to determine the gas transportation routes and distances. Information on the presence (or absence) of technical capacity of access to regulated gas transportation services, implementation of applications for access to gas transportation, and information on the conditions under which regulated gas transportation services will be provide are organised on the basis of the order of the Federal Anti-Monopoly Service (FAS) of 23 December 2011 No. 893, On Approval of Forms, Timing and Frequency of Disclosure of Information on Natural Monopolies Providing Services for Gas Transportation Through Pipelines. Some stakeholders complain that it takes too much time to conclude transmission contracts, which normally should take three weeks – up to two months – and that they are not very flexible. When storage contracts are signed simultaneously, or separately, they can be long and cumbersome to put in place.

29. Gazprom (2013), Annual Report 2012, www.gazprom.com/f/posts/77/194006/annual-report-2012-eng.pdf.

The leading independent gas producers appear to face no issue with the access to Gazprom's GTS and are satisfied with the procedures, terms and conditions. Some, however, complain that access terms can be unfair and not transparent, and that while access may be granted, the transportation distance is exaggerated, leading to prohibitive costs. Nonetheless, within the framework of one-year transportation contracts, independent companies have the possibility of regularly requiring changes in volumes and transportation routes, while not being liable to any ship-or-pay obligation, which in turn makes it challenging for Gazprom to manage the balance of the pipeline system. It normally takes three weeks to conclude contract. In particular, Gazprom is arguing that it faces challenges managing unpredictable flows from independent suppliers, especially when more gas is put in the system than buyers take and when there is a high degree of irregularity of offtakes and supplies.

Since 2009, the FAS has been working to enforce the legislation and prevent unfair treatment, and has filed some cases against Gazprom. In some cases, producers or distributors built pipelines directly to power generation facilities to avoid using the Gazprom network.

Another key issue determining the access to the transmission network is the transmission tariffs for independent companies. Before 1 August 2006, a single rate was set for transmission of 1 000 cubic metres per 100 km. Since 1 August 2006, a new differentiated rate-setting methodology has been used, where the rate consists of two components: a charge for using the gas transmission pipeline (in roubles per thousand cubic metres), which is determined depending on gas entry and exit zones in the GTS; and the transportation distance for 1 000 cubic metres of gas per 100 km. This tariff includes a decreasing coefficient so that in principle, the longer the transportation distance, the lower the transportation tariff per unit. Nonetheless, independent companies still have a strong incentive to supply gas at the shortest distance possible from the production locations. Tariffs for gas transmission via main gas pipelines that are part of the Unified Gas Supply System of Gazprom are proposed by Gazprom and approved by the Federal Tariff Service (FTS). According to the current calculation methodology, tariffs are calculated based on the weighted average transportation distance of gas from the entry zone to the exit zone, taking into account the range of all possible routes without differentiation on individual pipelines. Rate for the use of the main gas pipelines of Gazprom are established between the entrance zones of the pipeline system and the exit zone of the system, and not separately for each pipeline. Overall, these tariffs have been strongly increasing over the past years, above the inflation rate yet just below the level of increases of regulated wholesale gas prices, and often represent about 50% of the end price of gas. On average, the tariff is RUB 63.93 per thousand cubic metres (RUB/kcm) per 100 km (USD 2 per thousand cubic metres [USD/kcm] per 100 km) for domestic transportation or to Customs Union countries. As an illustration, by the end of 2013, the transmission tariff along the newly built 1 800 km Sakhalin-Khabarovsk-Vladivostok pipeline was RUB 2 400.75/kcm (about USD 72/kcm). The average tariff to transport gas outside of the Customs Union (for export) is RUB 70.8/kcm per 100 km (EUR 1.63 per thousand cubic metres per 100 km). The tariff calculation for 2013 takes into consideration the increase in Gazprom's spending on property tax payments.

Stakeholders and gas sales trends

The Russian wholesale market is characterised by a growing volume of gas sales undertaken by independent suppliers. These suppliers either directly produce their gas or buy it from other producers and resell it. Gazprom sells most of the gas it produces directly to Gazprom Mezhregiongas (interregiongas) for further delivery to the end consumers.

Gazprom used to buy small volumes from independent producers that found selling at the well head more attractive than shipping the gas to consumers, yet has ended this.

The Russian wholesale market is segmented: Indeed, Gazprom by law has to sell gas at regulated prices to industrial, municipal and individual customers. Independent producers can sell gas at non-regulated, market-based prices. These producers have enjoyed favourable taxation and the opportunity to sell their gas below the regulated price while making profits, thus taking an increasing market share from Gazprom in regions close to key production centres.

In 2009, 2010, 2011 and 2012, there was lower demand. Independent producers, benefiting from lower production costs, due partly to lower MET levels but also to their competitive gas resources, sold gas at prices below the regulated tariff charged by Gazprom. On 10 May 2010, during the financial crisis, the government passed resolution No. 311 allowing buyers of Gazprom gas a 10% over-selection of the contracted volume or a 20% under-selection. Against this backdrop, even Gazprom's subsidiaries, such as Mosenergo, chose to buy cheaper gas from independents rather from Gazprom – Novatek in 2012 signed a three-year supply contract for the delivery of 27 bcm. Gazprom reports that in 2012, independent manufacturers completely covered the gas needs of Sverdlovsk and Chelyabinsk regions. A large share of regional gas supplies was taken by independent manufacturers in the Khanty-Mansiysky Autonomous area – Yugra (73%), Perm region (72%), Novosibirsk (55%), Kemerovo (52%), Tomsk (46%) regions (with independent gas supplies via Gazprom Mezhregiongaz and its regional subsidiaries).[30] This trend is set to continue as much more gas is likely to be produced by independents in a market with limited demand growth and with independents supplying gas at a discount from Gazprom, which has to cover higher MET taxation rates than independents and sell gas at the regulated wholesale price. There is thus a clear indication that independents are increasing their gas sales on the domestic market while Gazprom gas sales are decreasing: Novatek increased its gas sales volume by 9.7% in 2012 versus 2011 and took a 16% share of Russia's domestic gas market, whereas that year, Gazprom sold 5.4% less at 249.7 bcm on the Russian domestic market with a share of 54%, down from 265 bcm in 2011. Gazprom's share of the domestic market has been declining over the past years, as it represented 73.1% in 2006 with 316 bcm sold. At the same time, Gazprom's revenues from gas sales to the domestic market have been constantly increasing, yet a large part of this increase went to pay higher MET taxes affecting the company.

According to already-signed contracts, Rosneft has committed to supply 34 bcm of gas in 2013 and 2014, 37 bcm in 2015, 72 bcm in 2016 and 77 bcm in 2017. Rosneft announced it already has contracts in place to supply over 70 bcm by 2017. The company has also set the long-term goal to increase its commercial gas production to 100 bcm by 2020 – so that when discounting potential production from Itera and from TNK-BP by 2020, Rosneft would need to add about 40 bcm of its own production by 2020. As an illustration, in 2012 Rosneft signed a landmark gas sales contract with Inter RAO to supply up to 875 bcm of gas from 2016 to 2040 (equivalent to up to 35 bcm/yr), with intentions of increasing sales to the power sector. Novatek in turn is confident that it will market all its future production.

Whereas Gazprom supplies gas to all of the federal regions connected to the grid, Novatek for example only concentrates its gas sales, amounting to 57 bcm (7 bcm are sold in addition to traders), in a few regions: in 2013, the company supplied 14.6 bcm to Chelyabinsk region, 11.9 bcm to Moscow city and Moscow region, 7.8 bcm to Perm region, 4.6 bcm to Kostorma region, 3.6 bcm to Orenburg, 2.7 bcm to Khanty-Mansiysk region,

30. *Ibid.*

2.2 bcm to Vologda region, 2.1 bcm to Sverdlovsk region, 2.0 bcm to Tyumen region, 1.3 bcm to St. Petersburg, 7.8 bcm to the YNND.[31] Gazprom reports that the average transportation distance for its own gas supplies is 1.8 times longer than independents.[32]

In 2014, the government was reportedly considering a proposal that would entitle Gazprom to offer up to 15% price discounts on regulated wholesale tariffs for industrial consumers. At the time of writing, any such decision had not been made, but should it be adopted, Gazprom would have an opportunity to better defend its market share on the domestic wholesale market.

Although there is a greater number of gas suppliers in the wholesale market, there is no full-fledged competition. Indeed, independent producers limit their sale to markets close to their production centres to reduce transportation costs. Independent suppliers tend to take dominant positions in some regions, thus replacing Gazprom. In distant and remote regions, Gazprom remains the sole supplier. Fostering competition between Gazprom and independent companies in regions close to production centres would benefit end consumers and would require fair conditions for all gas suppliers.

Gas trading platform

A gas trading platform was operational on an experimental basis from November 2006, and closed on 1 January 2009. A total of 13.25 bcm of gas was traded, including 7.4 bcm from Gazprom. The gas prices on the platform would only be competitive in a very narrow portion of Russia's region but within these boundaries could increase liquidity and competition in the market. In principle though, such a platform can make it possible to give more reliable and transparent signals on the wholesale market price, which is often different from the regulated level, and allow short-term supply/demand optimisation, which is important for the efficiency of the power market.

Decree No. 323 from 16 April 2012 enabled OAO Gazprom and its affiliates to sell up to 15 bcm at flexible prices at commodity exchanges in 2012, and starting from 2013, up to 17.5 bcm. However, Gazprom cannot sell more than total sales at the exchange from independent companies. Yet due to lack of regulatory framework regulating gas trades at the existing trading floors, and the ban on gas sales of Gazprom on analogue gas trading platforms (trading system), there were no sales of gas volumes. Gazprom is advocating the chance to sell gas not only on the commodity exchange but also via trading systems, based on current legislation. Overall, such a trading platform would only be effective if there were fair third-party access to the gas transmission infrastructure. It is questionable whether the trading platform could support a more liquid and competitive market in an environment marked by an oversupply of gas. Nonetheless, the platform could be an effective tool for gas supply and consumption optimisation. Indeed, long-term contracts between Russian suppliers and industrial end consumers in most cases offer a low rate of monthly, weekly and daily flexibility as minimal and maximal take-or-pay levels are usually set on a quarterly or yearly basis. The gas trading platform could help end consumers access more flexible supplies and on a short-term basis, especially if the obligation to provide third-party access to all the gas traded on the hub is effectively addressed and enforced.

The establishment of a competitive and effective hub comparable to the Henry Hub or the British NBP is challenging, as most gas on the wholesale market is sold at regulated

31. Novatek (2013), Annual Report 2013, www.novatek.com.tw/ir/AnnualReport.asp.

32. Gazprom (2013), Annual Report 2012, www.gazprom.com/f/posts/77/194006/annual-report-2012-eng.pdf.

prices, and due – to the fact that the transmission system operator is not independent. as well as due to the geographical disposal of gas resources and large industrial regions as well as the infrastructure linking the two.

In January 2013, Russia's Energy Ministry asked Gazprom, the Moscow International Commodities & Energy Exchange and St. Petersburg International Mercantile Exchange to launch the organised trading of gas in September 2013. Preparations were under way involving the Ministry of Energy, the Ministry of Economic Development, the FAS, the Federal Financial Markets Service (FFMS) and Gazprom. Yet the issue proves highly complex and technical, and requires inter-ministerial co-ordination, so the work to launch the organised trading continues at the present time.

Tariffs for wholesale and retail markets

Gazprom sells gas to the industrial and household sectors at regulated wholesale and retails tariffs. Gas sold by independent companies is not regulated, except for the population. Based on parameters defined by the Ministry of Economy in yearly forecasts for Russia's social and economic development, the FTS sets tariffs or upper and lower limits on a yearly basis including:

- Wholesale tariffs for natural gas for the industrial, power and district heating sectors, according to a price formula that includes the rouble's exchange rate against the US dollar and prices for fuel oil and gasoil on European markets. Any variation of this data in the price formula leads to a change in the wholesale gas price for industrial consumers.
- Regulated gas prices for Gazprom’s supplies to the residential sector.
- Gas transmission tariffs.
- The methodology for regulated prices for the residential sector.

These regulated wholesale and retail tariffs are very sensitive inasmuch as they determine the profitability of Gazprom (together with the taxation level), the competitiveness of the Russian industrial and thermal power sector, and the purchasing power of households. Regulated wholesale tariffs also set benchmark prices that also determine the profitability of independent producers’ gas supplies. When setting these tariffs, the FTS takes into account the transportation distance from major fields to reflect higher costs for Gazprom when transporting gas to distant consumers, as well as the different categories of consumers.

On 28 May 2007, Decree No. 333, On Improving State Regulation of Gas Prices, introduced a new gas pricing and tariff mechanism. Regulated wholesale prices were to increase to reach a netback parity level with Gazprom’s European gas export prices at borders of key markets. In addition, a new pricing mechanism was introduced for gas supplied by Gazprom, establishing a regulated price ceiling (minimum and maximum price levels) for different consumer groups. The regulated price set by the FTS defines the minimum price levels. The maximum level of increase to the regulated price was set as 10% as from 1 January 2011. The right to determine gas prices within these limits is granted to suppliers and buyers, for new consumers that sign their first supply contract after 1 July 2007, and to natural gas supplies in excess of the contracted volumes. This has allowed greater flexibility in adjusting prices to gas consumption levels by different industries and to seasonal fluctuations as well as consideration, upon agreement with certain consumers, of such factors as price variations depending on the supply schedules, offtake patterns during one day, one week, etc.[33]

33. Gazprom (2012), Annual Report 2011, www.gazprom.com/f/posts/51/402390/annual-report-2011-eng.pdf.

Decree No. 1205 from 31 December 2010 continued the move towards export parity netback level and defined a transition period from 2011 to 2014 during which regulated wholesale tariffs would increase by 15% per year on the basis of a price formula stipulating stage-by-stage transition to equal profitability of export and domestic gas sales with consideration given to the cost of fuel alternatives. The plan was that as from 2015 onwards, there should no more be a difference between export prices minus export duty and transportation costs, and domestic wholesale prices. Indeed, average regulated wholesale prices (net of VAT) steadily increased by 15% in 2010 and 2011: from RUB 2 372.7/kcm in 2010 (USD 71.2/kcm) to RUB 2 745.0/kcm in 2011 (USD 82.35/kcm) and RUB 2 961.3/kcm (USD 88.83/kcm) in 2012.[34] Average sale price in Russia has increased from RUB 1 1125/kcm in 2006 (USD 34/kcm) to RUB 2 961/kcm in 2012 (USD 90/kcm), marking a 2.6 times increase (in current prices). The regulated prices were to further increase according to key parameters of *Outlook for Social and Economic Development of the Russian Federation for 2013 and the Planned Period of 2013-2015* which established the following caps for average annual wholesale gas price increases with annual price indexation starting from the second half of the year: in 2013, 15.0%; in 2014, 15.0%; in 2015, 14.6% to 15.0%. Yet in 2013, later on the Economic Ministry then proposed cutting the growth of the gas tariff for industrial consumers to 5% in 2014-15, versus the earlier planned 15%, and 10% in 2016 As a consequence, Gazprom has benefited from tariff increases over past years and according to its reports, its average sales price in Russia has increased from RUB 1 652/kcm to RUB 2 964/kcm in 2012, marking an increase of 80%. Yet at the same time, the MET has increased, and so has inflation. In 2013, the regulated wholesale price increase was still 15% and reached RUB 3393/kcm (about USD 106/kcm).

Yet these yearly price increases to netback parity level have been increasingly questioned following the economic crisis and low US gas prices by industrial users who have stressed the need to preserve the competitiveness of the Russian economy against the background of lower domestic growth and higher inflation. Moreover, the increases in regulated wholesale price levels already allowed Gazprom, but especially independents, to produce and supply their gas in making good profits.

In 2013, the government decided to freeze regulated tariffs as from 1 July 2014 for a year and then to limit the increase at the level of inflation as from July 2015 for a period of two years. Price increases are always decided in January and implemented as from 1 July of a year. In its forecast for Russia's socio-economic development in 2014 and the 2015-16 planning period, the Russian Economic Development Ministry has proposed that beginning in 2016 the formula for setting the natural gas price charged to Russian industrial consumers should incorporate gas prices in other markets, including the US market. In 2014, there have been more discussions on the possibility of further changing these price levels and allowing higher increases than inflation.

Table 5.3 Estimate of regulated wholesale gas price increases, 2014-16

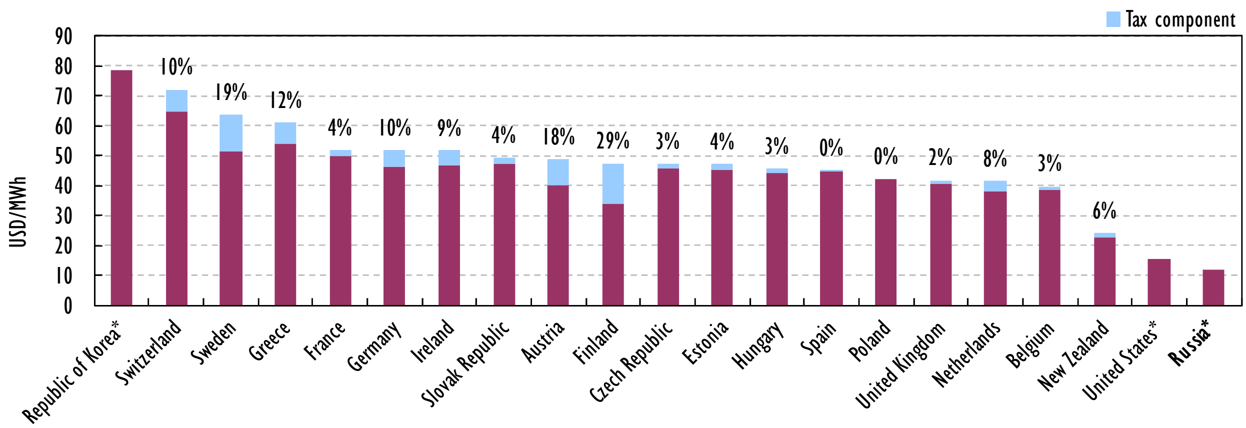
	2014	2015	2016
Wholesale gas price increase, average per year	7.6%	2.2%	4.9%
As from 1 July	0%	4.8%	4.9%

Source: Sberbank Investment Research.

34. Gazprom (2013), Annual Report 2012, www.gazprom.com/f/posts/55/477129/annual-report-2012-eng.pdf.

In 2016, the average wholesale gas price of gas (excluding VAT) for Russian consumers should reach levels of about RUB 3700/kcm (about USD 112/kcm), the exact levels being dependent on inflation. Figures 5.7 and 5.8 show that current wholesale gas price levels are on a par with the price paid by industrial consumers in them United States or Canada and still three to four times lower than in most member countries of the Organisation for Economic Co-operation and Development (OECD).

Figure 5.7 Industry gas prices in Russia and IEA member countries, 2013

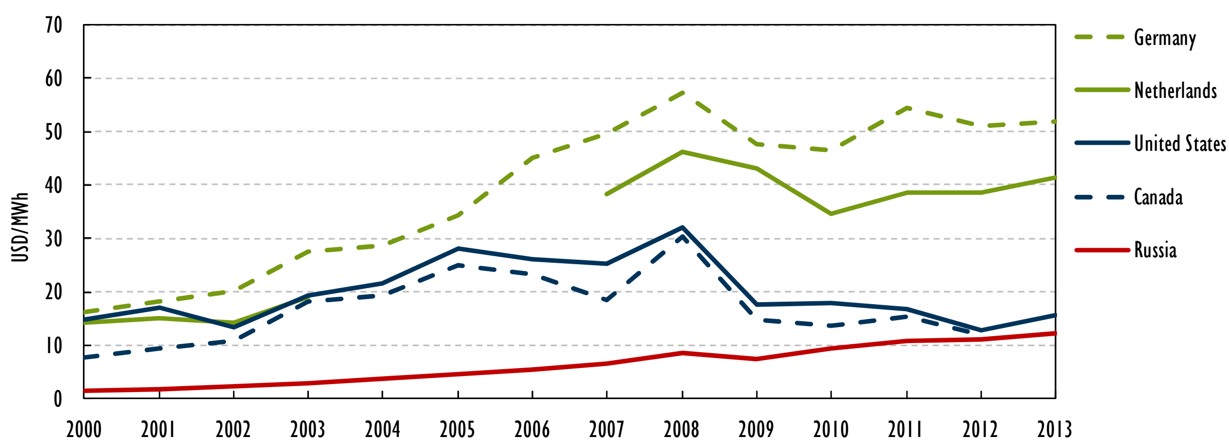


Note: USD/MWh = US dollars per megawatt hour. Data not available for Australia, Canada, Denmark, Italy, Japan, Luxembourg, Norway, Portugal and Turkey.

* Tax information not available.

Source: IEA (2013), *Energy Prices and Taxes*, OECD/IEA, Paris.

Figure 5.8 Industry gas prices in Russia and in selected IEA member countries, 2000-13



Note: Data not available for the Netherlands from 2004 to 2006; data not available for Canada for 2013.

Source: IEA (2013), *Energy Prices and Taxes*, OECD/IEA, Paris.

Regulated retail gas prices for gas supplied by Gazprom to households are set below the wholesale gas price, as providing affordable gas to the population is a key social policy that is implemented by state-controlled Gazprom. Gazprom's economic disadvantage as the monopoly supplier selling at relatively low regulated prices to the population is compensated by its almost total dominance of gas exports to European markets. The FTS sets a framework with minimal and maximal tariffs, and Regional Energy Commissions then determine the regional retail gas price, which varies depending on the category of households and the presence or absence of metering.

Retail gas prices set by the FTS as from July 2013 were in a range of RUB 2 600/kcm to RUB 3 100/kcm depending on the region (net of VAT), and averaged RUB 2 977/kcm (USD 89/kcm), and up to RUB 4 100/kcm for regions where gasification investments were being undertaken.[35]

TAXATION

Table 5.4 Main gas sector taxes and characteristics

Tax	Calculation modalities	Conditions and modalities of tax reductions and/or tax breaks	Tax amount per period	Remarks
MET on natural gas (RUB/kcm)	Following legislative changes in mid-2013, the MET rate calculation formula includes: - global Urals crude price - USD exchange rate - inflation - export duty on oil - domestic and export gas prices - composition of the field (the proportion of gas and condensate in production) - regional adjustment coefficient - gas transportation tariffs coefficient. The basis rate for gas is 35 RUB/kcm; As of 1 January 2015 for 12 tax periods (tax period = 1 month): The MET rate multiplied by the basic value of fuel equivalent and by the coefficient for degree of difficulty of gas and condensate extraction is combined with a transportation coefficient. If the amount is < 0, the tax rate will be 0. The figure for transportation costs will be calculated starting 1 January 2015 and will be in effect for 12 tax periods (each one month) starting on 1 January of the relevant year.	Decreasing coefficients to the base MET: - regional adjustment coefficient up to 0.1 (10% discount) for fields in the Yamal and Gydan peninsulas, the Astrakhan and Irkutsk regions, the Far Eastern Federal District, the sea of Okhotsk, and territories with isolated gas supply system until 2033; the regional decreasing coefficient for fields on the Yamal and Gydan peninsulas will be gradually raised to the base coefficient by 2025. This ratio will increase to the base rate after 12 years from the start of commercial development. - depletion coefficient up to 0.5 (50% discount) of the total rate - resource depth coefficient up to 0.5 (50% discount) for reservoirs at depths over 1 700 m. - transport costs coefficient includes three components, the average distance of gas transportation from the field in the previous tax year and two coefficients.	The differentiated MET rates adopted in 2013 will enter into force on 1 July 2014; transport coefficient = 0 until 1 January 2015.	In Gazprom's case, the MET rate would be adjusted downward by the amount of regional exemptions of its regional affiliates. In case the growth in regulated tariffs slows or is flat, the formula would serve as a buffer, yet a limited one. The level of the tax would also be impacted by changes in the global oil prices – and thus average export prices in long-term contracts, which is favourable to Gazprom, alongside the regional adjustment coefficients, as Gazprom's production is moving to Yamal. Independent companies raised concerns about the new gas tax formula calculations if the growth in gas transportation tariffs is above the level of inflation. As of 1 January 2015, a special tax compensation mechanism will take into account possible fluctuations in the actual gas transport tariff against the base level (the 2013 tariff adjusted for inflation). If the actual tariff exceeds the base level in the future, the MET rate for natural gas would be raised for taxpayers belonging to Gazprom group, owner of the Russian Unified Gas Transportation System, and lowered by the same value for the independents.

35. www.fstrf.ru/tariffs/info_tarif/gas/citizens/415 (visited on 24 October 2013).

For Gazprom			in RUB/kcm: 2012: 509 2013: 582 2014: 622.	The changes in Part 2 of the Tax Code of the Russian Federation, made in November 2011, envision an increase of 2.15 times in the MET rate for natural gas, applicable to OAO Gazprom and companies where it has over 50%, starting from 1 January 2012. For 2013 and 2014, MET rates were to increase by 14.3% and 6.9% respectively. Gazprom estimates that over the three-year period (2012-14) it will pay an additional RUB 440 billion versus 2011, including RUB 114 billion for 2012.
For independents			in RUB/kcm: 2012: 251 2013: 265 2014: 278.	
Associated gas			0 over the period	
Condensate	Formula is similar to gas, but the gas tax rate will depend on the share of condensate in the total production mix.		in RUB/kcm: 2012: 556 2013: 590 2014: 647.	
Export tax	30% of customs value as per the government resolution of 30 August 2013	Yamal LNG; Arctic offshore		The Ministry of Economic Development is responsible for calculating export duties according to the amendments to the law On Customs Duties effective as of 1 April 2013.
Profits tax			Maximum: 20%; minimum: 15.5%.	
VAT			18%	

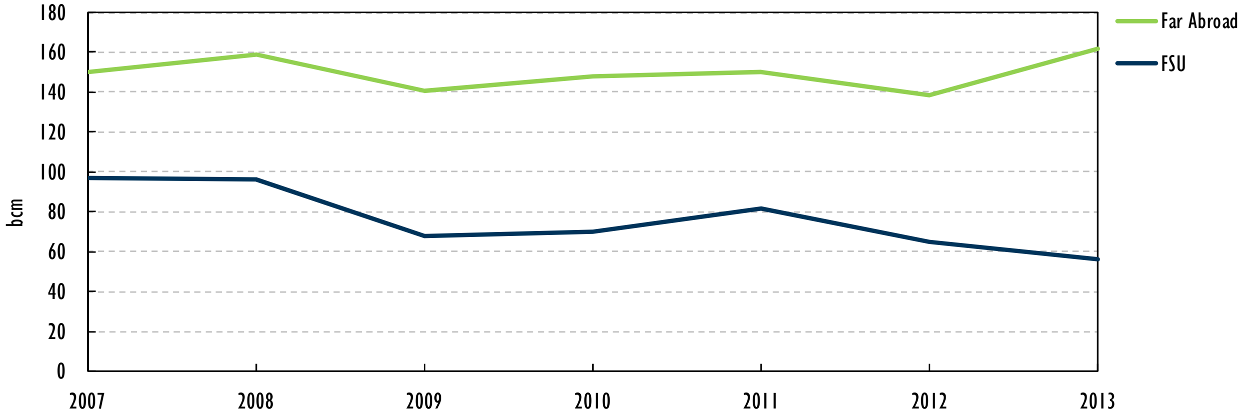
Sources: Gazprom Annual Reports 2011, www.gazprom.com/f/posts/51/402390/annual-report-2011-eng.pdf and 2012, www.gazprom.com/f/posts/55/477129/annual-report-2012-eng.pdf; Ernst & Young, www.ey.com/RU/en/About-us/Our-people-and-culture/Our-history/Our-history---Ernst---Young-in-Russia; PricewaterhouseCoopers, www.pwc.ru/en/; Ministry of Finance, www.minfin.ru/; Interfax, Russia & CIS Oil and Gas Weekly, 2012 and 2013 copies.

Russia's gas sector taxation plays an important role in determining budget revenues (although much less than oil as the gas sector overall is less taxed than oil), the nature and volumes of resources produced, and companies' production costs, in particular between Gazprom and independents given that the tax system has different taxation levels for Gazprom and independents that favour the latter. Main taxes are the MET (in a range of USD 20/kcm for Gazprom and USD 8/kcm for independents for the year 2013) and the export tax (30% of total export gas value). The government has recently introduced a number of tax reductions and breaks to stimulate the development of frontier and hard-to-recover gas resources and to stimulate LNG exports from Arctic areas. Table 5.4 provides an overview of the main taxes, modalities and calculation methodologies.

PIPELINE EXPORTS

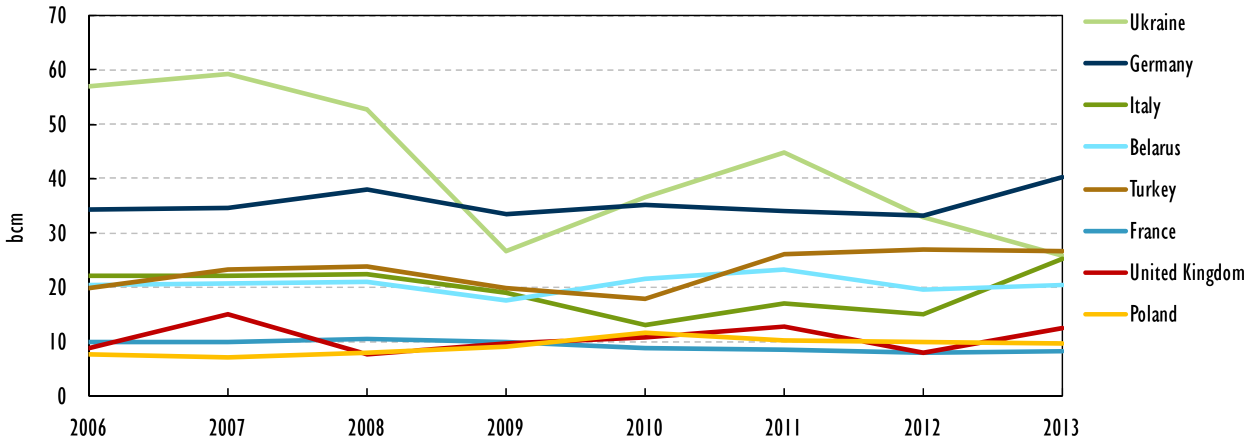
Russia is the world's largest gas exporter and plays a key role in regional and global energy security. Federal Law No. 117, On Gas Exports, from 18 July 2006 provides Gazprom with a monopoly on pipeline gas exports. Gazprom exports pipeline gas in different areas under long-term contracts: the FSU countries and European countries including the Balkans and Turkey. Gazprom's largest export markets in 2013 are Germany (40.2 bcm), Turkey (26.6 bcm), Ukraine (26 bcm), Italy (25.3 bcm) and Belarus with over 20 bcm. Gazprom in particular has managed to post a remarkable increase in sales to Germany and Italy over the past years. A key trend over the past five years is a decrease of Gazprom's exports to the FSU category, from 100 bcm in 2006 to about 60 bcm in 2013, mainly due to lower export volumes to Ukraine (Figure 5.10). At the same time, Gazprom's exports to the "Far Abroad" (Europe minus the Baltic States and Moldova, Ukraine and Belarus) reached record high levels in 2006 and 2007 before falling to 139 bcm in 2009 and growing again to a level of 161.5 bcm in 2013 (Figure 5.9).

Figure 5.9 Evolution of Gazprom's total exports to the FSU and Far Abroad countries, 2007-13



Sources: Gazprom's Annual Reports from 2006 to 2013 and press releases, www.gazprom.com/.

Figure 5.10 Evolution of Gazprom's exports to its key export markets, 2006-13



Note: Data for 2013 are estimates.

Sources: Gazprom's Annual Reports from 2006 to 2013 and press releases, www.gazprom.com/.

In 2013, exports to Ukraine reached a historical low level of 26 bcm due to oil-indexed gas prices, import diversification, use of coal and the economic crisis in Ukraine, which led to lower offtakes. The 2012 export low of 139 bcm to European markets proved to be short-lived as exports bounced back to 161.5 bcm in 2013. Regarding European gas markets, Gazprom's export levels are limited by the low competitiveness of oil-indexed gas prices against the backdrop of competition from alternative fuels, especially renewables and coal for power generation, and some alternative gas supplies. The consequences of the economic crisis are also an explanatory factor. In co-ordination with the government, Gazprom so far has largely stuck to oil indexation while making retroactive payments to European customers following price renegotiation or arbitrage procedures, thus marking its preference for a price support strategy over a volume support strategy. This enables Gazprom to cover higher production and transportation costs from its new upstream and midstream projects as well as to cover the high taxes on extraction and exports, while still making a reasonable profit margin. In the medium term, the company expects to increase its exports to European customers against the backdrop of economic recovery; tight global LNG markets and supplies diverted to the Asia Pacific markets; turmoil in North Africa; a decrease in domestic production in Europe, such as in the Netherlands and the United Kingdom; and a possibly growing demand for gas for power and heat generation. Yet rough calculations show that in the current market circumstances and assuming a EUR 10 per tonne carbon price, a 40% gas price reduction from today's German border price levels would be needed to compete with cheaper coal for power generation – perhaps slightly less for modern CCGTs. Russian gas exports to Europe are likely to increase only if gas becomes more competitive versus alternatives, if the European economy recovers, and if a genuine carbon price is established in Europe that could progressively and partly phase out coal for power generation. The diversification of European gas supplies from the Caspian Sea, the Black Sea, the East Mediterranean and Iraq are unlikely to have a major impact on Gazprom's future export levels to Europe, although in some European markets, these additional and alternative supplies are likely to foster competition.

LNG EXPORTS

Over the past few years, Russia has also embarked in a strategy to develop its LNG exports to the Asia Pacific region in order to gain market share in this fast-growing market, and to diversify away from the traditional European market, where large additional gas import requirements for Russian gas are not a certain assumption. Not only is this meant to raise supply opportunities there, but also to foster the development of the Arctic and Far East regions. Russia is currently developing its gas export strategy in view of increasing its gas exports to the Asia Pacific region. The 2009 Energy Strategy for the period to 2030 set the goal of increasing Russia's share of the Asia Pacific region in the total gas export structure from 0% in 2008, to 10% to 12% in 2013-15, 15% to 17% in 2020-22, and 20% in 2030. Subsequently, Russia set a target for LNG exports at 10.2% of the global market share by 2020 in its March 2013 State Programme on Energy Efficiency and energy development (up to 2020). Drivers behind this strategic policy objective include the will to develop and monetise gas resources in East Siberia and the Far East, to develop these regions, and to diversify away from Europe, where the potential for increases in exports is relatively limited.

The government is directly supporting this process in offering key tax incentives – export tax exemptions and MET exemptions for Yamal and Far East LNG export projects – as well as direct financial and technical support: The Sabetta port servicing the Yamal LNG plant is to be constructed by federal funds and nuclear icebreakers are allocated to enable navigation and break the ice in the port. At this moment there is no LNG export tax in Russia.

In 2009, Russia began LNG exports from the Sakhalin-2 plant, which is operated by Sakhalin Energy Investment Company on the basis of a PSA. The plant is located in the south of

Sakhalin and linked to the offshore fields via an 800 km pipeline. In 2011, Russia exported 10.6 Mt LNG and 10.8 Mt in 2012 – roughly about 15 bcm[36] – and 9.75 Mt in 2013.

Since 2012, there has been intense lobbying from companies such as Novatek and Rosneft to obtain the right to export LNG from their projects, mainly at Yamal and Sakhalin.

Until 2006, Russia's state-owned Gazprom enjoyed a *de facto* monopoly on the export of Russian gas (with some exceptions such as Itera),[37] and this monopoly was enshrined in the Federal Law on Gas Export of 18 July 2006.[38] However, the Federal Law No. 318-FZ,[39] which includes amendments to Articles 13 and 24 of the Federal law On State Regulation on Foreign Trade Activities, and Articles 1 and 3 of the federal law On Gas Export, was ratified on 30 November 2013 and entered into force on 1 December 2013. This new law is decisive as it regulates LNG exports and opens the door for LNG exports by non-Gazprom companies.

Some key conditions nonetheless restrict the right to export LNG under this new law to: companies that had gas extraction licenses as of 1 January 2013, that envisage building an LNG plant or producing gas to be liquefied; or companies (and their subsidiaries) in which the state controls more than 50% of the shares, which are developing offshore gas fields in the subsoil of internal waters, the territorial sea and the continental shelf of Russia, including the Black and Azov Seas, or gas production from projects developed under a PSA that was concluded by the time of entry into force of the law. Ultimately, this means that in addition to Gazprom, the following companies could develop LNG projects: Rosneft, Novatek, and also possibly GazpromNeft and Zarubezhneft, if they obtain offshore licences and have gas available that could be exported via LNG. It is worth noting that before this law, the government published the Federal Law No. 268-FZ of 30 September 2013,[40] granting tax and customs-tariff privileges to companies that carry out offshore hydrocarbon extraction activities.

At the same time, the government will still have oversight of LNG exports. Under article 2(g) of the law, exporters will be obliged to hand over information to the Russian Ministry of Energy on their gas exports in accordance with requirements to be set by the government. This means that while the amendments do not directly state that no LNG can be sold in a market where pipeline gas is sold, nor that no more than one company can sell LNG to the same market, the government may be able to control and organise gas exports by defining strict "requirements" at a later stage and putting conditions in the licences.

The impact of this restricted liberalisation of LNG exports will be important in the Russian gas industry and possibly also foreign markets. Increasing Russian LNG exports to the Asian market could free up some LNG redirected from Europe to Asia, and it might go back to Europe and compete with Gazprom's pipeline gas, especially if the price difference between Europe and Asia narrows. In addition, in the European market, such as in Spain or Portugal, but also the United Kingdom, non-Gazprom LNG might compete with Gazprom's possible future exports from its Baltic LNG, if developed.

36. For a detailed historical overview of LNG projects in Russia and current developments, see Mitrova, Tatiana, *Russian LNG: The Long Road to Export*, IFRI, Russie.Nei.Reports No. 16, December 2013; available at: www.ifri.org/?page=detail-contribution&id=7920 (accessed on 16 December 2013).

37. Itera was an independent Russian energy company that was consolidated into Rosneft in 2013.

38. www.rg.ru/2006/07/20/gaz-export-dok.html.

39. www.rg.ru/2013/12/04/gaz-dok.html.

40. www.rg.ru/2013/10/04/syrje-dok.html.

Currently, one LNG export project has taken the FID (Yamal LNG) and five others are being developed by Gazprom, Novatek and Rosneft, some in co-operation with different foreign partners from Europe, Asia and North America (see Table.5.5). These projects have different characteristics in terms of development status, resource base (offshore or onshore), transportation distance to markets, targeted markets, and customers. But most volumes would nonetheless be oriented towards the Asia Pacific region.

Russia has very ambitious targets given that global LNG supply capacities will increase strongly by then with new projects commissioned from Australia, North America and East Africa in particular. Yet Russia and its companies have the potential to develop some key projects successfully if only the right legal and regulatory framework is put in place, and if the most economically viable projects are quickly developed in an efficient manner, as the window of opportunity on future LNG sales is progressively closing. Indeed, China's increase in demand is constrained by a gas price reform, the uncertainties surrounding its shale gas developments and upsurging environmental concerns, yet China successfully signed up to additional gas supplies via LNG, Central Asia and Myanmar. Companies from the Republic of Korea, Japan and India have been signing North American, Australian and Qatari LNG contracts, and more could come. Assuming that every project is completed as planned, Russia would have additional LNG export capacity to Asia of 36.5 Mt (50 bcm) by 2020 and 53 Mt (72 bcm) by 2025, and pipeline export capacity of 38 bcm (28 Mt). A realistic assessment however is that not all these projects will be realised, and that much will depend on whether Gazprom manages to open up gas exports to China via pipeline and which LNG projects are the most cost-effective.

The window of opportunity for Russian gas is narrowing as companies in China, India, Korea, and Japan have been very active in signing new supply contracts. Nonetheless, Russia is not too late at this stage, although it took a lot of time for Russia to accelerate the development of its LNG potential. Although Gazprom is likely to develop its own pipeline and LNG projects in the medium to long term, primarily Novatek, but also Rosneft, will take an important role in unlocking Russia's gas exports to the Asian markets[41] together with foreign partners.

Yamal

Immediately after the LNG liberalisation law was adopted, the FID on the Yamal LNG project (60% Novatek, 20% Total, 20% CNPC) was taken in December 2013. This marks a major breakthrough as it confirms that it is Russia's most advanced LNG export project, as it will be the second LNG plant to be operated in Russia and as Gazprom is not involved – the whole project has been so far developed by Novatek and its foreign partner Total. A fourth company or consortium of companies, presumably from India or Japan, might enter this joint venture with a 9% stake, which in that case would reduce Novatek's share to 51%.

Production will come from the development of the onshore South-Tambeyskoye field and will be exported via three trains of 5.5 Mt per year, totalling 16.5 Mt capacity per year. According to Novatek, the first train is to be commissioned at the end of 2016 with first commercial deliveries in early 2017, followed by the second in 2018 and the third in 2019. Given the huge challenges in infrastructure construction and in spite of the fact that works had already begun before the FID decision (more than 4 000 workers reported

41. Asian markets include Japan, Korea, China, Chinese Taipei, India and other non-OECD Asian economies.

to the field in February 2014), some delay could be expected in the commissioning of these trains. The Yamal LNG project has also been marked by a cost increase, from USD 20 billion to USD 27 billion.

The Yamal LNG trading company has been quick and successful in signing sales and purchase agreements with Total, Novatek, Gas Natural Fenosa (2.5 Mt per year or 3.2 bcm over 25 years), CNPC (3 Mt per year over 20 years) and Gazprom Marketing & Trading Singapore (3 Mt per year over 20 years) with standard price formulas depending on the market. For example the price in the contract with CNPC is reportedly indexed to Japanese Crude Cocktail prices. As of May 2014, practically all the volumes had thus been pre-sold. Yamal LNG cargoes could be supplied via the northern route to the Asia Pacific in summer, or all along the Suez route during winter via transhipment to larger vessels at some European ports. Up to 16 ARC7 ice-class tankers able to operate in the Arctic waters without being accompanied by icebreakers have been ordered from Korea's Daewoo yards.

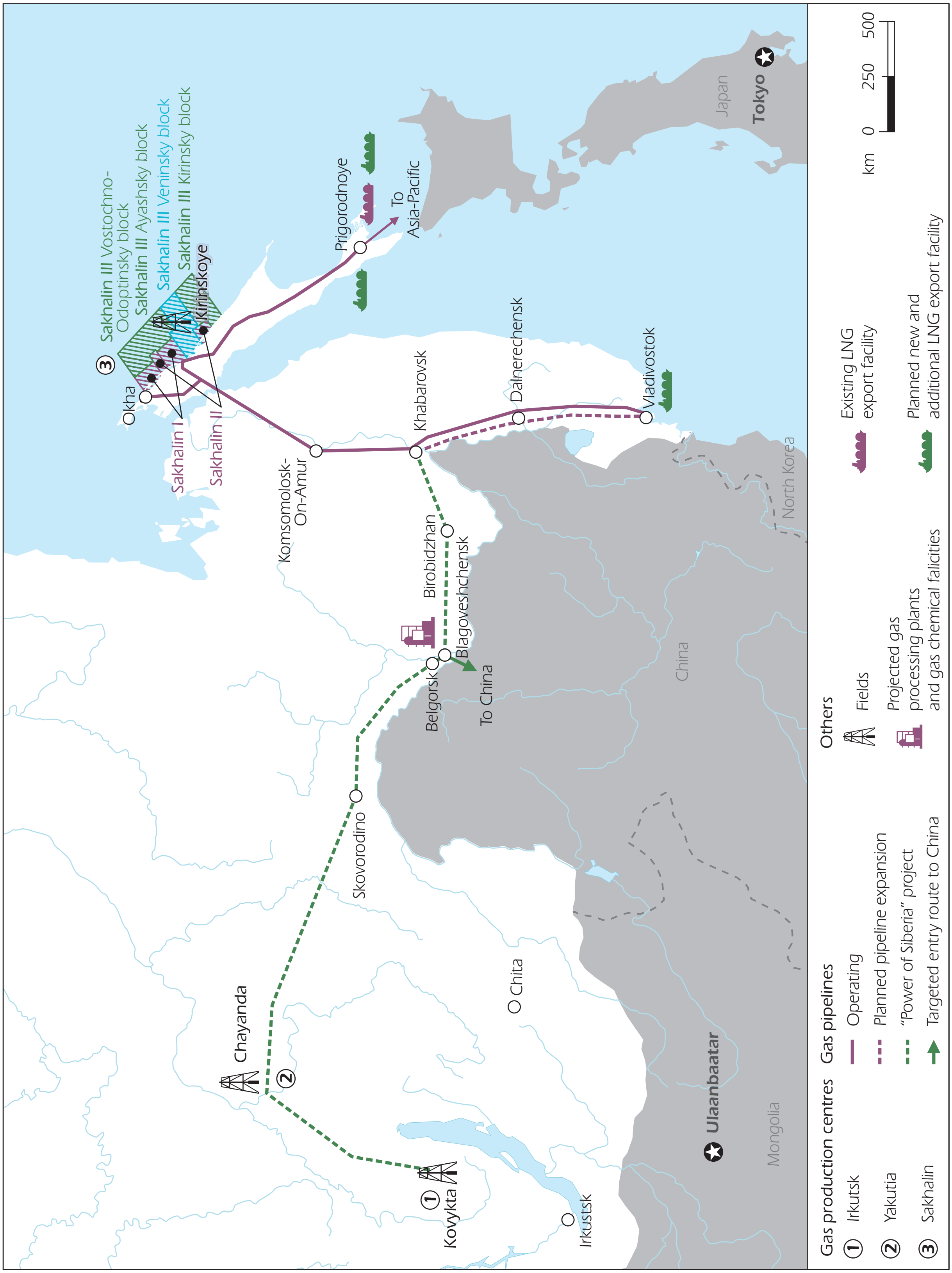
Immediately after the FID was made and following a request by Novatek, the government published the new governmental order No. 2413 dated 19 December 2013, On Amendments to the Governmental Decree No.1713-p[42] on the development of LNG production in the Yamal peninsula.[43] According to this new order, a second LNG export plant on the basis of gas fields on the Gydan peninsula was added to the same legislative framework that exists for the Yamal LNG project. This second plant, which could also have three train totalling 16.5 Mt capacity, would also benefit from the same tax exemptions – zero MET until production reaches 250 bcm and zero export duty. Feasibility studies and exploration works are currently underway.

Finally, Rosneft at some point in the future may also develop its own LNG project in this region, using the Sabetta port facility that is constructed with federal funds, as well as possibly the airport. Indeed, the company is currently conducting exploration activities in the offshore surrounding areas and is likely to identify important gas reserves that could be economically recoverable.

East Siberia and the Far East Sakhalin-2 LNG expansion: Currently this project is promoted by Sakhalin-2 consortium "Sakhalin Energy" (Gazprom [50%+1], Shell [27.5%-1], Mitsui [12.5%] and Mitsubishi [10%]) – however the final structure of a possible expansion is not decided yet. It aims at adding a third train to the Sakhalin 2 LNG plant and thus increases capacities, though resource base was not specified. (Initial design capacity is 9.6 Mt/yr.) The resource base would be the offshore Sakhalin-3 blocks Kirinskoe and Yuzhno-Kirinskoye as an option, yet Gazprom is also considering using it as a key supply source for the Vladivostok LNG plant. This project is based on offshore gas but would offer a relatively competitive option given low transportation distance from the gas source to the LNG facility and already existing infrastructure. It would give an important role to foreign companies.

[42] http://archive.government.ru/gov/results/12612//.
[43] http://government.ru/media/files/41d4ad1ad99d96ff0f7f.pdf.

Figure 5.11 New gas export projects in the Far East



This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

Sources: Gazprom; IEA.

Sakhalin-1 LNG: This project is promoted by Rosneft and ExxonMobil, and companies participating in Sakhalin-1 already may join (current structure is ExxonMobil [30%], SODECO [30%], ONGC [20%] and Rosneft-SMNG [20%]). This would consist of an initial 5 Mt or 7 bcm liquefaction plant to be commissioned by 2019 that would cost about USD 15 billion, and that could be expanded to 15 Mt at later stages. It would be supplied with gas from Sakhalin-1 (currently producing below its maximum potential as more stages could be developed), especially the offshore 485 bcm reserves from Chayvo, Odoptu and Arkutun-Dagi, and other fields could also be considered if resources are recoverable. Under this possible LNG project much of that volume has already been pre-sold through Heads of Agreement: 2.75 Mt to Vitol, 1.25 Mt to Marubeni and 1 Mt to SODECO. Rosneft and Marubeni signed a Memorandum for Strategic Partnership targeting the Sakhalin-1 LNG project. Gazprom for some time has been negotiating with Sakhalin-1 consortium to buy future gas production, yet negotiations ended unsuccessfully in autumn 2013. Developing this project would require building a possibly relatively expensive port and pipeline infrastructure for one train.

Vladivostok LNG: This Gazprom-developed project aims at building a LNG plant in the Vladivostok region with an initial capacity of 10 Mt by 2018, which can be upgraded to 15 Mt (20 bcm). Total cost of the project is estimated by Gazprom at USD 13.5 billion. So far, no gas sales and purchase contracts have been signed. The company plans to complete front-end engineering design (FEED) in the third quarter of 2014. Gas to feed the first two trains would come long distances from Sakhalin offshore fields: the Kirinskoe and Yuzhno-Kirinskoye fields with potential combined production of over 20 bcm/yr. Gazprom estimates production from Yuzhno-Kirinskoye at 16 bcm/yr but other estimates highlight that production from this field could be even higher. Currently, four wells have been drilled there with two more expected in 2014. Yet these fields may produce oil as well, which would need to be developed first, and are unlikely to be sufficient and ready on time to meet the current export plans. In addition, there is a mandatory commitment to also supply the Khabarovsk and Vladivostok regions. Beyond gas production for Sakhalin, Gazprom could also liquefy gas from Chayanda and/or Kovykta. Experts estimate that this project would be comparatively expensive and would thus require close cost controls. Yet its advantage is that the Sakhalin-Khabarovsk-Vladivostok pipeline has already been built; compression would need to be boosted.[44] It is worth noting the strong synergies between Vladivostok LNG and gas supply to China project via the Power of Siberia pipeline project.

The completion of both projects makes projects more attractive economically, because they might rely on the same gas sources and almost same pipeline projects. Yet Gazprom does not have export tax exemptions for onshore production from Chayanda and Kovykta.

The "Power of Siberia" pipeline to northeast China: The Power of Siberia pipeline project allows the shipping of gas from Chayanda and Kovykta fields to northeast China, where the gas would feed the Vladivostok LNG terminal and/or a pipeline to China via the "Eastern" route from Blagoveshchensk to Heilongjiang. This would not be the shortest route to enter China and the pipeline route would cost about USD 27 billion to be built. Gas purchase agreement negotiations with China have been ongoing since 2006 when a framework agreement over the supply of 68 bcm via two pipelines (Altai route and Eastern route) was signed. Although some agreement has been reached over the final gas transportation route since then – the Altai pipeline project has been abandoned – negotiations were still ongoing in early 2014. One of the issues under debate is the pricing structure, as

44. Sberbank Investment Research (2013), *Russian Oil and Gas. Private Parts*, April, Moscow.

CNPC is reportedly insisting on a lower price than the one offered by Gazprom. A binding agreement over gas volumes (38 bcm/yr), periods (30 years as from 2018), take-or-pay volumes, and delivery point was reached in September 2013. In addition, it remains to be seen whether Gazprom insists on a pre-payment of some of the gas to finance the infrastructure, and whether CNPC will insist on getting an upstream stake. China signed major gas supply agreements with Turkmenistan, bringing ultimate volumes up to 65 bcm by 2020, but this gas is unlikely to compete with Russian gas that is aimed at being consumed in Chinese coastal cities in the northeast of the country as well as in the Beijing area.

Table 5.5 Major Russian LNG projects under construction or planned

Project	Company	Investment resolution	Schedule and capacity (company information)	Committed or potential buyers	Investment	Gas source
Yamal LNG	Novatek (60%) Total (20%) CNPC subsidiary CNODC (20%)	FID made	LNG: 16.5Mt 1 train: 2017 2 train: 2018 3 train: 2019	CNPC: 3 Mt (15 years) Gas Natural Fenosa: 2.5Mt	LNG plant: USD 27 billion Port Sabetta: RUB 47.3 billion	Yuzhno-Tambeyskoye fields (Yamal Peninsula)
LNG project on the Gydan peninsula	Novatek	Planned	2022-25			Salmanovsk and Geofizik fields
Sakhalin-1 LNG	Rosneft ExxonMobil	Under pre-FEED	1 train: 2018 (5 Mt)	SODECO: 1 Mt Marubeni: 1.25 Mt Vitol: 2.25 Mt	LNG plant: USD 15 billion	For 1 train: Sakhalin-1 For future expansion: Sakhalin-3&5
Vladivostok LNG	Gazprom (MoU with Japanese companies)	Under FEED	1 train: 2018 2 train: 2020 3 train: ? Each train: 5Mt	NA	LNG plant: USD 13.5 billion Pipeline: USD 24.5 billion Chayanda explore: USD 13.7 billion	1 and 2 train: Sakhalin-3 3 train: Chayanda, Kovykta (after 2024)
Sakhalin-2 third train	Gazprom, Shell	Preparing for FEED	1 train: 2018 (5 Mt)	NA	LNG plant: USD 5-7 billion	Sakhalin-2 or Sakhalin-3

Sources: Gazprom; Rosneft; Novatek.

In addition, Gazprom is currently planning new export infrastructure projects for gas exports to European markets in a clear sign that these markets still remain essential for Gazprom and will continue to do so. This is especially the case since Gazprom is likely to see other Russian companies, such as Novatek and Rosneft, develop gas exports to the Asia Pacific region, whereas it is far less likely that Gazprom will face direct competition from these companies on direct gas exports to its markets in Europe currently supplied via pipeline. Developing such an additional export infrastructure emphasises that Gazprom expects to increase its gas exports to these markets in the future, notwithstanding growing competition from alternative suppliers and from alternative fuels. It also reflects Gazprom's goal of strengthening the security of its gas supplies.

Baltic LNG

This project aims at building a 10 Mt LNG plant near St. Petersburg. The project is currently at a pre-FID stage and the exact location is still to be determined. Gas could be exported in priority to Europe, where there are large free regasification capacities, or to Latin America. Gazprom aims to launch the first train by 2019.

Kaliningrad LNG regasification plant

In the fall of 2013, Gazprom announced that it would built a regasification terminal in Kaliningrad in order to strengthen the energy security of this enclave, which consumed about 2.2 bcm in 2012. Fall 2013 Gazprom announced the possibility of construction the regasification terminal in Kaliningrad with a suitable capacity for gas consumption projection in order to strengthen the energy security of this region. The terminal would link up with the storage infrastructure built there and would be operation as from the end of 2017.[45]

South Stream

This 63 bcm pipeline project aimed at linking Russia's Black Sea coast with Bulgaria through four spurs and a pipeline system of eight compressor stations in Russia, two in Bulgaria and two in Serbia is being actively developed. In September 2013, the board of directors approved a detailed construction schedule, endorsed the company's long-term budget and confirmed the commissioning of South Stream's first offshore line before the end of 2015. In addition, Gazprom Export and South Stream Transport B.V. signed a Gas Transmission Agreement.

Nord Stream 3-4

There are also discussions on further expanding the Nord Stream pipeline in adding to the already existing two lines a third and a fourth line and scaling up the compressor stations. The two lines, according to Gazprom, would be added in 2015 and 2017 and be completed in December 2018 and January 2020. This project is likely to depend on future demand prospects in Europe, alongside an agreement among partners to undertake such an expansion.

ASSESSMENT

RUSSIA'S GAS BALANCE AND EXPORTS

The Russian Energy Strategy to 2030 envisages a significant growth of domestic demand in coming decades and a considerably higher rate than the projections of the IEA or other institutes. At the same time, policy rightly emphasises the large energy efficiency potential of Russia. If energy efficiency gains are achieved, especially in the power and industrial sector, and if the economic growth remains at 2% to 3% per year or below, Russian domestic gas demand is likely to be measurably lower than expected. The Russian government should ensure that long-term energy strategy documents that guide investment decisions properly incorporate the expected positive developments in energy efficiency. In export markets, there is unlikely to be a major increase in demand for Russian gas beyond the level of 153 bcm to 167 bcm for Europe (Far Abroad category) and 55 bcm to 60 bcm for the FSU countries (Commonwealth of Independent States category). Against this backdrop, it seems that existing production and ongoing investment projects that are already economical at current domestic prices have a potential to create a significant excess supply over expected domestic and export demand in the medium term. This

45. Kommersant, 25 November 2013, www.kommersant.ru.

creates a risk of significant stranded investments in the Russian gas industry as well as significant losses for Gazprom, and indirectly to the Russian budget. That being said, a priority should be to reach the target of 95% utilisation of associated gas by 2016 given the environmental damage caused by flaring and the commercial opportunities related to this utilisation. Progress in past years in a number of companies has been too slow.

In order to avoid such a situation, Russian energy policy needs to ensure that only the most cost-efficient resources and projects are developed and find new market outlets for Russian gas, as demand in the domestic and external markets is likely to be a key constraint for the development of the production potential for Russian gas. Options include: ensuring a higher share of Russian gas in the European energy mix; development of new export channels to Asia and other new markets such as LNG and East Siberian pipelines; and developing a more competitive domestic market that will ensure the competitiveness of energy-intensive Russian industries. The government should continue to focus on developing the use of gas in the transportation sector as this would offer an opportunity to increase domestic gas consumption and free up oil or oil products for exports. Another option is to raise upstream taxation in order to ensure that only the most competitive resources are being produced. In order to achieve a higher share of Russian gas in the European energy mix, an alternative export strategy would be required that helps restore the competitiveness and economic viability of gas-fired power generation in Europe.

The government, Gazprom, Rosneft and Novatek have rightly prioritised the development of gas export projects to the Asia Pacific region, mostly via LNG export facilities, and legislation has finally granted LNG export access to independent companies meeting a specific set of conditions. The IEA commends this prioritisation because this region has fast-growing gas consumption and will need more secure and competitive gas supplies, which Russian projects can provide. Most Russian LNG projects are also extremely well-placed to serve the Asia Pacific market and will foster energy security in the region. Indeed, there will be a market for Russian gas, despite competition from new suppliers – Australia, North America, East Africa – as demand in the region grows. Russia thus has a golden opportunity to develop new gas resources and export markets. Yet this will require the gas to be competitive as the rise in demand will be limited by too-high price increases and coal as a strong competitor. Quick and strategic decisions and project development must also be priorities. Indeed, some of the current projects under development lack consistency and clarity, which may already deter some potential customers to prioritise Russian gas purchases and convince them to focus on other options. Credibility will be essential, and to be successful, Russia's LNG export strategy will need foreign participation, as foreign companies will bring experience in project management and facilitate raising finance for these projects.

It is thus of paramount importance that LNG exports be liberalised in an efficient manner. Possible governmental controls to provide export access on the basis of contracts, prices, customers and export markets could prove to be slow and procedural, open the way for influence-taking, and delay projects, sales and gas purchase contracts. It is thus also important to ensure that the most competitive and realistic projects are being developed to ensure a quick start of gas export and to ensure that supplies are competitive and that the budget can benefit from tax revenues. It is also essential that the government see LNG and pipeline exports as complementary, mutually reinforcing export options that should be aimed at creating synergies and optimising exports. The government must recognise that the key is no longer to control downstream pipelines or export infrastructure, especially in Europe, but to be able to be flexible and competitive.

It will be essential that the government enable Russia's LNG sellers to adapt to a possibly more competitive pricing environment in the Asia Pacific region, where North American LNG will be increasingly available based on Henry Hub pricing or some mixed and flexible price indexations. As a consequence, there is likely to be a growing pressure for more competitive LNG supplies, which would possibly require, among others, more flexibility on pricing and loosening of the traditional full oil price indexation link. This is paramount to sustain the increase in demand, especially since coal is more competitive than gas for power generation in the region.

The government should make a quick strategic decision over which projects to prioritise in terms of sequencing and gas resources. It should prioritise projects that have a resource base near the LNG facility, and that have a large and advanced customer base. This implies though that not all the projects currently envisaged can be economically viable and realised at the same time, especially since some of these projects are competing for the same resource base or the same markets. As such, there is a potential limitation from the resource base for additional gas exports from Sakhalin: The Ministry of Energy estimates that up to 47 bcm of gas could be produced at Sakhalin by 2020. But experts and companies doubt that such a high volume can be reached, and point to the fact that there is competition for this resource for the purpose of supplying the population – the current level of gas access being 10% of the population, while the government committed to increasing this share which might lead to additional 7 bcm of annual gas consumption – not to mention export volumes required to make the LNG projects viable.[46] At the same time, opening up pipeline gas exports to China should be a strategic priority that could also, in the longer term, improve the cost-competitiveness of the Vladivostok LNG project as more gas would be used through the Sakhalin-Khabarovsk-Vladivostok pipeline.

GAS MARKET REGULATION

Russia's domestic gas market is undergoing a major reshuffling and is being progressively liberalised, or at least less dominated, by Gazprom. This is illustrated by independent upstream production and wholesale supplies, thanks to attractive taxation and access to the pipeline infrastructure as well as a progressive increase, over past years, in regulated prices. This is still a transition phase in which important progress has been made, but elements of the regulated system prevail. Against this backdrop, fair and predictable regulation are needed as well as to complete the liberalisation effort for an efficient and more competitive gas market to develop further. Opportunities for reforms include:

- Granting effective third-party access to the pipeline through transparency of information: identification of bottlenecks and investments to remove them, regulation on the access to pipelines and regulation on balance of system (more gas put in the system than buyers take plus irregularity of offtakes and supplies). A recent resolution signed by the prime minister, calling for the preparation of legislative amendments to "develop competition on gas markets and in pipeline transportation", expected September 2014, could offer such an opportunity.
- Predictable and fair gas transportation tariffs: Gas transportation tariffs so far represent about 50% of the final gas price due to high transportation distances, and even more in some cases. This enables Gazprom to draw comfortable revenues from

46. Kommersant, 17 July 2013, www.kommersant.ru.

gas transportation and thus offset some of its higher transportation costs when supplying remote regions, and some of its expensive new pipeline investments. For the market to continue to develop, the gas transportation price has to increase less than the regulated wholesale gas price. Investment in new transmission infrastructure will help reduce congestion. Merging price and trading zones or enhancing rules on congestion management and capacity allocation would stimulate efficient network investment. Tariffs should have a very strict cost-control component; in addition, there need to be greater incentives for companies to supply gas to remote regions. A possibility would be to determine higher coefficients than those in place based on the average transportation distance between fields and end customers: the shorter, the higher the tariffs; the longer, the lower. As the government controls Gazprom, which plays a key role in tariff setting, it should make certain that the FTS ensures strictly independent controls of costs transmitted by Gazprom, and that Gazprom keeps gas transportation costs reasonable while also obtaining fair compensation for the fact that it is the only company supplying distant regions. Solutions need to be found to clarify and possibly end the current cross-subsidisation by Gazprom of its long-term distance gas sales in charging possibly higher tariffs for independents using shorter transportation distances.

- Gazprom would need to benefit from greater supply flexibility at non-regulated prices in order to be able to compete effectively with independent producers. This would also lead to the most cost-efficient gas supplies to compete with one another. As a consequence, the government should allow Gazprom to sell increasing gas volumes at a discount from the regulated price to industrial consumers.

UPSTREAM ARCTIC REGULATION

Regulatory challenges also need to be addressed in order to allow for successful partnerships between Russian state-owned companies and foreign IOCs, especially since PSAs are excluded to serve as a framework for this co-operation. Legal and regulatory conditions should be tailored to reduce economic, financial and legal risks foreign partners take in order to enable them to be comfortable investing some equity in developing these very capital-intensive projects in the future once exploration activities have been successful. Moreover, these issues have to be addressed in order to ensure that joint ventures can attract credit finance, which implies that banks are confident that risks, especially taken by foreign partners, are reasonable and addressed in the contractual and regulatory framework. As such, this is also in the strategic interest of Gazprom and Rosneft, as senior debt financing should represent about 70% of these projects' investments. Foreign company shareholders and banks may consider that the current framework has too many uncertainties, which could complicate attracting affordable long-term credits.

Companies teaming up in joint ventures to participate in exploration and, later, production, need to have a guaranteed right to participate in the development of the field in the event of a discovery. Within the boundaries of the model of risk service agreements, which have been chosen by Russian state companies, there is scope for further specifying and clarifying the role and status of foreign companies, especially as operators, in relation to the licence holder and the Russian partner, as well as the Russian state.

Overall, current regulations for offshore projects need to clarify responsibilities of IOCs in the role of operator and licence holder. The role of the operator as an owner and operator of assets on the continental shelf needs to be clarified, and the legislation should facilitate foreign companies' taking operator role. The concept of operator has been introduced into the tax legislation so that foreign companies in the role of operator could benefit from tax breaks in offshore Arctic projects, but needs to be further defined and developed in subsoil legislation. The law On the Continental Shelf would need to adopt and specify the concept of operator, as the concept of executing company is confusing, and could mean a contractor rather than an operator. Foreign companies also need to be protected against unilateral termination of licences by the state and against any conflicts or disputes between the state and the Russian licence holder. It needs to be noted also that the present civil code does not recognise the specific nature of risk service (operators) contracts. The civil code allows the termination of service contracts with compensation of direct expenses only, which is not acceptable. Relations between a state company and an operator need to be clarified and allow them to be governed by foreign law. Overall, these regulatory amendments need to be closely co-ordinated to ensure their consistency.

An important issue that would require further clarification for projects aiming at LNG or oil exports is how the resources are sold so that they could fairly and predictably benefit the IOC and cover exploration/production costs with an attractive profit – through the possibility of either obtaining a share of the resource as in-kind payment, a discount price on purchasing part of the resources, or a service fee. The legislation needs to ensure that there is an equal decision-making process within the joint venture on how the gas resources are to be marketed and sold and whom this will benefit. Indeed, to make the regulation viable and attract foreign companies, foreign partners in joint ventures need to get a full right to participate in the marketing of the gas or to obtain in-kind payments, while of course adhering to the conditions that would possibly frame the de-monopolised gas exports.

Exemptions from VAT of services and work under a risk service agreement are also needed. Another aspect is that essential facilities are often outside the project company, which creates new project risks for foreign companies that depend on infrastructure being developed by their partner company or by the state. By the same token, this infrastructure would need to be eligible for tax incentives as well. Amendment of tax legislation, as contained in the government directive of April 2012, needs to be implemented. Last but not least, legislation and regulation should ensure that project financing with foreign partners is eased and as cheap as possible, which requires offering a full and predictable understanding of risks. Moving reserve classifications closer to international practice is already an important step. In order to develop projects, it will also be important to facilitate human resources and transfers to these regions, especially foreign workers.

RECOMMENDATIONS

The government of the Russian Federation should:

- ☐ *Foster competition in the Russian wholesale gas market:*
  - *improving third-party access to the infrastructure and the transparency and effectiveness of regulation on entry/exit, storage and overall transmission procedures*
  - *allowing Gazprom to sell more gas at unregulated prices*
  - *developing the gas trading platform*
  - *enforcing reasonable and degressive gas transmission tariffs to incentivise distant gas supplies from independents.*

- *Develop an updated and realistic supply/demand forecast and adapt taxation policy to avoid a gas glut and to foster the development of the most effective resources and infrastructure projects.*

- *Ensure that the objective to cut gas flaring and attain a 95% utilisation level of associated gas by 2016 is attained.*

- *Facilitate the quick development of gas exports to the Asia Pacific region with the most cost-effective projects and predictable regulation, and pursue discussions over benefits of a change in the export strategy to Europe to help make gas more competitive.*

- *Continue to develop the use of gas for the transportation sector, in particular public transportation, rail and trucks, in providing the necessary tax and regulatory incentives.*
- *Further develop and adjust the legislative and regulatory regime for upstream Arctic licence areas to facilitate investment and resource development activities of foreign companies teaming up with Russian state companies and to ensure a high level of environmental protection.*

6. OIL

Key data (2012)

Crude oil production: 517 Mt,* 10.73 mb/d

Crude oil exports: 248.9 Mtoe, +29.8% since 2002

Refinery capacity: 298 Mt*

Inland consumption: 163.3 Mtoe (transport 35.8%, industry 29.4%, refineries and energy own use 17%, power generation 10.2%, residential 3.9%, commercial and public services 3.7%)

Share of oil: 21.8% of TPES and 2.6% of electricity generation

* Source: Ministry of Energy data.

OVERVIEW

Russia's oil sector plays an essential role in Russia's economic development, and its energy security as well as global energy security: In 2012 Russia was the world's second-largest oil exporter, and the largest exporter among non-member economies of the Organization of the Petroleum Exporting Countries (OPEC), but also the world's fifth-largest consumer. Russia's liquids production is currently at historically high levels and largely relies on brownfields. A small number of greenfields have fuelled the production growth but in the medium term, condensate is poised to be the key driver of growth in liquids production. However, the key challenge for Russia is now to minimise the expected declines in mature Western Siberian fields, which have remarkably slowed and even stabilised in past years, while bringing on enough greenfields to make up for the decline. Key ways include enhanced oil recovery (EOR) in Western Siberia; unconventional oils; gas condensate production; new greenfields, especially in Eastern Siberia; continental shelf exploration (Arctic, Black Sea, Caspian Sea, Sea of Okhotsk); and production of natural gas liquids (NGLs). In order to maintain oil exports at current levels, Russia will also need to limit the increase in consumption of oil products with higher efficiency standards and accelerate the replacement of gasoline with natural gas and liquefied petroleum gas (LPG) for public transport, trucks, trains and cars. The need to develop the next generation of oil resources and replace legacy brownfields places Russia's oil sector at a fundamental turning point in terms of skills, technologies and costs. Russia's oil industry will require unprecedented levels of investments and technology upgrades, alongside foreign expertise and investments. Key Russian companies are aware of this challenge and have started teaming up with independent oil companies as well as increasing their investments, and the government has started taking measures to support the process of moving from low-cost resources to higher-cost resources. For this process to be successful, a number of additional policy steps will need to be taken, which this chapter aims to highlight. The government has introduced major tax breaks to foster the development of Russia's next generation of oil resources, which may require further adjustment to reflect oil price developments, to reflect strict cost controls, and to closely factor in specific production, transportation and export costs. In particular, developing these more expensive resources in traditional and new areas requires prioritisation of the most cost-effective oil production sources. The government will also need to develop new budget resources through economic diversification, as needed tax breaks may lead to lower tax revenues from oil production in the longer term.

SUPPLY

PRODUCTION LEVEL

Russia's crude oil and condensate production in 2012 reached on average 10.73 million barrels per day (mb/d) or 517 million tonnes (Mt) (+1.2% year-on-year [y-o-y]), and total liquids production in 2013 amounted to 10.87 mb/d, with crude alone amounting to 10.09 mb/d. Past years' historically high production figures happened against the backdrop of an average Urals price of USD 108.8 per barrel (USD/bbl) in 2013 (USD 110.3/bbl in 2012) and improvements to tax conditions that have supported drilling activity. Russia in 2012 and 2013 was the world's second-largest total liquids producer, behind Saudi Arabia and ahead of the United States, representing about 12% of the world's total output. Such levels even exceeded the high production scenario from the Energy Strategy to 2030. However, in 2014 Russia is likely to be overtaken by the United States as the world's largest supplier due to the large increases in tight oil production there.

In Russia, according to the Ministry of Energy, Rosneft's Vankor oil field in Eastern Siberia contributed to about a half of the net production increase, by 3.1 Mt (about 62 000 barrels per day [bbl/d] or 62 thousand barrels per day [kb/d]).[1] The production increase also came from other fields: Surgutneftegaz's Talakanskoye-Central block (production of 145 000 bbl/d in 2013) and fields developed as part of Rosneft's Uvat project in the Tyumen region. In Western Siberia, production continued to decline slightly (-0.2% y-o-y),[2] but the decline was slower than from 2010 to 2011 (-1.5%).[3] Russian output hit a monthly record of 10.12 mb/d for crude and 10.89 mb/d for total liquids in September 2013. It did it again in October 2013, when crude output is estimated to have reached 10.19 mb/d and total liquids output was 10.96 mb/d. Western Siberia, with more mature fields, has experienced only a slight drop (some 30 kb/d) since January 2012 and accounts for about over 300 Mt production[4] (about 6.2 mb/d). Eastern Siberian fields more than made up for this deterioration, with an increase in output of about 170 kb/d between January 2012 and September 2013. Overall, since 2008, the decline in production from Western Siberian brownfields seen in the mid-2000s has been stabilised.

In the early 1990s, oil output, which was already stagnating in the late Soviet period, was depressed further by the fragmentation of production capacity into multiple entities at

1. There is not enough information available for a fully accurate conversion, because the quantity of the various liquids or products in the total is unknown. The conversion in this chapter is only to give the reader an approximate idea, which nonetheless should be close to fully accurate picture.

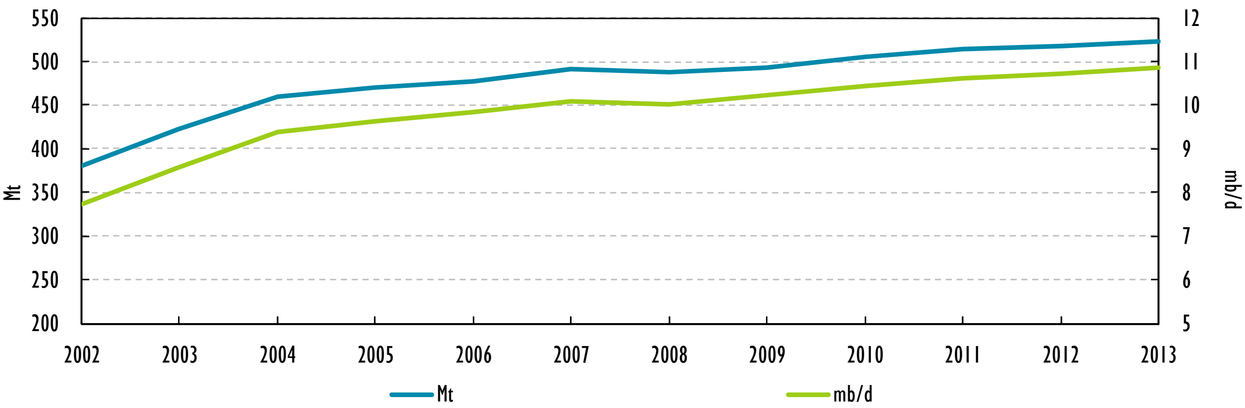
2. Министерство энергетики Российской Федерации [Ministry of Energy of the Russian Federation] (2013), "Итоги работы нефтегазового комплекса и угольной промышленности Российской Федерации в 2012 г." ["Results of the work of the oil and gas complex and coal industry of the Russian Federation in 2012"], Москва [Moscow].

3. Ministry of Energy of the Russian Federation (2013), Subprogram 3 "Development of the oil industry", state programme of the Russian Federation "Energy Efficiency and Energy Development", April.

4. *Ibid.*

the regional level lacking capital for investments. Production bottomed out in 1996 and then increased sharply over the 2000-05 period. This growth resulted from the resurgence of supply from Western Siberia, driven by the application of more modern field management technologies, in particular to better cope with the water-flooding of fields, alongside a reorganisation of key private oil producers. As oil prices and output increased, the government could impose increases in taxation on the sector while oil companies, initially reluctant, made profits and raised investments.[5] Over the past seven years, the annual growth increase has been more moderate given some overall decline in production from Western Siberia. This decline has nonetheless slowed and even to some extend stabilised, particularly in the last couple of years, thanks to wider use of horizontal drilling and a few new greenfield developments in traditional oil-producing regions. New production has come online in Sakhalin and, more recently, in other onshore parts in Eastern Siberia. Of note is the remarkable resilience in the Volga-Urals basin, in spite of this basin having already produced more than 60% of its estimated recoverable resources during the 70 years since production started. Production from this region has been steadily increasing in the period 2000-12 to almost 120 million tonnes per year(Mt/yr), though the yearly growth rate slowed after 2006. This resulted mainly from factors including large investments by oil companies, application of modern technology and improved field management, especially water-flooding. In 2012, over 90% of oil production still came from brownfields discovered before 1990,[6] and since the Volga-Urals are not an exception, a progressive decline of production from these fields in the future is to be expected. According to another estimate, in 2013, greenfields, NGLs and production from production sharing agreements (PSAs) amounted to slightly under 16% of total liquids production.[7]

Figure 6.1 Russia's total liquids production, 2002-13



Note: Data from the Russian Ministry of Energy put Russia's total liquids production in 2013 at 523 Mt and 10.53 mb/d. Because condensates are less dense (and some of Russia's production is really NGLs), the International Energy Agency (IEA) converts Novatek's and Gazprom's production using a different conversion factor that makes for a higher volumetric conversion, and adds in a baseline for NGLs. Indeed, Russian state data do not distinguish what is crude, what is condensate, and what are NGLs, hence these approximations for the barrel figures.

Sources: IEA, Monthly oil market reports, corresponding years; Ministry of Energy of the Russian Federation.

5. For a comprehensive and detailed overview of this period, see Gustafson, T. (2012), *Wheel of Fortune: The Battle for Oil and Power in Russia,* The Belknap Press of Harvard University Press, Cambridge, MA.

6. Lukoil (2013), *Global Trends in Oil & Gas: Markets to 2025*, Moscow, www.lukoil.com/static_6_5id_2263_.html (accessed 10 December 2013).

7. Sberbank Investment Research (2014), *Russian Oil and Gas – Two Weddings and a Funeral*, February 2014, Moscow, p. 49.

MEDIUM- AND LONGER-TERM PRODUCTION OUTLOOK

In the medium term, liquids production may increase slightly: Sberbank estimates that in total, 750 kb/d to 800 kb/d of net growth in liquid production could come on by 2018-20, with GazpromNeft accounting for 221 kb/d, SeverEnergia accounting for 216 kb/d, Lukoil 154 kb/d, Rosneft 188 kb/d, Gazprom 109 kb/d and Bashneft 42 kb/d, which would largely offset any decline in Western Siberian production.[8] The IEA *Medium-Term Oil Market Report 2013,* in line with projections in *World Energy Outlook 2013 (WEO 2013)*, estimates that over the period 2013-18, total liquids production in Russia is expected to increase slightly to around 10.76 mb/d as 1.3 mb/d in new greenfield production and improved oil recovery in low-permeability conventional reservoirs offsets a 3.0% average decline in brownfield production.

The IEA projects that gas condensate will add around 300 kb/d over the course of the outlook, so that gas companies are de facto turning into oil companies.[9] Sberbank estimates that condensate is likely to represent 50% of the growth, with SeverEnergia representing the bulk of this output. Against the backdrop of condensate output growth, and some additional greenfield production, Sberbank estimates that there would need to be a decline in brownfield production of 3.8% per year for Russian total liquid output to be flat. Yet as the decline of legacy fields is likely to be much smaller, as seen over past years, production is bound to continue growing in the medium term, although slightly.[10]

In the long term, the Russian government is confident that oil production will further increase, although only slightly. The Energy Strategy to 2030 foresees a gradual increase in crude oil production over the coming decades, to between 505 Mt and 525 Mt (about 10.3 mb/d to 10.8 mb/d) in 2020-22, and to between 530 Mt and 555 Mt in 2030 (about 10.9 mb/d to 11.4 mb/d), with additional condensate production estimated at between 31 Mt/yr and 34 Mt/yr. In its most recent projection, the government intends to stabilise annual oil and condensate production until 2020 at a level not less than 510 Mt[11] (about 10.5 mb/d) and by 2030, at a level of 525 Mt if the production potential for tight oil is realised.[12]

Yet in the IEA *WEO 2013* New Policies Scenario, Russian liquids production is expected to begin a gradual decline, to 10.4 mb/d by 2020 and to 9.5 mb/d in 2035.

The difference between these outlooks stems from the different views on the speed and pace of the production decline in Western Siberia and the pace of new oil production development in Eastern Siberia and the Arctic. According to the Russian Energy Strategy to 2030, crude production in Eastern Russia will increase by more than sevenfold, with the share of Eastern Russia in national crude production projected to rise from 3% in 2008 to between 18 and 19% in 2030.

The *WEO 2013* estimates that crude oil output from existing fields will drop from about 10 mb/d in 2012 to around 4 mb/d by 2035, a fall of 60%. The key challenge for Russia is thus to progressively compensate for the loss of 6 mb/d of production from current fields over the next 20 years.

8. Sberbank Investment Research (2014), *Russian Oil and Gas – Two Portraits in Oil*, October, p. 31; Sberbank Investment Research (2014), *Russian Oil and Gas – Two Weddings and a Funeral*, February, Moscow, p. 50.

9. IEA (2013), *Medium-Term Oil Market Report 2013: Market Trends and Projections to 2018*, OECD/IEA, Paris.

10. Sberbank Investment Research (2014), *Russian Oil and Gas – Two Weddings and a Funeral*, February, Moscow, pp. 50-55.

11. Ministry of Energy of the Russian Federation (2013), Subprogram 3 "Development of the oil industry", state programme of the Russian Federation on "Energy Efficiency and Energy Development", April.

12. Interfax, Russia & CIS Oil and Gas Weekly, 7 November 2013, based on the Long Term Forecast for the period until 2030 of the Ministry of Economic Development.

The IEA projects that production of NGLs will significantly increase in Western Siberia, and that the increased pace of production in Eastern Siberia will be lower due to high development costs. Total NGL production, though, is expected to rise by more than 300 kb/d in the next five to eight years to reach a total of almost 800 kb/d.[13]

The construction of additional gas stabilisation lines, such as the recent commissioning of two new units at Novatek's Purovsky plant (4.8 Mt [approximately 99 kb/d] processed in 2013, and the plant's ultimate capacity after expansion will be 11 Mt [approximately 226 kb/d]), as well as lower taxes on NGLs (condensates) compared to crude, will facilitate this. Lifting costs for greenfield projects are in the range of USD 6/bbl to USD 10/bbl due to their remoteness and the limited infrastructure, while costs of production are estimated in the range of USD 4/bbl to USD 8/bbl in the mature producing regions of Western Siberia. The IEA projects that the share of Eastern Russia in total production will rise only from 7% in 2010 to 11% in 2030, with NGL output possibly changing this outlook depending on the wetness of gas that is to be produced there.

A key challenge will be to attract the necessary investments and expertise to develop Russia's next generation of oil resources, be they tight oil, enhanced recovery, NGLs, new greenfields or frontier Arctic offshore resources. These options will substantially raise production costs as they will require more sophisticated technologies and increased drilling volumes alongside top-end project expertise and management, which will often need to be provided by foreign partner companies. An illustration of this change of magnitude in terms of costs and technologies comes from the example of tubing used for wells.

Traditional Western Siberian vertical drilling required standard American Petroleum Institute (API) tubing costing in a range of USD 1 000/tonne (USD/t) and requiring 300 tonnes (t) per well. Wells required for Bazhenov plays need to be resistant to higher pressure and corrosion and require premium tubes costing around USD 3 000/t when 400 t to 450 t are required per well. Finally, offshore drilling requires premium tubes costing about USD 3 000/t to USD 4 000/t and needs about 1 000 t per well – that tube cost is around ten times higher per well compared with a traditional, simple vertical well – this number may be slightly lower in Russia's offshore Arctic that has shallow waters. The Russian supply and service market, including TMK, will need to meet and adapt its products and offers to these new requirements.

ONSHORE DEVELOPMENT

Western Siberia: EOR

Oil production in Western Siberia peaked in 1988 at a level of 415 Mt (about 8.5 mb/d), before falling to its lowest levels in the period 1996-99 and growing again after that, in particular with the revival of the super-giant Samotlor field.[14] Production then peaked again in 2006. Most Russian oil reserves are concentrated in this region, which is forecast to remain Russia's largest oil production centre in the long term. The pace of the decrease will depend on four factors: the success in improving EOR at existing fields, the development of Bazhenov shale plays, NGL production, and a few greenfield developments.

13. IEA (2011), *World Energy Outlook 2011*, OECD/IEA, Paris.

14. See Gustafson, T. (2012), *Wheel of Fortune: The Battle for Oil and Power in Russia*, The Belknap Press of Harvard University Press, Cambridge, MA.

There is a potential to offset the decline in production through increasing the oil recovery factor by using methods of EOR.[15] Indeed, Russia's ultimate oil recovery factor remains below the world average at 30%, and geologists believe that there is capacity to improve it. As a matter of comparison, the factor in the United States is in a range of 35% to 43% and in Norway it is 46%. EOR-based output accounts for only 3% of Russia's total output, compared with over 10% in the United States.[16] Progress in improving the recovery factor has been slow and not prioritised so far: It has improved by only 2 percentage points since 2008.[17]

EOR has huge potential in Russia, and the government targets an improvement of coefficient of oil extraction to 0.47 by 2020.[18] In applying EOR to West Siberia, high well density may be an issue, yet the presence of a dense infrastructure and an available and trained labour force are favourable factors. Overall, the major impediment so far has been the absence of incentives to develop new but more expensive wells in this area in the absence of tax advantages. Another factor is the lack of available carbon dioxide for immiscible gas injection through which the gas mixes with or is dissolved into the oil, reducing its viscosity and increasing its susceptibility to being pushed by water.[19]

Indeed, the implementation of EOR will increase drilling costs and operational costs as new advanced wells will need to be drilled, and there are additional costs due to maintenance and the use of chemicals, gas injection or steam to heat the oil despite water injection that keeps flow rates constant. In particular, brownfields produce more and more water alongside oil. Deploying new technologies can help increase the recovery factor, and investments will be facilitated as all the production infrastructure is already in place.

Western Siberia: Tight oil and other hard-to-recover resources

Further to EOR, Western Siberia holds a large production potential from new tight oil plays, such as the Bazhenov formation,[20] but also other hard-to-recover resources in the Achimov layers (located above the Bazhenov) and the Tyumen layers (located below them) – see Figure 6.2.

Against the backdrop of the high oil price environment, technological progress and the awareness of the need to offset the decline in traditional oil production in Russia, the country's tight oil production potential has recently become a key focus of industry attention in Russia. Indeed, although there are very different assessments of the reserve potential, many concur that it is huge. Experts estimate that the resource and production potential is even bigger than the Arctic one.

15. EOR can be defined as the set of technologies that permits production of a greater share of the oil that remains after primary and secondary recovery. For more details, see IEA (2013), *World Energy Outlook 2013*, IEA, pp. 437-441.

16. Lukoil (2013), *Global Trends in Oil&Gas Markets to 2025*, Moscow, www.lukoil.com/static_6_5id_2263_.html.

17. Institute for Energy Strategy (2013), Presentation to the IEA review team, July.

18. Ministry of Energy (2013) Subprogram 3 "Development of the oil industry", state programme of the Russian Federation "Energy Efficiency and Energy Development", April.

19. IEA (2013), *World Energy Outlook 2013*, OECD/IEA, Paris.

20. Bazhenov formations are located in carbonate-clay-siliceous reservoirs, which were discovered in the 1970s. These formations are the main source rock for Western Siberian conventional oil reservoirs with ultra-low permeability but high oil saturation, located at depths of 2 kilometres (km) to 3.5 km, spread over territory of more than 1 million square kilometres (km^2). Total thickness in the Bazhenov and its reservoirs is 3 metres (m) to 8 m.

According to the Advanced Resources International (ARI) report (as a part of the United States Energy Information Administration [EIA] report), Russia holds the world's largest light tight oil reserves: 1 243 billion barrels (bbl) of risked shale oil in place, with 74.6 billion bbl as the risked, technically recoverable shale oil resource only in the Bazhenov formation.[21]

According to the Russian Ministry of Energy, total reserves of the Bazhenov formation as of the beginning of 2012 amounted to 501 Mt (about 3 758 million barrels [mb]) – 284 Mt in categories ABC1 and 217 Mt of category C2 (see Box 6.1. for an explanation of the Russian reserve classification system). These huge differences stem from assumptions about what is technically and economically recoverable, and what would be the recovery rate.

A recent study by the Skolkovo Energy Centre puts forward a view that the average tight oil recovery rate is likely to be 2% to 3% in Russia, so that the economically viable reserves should not be overestimated and that Russia's production outlook is not to compare with the Bakken.[22] The main part of the reserves is located in the Khanty-Mansiysk Autonomous Area – 489 Mt[23] (about 3 668 mb). According to Rosnedra, by 2025 oil production at Bazhenov may amount to 52 Mt/yr[24] (about 1.1 mb/d), which is approximately 10% of current oil production.

In 2013, the government introduced major tax breaks for hard-to-recover oil that have allowed the acceleration of exploration activities and testing of tight oil production potential: The law differentiates between resources based on their permeability, thickness, field depletion and size of the reservoir and provides coefficients that reduce the mineral extraction tax (MET) (see Section "Taxation"). The hard-to-recover category includes tight oil from Bazhenov layers but also high-viscosity oil extracted from reservoirs using steam heating techniques, for example.

Responding positively to the tax breaks, key companies possessing production licences in Western Siberia are already preparing test drillings to develop these resources with some international oil corporations: GazpromNeft with Shell (through their Salym Petroleum Joint venture), ExxonMobil with Rosneft, and Statoil with Rosneft all announced agreements in 2012 and 2013 to jointly explore and test the commercial viability of the resource. In particular, Shell and GazpromNeft are planning to test the Palyanovskaya structure in the Bazhenov-Abalak layer of the Krasnoleninskoye field as well as the Salym field's Bazhenov layer. ExxonMobil and Rosneft are exploring the Bazhenov layer of the already-producing Priobskoye field, and Statoil and Rosneft are studying the Stavropol shale resource in southern Russia.[25]

Current production from Bazhenov formations amounts to about 1 Mt of oil per year.[26] Although major Russian producers have teamed with foreign companies to bring expertise on shale oil development, it is still unclear if and when Russia will benefit from a "golden age" of shale oil, for several reasons.

21. US EIA (2013), *Technically recoverable shale oil and shale gas resources. An assessment of 137 shale formations in 41 countries outside the United States*, May, www.eia.gov/analysis/studies/worldshalegas/pdf/chaptersviii_xiii.pdf?zscb=94365156.

22. Skolkovo Energy Research Centre (2013), *Unconventional Oil: Will Bazhenov become another Bakken?*, Skolkovo – Moscow School of Management, http://energy.skolkovo.ru/upload/medialibrary/07c/SEneC_Tight_Oil_ENG.pdf.

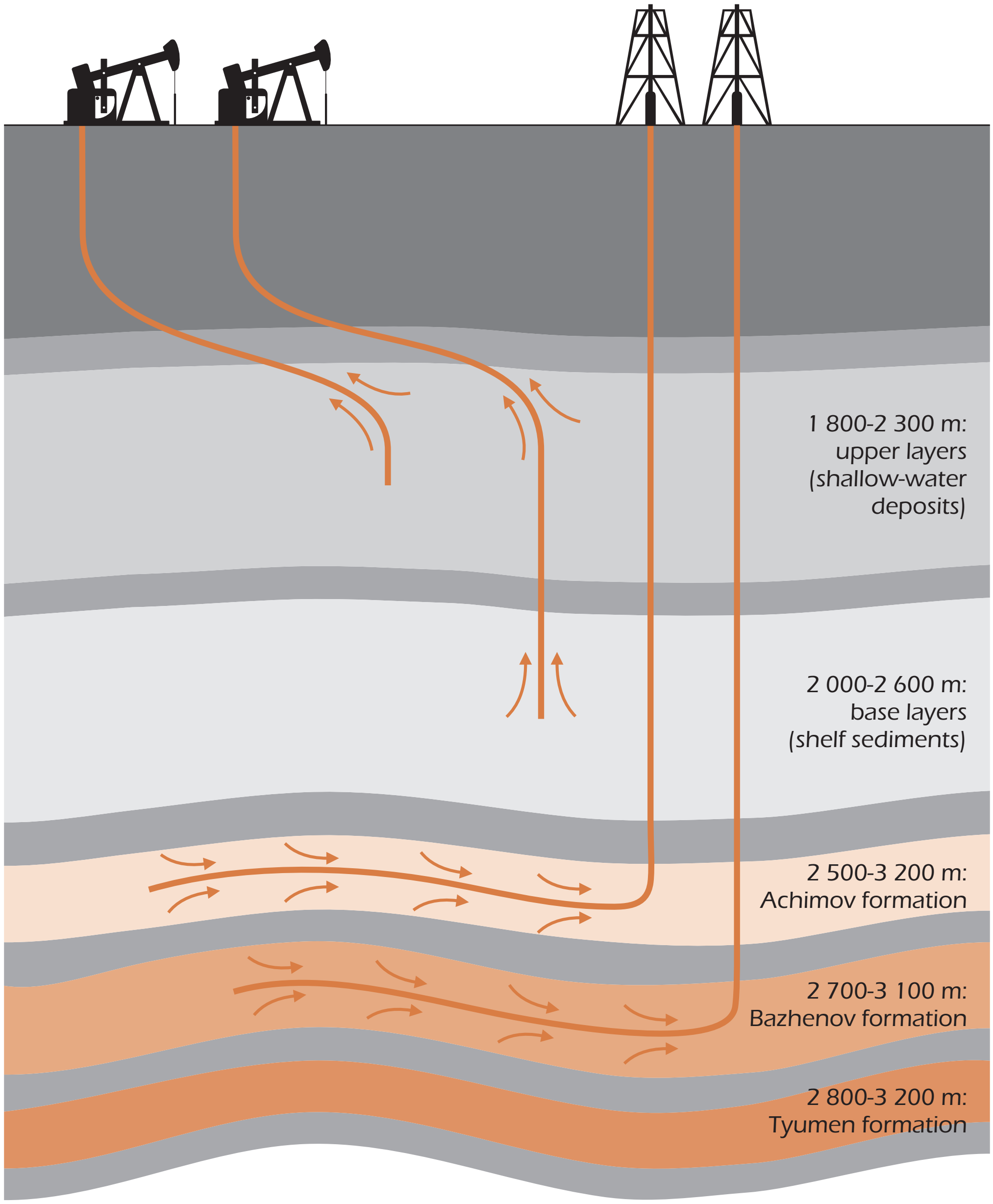
23. Ministry of Energy of the Russian Federation.

24. Interfax, 7 November 2013, Moscow.

25. Henderson, J. (2013), *Russia's tight oil potential. Oxford Institute for Energy Studies*, October, www.oxfordenergy.org/2013/10/tight-oil-developments-in-russia/.

26. Lukoil (2013), *Global Trends in Oil&Gas Markets to 2025*. Moscow, www.lukoil.com/static_6_5id_2263_.html.

Figure 6.2 Geological structure of Western Siberia's hard-to-recover oil reserves as compared with sandstone reservoirs



Sources: Rosneft; IEA (2013), *World Energy Outlook*, OECD/IEA, Paris.

First, Russia's industry is currently performing a testing phase using different technologies with more concrete and reliable results which are expected in late 2014 or 2015. Russia's geology in these areas is different from structures found in, say, North American formations.[27] The thickness and porosity of formations differ, for example. The Bazhenov also has a highly heterogeneous structure and is less brittle than formations such as the Bakken in

27. For a detailed discussion on the geology of hard-to-recover resources and technical production challenges, see Skolkovo Energy Research Centre (2013), *Unconventional Oil: Will Bazhenov become another Bakken?*, Skolkovo – Moscow School of Management, http://energy.skolkovo.ru/upload/medialibrary/07c/SEneC_Tight_Oil_ENG.pdf.

North Dakota. Then, as in the United States, well production results will vary a lot. It is not clear if initial high production rates will be enough to recover costs before the decline sets in, and if enough wells will allow for commercial production. Well testing will need to determine where exactly resources are concentrated and how best to extract them, which is a key technical challenge. As a consequence, the uncertainty over the volume of economic recoverable resources is still high at the time of writing.[28] Against this backdrop, the Skolkovo Energy Centre estimates that production levels will remain modest in the medium term and that production growth is more likely to come from the low-permeable reservoirs in the Achimov and Tyumen formations.[29]

Then, there is a lack of equipment base, especially units for multistage hydraulic fracturing, and a lack of skilled personnel to operate them. Developing Russia's tight oil potential will require drilling thousands of horizontal wells with sufficiently high speed at reasonable price. Average costs for drilling and completing a well are in a range of USD 8 million to USD 8.5 million in the United States, and the question will be how much more such a well would cost on average in Russia – this could be up to USD 15 million for the most complex wells. A recent study estimates that up to 275 new rigs would need to be built over the next ten years to meet the production targets, representing an investment of about USD 15 billion.[30]

Also, although in some areas existing licences allow deeper drilling, new licences will nonetheless be needed to be acquired in many cases, which may take some time.

Moreover, partnerships with Western companies are still at an early stage and Russia is short of small and medium-sized companies with risk-taking capital and high capacity to adapt, which played a crucial role in the North American tight oil revolution. The development of light tight oil resources in the United States required "trial and error", the lessons of which may not be applicable to Russian formations. And when Russian companies look at the risk compared with alternative investments, they may logically conclude that, within the Russian context, alternatives are simply better investments. Last but not least, even though the government has provided a tax preference regime for hard-to-recover oil reserves, these tax advantages may still be insufficient to stimulate necessary investment, because of huge development costs, especially as a number of expensive wells may end up dry or have uneconomic production rates. The essential question to be answered is whether companies will feel comfortable with the rate of return they will obtain, once they know the development costs and what the production potential will be. Further discussions between companies and the Ministries of Energy and Finance may need to take place. The export tax might need to adjust to make these projects viable, which would essentially represent a move towards project-based profit taxation. The government should also consider whether fields that can be economic only under extremely low taxation regimes should be prioritised over other investments, such as conventional EOR.

Against this backdrop, the *WEO 2013* forecasts a production potential estimated at about 200 kb/d by 2018, which is likely to grow further in the long term. One of the keys to open this prosperous formation is the tax break. New legislation, which has been

28. Henderson, J. (2013), *Russia's tight oil potential. Oxford Institute for Energy Studies*, October, www.oxfordenergy.org/2013/10/tight-oil-developments-in-russia/.

29. Skolkovo Energy Research Centre (2013), *Unconventional Oil: Will Bazhenov become another Bakken?*, Skolkovo – Moscow School of Management, http://energy.skolkovo.ru/upload/medialibrary/07c/SEneC_Tight_Oil_ENG.pdf.

30. Henderson, J. (2013), *Russia's tight oil potential. Oxford Institute for Energy Studies*, October, www.oxfordenergy.org/2013/10/tight-oil-developments-in-russia/.

enforced in 2014, provides a long-term MET exemption, which is well-received by industry; however, a restructuring of the regulatory system to focus on taxing profits rather than revenues might be discussed. In addition, reductions in export tax rates might also be required for further development.

Box 6.1 "Shale revolution" in Russia? Lessons from the United States

Unconventional oil production in the United States has increased at such a pace that a real revolution has been occurring there, enabling the country to recover and boost oil production, likely to overtake Russia in total liquids soon.

Key factors supporting the boom of oil production in the United States include:

- technological progress with multistage hydraulic fracturing and horizontal well drilling
- high oil prices
- presence of a very large and efficient service industry which provides rigs and wells at competitive prices and great availability; this is essential to cope with rapid decline rates of oil flow
- the presence of mature and effective domestic financial institutions: venture capital and private firms eager to fund independent companies and more open to forms of private financing
- well-developed midstream and downstream infrastructure, adequate water supplies
- favourable investment climate and conditions, which allows easy entry of thousands of oil companies, such as easy licensing, and job creation and prosperity which incentivises acceptance by communities
- favourable tax environment
- availability of a large and skilled workforce
- last but not least, a favourable regulatory environment whereby landowners own resources in the ground and can sign contracts on exploration with oil companies.

A comparison with Russia shows that many of these conditions are available (although the different geology means that some of the technical and geological lessons are not directly applicable) – yet the key missing elements are the existence of a very large and efficient service industry which provides rigs and wells at competitive prices and great availability, alongside possibly a tax environment that fully incentivises investments.

Natural gas liquids

Russia's total oil production will increasingly also benefit from a growing output of liquids-rich gas in the coming years, blurring the line between oil and gas companies, as has happened in other countries. Liquids-rich gas from Valanginian layers, as opposed to dry gas from traditional Cenomanian layers, comes from greater depth (typically between 1 700 m and 3 200 m compared with 1 100 m to 1 700 m for dry gas), is under higher pressure, and is hotter. Other such gas-rich structures are Achimov layers below Valanginian layers and Turonian tight gas layers located above Cenomanian layers. In October 2013, increased production of NGLs contributed strongly to the overall record in liquid output seen in Russia, especially from Russia's main gas-producing region, the Yamal-Nenets Autonomous District (YNAD).

New regions, such as Eastern Siberia and Sakhalin, have wetter gas than traditional natural gas-producing areas in YNAD, so new developments there have brought on even more liquids per unit of dry gas. Investment in gas processing plants to recover the NGLs has been slow, so only a small part of the ethane and about half of the butane and propane are currently marketed. But further development of gas processing facilities is an important part of the strategy of the Ministry of Energy, with a dozen new or refurbished plants planned for the next ten years. Companies have a strong incentive to invest in processing capacities as these liquids are very profitable and make a key contribution to the profitability of upstream gas projects. Indeed, the oil price and tax regime are currently very favourable for NGLs, which has already prompted companies like Novatek to invest in gas processing facilities and to export NGLs. Novatek is able to earn in the range of USD 40/bbl to USD 42/bbl on condensates while the average profit per barrel for Russian producers of crude oil in late 2013 was about USD 14.[31] This makes a very positive contribution to the economics of their gas fields and provides access to export markets, whereas gas is restricted to the domestic market. Over the past few years, NGL production in Russia has risen to unprecedented levels. This growth is set to continue. Sberbank research estimates that liquids-rich gas will provide 60% of total growth of liquid production in Russia over the period 2013-20.[32]

Gazprom is the largest NGL producer in Russia and has recorded a steady growth in output (11.3 Mt [about 263 kb/d] in 2010, 12.1 Mt [about 282 kb/d] in 2011, 12.9 Mt [about 300 kb/d] in 2012), and Gazprom's condensate output grew by 15% y-o-y.[33] Its production is set to further grow to 18.1 Mt (about 420 kb/d) in 2016 according to the company. Sberbank research puts forward a view that Novatek and its affiliated companies in the period 2013-17 are expected to increase NGL production by 17 Mt (about 396 kb/d), with 5.9 Mt (about 137 kb/d) directly attributable to Novatek from 4.7 Mt (about 109 kb/d) in 2013 (representing over 20% of total condensate production in Russia). In particular, SeverEnergia's projects are becoming a symbol for how liquids-rich gas production is booming in Russia and progressively overtaking extraction from dry gas fields. SeverEnergia alone, in which Novatek is a shareholder with 50%, could produce one-third of this total output.[34]

Greenfield projects in brownfield regions

In Western Siberia many of the newer oil fields are not as large as the ones dating from the Soviet period. In 2011, Rosneft obtained the licence for the Naulskoe oil field with reserves of more than 50 Mt (about 367 mb). Commercial production was expected to start in 2014.

Bashneft and Lukoil created a joint venture, Bashneft-Polyus, for developing the Trebs and Titov oil field in Timan-Pechora, north of the Arctic Circle. There are recoverable reserves of about 140 Mt (about 1 026 mb). Bashneft acquired this licence in 2011 and test production on Trebs was started in late 2013. The expected oil production by the end of 2013 was 0.3 Mt (about 6 kb/d), with 0.9 Mt (about 18 kb/d) forecast for 2014. Commercial production is planned to start in 2016, and it is expected to reach a plateau

31. Argus FSU Energy (2013). "Novatek Looks to Crude". 14 November.

32. Sberbank Investment Research (2014), *Russian Oil and Gas – Two portraits in oil*, Moscow, October.

33. www.gazprom.ru.

34. Sberbank Investment Research (2014), *Russian Oil and Gas – Two portraits in oil.* Moscow, October; Novatek Press Release, 10 January 2014, www.novatek.ru/en/press/releases/index.php?id_4=823 (accessed 21 February 2014).

of 4.8 Mt (about 96 kb/d) by 2020, once around 200 wells will be operating. Bashneft holds four more licences in the Timan-Pechora oil-producing region. Lukoil recently acquired the right to develop the Imilorskoe field located in Western Siberia with ABC1+C2 reserves of 193.7 Mt (about 1 420 mb).

Eastern Siberia: Greenfields

Eastern Siberia is projected to make a large contribution to incremental Russian supply during the period to 2035, especially since the region benefits from tax breaks (see Section "Taxation"). Further to the Vankor field, Rosneft is also planning to develop the Yurubcheno-Tokhomckoe and Verkhnechonskoe fields. The share of Eastern Siberia in total oil production was approximately 6.7% in 2012, but could increase to 16% by 2030 according to the government's data.[35]

The Vankor oil and gas field, commissioned in 2009 by Rosneft, is the biggest oil and gas condensate field to have been discovered and brought into production in Russia in the last 25 years with reserves estimated at 3 billion barrels. It is geologically related to West Siberia but administratively located in Eastern Siberia. Vankor's recoverable reserves are currently estimated at 524 Mt (about 3.84 billion barrels) of oil and gas condensate. The field ramped up production to 18.3 Mt in 2012 (about 367 kb/d) and 22 Mt in 2014 (442 kb/d), and will continue to increase production to a plateau level of 25 Mt/yr[36] (about 502 kb/d) through the joint development of Suzun, Tagulskoe, and Lodochnoe deposits acquired as a part of TNK-BP. Rosneft has constructed a 500 km pipeline from Purpe to Samotlor (see Section "Infrastructure") linking Vankor to the Transneft system, which creates the link to the Eastern Siberia-Pacific Ocean (ESPO) and Eastern markets.

The Yurubcheno-Tokhomskoe field is one of the biggest oil and gas condensate fields in Krasnoyarsk territory. Its ABC1+C2 reserves amount to 348 Mt (about 2.610 billion barrels) of oil, and it is located no more than 100 km from the Kuyumba field, the second-largest in the region (ABC1+C2 reserves of 530 Mt [3.97 billion barrels]). The Yurubcheno-Tokhomskoe field will be developed by a joint company involving GazpromNeft and Rosneft. Production is planned to start in 2017. In order to enable the transportation and export of this oil, a 603 km, 15 Mt/yr (about 308 kb/d) pipeline from Kuyumba to Tayshet, the start of the ESPO pipeline, is to be completed in the fourth quarter of 2016.

The Verkhnechonskoye field, operated by Rosneft subsidiary Verkhnechonskneftegaz, is in the Irkutsk region with a possible 434 mb of oil and gas condensate reserves. Commercial production began in 2008 and is expected to peak at 150 kb/d.

In 2013 Rosneft consolidated Taas-Yuriakh Neftegazodobycha LLC into Rosneft subsidiary RN-Vostochnaya Sibir LLC, which will enable Rosneft to book Srednebotuobinsk field reserves and to increase production in Eastern Siberia. Immediately after this announcement, Rosneft and CNPC signed a memorandum calling for the creation of a joint venture to explore and produce oil in the Srednebotuobinsk oil and gas field, which is one of the largest fields in Eastern Siberia. Production started in September 2013 and had reached 19 kb/d by November 2013. Its volumes are expected to increase to over 5 Mt/yr (about 100 kb/d) by 2017.

35. Interfax, 7 November 2013, based on the Long Term Forecast for the period until 2030 of the Ministry of Economic Development.

36. www.rosneft.ru.

Other new greenfield projects

The Yamal region will not only produce increasing amounts of NGLs, but a few crude oil greenfield projects are also being developed there. One of these is Gazprom Neft's and Rosneft's Vostochno-Messoyakhskoe field, where the first oil was produced in a pilot project in 2012. The project's partners state that a more accurate assessment of reservoirs and well flow rates will become available in 2014 and that preliminary estimates show that production could plateau by 2022-23 at 10 Mt of oil and 5 billion cubic metres of gas per year.

OFFSHORE DEVELOPMENT

Caspian

The Russian part of the Caspian Sea, as well as onshore regions bordering the Caspian, hold significant oil resources. Lukoil has been very active in developing oil production in this region. The Yuri Korchagin field was discovered in 2000 with proved oil reserves of 270 mb. It is the first large offshore field to be developed in the Russian sector of the Caspian. Production started in 2010 and production growth was largest among Lukoil's oil fields and increased by 454.8 kilotonnes (kt) (about 9 kb/d) in 2012. It is set to further ramp up to 2.5 Mt/yr (about 50 kb/d). The Filanovsky field, the largest offshore field discovered in the Russian Caspian Sea with more than 1 billion barrels of recoverable resources, was discovered in 2005. The field's commissioning is expected to take place in 2016, benefiting from export duty exemptions for the period 2016-22. The field is likely to produce 6.2 Mt/yr (about 127 kb/d) of oil and condensate. The development of the Tsentralnoye field in the Caspian Sea, which should be developed under a PSA between Lukoil, Gazprom and KazMunaiGaz, is likely to be delayed over the legal framework for the field's development.[37]

Okhotsk, Sakhalin

Rosneft launched exploration works and environmental analysis at Sea of Okhotsk blocks (Lisyansky, Kashevarovsky and Magadan-1) in July 2013 with Statoil. The total prospective recoverable resources stand at 1 741 million tonnes of oil-equivalent (Mtoe). Oil and condensate production at Sakhalin is also expected to be developed. Peak production from the Sakhalin-1 project was reached in 2007 at about 11.2 Mt/yr (229 kb/d), and since then production has gradually declined, but additional volumes from Odoptu (since 2009), and Apkutun-Dagi, where the first oil production is expected in 2014, could raise production to 225 kb/d by 2020. In November 2013, total production of Sakhalin-1 and Sakhalin-2 was 252 kb/d. Sakhalin-3 also has potential to add oil production, but commercial production is not expected in the near future. Finally, Gazprom is likely to produce condensate from its Kirinskoye fields (especially Yuzhno-Kirinskoye).

Black Sea and Kara Sea

Rosneft and ENI formed a joint venture in April 2012 to explore the West Chernomorsky block. The block covers an area of 8 600 km^2 at water depths ranging from 600 m to

37. Interfax, 31 January 2014.

2 250 m. Two exploration wells are to be drilled in 2015-16 in line with licence obligations. Rosneft has stated that total recoverable reserves, after some seismic studies, are likely to be approximately 10 billion barrels.

Rosneft and ExxonMobil formed joint ventures for the Black Sea (Tuapsemorneftegas SARL) and Kara Sea (Karmorneftegaz SARL) projects in 2013. They will commence project implementation activities as operator. Rosneft holds 66.67% interest and ExxonMobil holds 33.33% interest in the two projects. The initial cost of exploration in the two areas is estimated at more than USD 3.2 billion, the majority of which will be financed by ExxonMobil. The start of drilling operations is planned in 2014.

Arctic

There are many expectations around Arctic resources, though the IEA *WEO* projection of Arctic oil production is modest – 0.11 mb/d, 1.1% of total Russian production by 2035. Existing legislation restricts private companies' access to development of shelf fields, unless they enter in joint ventures with Gazprom or Rosneft. Rosneft and ExxonMobil are to conduct exploratory drillings in 2014 in the Kara Sea. The government offered a full MET exemption and an export tax exemption until 2042, yet more incentives are likely to be necessary in order to attain higher investment levels, given the very high anticipated production costs. Fully developing this potential is thus many years away and will require more advanced knowledge of the level of economically recoverable reserves held in these offshore licence areas.

Nevertheless, Gazprom launched the Prirazlomnoye oil field located in the Pechora Sea in December 2013 and plans to produce 7 kb/d or 300 kt of oil in 2014 (the field is being transferred to GazpromNeft). Production plateau is expected to be reached in 2016 at 6 Mt/yr (about 139 kb/d), but delays are possible. This oil field was discovered in 1989 and is located offshore on the Pechora Sea, 60 km from the coastline at a depth of 19 m to 20 m. It was in the spotlight recently as Greenpeace activists approached the platform in order to raise environmental concerns. The project envisages a total of 36 wells with two ice-class equipment vessels and two ice-class tankers. Reserves are about 70 Mt of oil (approximately 595 mb). Total operates the Kharyaga project, 60 km north of the Arctic Circle in the Timan-Pechora basin, as a PSA, with production of about 5 kb/d. This is the only other currently producing PSA in addition to the Sakhalin projects.

Meeting high technological, environmental and safety standards and having transparent activities and accountability and reporting procedures will be essential. In particular, oil spill management and emergency response in sensitive environments such as the offshore Arctic must be robust, flexible and effective to reduce to a minimum the potential impacts on environment. A methodology needs to be developed to select the most appropriate, efficient and safe techniques, and regulation needs to include modern best practices in this area, in particular, the adoption of an Incident Command System. The 30 December 2012 Federal Law No. 287-FZ, On the Prevention and Amelioration of Oil Spills in Internal Sea Waters, Territorial Seas and the Continental Shelf of the Russian Federation, marks a good step in this direction and would thus benefit from being further expanded.

MARKET STRUCTURE OF UPSTREAM PRODUCTION

Production of oil and gas condensate in Russia in 2012 was carried out by 301 companies with a subsoil use licence, including:

- 124 companies and organisations within the structure of the eight vertically integrated oil companies (VIOCs), each combining exploration, production, refining, distribution and retailing (Gazprom and GazpromNeft being counted as one single company).
- 174 independent companies, representing 12% of total production in 2012, of which the largest producer is by far Tomskneft.
- Three consortia working under three PSAs – Sakhalin-1, Sakhalin-2 and Kharyaga. PSAs represented about 2.7% of total production in 2012.

Four key companies – Rosneft, Lukoil, Surgutneftegaz and GazpromNeft – produce about 71% of total output (2013). The Russian oil industry has undergone profound changes: In the early 2000s, private oil producers such as Yukos, Sibneft, Lukoil and Surgutneftegaz helped to increase oil production; since the mid-2000s, there has been a trend of a growing concentration of oil production through state-controlled companies, such as Rosneft and GazpromNeft, while only two major private companies remained at the end of 2013: Lukoil and Surgutneftegaz. In 2013, Rosneft took over TNK-BP, so that Rosneft alone represented slightly less than 40% of total Russian oil and condensate production – 4.2 mb/d in 2013.[38] Private companies represent about 57% of total liquids production in Russia, but this share is likely to decrease in the medium term as GazpromNeft and Rosneft are likely to post production growth in the coming years. This represents a major shift from the situation in the end of the 1990s and the 2000s, when production was almost entirely driven by private companies that brought in modern technologies and management.

Box 6.2 Russia's eight VIOCs

Rosneft: Rosneft is the biggest VIOC as a result of acquisition, which became possible after large-scale privatisation of Russia's oil industry in the years after the collapse of the Soviet Union. Rosneft was established in 1993 as a state enterprise on the basis of assets previously held by Rosneftegaz, the successor to the Union of Soviet Socialist Republics' Ministry of Oil and Gas. In 1995, Rosneft was transformed into an open joint-stock company by a government decree. Consolidated output of the former Rosneft and the acquired TNK-BP Holding (renamed RN-Holding) is currently just under 40% of total Russian output. Rosneft plans to commission 12 new greenfields over the period 2013-15, allowing a production increase of 400 kb/d by 2017 and 800 kb/d by 2020. yet yet due to the decline in brownfield production, overall oil production growth is likely to be limited to about 1% over this period.

Lukoil: Publicly listed Lukoil is the second-largest in Russia, and the largest privately owned, publicly traded oil and gas company in terms of proven oil reserves in the world. It produces about 16% of Russian crude oil and carries out 17.7% of oil refining.

Western Siberia is where the company's main resource base within Russia is located. 2012 revenue was USD 139.1 billion, and net income was USD 11 billion. Production in July 2013 increased to 1.73 mb/d, reflecting their efforts to stem declines at mature fields in Western Siberia and recent acquisitions, including the 51 000 bbl/d producer Samara Nafta, as well as Kalmtatneft and Kama-Oil. The company also has major foreign operations, managed from a regional headquarters in Dubai.

38. Rosneft (2014), Consolidated IFRS financial statements for 12 months of 2013, 4 February.

Box 6.2 Russia's eight VIOCs (continued)

Surgutneftegaz is the third-largest Russian oil-producing company and accounts for about 12% of Russia's crude oil output. Revenue in 2012 was USD 42 billion and net income USD 5.7 billion. The company was established in 1993 as a result of privatisations.

GazpromNeft, a subsidiary of Gazprom, is engaged in oil and gas exploration and production, the sale and distribution of crude oil, and the production and sale of petroleum products. The company's proven oil reserves amount to 915 Mt, according to the Petroleum Resources Management System classification. GazpromNeft operates in many of the major oil and gas regions of Russia: Khanty-Mansiysk Autonomous District, YNAD, Tomsk and Omsk Regions, and Chukotka Autonomous District.

Tatneft ranks fifth in Russia by the volume of oil production, based on domestic projects. The company was established in 1950 and operated by the Republic of Tatarstan. Tatneft owns most licences for oil exploration in the territory of Tatarstan, and has expanded its resource base through deposits development in Republic of Kalmykia, Orenburg, Samara, Ulyanovsk regions and Nenetsk Autonomous district. Its proven oil reserves amounted to 862.2 Mt (about 6 320 mb) in 2010.

Slavneft is a jointly owned by Rosneft (through TNK legacy) and GazpromNeft. The company was established in 1994; the original founder was the Russian State Property Committee (86.3%) and Ministry of State Property of the Republic of Belarus (7.2%). The annual output of all this holding company's subsidiaries is approximately 18 Mt of oil; its refineries annually process over 26 Mt of hydrocarbons and produce over 5 Mt of gasoline. Slavneft holds licences for exploration and oil and gas production at 31 licence areas located in Western Siberia (Khanty-Mansiysk Autonomous Area-Yugra) and the Krasnoyarsk region.

Bashneft has maintained its position as one of the fastest-growing producers with output rising by 3% per year to 320 kb/d. It originates from the Bashkiria Republic oil company, and in 2009 Systema group became its owner. The company's output is set to climb higher since it launched production on 1 August 2013 from the 1 mb-plus Trebs and Titov oil fields in the oil-rich Timan-Pechora province.

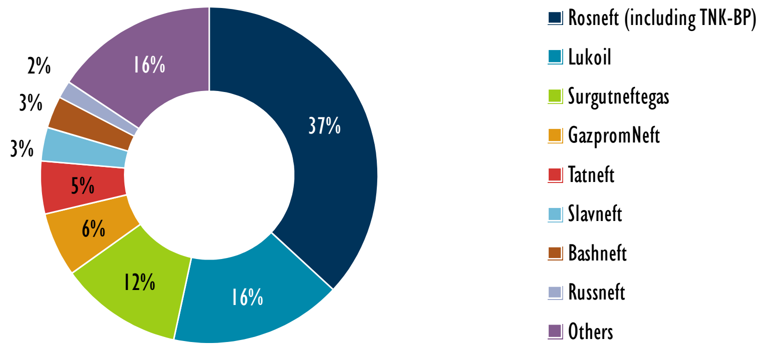
Russneft was established in September 2002, acquiring part of the assets of Slavneft. Russneft is tenth among Russian oil companies in terms of oil production volume (independent Tomskneft's production is higher). Production in 2012 accounted for 13.9 Mt (about 279 kb/d). Russneft operates in 11 regions of Russia and in the Commonwealth of Independent States (CIS) and West Africa. The company has developed a total of 166 oil and gas fields.

Overall, Russia's oil companies have weak track records in terms of corporate governance, shareholder rights, transparency and ownership disclosure. Surgutneftegas, Russia's third producing company, has a non-transparent shareholder structure, which is surprising given the role and importance of this company. This creates uncertainty. Overall, there is much room to improve the transparency among producers, transporters, exporters and traders on the Russian oil market.

Sources: Annual reports and companies' websites; Clover, C. (2013), "Russian puzzle proves hard to crack", *Financial Times*, 23 October 2013.

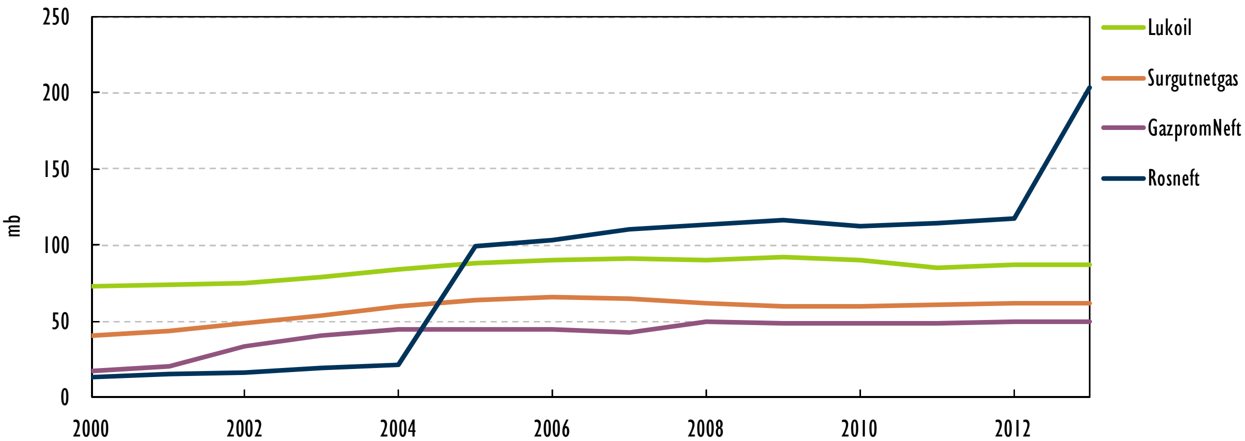
It is noteworthy that gas companies are also increasingly producing liquids, and even getting into crude oil development. Novatek plans to bring the Yarudeyskoye field online in 2015, which is expected to reach plateau production of 3.5 Mt in 2016 (about 81 kb/d). According to Sberbank, Novatek's SeverEnergia will account for almost 50% of the increase in liquids production over the period 2013-17, with condensate production projected to grow from 0.2 Mt (about 4.7 kb/d) in 2013 to 3.9 Mt (about 90 kb/d) in 2017.[39]

Figure 6.3 Split of Russian oil production by companies, 2013



Sources: Nefte Compass; Interfax.

Figure 6.4 Evolution of crude oil and condensate production by leading Russian oil companies, 2000-13



Note: Rosneft's production includes Yukos' production from 2005 and TNK-BP's production from 2013, although the takeover of TNK-BP was completed in March 2013.

Source: Ministry of Energy of the Russian Federation.

DEMAND

CONSUMPTION OF OIL PRODUCTS

Against the backdrop of robust economic growth during the 2000s, Russia's oil product demand increased quite sharply in the 2000s. Petromarket data show that consumption of gasoline increased by 4% y-o-y in 2012 to 34.5 Mt. Jet fuel consumption was 9.0 Mt (+3.5%). Large commercial airports consume 70% of jet fuel, and Moscow's airports,

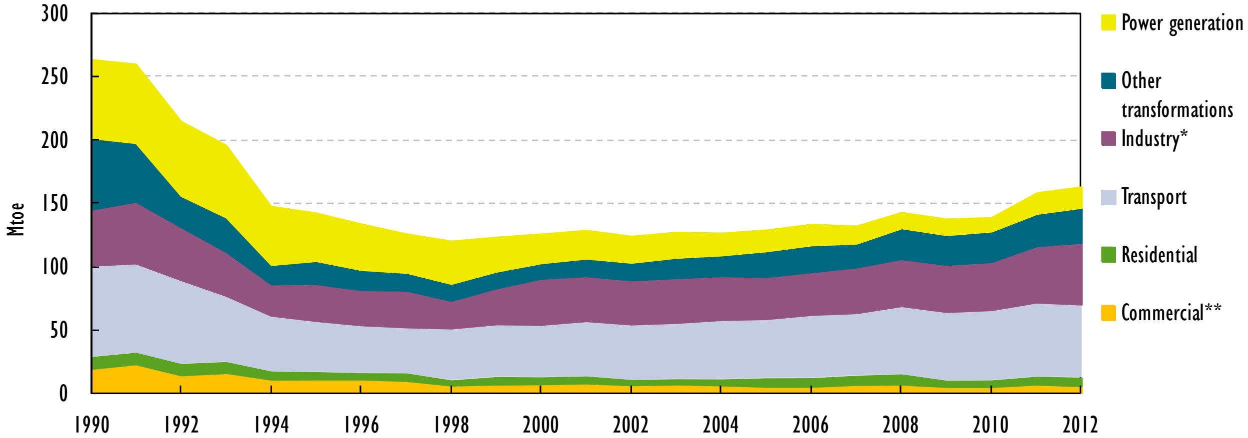
39. Sberbank Investment Research (2014), *Russian Oil and Gas. Two Weddings and a Funeral*, February, Moscow, p. 51.

such as Domodedovo, Sheremetyevo and Vnukovo, account for over half of the Russian market. The consumption of fuel oil increased by 3.5% y-o-y and amounted to 23.7 Mt (about 419 kb/d). On the downside, the consumption of diesel fuel in 2012 amounted to 28.2 Mt (576 kb/d), marking a 2% decrease versus 2011, and heavy fuel oil demand is also in decline.

Relatively robust demand growth is forecast in the coming years, albeit at a gentler pace than the 2000s as some modest efficiency gains are assumed. For example, the average efficiency of the Russian car fleet is forecast to increase by around 1% per year over the period 2010-15, accelerating to 1.3% over the period 2015-20. Growth in Russian demand is expected to average just over 3% per year in the period 2012-18, with momentum gradually easing through the post-2014 forecast.[40]

Overall oil consumption in Russia increased by 4.1% according to preliminary data, and a 2.9% increase was foreseen for 2014, to roughly 3.5 mb/d.[41]

Figure 6.5 Oil demand by sector, 1990-2012



Notes: Data for 2012 are provisional. Total primary energy supply (TPES) by consuming sector.

* *Industry* includes non-energy use.

** *Commercial* includes commercial, public services, agriculture/forestry, fishing and other final consumption.

Source: IEA (2013), *Energy Statistics of Non-OECD Countries*, OECD/IEA. Paris.

Given a growing middle class and economic growth, about 2.9 million cars are sold every year on the Russian market and the growth rate is expected to be 5% to 6% per year until 2020, when over 4 million new cars could be sold per year – yet it could be lower if growth in gross domestic product (GDP) continues to remain in the range of 1% to 3%. This growth will contribute to increased gasoline demand, especially of higher quality standards. A key trend that may limit oil product demand for the transport sector, in addition to vehicle efficiency, is that in major cities, more and more Russians could change their car usage habits as parking spaces become expensive, traffic problems increase and public transportation improves. In addition, Russians increasingly tend to buy smaller cars – this will slightly further contribute to slowing the growth rate for gasoline demand.

40. IEA (2013), *Medium-Term Oil Market Report*, OECD/IEA, Paris.

41. IEA (2014), *January 2014 Oil Market Report*, OECD/IEA, Paris.

Vertically integrated companies control 90% of the gasoline market in Russia. The Federal Anti-Monopoly Service (FAS) is monitoring for any competition abuse, since in many regions, the market is dominated by very few companies which control about 40% of the market. In 2013, the FAS asked Rosneft, following the TNK-BP takeover, to sell filling stations in six regions: Oryol, Smolensk, Tambov, Kostroma, Saratov and Samara. In most cases there is one refinery to accommodate almost all regional demand. Ensuring a sufficient level of competition in these circumstances, given the size of territory, is a challenge. Independent retailers have difficulties in matching prices offered by vertically integrated retailers, even if they buy petroleum products on the exchanges. In November 2013, A-95 gasoline prices average around RUB 33 per litre (RUB/L) (EUR 0.76 per litre) in Moscow, and almost the same for diesel. Diesel used to be sold about 30% less than gasoline in the mid-2000s. Yet with growing demand, diesel is now being sold almost at parity prices with gasoline.

Russia's petroleum products are supplied by integrated oil companies and partly via the spot market, where about 3.5 Mt of crude is sold per month – almost a fifth of all oil consumed in Russia. Crude in the domestic spot market is bought mostly by refineries which do not have any, or enough, production of their own. This spot exchange is not seen as efficient by some market stakeholders, as transactions lack transparency and have no impact on prices and competition.

As its car fleet is modernising and as Russia has embarked on a strategy to modernise refineries, higher fuel standards have been adopted. Russia has adopted European emissions standards, which apply to both manufactured and imported vehicles. In January 2013, Russia decided to ban Euro-3 fuels as of 31 December 2014 and Euro-4 standards as of 31 December 2015, so that only Euro-5 standards would then remain on the market.

To support this move toward better quality products, the excise tax on oil products is differentiated and favours high-quality products with Euro-4 and Euro-5 grades over low-quality products. The gradual increase of tax rates over the period 2012-15 is especially higher for low-quality products than for high-quality products.

For gasoline, the excise tax for standards below Euro-3 is to move from about RUB 7 500 per tonne (RUB/t) to almost RUB 13 332/t in 2015, and from RUB 6 800/t to RUB 10 858/t for Euro-4 standards, whereas for Euro-5 standards, the tax rate for the same period is in a range of RUB 5 000/t to7 750/t.

For diesel, the excise tax for standards below Euro-3 is to move from about RUB 3 000/t to RUB 7 735/t over the period 2012-15 and from about RUB 3 500/t in 2012 to RUB 5 970/t for Euro-4 in 2015 for Euro-4 standards; by contrast, Euro-5 standards are taxed less, in a range of RUB 3 500/t to RUB 5 244/t in 2015.

The Russian retail market experienced shortages in April to July 2011 which were accompanied by price hikes. One of the reasons is that oil companies were exporting higher volumes of gasoline in seeking to benefit from the difference between domestic and foreign market prices – the latter had increased whereas domestic regulated prices had been kept steady – at a time when the rouble was weak. Oil companies increased gasoline exports by 31.7% between January and July 2013. A consequence was that some spot volumes available for retailers decreased, leading them to pay high premiums which were then transferred to gasoline prices at the pump, which rose by 30% during the period to reach around RUB 31.70/L (USD 0.95 per litre) in July.

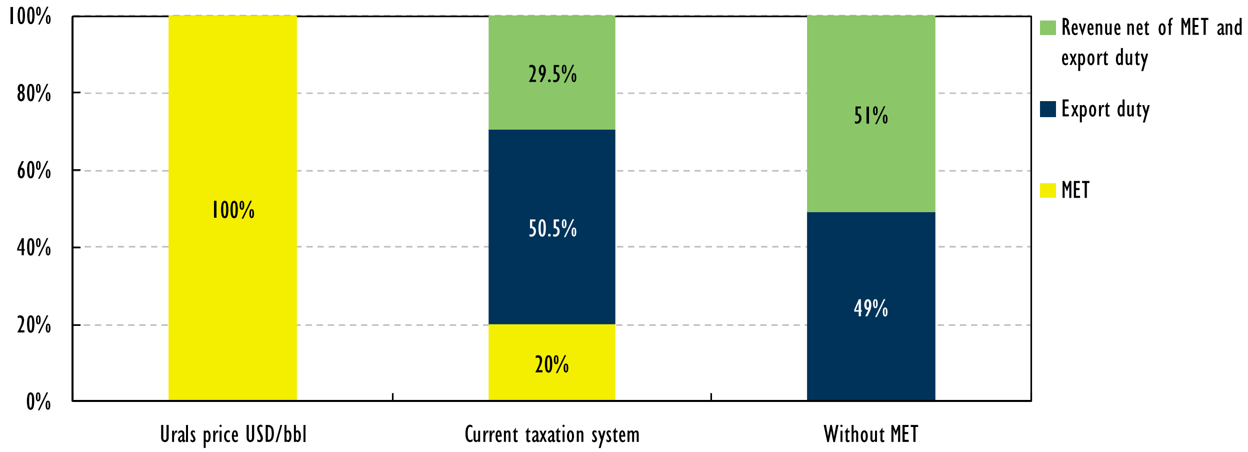
The price hikes also resulted from the surge in demand for petroleum products for storage ahead of maintenance at several oil refineries and also increasing demand from the agricultural sector. The Ministry of Energy advised companies to reduce exports and to increase imports from Belarus. To limit gasoline exports, the government then imposed a very high export duty on gasoline. Currently, the Russian market needs to import gasoline products from Belarus's Mozyr refinery.

A challenge for the retail market is the continued presence of counterfeit products, either from illegal refining or from illegal mixing of fuels, which may well increase as fuel quality standards rise, driving some increases in prices and possibly fuelling demand for low-quality and cheaper products on the consumer side and creating incentives for criminals on the seller side to cheat with fuel quality and mix, for example, blends. Quality controls and inspections and criminal investigations will thus need to play an increasing and deterring role.

TAXATION

Russian oil production and export activities are a key contributor to the Russian budget – about 35% to 40% per year – and are subject to the MET and the export tax. Tax levels are relatively high compared with gas and are a fundamental issue in terms of how they impact the level of costs and profits of companies, and hence, the levels of production and exports, as well as budget revenues. The challenge for the government is to strike the right balance between these fundamentals and to ensure the most optimal outcome for the Russian budget. So far, the Russian government has managed to set tax levels that enable an increase in production levels.[42]

Figure 6.6 Overview of current taxation levels for conventional crude oil



Sources: IEA; Ernst & Young; PricewaterhouseCoopers.

The challenge in the future is to set the right tax levels, alongside other regulations, to sustain these very high production levels, or minimise the decline in output. It is noteworthy that in March 2014, the government was reportedly considering a reduction of export duties by almost four-fifths to the level of those charged by Kazakhstan, while doubling

42. For an overview of oil taxation in Russia since the turn of the century, see Thane Gustafson (2012), *Wheel of Fortune: The Battle for Oil and Power in Russia*, The Belknap Press of Harvard University Press, Cambridge, MA, pp. 369-381.

the MET in return. This would synchronise the export duties across the members of the Customs Union (Russia, Kazakhstan and Belarus), but depend on the outcome of discussions among the members, and would obviously raise issues about which companies would win and lose from this unexpected major tax reshuffle, as well as about the predictability of taxation.

MET

This tax applies to the volumes of liquids that are being extracted. It represents about 20% of the value of oil on the basis of a USD 100/bbl oil price.

Over the past years, the government has introduced a number of tax breaks to foster the development of oil resources in Russia's Far East. In 2013, the government introduced a major tax reform package aimed at fostering the development of hard-to-recover oil and frontier oil resources, offering additional tax incentives (tax reductions, tax breaks and holidays) in particular for offshore Arctic projects, tight oil and super-viscous oil, that is, hard-to-recover resources. In parallel, the government has been increasing MET rates on other types of oil production, which has triggered concerns from leading oil companies about the profitability of some upstream projects, especially as they were also facing higher rail transportation tariffs.

Table 6.1 Key characteristics of the MET

Tax rate: base MET rate on crude oil	Formula	Geographical exemptions/reductions
2012: 446 RUB/t 2013: 470 RUB/t 2014: 493 RUB/t 2015: 530 RUB/t 2016: 559 RUB/t	Calculation formula: **MET=R*Kwp*Kd*Kr*Kh*Khd** where: R = base MET rate (RUB 470/t in 2013; RUB 493/t in 2014; RUB 530/t in 2015; RUB 559/t in 2016); Kwp = global oil prices coefficient determined by taxpayers: Kwp = (Wp-15)*P/261, with Wp = Urals average world price over the tax period and P = USD/RUB exchange rate as fixed by the Central Bank of Russia; Kd = depletion coefficient of each given oil field. If depletion rate ranges from 0.8 to 1, Kd is calculated as follows: Kd = 3.8-3.5*N/V, With N = accumulated oil production of the field as per State Register of Reserves data as of 1 January of a minus-1 calendar year and V = initial recoverable oil reserves. If depletion rate exceeds 1: Kd = 0.3. In all other cases: Kd = 1; Kr = reserves volume coefficient implies MET reductions for fields with recoverable reserves up to 5 Mt of oil and small and new deposits with less than 5% depletion rate. Kr does not apply to the oil extracted from the fields eligible for 0 base rate. Kr = 0.125*Vr+0.375 Vr = initial recoverable oil reserves; Kh = hard-to-extract oil coefficient of 0; 0.2; 0.4; 0.8; to 1 depending on oil deposit characteristics (permeability, oil-saturation, etc.); Khd = hard-to-extract oil depletion coefficient ranging from 0.3 to 1.	0 MET rate applies to the new fields located in: Sakha Republic, Irkutsk region, Krasnoyarsk Krai, to the north of North Pole, the Azov, Okhotsk, Black Sea and Caspian Sea, Yamal peninsula, Nenets region Zero rate is only valid for new deposits, up to a certain level of production or development time. In addition, special rules apply to new deposits located in the continental shelf: a zero rate for such deposits is set until the year of the approval of the flow chart of the development, and subsequent application of the preferential terms.

Sources: Ernst & Young; PricewaterhouseCoopers.

For the offshore resources, the Federal Law No. 268-FZ of 30 September 2013 enacts a special tax regime for hydrocarbon production from the existing and new fields located under the domestic and territorial Russian waters and on the continental shelf on Russia, including the Sakhalin island continental shelf. The law envisages splitting the Russian continental shelf into four categories depending on the location and complexity of the fields. The scale and duration of MET reduction vary according to the category with the reduction coefficient ranging from 5% to 30% of the global oil price. The new tax regime applies to the new offshore oil and gas deposits put in commercial exploitation as of 1 January 2016. The commencement of commercial extraction at a deposit is the date when the state balance sheet of reserves first shows that the level of depletion of hydrocarbons reserves (except associated gas) extracted has exceeded 1%. The validity of the tax breaks varies from 31 March 2022 to 31 March 2042 depending on the deposit category.

Table 6.2 MET breaks for offshore resources

Category of offshore locations	Modalities of tax reductions
Category 1: deposits lying wholly in the Sea of Azov or at least 50% in the Baltic Sea	30% for 60 months after production begins but not later than 31 March 2022
Category 2: deposits lying at least 50% within the Black Sea (up to 100 m deep), Pechora Sea, White Sea, Caspian Sea, southern sector of Okhotsk Sea	15% for 84 months after production begins, but not later than 31 March 2032
Category 3: deposits lying at least 50% within deeper waters of the Black Sea, northern sector of Okhotsk Sea, southern part of Barents Sea	10% (except natural fuel gas) for 120 months after production begins, but not later than 31 March 2037 1.3% for natural fuel gas for 120 months after production begins, but not later than 31 March 2037
Category 4: deposits lying at least 50% in Kara Sea, northern part of Barents Sea and eastern Arctic	1% for extracted natural fuel gas 4.5% for other hydrocarbons extracted by companies without export licences for liquefied natural gas; 5% in other cases for 180 months after production begins, but not later than 31 March 2042

Sources: Ernst & Young; PricewaterhouseCoopers.

Table 6.3 MET breaks for hard-to-recover resources

Resource benefiting from tax incentives as of 1 September 2014	Tax rate	Additional measures
Bazhenov, Abalak (Khanty-Mansiysk region), Khadum (Volga-Urals), Domanic (southern Russia) formations	0 MET rate	Decreasing factor Kd to the MET rate is applied over a definite period starting from 1 January of the year when 1% depletion of a reservoir is reached. 180 tax periods. (calendar month) = 15 years
Tyumen formations	0.8 of the base MET	120 tax periods; (calendar month) = ten years
Super-low permeability and thickness ≤ 10 m reservoir	0.2 of the base MET	
Super-low permeability and thickness > 10 m reservoir	0.4 of the base MET	
Individual hard-to-recover oil reservoir	From 1 to 0.3	

Sources: Ernst & Young; PricewaterhouseCoopers.

As for hard-to-recover resources, a number of tax incentives have also been adopted which have been praised by the industry as a major step forward. These are described in Table 6.3. Implementing these tax incentives may, however, prove challenging in some cases. For example, developing a separate accounting and measurement infrastructure for hard-to-recover oil reservoirs located within subsoil plots already under development will require substantial investments resulting in decreasing economic profitability of hard-to-recover oil reserves even with MET incentives. The government is still to adopt methodologies for defining reservoir permeability and thickness. Until then, companies will apply the depletion coefficient based on data included in the State Register of Reserves as of 1 January 2012.

Export tax

The export tax also plays a key role as it is the biggest tax and represents about 50% of crude oil value. There is a differentiation between crude oil export and petroleum products exports, the latter being incentivised through lower tax rates in order to stimulate the domestic refinery sector. Oil and petroleum products are exported free of export duties to the countries of the Customs Union (Kazakhstan, Belarus). On 30 September 2013, the President of the Russian Federation signed Law No. 263-FZ, changing the current rates of export duty and establishing the future base rates of the MET on crude oil. The new rates were to come into force on 1 January 2014.

The law establishes the following rates of MET per tonne of oil produced – an increase over the current base rate of RUB 470:

- RUB 493 in 2014
- RUB 530 in 2015
- RUB 559 from 1 January 2016.

The maximum rate of export duty on crude oil is being lowered (by reducing the coefficient in the formula) from the current 60% to:

- 59% in 2014
- 57% in 2015
- 55% from 1 January 2016.

Table 6.4 Export tax rates for crude oil and oil products

Type	Tax rate	Comment
Crude oil	USD 395.9/t as from 1 November 2013 down from USD 416.4/t in October 2013.	The maximum oil export duty will drop from 60% in 2013 to 59% in 2014, to 57% in 2015 and 55% in 2016.
Light and dark petroleum products	66% of the oil duty, will be USD 261.2/t from 1 November 2013 (USD 274.8/t since 1 October 2013).	Gasoil will go down from current 66% of the crude oil export duty to 65% in 2014, to 63% in 2015 and 61% in 2016. Fuel oil export duty is projected to go up to 75% in 2014 and 100% in 2015 from 66% in 2013.
Super-viscous oil	USD 39.5/t, down from the USD 41.6/t effective since 1 October 2013	
Gasoline	Based on a coefficient of 0.90 of crude oil duty, as of 1 November 2013: USD 356.3/t down from USD 374.7/t in October 2013.	Gasoline and naphtha export duty maintained at 90% of the crude export duty.
LPG	USD 192.9/t from 1 November 2013. Currently: USD 208.3/t	
Crude oil	USD 395.9/t as from 1 November 2013 down from USD 416.4/t in October 2013.	The maximum oil export duty will drop from 60% in 2013 to 59% in 2014, to 57% in 2015 and 55% in 2016.

Sources: Ernst & Young; PricewaterhouseCoopers.

According to a number of mass media sources, the change also involves lowering the level of export duty on light petroleum products (with the exception of gasoline), established by government decree on a monthly basis, from the current 66% of oil duty to:

- 65% in 2014
- 63% in 2015
- 61% from 1 January 2016.

Similar tax incentives for the development of hard-to-recover and frontier resources also relate to the export taxation. Table 6.5 shows exemptions for offshore deposits.

Table 6.5 Export tax breaks for offshore deposits

Type of resource	Modalities of tax breaks
New offshore hydrocarbons deposits (NOHDs) falling into categories 1 and 2	Full exemptions until 31 March 2032
NOHDs from categories 3 and 4	Full exemptions until 31 March 2042
Offshore hydrocarbons deposits with 50% and more located in the southern part of Sea of Okhotsk provided the depletion level is less than 5% as of 1 January 2015.	Exemptions until 1 January 2021

Sources: Ernst & Young; PricewaterhouseCoopers.

Hard-to-recover resources still do not benefit from export tax breaks, with the exception of oil produced from oilfields with more than 80% of reserves consisting of Tyumen formation, under some conditions.

Resources from East Siberia and Sakhalin also benefit from some export tax reductions, in order to stimulate their development and compensate for the expensive infrastructure that needs to be developed there.

REFINERIES

Although the Russian refining system is the third-largest in the world behind the United States and the People's Republic of China, with a crude distillate capacity of 5.8 mb/d at the end of 2013, the majority of the country's refineries are inefficient and insufficiently modernised, yielding a high proportion of low-value oil products, such as fuel oil. The average processing depth of refineries was 71.5% in 2012.[43] In the Energy Strategy to 2030, the government has set the target to increase the refining depth to 83% by 2020-22 and up to 89% to 90% by 2030.

This goal has been repeated in the Governmental Programme of the Russian Federation "On Energy Efficiency and the Development of Energy" developed by the Ministry of Energy and approved by the government on 3 April 2013,[44] which targets a depth of refining of no less than 90% by 2020 and an increase in refinery capacity of 20% to reach

43. Ministry of Energy (2013), Subprogram 3 "Development of the oil industry", state programme of the Russian Federation "Energy Efficiency and Energy Development", April. "Depth of refining", a term used primarily in Russia, was defined as "the sum of the products, less fuel oil, less refinery fuel, and less losses, expressed as a function of crude capacity" in the article entitled "Refinery upgrades essential to Russian recovery" published on 27 March 2000 in *The Oil and Gas Journal*.

44. http://minenergo.gov.ru/upload/iblock/afc/afc90b96ec0fef29f2ededabb6a4a131.pdf (accessed 14 December 2014); http://government.ru/en/news/1174.

304 Mt/yr (about 6.3 mb/d) from 256 Mt/yr (about 5.3 mb/d) in 2011. It has subsequently ordered state-controlled companies and other vertically integrated companies to invest in the modernisation of refineries and the expansion of capacity. To encourage this development, the government provided two major tax incentives: a more favourable export regime for oil products than for crude oil alongside a progressive taxation of heavy oil products at the level of crude oil by 2015 on the one hand (the so-called 60-66-90-100 regime introduced in 2011), and lower excise tax on high-quality oil products such as gasoline and diesel on the other hand.

Russian refinery throughputs have increased from 3.9 mb/d in 2004, to 4.7 mb/d in 2008 and 5.3 mb/d in 2012. In the summer of 2013, Russian refinery throughputs surged to new record highs, marking an impressive increase of almost 40% over the past eight years. For the year 2013, refinery output reached 271 Mt (about 5.6 mb/d), +2.3% y-o-y according to data from the Ministry of Energy, including 38.5 Mt of gasoline, 71.6 Mt of diesel and 74.8 Mt of fuel oil.[45]

Over the period 2008-12, improvement in Russian refineries of the average depth of refining and the share of light products produced has been slower than expected. One of the reasons is that the low duty on fuel oil exports compared with crude oil boosted refinery margins for simple refineries, despite the low-value products they produced. In effect, the differentiated export duties provided incentives not to invest in upgrading the plants. Another reason is that the mandatory improvement of fuel quality standards has been delayed several times, which has brought some unpredictability and challenges for companies that had done the investments without being able to fully reap the benefits.

This also contributes to a shortage of high-quality products that is likely to increase if modernisation plans are delayed. Yet the government decided to sharply increase the export taxation of heavy fuel products in the next two years – see Section “Taxation”– which is likely to reduce exports and create economic difficulties for those refineries that failed to modernise.

At the same time, the export duty on high-quality oil products will decrease, the reward for investment will be stronger, and those complex Russian refineries that modernise or have modernised will enjoy substantially higher refinery margins, especially compared with competitors in Europe. Simple refineries will see their margins decrease significantly with the new duties.

Rosneft is the company holding the largest capacities (about 40%), with nine large oil refineries in Russia totalling 54 Mt (about 1.1 mb/d) of overall primary refining capacity: Komsomolsk, Tuapse, Novokuibyshevsk, Kuibyshev, Syzran, Achinsk and Angarsk Petrochemical Company, as well as the Ryazan and Saratov refineries which belonged to TNK-BP. Rosneft’s total output of petroleum products in 2012 reached 48.8 Mt/yr (about 1.0 mb/d).

In 2013, Lukoil’s five refineries representing 17% of oil product capacities in 2013 were all producing Euro-5 standard products and had a 54% share of light products. Lukoil’s 2012 refinery capacity in Russia was 45.7 Mt/yr (about 940 kb/d) and refinery crude runs in Russia was 44.3 Mt (about 910 kb/d).

The third-largest Russian company in terms of refining capacity and output is GazpromNeft. The company owns two large refineries, Moscow and Omsk, and a 50% stake in the Yanos refinery in Yaroslavl. The company produced 36.7 Mt (about 752 kb/d) of products in Russia in 2012.

45. Ministry of Energy of the Russian Federation website: www.minenergo.gov.ru.

It is also noteworthy that about 70 mini-refineries operate in Russia, some reportedly in non-transparent conditions as output may not be properly monitored and controlled. In some cases their products are sold on the domestic market, often reportedly illegally, or exported as heavy fuel, which so far has been less taxed.

Refinery output in 2012 included 21% gasoline, 26% diesel, 28% heavy fuel, 4% kerosene, and 21% of other products. Since 2002, production of naphtha and gasoline has nearly doubled, while gas and diesel oil, residual fuel oil, LPG and kerosene-type jet fuel have grown by around 30%. Russian refineries produce over 100 Mt (about 2.0 mb/d) of motor gasoline and diesel annually, with 20% of gasoline and 55% of diesel exported. The remainder is sold domestically.[46] Production of Euro-5 gasoline has already increased by 69% over the past five years to 16.5 Mt (about 382 kb/d), up from 10 Mt (about 232 kb/d) in 2009, yet is still insufficient to meet domestic demand.

Key companies have plans to modernise their existing refineries. Rosneft is planning to invest a total of RUB 960 billion (USD 29 billion) by 2017, to build a petrochemical complex in the Far East with a capacity of 30 Mt/yr (about 616 kb/d) once (and if) the three planned phases are completed (first phase of 240 kb/d likely to be completed after 2020). The complex will include 24 Mt (about 482 kb/d) of crude oil and 6 Mt (about 146 kb/d) of naphtha (Far East Petrochemical Company), specialising in the production of polymers.

The realisation of this project will depend on different factors including the availability of crude oil. The Grozny refinery is to have an input capacity of 1 Mt of crude oil. Rosneft is also conducting modernisation at the Komsomolsk refinery to be completed by 2017, which will increase primary processing capacity at company plants to 17.7 Mt (about 364 kb/d) from the current 8 Mt or 160 kb/d.

At the project for expansion of capacities at the Tuapse refinery, up to 12 Mt has been completed, boosting its capacity from 4.2 Mt (about 86 kb/d) to 12 Mt (about 247 kb/d) per year with a very high efficiency grade and large Euro-5 fuel production. Rosneft projects the production of 46 Mt (about 1.1 mb/d) of almost entirely Euro-5 motor fuels by 2017 from almost none in 2012, and plans to increase the share of light products, including diesel, from 56% in 2012 to 80% in 2017, following a USD 25 billion investment programme.[47] Through this investment programme, the company also aims to increase oil processing to 90.4 Mt/yr (about 1.9 mb/d) with an average refining depth of 80.2%.

GazpromNeft is also investing in the modernisation of its refinery assets as currently its Moscow refinery and Omsk refineries are producing Euro-4 fuels – Euro-5 by 2015 – and targets reaching a 90% processing depth by 2020. The successful completion of the capacity expansion and upgrade investments will depend on the stability of the export tax system as well as of the excise tax system.

According to quadripartite agreements concluded by oil companies with FAS, Rostechnadzor and Rosstandart, oil companies commit to implementing the investment programme for the construction and modernisation of Russia's refining capacity and petroleum products volume that meet the requirements of the technical regulations for the period until 2020. Modernisation of Russia’s refining capacity includes the implementation of secondary refining and secondary processes to ensure quality of the domestic motor fuel market.

46. Argus; Russian Motor Fuels (2013).

47. www.rosneft.ru.

Table 6.6 Characteristics of Russia's largest refineries

Refinery	Owner	Technical capacity (Mt)	2012/13 crude runs (Mt)	Nelson index
Omsk	Gazprom group	21.4	20.95/20.23	8.1
Kirish Nizhny Novgorod	Kirishnefteorgsintez Lukoil	21.2 17.5	16.05/17.16	6.3
Yaroslavl	Gazprom group/Slavneft	15.2	15.28/15.04	5.3
Salatov Ryazan	Gazprom group Rosneft	11.7 18.0	16.32/17.20	5.3
Perm	Lukoil	13.5	13.12/12.83	7.9
Moscow	Gazprom group	12.2	10.67/11.08	4.7
Volgograd	Lukoil	11.3	11.38/11.09	5.4
Angarsk	Rosneft	11.0	10.05/10.13	4.6

Sources: Company information from Lukoil, Rosneft and Gazprom company information; Ministry of Energy of the Russian Federation.

INFRASTRUCTURE

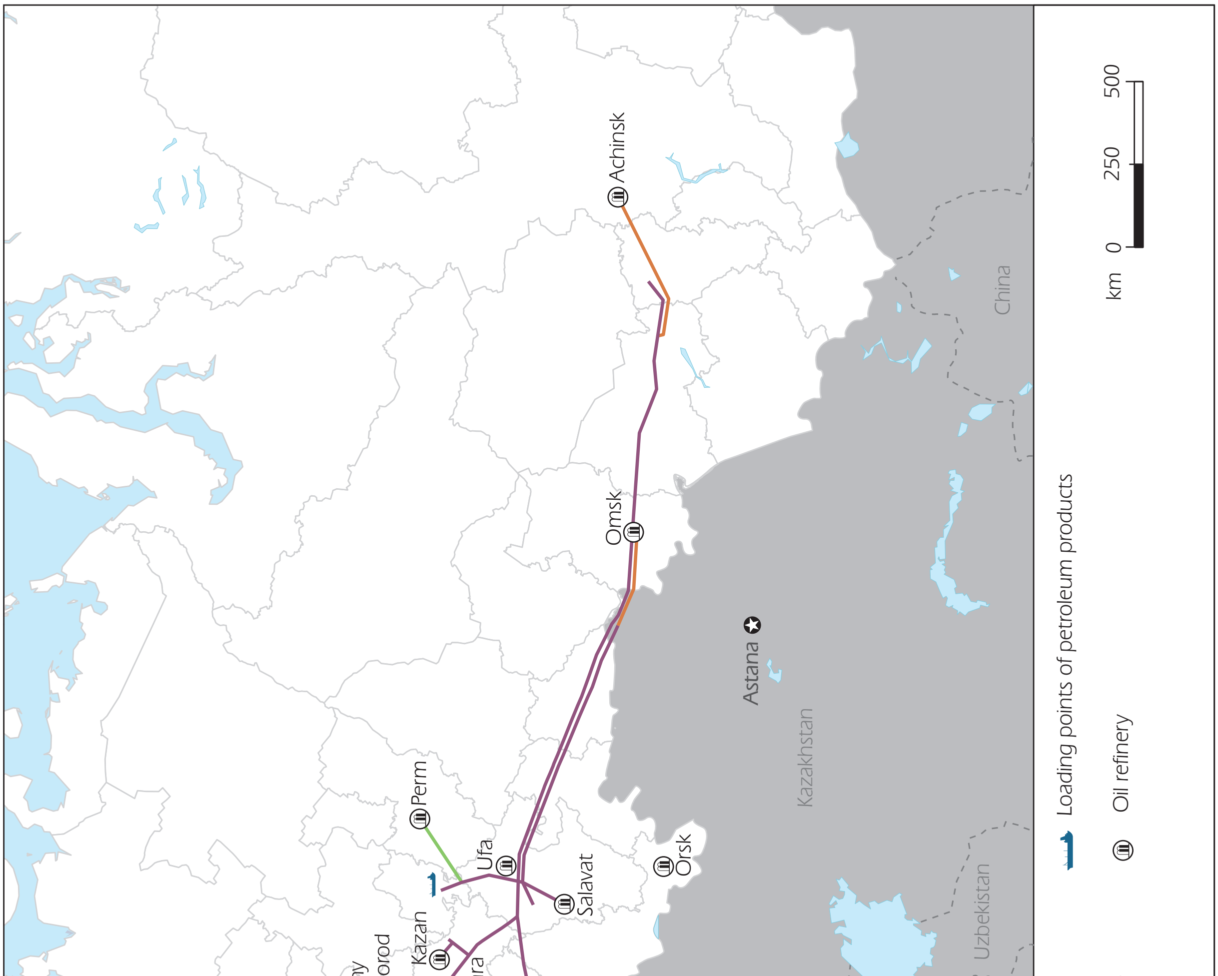
TRANSMISSION PIPELINES

The Russian oil pipeline system, operated by the state-owned company Transneft, is a natural monopoly that overall is functioning relatively efficiently, and third-party access is ensured in most cases. Capacity for transporting oil and oil products is allocated in accordance with the production volume in relevant regions. Nonetheless, there are frequent disputes over the financing of additional infrastructure and the transportation tariffs between Transneft and leading Russian oil producers and exporters.

Transneft operates more than 53 000 km of trunk crude oil and 19 000 km of oil product pipelines, including more than 500 pumping stations and more than 20 million cubic metres (m^3) of tank capacity. The pipelines move 93% of Russian oil and more than 20% of petroleum products. Transneft proposes transmission tariff changes for every major route and pipeline and submits them to the Federal Tariff Service (FTS), which then decides whether to adjust tariffs accordingly.

With growing oil production and refinery upgrades, expanding the oil pipeline and product pipeline system has become necessary. In the period of 2010-13, Transneft set the goal to build 3 539 km of pipelines and 18 pumping stations, investing RUB 509.6 billion. In past years, Transneft has focused on crude oil pipelines yet its current main projects focus on product pipelines. In line with the scheme of pipeline system development up to 2020, the oil product pipeline system run by the specialised subsidiary of Transneft, Transnefteproduct, increased from the current 600 kb/d (30 Mt/yr) to more than 1 mb/d. The challenge indeed is to modernise and expand the transmission infrastructure for products and to be competitive with rail shipments that play a key role for product transportation in Russia. Overall, both Transneft and Transnefteproduct have raised concerns over the financing of these expensive infrastructure developments, which has led to difficult discussions with the government, the FTS and producing companies over tariffs and financing of investment plans.

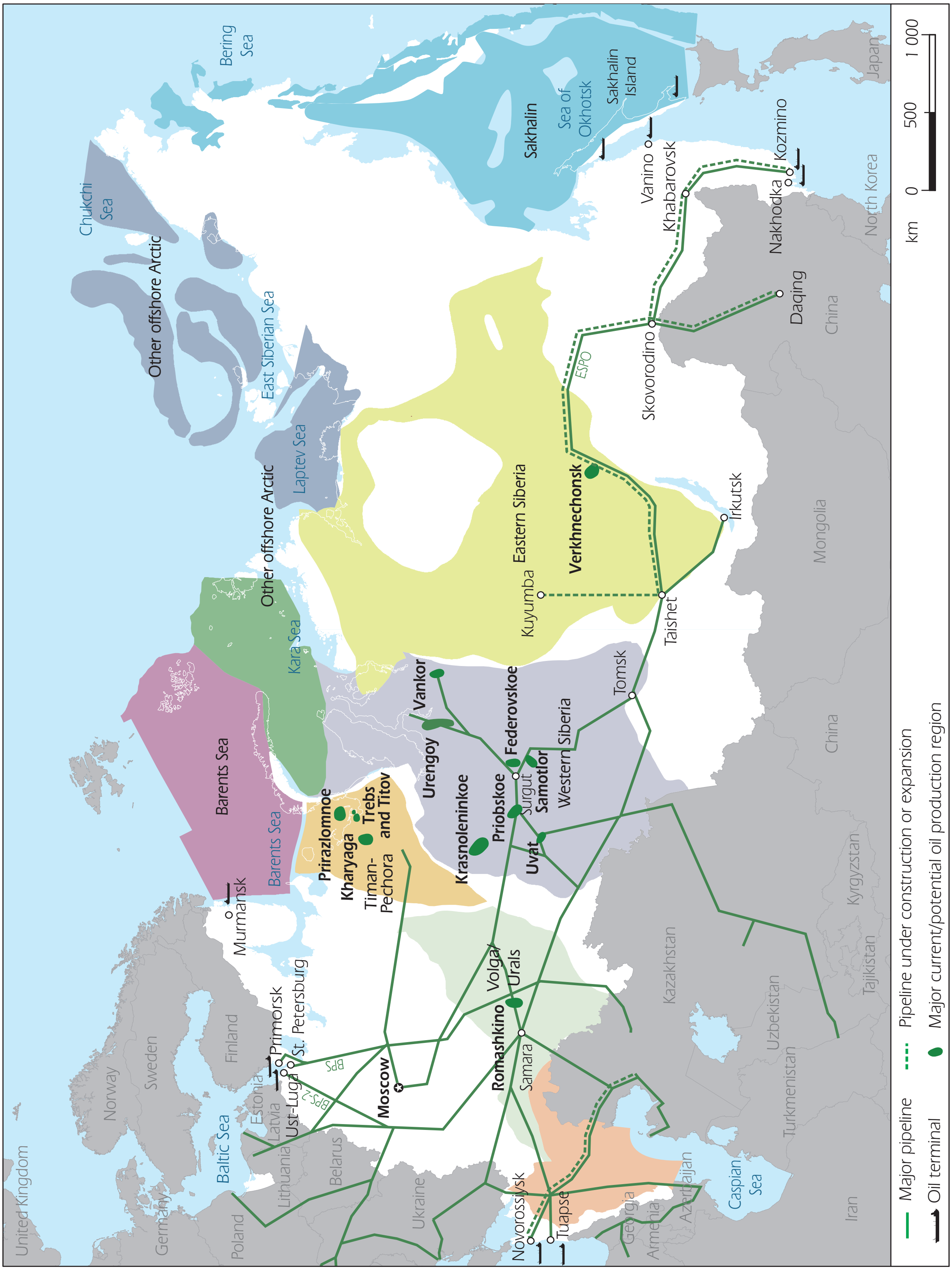
Figure 6.7 Transneft's oil product pipelines



This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

Source: Transneft.

Figure 6.8 Transneft's crude oil pipeline system



This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

Sources: IEA; Transneft, www.transneft.ru.

The Russian territory also transports Kazakh oil to various outlets and markets: via rail to Belarus and Ukraine or for onward transit via Druzhba or to Baltic ports, and via the CPC (Caspian Pipeline Consortium) pipeline from Western Kazakhstan to Russia's Black Sea port of Novorossiisk where the crude oil is loaded on ocean-going tankers for further delivery. This 1 580 km, 35 Mt (about 719 kb/d) capacity pipeline transported almost 30.6 Mt of CPC Blend oil via the South Ozereyka-2 terminal in 2012. The CPC is currently expanding the pipeline's capacity to up to 76 Mt (about 1.6 mb/d) by 2015 in order to ship Kashagan oil to markets, and possibly also larger volumes of Tengiz oil. The expansion is marked by some delays, however. At the same time, some Kazakh oil is also shipped to Russia via the Atyrau-Samara oil pipeline. The CPC handled roughly 50% of Kazakhstan's total oil exports in 2012 and the Uzen-Atyrau-Samara pipeline route about 15 Mt in 2012 – that is 22% of total exports. These two pipelines in total carried about two-thirds of Kazakhstan's total oil exports. Finally, there is also some Azeri oil supplied via the Baku-Novorossiysk pipeline – SOCAR exported 2 Mt of oil along that route in 2012 and reduced shipments to 35 140 bbl/d in 2013. Commercial issues halted transit through this pipeline in autumn 2013 and uncertainty remains about its future use. A Russian-Azeri governmental agreement envisaging the annual shipment of 5 Mt of oil expired on 14 February 2014 and had not been renewed at the time of writing. Transneft also reportedly shut down the oil pipeline from Shirvanovka in Azerbaijan to Makhachkala. The Makhachkala-Novorossyrsk pipeline remains operational and in use and Transneft was reportedly working to attract oil supplies from Turkmenistan and additional supplies from Kazakhstan through that route.

The Baltic Pipeline System (BPS) transports oil from the Timan-Pechora, Western Siberia and Volga-Urals regions to the Primorsk oil terminal located on the Gulf of Finland. The capacity of the BPS-1, commissioned in 2006, is 76.5 Mt of oil per year. The construction of a second trunk line running from the Unecha junction of the Druzhba pipeline near the Russia-Belarus border to the Ust-Luga terminal on the Gulf of Finland, with a 172 km long branch line to Kirishi oil refinery, was started in 2009. The construction of the pipeline system BPS-2 with a total capacity of 65 Mt/yr (about 1.3 mb/d) was originally envisaged to be implemented in two stages. Power fluid systems in the first stage are limited to 30 Mt (about 616 mb/d) per year. The term for the realisation of the second stage (i.e. increase of total capacity up to 65 Mt) is not defined yet. The first stage of the BPS-2 pipeline was commissioned at the end 2011 with a capacity of 30 Mt. In 2012, only 15 Mt (approximately 308 kb/d) of crude oil was transported through this pipeline.

In 2011, Transneft commissioned the 429 km Purpe-Samotlor oil pipeline with a capacity of 25 Mt/yr (about 514 kb/d). This pipeline might play a strategically important role in securing Russian oil supply to the Asia Pacific region, connecting some oil fields to the ESPO pipeline. The aim of the project is transportation of oil from the YNAD and the north of Krasnoyarsk region, including the Vankor Field, both to the Russian and foreign oil processing facilities.

New projects, expansions, capacities

A number of key infrastructure projects are being discussed or actively developed by Transneft:

- For oil transportation from Black Sea ports to the Mediterranean, bypassing the Bosphorus strait: the Burgas-Alexandroupolis oil pipeline project, through which oil would be loaded in tankers from Novorossiysk, unloaded at Burgas in Bulgaria, shipped via a short pipeline to Alexandroupolis in Greece and reloaded again on larger tankers; or the Samsun-Ceyhan pipeline (500 km, 50 Mt/yr capacity [about 1.0 mb/d]), through which oil would be loaded in tankers at Novorossiysk, unloaded in the pipeline in Samsun and reloaded into tankers in Ceyhan. Both projects are still mentioned by Transneft but were stalled for reasons including costs and environmental concerns.

- Petroleum product pipelines "North" and "South": The “South” pipeline project is a 8.7 Mt/yr (about 178 kb/d), 1 465 km long oil product pipeline running along the route “Syzran-Saratov-Volgograd-Novorossiysk”. It will allow the export of large volumes of diesel from the Novorossiysk port to European and other countries. The pipeline is to be commissioned by 2018 and Lukoil is likely to use most of its capacities, with 3 Mt/yr (about 62 kb/d) of diesel reportedly pre-booked.[48] The “North” oil product pipeline runs 600 km from Vtorov to Primorsk. The first stage is already commissioned and its capacity will be 15 Mt/yr (about 308 kb/d). The pipeline’s expansion is to be commissioned by 2018.
- Transneft was to start, in early 2014, the construction of a 603 km, 15 Mt/yr pipeline from Kuyumba to Tayshet, the starting point of the ESPO pipeline. The project, linking up fields jointly developed by Rosneft and GazpromNeft (Kuyumbinksoye) as well as Rosneft’s Yurubcheno-Tokhomskoye field, is to be completed in the fourth quarter of 2016. In early 2014, shipment contracts for that pipeline had yet to be signed according to Transneft.[49]
- The Zapolyarye-Purpe Pipeline: The 490 km, 45 Mt/yr (about 925 kb/d) capacity polar region-Purpe oil pipeline is aimed at transporting oil from fields of the YNAD and the north of Krasnoyarsk Krai. It will link oilfields of Yamal with the ESPO oil pipeline. Construction has started and is to be completed in the fourth quarter of 2016, and will involve three phases. The first line is to be commissioned at the end of 2014. The loading of the pipeline will depend on arrangements found with Rosneft – the pipeline was planned when TNK-BP was still independent and Rosneft has other oil transportation options that require adjustments in the planning for the pipeline’s loading.
- An oil pipeline running from Andreevka-Ufa-Subkhankulovo-Almetyevsk-Kstove Sea transports liquid hydrocarbons, including those from the coastal areas of the Russian Arctic.

The FTS has prepared a draft governmental law that says the exact level of expenses of a product pipeline project to be included in the tariff either would be defined by the government or would be fixed in separate agreements between Transneft and those oil companies that are interested in a particular pipe construction or expansion. Transneft has long sought amendments to the current legislation that bars financing construction and upgrades of the products pipeline system by hiking crude oil shipping tariffs.

Ports

Russia’s Transneft and other private oil companies have developed a number of key port infrastructures to export crude oil and oil products from the Black Sea, the Baltic Sea and the Barents Sea to the Asia-Pacific markets. These have substantial capacities, providing flexibility.

48. Nefte Compass (2013), “Russia wrestles with oil product pipeline challenges”, 17 October.

49. Interfax, 19 December 2013.

Table 6.7 Major ports for oil export

Port (name, location)	Capacity (crude and products)	2013 flows	Expansion plan	Comment
Primorsk	1.5 million bbl/d	50.6 Mt		Russia's largest terminal which is supplied by the BPS-1 pipeline
Novorosiysk	950 000 bbl/d	26.9 Mt		Russia's second-largest terminal
Kozmino	500 000 bbl/d	21.3 Mt	1 million bbl/d	Located in Russia's Far Eastern Primorsky province, transport of ESPO oil
Ust-Luga	30 Mt	17.2 Mt	Can be expanded to 38 Mt	The latest big oil terminal put into operation (2012); the terminal is supplied by the BPS-2 pipeline. The terminal's tank farm has capacity of 40 000 m^3 for LPG in isothermal tanks and 10 000 m^3 in pressurised tanks, as well as 100 000 m^3 for light oil products.
Tuapse	350 000 bbl/d capacity for petroleum product handling			Reduction in volumes is observed.
Varendey	12 Mt	3 Mt		Exported volumes are likely to increase in the medium term with new fields connected.

Sources: Transneft, www.transneft.ru; Nefte Compass.

CRUDE OIL AND OIL PRODUCTS EXPORTS

Russia is a key crude oil exporter, and with the growth of oil production, crude oil exports have been rising during the 2000s, from 144.4 Mt (about 3 mb/d) in 2000 to 239.7 Mt (4.9 mb/d) in 2012, representing about 40% of total production. Crude oil exports declined slightly, by 2% in 2013, at 234 Mt (about 4.8 mb/d). Over the past years, not least due to a new export tax legislation favouring oil product exports over crude oil, the exports of products have grown strongly whereas the exports of crude oil has slightly fallen. Between 2001 and 2011, the export of oil products has more than doubled from 63 Mt to 132 Mt and continued to increase towards 150 Mt since then.

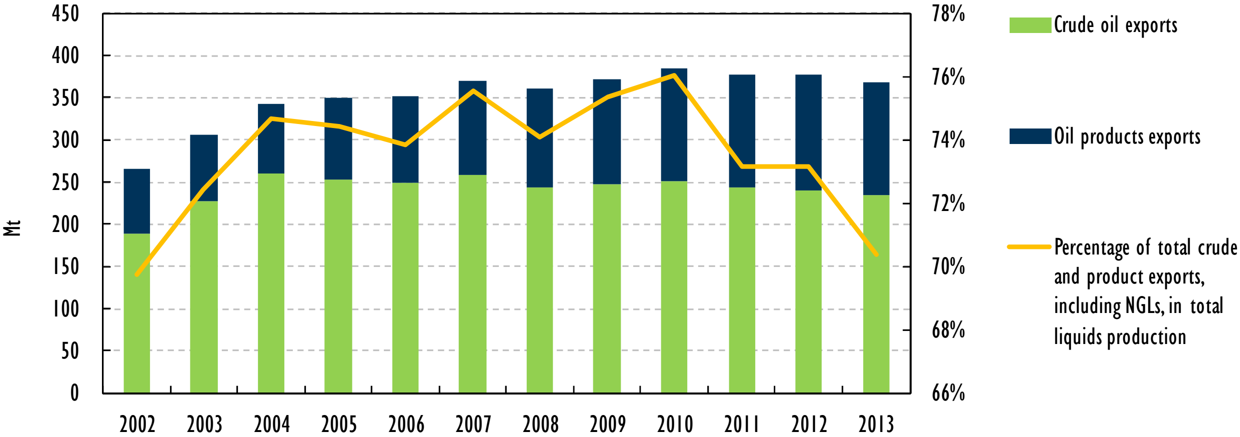
Crude oil exports in 2012 were destined for the main ports in Europe, including the Netherlands (17%) – mainly for trading though – Germany (8.6%) and Italy (9%), as well as Eastern European countries Poland (9.2%) and Belarus (7.4%). China was also a considerable destination for exports with 8.7% of the total. The exports of crude oil and petroleum products represented about 70% of Russia's total liquids production in 2013, down from 76% in 2010.

The Energy Strategy to 2030 estimates that oil and petroleum products export volumes are set to remain stable at approximately 315 Mt/yr to 330 Mt/yr (6.5mb/d to 6.8 mb/d). The government's most recent projections foresee an increase of overall crude exports from 240 Mt (about 4.9 mb/d) in 2012 to 263 Mt (about 5.4 mb/d) in 2030.[50]

This stands in contrast with IEA projections, which foresee a decrease in Russian crude and product exports over the next 20 years. The *WEO 2013* projects that total oil exports (crude and products) decline from 7.8 mb/d in 2012 to 6.2 mb/d in 2035 squeezed by increasing domestic demand and, to a greater extent, a fall in production. This dip in exports, coupled with the expansion of the economy overall, means that oil revenues as a share of GDP would fall from over 15%, to under 7%.

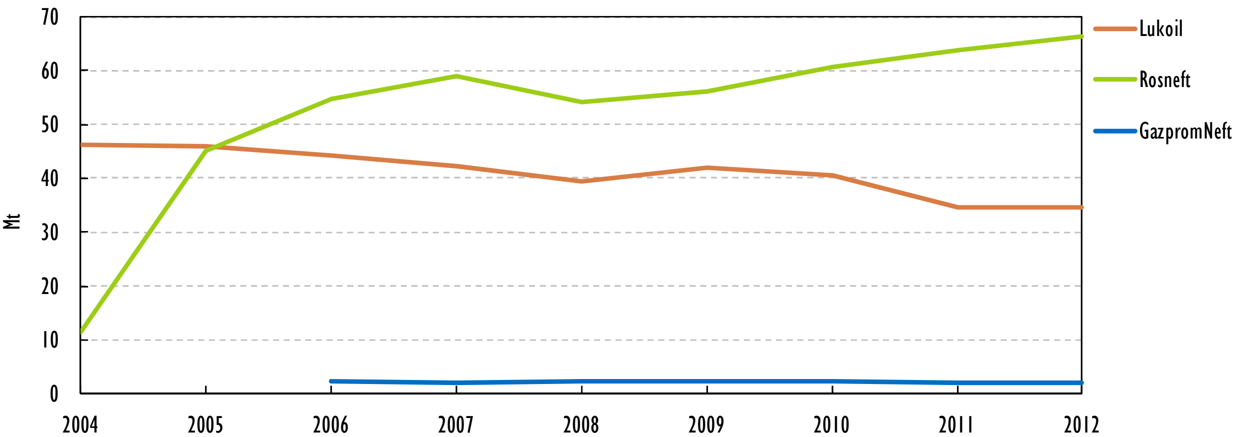
50. Interfax, 7 November 2013, based on the Long Term Forecast for the period until 2030 of the Ministry of Economic Development.

Figure 6.9 Russia's exports of crude oil and oil products and share of exports in total liquids production, 2002-13



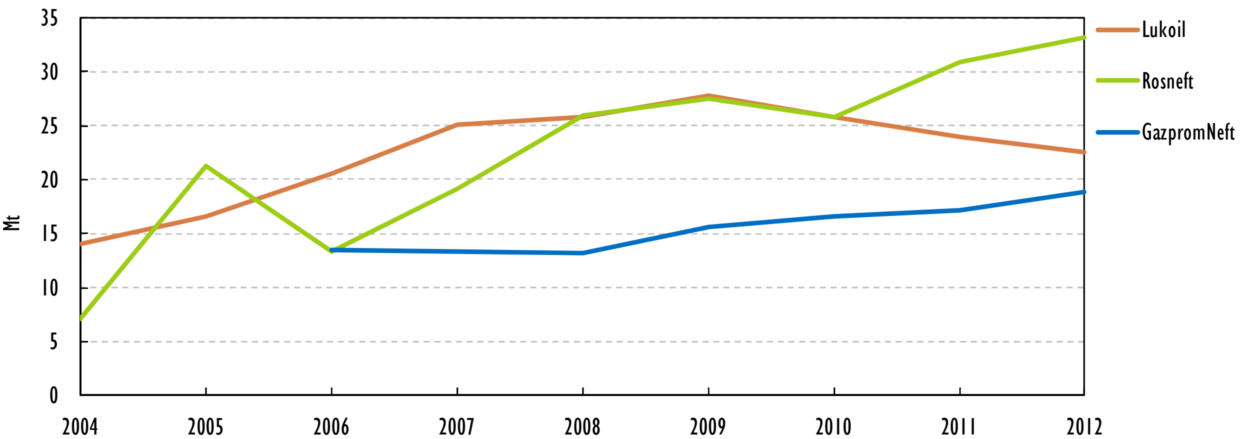
Sources: Rosstat; Bank of Russia.

Figure 6.10 Russia crude oil exports by leading companies, 2004-12



Sources: company information from Lukoil, Rosneft, GazpromNeft .

Figure 6.11 Russia's exports of oil products by leading companies, 2004-12



Sources: Annual Reports from Lukoil, Rosneft and GazpromNeft for the period.

Crude oil exports from Russia are projected by the IEA to decline by 1 mb/d between 2012 and 2035, to 4.2 mb/d, due to lower oil output. Refinery runs decrease by 600 kb/d by 2035 as fiscal changes limit the opportunities open to simple refiners. As a result, total product exports also decline by about 600 kb/d, to 1.9 mb/d, with exports of low-value fuel oil losing out. However, higher-value diesel exports grow thanks to refinery upgrades, and LPG exports also grow with higher NGL output.

EXPORT DIRECTIONS AND MARKETS

Russia's oil exports are undergoing major changes in terms of export routes and proportion of crude oil versus oil products. Four key changes can be observed:

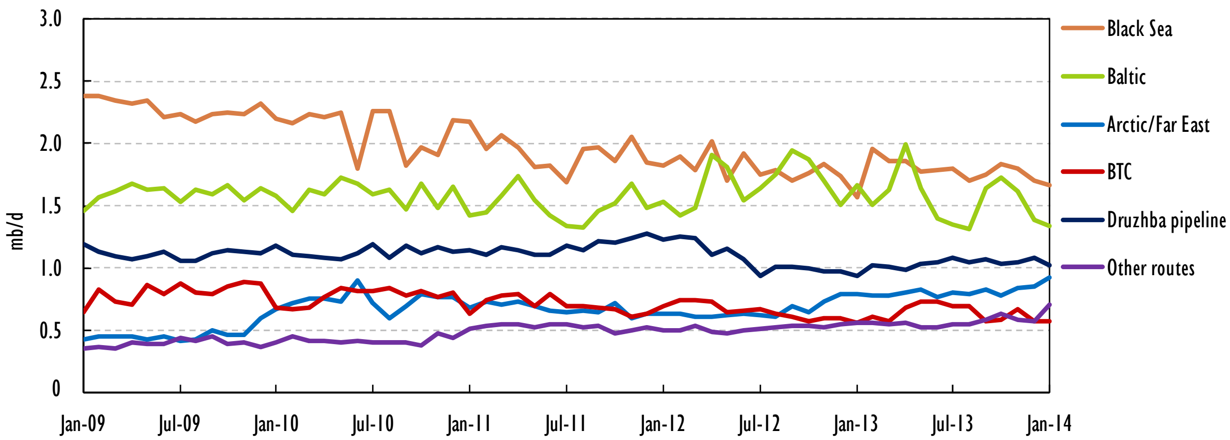
- The bulk of Russia's crude oil exports are directed towards markets outside Former Soviet Union (FSU) countries. Markets in FSU countries (except the Baltic States) in 2013 received 28 Mt of oil, and other markets 206.8 Mt according to data from CDU TEK.
- Since 2009 and the commissioning of the ESPO pipeline, Russia has started exporting large and growing volumes of oil to the Asia Pacific region, while crude exports to European markets have slightly decreased over past years to a level of 77% of total crude oil exports, not least because some oil was transferred from west to east and because oil product exports have increased. This trend is set to continue in the medium term as new pipelines feeding ESPO will be commissioned, reflecting also the fact that there is a growing demand for Russian oil in this region. Given that total oil exports are unlikely to grow as fast as the increase in exports to the Asia Pacific region, the proportion of European energy markets in the total volume of Russian oil exports will steadily decline in the medium to long term. The share of Asia Pacific countries in total exports of Russian crude oil to foreign countries increased from 6% in 2008 to 20.4% in 2012.[51] Exports to the CIS decreased by 1.7 Mt (about 35 kb /d) (-5.7% to 2011), especially to Ukraine (-3.9 Mt [about 80 kb/d]) due to the termination in March 2012 of deliveries of crude oil. The government projects that Asia Pacific-bound exports will represent up to 33% of total Russian crude exports by 2020.[52]
- For west-bound oil exports, a key trend is that there are more seaborne exports through newly built Primorsk and Ust-Luga terminals on the Baltic Sea at the expense of oil exports via the Druzhba pipeline system and Black Sea ports. The ESPO pipeline is also negatively affecting volumes supplies through Druzhba.
- The share of oil product exports has been growing as the new tax regime for the Russian oil industry entered into force on 1 October 2011 (the "60-66-90" regime). Oil product exports are set to increase particularly in the Asia Pacific region once refinery capacity planned by Rosneft to serve these exports has been commissioned after 2020.
- Thanks to the many different export outlets (Figure 6.12), Russian oil producers and exporters can very efficiently fulfil incremental demand and orient their exports towards the outlets offering the highest netbacks. Russia indeed possesses much larger export capacity than actual and future export volumes in Europe especially, and is thus equipped to maximise its export revenues.

51. Министерство энергетики Российской Федерации [Ministry of Energy of the Russian Federation] (2013), "Итоги работы нефтегазового комплекса и угольной промышленности Российской Федерации в 2012 г." ["Results of the work of the oil and gas complex and coal industry of the Russian Federation in 2012"], Москва [Moscow].

52. Interfax, 7 November 2013, based on the Long Term Forecast for the period until 2030 of the Ministry of Economic Development.

- As far as oil products are concerned, a continued trend should be an overall decline in exports, down to 104 Mt (about 2.1 mb/d) by 2030 from 138 Mt (about 2.8 mb/d) in 2012 according to the government's estimates, primarily due to lower residual fuel oil exports. Yet exports of high-quality diesel, in particular via Novorossirsk and Primorsk when the North and South product pipelines are built, will increase, alongside exports of kerosene and gasoil used for other uses.
- Russian refineries should ship greater volumes of Euro-5 diesel products to Europe in the second half of this decade, possibly in a range of 300 kb/d in the medium term and up to 900 kb/d in the long term according to some estimates, depending on the export tax system, the pace of modernisation of domestic refineries and domestic oil product demand trends.

Figure 6.12 Flows by major export direction, January 2009 to January 2014



Sources: Argus; IEA, Monthly oil market reports, corresponding months.

Export through ESPO

Russia's Energy Strategy to 2030 has set the target of increasing oil exports to the Asia Pacific region from 8% of total exports in 2008 to between 22% and 25% by 2030. This is a strategic priority of the government. Discussion about exports of oil and gas from Eastern Russia to the countries of the Asia Pacific region has been ongoing since the 1970s, yet only the construction of the ESPO oil pipeline has enabled the opening of this new export direction with large oil volumes. So far, Russia has successfully implemented this strategy as its oil exports to China have been growing steadily and already represented 20% of total exports in 2012.

The construction of the ESPO pipeline started in 2006, and full-fledged operations of the Kozmino terminal started in December 2009 and ESPO-2 in November 2012. The total length of the pipeline is 4 740 km and the current capacity is 30 Mt per year (about 616 kb/d). More upgrades are planned so that the final throughput capacity would amount to 50 Mt/yr (about 1 mb/d) by 2014. ESPO construction was realised in two phases. The first stage, "ESPO-1", consisted of the construction of the oil trunk pipeline from Taishet (Irkutsk oblast) to Skovorodino (Amur oblast) with a capacity of 30 Mt/yr (about 616 kb/d) and length of 2 694 km alongside the construction of the oil loading port of Kozmino in the area of Nakhodka. In December 2009, ESPO-1 was commissioned and the transportation of oil from Skovorodino to Kozmino was realised by railway. Within the second phase of the construction, which is known as ESPO-2, the main trunk oil pipeline from Skovorodino to Kozmino was constructed, and the corresponding increase of capacity of the already built Taishet-Skovorodino line was completed to increase the capacity to 58 Mt/yr (about 1.2 mb/d) by 2014 and to 80 Mt/yr in future. In 2013, exports via the Kozmino outlet reached 427 kb/d, marking a 30% y-o-y increase, and exports via the spur to China grew by 4.4% to 316 350 bbl/d.

The ESPO pipeline has a branch line to China launched in 2011, extending from Skovorodino in Russia to Daquing via Mohe, in the northeast China's Heilongjiang province. With the total length of 63 km in Russia and 960 km in China, the pipeline can transport 20 Mt (about 410 kb/d) of oil from Russia to China per year, with currently 15 Mt (about 308 kb/d) of oil shipped annually. In 2013 Rosneft and Transneft agreed to increase the capacity of the Skovorodino-Mohe spur to 20 Mt by 2015, and 30 Mt by 2018.

The ESPO pipeline opens a historical opportunity for Russia to export ever-larger oil volumes to the Asia Pacific region, especially to China. Before the ESPO pipeline, Russian crude exports to this region were limited to some Sakhalin-1 and Sakhalin-2 supplies and shipment by railway to China with a small amount of transport via Kazakh pipeline to China. The opening of this major oil export route is also a strategic opportunity for Asia Pacific buyers such as China or Japan to diversify their exports away from the Middle East and the Hormuz and Malacca straits and access a secure, close resource that can also help meet growing demand, especially in China. Given the geographical proximity, the availability of supplies is also quicker than for oil coming from the Middle East, where the transportation distance is much longer. This is why ESPO oil exports are of strategic importance both for Russia and for its buyers.

Rosneft has been the driver of increased oil exports via ESPO to Kozmino but especially through the ESPO spur to China. In 2010, Rosneft agreed with CNPC that it would supply 15 Mt/yr (about 308 kb/d) of crude from 2011 to 2030, that is over 20 years, via the Skovorodino-Mohe route. In 2012 oil exports to China reached 330 kb/d via the ESPO pipeline. The Kozmino port handled on average about 435 kb/d in 2013, with major export markets being the United States (27%), Japan (19%), China (18%) and the Republic of Korea (13%).

Further change in the Asia ESPO Pacific oil market is envisaged with the new agreement between Rosneft and CNPC. In 2013, Rosneft agreed a USD 270 billion deal with CNPC to double oil supplies to China from 2018 for a period of 25 years. As a consequence, annual exported volumes were to increase from 15 Mt (bout 308 kb/d) to 30 Mt (about 616 kb/d).

The agreement includes a progressive Chinese up-front pre-payment of USD 70 billion reportedly at an interest rate of 2.63% (about USD 1.8 billion annual reimbursement). China would then become Russia's largest oil importer, a position currently held by Germany. Rosneft and CNPC, via their 49%/51% Vostok Petrochemical joint venture, were also developing a project to build a 13 Mt/yr refinery in Tianjin to process some of the crude oil supplied to China via the ESPO spur and target Northern China's market.

Rosneft's 2013 additional supply commitment to China, and ongoing discussions over additional supplies to China to Sinopec and the Tianjin refinery, a project jointly developed with CNPC, has sparked discussions about the availability of transportation capacity and oil production to meet it, and especially whether it would require diverting oil exports away from Europe to this direction. Parties, especially Rosneft and Transneft, came to an agreement to finance the expansion of the ESPO-China link to reach 30 Mt (about 616 kb/d), which will open the way in the future for higher exports.

Table 6.8 Crude oil transportation and exports to the Asia Pacific region from the ESPO system, 2013 and 2018

	2013	2018
ESPO-1 (Taishet-Skovorodino, 2 694 km)	30 Mt or 616 kb/d	50 Mt or 1mb/d
Skovorodino-Chinese border/Mohe, 63 km	15 Mt to 20 Mt or 308kb/d to 410 kb/d	30 Mt or 616 kb/d
ESPO-2 (Skovorodino-Kuzmino, 2 060 km)	30 Mt or 616 kb/d	50 Mt to 65 Mt or 1mb/d to 1.3 mb/d
ESPO pipeline export from Kozmino terminal	300 kb/d	600 kb/d
Petrochemical complex (Rosneft)	0	200 kb/d to 480 kb/d
Komsomolsk refinery	7.1 Mt	17.7 Mt (after 2017)
Khabarovsk refinery	88 kb/d	160 kb/d

Sources: Transneft; Interfax; Reuters.

To supply oil for the ESPO pipeline, two new pipelines are planned. The construction of the 490 km Zapolyarye-Purpe pipeline will be completed by 2014-16 with a capacity of 900 kb/d. It will allow the transport of oil from Yamal peninsula (Messoyakha, Suzun, Tagul, etc.). The 730 km Kuyumba-Taishet pipeline will link Irkutsk region fields (Yurubcheno-Takhomskoye and Kuyumba) to ESPO and is expected to be commissioned in 2016 with a capacity of 300 kb/d. Finally, should these upstream or midstream projects not be ready according to schedule, then Rosneft would be likely to divert some of the Kozmino oil tanker exports to focus on exports to China to make up for the missing supplies.

A number of new fields are to be developed, especially by Rosneft, to increase oil production for Asia Pacific-bound exports.

Table 6.9 Key oil fields that are or will be supplying the ESPO pipeline

	Operator	Recoverable reserves	Launch year	Region
Vankor	Rosneft	524 Mt	2009	Krasnoyarsk region
Yurbcheno-Tokhomsk	GazpromNeft, Rosneft	498.9 Mt	2016	Krasnoyarsk region
Verkhnechonsk	Rosneft	434 Mt	2008	Irkutsk region
Srednebotuobinsk	Rosneft and CNPC	134 Mt (C1+C2)	2014	Irkutsk region
Talakanskoye	Surgutneftegaz		2008	Yakutia
Kuyumbinskoe	Rosneft, GazpromNeft	504.7 Mt (C1+C2)	2017	Krasnoyarsk region
Suzunskoye	Rosneft	44.9 Mt	2016	Krasnoyarsk region
Tagulskoye	Rosneft	na	2017	Krasnoyarsk region
Lodochnoye	Rosneft	na	2017	Krasnoyarsk region

Sources: Rosneft; Surgutneftegaz; GazpromNeft.

Rosneft has also developed a new oil export route to China via Kazakhstan using swaps for volumes of up to 7 Mt/yr (144 kb/d) for the period 2014-19. Rosneft-arranged swap deals with Kazakhstan started on 1 January 2014. According to the five-year intergovernmental agreement between Kazakhstan and Russia (which can be extended for another five years) and involving Rosneft, KazTransOil and KazMunaiGaz, Rosneft delivers 7 Mt or 140 kb/d of oil to China through Kazakhstan via the Priirtyshk-Atasu-Alshankou pipeline. Payment for transit started in January 2014. According to an additional protocol, shipments could increase to 10 Mt (about 205 kb/d) but would require modernising the pipeline.[53]

Other companies are also likely to increase their oil shipments via ESPO in future, such as Bashneft, GazpromNeft and Surgutneftegas. Export allocations are distributed by the Ministry of Energy of the Russian Federation every quarter. Transneft issues port schedules normally about two months prior to loading dates.

A number of projects in the Russian Far East will also require additional capacity allocation in ESPO, in addition to volumes dedicated for exports to China or via Kozmino. Consumption of oil produced in Eastern Siberia may also increase as Rosneft is planning to build the Far East Petrochemical Complex at the end of the ESPO pipeline with a capacity of 200 kb/d to 480 kb/d by 2020-25. The project is pending approval from the Ministry of Energy at the time of writing. The commissioning of this project on time and its capacity will depend on the availability of crude oil once the export contracts to China have been fulfilled. Rosneft is also conducting the modernisation of the Komsomolsk refinery with upgraded capacity to reach a total of 120 kb/d to 140 kb/d by 2017 (8 Mt/yr). The refinery, currently supplied by rail, will be connected via a dedicated pipeline to the ESPO system. In addition, the Khabarovsk refinery, currently being modernised to ultimately process 120 kb/d, will be linked up to the ESPO system to receive crude.

ESPO crude trades at a premium to Middle East crude benchmark Dubai, although in the beginning it had traded at a discount to Dubai. The ESPO premium to Dubai has remained since August 2010. Indeed, ESPO oil is a sweeter and lighter crude than Dubai-quoted crude, and has a geographical advantage – this is why it benefits from a premium over Dubai deliveries. As long as ESPO continues to be priced off Dubai, it is not possible to say whether ESPO oil can become an Asian benchmark and to what extent it will maintain or increase the premium. It is still difficult to assess whether ESPO will be able to develop as a price marker for the Asia Pacific or if issues such as oil quality may impede it from becoming such a reference. To support this objective, Russian companies are likely to divert lighter, sweeter Western Siberian oil to ESPO to offset the more sulphurous volumes. In addition, the promotion of that oil grade would require having more oil supplied on the open market and more traders handling these volumes.

Should all these export projects be realised and the refinery and petrochemical complex in the Far East developed according to plans, calculations show that additional production will need to come from new greenfield projects that have not been developed yet.

Exports to European and global markets

Via Black Sea ports

Oil export volumes via Black Sea ports (Figure 6.12) are rather volatile, but follow a trend of decline in past years as Transneft and other companies have prioritised oil exports via new terminals Primorsk, especially Ust-Luga. Novorossiysk daily loading is now typically in a range of 500 kb/d to 750 kb/d versus about 800 kb/d a few years ago. In 2013, average loading reportedly amounted to 540 kb/d, down from just under 600 kb/d in 2012.

53. Interfax, 25 December 2013.

Russia may be confronted with oil quality issues on this export outlet with higher sulphur content as sweeter crude is diverted eastwards or used in domestic refineries. Exports from the Tuapse port are also decreasing as Siberian light oil is increasingly used in Rosneft's Tuapse refinery.

Via Druzhba and via the ports of Ust-Luga and Primorsk

Following the commissioning of the BPS-1 and BPS-2 pipeline systems – totalling about 2.1 mb/d export capacity – as well as the commissioning of the ESPO-2 pipeline, Russian oil exports through the Druzhba system to Ukraine and Central Europe have decreased (Figure 6.12). The BPS-1 and BPS-2 pipeline systems were built to reduce transit reliance on the Baltic States (BPS-1) and on Belarus and Ukraine (BPS-2), and also to help diversified supplies to reach the Atlantic basin. Ukraine and Belarus in 2011 and 2012 even reversed flows through one of the two 17 Mt/yr Druzhba oil pipelines to allow shipments of Azeri oil to the Mozyr refinery. Export volumes via Druzhba were in a range of 1 mb/d in 2013.

Overall, crude volumes exported via Russia's western ports or pipelines are also structurally declining as more oil products are exported instead of crude oil, including processed NGLs. On a shorter-term basis, export fluctuations can be explained by Russia's strategy aimed to suppress the discount on the Urals (typically in a range of USD 1/bbl to USD 2/bbl), stemming from a higher sulphur content that requires more refining and targeting a price parity with the Brent. Export fluctuations are also explained by the variations in refinery margins in Russia – when these are high, crude exports tend to decrease slightly. In June 2013, for example, daily oil shipments to Primorsk were down to 953 000 bbl/d from about 1.4 mb/d during past years, and averaged 1.02 mb/d in 2013. In 2013, overall exports via Primorsk were down 21% as flows were redirected to Ust-Luga to ease the burden on the heavy-loaded Primorsk port. Exports via Ust-Luga at 464 000 bbl/d in June 2013 increased to 538 000 bbl/d in November 2013, and averaged about 460 000 bbl/d in 2013, also because it handled crude previously exported via Gdansk.[54] While combined loadings from Ust-Luga and Primorsk usually come up to about 1.9 mb/d out of a total capacity of 2.1 mb/d, fluctuations can be very large. Another factor can be that refineries are in maintenance in spring and autumn, leading to higher crude oil exports, or that refineries are building stock for the summer and the winter, leading to lower crude exports. Finally, producers sometimes also hold over their export allocations in expectation of a lower crude duty the following month.

Supplies through Druzhba are likely to remain at these 1 mb/d levels over the medium term. In July 2013, Rosneft signed an agreement with PKN Orlen for supplies of 8 Mt/yr (about 161 kb/d) until 2016 – 2.4 Mt/yr (about 49 kb/d) to the Czech Republic until 2016 (apparently involving some swap agreement with Lukoil over quotas on the ESPO pipeline). GazpromNeft has a 600 000 t quota for supplies to the Czech Republic.

Via Varandey

Lukoil has a unique position as it owns the Varendei terminal on the Barents Sea, which is supplied via its own pipeline that links up some of its fields in the Timan-Pechora province, including the Yuzhno-Khkylchuyuskoye field, and which allows exports from a

54. Bloomberg (2013), "Urals Exports Plunge as Russia Refiners Keep Oil: Energy Markets"- June 7; Interfax, Russian & CIS Oil and Gas Weekly, 7 November 2013.

fixed offshore ice-resistant offloading terminal. The terminal's capacity is 12 Mt yet it was used at a fourth of its capacity in 2012 due to lower output at fields. Yet new fields are being connected to that port, such as Trebs and Titov being developed by Bashneft-Polyus, a joint venture between Bashneft and Lukoil, and could increase exports in the near future. Lukoil is reportedly seeking a certification for the crude exported and will introduce a quality bank to stabilise the crude quality.[55]

ASSESSMENT

UPSTREAM

The government's 2013 upstream tax reform package, which comes in addition to similar measures already implemented for East Siberia, should help unlock the development of Russia's next generation of oil resources and reflects the government's commitment to maintaining oil production at current high levels over the long term. Yet the challenge is huge as the decline in current brownfield production is inevitable and will need to be both contained and offset by additional liquid production.

The government should carefully balance its approach as to which resources it decides to give tax advantages and the extent of these advantages, because among the different resources that can be developed to keep oil production at high levels, not all have the same economics, potential and costs. The most expensive output may not need to be prioritised.

The government should consider placing a priority on the deployment of EOR techniques at existing Western Siberian brownfields and consider fiscal incentives for this purpose. Russia has not pursued this approach. There are currently few incentives for brownfields, therefore EOR remains underutilised in Russia. More attention should be given to existing producing areas, which are likely to be the easiest and least expensive ways to maintain oil production levels in the long term, especially because infrastructure is already in place, and could produce significant production gains. This would also require the right conditions to be in place for small and medium-sized oil companies to access licence areas and fields and focus on enhancing recovery from small depleted fields, for example, which would otherwise be abandoned. It should also further support the commercialisation of NGLs in continuing to provide favourable tax conditions for the usage of these resources.

Once exploration drilling for tight oil resources has provided a better overview of the geological, technical and economic opportunities and challenges to developing these resources, the government should convene again with the industry to assess whether further tax adjustments are needed. Unlocking Russia's tight oil production potential in an environmentally and economically sound fashion is an important element in Russia's future oil production and export strategy, and should continue to receive attention. The government could also benefit from the option of moving to profit-based taxation for projects, which would occur if the MET and export tax were removed as current tax incentives might not be enough in some cases. This is the same for Arctic developments, which are a longer-term prospect but where unlimited export duty exemptions would already appear to be needed to ensure that projects are viable. A pilot project approach could enable this progressive evolution in this direction. In parallel, this move will need to be accompanied by strong improvements in corporate governance and management

55. www3.energyintel.com/WebUploads/gei-moscow/media-files/nc-story-24-10-three.html.

of public companies, which now represent the majority of Russian production, in order to provide for full transparency of costs, especially through transparent and fully competitive tenders. As changes are made, the Ministry of Finance needs to ensure that costs are not inflated and profits hidden.

There has been progress in moving reserve and resource calculations closer to international standards and in making these publicly available. More progress can be made, though, in financial reporting, general transparency and openness of tenders, alongside transparency of companies' ownership, transactions and reporting. The government would also need to ensure the development of a vibrant and competitive service industry in Russia capable of providing state-of-the-art drilling technologies at reasonable and competitive prices.

EXPORT MARKETS

The IEA commends the government and Russian oil companies for diversifying its export markets, which strengthens global energy security.

The government needs to encourage Transneft and Russia's key producers to continue dialogue and co-operation on planning for future oil exports to the Asia Pacific region. There need to be fair opportunities for all market participants if there is an interest in promoting the ESPO crude as a benchmark for the Asia Pacific region. This will require a diversity of sellers and greater transparency of flows and transactions. The government also needs to ensure that arbitrage between eastern- or western-bound oil export flows does not lead to shortages or price fluctuations which would strengthen speculation and could impact the oil supply security of some European countries.

DOWNSTREAM MARKETS

The IEA commends the government for raising fuel quality standards and supporting the modernisation of Russia's refineries. The government needs to ensure that the implementation of new fuel quality standards faces no further postponements and that companies fulfil their commitments to modernise their refineries and the production capacity of Euro-5 product standards in order to avoid further shortages. In addition, the government needs to increase fuel quality controls and raise controls of some mini-refineries or retail stations producing or selling counterfeit or adulterated products. Indeed, the move to high-quality products is likely to be accompanied by increasing counterfeiters of oil products and by increasing sales of cheaper and low-quality products. The government should also strengthen the transparency of the retail market in setting up a regional price information and monitoring system for all consumers, as well as in fostering the ability of the FAS to monitor price developments.

ENERGY STATISTICS

Russia's weight in fossil fuel resources, production and export give it a critical role in ensuring the adequacy and reliability of the global energy supply. Global energy markets are in a period of uncertainty, and market transparency is more than ever a priority. At a time of transformation in global oil markets, including steep growth of consumption in non-member economies of the Organisation for Economic Co-operation and Development (OECD) and changes to the global oil map, the importance of Russia is increasing. Russia should ensure timely submission of energy statistics based on OECD/IEA methodology, which are standardised with the prerequisites of other energy-collecting international organisations such as the United Nations, and pursue its timely and adequate contribution to IEA and Joint Oil Data Initiative statistics. In addition, Russia should consider clear data reporting on NGLs and condensate, which are often mixed up in statistics.

RECOMMENDATIONS

The government of the Russian Federation should:

- *Prioritise the deployment of EOR at brownfields and ensure that the right framework is in place to develop hard-to-recover oil resources. This will require a balance between maintaining consistency and predictability in the tax and regulatory regime and being flexible and adaptable to reflect the changing economic, technological and local geological realities.*
- *Continue to adjust taxation (MET and export duty tax) as necessary, yet in a predictable, uniform and consistent manner to encourage investment in new extraction techniques, particularly for hard-to-recover resources, so that economies of scale and efficiencies can be achieved. It should also ensure that in the long run varying taxation rates do not distort producers' economic choices; and make preparations for a progressive move towards a profit-based upstream taxation system.*
- *Continue to encourage foreign partnerships and investments and create a more favourable investment and regulatory environment for small and medium-sized companies operating in the upstream or service industry to foster competition, and the development of a dynamic service industry market upstream segment that can meet the specific needs of EOR, tight oil and other hard-to-recover resources.*
- *Continue to improve the quality of refined products and the competitiveness of the downstream and retail sectors, and ensure efficient monitoring and controls over quality and competition.*
- *Continue to contribute to enhanced market transparency and move expeditiously towards the introduction of statistics based on internationally agreed standards, methods and reporting mechanisms.*

7. COAL

Key data (2013 estimated)

Production of hard coal: 274 Mt, +80% since 2000

Production of lignite: 78 Mt, -11% since 2000

Imports: 30 Mt

Exports: 143 Mt

Share of coal (2012): 17.3% of TPES and 15.7% of electricity generation

Inland consumption (2012): power generation 62.4%, other transformations (17.4%), industry (16.9%), commercial and public services 2%, residential 1.2%

OVERVIEW

Russia is one of the world's largest coal resource holders and producers. Most of Russia's coal resources are largely concentrated in Siberia and the Far East regions, which is challenging for its commercialisation due to long transportation distances to reach domestic and foreign markets. This makes coal expensive to be transported to most destinations in the country and especially to foreign markets. Russia is the third-largest coal exporter in the world after Australia and Indonesia, and thus plays a significant role globally to ensure the security of supply. As mining is a labour-intensive industry and takes place in remote regions, coal production is also an important aspect of social and regional policy. Against this backdrop, coal could potentially play a leading role in Russia's energy mix, yet it faces competition from relatively cheaper and abundant gas, especially in Russia's European regions.

After the collapse and privatisation of the formerly state-owned industry during the 1990s, Russia's coal sector faced a series of challenging issues, i.e. the lack of modern mining equipment, the rationalisation of unprofitable mines, the lack of a skilled workforce and the exposure to global markets. The industry was able to address these challenges, and now coal is an important part of the Russian energy and electricity mix, providing around 16% of the electricity generation and 17% of the total primary energy supply (TPES).

In January 2012, the government approved the Long-term programme for the development of the Russian coal industry for the period to 2030, with the aim of modernising coal production and establishing a sound business environment for the coal industry. The strategy intends to increase production by up to 390 million tonnes (Mt), of which 170 Mt are for exports and the other 220 Mt are for domestic demand, following a projected increase in coal power generation.

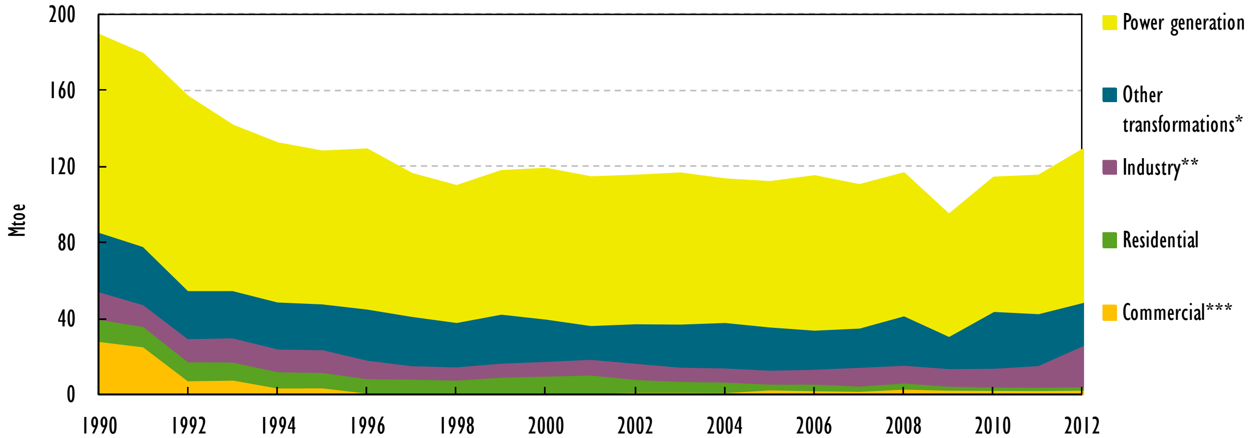
Future additional coal production is set to be in a range of 325 Mt and 430 Mt, mainly depending on the development of railroad tariffs and transportation costs. The government is currently adjusting the programme, but what is relevant about those numbers is how dependent coal production levels are on transportation tariffs. As a consequence, one of the government's strategic objectives is to develop new production locations in the Far East, which would ease logistical challenges and improve the competitiveness of Russian coal exports on Asian markets. Overall, achieving these objectives will depend on the evolution of gas prices in Russia, growth in the gross domestic product, growth in electricity demand and consumption in energy-intensive industries, the development of large hydro in East Siberia, environmental standards, the removal of transport and export bottlenecks, and demand levels in foreign markets.

SUPPLY

According to the German Federal Institute for Geosciences and Natural Resources,[1] Russia accounts for 160 billion tonnes (Bt) of coal reserves, making up more than 15% of global reserves and ranking third in the world only after the United States and the People's Republic of China. There are approximately 755 gigatonnes (Gt) of hard coal reserves (i.e. commercially usable deposits) around the world, with Russia holding 69 Gt or 9.1%. This places the country at fourth-highest behind the United States (29.8%), China (23.9%) and India (10.2%). The global reserves of lignite are estimated at 283 Gt, with Russia at the top, holding approximately 91 Gt (32%), followed by Australia (15.6%), Germany (14.3%) and the United States (10.8%). According to the Russian Ministry of Natural Resources, Russia's total coal reserves are even higher, at 194.7 Bt as of January 2013.

Coal, including hard coal and brown coal (lignite), contributed 129.6 million tonnes of oil equivalent (Mtoe) to the TPES in Russia in 2012. This accounts for 17.3% of TPES, a share which has fallen from 18.6% in 2002.

Figure 7.1 Coal supply by sector, 1990-2012



Notes: Data for 2012 are provisional. TPES by consuming sector.

* *Other transformation* includes coke ovens, blast furnaces and energy own use.

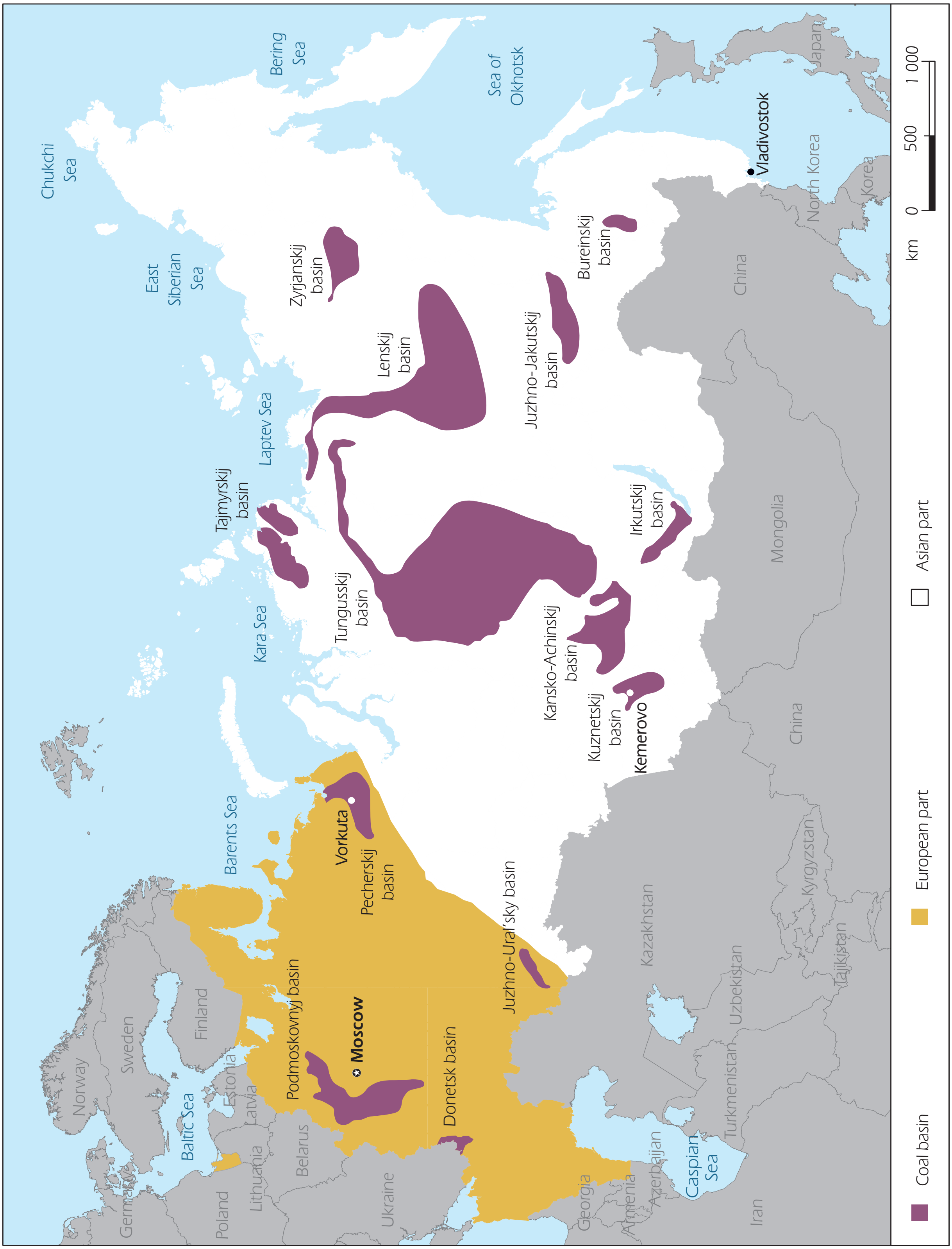
***Industry* includes non-energy use.

*** *Commercial* includes residential, commercial, public services, agriculture/forestry, fishing and other final consumption.

Source: IEA (2013), *Energy Balances of Non-OECD Countries*, OECD/IEA, Paris.

1. BGR (Federal Institute for Geosciences and Natural Resources) (2011), "DERA Rohstoffinformationen" in Energy Study 2012: Reserves, Resources and Availability of Energy Resources, Hannover, Germany.

Figure 7.2 Coal basins in Russia



This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

Note: km = kilometre.

Source: IEA.

Russia ranked as the sixth-highest hard coal producer in the world behind China, the United States, India, Indonesia and Australia in 2012. It produced 272.7 Mt of hard coal in 2012. Russia ranked second-largest with regards to lignite production, amounting to 77.8 Mt in 2012, behind Germany. The production of hard coal has increased by 81% since 2000, while the production of lignite has decreased by 11%. Figure 7.1 shows the evolution of coal supply by sector since 1990, with the big decline following the fall of the Soviet Union.

In 2012, run-of-mine coal production was 354.9 Mt. Of that, 156 Mt was washed,[2] and 319 Mt was sold: 185 Mt in the domestic market and 134 Mt in exports (116 Mt of steam coal and 18 Mt of coking coal). In addition, 30 Mt were imported, mainly from Kazakhstan, so domestic coal supply was 209 Mt. Of the production, 71%, or 251 Mt, was from open-pit mining and the balance was from underground operations.

The geographical distribution is shown in Table 7.1 and regions holding the main reserves are highlighted in Figure 7.2.

Table 7.1 Coal production in the main regions (2013)

Federal District	Region	Production (Mt)
Siberia	Kemerovo	203
Siberia	Krasnoyarsky	38
Siberia	Zabaykalsky Krai	21
Siberia	Republic of Khakasia	14
Siberia	Irkutsk	13
Siberia	Novosibirsk	5
Northwest	Republic of Komi	14
Far East	Republic of Sakha	13
Far East	Primorsky	8
Far East	Khabarovsk	5
Far East	Sakhalin	4

Source: Ministry of Energy of the Russian Federation.

In 2012, anthracite production was 14 Mt and steam bituminous coal was 187 Mt. Coking coal production was 76 Mt and lignite production was 78 Mt.

Currently, 11 large companies account for roughly 70% of production. The main producers are the Siberian Coal Energy Company (97.5 Mt in 2012) and Kuzbassrazrezugol (45 Mt), producing mostly steam coal and focusing mainly on exports. Coking coal is controlled by vertically integrated metallurgical holdings producing 90% of the total, with the main groups being Evraz, Severstal and Mechel.

2. Washing refers to coal processing, both in wet and dry ways.

CONSUMPTION

As in most countries in the world, coal is mainly used for electricity production and accounts for 28.3% of fossil fuel consumption. In 2012, the consumption of steam coal in the domestic market was 172 Mt. Volumes of steam coal in domestic markets decreased in recent years. There is a slightly increasing trend of coal consumption for power generation to 108 Mt, mainly due to a small growth in power generation in Siberia because of lower hydro generation. According to the government, there are 184 thermal coal power plants, accounting for 60.91 gigawatts (GW), many of them co-generation.[3] The district heating and communal sectors accounted for 24 Mt in 2012, on a declining trend. Total coal supplies to the power generation segment amounted to 99.9 Mt in 2012.

In 2012, Russia was the fifth-largest steel producer in the world, after China, Japan, the United States and India. The steel industry is the main consumer of coking coal by far.

Most cement plants are gas-fuelled, with only five plants located in Siberia and the Far East reporting coal consumption (out of 50 cement plants).

Coal consumption levels are largely determined by competition with gas, and hence, closely linked to the evolution of gas price levels. In the 2000s, prospects for the Russian domestic coal market were buoyant, due to expected growth in natural gas prices (see Chapter "Natural Gas") which were to reach export parity netback levels. This would have increased the competitiveness of coal in the domestic market, and changed the fuel balance of the power supply in the European part of Russia and the Urals, even leading to the construction of new coal-fired power plant capacities, ultimately leading to higher coal consumption for power generation. However, the increases of regulated gas prices have been lower than initially envisaged, due partly to increasing volumes of gas supplied to power generation companies by independent producers below the level of regulated prices, so that the prospects for coal in power generation became more bearish.

Looking ahead, the future consumption in the domestic market will be determined by the following factors:

- The utilisation level of coal power plants in all regions, primarily in Siberia. This will depend on the realisation of the project capacity of the Boguchanskaya and Sayano-Shushenskaya hydropower plants, as well as on if projects to build new aluminium plants will be realised.
- The level of regulated wholesale gas prices will be pivotal for the evolution of coal demand for power generation in the European part of Russia and in the Ural region.
- The success in modernising and constructing new coal power units under the power delivery contract mechanism.[4] The commissioning of this new capacity is planned in the period 2013-16. New coal units are expected to contribute 2 736 megawatts (MW), with an additional 1 000 MW expected as the result of plant modernisation.
- The extent to which, in certain areas, there could be a transition of cement plants from gas to coal and construction of new cement plants powered on coal.

The main volume of steam coal in the domestic market is sold under annual contracts with a fixed price, although the share of deliveries under contracts for more than a year,

3. Co-generation refers to the combined production of heat and power.

4. See "Electricity" chapter.

i.e. three to five years, gradually increases. The prices in such contracts are fixed initially or indexed according to the inflation rate. Coking coal is largely sold under contracts lasting from about six months to one year. Spot deliveries are used scarcely, to cover short needs.

Pricing in the domestic market for coal varies for the different types of coal and by the type of contract. Steam and coking coal prices are close to the export netback levels. As domestic steam coal usually has a low calorific value, it is sold at a price discount. Lignite prices are usually unrelated to international prices, based on negotiations between consumers and providers. High-grade coal is a market niche, priced depending on its quality and use.

Whereas the evolution of the market shows very positive signs, such as the absence of government intervention, especially on price formation, it is still far from a competitive, transparent, liquid market. By Amendment of the Decree of the government of the Russian Federation No. 167 of 10 February 2011), in order to increase transparency, all contracts involving more than 1 Mt are due to be reported at one of the commodity exchanges.

EXPORTS

More than a third of Russia's coal production is exported (143 Mt in 2013), 70% of it to the Atlantic market. Russia for example is the European Union's largest external coal supply source. The government envisages a growth in coal exports over the period to 2030, in particular to Asia, so that by 2030, total exports could amount to 170 Mt, equally transported to the Asia Pacific and Atlantic markets. Projections from the International Energy Agency (IEA) are more cautious, envisaging a growth in exports by 2020, but afterwards a peak and decline to levels lower than 2011 by 2035.[5]

While most of Russian coal is consumed domestically, the bigger potential for the sector's growth comes from exports. Despite the intense debate on climate change and the different policies worldwide to tackle it, the fact is that, during the last decade, coal provided almost as much additional primary energy to the world as the rest of the fuels – fossil, nuclear and renewable – combined. And whereas most of the growth was concentrated on China and India, the rest of the world is not decreasing its coal use.

Given the existence of a few countries with large reserves and competitive costs, an increasing part of the demand growth is met by importing coal and as a result, international trade is growing at a higher rate than demand. In 2012, seaborne trade of thermal coal increased for the 19th year in a row, marking a record, especially since this period includes the 2008 recession and the Asian technological crisis. In Europe, with the Emissions Trading Scheme in place and the recession installed for months, coal imports never reached the 2005 level. Table 7.2 shows the evolution of imports in the main countries.

Looking at the medium term, the IEA projections show that this trend is not likely to stop, although with a few aspects to be mentioned. Chinese import levels are highly dependent on domestic and international price levels. Japan, Korea and Chinese Taipei, without domestic resources (Korea produces small volumes) are fully dependent on imports. As a consequence of lower nuclear power generation in both Korea and Japan, imports will be strong in the area, especially in Korea where new coal-fired plants will come on line. India, with elasticity somewhere in between, will absorb imports from South Africa, Australia and Indonesia, but importing Russian coal is not attractive given

5. This is the Central Scenario of the *World Energy Outlook 2013*, which assumes that new climate change policies will be enforced in order to keep temperature increase below 4 degrees Celsius (°C).

its geographical position. In addition to the mentioned countries, other countries in the Association of Southeast Asian Nations (ASEAN) are expected to increase coal consumption. In Europe, despite the favourable coal to gas price, the sluggish economic perspectives, renewables additions and retirements obliged by the Large Combustion Plant Directive will more than offset the significant new coal-fired capacities coming on line in Germany and the Netherlands. Declining domestic production in Germany, Spain and the United Kingdom will mitigate the fall in imports, but at the end of the day, the net result is an important shift of the coal trade to the Pacific basin.

Table 7.2 Comparison of coal imports in the main importing countries, 2007 and 2012

Country	Imports in 2007 (Mt)	Imports in 2012 (Mt)
China	51	289
Japan	187	184
India	50	160
Republic of Korea	88	126
Chinese Taipei	65	65
Total	**441**	**824**

Note: Numbers in the table represent an impressive 13.3% annual rate growth on average.

Source: IEA (2013), *Medium-Term Coal Market Report*, OECD/IEA, Paris.

Looking at the long term, the IEA projections show that given characteristics of population and economy in China, coal imports will peak soon after 2020, although India and other ASEAN countries will take over with continued strong import growth.

On the supply side, competition is very limited. Six countries account for all the thermal seaborne coal exports: Indonesia, Australia, Russia, the United States, Colombia and South Africa. When adding Canada, the same is true for metallurgical coal. And when including Kazakhstan (thermal) and Mongolia (metallurgical), the same is true for seaborne and inland coal exports. The main new developments are located in the same countries, with the exception of Mozambique. Despite recent problems, Mozambique holds vast competitive coal resources that will be available for exports someday. Liquidity of financial coal markets is increasing and more hedging instruments are available to protect against volatility, covering more geographical areas and a variety of coal types and qualities. Russian coal is highly competitive when mining costs are considered, but given distance to ports, transportation costs are pivotal. Due to the lack of hedging for rail, it is not only about cost, but also about flexibility. The next section is devoted to these matters.

Imports to Russia are however a different story, completely isolated from export dynamics. Russian coal imports come from Kazakhstan, which goes back to the Soviet times, as a series of power plants is located near the border with designs suitable for coal from Kazakhstan. Remarkably, coal from Kazakhstan to Russia represents the largest inland coal exports in the world.

CHALLENGES OF THE RUSSIAN COAL INDUSTRY

Competitiveness, safety and transportation

As the privatisation process was completed in the early 2000s, the days of a state-planned unprofitable industry are long gone and the Russian coal industry has generally become efficient and competitive, working without state subsidies. Recent developments of the Russian coal industry have even surpassed expectations. Capacity expansions in the last five years are in the order of 80 Mt, while coal processing capacity increased by 40 Mt. The Kuznetsk Basin led those developments. Nevertheless, there are some challenges the coal industry must overcome in the coming years.

In a country where cheap gas is largely available, coal demand will suffer the push of gas, which will be more important in European Russia and, given that the wholesale gas tariffs are regulated, will depend on political decisions. The Russian coal industry is facing an important shortage of skilled workers. The average depth of mines is increasing (from 380 metres [m] in 2000 to 425 m in 2010). This increases operating costs and also leads to higher investments. Looking at exporting markets, the bottlenecks in the railway infrastructure, especially in the direction of the Far East, are a curtailing element for coal development.

Despite the improvement in washing capacity, which translated to 30% more coal washed in 2012 compared with 2007, the quality of Russian coal is still far from international standards, in particular, domestically consumed coal. According to the information received, in 2010 the average calorific value of coal consumed in power generation was under 4 800 kilocalories per kilogramme, largely due to its high ash content. This creates environmental problems, together with the reclamation of areas affected by coal mining, disposal of wastes, methane releases and other issues related to the coal use, primarily in power plants: emissions, ash disposal, etc.

Safety is an issue in most of the coal-producing countries around the world, especially in those with a significant share of underground production. Russia is not an exception, with 0.15 fatal accidents per million tonnes in 2012, compared with 0.48 in 2010. However, to be noted are the existence of outdated technical regulations on mining still in force, scarce investment in infrastructure in some mines and frequent shortage of modern mining equipment sometimes due to restrictions on imports. Low productivity, 1 880 tonnes per man per year, is partly the result of these problems, and is also linked to both economic and safety issues.

A very specific Russian issue is the lack of skilled workforce, especially in uninhabited areas where coal production is expected to be developed. This shortcoming is likely to gain importance as production shares of Eastern Siberia and South Yakutia are projected to increase in the future.

Regarding fiscal issues, today Russian coal producers pay mineral extraction rates of around USD 0.7 per tonne (USD/t) for thermal coal and USD 1.6/t for coking coal, although there are adjustments for specific mines. In accordance with a new decree adopted in December 2013, deposits located in the Far East and East Siberia will receive preferential tax rates. After a three-year exemption from when operation starts, the rate will gradually increase between the fourth and tenth years until it is equal to the tax rate in the rest of the country. The exploitation of deposits in the Far East and East Siberia are investment-intensive, because of the lack of infrastructure and harsh conditions. This tax system is positive in principle for development of those areas. However, the amount involved is not significant and exemption will be granted only for newly established entities, and therefore, its effect is expected to be moderate.

Competitiveness: Inland transportation

Given the distance from production centres to consumption centres and ports, an efficient rail network is essential, especially because the potential for growth comes from exports. About 300 Mt of coal were transported via rail in 2013, representing just under 25% of total freight. Frequent bottlenecks, aged wagons and lack of clear framework for development of new infrastructure are the main challenges associated with infrastructure. Bottlenecks and undeveloped infrastructure can curtail growth of coal exports destined for the Asia Pacific region.

Synchronisation of rail and port development is key, but difficult, as most of the ports are privately developed whereas rail is a monopoly held by Russian Railways. Moreover, the possibility of increasing port capacity is limited.

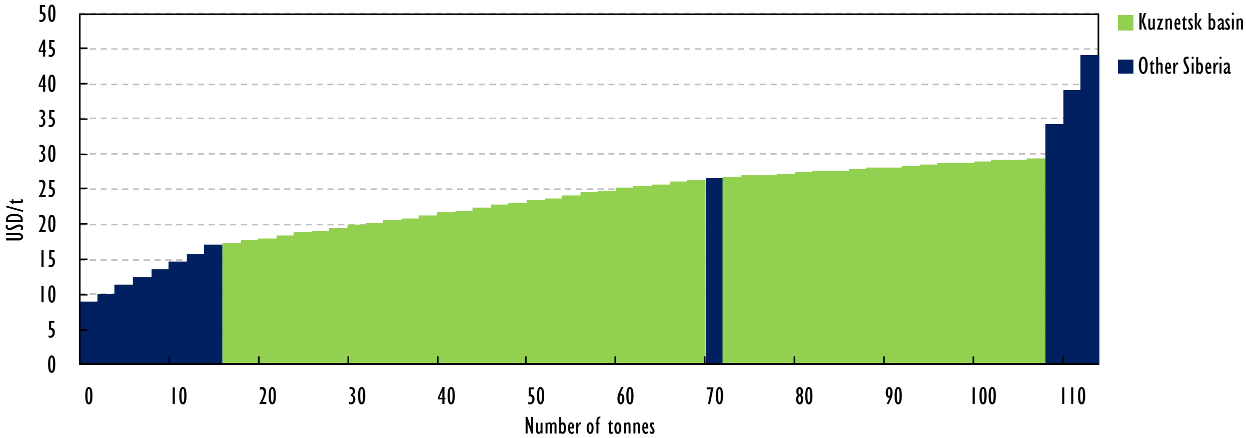
Whereas Russian coal is relatively low-cost when compared with mining costs at international levels (despite the fact that there is an increase in costs seen in past years due to higher electricity costs, material and fuel costs, and wage increases above the level of productivity gains), coal-producing areas are generally far from consumption centres and especially from exporting ports. In accordance with the information collected, in 2012, only 142 Mt, or 40% of domestic coal, travelled less than 500 km, with 115 Mt travelling more than 4 000 km, of which 14 Mt travelled more than 6 000 km. This does make sense as Kemerovo is 4 411 km from Novorossiysk, 4 732 km from Murmansk and 5 306 km from Vanino. The average distance for the domestic market was 850 km and 4 400 km for exported coal. Therefore, inland transportation expenses remain a key factor influencing competitiveness and profitability of Russian coal.

As capital investments for coal production are lower than those needed for oil or gas production, the short-term marginal costs, or free-on-board (FOB) cash costs, are influential in determining the competitiveness of coal. The breakdown of FOB cash costs is different from country to country and even from mine to mine. Moreover, this breakdown is very volatile, and so are its different components. The main components of FOB cash costs are generally the mining cash costs and the inland transportation costs, with other significant costs being those for processing, overhead, royalties and others. Mining cost breakdowns are different for different techniques. Although the exact breakdown depends on the particular mine and producer, in general, open-pit mining, dominant in Russia (70% of production), is more intensive in diesel, tyres or explosives. Underground mining, accounting for 30% of Russian production, is more labour-, electricity- and steel-intensive.

The Figure 7.3 displays the mining cash cost curve of Russian exported thermal coal and shows the high competitiveness of mining costs, with most coal below the USD 30/t level and a great proportion below USD 20/t.

Therefore, it becomes obvious that in Russia, due to the low mining costs and the long distances between producers and consumers or ports, inland transportation costs are a key issue for coal competitiveness. Actually, rail costs can be one-third of FOB cash costs for domestic coal and well above half of the FOB cash costs for exported thermal coal. In the case of coking coal, involving higher mining costs, the percentage is lower, but still important, as transportation costs can be around 25% to 30% of FOB cash costs.

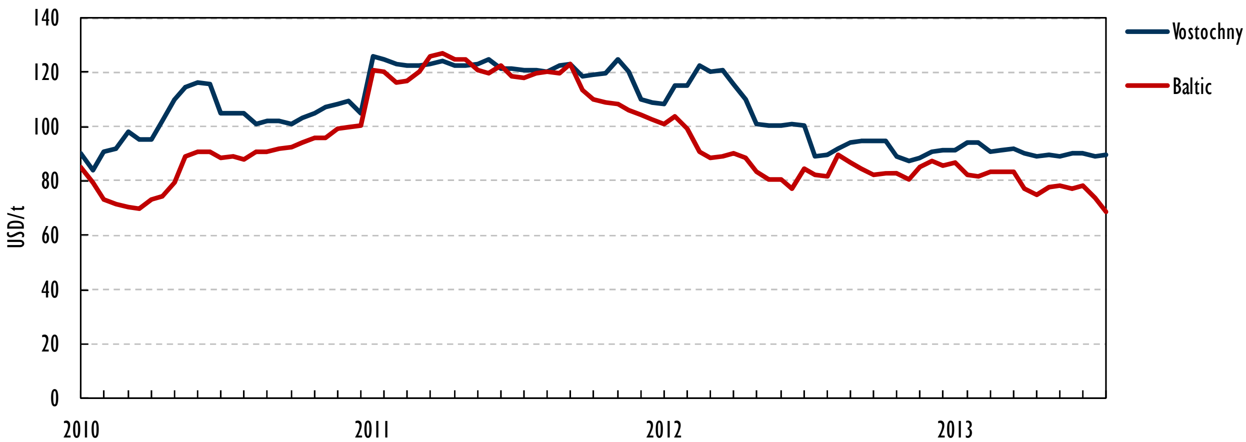
Figure 7.3 Mining cash cost curve of thermal exported coal in Russia



Source: IEA analysis from Wood Mackenzie data.

Figure 7.4 displays recent FOB price developments in Baltic and Far East ports. It supports the view that at 2011 price levels, coal exports from Russia were profitable even with high transportation costs in the range outlined above. However, margins have been squeezed dramatically in the last year and now some producers are at the edge of profitability.

Figure 7.4 FOB prices of thermal coal from Vostochny and Baltic ports, 2010-May 2013



Source: McCloskey (2013), *McCloskey Coal Reports 2010-2013*, McCloskey's, London, http://cr.mccloskeycoal.com.

In general, the costs to transport goods by rail in Russia are obtained after a complex and multi-component process. The total cost depends on many factors, including the direction of transportation, the distance, different tariff discounts, the ownership of the trains, the volume of transportation and the goods being transported. Therefore, any simplification is risky. But in general terms, the tariff set by the Federal Tariff Service (FTS) charges for rail infrastructure utilisation and locomotives services. This is a monopoly run by Russian Railways and a payment for the train wagon use, which is a competitive market in which Russian Railways also participates.

The FTS is the federal executive body responsible for setting a series of tariffs, in particular, rates for freight rail transportation. The tariffs were developed on the basis of the average network costs with some margin for profitability pursuant to a resolution of the Federal

Energy Commission of Russia of 17 June 2003 No. 47-t/5, "Tariffs for freight traffic and infrastructure services performed by Russian Railways (Price list No. 10-01)", which sets base levels. Those levels are updated in accordance with indices considering feasible costs and standard profits (approved by the FTS).

Coal transportation tariffs are differentiated by a wagon train component and the infrastructure and locomotive component, which includes electricity, or diesel when applicable, as most transportation is electrified.

Different tariffs are assigned to first-, second- and third-class freights. Classes are defined considering the weight of transport costs in the final price of the goods. First class refers to transport costs higher than 15% of the final price. Second class refers to transport costs between 15% and 8% of the final price and third class refers to costs lower than 8%. The balance among the three tariffs needs to provide the necessary returns to Russian Railways. Another particularity is that whereas coal tariffs are set by half-sided train (approximately 70 tonnes), oil is charged on a "per tonne" basis. Coal is a first-class freight so it enjoys relatively lower prices than other products. Oil for example is in class three and fertilisers are in class two.

In December 2013, the FTS decided on the indexation of railway tariffs for five years, and set the infrastructure component in the tariff at 0%, versus 4.1% to 4.9% annual growth in previous years.

Although the Russian railroad network is one of the world's largest, development of the coal industry is constrained by bottlenecks throughout the rail system. The estimated length of bottlenecks in the main network is more than 8 100 km out of around 125 000 km of main tracks. In accordance with the long-term programme for the development of the Russian coal industry for the period to 2030, the volumes of coal exported will double, with increases planned in all directions, especially to the Far East, in accordance with projections that forecast a shift to the Asia Pacific region. Therefore, the rail network needs huge investments for both reducing bottlenecks and developing new capacity, especially toward the east.

Russian Railways, established during the structural reform of the rail system, is responsible for rail infrastructure and network traffic. Among its ambitious targets are the integration of the national systems of Russia, Belarus and Kazakhstan, improvement of the tariff system and rail track development. The main projects include the following: The Baikal-Amur Mainline development project intends to increase capacity on this challenging line, which complements the Trans-Siberian line through seven mountain ranges, across 11 rivers and winter temperatures of -60°C; A new 400 km line to link the Trans-Siberian line to the coking coal deposits in Tyva, where four companies – Severstal, Evraz, En + Group and Russian Copper – have plans to produce coking coal to mainly serve Asian markets. There are also plans to increase capacity in the Khakassia Republic region (Mezhdurechensk-to-Taishet direction). In addition, rail capacity from Kuzbass to Ural-Baltic ports and the Barents and Black Seas is targeted for expansion.

Nonetheless, the capacity of the transportation infrastructure to the Far Eastern ports remains a major uncertainty that could limit the exports of coal, in particular at the exit of the Kuzbass region, along the Trans-Siberian in the Irkoutsk and Zabaikal regions, and near ports.

Capacity at the Vania and Primorya ports in the Far East has been expanded and is already 10% to 15% above actual volumes. Further expansion plans are being developed so that port export capacity should not be an obstacle to higher coal exports in the future. In January 2014, a pilot project consisting of auditing Russian Railways' investment programme in the Far East was conducted. Recommendations were made to modify the investment programme to meet the needs of expanding coal production and exports to the Asian markets.

CURRENT COAL POLICY DEVELOPMENTS

The long-term programme of the Russian coal industry up to 2030

On 24 January 2012, the government approved the Long-term programme for the development of the Russian coal industry for the period to 2030, developed by the Ministry of Energy of Russia.[6] The objective of this programme is to stimulate the development of the Russian coal industry, with three main strategic goals: meet energy demand in an efficient way, ensure competitiveness of coal production, and improve performance of coal mining companies in operational safety and environmental impact. The programme identifies the main challenges the coal sector is facing and proposes a strategy in order to develop the coal industry, which includes: establishing new centres for coal mining and deep processing; modernisation of existing companies; development of transport infrastructure; establishing coal, power and chemical clusters; improving underground mining safety; and completing coal industry restructuring and resettlement of miners.

The budget for the strategy is RUB 3.7 trillion (about USD 111 billion), of which public funds are foreseen to cover RUB 250.7 billion (about USD 7.6 billion), or 9% of the needs. The strategy, therefore, relies on private initiative and public-private partnership to finance it. However, it is not clear how the current business environment and regulatory framework is going to attract such huge capital.

The programme hopes to create a competitive, transparent, liquid market. In order to do so, it seeks to improve standardisation of coal and communication technology, and by monitoring transactions, to increase transparency. It forecasts exports increasing up to 220 Mt, and this will require significant port expansions.

According to the programme, in order to reach the 220 Mt per year of exports, trans-shipment is projected to increase from 11 Mt in 2010 up to 22 Mt in 2030 through the northern ports; from 13.5 Mt up to 21 Mt through western ports; from 7 Mt up to 20 Mt through southern ports; and from 31 Mt to 77 Mt in 2030 through the Far Western ports. This is a clear challenge for the rail infrastructure, currently plagued with bottlenecks. The programme identifies the main needs of the rail network to both end the current bottlenecks and satisfy the new demand: the Baikal-Amur line, rail to the Elegestsky deposit, an increased transportation capacity from Kuzbass to the main ports and development in the Mezhdurechensk-Taishet direction. Again, it is not clear how the huge investments needed for rail developments will be attracted, without a clear and predictable framework for either private or private-public initiatives.

Regarding human resources, the programme establishes its main priorities on improvement in labour relations, improvement of vocational training, implementation of the concept of continuing education, corporate social responsibility of the companies and greater engineering support in coal production, increasing the share of technical engineering personnel from 17% to 30%.

The programme intends to develop service and ancillary companies to support coal companies in those areas in which very specialised personnel are required, i.e. integrated research or degasification of coal mines.

The programme intends to create clusters for high added-value products, coal-to-liquids, coal-to-ethanol and coal-to-chemicals. Whereas those projects are very attractive for low-

6. www.rosugol.ru/upload/pdf/dpup_2030.pdf.

cost, far coal deposits, like Russian coal, they are also capital-intensive and environmentally complex, especially regarding carbon dioxide (CO_2) emissions. It is not clear how these issues will be addressed.

The Presidential commission for strategic development of the fuel and energy sector and environmental safety, in its meeting of 26 August 2013, tasked federal executive authorities with updating the provisions of the Long-term programme of activities and development of the coal industry in Russia for the period up to 2030 with amendments taking into account current trends in domestic and foreign coal markets and the need to synchronise with the general scheme of developments of power plants until 2020, the draft Transport Strategy of Russia for the period up to 2030, the strategy on the development of seaport infrastructure of Russia until 2030, and other programme documents. Currently, work on updating the Long-term programme of activities and development of the coal industry in Russia for the period up to 2030 is in its final stage.

Clean coal technologies

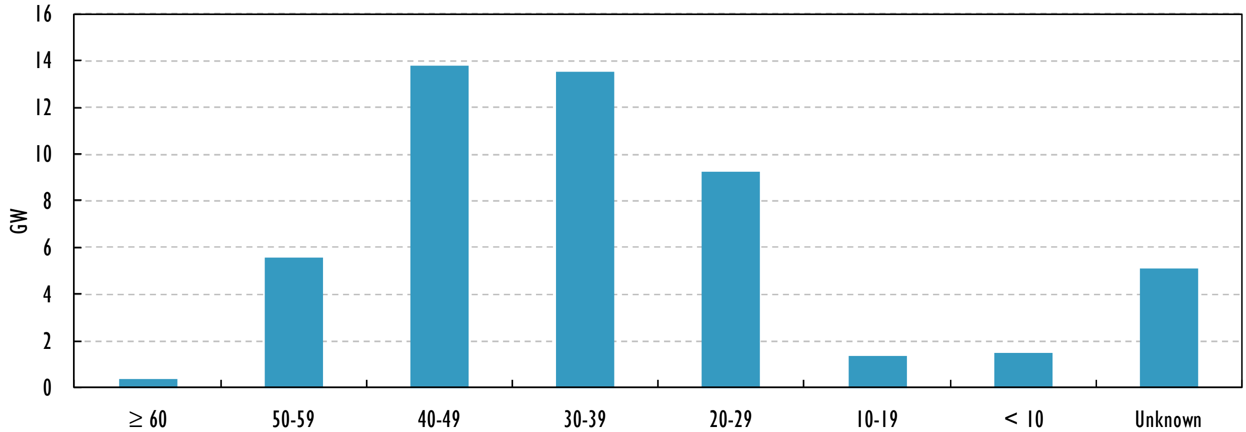
The need to use cleaner technology extends throughout the whole chain, from the mine until the final use. In previous sections of this chapter, some environmental challenges facing the Russian coal industry were mentioned, i.e. those related to the environmental impact of mining and proper reclamation of land affected by the operations and those related to lack of washing. Ash is hardly used, and coal mine methane is scarcely developed, wasting a profitable resource while releasing greenhouse gases to the atmosphere.

Regarding coal use, there are proposals by which the list of parameters of rationing and threshold values of harmful emissions would meet European standards. Despite these positive trends, Russian coal-fired power plants are generally old and inefficient, consuming mostly unwashed coal. These ageing coal-fired power plants would need to be modernised to improve their efficiency and environmental performance. However, the competition from cheaper gas makes investments in non-mine-mouth coal plants generally uneconomical in European Russia. It is not clear how the investments needed to improve the environmental performance of the generation fleet are to be mobilised. Supercritical (SC) and ultra-supercritical (USC) plants are more capital-intensive than subcritical plants (around 20% higher for SC, and 30% higher for USC). Therefore, financing is a key issue, which is closely related to risks perceived by investors. The higher capital is recovered through lower fuel costs and lower CO_2 emissions. In the absence of a significant CO_2 price, economics of SC and USC plants are more difficult. Moreover, even if economics work, other factors curtailing development of SC/USC technology are related to fuel quality and price (savings in fuel are higher with a higher price, but domestic coal can be high ash or moisture), domestic technical and engineering capacity to construct and operate SC/USC plants, and the size (SC/USC efficient plants require a minimum capacity).

A new environmental law is being prepared and it could have an impact on the usage of new clean coal technologies. Planned changes concern regulation of the amount of emissions and the release of polluting substances to the environment, and new payments for standard and excess releases and emissions. Also, the concept of best available technologies is expected to be included. Producers will have the right not to pay the raised penalties in case of application of these technologies.

There are no special decisions concerning support for carbon capture and storage. More information on this can be found in Chapter 4.

Figure 7.5 Age of coal-fired plants, by capacity (GW)



Source: IEA (2011), *World Energy Outlook 2011*, OECD/IEA, Paris.

ASSESSMENT

Russia is endowed with vast coal resources and is currently the third-largest coal exporter in the world. Russian coal plays an important role for energy security and supply diversification both domestically and also globally. Following privatisation, the Russian coal industry has developed at a rapid pace, including the emergence of private companies as well as few vertically integrated steel companies producing coking coal to mainly meet their needs. Nevertheless, a range of small producers face serious profitability problems.

In regard to the competitiveness of Russian coal on global markets, Russian coal is relatively low-cost when referring to mining costs. However, the Russian coal export industry has to cope with high transportation distances and costs as coal mines are far from both domestic and international markets. Recently, the oversupply in the thermal coal markets is driving international coal prices to very low levels, and thus challenging the profitability of most of the Russian exported thermal coal. Developing new coal production locations in East Siberia could help bring production centres closer to export markets.

Due to the remote location of the largest deposits, efficient transport infrastructure, i.e. rail, is pivotal for a competitive coal industry. Currently, bottlenecks are numerous and there is also a shortage of locomotives. Main-line railroads are a state monopoly in Russia (Russian Railways). Some companies have developed private lines to connect with the state network, but as of today there is no transparent procedure for rail development by private operators and cost-sharing methodology. Whereas train prices are negotiated in the free market, rail tariffs are fixed by the FTS.

The development of the domestic coal market is challenged by factors including the abundant availability of relatively cheaper gas for power generation, except for mines close to the power plants, and of course where no gas transmission infrastructure is available; a shortage of skilled personnel; and some aspects of technical and labour regulation.

Despite progress, the coal mining industry still has considerable room to improve work safety, coal quality and environmental performance as well as increase productivity. Russian coal-fired power plants are generally old and inefficient, and consume mostly unwashed coal. Due to the ready availability of cost-efficient gas, the economics of investment into new coal capacities in European Russia is questionable – although ageing coal-fired power plants would need to be modernised to improve environmental performance and improve their efficiency. There is a need to maintain a technology-neutral competition between conventional power generation technologies while implementing policies to improve the efficiency and environmental performance of the generation fleet.

The Long-term programme for the development of the Russian coal industry for the period to 2030 identifies the main issues and proposes an ambitious strategy for a safe, clean and highly productive coal sector, which the IEA welcomes. Whereas the actions of the strategy are generally well-oriented and the main problems properly identified, it is uncertain where the funds required to develop the strategy will come from and whether key goals will ultimately be met. The public budget covers only about 9% of the needs and it is not clear how private money will be attracted. The IEA supports an approach further encouraging well-functioning free and transparent markets, including free access to imported best technologies and regulatory framework obliging companies to internalise social and environmental externalities, i.e. those related to minimisation of environmental impact, proper waste management, reclamation of the affected land and provision of funds for workers after liquidation. Only a small fraction of coal mine methane is utilised, which is undesirable from an environmental perspective. Measures to encourage coal mine methane utilisation need to be incentivised to make this economically viable.

Whereas coal mining issues can be dealt with in an independent manner from the rest of the energy sectors, transportation issues are closely related to rails, and downstream coal usage is dominated by power generation and thus the challenges identified are linked to other chapters of this review, i.e. on gas, electricity, energy efficiency and climate change issues.

RECOMMENDATIONS

The government of the Russian Federation should:

- ☐ *Ensure implementation and monitoring of policies to encourage a safe, clean and highly efficient coal mining industry in a full and timely manner. In particular, give priority to the adoption of global best practices; reform technical regulations based on international standards; and ensure that the companies adhere to environmental and social obligations.*
- ☐ *Support the strategy aimed at shifting production to areas closer to export markets in order to maintain the competitiveness of Russian coal on international markets by reducing transportation costs.*
- ☐ *Set a transparent and predictable framework to allow private investments and public-private partnership in the rail transportation sector in co-ordination with expansions to be developed by Russian Railways to support the strategy to increase coal exports from mines in the Far East to Asian markets.*
- ☐ *Produce a transparent methodology to set rail tariffs, which might include flexible provisions defining diesel/electricity and track components, and foster competition for rail freight transportation.*
- ☐ *Consistent with the electricity sector reform, adopt a technology-neutral, competitive framework that provides incentives for the renewal of the ageing coal power plant fleet through efficient new generation capacities. Adopt policy measures to improve the environmental performance of existing coal-fired plants.*

8. ELECTRICITY

Key data (2012)

Installed capacity: 223 GW, +3.8% since 2002

Peak demand: 157 GW

Total electricity generation: 1 069.3 TWh, +20.2% since 2002

Electricity generation mix: natural gas 49.1%, nuclear 16.6%, coal 15.7%, hydro 15.5%, oil 2.6%, biofuels and waste 0.3%

OVERVIEW

The electricity sector has been the backbone of Russia's economic and industrial development. After a decade of efforts made to reform and liberalise the Russian electricity sector with the unbundling of electricity networks and generation, the privatisation of generation assets, and the creation of the wholesale energy and capacity market, the reform process reached a crucial point in 2013. Discussions are ongoing over the future direction of the electricity market reforms, and the government is currently focusing on reforms of the heat sector in order to stimulate modernisation of combined heat and power (CHP) plants. Other policy efforts focus on phasing out cross-subsidisation, and improving the efficiency of electricity grid investment as well as the payment discipline of consumers.

A well-functioning Russian electricity market can ensure competitive and affordable energy supplies, in particular to Russia's large energy-intensive industrial sector and households. Thanks to the past reforms, Russia has attracted investment in generation capacity, including foreign investment. Looking ahead, the Russian electricity market will need to drive the modernisation of Russia's large fleet of CHP plants, which were built 50 to 70 years ago. The electricity sector is expected to require USD 355 billion to USD 554 billion for generation and between USD 217 billion and USD 334 billion in networks by 2030.[1]

Russia has yet to determine a roadmap for the completion of the electricity wholesale and retail market reforms up to 2015, which remains a major challenge given the expected outlook for flat electricity demand growth of around 2%, changing the market fundamentals of the past. The freezing of regulated gas and heat prices and power network tariffs which was decided for fall 2013, 2014 and 2015 undermines investors' confidence. The reform process should not lose momentum at a time when further liberalisation and competition in the wholesale and retail markets are a key prerequisite to unlocking investments for the modernisation. To successfully complete this process, Russia will need to consolidate the electricity market reforms. This includes the completion of the regulatory and institutional governance as well as the retail market reform and the creation of a fully competitive wholesale energy and capacity market. The success of

1. Energy Strategy of Russia for the Period up to 2030, Decree No. 1715-r of the government of the Russian Federation, 13 November 2009. The English version is available at: www.energystrategy.ru/projects/docs/ES-2030_(Eng).pdf.

these reforms will be measured by liberalised electricity markets delivering adequate and timely investment by 2030, alongside competitive and secure supplies.

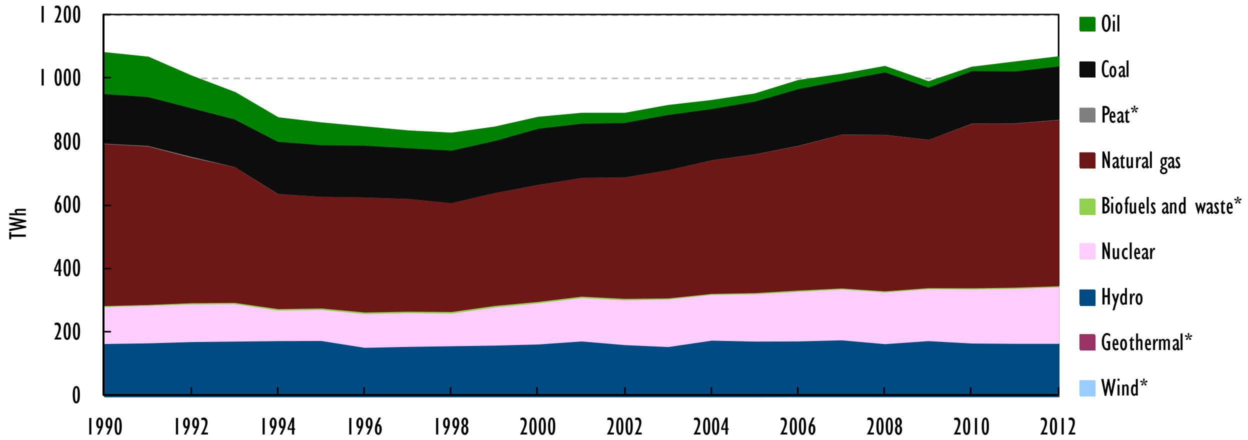
SUPPLY AND DEMAND

ELECTRICITY GENERATION

The Russian national energy system consists of 69 regional energy systems that are brought together into seven interconnected power systems (IPSs): Northwest, Centre, Middle Volga, Urals, South, Siberia, East (which itself consists of four power systems in the Far East). Six out of seven systems are run in synchronous mode at a frequency of 50 hertz, while the East IPS forms a separate synchronous zone that is connected to the Siberia zone via a back-to-back reversible station (200 megawatts [MW]) which is now in test operation.

Total electricity generation in Russia was 1 069.3 terawatt hours (TWh) in 2012. This is the highest level since 1991. Electricity production has been increasing since the late 1990s, with a slight decline during the economic recession in 2009. Total electricity output increased by 20.2% from 2002 to 2012, notwithstanding a moderate increase of 3.8% in total generation capacity.

Figure 8.1 Electricity generation by source, 1990-2012



Note: Data for 2012 are provisional.

* Negligible.

Source*:* IEA (2013), *Energy Statistics of Non-OECD Countries*, OECD/IEA, Paris.

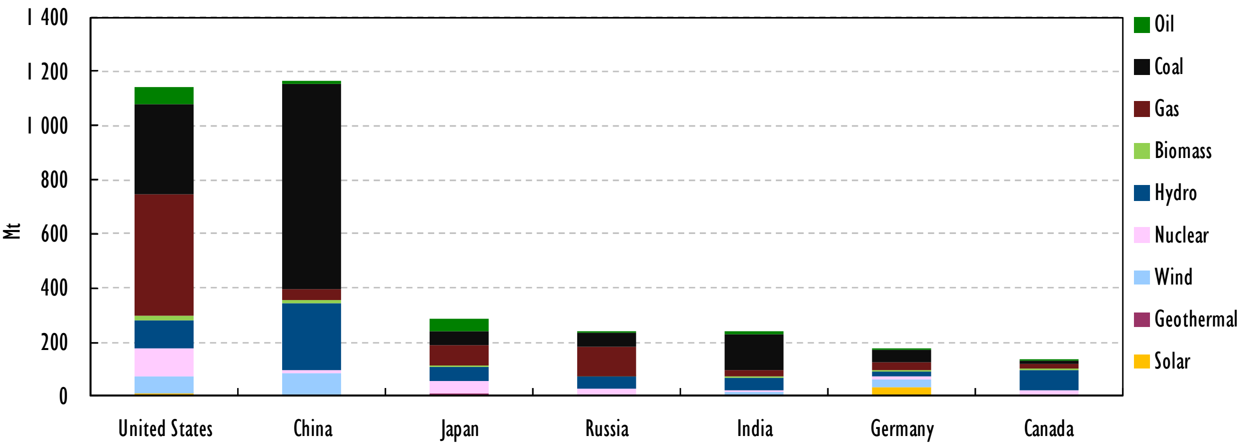
The economic slowdown seen since 2012, and the drop in growth in the gross domestic product (GDP) from 3.5% in 2012 to 1.3% in 2013, led to lower electricity demand, notably in the industry sector (aluminium, iron and steel producers) and thus lower electricity supply. In 2013, total electricity generation stood at 1 056 TWh, marking a slight decrease from 2012 (1 065 TWh).[2]

2. Latest data by the Ministry of Energy of the Russian Federation, 2014: www.minenergo.gov.ru/activity/statistic/17359.html; www.minenergo.gov.ru/activity/statistic/17135.html.

In 2012, nearly 49.1% of electricity was generated from natural gas. Natural gas usage in generation has seen solid growth in the past decade, with the electricity supplies from gas-fired power stations increasing by 36.6% since 2002. Electricity supplies from nuclear, hydro and coal accounted for 47.9% of total output, with a share of nuclear at 16.6%, coal at 15.7% and hydro at 15.5%. Generation from nuclear power has been on the rise since the late 1990s, increasing by 25.4% from 2002. Hydropower has risen by a marginal 2.3% over the same period, while electricity generation from coal has declined by 0.5%. The remainder is from oil, biofuels, waste and peat, which play a marginal role in electricity generation.

In 2012, the installed capacity of the Russian national energy system stood at 223 gigawatts (GW) with thermal power plants (natural gas and coal) accounting for 68.1% or 151.8 GW, hydropower for 20.6% or 46 GW, and nuclear capacity for 11.3% or 25.3 GW. Including power generation capacities in Russia's isolated areas, the total installed capacity reached 242 GW in 2012 (see Figure 8.2). There were 109 GW of natural gas, 52 GW of coal, 48 GW of hydropower and 25 GW of nuclear capacity, with the remainder being oil (6 GW) and biomass (1 GW). On a global scale, Russia's capacities are the fourth-largest in the world, in terms of the installed capacities, after the United States, the People's Republic of China and Japan.

Figure 8.2 Installed electricity generation in key global economies by fuel, 2012

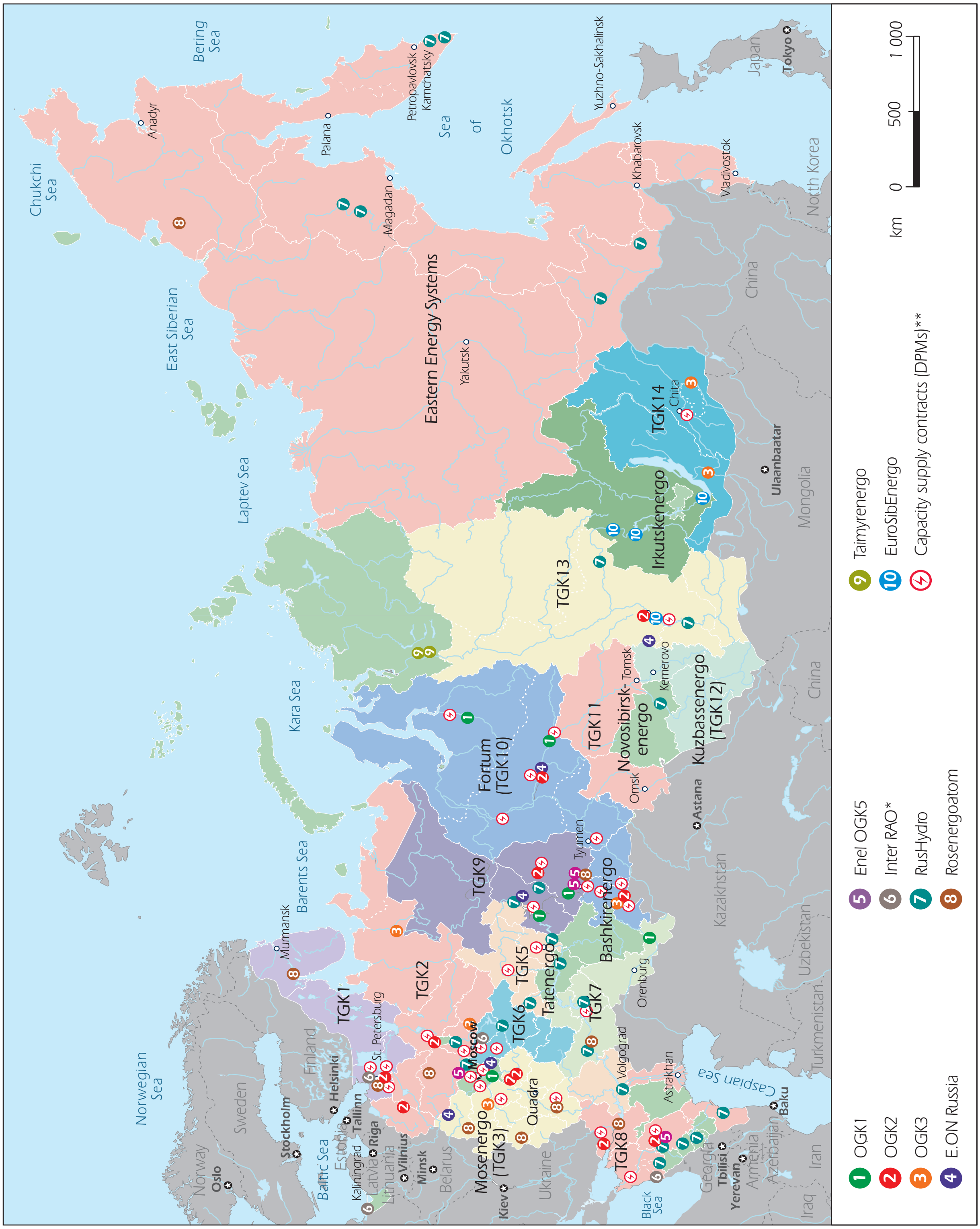


Note: Mt = million tonnes.

Source: Platts (2012), *World Electric Power Plants* (database), www.platts.com/products/world-electric-power-plants-database.

Russia has a diverse installed electricity capacity that largely reflects the different natural resources available across the vast territory (see Figure 8.3). Large hydropower capacity is mostly located in the Siberia and Volga regions. Coal-fired capacity has been installed in Siberia and the East. Gas-fired power plants dominate the generation mix in the Centre region. Nuclear power is located in the Northwest and Centre regions. Renewable energy installations (except large hydro) are still very few and remain almost absent in the current electricity generation mix (see Chapter "Renewable Energy").

Figure 8.3 Generation capacities in the Russian national energy system, 2012



This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

Note: km = kilometre.

* Inter RAO's initial assets.

** Key generating blocks under capacity supply contracts (200 MW or more).

Source: Sberbank Investment Research (2012), *Russia Utilities Atlas*, Moscow.

IMPORTS AND EXPORTS

The Russian united national power system (UPS) is connected to neighbouring Baltic States (Estonia, Latvia and Lithuania), Belarus, Ukraine, Mongolia, Kazakhstan, Georgia and Azerbaijan with some electricity cross-border power trade. The system runs in synchronous mode with the power systems of Ukraine, Kazakhstan, Belarus, Azerbaijan, Georgia, Mongolia and Norway (limited to several hydropower plants in the Kola energy system). In 2009, Uzbekistan, alongside Tajikistan, disconnected from the energy system, so that today, cross-border trade with Uzbekistan and Kyrgyzstan can be realised through the Kazakh power system and trade with Moldova through the Ukrainian system. There are two interfaces to the European electricity network – in Finland and with the Baltic States.

The Baltic States run in synchronous mode with the Russian and Belarusian systems based on the BRELL (Belarus-Russia-Estonia-Latvia-Lithuania) operational agreements. The Russia UPS runs in interconnected operation with the Finland power system (and the Nordic market) and China. The system is directly interconnected with the Finland power system (and the Nordic market) by means of three extra-high-voltage (EHV), 400 kilovolt (kV) lines with a back-to-back (4 x 355 MW) connection to Finland at Vyborg substation. In 2013, Finland stopped imports of electricity from Russia and plans to export electricity to the Russian market, once the tests at the Vyborg power link are completed.

Up to 2035, the Russian government plans to increase electricity exports, notably to the Asia Pacific region. Since April 2012, a new EHV 500 kV interstate overhead line (750 MW) has connected Russia (Amurskaya substation) with China (Heihe) through a back-to-back station (750 MW). In 2013, according to the latest data by the system operator (SO) of the UPS (SO UPS), Russia exported around 3.5 billion kilowatt hours to China, mainly through a long-term contract between the Inter RAO subsidiary Eastern Energy Company.

Future electricity exports to the European Union (EU) markets from Russia will depend on the outcome of European Union-Russia-Belarus negotiations towards harmonising the rules for power system regulation in the Baltic States, which is an important step towards the implementation of a common EU trade regime for electricity from third countries.

In addition, Inter RAO plans the construction of a subsea cable to link Russia's Far East Sakhalin and Japanese Hokkaido island through the Hokkaido-Sakhalin Cable System. The prospects of the project depend on the future role of nuclear power in Japan and electricity imports, and the investment in new power generation capacity in Sakhalin.

Russia is a net exporter of electricity, with total exports of 17.5 TWh in 2013 (-4% year-on-year [y-o-y]). This accounts for under 2% of electricity generation and trade does not play a significant role in the country's electricity supply. The main function of cross-border connections and trade is balancing the power systems in the synchronous area. Even though total trade volumes are low, exports have been gaining importance over the years, with a total increase of 33.2% since 2002. In 2013, imports were much smaller at 4.5 TWh, yet increased 75% versus 2012.

Most of the electricity was exported to Finland (23%, in slight increase y-o-y, but sharp decline versus 2009, when exports amounted to 11 TWh),[3] Belarus (20.5%, almost flat y-o-y), Lithuania (20%, in decrease y-o-y), China (19.9%, in increase y-o-y) and Kazakhstan (9.5%,

3. There has been no Russian import capacity at the 400 kV interface between Russia and Finland since the beginning (1980s). In 2013, the Federal Grid Company (FSK) successfully tested the reversible functioning of the Vyborg back-to-back station for 300 MW to 350 MW. The contractual basis for reversible exchanges is in the stage of elaboration.

in decrease y-o-y). Imports originated mainly from Kazakhstan (86%, double the 2012 level), followed by Georgia (8%, flat y-o-y) and Azerbaijan (2.8%, in sharp decrease).

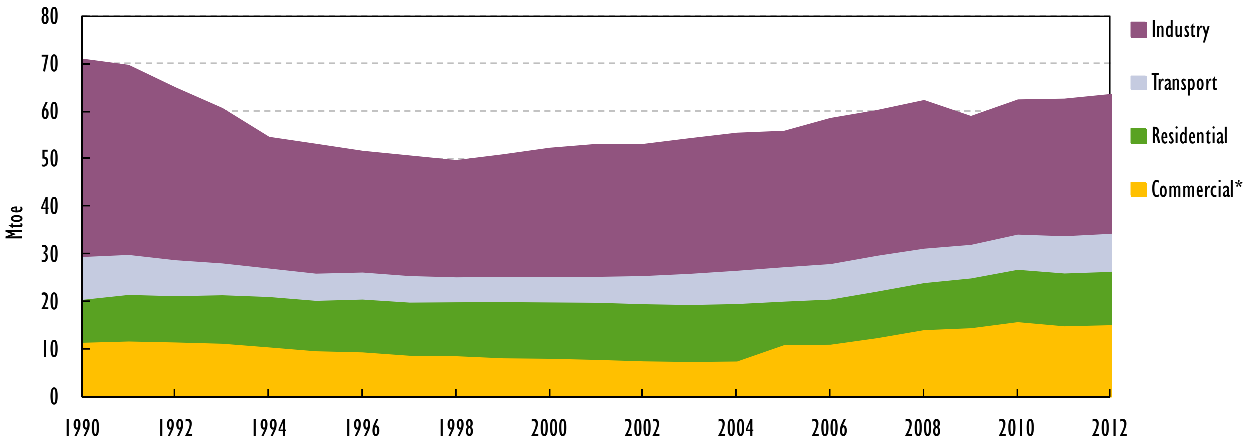
During periods of wet years and low prices in the Nord Pool market, as was the case in 2012, exports to Finland are lower. Ukraine almost ceased electricity imports from Russia in 2009, after which the exports became occasional. Following the closure of the last unit of the Lithuanian Ignalina nuclear power plant (NPP) in 2010, exports from Russia to Lithuania increased. Imports to Russia have fallen sharply from a high of 12.2 TWh in 2004, following the closure of Ignalina NPP and the start of the second Kaliningrad combined-cycle co-generation plant in 2006, as well as rising imports from Kazakhstan (around 1.9 TWh in 2012). Exports to China have been increasing in recent years to around 3.5 TWh in 2013, and further interconnection projects are under discussion.

ELECTRICITY CONSUMPTION

Electricity consumption in Russia has increased by 19.7% since 2002, continuing on a growing trend since 1999, driven by economic growth. Total consumption was 874.7 TWh or 63.7 million tonnes of oil equivalent (Mtoe) in 2012, or 13.7% of total final consumption (TFC) of energy. Because of solid growth in electricity demand in the past decade, its share in TFC has increased from 12.5% in 2002. Consumption was down by 5.4% during the economic recession in 2009, but it recovered in 2010-11. The industry sector is the largest consumer of electricity, amounting to 45.7% of the total. The residential sector accounts for 17.9% of the total, and the commercial and public services sector accounts for 24%, while the remainder is consumed by the transport industry (12.4%).

During the 2000s, there was a shift in demand for electricity from the residential and industry sectors towards commercial and transport use. Demand from the commercial and public services sector has increased by 101.5% since 2002, while demand from transport is up by 35.7%. Conversely, industry consumption has increased by a moderate 5.9% while residential electricity consumption has declined by 7.4%.

Figure 8.4 Electricity consumption by sector, 1990-2012



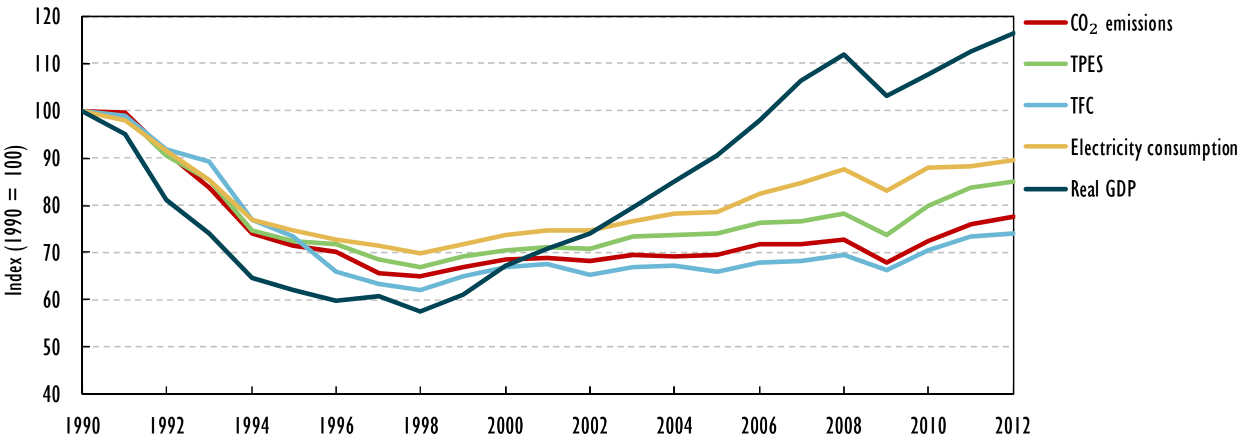
Note: Data for 2012 are provisional.

* *Commercial* includes commercial and public service, agriculture, fishing and forestry.

Source: IEA (2013), *Energy Statistics of Non-OECD Countries*, OECD/IEA, Paris.

In the medium term, annual growth levels of electricity consumption are expected to develop at a much flatter rate than in the past decade, as GDP growth is likely to be in the range of 2% to 3% instead of previously expected 4% to 6%. Economic growth and electricity consumption are strongly correlated, as illustrated during the economic crisis in 2008/09. Latest projections by the Ministry of Energy of the Russian Federation, underpinning the medium-term generation adequacy outlook, assume an average electricity demand growth of 1.79% for the period until 2020. The International Energy Agency (IEA) *World Energy Outlook 2013* (*WEO 2013*) estimates that electricity consumption will grow to 1 256 TWh, or by 1.7% under the New Policies Scenario (as opposed to the Current Policies Scenario of 2.1%).

Figure 8.5 Trends and drivers of carbon dioxide (CO_2) emissions, GDP and electricity consumption, 1990-2012



Notes: Data for 2012 are provisional. TPES = total primary energy supply.

Source: IEA (2013), *Energy Statistics of Non-OECD Countries*, OECD/IEA, Paris.

OUTLOOK FOR GENERATION ADEQUACY

At the time of the privatisation of the utility RAO UES (in Russian, *Edinaja Energeticheskaja systema*) in 2007/08, the government and industry expected strong economic growth and a steep increase in electricity demand (the “Tshubais cross”).

Encouraged by privatisation and the introduction of the capacity contracts (in Russian, *Dogovor o Predostavleny Moshnosty* [DPM]), investment in new capacities has materialised (see Figure 8.6); notably, new gas-fired power generation plants have come into operation in recent years. The privatisation of parts of the power generation segment has attracted considerable private investment and modern power infrastructure.

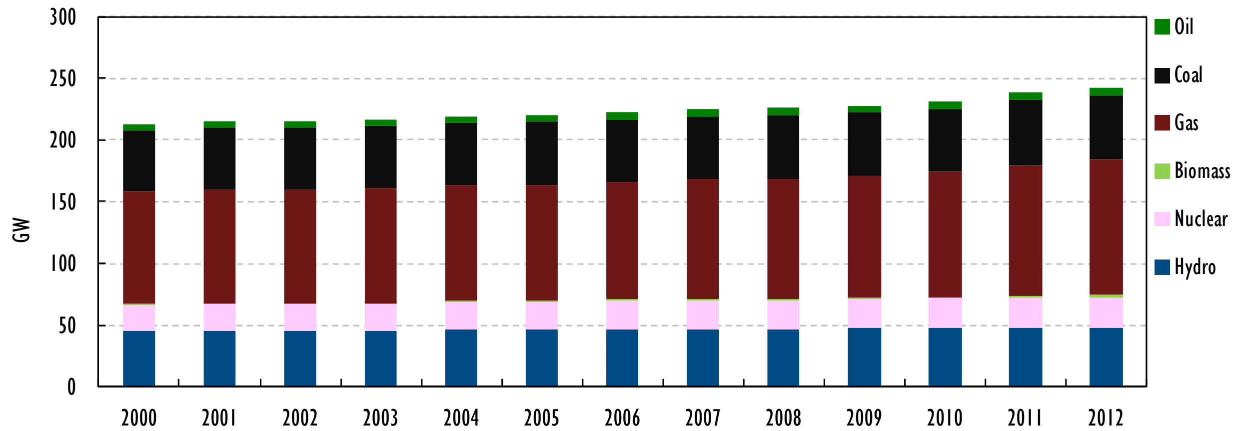
In 2009, the Russian government expected installed capacity to grow from 223 GW in 2011 to reach 355 GW to 445 GW by 2030, out of which 106 GW to 112 GW were to come from co-generation plants, 100 GW to 148 GW from other power generation, 91 GW to 129 GW from hydropower and renewable energies, and 52 GW to 62 GW from nuclear energy.[4]

Up to 2020, the generation adequacy outlook for the Russian energy system is set out in the State Development Scheme (with a six-year horizon) on the basis of the analysis by the

4. Ministry of Energy of the Russian Federation (2009), *Energy Strategy of Russia for the Period up to 2030*, Decree No. 1715-r of the government of the Russian Federation, 13 November 2009, www.energystrategy.ru/projects/docs/ES-2030_(Eng).pdf.

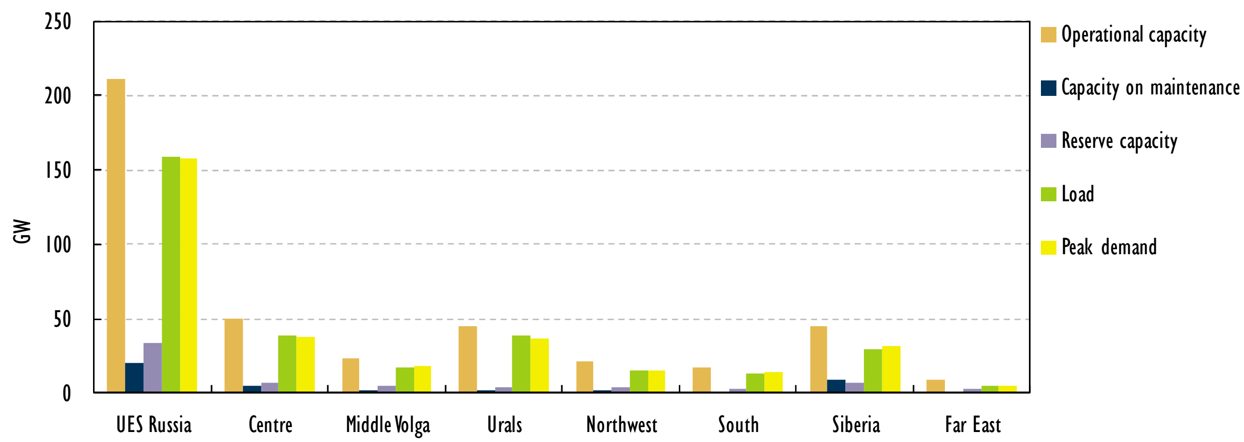
infrastructure operators and state-controlled companies.[5] The latest available scheme of 2013 analyses the capacity supply/demand balance, based on assumed maximum loads in the regions and contracts for electricity import-export by electricity company Inter RAO, Russia's state-controlled power generator and distributor. A normative reserve capacity is calculated per region, taking into account maintenance, compensation for unplanned outages and strategic reserve needs (see Figure 8.7), with system reliability rates set at around 20% (see Table 8.1). In 2012, peak load occurred on 21 December 2012 and stood at 157 GW.

Figure 8.6 Investment trends: Installed power capacity in Russia, by fuel, 2000-12



Source: Platts (2012), *World Electric Power Plants* (database), www.platts.com/products/world-electric-power-plants-database.

Figure 8.7 Supply/demand balance in the Russian energy systems for the peak demand day of 21 December 2012 (GW)



Note: UES = unified energy system.

Source: Ministry of Energy of the Russian Federation, 2013.

Table 8.1 Normative reserve margins in the UES, in %, 2013

UES Russia	Northwest	Centre	South	Middle Volga	Urals	Siberia	Far East
20.5	19	22	19.5	16.5	20	22	23

Source: Ministry of Energy of the Russian Federation, Order No. 309, 2013.

5. Ministry of Energy of the Russian Federation (2013), Order No. 309, "On the Scheme and Development Programme of the UPS of Russia for the Years 2013-19", 19 June.

In the projections of the Ministry of Energy of the Russian Federation, electricity demand growth in the Russian UPS for the period 2013-19 is expected to average 1.79%.[6] This assumes a stable average economic growth rate of 4.5%, supported by industry growth in the range of 3.6% to 3.7%. However, electricity consumption data as well as GDP growth data for 2012 and 2013 suggest that this forecast is unlikely to be realised and would need to be re-assessed in line with the lower governmental GDP growth assessment.

The development scheme suggests that modernisation is to continue throughout 2014-17 and help improve the energy efficiency of the economy, bringing down electricity demand growth, and achieving a 26% reduction of energy intensity of GDP by 2019. In the medium term (2013-19), the government forecasts that demand for capacity in the Russian UES will reach 159 GW in 2013 and 175 GW in 2019, driven by the projected need for new capacity in the South and the Far East. The total investment programme for 2013-16 foresees the commissioning of 27 GW of additional capacity.

In the aftermath of the global economic and financial crises, energy consumption growth developed at a lower pace than expected as GDP growth is likely to be in the range of 2% to 3%, instead of expected 4% to 6% in the period to 2020. In 2013, there was a clear trend of lower or even flat growth levels of electricity consumption. The government has begun to define projections up to 2035 by launching preparations for a new Russian energy strategy to 2035.[7] It adapted the scenarios and expects growth of the installed generation capacity by one-third (or 297 GW to 323 GW), leading to an increase in electricity generation by 1.6, while providing for a larger role of nuclear energy (increase from 16% to between 22% and 23%).

Even under a low energy demand outlook, in the medium term, the renovation and modernisation of the Russian power generation fleet remains the priority. As shown in Figure 8.8, almost two-thirds of Russian thermal power plants are more than 30 years old and average between 50 years old and 60 years old. Approximately, 80% of nuclear capacity reaches end of lifetime, and 78% of hydropower plants are in need of refurbishment.

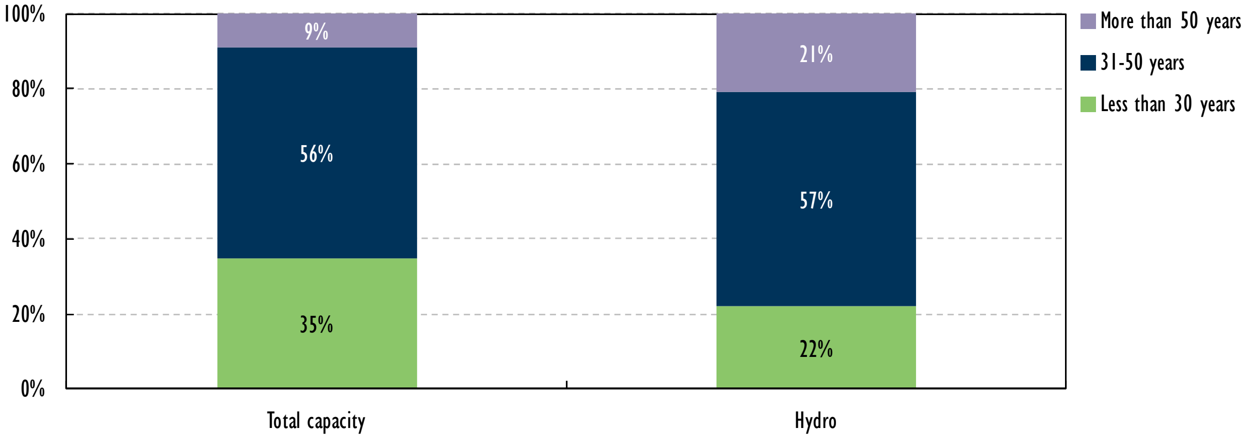
The upgrading and decommissioning of old CHP plants and related networks amid rising maintenance and repair cost have become a pressing concern for generation adequacy. During the past 20 years, there has been little investment in CHP, and decommissioning of existing plants has been limited. Amid constraints in system operation, grid development and the primary need for heating (rather than electricity in winter periods), the decommissioning of existing plants has not been easy to implement. In practice, most co-generation plants are required to stay online beyond their lifetime. There is no explicit policy in place to support the decommissioning of old, high-emissions and inefficient fossil fuel power plants.

The challenge is significant. The *WEO 2013* indicates that in Russia 149 GW of power generation capacity (out of a total of 223 GW in 2012) is to be retired between 2013 and 2035, including 43 GW of coal-fired capacity, 80 GW of gas-fired capacity and 20 GW of nuclear capacity. In the same period, capacity additions are estimated to be in the range of 222 GW, notably from gas (116 GW), coal (38 GW), nuclear (33 GW) and hydro (18 GW). This equals a net capacity addition of around 73 GW during the period up to 2035.

6. *Ibid*.

7. The concept note on the new Energy Strategy to 2035 was published on the website of the Ministry of Energy of the Russian Federation, 23 January 2014. Available at: http://minenergo.gov.ru/documents/razrabotka/17481.html.

Figure 8.8 Age of installed thermal generation capacity in Russia in general and for hydropower in particular



Source: Sberbank Investment Research (2012), *Russia Utilities Atlas*, Moscow.

INSTITUTIONS

The government established the general framework for the energy sector through the adoption of state programmes and sector laws. There are two co-ordination bodies, the Governmental Commission for Electric Power Development and the Government Commission for Electrical Supply Safety Protection (Federal Staff).

The Ministry for Economic Development of the Russian Federation is in charge of economic and regional development and oversees the tariffs and investment in the energy sector in line with its socio-economic outlook. The Ministry of Energy of the Russian Federation is in charge of general energy policy, and notably of the development of the legal framework for the electricity sector. It approves the overall energy system needs in a medium-term (six years) investment programme for the development of the Russian UPS. It oversees the investment plans of regulated and state-owned entities.

The Federal Tariff Service (FTS Russia) prepares for approval and modification the level of regulated electricity transmission tariffs, and the price floors for the wholesale tariffs for the non-price zones and for electricity retail tariffs and the ceilings for heat (co-generation) tariffs. FTS Russia establishes the charges for system operation services provided by various infrastructure entities (Administrator of the Trading System [ATS], SO UPS, etc.) and sets the price caps for the capacity market. The federal subjects of Russia have their own regional regulatory authorities, the Regional Energy Commissions, in charge of tariff regulation, under the authority of the regional government authorities. They approve the retail (electricity and heat) tariffs, including distribution network tariffs for the interregional distribution grid companies (MRSKs), within the established minimum or maximum tariff limits determined by the FTS.

The Federal Anti-Monopoly Service (FAS) supervises the competition and abuse of market dominance, including the compliance with unbundling rules, in the competitive segments of the wholesale markets and retail electricity markets, and enforces compliance of the SO and the market with non-discriminatory access rules to regulated networks. The FAS is also the agency responsible for the procedure of authorisation of foreign investment in strategic sectors that also include the electricity transmission (not distribution) sector (Foreign Strategic Investments Law, 2008). In Russia, unlike in most jurisdictions around the world, FAS, not the regulator FTS, is in charge of third-party access regulation, which is directly linked to competition law and not the regulation of network monopolies. There is no clear division of responsibilities between entities for the regulated and competitive segments of the Russian electricity market.

The SO UPS is a specialised organisation in charge of the centralised operational dispatch across the synchronous systems of UPS, except for isolated energy systems[8] (here regional system/dispatch operators fulfil SO tasks). The operations includes the management of internal and cross-border electricity flows, the dispatch through unit commitment for the day-ahead and the balancing markets, evaluation of the supply/demand adequacy, administration of the capacity auctions and elaboration of proposals for new generation and network capacities, participation in designing and agreeing development plans.

The joint-stock company Russian Grids (Rosseti) ensures the power system operation by providing electricity transmission and distribution services, grid availability, and load flow metering. Rosseti carries out the network investments for the expansion of the UPS.

The Centre for Financial Settlements (CFS) executes payments and monitors settlements of the participants in the wholesale energy/capacity and retail markets through a unified clearing system.

The ATS organises the wholesale market and related trading activities, notably for the electricity and capacity trade at exchange and over-the-counter level, except for bilateral contracts.

The self-regulatory organisation for the wholesale energy/capacity markets and retail market, the Market Council, develops the regulatory framework through market rules and ensures compliance. The Market Council brings together representatives of the Russian electricity sector, including the government; FTS Russia; FAS; the suppliers, consumers and market operators; ATS; CFS; the SO; and network companies.[9] The ATS is supervised by FAS and the Market Council.

MARKET DESIGN AND REGULATION

REFORM PROCESS AND MODERNISATION

Russia embarked on the reform process in the electricity sector, following the Resolution of 1997 and 2000, On the Main Directions of the Policy on Restructuring the Electric Power Industry in Russia, and launched the electricity market reform on the basis of the Government Resolution No. 526 On the Restructuring of the Electric Power Industry of 11 July 2001.

The new market design for the electricity sector was established in Federal Electricity Law No. 35 of 26 March 2003, complemented by Federal Law No. 36 of 26 March 2003 On the Special Functioning of the Electricity Sector in the Transition Period, which announced the transition to free-market pricing at the wholesale market by 2011 and at the retail market by 2015.

8. Isolated only 2%.

9. Florence School of Regulation, Conference on regulators' role in developing energy infrastructure, investment and operational rules for networks: EU and Russian experience and plans, Presentation by Vyacheslav Kravchenko, Chairman of the Board of the NP Market Council, 6-7 February 2012.

In October 2005, the balancing market was launched on the basis of Government Decree No. 620 of 17 October 2005 On Amending the Russian Government Decree on the Deviations Sector of the Transitional Wholesale Power/Capacity Market.[10]

System operation, dispatch, investment planning and transmission service functions are separately organised in Russia. During 2002 and 2008, the sector underwent deep reforms. The incumbent electricity utility RAO UES was horizontally and vertically unbundled into generation and networks activities, and RAO UES was liquidated in June 2008. Russia implemented ownership unbundling in 2002. It requires a split between generation and independent system and network operators: the Federal Grid Company (FSK), established in 2002; the MRSKs, established in October 2007; and the SO UPS, established in June 2002. Thus, combining generation and distribution assets in one company is not allowed.

During 2007-11, the liberalisation process continued with the privatisation of generation assets (wholesale generation companies [OGKs] and territorial generating companies [TGKs]) and through the adoption of new rules for the Russian wholesale and retail markets. In return for privatisation, the new investors took on board commitments to continue the investment programme of RAO UES through bilateral capacity contracts for ten years, the so-called DPM mechanism. The transition and phase-out of price regulation over time and the move towards full price liberalisation on the wholesale and retail markets was intended to emerge by end of 2011. However, following blackouts in Central Russia in 2005 and an accident at the Sayano-Shushenskaya hydropower plant in 2009, the government introduced measures to strengthen the modernisation and adequacy through the introduction of incentive-based (regulated asset base [RAB]) regulation for electricity networks and a capacity market as well as price regulation with a view to strengthening security of the electricity supply (Decree No. 929).

In 2008, Russia introduced incentive-based, return-on-investment regulation for electricity transmission and parts of the distribution networks, the so-called RAB regulation pursuant to Government Resolution No. 459 of 18 June 2008 On Changes to the RF Government Resolution No. 109 of 26 February 2004 On Formation of Prices for Electric and Thermal Power in the Russian Federation and Annex to the Federal Tariff Service Resolution N 231-e of 26 June 2008 Methodology for Regulation of Tariffs Using the Return on Invested Capital Approach. By 2014 all network companies should migrate to RAB regulation.

Under Russian Law on foreign investment restrictions in strategic sectors, the Foreign Strategic Investments Law (2008, with amendments in 2008, 2011 and 2013) foreign companies are not allowed to own more than 50% of TGKs, which are state-controlled, or acquire shareholdings in the transmission company.

The Energy Strategy to 2030 (No. 1715) of 13 November 2009 calls for overcoming the lack of interconnection capacity to the isolated energy systems and between the European part of the UPS, including Urals and Siberia, and the lack of flexible peak plants, and sets out the aim of abolishing the cross-subsidisation between the electricity and heat markets. Under the strategy, the total investment needs in the sector are expected to be in the range of RUB 2.4 trillion to RUB 2.8 trillion by 2030.

The governmental programme On Energy Efficiency and the Development of Energy developed by the Ministry of Energy and approved by the government on 3 April 2013[11]

10. Sidorenko, A. (2009), *Electricity in Russia*, https://economics.adelaide.edu.au/downloads/services-workshop/Electricity-In-Russia.pdf.

11. http://minenergo.gov.ru/upload/iblock/afc/afc90b96ec0fef29f2ededabb6a4a131.pdf; http://government.ru/en/news/1174.

follows from the Energy Strategy to 2030 and sets out the reform objectives for the Russian heat and electricity markets, and contains an investment sub-programme on the development and modernisation of the Russian electricity sector (by state-owned companies). These measures include the modernisation and introduction of technology innovation in thermal power plants (co-generation) and networks, investment in new generation capacity and grid infrastructure, increased safety and availability of and access to energy infrastructure, and the mitigation of negative environmental impacts.

Reform of the heat sector (see Chapter "District Heating") is expected to deliver a stable regulatory framework including incentives for the modernisation of Russia's ageing co-generation fleet and should lead to increasing their fuel efficiency, operational reliability and emissions performance. The remuneration of co-generation plants on the energy and capacity wholesale market (OREM) is to be adapted to avoid discrimination of co-generation plants.

The investment programme includes the renovation of hydropower plants, energy transmission and distribution networks (reducing losses), and related infrastructure, and the development of energy storage. This shall ensure the availability of flexible backup capacity to cover demand peaks and ensure the ability of the grids to integrate distributed generation (from renewable energies or small plants).

By 2020, the government aims to simplify, step-by-step, and shorten the electricity grid connection process (from 281 days to 40 days in 2013), as set out in government by-law No. 1144-r of 30 June 2012, On Raising Access to Energy Infrastructure (Roadmap). This law follows up on the low rating Russia received in the World Bank *Doing Business* publication in 2012.

The government has a special regional focus on the economic development of the Far East and the Trans-Baikal regions, supported by the respective State Development Fund. The investment programmes in these regions foresee the construction of electricity transmission lines between Eastern Siberia and the Far East. These new lines will connect isolated energy systems and satisfy the needs of a growing industry base, make use of renewable energies, and create electricity export capacity to China.

In January 2014, the government set out the main priorities and directions for the new Energy Strategy to 2035. With regard to the wholesale electricity market, the government considers the most important challenge the creation of a new mechanism for attracting investments after the current DPM is phased out, while in the retail market the elimination of cross-subsidisation remains the priority.

REGULATION

The Russian electricity sector is governed by federal laws, including the civil code, the above-mentioned federal law on the electric power industry, the federal law on energy saving and energy efficiency, and the federal law on heat supply and others.

There are several government acts on wholesale market rules, retail market functioning fundamentals, non-discriminatory access rules, information disclosure standards and electricity pricing fundamentals.

The rules for non-discriminatory access to electricity transmission services were laid out in Government Resolution No. 861 of 27 December 2004. Government Resolution No. 929 of 14 November 2009, On the Procedure for the Implementation of State Regulation in the Electricity Sector, provides for price regulation in case of capacity shortages or emergencies. Tariff regulation was established under Resolution No. 1178 of 29 December 2011, On the Fundamentals of the Formation of Regulated Electricity Tariffs. A set of pricing rules followed suit for guaranteed suppliers (GSs) under Government Resolution No. 1179 of 29 December 2011 On the Rules for Price Setting and Application of Non-regulated Energy and Capacity Prices by Guaranteed Suppliers.

Retail market rules were introduced very recently. On 4 May 2012, Resolution No. 442 established the Basic Rules on the Functioning of the Retail Electricity Markets. There is a growing discussion on the adequate regulatory model for the Russian distribution sector with regard to unbundling requirements, supply and network operation.

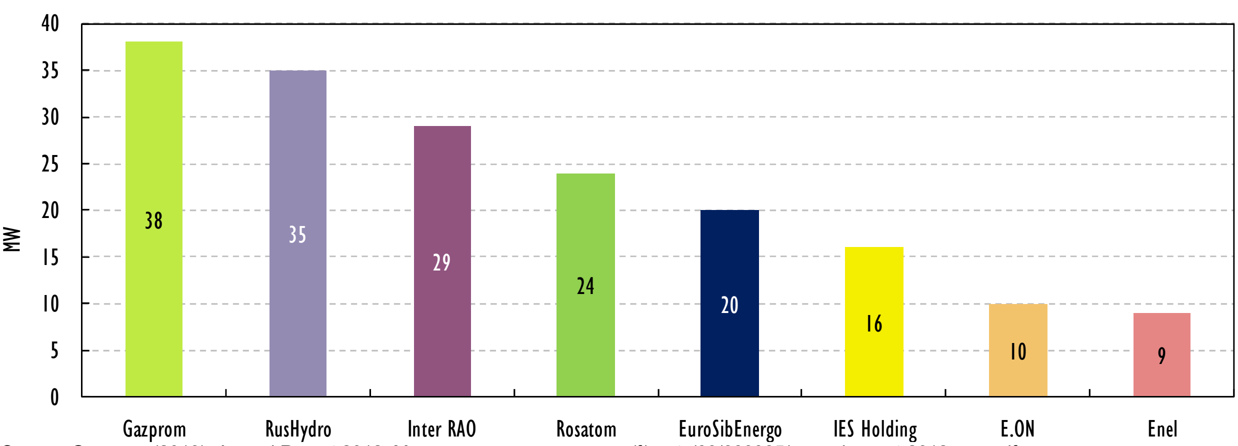
At the level of ministerial acts, there are orders by the federal executive authorities, including the Ministry of Economic Development of the Russian Federation, the Ministry of Energy of the Russian Federation, FAS and the FTS. Together, under the Market Council, the rules for electricity wholesale and retail markets are further developed.

On the wholesale market, all market participants have to follow the terms and rules of the Accession Contract, which is not a legal act, but a contract that is binding upon the commercial parties.

MARKET STRUCTURE

Electricity generation in Russia was liberalised and partly privatised in 2005, leading to the liquidation of RAO UES of Russia in 2008, after it had been reorganised into separate companies responsible for generation, system operation and network services in 2002 with the creation of FSK and the MRSKs.

Figure 8.9 Installed capacity of Russian electricity generating companies



Source: Gazprom (2013), Annual Report 2012, Moscow, www.gazprom.com/f/posts/60/660385/annual-report-2012-eng.pdf.

Following liberalisation in 2005, foreign private utilities entered the Russian electricity market (Enel, Fortum, E.ON and EDF). The privatisation led to an increase in the diversity of ownership and investment. E.ON acquired 83.7 % of OGK-4, Enel 56.4% of OGK-5 and 49% of Rusenergosbyt, and Fortum owns 97% of TKG-10 and has a blocking shareholding in TGK-1. EDF has become the management company for Tomsk Distribution Company. At the same time, consolidation increased among generators, as Inter RAO brings together the generation assets (OGK-1, OGK-3, TGK-11, Bashkir generating company) that could not be privatised.

On the generation side, there are five OGKs on the wholesale energy market, owned by Inter RAO, Gazprom Energoholding, Enel and E.ON. There are also 14 TGKs, which are thermal power plants (coal/gas). Hydro and nuclear energy generation are state-owned and remain in priority dispatch. All ten operating NPP sites are owned and operated by Rosenergoatom and all large hydropower assets by RusHydro. Under Russian law, the state has a controlling stake in RusHydro (above 50%). There are a few regional utilities, including Tatenergo, Bashkirenergo, Irkutskenergo and Novosibirskenergo. In the East, vertically integrated Eastern Energy Systems, controlled by RusHydro, operates generation and grid businesses. Large industrial producers, including aluminium, metal and coal companies, have also invested in their own generation facilities (for instance the Siberian Coal Energy Company). Cross-ownership (gas, electricity) and re-integration into large state-owned companies holds the potential for collusion and abuse of dominant position.

In terms of competition, the wholesale market structure is diversified with moderate concentration (see Table 8.2), as four large government-owned generators (Gazprom, RusHydro, Inter RAO and Rosatom) control 126 GW. Most of the capacity is located in the competitive market segments in Europe and Urals and parts of Siberia. However, within each price zone, concentration seems to be higher. In 2012, FAS noted high concentration levels with significant market power in Siberia (price zone two).[12] Recent IEA analysis comparing Russia with IEA member countries shows a diverse wholesale market structure, with the lowest market share for the top three generators, largest diversity of ownership and low market concentration level, comparable to Germany or Spain.[13] Concentration on the capacity market is however higher due to the high number of small capacity zones, and regulated price caps in most zones. Competition is limited also due to network congestion at around 700 out of 8 400 network nodes, according to the SO.

Electricity generator Inter RAO participates in the wholesale market for the sale of imported electricity and the purchase of electricity for exports. It owns and operates the groups of supply points destined for export and import of electricity, located on Russia's borders with neighbouring countries. Inter RAO balances physical and financial flows and provides commercial electricity to ensure the reliability of power systems through the sale and purchase of reserves of capacity and deliveries for mutual emergency aid. Inter RAO owns generation assets and also holds the *de facto* monopoly over the exports (97% market share).

Retail market participants are power supply and sales companies, including GSs, who are supplying electricity on the basis of a universal service obligation to final consumers, in geographically defined areas. There are also retail generating companies (with no more than 25 GW installed capacity), retail consumers (public housing utilities) and end users. Network companies purchase electricity (capacity) in the retail markets to compensate for their electricity losses and may act as consumers as well.

In 2012, due to the insolvency of a number of GSs, interregional distribution grid companies needed to replace the GS as grid operator and supplier for a temporary period of one year. Generators such as Inter RAO and IES Holding have shareholdings in electricity distribution. Russian law provides for the unbundling of generation and network (transmission-distribution) activities and extends to subsidiaries operating in the same price zone. It is not possible for generators to act as a grid company, unless they are a GS. However, generators (EN+ Group, Sistema, Gazprom Energoholding, EDF, Enel, E.ON and Fortum) are interested in acquiring shares in distribution operation.

12. FAS (2012), *Review of the State of Competition in the Wholesale Market of Electricity and Capacity in 2011*, Federal Antimonopoly Service, Moscow.

13. See the in-depth competition assessment by the IEA: IEA (2013), *Russian Electricity Reform Update 2013*, OECD/IEA, Paris.

Rosseti and 11 MRSKs became the majority stakeholders of FSK in 2013, with shareholders being the Russian state (61.7%), Gazprom (7.62%) and free-floating shares (30.62%). When authorising the merger, FAS imposed a structural remedy on Rosseti to spin off the nine regional supply companies, which the MRSKs took over as a consequence of the insolvency of regional suppliers in recent years.

NETWORKS

Spanning a territory of 13.6 million square kilometres and 74 out 83 of federal subjects, the Russian electricity grid is the largest publicly controlled network in the world, with a total length of power lines of 2.44 million km in 2012, of which the lion's share (97%) are interregional distribution grids.[14] In Russia, the differentiation into transmission and distribution is done in accordance with voltage levels (220 kV as reference) and system importance and system functions (see Table 8.2).

UNITED NATIONAL TRANSMISSION GRID

There are around 139,000 km of transmission lines (UPS) with 750 kV to 1 150 kV voltage lines providing for intersystem functions and the delivery of NPP capacity, and 220 kV to 750 kV lines, connecting large industrial consumers.

MRSKs

In 2012, there were 2.4 million km of regional distribution lines (below 220 kV) to ensure distribution of electricity to residential customers and small and medium-sized industry and commercial customers. The 11 MRSKs consist of several branches. Most of the MRSKs are owned by the local municipalities in the regions.

Table 8.2 The Russian electricity network (in 1 000 km)

	Total length	750-1 150 kV	500 kV	330-400 kV	220 kV	110-154 kV	35-60 kV	3-20 kV	0.38 kV
RGCs	2 312.6	-	3.7	0.2	18.0	302.2	199.4	990.4	798.7
UNPG	139.7	4.4	36.5	10.8	85.9	1.6	0.2	0.3	0
Total	2 452.3	4.4	40.2	11.1	103.9	303.8	199.6	990.6	798.7

Note: - = absolute zero; RGC = regional generation company; UNPG = Unified National Power Grid.

Source: APBE, 2013.

NETWORK DEVELOPMENT

The National Power Grid Strategy, as prepared by FSK every five years, provides an outlook for a ten-year period. According to the 2003-15 strategy for the development of the national power grid, there is an urgent need for the modernisation of the grid infrastructure, and for investment in interconnection among energy systems, notably to reinforce the weak links among Europe and Urals and Siberia and to link the currently isolated energy system in the Far East and the North of Russia (see Figure 8.10) and the connections to Asian markets.

The main challenge in the Russian network sector is the need to modernise the grids and attract investment in new transmission infrastructure and interregional distribution networks,

14. APBE (2012), www.e-apbe.ru/en/EP-sector/UES/Transmission%20and%20distribution%20system.php.

while mitigating network tariff growth. Under the 2030 energy strategy, investment of USD 217 billion to USD 334 billion in electricity grids is needed for the period up to 2030.

ACCESS AND TARIFF REGULATION

In 2009, Russia introduced a new regulatory model, RAB regulation, with the objective of increasing network efficiency. The regulatory period is five years (2009 through the end of 2014) for the regulation of FSK and some of the branches of the interregional MRSKs. The new regulatory period is to commence in 2015.[15] The regulated rate of return has been determined at 11% for new assets and 1% to 11% for older assets.[16] Tariffs are set on an annual basis on 1 July. The main challenges arising from the implementation of the new regulatory model relate to four key elements. In the light of international experience with RAB regulation the following elements are crucial in good regulatory practice:

- an effective benchmarking of operational cost (OPEX), including network losses, for a large FSK and the different MRSKs
- a robust evaluation of the needed investment (capital expenditure [CAPEX])
- more efficient electricity network planning with participation of market participants and consumers
- ensuring reliability and quality of supply.

The regulatory authorities, including the FTS Russia and Regional Energy Commissions, should adapt their capacities and to take into account those four key elements with a view to strengthening regulatory evaluation, audits and economic assessments. The benchmarking of the transmission company FSK is a regulatory challenge, as there is no comparable single network operator at international level with similar characteristics. Instead, Russian MRSKs can be easily compared to their international peers and also to the performance of the recently privatised MRSK Tomsk.

Given the vast size of the electricity grid and the challenge of grid connection of isolated energy systems, quality of supply and energy efficiency are key elements of grid operation in Russia. In 2012, total transmission losses accounted for 8.11%, a relatively low level considering the distance and total network size. In 2012, Russian Grid Company invested RUB 5 633 million in the reduction of losses to 8.11% in 2012, which were at 8.69% in 2010.

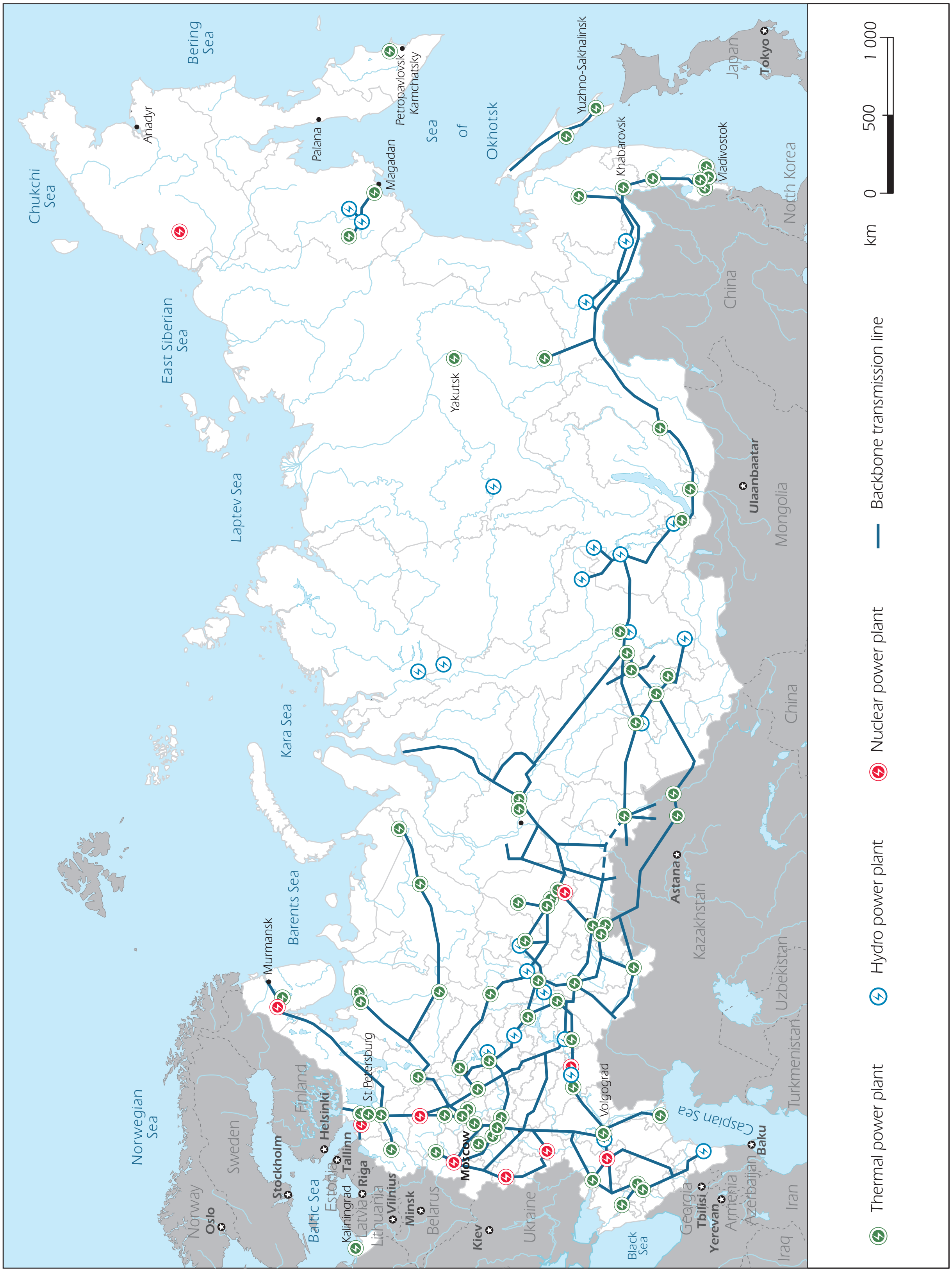
Internationally, RAB regulation has proven to be an adequate instrument to reflect quality of supply aspects. In order to ensure an efficient benchmarking of quality investment and performance of network operators, the FTS needs to further develop dedicated indicators for security of supply, including the System Average Interruption Frequency Index (SAIFI) and the System Average Interruption Duration Index (SAIDI),[17] measuring the number of supply interruptions, and link their outcomes to the RAB regulation. Russia should develop a sound quality of supply regulation, which rewards efforts by the grid companies to improve quality of supply and thus balance efficiency targets. Security of supply should be of similar importance as reducing losses and efficiency.

15. RAB regulation does not apply to all MRSKs branches; only 44 out of 65 were under RAB at the end of 2012, but more are to migrate to the RAB model. The other MRSK branches remain under cost-plus or indexation regulation.

16. Sberbank Investment Research (2012), *MRSKs*, Investment Research, Russia/Utilities, November.

17. The SAIFI is a reliability indicator of electric power supplies, referring to average number of interruptions that a customer experiences. The SAIDI counts the average outage duration for each customer served.

Figure 8.10 Major transmission lines and generation capacities in Russia



This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

Source: Sberbank Investment Research (2012), *Russia Utilities Atlas*, Moscow.

On the basis of the grid strategy, the Ministry of Energy of the Russian Federation started privatisation in the segment of regional grid companies, supported by the government with a view to increasing efficiency in the management and operation of regional grids. In November 2013, the government announced its intention to continue the privatisation of MRSKs in 2014, following the example of MRSK Tomsk. Auctions are likely to take place in the second half of 2014; potential buyers may include global utilities and infrastructure companies as well as private equity funds. Sberbank positively values some of the key MRSKs for further privatisations (MRSK Volga, MRSK Centre-Volga, MRSK Centre).[18] Privatisation is to follow the model of the Russian generation company OGK/TGK privatisation from 2007-08. In line with the grid strategy, the ministry aims for a direct sale of a controlling stake to a strategic investor combined with an initial public offering of the shares of the privatised MRSK to raise capital for investment.

Amid curtailment of retail tariff growth in 2014-16 and the reduction of CAPEX investment programmes by the Ministry of Energy of the Russian Federation, MRSKs will need to reduce costs in the coming years and attract new equity capital, including from privatisation. Network regulation is thus important for investors and the security of supply of final consumers.

WHOLESALE ENERGY AND CAPACITY MARKET

The Russian electricity market is operated on the basis of nodal pricing, and wholesale market prices were fully liberalised in 2011. The wholesale market OREM (in Russian, *Optovyi Rynok Electroenergii i Moshchnosti*) consists of a separate energy and capacity market, in many aspects similar to the Pennsylvania-New Jersey-Maryland model.

The wholesale energy market

The day-ahead market (DAM) is a mandatory pool with competitive prices formed on the basis of marginal pricing determined at around 8 400 nodes, in two liberalised price zones: the first price zone Europe and Urals, and the second price zone Siberia. There are four non-price zones (Kaliningrad Region, Komi Autonomous Republic, Arkhangelsk Region, and the Far East Federal District which also includes the territories of Sakha Republic [Yakutia], Primorsky Krai, Khabarovsk Krai, Amur Oblast and Jewish Autonomous Oblast) and the isolated energy systems (spanning across the vast territory of the Russian North with a share of less than 2% in total consumption), where regulated electricity tariffs apply, as competition is considered to be weak or absent. The wholesale electricity market today has few free bilateral contracts (around 2%), and 18% remain regulated and 80% in wholesale DAM.

Between 2006 and 2013, average wholesale DAM prices in the first price zone Europe and Urals were fluctuating between USD 19 per megawatt hour (USD/MWh) and USD 39/MWh (see Figure 8.11), while in the second price zone (Siberia) wholesale electricity prices are consistently lower. Siberian prices reflect the average coal price, while prices in the first price zone (Europe and Urals) depend on the (regulated) gas price. In July 2013, for the first price zone, prices stood at EUR 20.79 per megawatt hour (EUR/MWh), and in Siberia EUR 16.23/MWh.[19] There is a significant difference between prices in regulated contracts and the DAM prices. As a result of limited system operation flexibility, there are many

18. Sberbank Investment Research (2013), *MRSKs and FGC*, Investment Research, Russia/Utilities, Moscow, June.

19. Sberbank Investment Research (2013), *Russian Gencos*, Investment Research, Russia/Utilities, Moscow, August.

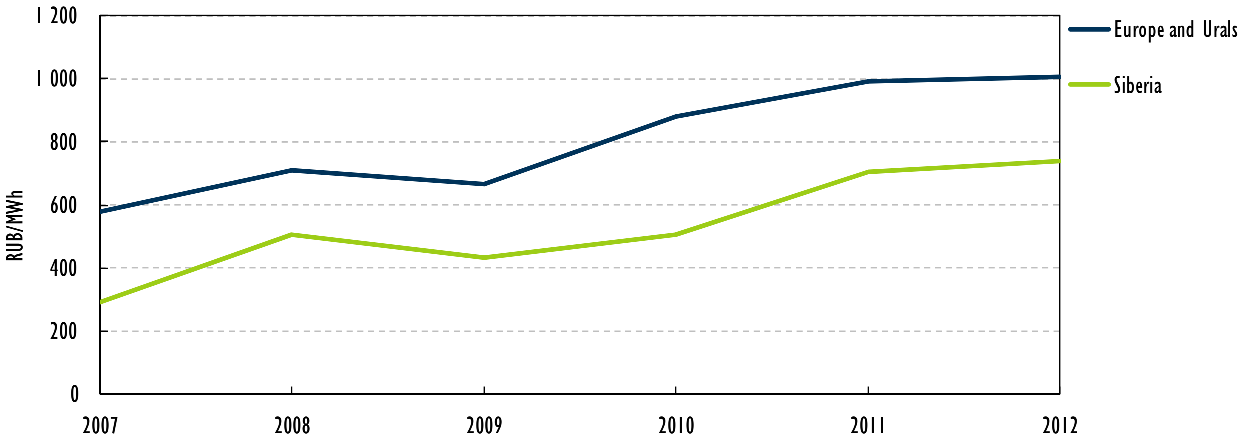
must-run generators, which in practice make system operation and capacity markets inflexible in Russia. The Russian dispatch is largely determined by a high percentage of base-load capacity in priority dispatch (nuclear and *de facto* hydropower plants) which receives the DAM marginal price; demand-side participation is excluded.

There is no dedicated deep and liquid financial market in Russia. Financial derivatives (futures contracts of electric power) can be traded on the Derivatives Market of Moscow Energy Exchange by participants of the OREM and retail electric power market. Market participants have some possibility to hedge supply risks. As Russia has a capacity market with price caps, the need for risk management is lower. Demand volatility is low and electricity trade dynamics largely reflect inflexible unit commitment of the SO.

At wholesale level, the Market Council (the FTS, the FAS and the Ministry of Energy of the Russian Federation) monitors and controls the electricity day-ahead and capacity prices. There is a strong drive by the authorities to reduce sudden price spikes, notably from a competition and affordability point of view. If price growth rates are beyond the reference values over a three- to seven-day period, a so-called price smoothing mechanism can be introduced, which reduces the bids to the level of the regulated tariff. If the Market Council finds price manipulation on the market, it forwards the results of its analysis to the FAS and the Ministry of Energy of the Russian Federation, which have enforcement powers to follow up.

Dynamic pricing on the wholesale market is not always desirable from a consumer's point of view, as it can sometimes bring sudden price spikes. In an energy-only market, peaking capacity is rewarded through the revenues realised during price spikes, when prices remunerate not only the marginal cost of production but also its capacity value. Prices at the peak may also approach the value of lost load, which is the average amount electricity consumers are willing to pay to avoid power loss. Russia has chosen to keep wholesale energy prices within a limit while remunerating capacity on the basis of two separate systems.

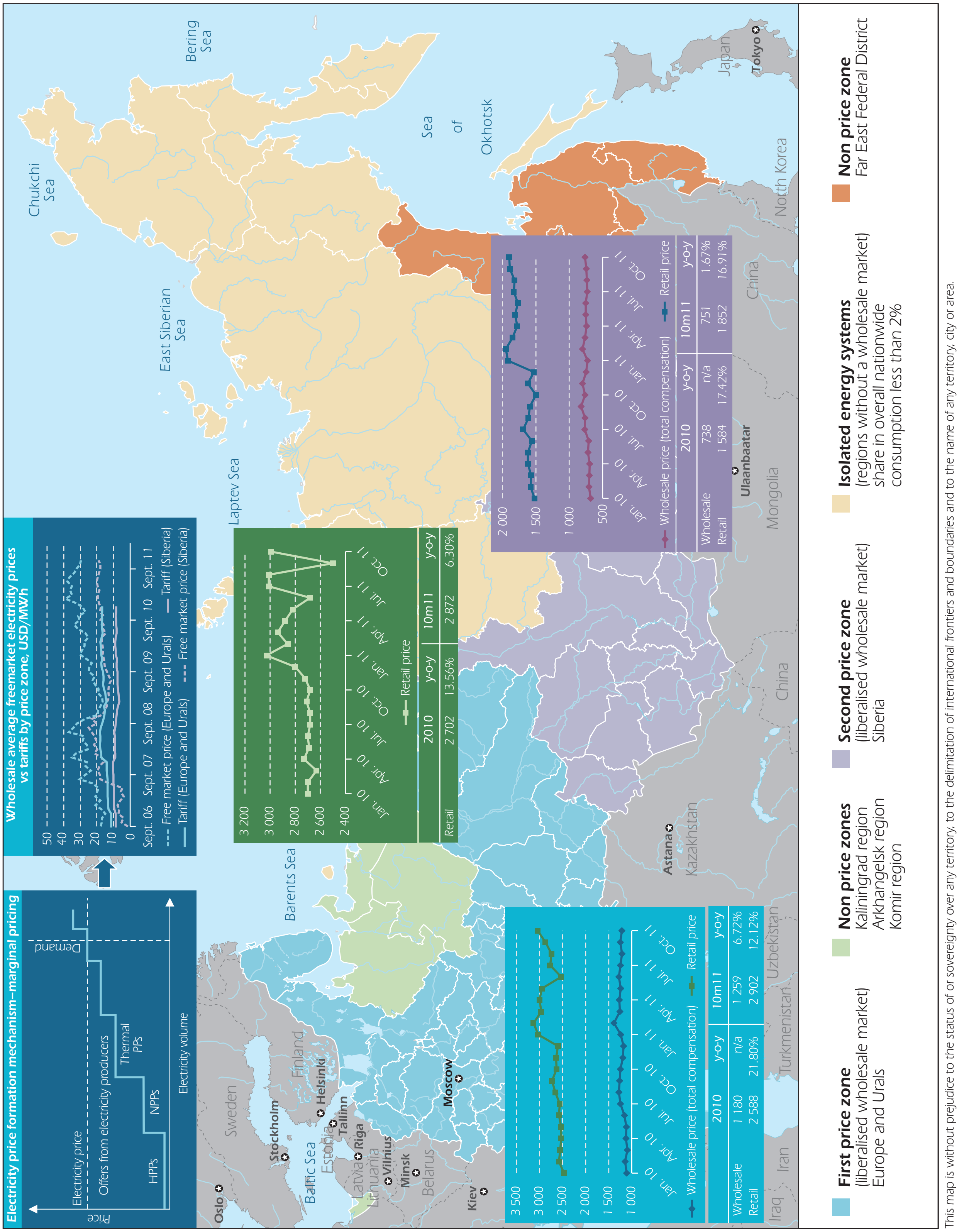
Figure 8.11 Average wholesale electricity price, 2007-12 (RUB/MWh)



Note: RUB/MWh = Russian roubles per megawatt hour.

Sources: ATS; Sberbank Investment Research (2013).

Figure 8.12 Wholesale electricity price zones (RUB)



Note: HPP = hydro power plant; 10m11 = ten first months of 2011.

Source: Sberbank Investment Research (2013), *Russia Utilities Atlas*, Moscow.

The wholesale capacity market

The Russian capacity market is composed of two capacity elements: the competitive capacity selection, which ensures revenues mainly for existing capacity, and the capacity mechanism, which is an out-of-market payment for new capacity included in the preselected list.

On the basis of annual competitive capacity selection, the so-called KOM (competitive selection of capacity) procedure, the SO selects existing capacity in each free-flow area (FFA) to cover the adequacy needs calculated per zone. The price cap applied is too low to encourage selection of new capacity. Installations are required to provide reserve capacity in addition to their monthly peak load. The installations selected are remunerated with a capacity price for every FFA that is not a marginal price. During the annual auctions, almost all capacity is selected and installations are required to be ready to produce the amount of electricity for the capacity sold. The capacity market penalises unavailability.

Capacity prices are regulated in the areas where there is market concentration. The capacity market is highly fragmented in many FFAs, with regulated price caps in most of them. Today, the capacity zones are either too small or too large, (see Figure 8.13), hence competition is limited and price caps apply in most zones.

In 2013, the FAS formed 23 FFAs. This is a reduction from 27 in 2012 and 29 capacity zones in 2011, following the merger of capacity zones into larger ones. In 18 zones, there are regulated price caps, while five zones are free zones where the KOM results determine the capacity price (Centre, Urals, Siberia, Volga, Vyatka). Commendably, FAS continues the process of capacity zone mergers to larger zones. In 2014, capacity zones will come down to 21, with 16 zones remaining under price caps.

Competitive capacity selections for 2012 were held in December 2011. In 24 FFAs out of 27 the price cap was established, and in all of the 24 the capacity price reached its maximum: in FFAs of the first price zone, this was RUB 118 125 per megawatt per month (RUB/MW/month) (EUR 2 747 per megawatt per month [EUR/MW/month]); in FFAs of the second price zone, it was RUB 126 367/MW/month (EUR 2 938/MW/month). In FFAs without price caps, the following capacity prices were formed: FFA Siberia, RUB 146 787/MW/month or EUR 3 508/MW/month; FFA Urals, RUB 118 118/MW/month or EUR 2 823/MW/month; FFA Centre, RUB 118 100/MW/month or EUR 2 822/MW/month.[20]

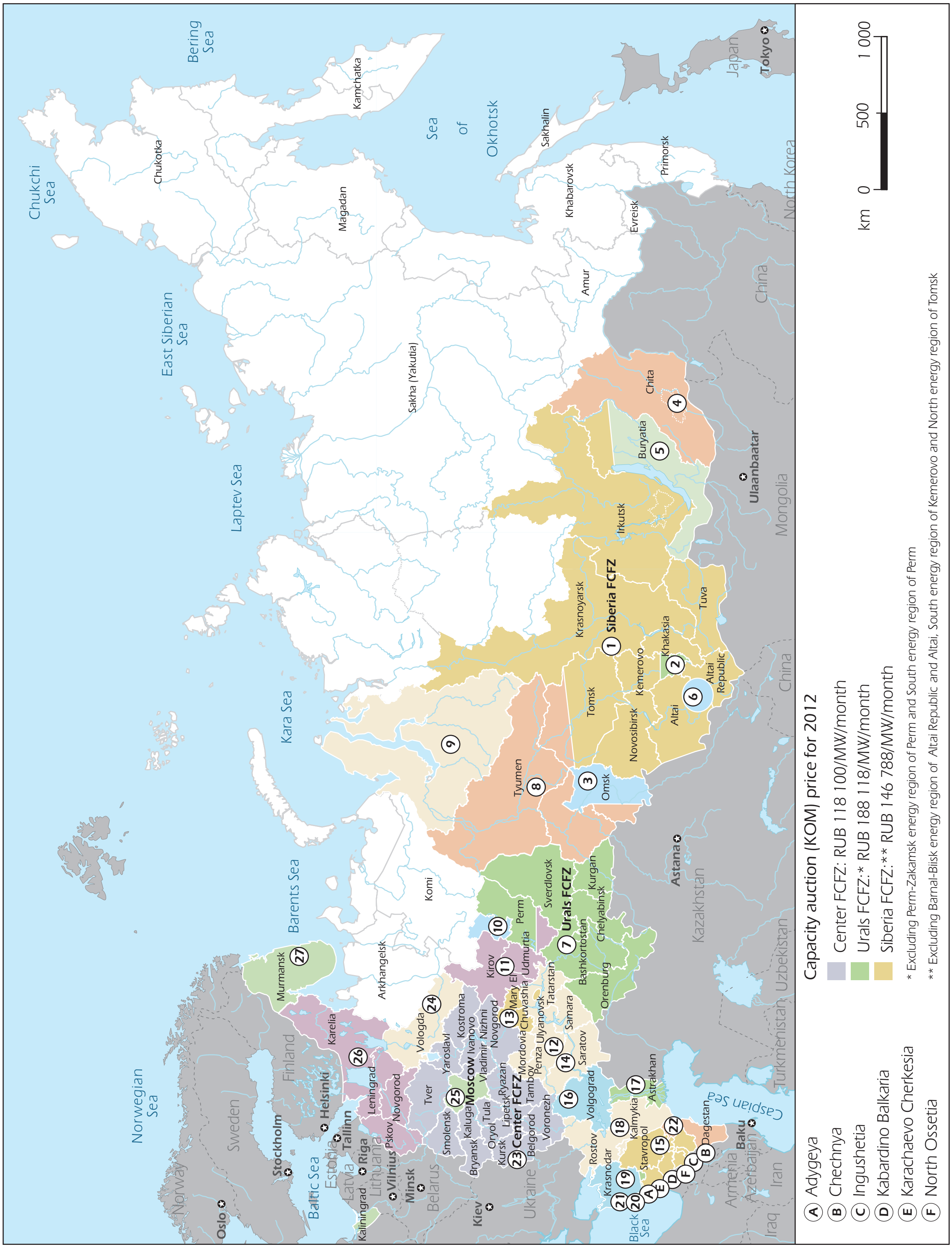
As part of the transition, it was planned to introduce auctions with a longer term, three- to four-year horizon. In practice, auctions have remained annual ones. This is explained by the inability of the SO to forecast future capacity needed to keep up with market and demand developments.

In addition, there is a capacity supply agreement for new capacity, the so-called DPM. The DPM mechanism was introduced in 2007 on the basis of a closed and fixed list of projects which were originally agreed as mandatory investment plans between the government and the generator during the privatisation process. The remuneration is based on an obligatory power purchase agreement (PPA) with all consumers at a regulated price for the capacity, with the energy price being set by the DAM.

By 2020, more than 40% of the capacity will be regulated through PPAs for new capacity and regulated payments for existing plants. Generators have no need to hedge against capacity changes, as all capacity is remunerated.

20. Inter RAO; ATS (2013).

Figure 8.13 The 27 capacity market zones



This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

Note: FCFZ = free capacity flow zone.

Source: Sberbank Investment Research (2013), *Russia Utilities Atlas*, Moscow.

While the capacity market provides for stable revenues for generators, it does not allow for dynamic pricing or peak capacity remuneration or demand-reduction bids. The current capacity market has not delivered the renovation of old co-generation plants, which cannot be shut down, as the government requires the operators to keep the plant for two to three years.

The annual capacity payment at present is focused on the short term and does not give a long-term signal, and the regulated price caps in most zones apply only to existing plants. Price caps distort the capacity market, as most prices will tend towards the cap. Longer-term capacity auctions are key, while retroactive changes to the DPM contracts can undermine investors' confidence in the delivery of new investments.

While Russia benefits from a nodal system, the nodal information is managed by the SO and ATS, but not used in a transparent way by other market participants, including the network companies and the generators, who do not have information on lack of capacity or network congestions. Given that the Russian model has separated system and grid operation, it would benefit from greater co-ordination among the different infrastructure operators on network planning and grid development based on the nodal system. Thanks to nodal pricing, investments in network expansion to lift congestion and generation to reinforce adequacy should be visible on the basis of locational signals to ensure investments at good times and locations.

The balancing market

Russia has an elaborate physical balancing market for each of the 8 400 nodes of the energy system, which reacts to deviations on the same-day, even hourly, basis. The balancing market is operated by the SO. The balancing prices are based on the price bids submitted in the DAM. The balancing market design does not include demand-side participation, as the metering and demand aggregators have not been developed.

System operation

Dispatch by the SO is effective, but constrained by a number of technical, safety and geographical limitations. Dispatch is prioritised in such a way that the order of dispatch brings in first nuclear plants; then co-generation plants for heat production, associated gas and hydropower; and third, electricity under bilateral contracts. These must-run generators limit the competitive bidding on the wholesale energy market. This is not a unique feature of the Russian system operation; in many IEA jurisdictions, renewable energies and nuclear are dispatched in priority order, too.

The SO selects some ancillary services, namely normative primary frequency control, automatic secondary load/frequency control and voltage control without active power generation (emergency reserves or procurement of system reserves), on the basis of competitive annual tenders. Ancillary services are paid by the SO, these expenses being covered in the frame of SO-regulated tariffs.

RETAIL MARKET

The Russian government set out plans for the retail market to be fully liberalised by 2015. Today, prices remain regulated. Retail market participants are power supply and sales companies, including GSs and retail generating companies (with no more than 25 GW installed capacity), retail consumers (public housing utilities) and end users. Network companies purchase electricity (capacity) in the retail markets to compensate for their electricity losses and may act as consumers as well.

In most regions, there is currently no choice for consumers with regard to their suppliers, which hinders competition for quality, price and service. There is no significant competition in the end-user supply, as the GS has been given the universal service obligation and enjoys a monopoly position (supplier of last resort) in many regions for reasons of network topology and geographical characteristics. On the basis of an established price formula, the GS has to purchase electricity on the wholesale market in his region and passes the wholesale market price on to the consumer. Within the (regulated) tariff limits set by the FTS, the Regional Energy Commissions under the authority of the federal subjects of Russia the end-user tariffs.

Only in the case of the GS losing its status, for instance in case of insolvency, may end users choose a new supplier. The change of the GS is carried out by the Ministry of Energy of the Russian Federation on the basis of competitive auctions for all regions, except for the isolated energy systems and the non-price zones, where the regional subjects of Russia decide. In case of insolvency, MRSKs are authorised to act as GSs for a maximum of one year; after that, competitive auctions are to take place.

There are few independent suppliers that serve large industry customers or GSs. The independent suppliers may enter into a contract with a customer on any terms. The majority of consumers cannot enter into bilateral contracts with wholesale market generators.

In recent years, the GS model showed shortcomings, amid rising non-payment of GSs that resulted in an accumulated debt of around RUB 50 billion in the wholesale market. In 2013, the government introduced a number of measures to fight non-payment and improve the sustainability of the distribution/retail business.

On 1 July 2013, the government put in place the obligation for GS to have financial guarantees when authorising participation on the wholesale market. The Market Council banned 13 suppliers (whose accumulated debt stood at RUB 29 billion) from participating to the wholesale market; the Ministry of Energy of the Russian Federation subsequently cancelled the GS supply licences of these companies. Criminal investigations were carried out into the financing of the GS.

The Ministry of Energy of the Russian Federation launched tenders in 11 regions for new suppliers of last resort to replace the indebted incumbents. By the end of 2013, applications for suppliers from all regions (Gazprom, Inter RAO, KES Holding, TNS Energo, Rosatom) were received with companies being ready to partially take on board the debt of the incumbent supplier, but only to an extent of 20% of the accumulated debt.

International best practice confirms the benefits of a competitive selection of suppliers of last resort. In the context of the current financial restructuring of the Russian retail market, the successful auctions of GSs can be a useful instrument; this also applies from a competition point of view. Rather than relying on ad hoc measures, however, the government should clarify in the retail market framework the status and conditions, as well as geographical and customer scope, of the supplier of last resort and default supplier (e.g. if the distribution SO can act as supplier of last resort), in case the single supplier can no longer supply (insolvency or for technical reasons).

Experience in New Zealand and European markets, notably Ireland, shows that the deployment of smart meters can be facilitated by establishing an independent data management system, effective switching procedures, strong regulatory oversight and more dynamic pricing for innovative retail product development. The distribution unbundling and collective consumer switching, as for instance used in the Netherlands, could be one option to increase competition and consumer choice in the retail market.

Box 8.1 Empowering consumer choice in electricity markets

International experience suggests that the key elements of an effective and integrated approach would include:

- increasing customer exposure to real-time pricing, with protection of vulnerable consumers addressed through targeted transfers that do not unduly distort efficient price formation
- a competitive, dynamic retail market to encourage the development of innovative products and services that can harness demand response effectively and at least cost
- ready access to detailed, real-time customer information, while ensuring privacy, to help stimulate competition, facilitate competitive entry, support the emergence of innovative business responses, and improve the quality of customer choice
- a knowledgeable and well-informed customer base that has the capability and opportunity to take full advantage of available choices
- market processes for contracting, switching and billing that are as simple and seamless as possible to keep transaction costs to a minimum
- legal and regulatory governance frameworks that reduce uncertainty; establish clearly specified rights, responsibilities and obligations on contracting parties; promote greater harmonisation of standards and functionality specifications; and maximise scope for participation among potential service providers and customers
- enabling technologies that provide cost-effective, real-time metering information, verification and control capability to support the introduction of real-time pricing, the development of a wider range of innovative demand response products, and more effective customer choice.

Source: IEA (2011), "Empowering Customer Choice in Electricity Markets", www.iea.org/publications/freepublications/publication/Empower.pdf.

Full market opening on the retail market side will need to be complemented by the introduction of GSs to most vulnerable consumer groups. The government announced the introduction of a social norm, the guaranteed minimum electricity consumption for households under a socially supported tariff, as of 1 July 2014. While this is a step in the right direction, it seems that the coverage is very large. The norm is expected to cover 70% of the population, while 30% would be exposed to higher prices. In seven regions, the government already operated pilot projects in 2013.

ELECTRICITY PRICES AND TAXES

In 2012 (see Figure 8.14), household electricity prices in Russia were low in comparison to member countries of the Organisation for Economic Co-operation and Development

(OECD). Moreover, contrarily to Russia, in most OECD member countries, household prices are consistently higher than industry prices, a fact which reveals the level of cross-subsidisation between industry and households in Russia.

Amid slower energy demand growth in Russia, competitive pressure from the United States and Asian markets is on the rise, and Russian industry has to directly compete with other markets, such as the United States, which might incentivise large industry to relocate. Competitive fuel and electricity prices for Russian industry have become a key concern.

In 2011, the end-user electricity bill (see Figure 8.15) was composed of the cost of wholesale or regional generation (energy and capacity, including for renewable energies, 60%), tariffs for distribution (28%) and transmission (5%), and cost of infrastructure operators' services.

The share of transmission cost in the end-user electricity price rose to around 8% to 9% in 2013. The electricity retail bill has been increasing by 15% to 20% over time, mainly as a result of the rising distribution network cost, which amounts to around 30% of the final retail price (see Figure 8.15). Depending on the region, supply cost on the wholesale market can be lower, and network tariffs reach over 60%, reflecting higher losses, according to data by the Market Council.

THE LAST MILE

Over the period 2001-11, the government continuously raised retail tariffs to phase out cross-subsidies and render prices cost-reflective. The Ministry of Economic Development of the Russian Federation has the declared objective of converging industry and household prices by 2020. While in the past decade, Russia saw a growth in industry and household electricity prices (see Figure 8.14), a large gap remains between end-user prices for industry and residential users.

This is linked to substantial cross-subsidisation. The tariff structure in Russia has cross-subsidisation between network users, mainly between large industry, which is connected to the transmission grid, and small and medium-sized enterprises and households, connected to the distribution line. Up to now, industry connected to the transmission networks of FSK paid a contribution to the distribution grid cost (MRSKs) via last-mile contracts. In addition, there is an increasing trend for companies to build their own generation plant and thus get disconnected from the grid and the last-mile contracts.

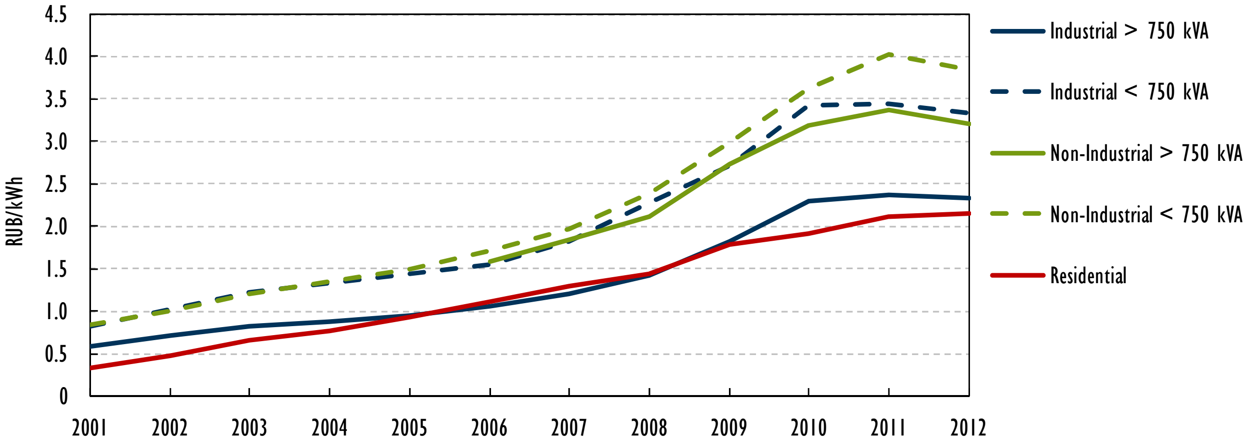
According to the grid strategy up to 2030, new government measures in the network segment are focused on raising the efficiency of network operators and gradually phasing out cross-subsidisation in the distribution tariff by 2030. By the end of 2013, Russia adopted a new scheme for the distribution of network costs (law on the last mile) with a view to cut and phase out cross-subsidisation totalling RUB 232 billion to RUB 50 billion by 2023 and keep it stable until 2030. The share of electricity network tariff in the total end-user price should not go beyond 40%. The elimination of the last mile will gradually bring down cross-subsidisation by rendering investments of network operators efficient, by increasing the contribution from large industry consumers and end consumers to the total distribution cost.

Under the new legislation, large industrial electricity consumers are allowed to connect directly to the FSK from 2014 onwards and cancel their last-mile contributions to the MRSKs. The last-mile contracts were to end as of 1 January 2014 but be gradually phased out over 3 to 15 years in 19 remaining regions. Last-mile contracts are extended until 2025 in four of these regions (Buryatia, Trans-Baikal Territory, Amur Region and the

Jewish Autonomous Region) and by three or five years in 15 regions. The new tariff structure consists of a special transmission tariff (FSK, voltage level VN1) and an average cross-subsidy rate in the region. In all 19 regions, if MRSKs cannot manage cost cuts sufficiently, up to 50% of lost grid revenue could be covered by the federal budget.

Amid slower economic growth, the government decided to curtail tariff growth for natural monopolies in line with inflation. In 2013, the Ministry of Economic Development of the Russian Federation decided to freeze the natural monopoly tariffs (gas, water, electricity, railways) for one year in 2014, instead of planned increases in line with inflation (consumer price index indexation). Rosseti announced that the new tariff freeze will translate into a cut of OPEX by 5% in 2014 and 15% by 2017. This will mean a 30% CAPEX reduction with the cancellation of planned investment programmes of the Russian Grids Holding to RUB 155 billion per year (planned investment was at RUB 161.8 billion in 2014, RUB 156.6 billion in 2015 and RUB 161 billion in 2016).

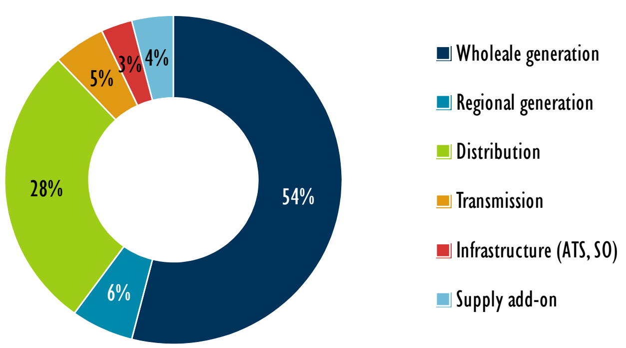
Figure 8.14 Trends in end-user electricity prices, 2001-12



Note: RUB/kWh = Russian roubles per kilowatt hour; kVA = kilovolt-ampere.

Sources: IEA (2013), *Russian Electricity Reform Update*, OECD/IEA, Paris, www.iea.org/publications/insights/RussianElectricityReform2013Update_FINAL_WEB.pdf; APBE, Materials and information accessible in 2013 at: www.e-apbe.ru.

Figure 8.15 The electricity bill, 2011

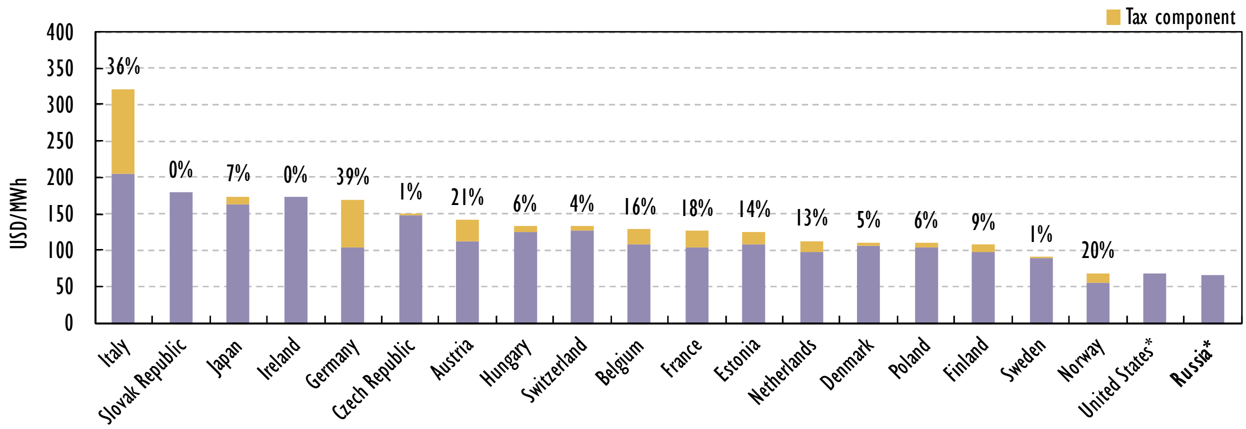


Source: APBE, Materials and information accessible in 2013 at: www.e-apbe.ru.

Commendably, the government took action to increase efficiency of network operators. Tariff reductions and CAPEX cuts to mitigate end-user price increases and operator's investment expansion, however, risk undermining investor confidence in the RAB regulation and the financial stability of MRSKs. In turn, this might undermine the grid strategy, at a time when privatisation of distribution networks and grid investment are needed more than ever. Any tariff freeze is likely to result in further costs to the federal budget needed to raise the dividend payout ratios of the regional grid operators to satisfy investors or to compensate for lost revenues from last-mile in some cases.

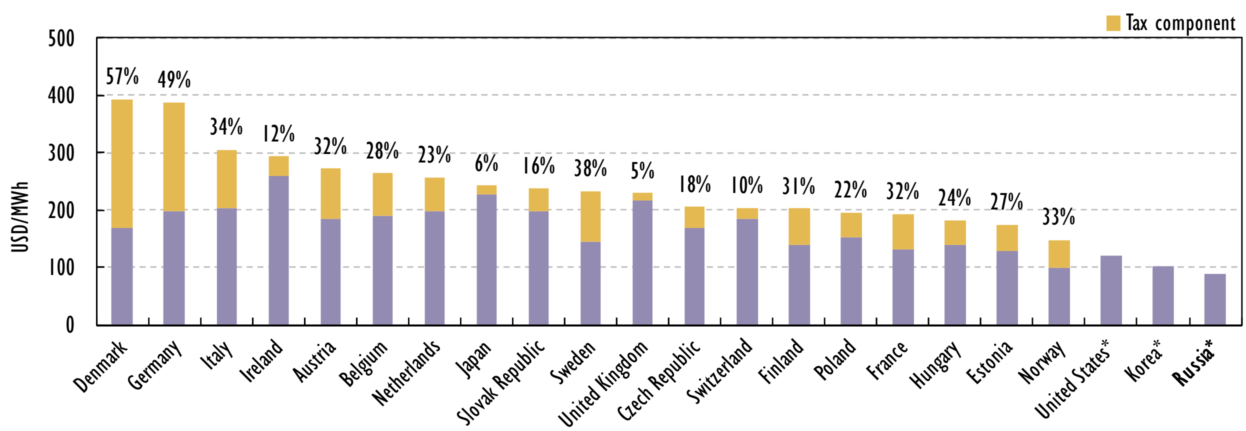
Figure 8.16 Electricity prices in Russian and IEA member countries, 2013

Industry



Note: data not available for Australia, Canada, Greece, the Republic of Korea, Luxembourg, New Zealand, Portugal, Spain, Turkey and the United Kingdom.

Households



Note: data not available for Australia, Canada, Greece, Luxembourg, New Zealand, Portugal, Spain and Turkey.

* Tax information not available.

Source: IEA (2013), *Energy Prices and Taxes*, OECD/IEA, Paris.

ASSESSMENT

Over the past six years, Russia has taken significant steps to reform the power sector. The successful implementation of further reforms will be a key driver of the overall modernisation, competitiveness, efficiency and sustainability of the Russian economy. The IEA has been providing advice over time in this reform process and this chapter builds upon the comprehensive analysis on the reforms and detailed recommendations carried out by an IEA study presented to Russian stakeholders at a joint IEA/Market Council conference in December 2012 in Moscow and published in April 2013.[21]

The pace and results of the reforms are impressive and include the USD 30 billion privatisation of the electricity generation assets of RAO UES, which attracted foreign investment; the liberalisation of the wholesale market, including the creation of a day-ahead spot market and capacity market; the unbundling of generation/supply and network activities; the introduction of RAB regulation; and the recent launch of an ancillary services market and financial guarantees at the wholesale level. Russia has also created an institutional framework for the sector.

In 2013, the reform process reached a crucial point: To successfully complete the modernisation, Russia will need to consolidate the electricity market reforms in the new economic context of flat electricity demand growth and complete the institutional and governance structure for the wholesale and retail markets. The government should set out milestones for achieving the long-term objective of fully functioning and competitive wholesale and retail markets, while in the medium-term period ensuring predictable, non-discriminatory and transparent market rules for securing the urgently needed investment in renovation of ageing infrastructure and decarbonisation.

All consumers need to be taken along the reform process with better information and choice, while keeping affordable supplies, in particular to vulnerable consumer groups.

WHOLESALE ENERGY AND CAPACITY MARKETS

The creation of a DAM, covering 95% of the supply in two price zones, is a remarkable achievement; however, the DAM is only partly competitive. Two-thirds of the total generation (nuclear, hydro and co-generation in winter periods) are on priority dispatch or as must-run generators, not actively participating to the market and, as they receive the system marginal price, thus not actively participating in the competition on the DAM.[22] GSs purchase electricity on the DAM at regulated prices to supply households. Outside of the two price zones, vast remote areas in the Far East and North do not have a wholesale market and have regulated tariffs.

The IEA encourages the government to continue its reforms towards the competitive wholesale electricity market. This requires cost-reflective prices along the value chain as basis for efficient price formation and investment, a liquid, deep and transparent financial market for efficient risk management, and access to capital, as well as full wholesale transparency ensured by the provision of timely and accurate information to all market participants. The completion of the liberalisation and reform process is fundamental if Russia wants to secure private investment in the renewal of the 65% of current inefficient generation capacity. The current regulatory uncertainty about the future design of the Russian OREM should be reduced by providing a clear outline for the reforms.

Lifting restrictions on the decommissioning of old plants is a key issue for the modernisation reform. Currently, modernisation of the old co-generation plants is not possible due to a number of constraints in the system operation and grid topology. A decommissioning policy could help to incentivise the phase-out of inefficient capacity, including emissions

21. IEA (2013), *Russian Electricity Reform 2013 Update*, OECD/IEA, Paris, www.iea.org/publications/insights/name,37170,en.html.

22. *Ibid.*

performance standards. This would provide signals for network investments, too, if carried out hand in hand with the necessary grid investment strategy.

The Russian electricity market lacks transparency, and some basic market information is unavailable for market participants, although efforts are being undertaken to improve this. The Market Council, which brings together all actors, could provide for such an information platform. Market transparency will allow market participants to take decisions based on prices and locational signals from the nodal pricing.

On the wholesale energy market, *ex post* control and price intervention remain high. The high share of regulated segments of the market, including the capacity market, require frequent government intervention in price formation, which undermines the price signals and trust of market participants for those segments which are competitive business. Cross-ownership (gas, electricity) and horizontal re-integration into large state-owned companies hold the potential for collusion and abuse of dominant position. While the supervision of wholesale markets is an essential task for government and market supervisory bodies, competition policy and wholesale market regulation should not be used to justify frequent price intervention in competitive market segments. The government should consistently separate anti-monopoly and network monopoly regulation for the Russian energy market, with a view to remedy competition concerns for natural monopolies *ex ante* (via FTS Russia) and thus reduce the need for *ex post* competition and price intervention by the Market Council and FAS. Where markets have become competitive, notably in the wholesale market areas, regulation should be phased out. At the same time, the strengthening of the independent regulatory assessment will be essential for the successful completion of the RAB regulation and tariff approval.

The capacity market remains highly regulated with price caps in most zones, and it remains fragmented with a high number of trading zones. New capacity is limited to bilateral contracts between incumbent generators and Russia (DPM). These are costly and inflexible for new entrants and the changing economic and supply/demand adequacy needs of the market. The DPM was designed as a transitional arrangement to secure incremental investment by 2018. While Russia decided on a capacity market, it has to keep in mind that regulated capacity mechanisms reduce the incentives and signals from locational pricing, based on the nodal system. Current short-term capacity auctions do not incentivise costly investment, necessary for the urgent modernisation and renovation of existing capacity.

NETWORKS

Russia only recently introduced RAB regulation of electricity transmission and distribution networks. Network tariffs are on the rise and have reached a share of 40% to 80% of the retail price, depending on the region.

The vesting of the assets of the electricity transmission and distribution grids (FSK and the 11 interregional MRSKs) into the Russian Grids Company aims to contribute to greater efficiency and the delivery of the ambitious investment programme. The recent efforts by the government to increase efficiency of network planning, cost benchmarking and access regulation under the RAB model are commendable.

Given the need for modernisation of the Russian electricity grid as outlined in the grid strategy, the IEA considers it of outmost importance to enhance the economic assessments of the asset base and the benchmarking of cost-efficiency of the network operation, in the light of the grid renewal and expansion needs, which include management of losses, quality of supply and energy efficiency gains in the networks.

The Regional Energy Commissions, supervising the cost-efficiency of distribution networks, equally need adequate resourcing and expertise, and good co-operation with FTS Russia. In addition, the monitoring and enforcement of quality of supply will need to be established within the RAB regulation.

The IEA welcomes the government commitment to reduce the connection procedures to five and ensure connections by 2020 within 40 days, and should focus on rapidly taking steps to remove the unnecessary delays for connection to the electricity network. The roadmap and targets aiming at cutting delays in grid connection are commendable. The financial liability of the grid company for the failure to connect could improve the connection discipline and cut the delays in grid connection. First results show progress. Russia has considerably improved its rank (from 188 in 2013 to 117 in 2014) in the World Bank Doing Business benchmark on electricity connections, which is remarkable.

The Russian Grids Company, in charge of carrying out network investment, and the SO, responsible for the system operation, dispatch, supply/demand adequacy, calculating the capacity of interconnectors and managing electricity flows, will need to closely co-operate to ensure efficient network investment in line with generation adequacy needs. There are benefits from enlarging the generation and network adequacy assessments beyond one price zone, such as to identify the economic benefits from lifting congestions among the regional grids and fostering regional market integration across the price zones. Such a co-ordinated generation and network adequacy assessment is also crucial for encouraging investment into the modernisation and decommissioning of old generation assets.

Retroactive intervention in the essential investment parameters during the regulatory period by freezing tariffs or cutting capital investment budgets can deteriorate investors' capacity to maintain investment plans, reducing the investment certainty and impacting the business climate in Russia. Network planning should be complemented by cost-benefit analysis for new investment, a transparent public consultation process involving all stakeholders. This consultation process should take into account public acceptance, energy efficiency and market integration needs, reduction of losses, and the smart management of the grid, as well as demand-side responses in the reserve and balancing markets.

Inter RAO operates all export/import operations and contracts at the cross-border delivery points, leading to a *de facto* monopoly on exports/imports (with a market share of 97%). To foster international trade, the IEA encourages the Russian government to liberalise international trade in the longer term.

REFORMING THE ELECTRICITY MARKET

The government proposed a first draft of a new electricity market model in September 2013. The objective of the new model is to facilitate investment in the electricity generation and network sectors. The reform was postponed to 2014 and new legislation is to be presented in mid-2014 and launched in 2015, after completion of the heat market reform programme. The current stalemate in the electricity market reforms risks adding regulatory uncertainty for investors who require a 20-year investment outlook.

In the heat market, the government is to introduce RAB regulation for transportation and generation with new tariff regulations for co-generation units, possibly based on the value of the alternative boiler. RAB regulation is to become the default regulatory model and its scope expanded to more MRSKs. This shall abolish the current cross-subsidisation between heat and electricity and incentivise renewal.

The new market model, as currently discussed, aims to increase the share of bilateral contracts and to merge energy and capacity markets under one contract with one price. It is planned to phase out price caps (but retain implicit price caps) and regulated contracts. A secondary market for the trading of capacity is suggested to allow the settlement of imbalances generated in the capacity market (instead of penalties). As an alternative, the reform of the capacity market (KOM procedure) is under discussion. The main goal is to create a more liquid and longer-term market through an effective application of long-term capacity auctions (four years and more). As a third model, a new DPM mechanism with focus on the renovation and modernisation of the generation fleet, including gas, coal and nuclear, is considered.

Partial liberalisation of the retail market, in particular for industry clients, is an intermediary step to encourage new players to enter the wholesale market and thus encourage competition at supply level. On the retail market side, it is proposed to allow retail consumers to enter into direct contracts on the wholesale market. A social consumption norm is to be adopted in 2014 to ensure secure and affordable supplies to households. The complete phase-out of regulated prices by 2015 was envisaged, but besides tariff cuts and network regulation, concrete measures have not been adopted.

Given the lack of clarity on the nature and timing of the reforms, investors currently are concerned by the potential risk of re-regulation and reversal of the reform process. There is considerable uncertainty over the future market design, which undermines market participants' visibility and need for a stable and transparent regulatory framework. The government should set out a timeline with clear actions and milestones for the completion of the reform process for both the retail and the wholesale markets.

During the transition to a wholesale energy-only market, a capacity market may be needed, but this needs to be carefully assessed on the basis of a sound supply/demand adequacy analysis. The reform process should be complemented by an integrated assessment of grid and generation adequacy, improved system operation with the reduction of must-run operators, transparent investment planning incentives from nodal pricing to encourage modernisation and renovation at the right time and location, more flexible and transparent unit commitment, under the inclusion of hydro and nuclear power, and demand participation in the balancing markets.

The IEA encourages the government to implement its plans to replace annual capacity auctions with a four-year forward capacity auction and merge the capacity trading zones into larger ones, encouraging a competitive capacity market that includes existing capacity in need of renovation. This should be complemented by a clear decommissioning policy, incentivising the replacement of inefficient old plants. The modernisation of electricity infrastructure will contribute to the long-term affordability of electricity supply. Experience in other jurisdictions around the world, including the United States, Canada and China (see Chapter "Climate Change"), indicates that emissions performance standards, setting limits to all combustion plants, is an essential element of any decommissioning policy. Next to phasing out inefficient fossil fuel power plants, such a policy will incentivise investment in new low-carbon generation, including renewable energy capacities (see Chapter "Renewable Energy").

Given the modernisation challenge, it could be necessary to maintain payments to existing capacity through competitive capacity auctions during the time of modernisation. Any new DPM, if chosen, would however need to be non-discriminatory, to provide for new entrants and to be based on competitive auctions rather than a list of preestablished projects. In this sense, the competitive selection process seems to be an adequate default selection for both old and new capacities and could provide for specific modernisation selection bids.

RETAIL MARKETS AND CONSUMERS

Retail market rules were only recently adopted in May 2012. Commendably, the government is creating a framework which defines the roles and responsibilities of each of the market participants. The market structure design is at an early stage, and the focus of the reforms should be on the creation of a more innovative and consumer-oriented market.

The retail market is far from being liberalised, as prices to final household consumers remain regulated by regional energy regulatory authorities within the limits determined by the tariff caps. Only industrial and commercial users have retail choice and can purchase electricity on the wholesale market. This cross-subsidisation between industry and households is a barrier to the creation of a competitive retail market. The government acknowledged the need to phase out cross-subsidies (last-mile contracts) and increased tariffs towards cost recovery over the past years.

The introduction of GSs, supplying electricity on the basis of a universal service obligation to final consumers, led to the fast growth of small regional supply monopolies. The lack of switching procedures following from the *de facto* local monopoly limits consumer choice for quality and price. The government may wish to consider further unbundling of supply and grid operations, in order to guarantee both efficient grid operation and free choice of suppliers. Experience in other jurisdictions suggests that such practice can be successful, provided that the wholesale market is sufficiently competitive with a large number of players.

The general goal to move towards a fully competitive retail market should become the main focus of the new electricity market model. There is a need for clarity on the legal status of distribution and supply in the regions, the roll-out of meters, and the collection of the metering information by an independent retail infrastructure provider.

Retail market reforms would also need to review the status of the suppliers of last resort as well as arrangements for disconnections for non-payment. The government should proceed with retail market reform and complement it with a greater consumer focus, in the light of rising tariffs and non-payment. Encouraging new entrants through competitive auctions and consumer switching will be an important first step. Ensuring transparent consumer information, including price comparison tools and quality of supply, will support informed decisions and consumer choice.

The IEA commends the government for its efforts to reduce cross-subsidisation by 2030, including the abolishment of the last-mile and network cost restructuring. The pace and magnitude of the transition to cost-reflective prices, leading to price hikes at retail level, can be mitigated by using energy efficiency gains on the supply and demand side, through efficient refurbishment, network planning and operation. While the introduction of a social consumption norm for 70% of the population is a step in the right direction, the government should provide for the protection of the truly vulnerable consumers through social law. Such an approach reduces cross-subsidisation over time without jeopardising competitive, secure and affordable electricity supplies to households and industry.

By introducing financial guarantees, the government also solved the problem with non-payment by suppliers that led to the accumulation of a RUB 50 billion debt at the wholesale market. Commendably, the government tackled the matter of non-payment on the wholesale market. Further measures will be needed to improve the payment discipline also in the retail market. The financial guarantee scheme and revocation of licences could be extended to retail market participants, with stricter supervision of their financial viability, and by providing for disconnection in case of systemic non-payment.

The recent retail tariff freeze sends a negative signal that might discourage investment. With a view to increasing competitiveness of Russian industry, the government should place the focus on measures to cut the underlying production cost and increase efficiencies rather than directly cutting final electricity and gas tariffs. Phasing out regulated end-user prices and separating them from network tariffs will also allow increasing network efficiency while safeguarding suppliers' and investors' investments.

On the retail side, encouraging energy efficiency and demand response should be the primary steps before intervening in retail price formation. Making energy consumers free to choose their supplier encourages competition among retail suppliers and makes consumers responsible for their consumption.

Regulated end-user prices distort market functioning and jeopardise security and quality of supply to consumers.[23] As the conditions for the supplier of last resort improve and the protection of vulnerable consumers under the social allowances framework is secured, the phase-out of regulation can be considered. The government should analyse which areas and customer groups would benefit from the phase-out of regulated prices over time with a view to further liberalise the retail market and ensure sustainable retail business and industrial development. A roadmap for the phase-out of regulated prices should be established.

RECOMMENDATIONS

The government of the Russian Federation should:

- ☐ *Set out a clear timetable for achieving the long-term objective of fully liberalised energy wholesale and competitive retail markets to deliver on the modernisation agenda.*
- ☐ *Develop a competitive capacity market to reward existing and new generation investment after the end of the capacity contracts (DPM) based on a competitive capacity selection to allow for transparency, non-discrimination and flexibility to adjust to different economic realities in line with supply/demand adequacy needs.*
- ☐ *Complement the regulatory reforms of the OREM with a decommissioning policy, which should include emissions performance standards, to support the phase-out of inefficient fossil fuel power plants over time*
- ☐ *Strengthen the independence from the government, co-ordination, effective resourcing and staffing of the regulatory authorities at federal and regional levels to foster their ability to meet the needs of non-discriminatory network access, economic assessments in dynamic energy markets and stronger consumer focus. In this context, ensure*

23. An overview on how retail markets are organised in different EU member states is provided in the CEER Status Review of Customer and Retail Market Provisions from the 3rd Package as of 1 January 2012, 7 November 2012.

public consultation, consumer information and transparency of the regulatory process, economic assessment, and international co-operation.

- *Encourage transparency of nodal system information to all market players with a view to fostering efficient and transparent network planning at regional and federal levels. Support the assessment of network congestions, scenarios of future power investment, costs and benefits, as well as supply/demand adequacy through co-ordination between the SO and Russian Grids Companies and the market participants.*
- *Encourage new entry and supplier switching at retail market level for greater consumer choice complemented by a roadmap towards cost-reflective tariffs to end cross-subsidies while protecting vulnerable consumers through social policy.*

9. RENEWABLE ENERGY

Key data (2012)

Share of renewable energy: 3% of TPES and 15.8% of electricity generation

Hydro: 1.9% of TPES and 15.5% of electricity generation

Biofuels and waste: 1% of TPES and 0.3% of electricity generation

Other renewable energy: 0.1% of TPES

Target: 4.5% of electricity production from RES (excluding hydropower stations with a capacity larger than 25 MW) by 2020

Installed capacity: 2 300 MW including large hydro

OVERVIEW

Russia is endowed with a considerable potential for the development of large amounts of diverse renewable energy sources (RES) across the whole territory. The potential is particularly large for wind, biomass, small hydro, geothermal and solar, depending on the regions. This makes Russia a potential "green giant".[1] But RES remain largely undeveloped so far (with the exception of large hydro), which makes Russia strongly lagging behind member countries of the International Energy Agency (IEA), but also other countries such as Brazil, India, the People's Republic of China, Indonesia and South Africa, for example.

This potential and its economic and social benefits have been progressively acknowledged at the federal and regional levels. Since 2007, Russia has developed a comprehensive political and regulatory framework for renewables in the wholesale and retail markets. The fine-tuning of the framework and actual deployment have been very slow due to the large availability and share of fossil fuels used for heat and power generation, the concern about avoiding higher end-user electricity prices, and challenges from how to integrate renewables in the electricity system.

After an initial focus on a premium support scheme, Russia has introduced a capacity-based support scheme for the wholesale market which is in place in no other country. Key regulatory changes and improvements were adopted in 2012 and 2013 and there are continued legislative adjustments. Yet the 2009 target to achieve a 4.5% of electricity generation from RES (excluding hydro over 25 megawatts [MW]) by 2020 is highly unlikely to be achieved. However, Russia stands a good chance of achieving this target by 2030 if remaining regulatory uncertainties are addressed and obstacles are lifted. Regions also need to develop the necessary capabilities and leverage to foster the deployment of RES, especially in the retail market.

1. IFC Russia Renewable Energy Program (2011), *Renewable Energy Policy in Russia: Waking the Green Giant*, Washington D.C., www.ifc.org/wps/wcm/connect/region__ext_content/regions/europe+middle+east+and+north+africa/ifc+in+europe+and+central+asia/publications/renewable+energy+policy+in+russia+-+waking+the+green+giant (accessed 14 December 2013).

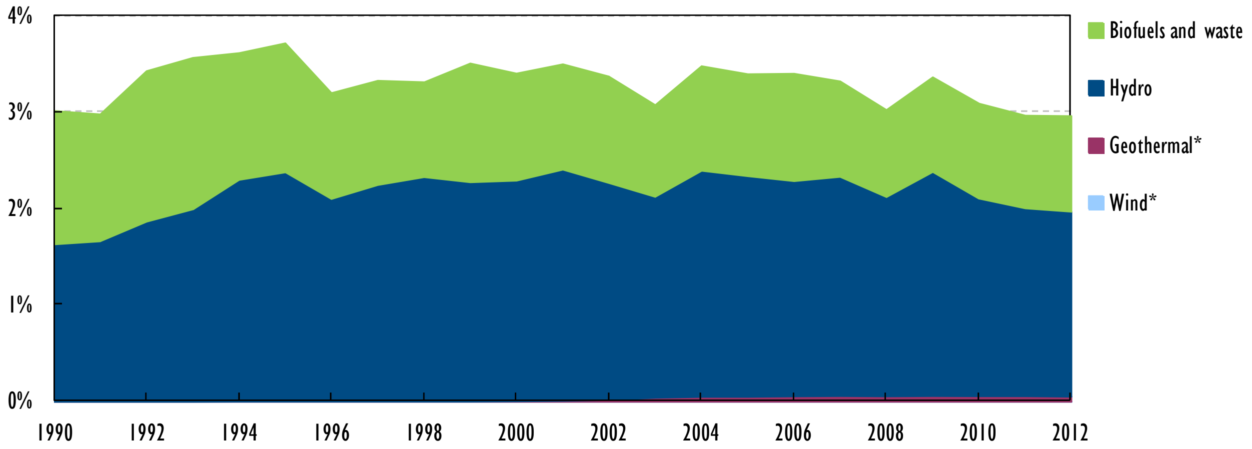
SUPPLY AND DEMAND

Renewable energy in Russia accounts for only about 3% of total primary energy supply (TPES), amounting to 22.1 million tonnes of oil-equivalent (Mtoe). Energy from renewable sources has experienced growth of 5.3% since 2002, while TPES has increased by 20%. Consequently, the share of renewables in TPES has fallen from 3.4% in 2002. This places Russia at one of the lowest rankings compared with IEA member countries for the share of renewables in the TPES (Figure 9.2).

Figure 9.1 demonstrates that large hydro is the main source of renewable energy in Russia, and accounts for 1.9% of TPES (14.3 Mtoe in 2012). Since 2002, the supply of energy from hydro has increased by 2.3%. Biofuels and waste account for 1% of TPES, and energy from this source has increased by 7.6% over the same period. The supply of geothermal energy has tripled over the past decade, but it still accounts for only around 0.1% of TPES.

Electricity generation from RES including large hydro amounted to 169.4 terawatt hours in 2012, which accounts for 15.8% of total generation. This share has declined from 18.6% in 2002, due to a slower growth in renewable energy compared with nuclear, gas and oil. Hydropower in 2012 represented 15.5% of electricity generation, while biofuels and waste accounted for 0.3%. Russia thus enjoys a medium ranking for renewable electricity generation compared with IEA member countries (Figure 9.3).

Figure 9.1 Renewable energy as a percentage of TPES, 1990-2012



Note: Data for 2012 are provisional.

* Negligible.

Source: IEA (2013), *Energy Statistics of Non-OECD Countries*, OECD/IEA, Paris.

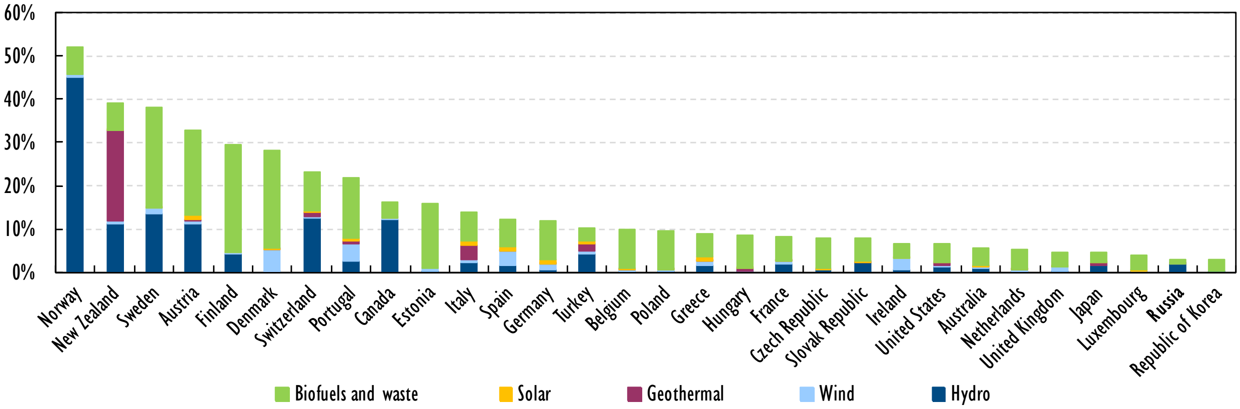
Large hydropower represents more than 20% of installed electricity production capacity, but the development of other types of renewable energy is still at embryonic stage. Electricity generation from RES (excluding large hydro) was close to 2.2 gigawatts (GW) and below 1% of total output in 2012.[2] These numbers mark no real improvement from 2000, when renewables accounted for 0.5% of total electricity generation.[3] In the heating sector, the

2. http://minenergo.gov.ru/upload/iblock/afc/afc90b96ec0fef29f2ededabb6a4a131.pdf.

3. IEA (2003), *Renewables in Russia: From Opportunities to Reality*, OECD/IEA, Paris, www.iea.org/publications/freepublications/publication/RenewRus_2003.pdf.

role of RES is marginal with heat production (primarily from wood products and geothermal energy) amounting to about 4% of total output, but at the same time significant when taking into account the sheer size of Russia's heat output (1.6 billion gigacalories per year).

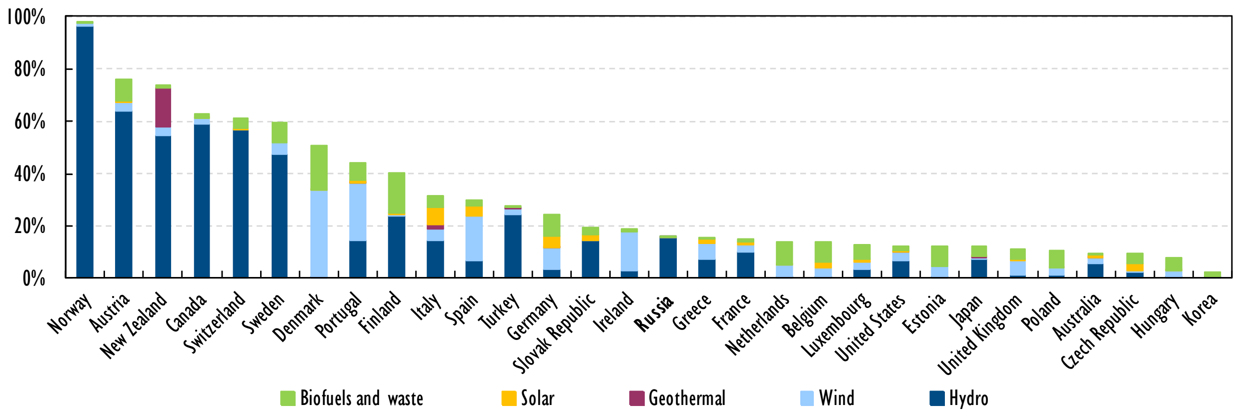
Figure 9.2 Renewable energy as a percentage of TPES in Russia and IEA member countries, 2012



Note: provisional data.

Source: IEA (2013), *Energy Statistics of Non-OECD Countries*, OECD/IEA, Paris.

Figure 9.3 Electricity generation from renewable sources as a percentage of all generation in Russia and IEA member countries, 2012



Note: provisional data.

Sources: IEA (2013), *Energy Statistics of Non-OECD Countries*, OECD/IEA, Paris; IEA (2013), *Energy Balances of OECD Countries*, OECD/IEA, Paris.

After large hydro, the next largest RES present in Russia are biofuels from biomass and waste and small hydro. It is estimated that a significant amount of households, especially in rural areas, not connected to centralised district heating systems, use wood or turf biomass for heating, yet it is difficult to estimate the exact amount, because coal is used as well. Some geothermal energy is used in local areas. For example, RusHydro has existing geothermal plants in Kamchatka (Pauzhetskaya, VerkhneMutnovskaya and Mutnovskaya). As of 1 January 2012, the total installed facility capacity was 76.1 MW and annual generation was approximately 400 million kilowatt hours.[4] The development of wind, solar and biogas

4. www.eng.rushydro.ru/industry/general/.

remains marginal. By 2013, there were about 16.8 MW of installed wind capacity,[5] yet not all operational. In 2012, about 2 500 MW capacity of wind was being developed at the engineering stage through about 46 projects, and an additional 3 000 MW in feasibility studies that could come in a few years.[6] The largest wind facility in Russia is located in the Kaliningrad region, with a capacity of 5.1 MW.

Given its geographic size and the variation in its climate and terrain, Russia has vast potential RES – wind, solar, hydro, thermal, biomass – with a huge technical potential that can be estimated at up to 30% of TPES.[7] According to the Ministry of Energy, Russia's territory includes 46% non-tropical forests, with more than half ready for harvest or over-mature (an annual increase of more than 1 billion cubic metres [bcm]). Commercially available geothermal resources are large and the technical potential of energy resources of the rivers is 382 billion kilowatt hours per year (kWh/yr). Annual production of organic waste is 390 million tonnes (Mt), including 250 Mt of agricultural waste, 60 Mt of municipal solid waste, 10 Mt of municipal waste and 70 Mt of wood waste.[8]

Solar collectors for hot water and photovoltaic (PV) cells for power generation could be deployed in particular in the regions around the Black Sea and the Caspian, the North Caucasus, the Krasnodar region and around Lake Baikal, and in South Siberia. There is a large potential for onshore wind energy in the Kaliningrad region, as well as in the northwest part of Russia, the south and alongside the Central/Volga region. The geothermal potential is strong in Kamtchatka, the North Caucasus and the Kuril islands, and to some extent already exploited. There is also a potential to install more small-scale hydropower stations and micro-hydropower stations with capacity of up to 100 kilowatts, which can be installed everywhere there are small or large rivers. Finally, there is a large potential to develop the use of biomass and agricultural, municipal and industrial wastes to produce energy for district heating systems.

Demand for RES is particularly strong in remote areas and regions that are not connected to power and heat supply grids and networks. Off-grid solutions are needed for about 10 million people not connected to the main transmission grids and where additional transmission networks would be too costly to be build. In addition, about 16 million families own summer country houses with many of them are off grid.[9]

As an example, the Yamal-Nenets Autonomous District looks to substitute imports from the neighbouring Yugra region and to fill a shortage of over 1 000 MW capacity, and reduce costs related to high prices of diesel supplies. Biomass could also be used for heat supplies, in particular in heat-only boilers and small co-generation plants.[10] Solar thermal cells could be used for hot water production. Russian Railways, for example, is using about 300 boilers on trains and consuming about 6 000 tonnes of biofuel every year, such as

5. Russian Association of Wind Industry, http://rawi.ru/en/events/past-conferences-seminars/5th-national-rawi-conference.php.

6. Russian Association of Wind Industry, http://rawi.ru/media/conf13/RAWI_Bryzgunov%20Igor.pdf.

7. Technical potential represents the part of the gross potential that can be effectively used with known technologies, taking into consideration social and ecological factors. Economic potential is part of the technical potential, the use of which is economically justified at the present level of prices for fossil fuels, heat and electricity, equipment and materials, transportation, and wages. An overview of this potential by RES is provided in IEA (2003), *Renewables in Russia: From Opportunities to Reality*, OECD/IEA, www.iea.org/publications/freepublications/publication/RenewRus_2003.pdf.

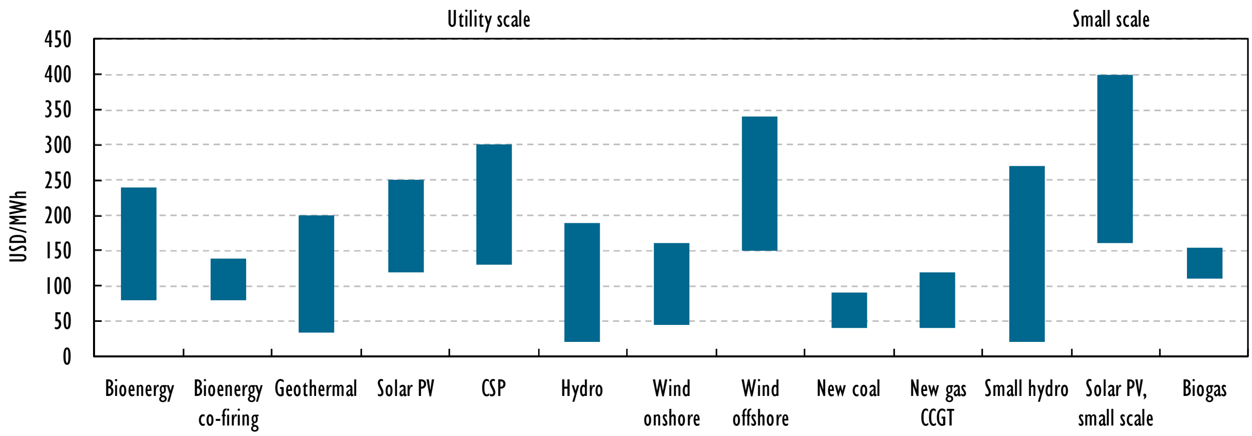
8. http://minenergo.gov.ru/upload/iblock/afc/afc90b96ec0fef29f2ededabb6a4a131.pdf.

9. IEA (2003), *Renewables in Russia: From Opportunities to Reality*, OECD/IEA, Paris, p. 11, www.iea.org/publications/freepublications/publication/RenewRus_2003.pdf.

10. Co-generation refers to the combined production of heat and power.

biofuel pellets.[11] The potential to use biofuel for vehicles is also strong and could enable Russia to free up oil and oil products for exports. Finally, in the longer term, there is a potential to export biomass and green energy to neighbouring regions, such as the European Union and China. As recognised in the EU-Russia Roadmap on Energy Co-operation until 2050, Russia should examine how this potential could be developed in co-operation with European partners with a view to export green electricity to the European Union.[12]

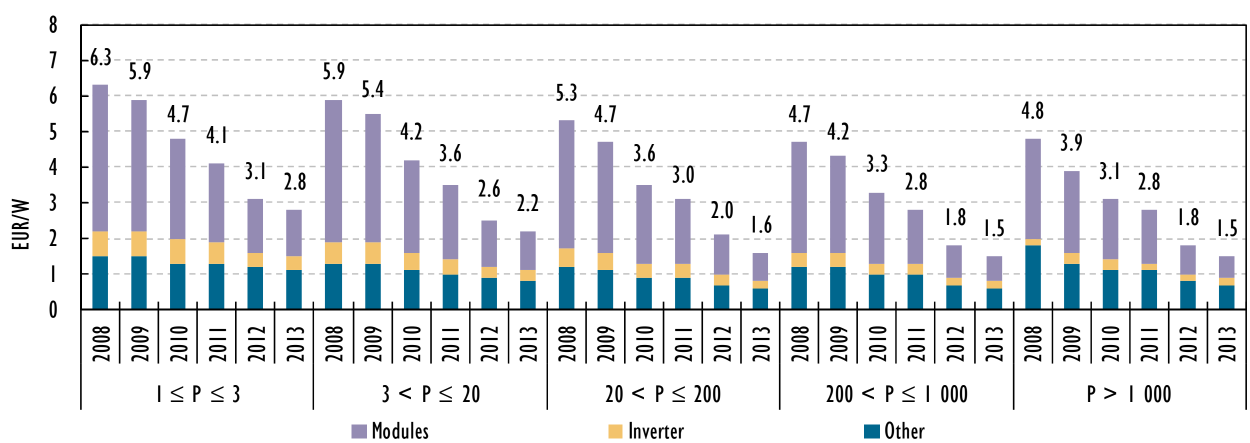
Figure 9.4 Global levelised costs of power generation ranges, first quarter of 2013



Notes: USD/MWh = US dollars per megawatt hour; CSP = concentrated solar power; CCGT = combined-cycle gas turbine. Costs reflect differences in resource, local conditions and the choice of sub-technology.

Source: IEA (2013), *Medium-Term Renewable Energy Market Report*, OECD/IEA, Paris.

Figure 9.5 Evolution of average investment costs for solar PV systems in Italy by size



Note: EUR/W = euros per watt.

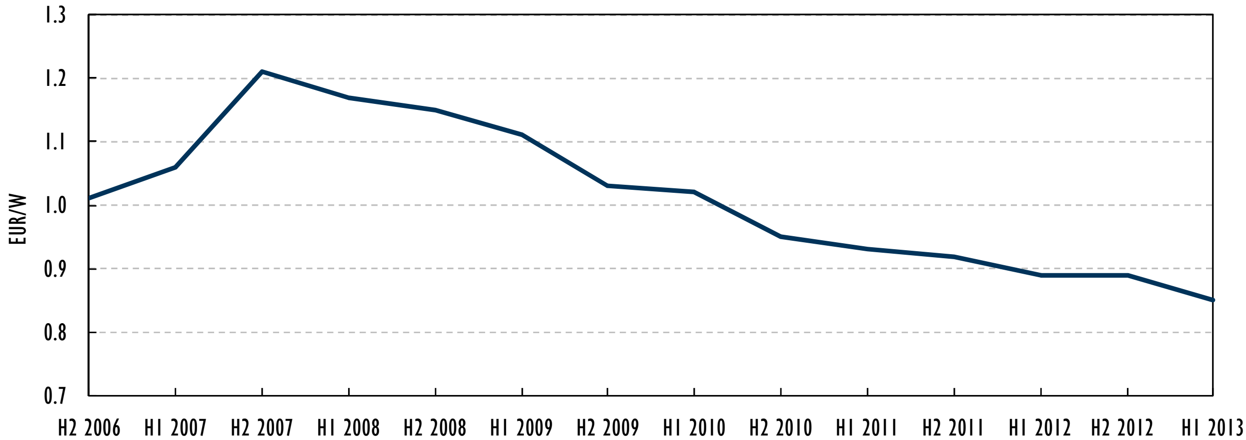
Source: Gestore dei Servizi Energetici (GSE s.p.a), www.gse.it/it/Pages/default.aspx.

11. 16 May 2013, Russia's national rail operator is increasingly utilising bio-fuel.

12. http://ec.europa.eu/energy/international/russia/doc/2013_03_eu_russia_roadmap_2050_signed.pdf; see also Boute, A. and Willems, P. (2012), RUSTEC: "Greening Europe's energy supply by developing Russia's renewable energy potential", *Energy Policy*, Vol. 51/1, pp. 618-629.

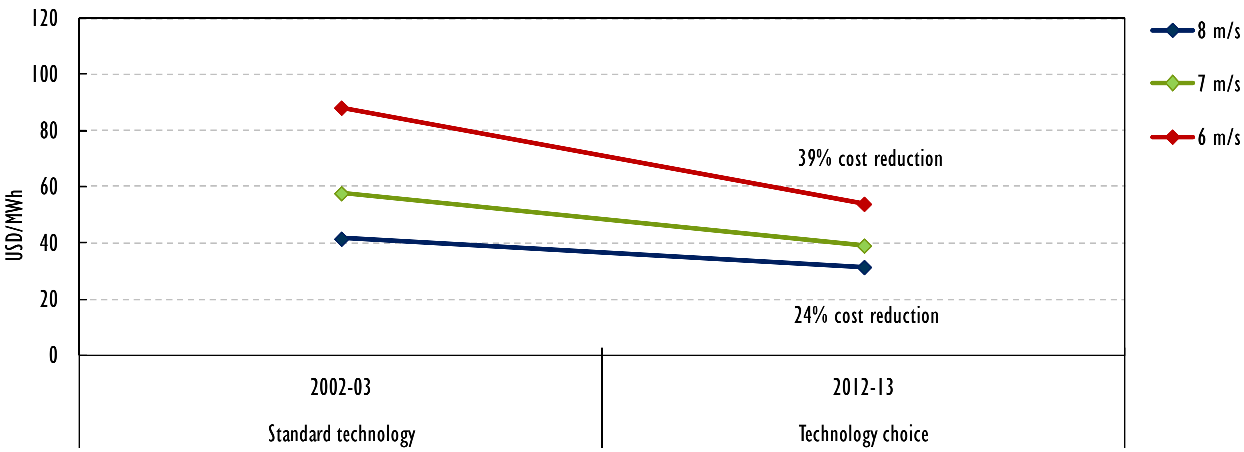
Last but not least, unleashing Russia's huge RES potential would be backed by a clear trend towards decreasing capital expenditure (CAPEX) and operating expenditure (OPEX) costs related to RES investments and operations. Technology improvements and economies of scale have been driving sharp cost reductions, in particular for PV and land-based wind turbines (see Figures 9.4 to 9.7). Where resource and market conditions are favourable, both wind and solar PV can now be cost-competitive with fossil fuel generation without specific financial support. Capital costs for wind in the best-developed markets are now around USD 1 600 per kilowatt (USD/kW),[13] and PV has achieved around USD 1 700/kW. This compares with the maximum levels for capital costs specified in recent Russian regulations of USD 2 000 (RUB 66 000) for wind and USD 3 550 (RUB 117 150) for PV.

Figure 9.6 Evolution of power generation costs from land-based wind turbines, H2 2006-H1 2013



Source: IEA (2013), *Medium-Term Renewable Energy Market Report*, OECD/IEA, Paris.

Figure 9.7 Evolution of power generation costs from land-based wind turbines, 2002-13



Note: m/s = metres per second.

Source: IEA (2013), *Medium-Term Renewable Energy Market Report*, OECD/IEA, Paris.

13. IEA (2013), *Medium-Term Renewable Energy Market Report*, OECD/IEA, Paris.

POLICIES AND SUPPORT MEASURES

INSTITUTIONS

Russia's renewable energy policies are determined and implemented by the following institutions:

The **Ministry of Energy** (Department for the Development of Electricity): Its role is especially to prepare, implement and monitor the national policy on renewable energy; set objectives and ensure the achievement of renewables-based electricity generation and consumption targets; and develop and implement the related support scheme. The Russian Energy Agency (REA) under the Ministry of Energy is involved in strengthening capacity-building on RES and various economic assessments, and in policy and capacity-building co-ordination between the federal and regional levels.

The **Ministry of Economic Development**, which is the leading ministry co-ordinating policies in the area of biotechnologies and bioenergy.

The **Ministry of Education and Sciences and the Ministry of Agriculture**: Both ministries are involved in the area of developing innovations in bioenergy and implementing the Concept for Long-Term Social and Economic Development to 2020, which envisages that Russia will become an innovative economy that is competitive worldwide, including winning leading positions in the development of RES. This includes producing very cost-efficient wind turbines, solar panels and biofuel-run medium-sized power generation (wood processing waste).

The **Federal Tariff Service** (FTS), which is the highest tariff authority, establishes methodologies and limits for tariffs at regional level, such as tariffs for generation of RES in regions and for types of RES where the law foresees tariff regulation.

Regions: Regional energy commissions adapt and implement tariff regulation and determine renewable energy tariffs at retail market level for the electricity produced from RES that network companies must purchase to compensate for losses on their network, as well as for retail networks, which provide economic incentives to foster energy efficiency and the deployment of RES, within the framework of the FTS. Regional administrative authorities also develop energy efficiency programmes that should include targets and support measures for RES. As an example, the Belgorod Oblast, the Tomsk Oblast, the Krasnodar Kraj, the Amur Oblast and the Volgograd Oblast have adopted regional acts to promote the development of RES. Finally, Regional Energy Commissions set tariffs for network companies that have the obligation to purchase electricity from RES at regulated prices to compensate for losses in their networks.

The **Administrator of the Trading System** (ATS) is responsible for the organisation of tenders for the selection of renewable energy investment projects on a competitive basis at wholesale market level. It is also responsible for measuring electricity generated from RES in order to verify the fulfilment of conditions of the agreements on the supply of capacity for projects that were selected through the tender process.

The **Market Council**, which is the regulator of the wholesale and retail markets, is tasked by the law No. 35, On Electric Power, to manage the process of qualification of renewable energy suppliers, which is a condition to be eligible for support schemes. It also is tasked with the responsibility for maintaining a register of certificates confirming production of

RES, and for allowing the registration of generators in the wholesale market trading system. To access the wholesale market, generators must sign the Standard Agreement for Accession to the Wholesale Market Trading System. This includes the annexes to the Standard Agreement. These annexes are key because they include the technical regulations governing the wholesale market and the standard purchase agreements. The Market Council drafts these regulations and agreements, including the long-term capacity supply agreement with RES installations (the agreement is called DPM based on the Russian *dogovor predostavlenia moschnosti*), which plays a key role. The Market Council has for instance imposed a guarantee obligation on the participants in the RES tender, which could not be met by smaller project developers and which has resulted in very low participation. Indeed, the Market Council required participants to secure their bids with a guarantee provided by energy suppliers controlling more than 2 500 MW.

Finally, business associations provide useful information and support for business development: the Russian Wind Energy Association[14] and the Russian Association of Wind Power Industry,[15] or for example the non-profit partnership for the development of renewable energy EUROSOLAR Russia.[16]

POLICY OBJECTIVES

Russia has started in 1999 a history of progressively developing a policy and regulatory framework for the development of renewables.[17] Since 2007, Russia has developed a comprehensive political and regulatory framework for RES that over the past two years has seen key operational developments that have opened the way for concrete project developments.[18] The government has indeed acknowledged the many opportunities and benefits from unleashing Russia's renewable energy potential:[19]

- fostering energy security:
  - in remote regions that are currently supplied with less cost-effective and polluting electricity produced from diesel, such as Sakhalin, Khabarovsk and Kamchatka, where the priority is to deploy RES in building wind-diesel systems, the objective is to install over 1 GW of RES
  - in reducing or replacing the large transportation distances of gas, electricity and coal with locally produced resources and reducing transmission losses
  - as renewables can help meet the growing power consumption and offset the decommissioning of outdated power plants and meet new capacity needed, the objective is to support the deployment of 6 GW of RES in the pricing zones of the Russian wholesale market.

14. http://rwea.ru/.

15. http://rawi.ru/en/main.php?lang=EN.

16. www.eurosolarrussia.org/.

17. See REA for an overview: http://rosenergo.gov.ru/slo.pdf.

18. See Ministry of Energy of the Russian Federation (2009), "Russian Energy Strategy until 2030", Moscow; Government of the Russian Federation (2009), Resolution of the Russian government "On Energy Strategy of Russia until 2030", No. 1715-r as of 13 November; Government of the Russian Federation (2008), Resolution of the Russian government on "Concept for the Long-Term Social and Economic Development of the Russian Federation until 2020", No. 1662-r as of 17 November (version as of 8 August 2009).

19. Government of the Russian Federation (2009), Resolution of the Russian government No. 1-r on "The Main Areas of Government Policy to Raise the Energy Efficiency of Electric Power from RES for the Period to 2020", 8 January, http://minenergo.gov.ru/upload/iblock/afc/afc90b96ec0fef29f2ededabb6a4a131.pdf.

- stimulating economic growth and competitiveness and regional development through the development of small and medium-sized companies, and finding a solution for waste treatment and a limitation to the depopulation of some regions; becoming a global leader in the development of biotechnologies by 2020, which requires the expansion of their use in Russia by 8.3 times by 2020 and their production by 33 times by 2020[20]
- improving health, protecting the environment, managing waste and fostering climate change mitigation, which according to calculations by the International Finance Corporation (IFC), could save significant carbon dioxide emissions every year if targets are met[21]
- developing exports of biomass or electricity from renewables, in particular to the European Union or China.

TARGETS FOR RENEWABLE DEVELOPMENT

Key legislative and regulatory steps were taken in 2007. A target of 4.5% of total electricity generation from RES (excluding hydropower stations with a capacity larger than 25 MW) to be achieved in 2020 was adopted in 2009.[22] This would imply the installation of additional generation capacities which, according to different sources, would require between 14 GW[23] and 25 GW[24] by 2020.

The Energy Forecasting Agency calculated in its 2010 General Scheme for Electricity Supply that state support for renewables could lead to the generation of 80 billion kWh/yr to 100 billion kWh/yr from renewables by 2030. Depending on the evolution of power demand, the General Scheme envisages output from RES in the range of 6 GW (basis), including 1.6 GW wind, 2.5 GW biomass, 1.7 GW small hydro and 0.2 GW geothermal, and in the maximum scenario, 14.3 GW including 7 GW wind, 3.9 GW biomass, 2.9 GW small hydro and 0.4 GW geothermal.

However, most experts and forecasting agencies estimate that the 4.5% target for 2020 will not be attained, and could only be met in a very optimistic scenario by 2030. A 2.5% share of total electricity generation is more likely to be achieved by 2020, and the 4.5% target could be revised. This view is supported by the fact that initial targets for 2011 and 2013 have not been achieved, as for example no wind project was developed in Russia in 2012. Resolution No. 512 on a governmental programme of Russia, On Energy Efficiency and the Development of Energy, developed by the Ministry of Energy and

20. www.economy.gov.ru/wps/wcm/connect/2c9d7d804b0988f09b2a9ba338dd8a95/biotechdevelopcomprog_2020.pdf?MOD=AJPERES&CACHEID=2c9d7d804b0988f09b2a9ba338dd8a95.

21. IFC Russia Renewable Energy Program (2011), "Renewable Energy Policy in Russia: Waking the Green Giant", Washington D.C., p. 5; www.ifc.org/wps/wcm/connect/region__ext_content/regions/europe+middle+east+and+north+africa/ifc+in+europe+and+central+asia/publications/renewable+energy+policy+in+russia+-+waking+the+green+giant, (accessed 14 December 2013).

22. Government Resolution No. 1-r of 8 January 2009, "Main Directions for the State Policy to Improve Energy Efficiency in Power Sector on the Basis of RES for the Period up to 2020" introduces the objective to have 4.5% of all electricity produced and consumed by 2020 to be generated from RES. In Article 3, it defines the set of RES: sun, small hydro, wind, tidal, geothermal, thermal with biomass (and biogas as one of the fuels), excluding hydro over 25 MW, with provisional targets being 1.5% in 2010 and 2.5% in 2015.

23. APBE, Material on Russia's electricity transmission and distribution systems, accessible in 2011 at: www.e-apbe.ru.

24. Government of the Russian Federation (2009), Resolution of the Russian government "On Energy Strategy of Russia until 2030", No. 1715-r as of 13 November 2009, p. 54.

approved on 3 April 2013,[25] recognises "the slow pace of energy development through the use of RES (excluding large hydropower capacity of over 25 MW and thermal power plants based on biomass)". Among the reasons officially named are the lack of competitiveness of RES projects versus fossil fuels; the presence of institutional barriers; the lack of programmes to support the widespread use of RES; the lack of infrastructure required to ensure the rapid development of power through the use of RES, including the failure of the scientific level and quality of service; the low level of technological development; and the absence of technical and methodological regulations, as well as engineering and software required for the design, construction and operation of power generation facilities, operating on the basis of RES.

Against this backdrop, the government's April 2013 state programme "On Energy Efficiency and the Development of Energy" outlined a more targeted, streamlined support effort for the period 2013-20. The plan set the target to support up to 6.2 GW of renewables in the wholesale market by 2020 or 2.5% of power generation (from 1% currently) through better tailored support measures and infrastructure conditions. This specific support plan de facto implies a downwards revision of the 2009 objective of 4.5%. Indeed, although it does not count for off-grid developments nor retail market renewable deployments, it is very unlikely that an additional deployment of 2% of total electricity generation can be achieved in the remaining time period until 2020. The April 2013 state programme assessed the total financial needs to support these objectives for the period 2013-20 at RUB 681.8 billion (about EUR 15.6 billion), including RUB 1.8 billion (EUR 41.1 million) from the federal budget, the remainder coming mainly from private investments.

A key step was achieved on 28 May 2013, when Decree No. 861 "On Changes to the Main Directions of State Policy in the Sphere of Improving Energy Efficiency of Electricity Supplies on the Basis of Using Renewable Energy Sources for the Period until 2020"[26] was adopted. In this important decree, the government outlined capacity installation targets for the period 2014-20 (Table 9.1), alongside the expected power generation output from these capacities.

Table 9.1 Targets for the installation of renewable energy capacity for the period 2014-20 (MW)

	2014	2015	2016	2017	2018	2019	2020	Total capacity
Wind	100	250	250	500	750	750	1 000	3 600
Solar	120	140	200	250	270	270	270	1 520
Small hydro	18	26	124	124	141	159	159	751
Total	238	416	574	874	1 161	1 179	1 429	5 871

Note: although the amendments introduced to Resolution 1-r are not explicit on this question, it could be argued that these targets apply to the wholesale market only. Indeed they were introduced together with the adoption, on the same day, of Decree 449 on the wholesale market support scheme. Decree 449 explicitly requests the adoption of targets for RES capacity to be built on the basis of capacity tenders. This decree also approved the mechanism to determine prices for capacity supply from RES facilities.

Source: Ministry of Energy of the Russian Federation (2013), unpublished email correspondence.

25. http://minenergo.gov.ru/upload/iblock/afc/afc90b96ec0fef29f2ededabb6a4a131.pdf. http://government.ru/en/news/1174. Also noteworthy are the January 2013 long-term projections for Russia's economic development to 2030 prepared by the Ministry of Economic Development, which foresees, in the best case scenario, gas production at 783 bcm by 2020 and 870 bcm by 2030 and gas consumption to increase by 20% by then. Available at www.economy.gov.ru/minec/activity/sections/macro/prognoz/doc20130325_06.

26. http://rawi.ru/media/Text_files/rasp-34407.pdf.

Table 9.2 Total expected power generation from RES, 2014-20 (MW)

	2014	2015	2016	2017	2018	2019	2020	Total generation
Wind	219	547.5	547.5	1 095	1 642.5	1 642.5	2 190	7 884
Solar	136.7	159.4	227.8	284.7	307.5	307.5	307.5	1 731
Small hydro	46.4	69.6	324.6	324.6	371	417.4	417.4	1 971
Other renewables	-	-	-	-	-	-	-	-
Total	402	776.5	1 099.9	1 704.3	2 321	2 367.4	2 914.9	11 586

Source: Ministry of Energy of the Russian Federation (2013), unpublished email correspondence.

The first tender for renewable energy production capacities was held in September 2013, and the winners pledged the lowest-cost capital investments. A total of 399 MW of the planned 710 MW of solar capacity were awarded to Russian companies, since foreign investors were at disadvantage due to procedures, but only 105 MW of the envisaged 1 100 MW of wind were awarded, so that wind was clearly undersubscribed. There were no bidders at all to build small hydroelectric power plants. There were 58 bidders for solar projects. The maximum on CAPEX was put at a high level: USD 2.05 per watt (USD/W) in 2014, falling to USD 2.04/W by 2020 for wind; USD 3.63/W in 2014, falling to USD 3.2/W in 2020 for solar; USD 4.6/W for all years for hydro. The next tender will be held in May or June 2014, to offer a further 1.6 GW of wind, 496 MW of solar and 415 MW of small hydro capacity.[27]

POLICY DEVELOPMENTS AND REGULATORY FRAMEWORK: THE WHOLESALE MARKET

Under the Russian legislation, the promotion and regulation of renewable energy is part of the broader concept of energy efficiency.[28] The 2007 amendments to Federal Law No. 35-FZ of 26 March 2003, On the Power Sector, for the first time introduced provisions on renewables and also defined renewables. The law established a support mechanism based on premium payment to the equilibrium price of the wholesale market, and included the principle of compensations for grid connection costs and the principle of a priority purchase by grid companies from "qualified renewable suppliers" to cover losses in the retail market. Resolution No. 426 from 3 June 2008, On the Qualification of a Renewable Energy Generating Facility, establishes the conditions to be eligible for support. The resolution also establishes a register of qualified renewable generating facilities managed by the Market Council. However, there has been no decree on the Procedure for the Determination of the Premium Added to the Equilibrium Price of the Wholesale Market and no details given on what the premium for each renewable technology should be or what the relation with the wholesale price changes should be. Ultimately, the premium scheme never worked, due to regulatory gaps and uncertainties as well as concerns over its impact on end-user prices.[29]

27. Bloomberg Finance (2013), "Russian solar revolution gets off to a fast start". 25 September.

28. Boute, A. (2012), "Modernizing the Russian District Heating Sector: Financing Energy Efficiency and Renewable Energy Investments under the New Federal Heat Law", *Pace Environmental Law Review,* Vol. 29, p. 763; http://digitalcommons.pace.edu/cgi/viewcontent.cgi?article=1704&context=pelr.

29. IFC (2012), *Financing Renewable Energy Investments in Russia: Legal Challenges and Opportunities*, Russia Renewable Energy Program, p.5, www.ifc.org/wps/wcm/connect/9f6e55804df642c69c35bc7a9dd66321/PublicationRussiaRREP-FinancingEnergy.pdf?MOD=AJPERES.

Capacity-support scheme

In December 2010, the government then completely modified the rules for the wholesale electricity market in order to promote renewable energy investments through regulated capacity payments. Russia already had experience with a similar scheme to foster the development of additional capacities of conventional power generation. Law No. 401-FZ amending the Federal Electricity Law provides a legal basis for the Capacity-Based Scheme, and Federal Law No. 394, "On Changes to the Federal Electricity Law", from 6 December 2011 refers in detail to the RES capacity-based scheme.

The introduction of this scheme was a welcome step aimed at giving a new impetus to the development of renewables in Russia. Yet it marked a completely new approach: The Russian model considers installed capacity per month or year (for solar and wind) instead of output in megawatt hours, which is widely used internationally, especially in countries where there is already a large deployment of RES.[30]

For the wholesale market, RES meeting a set of conditions obtain the right to conclude a special agreement on the supply of capacity (DPM RES), which foresees the monthly payment for capacity at a higher level than traditional generation sources available in the market. The ATS determines a capacity price based on the methodology developed in Decree No. 449 adopted by the government on 28 May 2013, which introduced specific amendments to reflect the variability of RES and the financial characteristics of these projects, placing RES in the priority order for capacity supply. This means that, when determining what installations are used to meet the capacity purchase obligations of consumers, renewable energy capacity must be selected before installations that participate on the free (non-regulated) capacity market.[31]

This support scheme relies on the obligation for every buyer on the wholesale market, as part of its capacity purchase obligations on the wholesale market, to contract a certain percentage of RES capacity in proportion to its total purchases of power on the market. Article 21, Paragraph 2 of the Federal Electricity Law provides the legal basis for the introduction of RES purchase obligations. The whole scheme is thus fully financed by wholesale buyers.

The scheme does not only target the renewable electricity output in megawatt hours, but also the installed capacity in megawatts, which makes it quite specific. Indeed, electricity producers' revenue consists of two elements – capacity payment and payment for selling electricity. Calculating the price for capacity includes revenue that a producer gets from the wholesale market (participation in the day-ahead market). The rest is covered by a capacity payment. There is also a minimal capacity ratio for each technology. In case of not meeting this ratio, penalty coefficients are applied to the amount of due capacity payment, which is aimed at stimulating a producer to generate electricity.

The section below provides a more detailed overview of the capacity-based support scheme:

Eligible renewables: Decree No. 449 from May 2013 limits support in the wholesale market under the capacity-based scheme to solar energy, wind and small hydropower only,[32] a

30. Boute, A. (2012), "Promoting Renewable Energy through Capacity Markets: An Analysis of the Russian Support Scheme", in *Energy Policy* No. 46, pp. 68-77.

31. Decree No. 449 places renewable energy installations in the fourth order of priority: renewable energy capacity must be selected after installations that are part of the technical capacity reserve, installations covered by traditional DPM agreements (including nuclear and hydropower plants), and strategic installations that are subject to mandatory electricity production requirements.

32. IFC (2013), *Russia's New Capacity-based Renewable Energy Support Scheme*. An analysis of Decree No. 449, Russia Renewable Energy Program, Washington D.C.

much narrower definition of "renewable energy sources" under Article 3 of the Federal Electricity Law. This decree has excluded biomass from the capacity-based support scheme (however, at time of drafting, the capacity-based scheme for biomass was being considered by the government). Moreover, the capacity scheme related to the wholesale market is limited to renewable energy generating facilities with an installed capacity equal to or exceeding 5 MW, the minimum limit for participation in the wholesale market. For wind, the threshold is 25 MW. As such, this support scheme does not apply to small capacity RES, nor does it apply to non-price zone of the wholesale market, especially isolated regions. Biomass projects, and especially off-grid projects, thus need to rely on specific sector subsidies or support measures or to be developed within the retail market scheme (see below).

Procedure for projects to become eligible for support measures: Renewable energy investors/producers and wholesale market consumers need to conclude Agreements for the Supply of Capacity, through the Centre for Financial Settlement,[33] which acts as an intermediary. The ATS (the operator of the wholesale market trading platform), the Market Council (the regulator of the wholesale market) and the system operator (SO) also participate in this process.[34] These Agreements for the Supply of Capacity set a regulated price during a certain period.

The IFC provides an overview of this bidding procedure aimed at allowing project developers to be entitled to sign Agreements for the Supply of RES Capacity.[35] Decree No. 449 tasks the ATS with organising a competitive selection of renewable energy investment projects each year and for each type of renewable energy covered by the scheme (i.e. wind, solar PV and small hydropower), and within the yearly targets set for renewable energy capacity deployment.

The bids that project developers submit to participate in the competitive selection of projects must contain the following information:

- the identity of the project participants
- the designation of the specific project and proposed RES generating facility
- the location of the proposed generating facility
- the type of renewable energy technology
- the projected installed capacity
- reference to the provisional supply points on the wholesale market calculation model
- the proposed starting date of capacity supply
- the planned capital costs (including connection costs) expressed in roubles per kilowatt of installed capacity
- the planned local content
- the guarantees to secure the implementation of the project.

33. http://cfrenergo.ru/company/information/.

34. IFC (2013), *Russia's New Capacity-based Renewable Energy Support Scheme*. An analysis of Decree No. 449, Russia Renewable Energy Program, Washington D.C.

35. *Ibid.*

The regulation also foresees that renewable energy investment projects cannot exceed capital cost limits set by the government for each type of RES and for each year up to 2020. Capital costs include installation investment costs and costs related to connection to the grid.

In its 28 May 2013 Resolution No. 861 "On Changes to the Main Directions of State Policy in the Sphere of Improving Energy Efficiency of Electricity Supplies" on the Basis of Using RES for the Period until 2020, the government adopted the limits shown in Table 9.3.

Table 9.3 Maximum capital costs set by the government for RES to be eligible for certification (RUB per kilowatt)

	2014	2015	2016	2017	2018	2019	2020
Solar	116 451	114 122	111 839	109 602	107 410	105 262	103 157
Wind	65 762	65 696	65 630	65 565	65 499	65 434	65 368
Small hydro	146 000	146 000	146 000	146 000	146 000	146 000	146 000

Source: Ministry of Energy of the Russian Federation.

Decree No. 449 requires the Ministry of Energy to inform the government of the development of average capital costs of renewable energy investments on a yearly basis. This seems to indicate possible regulatory intervention by the government to reduce capital cost limits to reflect these developments. In the absence of clear transition periods, possible changes to capital cost limits could affect the investment predictability of the capacity scheme.

Procedure for qualification

The Federal Electricity Law established a system of qualification of renewable energy suppliers. According to Decree No. 449, investors need to conclude DPM agreements before the construction. This is a mandatory step that is managed by the Market Council. Future producing units must be included in the governmental list of power plants covered by DPM and investors need to conclude DPM with the Market Council, which sets the regulated capacity tariffs, for a long-term period, on the basis of a methodology established by a governmental resolution (No. 238 from 13 April 2010 "On the Determination of Price Parameters for the Trade in Capacity").

Then, after construction, connection to the network and commissioning of the renewable energy installation, and prior to being eligible for the regulated tariffs, renewable energy producers need to qualify as producers of renewable energy in line with Decree No. 426 from 3 June 2008, On the Qualification of Generating Capacities. This procedure requires them to meet the definition of renewable energy of a certain capacity and type, to have metering devices installed and to have an operational facility. The qualification procedure is thus a federal competence that is dealt with by the Market Council. By nature, such an *ex ante* procedure immediately raises concerns as it is likely to bring strong uncertainties to investors who may face the risk, once the investment is made, to find out that they were not qualified for the DPM process but failed the qualification procedure and thus are unable to supply capacity. Reasons could be, for example, that too many projects have been accepted, or that the federal budget for grid connection has been used already, or any other hazard.

There is a need not only to qualify as a producer of renewable energy and be certified by the Market Council, but also to be included on the list of renewable energy facilities of the

Ministry of Energy according to Order No. 316 from 29 July 2011 “On Approving the Scheme for the Location of RES Installations”. This represents an additional bureaucratic hurdle and source of uncertainty that affects the scope of participants in the competitive selection.[36]

Importantly for retail market projects, investors can get a tariff decision only after qualification, that is, after construction of the RES plants. This also creates an important element of regulatory uncertainty because the investor does not know when investing what the tariff will be. Tariff methodologies being developed by the FTS should provide some predictability, but the final tariff decision will always be made after commissioning and qualification of the RES facility.

By limiting the amount of renewable energy projects covered by the scheme, Decree No. 449 aims to minimise the costs of this support policy and thus the impact on end-user electricity prices. The government also aims to limit the price impact of the capacity scheme by introducing limits on the capital costs of renewable energy projects. This qualification and certification scheme enables the government to directly control the capacity and total costs of the renewable energy deployment scheme, and in particular for each type of renewable, the volume of installed capacity, its location, and the respective connection and construction costs, and to make sure that the most competitive projects are selected, another way to manage the costs.

Integrating intermittent renewables in a capacity-based scheme: Integrating flexible and intermittent RES into a capacity market is a regulatory challenge as these require a high level of availability and predictability of installations to implement dispatching order and provide fines for failing to guarantee the availability. This requires specific regulatory arrangements to reflect the intermittent nature of renewable energy installation that cannot be run as thermal power plants. Indeed, wind, hydro or solar installations can hardly give 100% reliable commitments and guarantees on their power output on demand, which is the basic principle of wholesale market rules governing Russia’s capacity market for electricity. This also implies that fines for non-compliance with capacity availability commitments would also need to be adapted depending on the type of production and installation and amount of unavailable capacity.

Initial legislation regulating RES contained no provision to address this challenge and avoid the fact that variable renewables are penalised in the capacity market. This has largely contributed to stalling the deployment of renewables in Russia. But finally, on 28 May 2013, the government responded to these concerns and adopted Decree No. 449, “On the Mechanism for the Promotion of Renewable Energy on the Wholesale Electricity and Capacity Market”.[37] This has amended the wholesale market rules by exempting renewable energy installations from the existing dispatchability requirements, and introduced an annual capacity factor that solar and wind can reach if properly located. Instead, the operators of renewable energy installations need to guarantee the readiness of their installations to interrupt supply of electricity in response to an order of the SO. In the event of a failure of the generators, their capacity remuneration will be significantly reduced for the month during which they failed to interrupt supply when the SO ordered them to do so.[38]

36. IFC (2012), *Financing Renewable Energy Investments in Russia: Legal Challenges and Opportunities*, Russia Renewable Energy Program, Washington D.C., www.ifc.org/wps/wcm/connect/9f6e55804df642c69c35bc7a9dd66321/PublicationRussiaRREP-FinancingEnergy.pdf?MOD=AJPERES.

37. www.minenergo.gov.ru/upload/iblock/9ef/9ef9b992ebdce9acd3455f396c031433.pdf.

38. See IFC (2012), *Financing Renewable Energy Investments in Russia: Legal Challenges and Opportunities*, Russia Renewable Energy Programme, Washington D.C., p. 7-8 and pp. 62-64.

In addition, to avoid investors' focusing on installing capacity only without actually ensuring a production capacity and real output, Decree No. 449 sets provisions that reduce the capacity remuneration of renewable energy generating facilities that fail to produce a certain minimum amount of electricity per year, expressed as a capacity factor: for solar energy, 14%; for wind 27%; for hydropower, 38%.

Local content requirements: Decree No. 449 introduces local content indicators into Decree No. 426 "On the Qualification of RES Installations". Following these amendments, the Market Council has been required to take into account the level of local equipment used when certifying renewable energy installations. Resolution No. 861 from 28 May 2013 also strongly raised the level of local content requirements for the period 2014-20 for renewable energy generating facilities (Table 9.4). There are wind turbine equipment and manufacturers in Russia, yet overall, the manufacturing, service and maintenance markets are not developed and dynamic enough to provide a diversified and competitive offer that can support the competitive deployment of RES.

Further regulatory intervention is required to implement the local content policy of Decree No. 449: The Ministry of Industry and Trade is required to adopt a procedure to certify the percentage of local content in all renewable energy generating facilities. Certification of local content takes place after the construction of the facilities. The ministry could therefore in theory adopt this regulation after the first competitive selection of projects. However, uncertainty regarding these procedures is likely to affect investors' confidence in the scheme, alongside the high local content requirements, as the Russian construction industry is unlikely to be able to develop quickly and competitively enough.[39]

Table 9.4 Minimum local content requirements as in Resolution No. 861

	Minimum local content requirement	Year
Wind farms over 5 MW	35%	2014
	55%	2015
	65%	2016-20
Solar PV over 5 MW	50%	2014-15
	70%	2016-20
Small hydro over 5 MW	20%	2014-15
	45%	2016-17
	65%	2018-20

Source: Government of the Russian Federation, Decree No. 861, "On Changes to the Main Directions of State Policy in the Sphere of Improving Energy Efficiency of Electricity Supplies on the Basis of Using Renewable Energy Sources for the Period until 2020".

REGULATED TARIFFS, PRICE-SETTING MECHANISMS AND DURATION

The regulation specifies that retail tariffs be set by Regional Energy Commissions regarding RES electricity purchased by network companies whereas in the wholesale market, capacity prices are set by ATS, within price limits set out in Decree No. 449.

39. http://rawi.ru/media/Text_files/RAWI_in_Energypolis_12.pdf; http://kommersant.ru/doc/2177219?fb_action_ids=567404923291987&fb_action_types=og.likes&fb_source=other_multiline&action_object_map=%5B403404976434148%5D&action_type_map=%5B%22og.likes%22%5D&action_ref_map=%5B%5D.

Capital costs retained by the Market Council have been lower than those proposed by the Ministry of Energy and tend to favour only large installations rather than smaller installations, which could be primarily deployed in isolated regions for example.

Box 9.1 Determining capacity prices in the wholesale market

Capacity prices are paid on a monthly basis. Prices are regulated: ATS is required to determine the capacity price for each individual renewable energy installation following the method set out in Decree No. 449. It must, however, be noted that prices are calculated based on bid capital costs that investors submitted for participation in the competitive selection of renewable energy projects.

Capacity prices are determined on the basis of the following three main steps: *i)* ATS determines the total revenues that renewable energy investors require to recover their operating and investment costs; *ii)* ATS determines the share of costs to be recovered with capacity prices, taking into account expected revenues on the electricity market; and *iii)* ATS calculates capacity prices by applying this share of costs to the total costs of renewable energy investments, adapted to the amount of electricity effectively produced and the level of local content.

First, ATS must determine the total amount of revenues (i.e. revenues for both electricity sales and capacity supply) that renewable energy investors require in order to recover the investment and operating costs of the renewable energy installation concerned. Importantly, the language of Decree No. 449 implies a right for renewable energy investors under the capacity scheme to receive sufficient revenues to recover their costs. This right is in line with the general principle of Russian tariff law according to which energy tariffs must be economically well-founded and should not force operators of energy generating facilities to operate at a loss. According to Decree No. 449, investment costs are determined on the basis of the bids that investors submitted for participation in the competitive selection of renewable energy projects minus government subsidies (e.g. subsidies for the compensation of network connection costs for installations under 25 MW). Decree No. 449 indirectly provides investors with the right to recover the investment costs set out in their bids, together with a certain return on investment, as well as standard operating costs. Operating costs are regulated/fixed (Table 9.3). Capacity prices are calculated based on these fixed operating costs. Investors could thus try to maximise revenues by controlling the operating costs of their projects. Decree No. 449 establishes a return on investment of 14% for renewable energy projects selected before the end of 2014 and 12% for investments made after 1 January 2015. Return on investment for a given year will be adjusted to the evolution of long-term state bond yield, which is 8.5% as a benchmark.

Secondly, ATS must determine the share of costs that will be covered through capacity prices. Capacity prices only cover part of the costs of the renewable energy installations. Revenues that renewable energy installations receive for the electricity they produce and sell on the wholesale market cover the remaining costs.

Source: IFC (2013), *Russia's New Capacity-based Renewable Energy Support Scheme*, "An analysis of Decree No. 449", Russia Renewable Energy Program, Washington, D.C.

Regulated tariffs for RES established by Regional Energy Commissions allow a recovery of the specific costs of investments and operating expenses of renewables within the framework of the economic “well-founded nature” and justification of costs.[40] Decree No. 449 sets the duration of DPM at 15 years and establishes complex formulae for the calculation of capacity prices.

SUPPORT FOR SMALL RENEWABLES IN THE RETAIL MARKET

The support scheme for RES in the retail market is based on the legal provision that all network companies have the obligation to buy power from RES in order to compensate for their transmission losses (Article 32 of the Federal Electricity Law).[41] There is no restriction on the type of RES that can be deployed in the retail market so that biomass and bio fuel are de facto supported only through the retail market.

In the retail market, eligible RES obtain a regulated tariff: Regional energy commissions adopt tariffs for RES installations under 25 MW that participate in the retail market support scheme, based on a methodology from the FTS, for making a certain volume of capacity available. Regional Energy Commissions establish regulated tariffs for the amount of green electricity that network companies purchase from qualified RES (by the Market Council) to compensate their network losses (priority purchase).

The amended law has kept the principle of compensation of grid connection costs for RES with a capacity below 25 MW with a cap and with no more than 50% of costs covered by the federal budget.[42] A decree by the Ministry of Energy dated 22 July 2013 subsequently set additional limits, including a cap at RUB 30 million (about USD 990 000) for one generating facility.[43]

Renewable energy producers obtain certificates, which they can monetise. This approach can be compared to feed-in tariffs – a support mechanism that has proven to be an effective instrument in supporting the development of renewable energy worldwide. However, in contrast to feed-in tariffs, retail green tariffs in Russia can only be adopted by Regional Energy Commissions for a one-year period as stated in the Principles for Price Regulation in the Electricity Sector approved by Decree of the Government No. 1178 of 29 December 2011. Regional Energy Commissions cannot adopt sufficiently long-term tariffs that correspond to the return on renewable energy investments. In addition, although there is a purchase obligation in the law at a possibly higher regulated tariff of renewable energy, the implementation of this obligation faces obstacles relating to unclear formulation of implementing decrees. Moreover, there is no clear priority access rule to the network. Further uncertainties stem from the absence of legal clarifications on these matters and how the scheme is interacting with the retail market rule that makes purchases from guaranteeing suppliers mandatory.[44] Another issue is that the FTS has not adopted a methodology for calculating retail renewable energy tariffs, which has led to uncertainties as tariffs established by Regional Energy Commissions could be contested, thus creating

40. IFC (2012), *Financing Renewable Energy Investments in Russia: Legal Challenges and Opportunities*, Russia Renewable Energy Programme, Washington D.C., www.ifc.org/wps/wcm/connect/9f6e55804df642c69c35bc7a9dd66321/PublicationRussiaRREP-FinancingEnergy.pdf?MOD=AJPERES.

41. The law specifies that this accounts for losses that are not included in the price of electricity. See also the Decree of the government of the Russian Federation No. 442, “On the Functioning of Retail Electricity Markets”, as of 4 May 2012 (version of 30 January 2013).

42. IFC (2013), *Regional Renewable Energy Tariffs in Russia*, Washington D.C., pp. 18-19.

43. www.rg.ru/2013/11/13/energo-dok.html.

44. IFC (2013), *Regional Renewable Energy Tariffs in Russia*, Russia Renewable Energy Program, Washington D.C., p. 30.

risks for investors.[45] Finally, a network company argued that the mechanism whereby it has to purchase relatively more expensive renewable energy to cover network losses leads to financial losses as network companies have to buy this electricity at prices higher than the guaranteed compensation price for losses charged from suppliers. Yet Decree No. 1178 ensures that these companies can increase distribution costs due to higher costs to compensate for losses, and the FTS should provide them with the opportunity to do so through more flexible tariff caps.

The fact that the integration of renewable electricity in the grid is limited to the volume of losses is arguably aimed at avoiding any balancing problem in the system, but is also likely to limit the deployment of renewables and to incentivise grid companies to reduce losses and thus to limit further the absorption capacity of renewables in the grid. In fact, this introduces a twofold limitation to renewable deployment, since one is in place when qualifying for the capacity-support scheme, and one is in place for feeding power into the grid.

A possibility of overcoming these deficits and fostering renewable energy deployment in the retail market under the support of regions would be to make additional legislative and regulatory amendments to eliminate the room for contradicting interpretations, and use opportunities provided in the energy efficiency legislation to compel network/distribution companies to integrate a certain amount of renewable energy and conclude long-term renewable energy purchase agreements on the basis of which they would calculate network tariffs.[46]

A few projects have been developed in the retail market, such as a biogas co-generation facility in Belgorod, a biomass co-generation plant in Vologda and a hydro plant in Karelia. The potential though is very large, in particular in the industrial sector, where there is a growing trend observed of developing stand-alone power generation systems relying on either gas, diesel, coal or possibly increasingly in future, RES. Indeed, RES such as wind or solar have almost zero operation costs, and these stand-alone systems allow for savings on transportation costs. Biogas facilities have also very little energy entrant costs.

The potential is also large in isolated regions, for off-grid solutions for power generation, heat and hot water supply. Indeed, many remote small cities and villages in Russia are supplied via diesel generators or plants – several hundred of them are operational. There is an increasing number of examples when these are being partly replaced by wind turbines, for example, and there are for example plans to expand windmills on Yamal. This brings challenges in particular for the construction due to the weather and poor infrastructure (roads, accommodation for workers), and also for the connection and operation of power or heat supply systems that are often worn out.[47] But it can be profitable, as diesel is subsidised and needs to be transported over long distances. The key is to develop affordable financing mechanisms to support the development of RES for isolated regions and to foster capacity-building on available technologies, feasibility studies, risk and project management and best practices on the ground. A federal agency, such as the REA, could play a key supporting role such as to regional administrations in this respect.

45. *Ibid.,* pp. 30-31.

46. IFC (2013), *Regional Renewable Energy Tariffs in Russia, Russia Renewable Energy Program*, Washington D.C., pp. 8-9 and pp. 38-41.

47. http://rawi.ru/media/conf13/Activity_Badelin%20Alexander.pdf.

Biomass

So far, biomass projects are not included in the capacity-based support scheme but can be developed within the retail market schemes. Developing biomass production and use in Russia is a priority included in the Comprehensive Programme on the Development of Biotechnologies in the Russian Federation by 2020, which was adopted in 2012.[48] The Russian Ministry of Agriculture in co-operation with other stakeholders among federal executive bodies, including the Russian Ministry of Energy, currently develops a support mechanism for biomass use (excluding renewable wood sources). A draft federal law project was presented in early 2014, On the Development of Production and Consumption of Bioenergy Sources. It defines the different bioenergy sources and aims at setting a framework for their development in the Russian market, including through state support. In the context of this work, proposals that are being considered to promote the use of biomass (with the exception of wood) include:

- introducing amendments to the Federal Law No. 89-FZ of 24 June 1998, On Industrial and Household Waste, in order to enable the government to set different payment rates for disposal of industrial and household waste by private entrepreneurs and legal entities
- establishing additional tax incentives for the persons investing in creation of facilities and technologies for utilisation (use) and neutralisation of industrial and solid household waste
- introducing amendments to the government's Decree No. 344 of 12 June 2003, On Payment Rates for Atmospheric Emissions of Pollutants from Stationary and Mobile Sources, Discharge of Pollutants into the Surface and Underground Water Objects, and Disposal of Industrial and Household Waste; and No. 632 of 28 August 1992, On Approval of the Procedure for Determining the Payment and its Maximum Size for Pollution of the Environment, Disposal of Waste and Other Types of Harmful Impact, to provide for the possibility of establishing different caps on payments for environmental pollution, depending on whether legal entities and private entrepreneurs use agricultural waste in economic turnover, including electricity generation
- ensuring timely inclusion of renewables-based (including biomass) power generating facilities into the scheme for the support of RES, primarily in the retail markets.

ASSESSMENT

Overall, Russian legislation and regulation in the field of renewables is being actively further developed and adjusted, and there is an awareness of the need to continue improving the framework to ensure that it is conducive to investments. The deployment of RES in Russia has suffered from delays and is still at an embryonic stage, thus lagging behind initial ambitious targets. The government's 28 May 2013 Decree No. 449 "On the Mechanism for the Promotion of Renewable Energy on the Wholesale Electricity and Capacity Market"[49] marked a key step in ensuring that conditions are met for finally kick-starting the deployment of RES in Russia. This was a very important additional piece of legislation needed for a functioning regulatory framework to promote RES. It has provided provisions

48. www.economy.gov.ru/wps/wcm/connect/2c9d7d804b0988f09b2a9ba338dd8a95/biotechdevelopcomprog_2020.pdf?MOD=AJPERES&CACHEID=2c9d7d804b0988f09b2a9ba338dd8a95.

49. www.minenergo.gov.ru/upload/iblock/9ef/9ef9b992ebdce9acd3455f396c031433.pdf.

for long-term and attractive support schemes. Indeed, the provisions for 15-year tariffs and a 14% rate of return on investment should allow the payback of most investments in different types of renewables. The decree has clearly facilitated the inclusion of renewables in the capacity market, and clarified some regulatory aspects of eligible renewables and capital costs.

The results from the first tender for renewable energy in the wholesale market organised in September 2013 show that the appetite from investors has been lower than available capacities in the areas of wind and small hydro, a sign that solar enjoys more favourable conditions given the Russian industry structure and benchmarks for capital and operational costs. For wind and especially small hydro, interest from investors has proven to be insufficient, partly due to some barriers remaining, including local content.

In the retail market, some of the few projects that have been developed using a renewable support scheme have encountered legal and regulatory problems.[50]

Strategy and policy approach: Renewable sources of electricity have particular characteristics that need to be taken into account in designing policies designed to stimulate their deployment. First, output from wind, solar and run-of-river hydro is inherently variable, depending on the availability of wind, sunshine and water. Secondly they are capital-intensive, but have almost zero running costs. This means that the costs of generation are not subject to fuel price variations and can be guaranteed once the project is built and in operation. On the other hand this means that investors require certainty about their likely revenue from power generation over an extended period, to ensure that their investments will be recovered and return a reasonable rate of financial return.

International best practice suggests that renewable energy support schemes are effective under the following conditions:

- clear and realistic long-term targets
- predictable, transparent, clear and long-term support schemes, reflecting changes in the costs of technologies in a foreseeable manner
- sufficient, reasonable and effective support schemes that incentivise long-term investments
- removal of institutional barriers; regulatory and administrative simplification
- clear and fair procedures
- clear division of responsibilities among different institutional stakeholders
- access to capital at reasonable cost
- availability of competitive and dynamic service and maintenance, and equipment and manufacturing market
- learning from the experience of others.

The government could develop a National Renewable Action Plan that could be inspired by European Union Directive 2009/28/EC, with a detailed roadmap on how to reach this binding target, including sectoral targets for heating, cooling, electricity and transport. This action plan should detail how exactly the targets are to be achieved and develop

50. IFC (2012), *Financing Renewable Energy Investments in Russia: Legal Challenges and Opportunities*, Russia Renewable Energy Programme, Washington D.C., www.ifc.org/wps/wcm/connect/9f6e55804df642c69c35bc7a9dd66321/PublicationRussiaRREP-FinancingEnergy.pdf?MOD=AJPERES.

plans for monitoring. It could be based on requirements from the April 2013 state programme "On Energy Efficiency and Deployment of Energy in Russia during 2013-20", which called for a planned approach involving key leading companies to determine specific targets per region and type of renewables and investment needs, and identify federal and regional budget support funds needed.

The need to have realistic objectives and adequate underpinning regulation and support schemes is key*.* In Russia, for example, it is not clear whether the 4.5% target of renewables by 2020 has been abandoned or postponed, given that it is unlikely to be met. At best, experts concur that the increase of RES in power generation is likely to reach 2% to 2.5% by 2020, that is, around 6 GW. Clarifications on these targets would be welcomed. Moreover, Russia should clearly make the development of bioenergy and biomass a priority. There is ongoing policy development with this regard, but quick progress and implementation will be important given the opportunity costs of not reaping this full potential.

Predictable schemes: A key obstacle to the investment into renewables is that no tariff decision can be provided before construction of renewable energy installations, thereby considerably complicating investment decisions in particular at the retail market level. Indeed, Decree No. 426 "On the Qualification of Renewable Energy Installations" states that generating facilities can be qualified only after their construction and connection, which represents a strong risk and uncertainty for potential investors. Amendments to this decree would provide greater certainty to investors in introducing the status of provisional qualification based on project documents, which could be confirmed by controls verifying if all criteria and procedures that were set out have been actually met.[51] International experience shows that indeed such administrative barriers create high levels of risks, which can discourage investors. Moreover, tariffs do not offer enough long-term predictability. In particular, according to the retail support scheme, it is not possible to ascertain the tariff available to investors for more than one year. This means that investors face significant risk and uncertainty in their revenue streams, which will seriously discourage investment.

Local content requirement: The Russian legislation has integrated very strict local content requirements in order to foster domestic innovation and support local industries. For sure, Russia has a large potential industrial basis that could develop products for RES, and such requirements were also imposed in other IEA member countries.

Yet these requirements could seriously affect the cost-effectiveness of this approach.[52] This could raise costs, especially since the deployment of RES will be limited in Russia and will thus not enable large economies of scale, and is unlikely to attract major foreign companies that could set up assembling plants in Russia. Russia's own industry exists in the solar segment (the Hevel company for example, a joint venture between Renova Group and Russian government technology group Rusnano), but not in the wind segment. To be successful, this local content requirement rule requires targets to be met at minimum, if not raised to ensure that a large enough market makes such investments into local content viable. As the Russian renewable market, following policies currently in place, is not going to be large enough, these local content requirements should be lowered, if not phased out completely if Russia is not to suffer higher costs or further delays in deployment, especially for isolated regions.

51. *Ibid.*

52. *Ibid.*

There remains room for arbitrary and unpredictable regulatory intervention in the field of local content requirement and maximum cost-setting of renewable energy installations, and this will discourage investment.

As shown earlier, there have been significant reductions in the capital costs of both wind and solar PV technology, due to technological research and development, learning from large-scale deployment, and the benefits of scaling up production. While it is not to be expected that the lower international costs could be achieved in Russia until the market and supply chains are better developed, current costs are very high by international standards, particularly for PV.

There is an opportunity for Russia to benefit from global technology learning and so to realise its renewables objectives at a lower cost by encouraging deployment based on best international technology. There is clearly a compromise between meeting the deployment targets cost-effectively and developing an indigenous Russian renewables industry. However, setting overambitious local content regulations may not be the best way of achieving this goal. An alternative would be to establish a secure and long-term market for the technologies. This would then attract suppliers of world-class systems and components to focus on the Russian market and encourage them to work with Russian partners to establish manufacturing facilities, as well as providing a stimulus to Russian suppliers to provide world-class competitive systems.

Remote areas and off-grid renewables: The economic, social and environmental benefits of replacing diesel-generated electricity at the hundreds of generators in place in Russia's isolated regions with renewable energy are largely recognised at the federal and regional levels. Bioenergy, for which the government has established a dedicated technology platform, for instance can contribute to economic development and employment. Solar PV in many cases is cheaper than diesel to produce electricity, as the fuel has to be transported long distances. However, tariff barriers and diesel-related subsidies prevent this development, and the government should clarify how isolated regions can benefit from existing support schemes. Following international best practice in remote areas, such as in Alaska or the Canary Islands, it is essential to make these existing preferential diesel tariffs available to RES (and to avoid a cost-plus pricing mechanism). This tariff level should be guaranteed for a sufficient duration so as to ensure the recovery of the capital costs of renewable energy investments, before sharing the benefits of the limited operating costs of renewable energy with consumers. The government could develop tariff schemes and guarantees that would allow the replacement of diesel generators with wind-diesel units. Indeed, with current costs of power production from diesel generators, wind turbines would be fully viable, yet as tariffs for power from diesel generators are based on high operating costs, there is a need to develop specific tariffs for wind generators that have low operating costs but higher investment costs. A scheme whereby investors would be able to keep tariffs of the diesel generator during a certain period and thus be able to recoup their investment would be needed. As demonstrated by international experience, this approach will contribute to the long-term affordability of energy supply in Russia's isolated regions.

Empowering regions: International experience shows that in many countries, the regional level plays a key role in fostering the implementation of renewable energy policies. The deployment of RES in Russia would much benefit from regions being able to play a greater role and exert greater leverage in deploying RES, especially on the retail market and for off-grid opportunities. The government should take the necessary regulatory and legislative steps to enable regions to have greater leverage in adopting tariffs and selecting and qualifying projects as well as to provide investors with long-term and *ex ante* tariff guarantees that support investment decisions in renewable energy projects. This would thus require reviewing the interaction between the FTS and the Regional Energy Commissions.

RECOMMENDATIONS

The government of the Russian Federation should:

- ☐ *Take advantage of international experience to establish the necessary regulatory and tariff conditions appropriate to the characteristics of renewable energy and provide the secure investor environment necessary for the deployment of renewable energy sources, in particular biomass, in retail markets.*
- ☐ *Create a level playing field in isolated energy systems that stimulates the replacement of diesel-fuelled power generation with renewable energy, e.g. by gradually switching diesel-related subsidies to renewable energy and extending diesel-related tariff guarantees to renewable energy, and promote international best practices and technologies in this area.*
- ☐ *Spread knowledge and best practices, especially based on the bioenergy technology platform, on the integration of renewable energy (e.g. biodegradable waste) in district heating systems and electricity systems, including through information campaigns, capacity-building initiatives, waste management policies, and energy efficiency programmes, subsidies and tariff guarantees.*
- ☐ *Review local content requirements with a view to reaping full benefit from international technological innovation in the area of renewable energy, extend the capacity scheme to a broader range of RES, and simplify the existing certification procedure in order to establish sustainable market architecture for renewable energy.*
- ☐ *Further develop the potential of bioenergy with a view to stimulating economic growth and employment opportunities in rural areas.*

10. NUCLEAR ENERGY

Key data (2012)

Number of reactors in operation: 33

Installed capacity: 25.2 GW

Capacity under construction/planned by 2030: 9 GW/25 GW

Electricity generation: 177.5 TWh, +25.4% since 2002

Share of nuclear: 6.2% of TPES and 16.6% of electricity generation

OVERVIEW

Nuclear energy plays a major role in energy policy and power generation in Russia. It represents about 17% of the electricity generation today, and according to the Energy Strategy to 2030, published in 2009, more than a doubling of the installed capacity from 24 gigawatts (GW) in 2008 to between 52 GW and 62 GW in 2030 is planned. More recent plans introduced by the Territorial planning scheme of the Russian Federation in the energy sector in November 2013 indicate that besides the 10 units currently under construction, more than 20 large-scale units would be built by 2030, in part to replace ageing capacity, but also to increase the overall nuclear capacity. Taking into account current lifetime extensions and planned shutdowns, this new build programme should bring the installed nuclear capacity to about 46 GW by 2030 and reach a 25% to 30% share of nuclear electricity by that time.

The drivers for this development are the need to diversify the fuel and energy balance of the country, and the need to improve the security of the energy supply, especially in the long term. The reduction of emissions from the power sector is also presented by Rosatom as one of the benefits of nuclear power. Today, nuclear energy represents the second-largest low-carbon technology (behind hydro) in the Russian power sector, and may become the largest in the next decades.

Achieving long-term operation (LTO) of the existing fleet, with lifetime extensions ranging from 15 years to 25 years added to the original 30-year license period, is one of the major objectives of Rosatom. In parallel, the country will need to address the challenge of decommissioning shut-down power reactors and other nuclear facilities in the coming decades. The management of the back end of the fuel cycle, including reprocessing of spent fuel as part of its strategy of closing the fuel cycle, and the disposal of high-level waste (HLW) in geological repositories are essential elements of the Russian nuclear energy programme.

Russia is also successful at selling its technology abroad, in both mature markets and newcomer countries, and proposing original financing models (the Build-Own-Operate [BOO] model, for instance). In order to successfully develop additional nuclear capacities in Russia and abroad, the government will need to ensure that adequate education programmes and skilled labour forces are in place. The recent law on radioactive waste management; the engagement of the state, the regulator and the nuclear operator in reviewing and improving the safety of the country's nuclear power plants (NPPs) following the Fukushima Daiichi accident; Russia's recent membership in the Nuclear Energy Agency of the Organisation for Economic Co-operation and Development (OECD); and the country's active participation in international collaborative efforts in the areas of nuclear safety and research and development (R&D) are welcome policy developments.

NUCLEAR CAPACITY

EXISTING REACTORS

Russia's installed nuclear capacity consists of ten NPPs with 33 power units in total, essentially located in the European part of the country, and representing a global gross capacity of 25 GW. The units consist of pressurised water reactors developed in the Soviet Union, *Vodo-Vodyanoi Energetichesky Reaktors* (VVERs), light water graphite-moderated reactors (LWGRs) including the large high power channel-type reactor, *reactor bolshoy moshchnosti kanalny* (RBMK) units[1] whose designed was modified after the Chernobyl accident in 1986, and one fast breeder reactor (FBR).

Table 10.1 lists the units currently in operation. VVER reactors represent 54% of the total installed capacity, and RBMK reactors represent 44%. LTO is being considered for all reactors which have reached or will reach soon their original design lifetime, with 15 to 25 additional lifetime years being granted by the safety regulator depending on the type and design. This requires major refurbishment and investments. Following concern about ageing of graphite in RBMK reactors, Rosenergoatom, the plant operator has carried out extensive R&D on the subject. Leningrad 1, the oldest RBMK in operation, was successfully reconnected to the grid in December 2013, after work was performed to resolve the deformation of the graphite moderator blocks. Similar work is planned for the remaining RBMK fleet.

Increased nuclear output will also come from power uprates of the existing VVER reactors, typically between 7% and 10% of the nominal power, as part of the refurbishment for LTO.

Table 10.1 Nuclear reactors in operation

Unit	Model (type)	Gross capacity (MW)	Start of construction	Grid connection (licence until, incl. LTO)*
Balakovo-1	VVER-1000 (PWR)	1 000	1980	1985 (2015)
Balakovo-2	VVER-1000 (PWR)	1 000	1981	1987 (2017)
Balakovo-3	VVER-1000 (PWR)	1 000	1982	1988 (2018)
Balakovo-4	VVER-1000 (PWR)	1 000	1984	1993 (2023)
Beloyarsk-3	BN-600 (FBR)	600	1969	1980 (2025)*
Bilibino-1	EGP-6 (LWGR)	12	1970	1974 (2019)*
Bilibino-2	EGP-6 (LWGR)	12	1970	1974 (2019)*
Bilibino-3	EGP-6 (LWGR)	12	1970	1975 (2020)*
Bilibino-4	EGP-6 (LWGR)	12	1970	1976 (2021)*

1. In Russian, Reactor bolshoy moshchnosti kanalnyi.

Kalinin-1	VVER-1000 (PWR)	1 000	1977	1984 (2014)
Kalinin-2	VVER-1000 (PWR)	1 000	1982	1986 (2016)
Kalinin-3	VVER-1000 (PWR)	1 000	1985	2004 (2034)
Kalinin-4	VVER-1000 (PWR)	1 000	1986	2011 (2041)
Kola-1	VVER-440 (PWR)	440	1970	1973 (2018)*
Kola-2	VVER-440 (PWR)	440	1970	1974 (2019)*
Kola-3	VVER-440 (PWR)	440	1977	1981 (2026)*
Kola-4	VVER-440 (PWR)	440	1976	1984 (2014)
Kursk-1	RBMK (LWGR)	1 000	1972	1976 (2021)*
Kursk-2	RBMK (LWGR)	1 000	1973	1979 (2024)*
Kursk-3	RBMK (LWGR)	1 000	1978	1983 (2013)
Kursk-4	RBMK (LWGR)	1 000	1981	1985 (2015)
Leningrad-1	RBMK (LWGR)	1 000	1970	1973 (2018)*
Leningrad-2	RBMK (LWGR)	1 000	1970	1975 (2020)*
Leningrad-3	RBMK (LWGR)	1 000	1973	1979 (2029)*
Leningrad-4	RBMK (LWGR)	1 000	1975	1981 (2031)*
Novovoronezh-3	VVER-440 (PWR)	417	1967	1971 (2016)*
Novovoronezh-4	VVER-440 (PWR)	417	1967	1972 (2017)*
Novovoronezh-5	VVER-1000 (PWR)	1 000	1974	1980 (2035)*
Rostov-1	VVER-1000 (PWR)	1 000	1981	2001 (2031)
Rostov-2	VVER-1000 (PWR)	1 000	1983	2010 (2040)
Smolensk-1	RBMK (LWGR)	1 000	1975	1982 (2022)*
Smolensk-2	RBMK (LWGR)	1 000	1976	1985 (2015)
Smolensk-3	RBMK (LWGR)	1 000	1984	1990 (2020)
Total: 33		**25 242**		

Notes: PWR = pressurised water reactor; MW = megawatt.

* Licence until, including long-term operation.

Sources: International Atomic Energy Agency (2014), www.iaea.org/PRIS; Rosatom, www.rosatom.ru.

PLANNED NUCLEAR CAPACITY

Planning for new NPPs takes into account projections for electricity demand, availability of existing power transmission lines, capacity to export to neighbouring countries, possibility of extending existing sites and availability of new sites, and local public acceptance. The final decision to construct is taken by the government.

The bulk of the nuclear capacity expansion currently planned consists of Generation III VVER reactors with levels of safety comparable to the more recent Western PWR designs (recent VVER designs comply for instance with the European Utilities Requirements). The Russian new build programme is the world's second-largest domestic programme after that of the People's Republic of China. It consists of ten reactor units, seven of which are VVER reactors with capacity between 1 100 MW and 1 200 MW.

Another type of NPP concept that Russia is developing is that of the floating NPP. A twin-unit (2x35 MW "KLT-40S" reactors) floating barge is currently under construction. With its modular conception (factory pre-assembly), it can be considered as the world's first small modular reactor. The targeted market is heat and power supply to remote areas, such as coastal regions of Far East. A site has been identified in the arctic port town of Pevek in the Chukotskiy Autonomous District, part of the Far East region.

The most recent construction starts relate to the Baltic NPP in the Kaliningrad exclave on the Baltic Sea, between Poland and Lithuania. The project aims at constructing two VVER-1200 units, with the objectives of making the exclave independent in terms of energy supply and of exporting electricity to neighbouring European Union member states. From the start, the project was opened to international investors, but to date, the project has been entirely borne by Rosatom. Unresolved issues with grid connections to neighbouring countries are slowing the project down. Only one unit is currently under construction. Rosatom is also exploring the possibility of installing small reactors in the exclave to meet its electricity demand and security of the energy supply, in the event the Baltic States were to leave the synchronous grid system of Russia and Belarus.

Table 10.2 lists the ten units currently under construction in Russia.

Table 10.2 Nuclear reactors under construction

Unit	Model (type)	Gross capacity (MW)	Start of construction
Baltic-1	VVER-1200 (PWR)	1 194	2012
Beloyarsk-4	BN-800 (FBR)	864	2006
Leningrad II-1	VVER-1200 (PWR)	1 170	2008
Leningrad II-2	VVER-1200 (PWR)	1 170	2010
Novovoronezh II-1	VVER-1200 (PWR)	1 199	2008
Novovoronezh II-2	VVER-1200 (PWR)	1 199	2009
Rostov-3	VVER-1000 (PWR)	1 100	2009
Rostov-4	VVER-1000 (PWR)	1 100	2010
Pevek-1	KLT-40S (TPP)	35	2007
Pevek-2	KLT-40S (TPP)	35	2007
Total: 10		**9 066**	

Sources: International Atomic Energy Agency, www.iaea.org/PRIS; Rosatom, www.rosatom.ru.

In addition to the ten reactors currently under construction, Russia is planning an ambitious new build programme up to 2030. In November 2013, the Russian government approved plans to build 23 new nuclear units by 2030, some on new sites, others on existing sites where they will replace ageing capacities.

The five new NPPs (ten units) are:

- Central (Kostroma) (two VVER-1200 units) about 350 kilometres (km) northeast from Moscow
- Nizhny Novgorod (two VVER-1200 units) about 330 km east of Moscow
- Tatar (two VVER-1200 units) about 130 km east of Kazan in the Republic of Tatarstan (or as an alternative location, in the bordering Bashkir region)
- Seversky (two VVER-1200 units) in the closed town of Seversk, 20 km from Tomsk
- South Ural (two BN-1200 FBR units) about 200 km southeast of Yekaterinburg.

The first BN-1200 FBR will be built at the Beloyarsk site where a BN-800 reactor is currently under construction; it should be connected to the grid in 2014. The construction of the BN-1200 first-of-a-kind unit is expected to start in 2015.

Twelve other VVER-1200 units are planned to be built to replace ageing units: two VVER-1200 units to replace the four VVER-440 units at the Kola NPP site,[2] and ten VVER-1200 units to replace the RBMKs at the Kursk, Smolensk, and Leningrad NPP sites.

Table 10.3 lists the new capacity additions that are planned until 2030, including the second unit at the Baltic NPP which has not yet been launched. Taking into account current lifetime extensions and planned shutdowns, this new build programme should bring the installed nuclear capacity to about 46 GW by 2030.

Table 10.3 Nuclear reactors planned until 2030

Unit	Model (type)	Gross capacity (MW)	Comment
Baltic-2	VVER-1200 (PWR)	1 200	
Leningrad II – 3&4	VVER-1200 (PWR)	2 x 1 200	To replace Leningrad-I (RBMK) units 3, 4
Central (Kostroma) – 1&2	VVER-1200 (PWR)	2 x 1 200	New site
Nizhny Novgorod – 1&2	VVER-1200 (PWR)	2 x 1 200	New site
Tatar – 1&2*	VVER-1200 (PWR)	2 x 1 200	New site
Seversky – 1&2	VVER-1200 (PWR)	2x 1 200	New site
South Ural – 1&2	BN-1200 (FBR)	2 x 1 200	New site
Kola II – 1&2	VVER-1200** (PWR)	2 x 1 200	To replace Kola 1-4 VVER-440
Kursk II – 1-4	VVER-1200 (PWR)	4 x 1 200	To replace Kursk 1-4 RBMK, first unit to be in operation by 2020
Smolensk II – 1-4	VVER-1200 (PWR)	4 x 1 200	To replace Smolensk 1-3 RBMK
Beloyarsk-5	BN-1200 (FBR)	1 200	To replace Beloyarsk-3
Total: 24		**28 800**	

* Or as an alternative location, in the bordering Bashkir region.

** Mid-scale capacity VVER-600 units could be installed at the Kola site as an alternative to VVER-1200 units.

Source: Rosatom, www.rosatom.ru.

2. As an alternative, mid-scale capacity VVER-600 units could be installed at the Kola site.

It is interesting to note that in the *World Energy Outlook 2011* (*WEO 2011*), the International Energy Agency (IEA) projects that nuclear capacity will rise to 50 GW by 2035 in its 450 Scenario, in line with the current objectives for 2030.

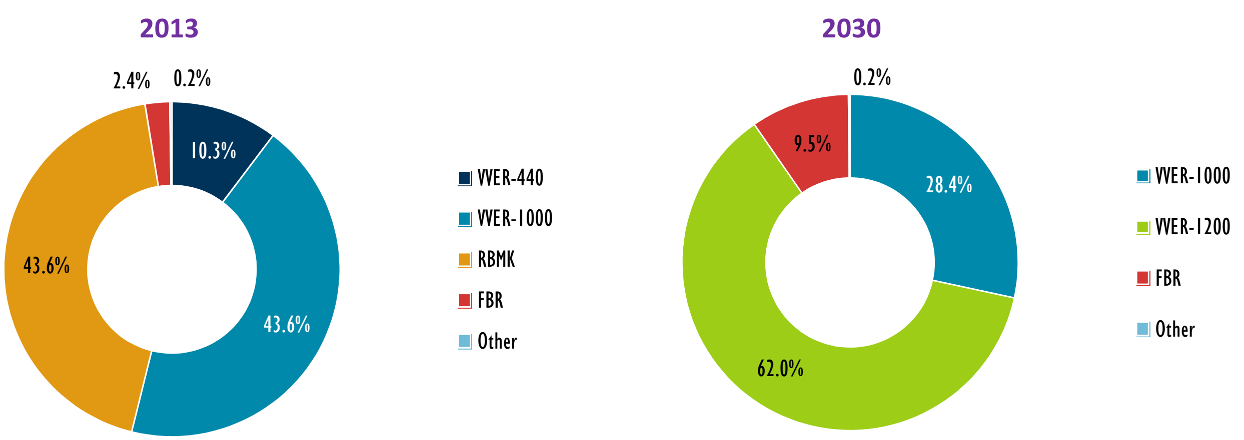
LONG-TERM DEVELOPMENTS

Russia has for decades followed a long-term objective of closing the nuclear fuel cycle using FBRs and multi-recycling of fuel. The benefits of this option, also pursued by France, Japan and more recently China, would be to reduce the reliance of NPPs on natural uranium (hence improving the security of the energy supply) as well as to reduce the volume and long-term toxicity of HLW for disposal, especially if minor actinides are recycled.

Russia is pursuing a multi-track FBR programme consisting of the operation and further development of sodium-cooled FBR (BN-800 under construction, BN-1200 planned), and the development of lead and lead-bismuth liquid metal cooled reactors. The objective of this programme is to assess the technical feasibility and competitiveness of FBRs compared with light water reactors, and to open up the possibility of large-scale transition to FBRs beyond 2030. Russia is also investigating concepts of supercritical water-cooled reactors with a fast spectrum core. An ambitious R&D programme in support of FBR development is ongoing, with the construction of a new material research reactor and irradiation facility called MBIR. Russia has the only sodium-cooled reactors currently in operation: the research reactor BOR-60 and the power reactor BN-600 at the Beloyarsk NPP, which has been in operation for more than 30 years. In 2030, according to the official plans, sodium-cooled FBR would represent about 10% of the total nuclear generation capacity (see Figure 10.1). The rest of the capacity will consist of VVER-1000 units (28%) and the newer VVER-1200 units (62%). All RBMKs and older VVER-440 units will have been retired.

Figure 10.2 describes the reactors in operation, those that are under construction and those that are planned up to 2030.

Figure 10.1 Nuclear capacity in 2013 and planned capacity in 2030*

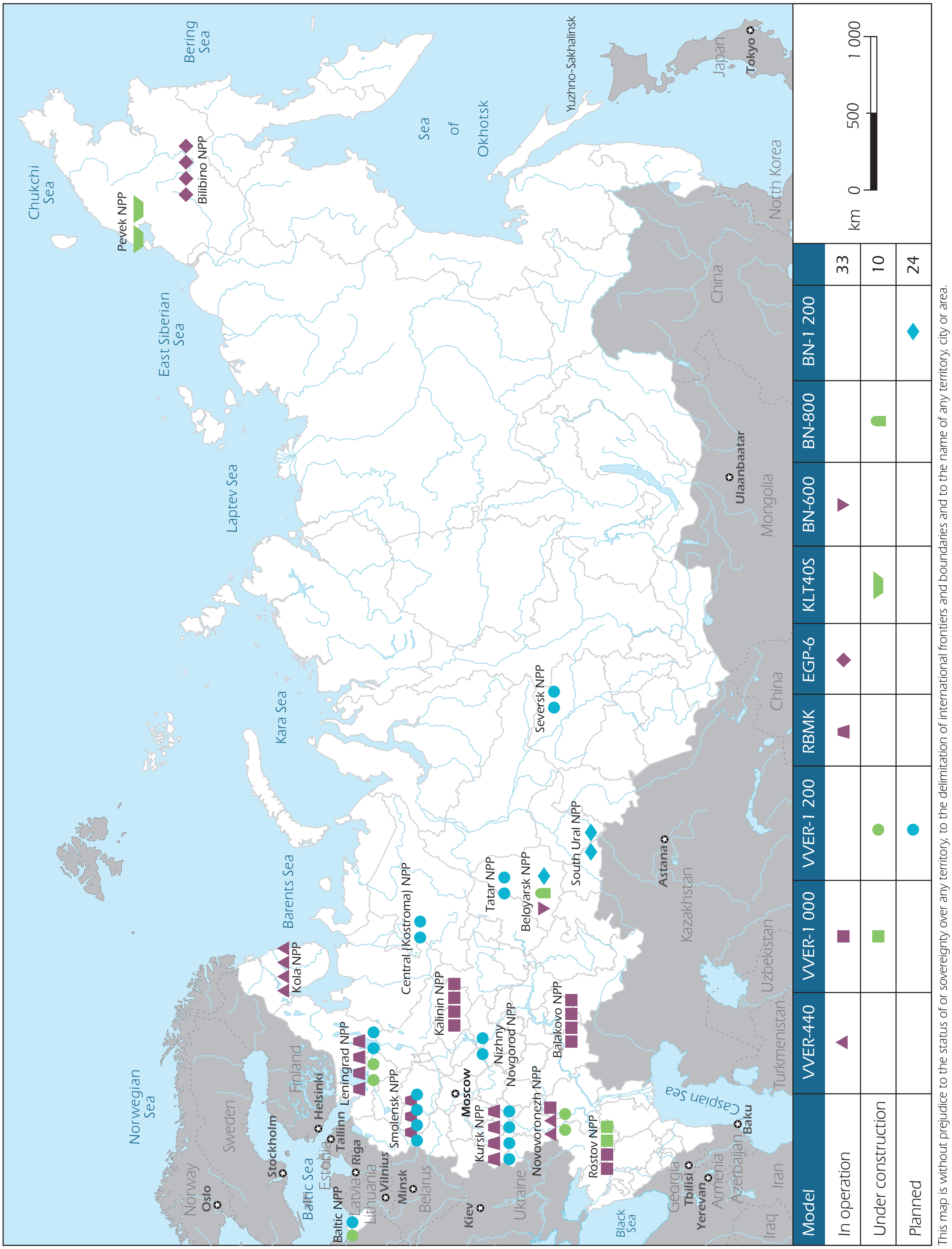


* Planned capacity in 2030 is according to current lifetime extension trends and new build plans.

Source: Nuclear Energy Agency, www.oecd-nea.org.

Against this backdrop, the Russian nuclear industry sector posts very robust achievements and ranks as one of the world's global leaders.

Figure 10.2 Reactors in operation, under construction and planned until 2030 in Russia



Source: Nuclear Energy Agency, www.oecd-nea.org.

Box 10.1 Russian nuclear energy sector in numbers

- 9% of known world uranium resources
- 45% of world's enrichment capacities
- 17% of world's fuel fabrication market
- third-largest installed capacity in the world behind the United States and France (and Rosenergoatom is the world's second-largest nuclear operator with 33 units)
- 17% electricity generation
- second domestic new build programme (behind China) with ten units under construction
- first exporter of nuclear power technology
- leading position in FBR technologies.

INSTITUTIONAL AND LEGAL FRAMEWORK

Russia is a member of the International Atomic Energy Agency (IAEA) and party to the main treaties and agreements on the non-proliferation of nuclear weapons and on co-operation with regard to the peaceful uses of nuclear energy. It is a member of the Nuclear Safety Convention, of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, and of the Convention on Early Notification of a Nuclear Accident. Russia has also concluded numerous nuclear co-operation agreements, in particular in relation to the rapid notification of incidents, with all its neighbouring countries operating NPPs. Russia is not party to the 1998 Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (Aarhus Convention).

Overall, Russia is very committed to ensuring a concrete, global non-proliferation regime. Russian experts are involved in the Nuclear Suppliers' Group; the joint Russia-United States Russian Research Reactor Fuel Return programme has helped repatriate spent fuel from abandoned reactors in a number of countries. Russia also established the International Uranium Enrichment Centre (IUEC) with Kazakhstan in 2007, proposing it for the creation of the IAEA Nuclear Fuel Bank in 2011.

The State Atomic Energy Corporation Rosatom was established by Russia as a publicly owned corporation on 18 December 2007, to replace the Ministry for Atomic Energy. The status, goals of its establishment and activities, and functions and authorities of Rosatom are stipulated in the federal law On the State Atomic Energy Corporation Rosatom, No. 317- FZ, as of 1 December 2007.

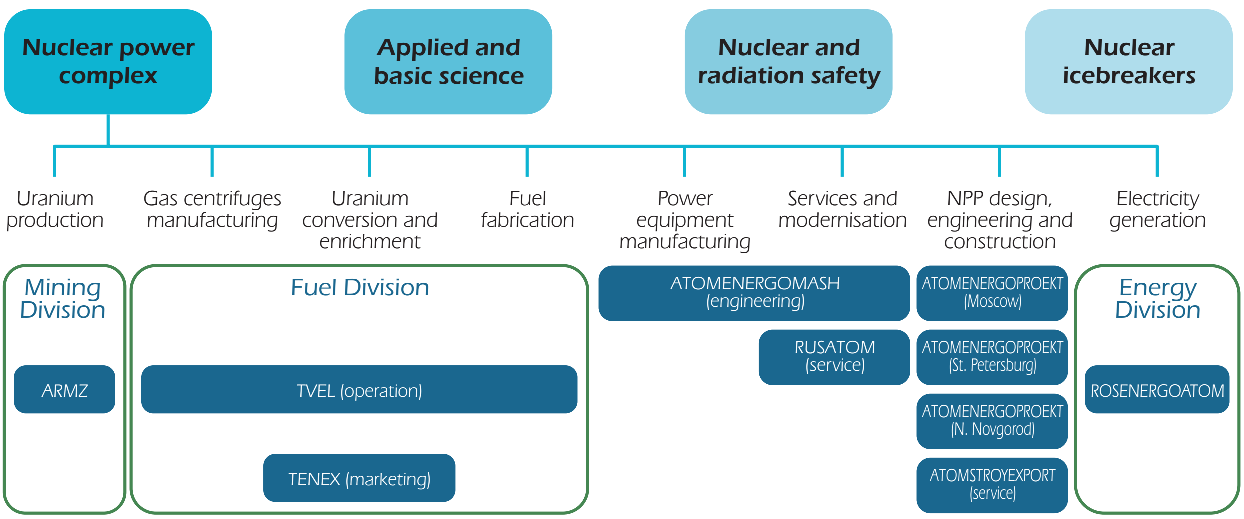
Rosatom is authorised, on behalf of Russia, to fulfil the country's international commitments in the field of the peaceful uses of atomic energy and nuclear non-proliferation observance. Rosatom is responsible for implementing federal policy in the field of the use of atomic energy, and represents a universal company that owns assets in all links of the nuclear power and industry chain from uranium exploration and mining to design and construction of NPPs, machine engineering, generation of heat and electricity, uranium product enrichment and conversion, nuclear fuel fabrication through decommissioning of nuclear facilities, and management of spent nuclear fuel and radioactive waste.

In June 2010, by presidential act, the nuclear regulator Rostechnadzor was re-entrusted with the functions of elaboration and implementation of state policy, development and enforcement of safety regulations for the use of nuclear energy (the said functions were within the competence of the Russian Ministry for Natural Resources and Environment from May 2008 to June 2010). The Russian nuclear safety regulator is an independent regulatory authority, and is a key institution within the Russian nuclear sector. It is also a key partner in international co-operation fora, specifically with the Nuclear Energy Agency, where it participates in several activities with regulators from OECD member countries. It is also a member of the Multinational Design Evaluation Programme, where opportunities for harmonisation of regulatory practices and co-operation on safety reviews of some Generation III designs are discussed.

STRUCTURE OF ROSATOM'S NUCLEAR POWER COMPLEX

The State Atomic Energy Corporation Rosatom includes a nuclear power complex, a science and technology complex, a nuclear and radiation safety complex, a nuclear icebreaker and support complex, and a defence complex. Figure 1 shows the organisation of ROSATOM's nuclear power complex.

Figure 10.3 Rosatom nuclear power complex



Source: Rosatom, www.rosatom.ru.

Rosatom is a vertically integrated company that spans the whole civilian nuclear sector through its holding Atomenergoprom, which includes the mining company ARMZ, the nuclear fuel producer and supplier TVEL, the uranium trading company TENEX, the nuclear power producer and operator of Russia's civilian NPPs Rosenergoatom, and the industrial company Atomenergomash (AEM).

AEM is a fully owned subsidiary of Rosatom that controls the whole industrial supply chain for Russian-design NPPs, including companies located in other countries (Czech Republic, Hungary, Ukraine).

INTERNATIONAL DEVELOPMENTS

While conducting a very ambitious domestic nuclear programme, Russia has also successfully promoted its nuclear technology abroad. Outside Russia, 37 Russian-design reactors are in operation in 9 countries, and 12 more units of Russian design are under development in Belarus, China, India and Turkey. Apart from that Rosatom has secured contracts to build nuclear units in Ukraine, Armenia, Bangladesh and Vietnam and is looking at opportunities in Finland, Jordan, South Africa, the United Kingdom and other countries. Besides building reactors, Russia is also offering fuel services, such as supply of fuel and repatriation of used fuel, which can be reprocessed. Separated waste can then be returned to the foreign customers. Rosatom currently supplies nuclear fuel for 76 reactors in 15 countries. Its ten-year foreign backlog pipeline of international projects (construction of power plants, uranium products, fuel services) reached USD 66.5 billion in 2012.

Table 10.4 Nuclear reactors under development outside Russia

Unit	Country	Model (type)	Gross capacity (MW)
Akkuyu-1	Turkey	VVER-1200 (PWR)	1 200
Akkuyu-2	Turkey	VVER-1200 (PWR)	1 200
Akkuyu-3	Turkey	VVER-1200 (PWR)	1 200
Akkuyu-4	Turkey	VVER-1200 (PWR)	1 200
Kudankulam-1	India	VVER-1000 (PWR)	1 000
Kudankulam-2	India	VVER-1000 (PWR)	1 000
Kudankulam-3	India	VVER-1000 (PWR)	1 000
Kudankulam-4	India	VVER-1000 (PWR)	1 000
Ostrovets-1	Belarus	VVER-1200 (PWR)	1 200
Ostrovets-2	Belarus	VVER-1000 (PWR)	1 000
Tianwan-3	China	VVER-1000 (PWR)	1 000
Tianwan-4	China	VVER-1000 (PWR)	1 000
Total: 12			**13 000**

Source: Rosatom, www.rosatom.ru.

The Energy strategy to 2030 opens up the possibility for public-private partnerships for the construction of NPPs as well as the opportunity for foreign companies associated with Russian equipment manufacturers to participate in the new build programme. The joint venture established in 2009 between France's Alstom company and Russia's AEM for the production of low-speed steam turbines for 1 200 MW reactor units seems like a promising example of such collaborations. Rolls-Royce also signed a Memorandum of Understanding with Rosatom in 2011, and recently, an agreement was signed by Rosatom, Rolls-Royce and the Finnish utility Fortum to assess the feasibility of introducing VVER-1200 technology in the United Kingdom.

At the same time, the strategy calls for a continuation of the protection of Russian manufacturers through customs and tariff regulations to limit the expansion of foreign manufacturers into the Russian market. However, since Russia joined the World Trade

Organization (WTO) in 2011, Russian legislation is evolving to ensure that it is consistent with the country's commitments with the WTO, and in particular, to ensure that there are no restrictions preventing access to the Russian market by foreign suppliers that could contradict WTO regulations and requirements.

NUCLEAR ENERGY AND ELECTRICITY MARKETS

All the power reactors in the European part of Russia operate as base-load supply to the wholesale electricity market in that zone. NPPs are "price takers" and do not participate in the wholesale price formation. The Energy strategy to 2030 mentions the lack of semi-peaking and peaking capacity in the Russian electricity market (European part), and suggests that new nuclear units should be commissioned together with pumped hydro storage plants.

It is also to be noted that ten of the existing NPPs also provide heat (district heating) to neighbouring municipalities or settlements, using waste heat produced from the reactors. This constitutes the world's largest experience of nuclear district heating, producing about 3.4 million gigacalories of heat in 2012.[3] However, because of deteriorating heat distribution systems and unfavourable heat market conditions, nuclear district heating is unlikely to be developed for future nuclear projects.

FINANCING NEW BUILD

With its domestic and export programmes, the Russian nuclear industry, which covers everything from reactor design to construction and to fuel cycle services, has probably the world's largest share of nuclear new build projects. It benefits from strong support from the state, with direct funding of nuclear power generation development in Russia. In particular, nine new reactor units whose start of construction is planned between 2011 and 2018 will benefit from the capacity market mechanism called DPM, which provides financing for a period of 20 years with a 13% return on investment. Rosatom is confident that the DPM mechanism will be extended beyond 2020, though under current electricity market rules where gas sets the price of electricity, any increase in the price of gas can help the competitiveness viability of nuclear projects.

Abroad, government-supported export credit is a widely used instrument for financing Rosatom NPP construction projects based on the engineering, procurement and construction model. Export loans are granted in the frame of intergovernmental negotiations and provide favourable financial terms and conditions, including maximum repayment term in excess of 20 years and concessional interest rates. The extent of the credit depends on the involvement and role of the Russian partners in the project.

Projects implemented under the BOO model, which also benefit from Russian state support, are attracting interest from countries not able to support the high capital investment that nuclear new build requires. Other investment models are available, such as partial ownership by private/foreign companies, which Russia offered for instance for the Baltic NPP project in Kaliningrad.

3. Energy Forecasting Agency APBE, based on Rosstat (2013).

FRONT AND BACK END OF THE NUCLEAR FUEL CYCLE: NUCLEAR WASTE MANAGEMENT AND DECOMMISSIONING

Russia has significant uranium resources, with about 9% of the world's resources in the cost category (<USD 130 per kilogramme of elemental uranium). Russia has plans to increase uranium production domestically though the huge Elkon development project, which is expected to more than double the country's production, has been put on hold, as it is not economical under today's uranium market price. Russia is also pursuing opportunities abroad, with the company ARMZ now fully owning Canada's Uranium One Company (which operates several projects in uranium-rich Kazakhstan). Russia has extensive conversion, enrichment and nuclear fuel fabrication capacities, providing fuel and services to Russian and foreign NPP operators. In particular, the IUEC was established in 2007 as an open joint-stock company between Russia and Kazakhstan to offer uranium enrichment services to its shareholders. Ukraine and Armenia joined the IUEC in 2009. The IUEC also provides guaranteed stockpiles of low-enriched uranium (LEU) for IAEA members, under an agreement between Russia and the agency.

In December 2013, the 20-year government-to-government agreement between Russia and the United States for the conversion of 500 tonnes (t) of Russian highly enriched uranium from nuclear warheads to LEU to fuel nuclear reactors in the United States (the "Megatons to Megawatts" programme) was completed following the last shipment of LEU dispatched in November 2013. Global demand for uranium from mines was expected to increase following the completion of this programme.

In the context of Russia's policy of closing the nuclear fuel cycle, spent fuel from NPPs is not considered a waste, but rather a resource to be used to fuel future fast neutron reactors (FNRs). Therefore, spent fuel is stored several years before it is reprocessed, at the RT-1 site in Mayak (this facility will be in operation until 2030, and a new facility is to be constructed at the Mining and chemical combine site in Zheleznogorsk in Siberia in the next decade). Currently, Russia has reprocessed spent fuel from VVER-400 reactors, from the sodium-cooled BN-600 reactor and from naval reactors. Reprocessed uranium has then been used to manufacture fresh RBMK fuel, while separated plutonium is to be used for fabrication of mixed oxide fuel for future FBR reactors. The remaining products from reprocessing, essentially "fission products", are vitrified and stored, and constitute HLW. Spent fuel from VVER-1000 reactors has not yet been reprocessed, nor has spent fuel from RBMK reactors. These are stored at the NPP sites and then sent to the MCC site for storage (pool storage for VVER fuel and dry storage for RBMK fuel). About 22 000 t of spent fuel are currently being stored (over 16 000 t at NPP sites and nearly 6 000 t in centralised storage) awaiting future reprocessing, and about 570 million cubic metres of radioactive waste (low level to high level) has been accumulated.

The Federal law of 11 July 2011 "On radioactive waste management" was the major step in defining the Russian waste management institutional framework. The law defines two categories of radioactive wastes: the accumulated waste up to the enforcement of the law (and including all the legacy waste from former military or research activities), which is under the responsibility of the state; and the newly generated wastes (i.e. generated after July 2011), which are the property of the producers. The latter are obliged to set aside a "radioactive waste fund" to cover the cost of managing these wastes. Russian Government Order No. 68 of 30 January 2002 for example sets the limit of Rosenergoatom's allocation to this fund at 1.5% of the company's revenue. The law specifies that HLW should be disposed of in a deep geological repository, and research is ongoing for site selection and qualification. It will likely be near Zheleznogorsk; an environmental impact assessment study has been carried out and is to be discussed with local populations. According to Rosatom, the HLW disposal facility should be commissioned around 2022.

Decommissioning is also being addressed. Russia has more than 130 nuclear and fuel cycle facilities that are in the final stage of shutdown. Experimental and demonstration centres on decommissioning are being established, and a new industry is being developed. As far as power reactors are concerned, four units representing a total capacity of 875 MW have been shut down: Beloyarsk unit 1, shut down in 1983; Beloyarsk unit 2, shut down in 1989; Novovoronezh unit 1, shut down in 1984; and Novovoronezh unit 2, shut down in 1990. By the year 2030, 14 other units are planned to be shut down. As far as funding is concerned, several sources are available: the federal budget through Federal Target Programmes (FTPs), as well as dedicated "decommissioning funds". Russian Government Order No. 1189 of 19 November 2012 for example specifies that 3.2% of Rosenergoatom's revenues must be allocated to the decommissioning reserve.

NUCLEAR SAFETY AND REGULATION

As required by the Convention on Nuclear Safety, which Russia signed in 1994, and the federal law on the use of atomic energy dated 21 November 1995, Rosenenergoatom, which operates all the NPPs in Russia, is fully responsible for their safety.

The Russian nuclear safety authority Rostechnadzor is entrusted with the monitoring and regulation of all the nuclear activities, such as licensing new reactors, granting licences for lifetime extensions for existing reactors, and providing regulatory oversight for the rest of the nuclear fuel cycle activities, including intermediate storage and reprocessing of spent fuel, HLW disposal and decommissioning.

The Integrated Regulatory Review Service (IRRS) performed by the IAEA in November 2009 identified several good practices, but also some priority issues which may not have yet been addressed. In particular, the IAEA recommended that better funding be available to the regulator to allow it to perform independent safety reviews and assessment of license applications. Another concern relates to the need to have better incentives to recruit and maintain competent staff. This is particularly important in view of the ambitious new build programme that Russia has engaged, as well as the necessary regulatory oversight of operation of power and research reactors, decommissioning of nuclear facilities, and waste management activities.

Within a few weeks of the Fukushima Daiichi accident in Japan in March 2011, Rosenergoatom and Rostechnadzor had carried out inspections of all the operating NPPs, to assess among other things the level of protection against extreme natural events, severe accident management procedures and emergency preparedness. A month later, proposals on improvements were made which were presented by the Russian delegation at the IAEA Ministerial Conference on Nuclear Safety on 20 June 2011. The same month, Rostechnadzor developed new requirements for safety assessments based on work performed by ENSREG, the European Nuclear Safety Regulators Group. These were the basis for the "stress test" reports submitted by Rosenergoatom to the regulator during summer 2011. Following the review, Rostechnadzor and Rosatom developed a programme to improve the safety of Russian NPPs in line with the IAEA's Nuclear Safety Action Plan. This programme is currently being deployed. The government, Rostechnadzor, and Rosatom and its power generation company Rosenergoatom can all be commended for their swift and thorough actions to assess the safety of Russian NPPs and implement improvements.

In November 2013, a second IRRS mission was conducted by the IAEA to review the implementation of the recommendations made in the 2009 mission, and to assess the response to the Fukushima Daiichi accident. According to preliminary findings published by the IAEA, the response of the Russian regulatory system following the accident in Japan in March 2011 had been "timely and effective". The IAEA recognised that there had also been improvements to the legal basis for nuclear safety regulation with changes in some laws, which have increased the authority and independence of Rostechnadzor, and expanded the range of its regulatory functions. The mission found, however, that improvements are still needed to reduce the salary gaps between the employees of Rostechnadzor and the personnel of operating organisations, in order to retain competent staff. The mission also recommended that operators of nuclear fuel cycle facilities (other than NPPs) conduct safety evaluations for events such as the Fukushima accident, that licence conditions related to the safety assessment of liquid radioactive waste disposal facilities be reviewed, and that regulations concerning emergency preparedness and response be revised in line with IAEA safety standards.

EDUCATION AND REASEARCH

Civil nuclear research is funded from the federal budget and by Rosatom. Research programmes funded by the former are carried out under FTPs or projects dealing with fundamental or long-term research (e.g. fusion), while those funded by Rosatom mainly focus on reactor technology improvements and the fuel cycle. More than 20 000 researchers and scientists are involved in civil nuclear research in Russia.

Russia benefits from a very dense network of academic and research organisations, and a highly qualified workforce of scientists and engineers. Internationally, Russia participates in the IAEA's International Project on Innovative Nuclear Reactors and Fuel Cycles and in the Generation IV International Forum (GIF) research activities.

It is expected that the Russian education system will train about 7 000 people at bachelor's level in the period 2013-18, about 2 300 people at master's level, and the same number at doctorate level. This should be sufficient to address the country's nuclear energy needs.

ASSESSMENT

The IEA considers that Russia's ambitious nuclear energy development programme will help the country diversify its fuel and energy balance, improve its security of the energy supply, especially in the long term, and contribute to the reduction of greenhouse gases from the power sector. The IEA is impressed by the modernisation efforts of the Russian nuclear industry, its leading position in all stages of the nuclear fuel cycle, the scale of its domestic new build programme and the successful promotion of its technology abroad. Strong industrial capacities and highly qualified human resources will be needed to ensure the success of these ambitions.

Current plans foresee a near doubling of the current installed capacity by 2030, through the construction of 22 units in addition to the 10 currently under construction. LTO as well as power uprates for existing reactors will also be required. This requires major refurbishment and investments, and of course, rigorous regulatory oversight and licences from the nuclear safety regulator once all conditions for continued safe operation are met. The IEA recommends in particular the highest level of transparency in the assessment of

LTO of the oldest reactors currently in operation, VVER-440 and RBMKs, to ensure their safe operation until they are permanently shut down, by 2030 at the latest. By that time, Russia will have a comparably modern fleet compared with other countries where there is not much new build activity.

The bulk of the nuclear capacity expansion planned by the government consists of Generation III reactors with levels of safety comparable to the most modern designs. The Russian new build programme is the world's second-largest domestic programme after that of the People's Republic of China. Russia has also secured or is negotiating contracts to build NPPs in a number of countries.

Managing Russia's new build programme together with the construction of reactors abroad is a challenge for the industry in terms of supply chain and human resources. In the *WEO 2011*, the IEA expressed some caution as to the capability of the Russian industry to address the dual challenge of the domestic nuclear programme and its export goals, both from the point of view of supply of large components (e.g. pressure vessels) and human resources. Projects abroad foresee up to 70% localisation of the supply chain, which will reduce the load on domestic industry and reduce project costs. But this may raise issues of quality of fabrication of components in countries that have no qualified supply chain, and require extensive inspection of suppliers and rigorous regulatory oversight of the projects.

The Russian Energy Strategy to 2030 opens up the possibility for public-private partnerships for the construction of domestic NPPs as well as the opportunity for foreign companies associated with Russian equipment manufacturers to participate in the new build programme. Even though the strategy called for a continuation of the protection of Russian industry through customs and tariff regulation to limit the expansion of foreign suppliers into the Russian market, legislation is evolving since Russia joined the WTO in 2011 to ensure that there are no restrictions that can contradict WTO rules. A balance between protecting national industry and allowing technology transfers through collaborations with non-Russian industry needs to be found if the ambitious nuclear programme and the modernisation of the industry are to be realised.

The IEA believes that a strong, well-staffed and independent regulator is necessary to ensure the safe operation of NPPs and other fuel cycle facilities, the oversight of nuclear waste management, and decommissioning of shut-down facilities. The Russian nuclear safety regulator Rostechnadzor is an independent regulatory authority, reporting to the government. Its organisation and missions were redefined in a presidential act in June 2010. The IRRS performed by the IAEA in 2009 identified several good practices, but also some priority issues. In particular, the IAEA recommended that better funding be available to the regulator to allow it to perform independent safety reviews. Another concern relates to the need to have incentives to recruit and maintain competent staff. The second IRRS mission conducted in November 2013, while recognising improvements since the first review, stressed again the need to ensure that the regulator has adequate resources and staffing incentives to attract and retain qualified personnel.

The Fukushima Daiichi accident showed the engagement of the government, the regulator and the nuclear operator in reviewing and improving the safety of the country's NPPs. Within weeks of the accident in March 2011, Rosenergoatom and Rostechnadzor had carried out safety inspections of all the operating NPPs. More detailed review reports were submitted by Rosenergoatom to the regulator during summer 2011. Rostechnadzor and Rosatom then developed a programme to improve the safety of Russian NPPs in line with the IAEA's Nuclear Safety Action Plan. The programme is currently being implemented.

The IEA welcomes the law of 11 July 2011 on the management of radioactive waste, which defines the Russian waste management institutional framework. The law categorises the different types of wastes including the HLW to be disposed of in a geological repository, and clarifies the ownership of legacy and newly generated wastes and the funding obligations.

Russia is following the long-term objective of closing the nuclear fuel cycle using FNRs and multi-recycling of fuel, to reduce the reliance of NPPs on natural uranium, and to reduce the volume and long-term toxicity of HLW for disposal. Under this policy, spent fuel from NPPs is not considered a waste, but rather a resource to be used to fuel future FNRs. Spent fuel is stored several years before it is reprocessed, separating uranium and plutonium for further use as fuel. The remaining products from reprocessing are vitrified and stored, and constitute the HLW. Research is ongoing to select a site for geological disposal of this waste.

Besides the management of different categories of waste generated by Russia's nuclear energy sector, the country has to decommission shut-down nuclear installations. This is a challenging task given the number and diversity of facilities that were in operation in the country. It requires qualified human resources and adequate financial support, as well as rigorous regulatory oversight. But the decommissioning challenges also offer a unique opportunity for Russian industry to develop technologies that can be applied in other countries.

RECOMMENDATIONS

The government of the Russian Federation should:

- *Continue to support the independence of the nuclear safety regulator Rostechnadzor and provide the means to enable it to carry out its missions, to implement the recommendations from the IAEA IRRS mission, and to attract and maintain a highly qualified workforce.*
- *Proceed in a timely manner with the implementation of nuclear waste management measures and best practices, including the construction and operation of a deep geological disposal site for HLW and generally, the management of legacy waste, and also proceed with decommissioning and clean-up of shut-down nuclear facilities by providing sufficient financial resources to these activities.*
- *Consider the benefits of further promoting industrial partnerships between Russian and foreign companies for the development of nuclear energy programmes domestically and abroad, addressing the needs of existing reactors, those of new build projects and the development of the next generation reactors.*

11. DISTRICT HEATING

Key data (2012)

Total district heating production: 1.6 billion Gcal

Share of population connected: 70%

Share of co-generation in total heat production: 30%

Number of heat-only boiler houses: 73 600

Fuel mix of district heating systems: natural gas (around 60% – 72 bcm in 2012), coal (around 20%), oil products (5%).

Heat supply chain losses (generation, transmission and distribution, end use): up to 60%, average about 30% to 40%

OVERVIEW

Russia has the largest district heating system in the world. Its district heating sector is closely regulated and interlinked with the electricity sector due to the large number of combined heat and power (CHP) plants. The cost of heat for households is a key social and political issue, which is an important parameter when designing reforms for the district heating sector. Russia's district heating systems are in dire need of modernisation investments. Their modernisation is critical for Russia given that it is a country with harsh climate conditions and that the bulk of the population relies on centralised systems for heat supply. The government has taken important legislative and regulatory steps to support this process, yet so far, these have failed to deliver the expected investments. Additional political and regulatory measures are being developed, including in areas such as tariff methodologies and levels. Speed and investor confidence are essential, because postponing this crucial and massive modernisation effort will inevitably raise future costs of upgrading and lead to growing failures, inefficiencies and disconnections. Modernising the district heating systems through a systemic approach that also includes metering and buildings upgrades will ultimately contribute to the affordability and quality of heat supply (especially when tariff increases are needed) and will ensure the efficiency of centralised systems. At the same time, the government should ensure a framework that identifies where it would ultimately be more efficient to shut down ageing centralised systems and replace them with modern stand-alone condensing boilers at the building or block level. To kick-start the modernisation process, the government will need to ensure that tariff methodologies and tariff predictability periods are long enough to attract investments and offer an attractive rate of return that covers all investment costs. This also requires that regulatory predictability be provided to reduce risks and ultimately, costs. As a further step towards reducing these costs, the government and regions could increase their financial support to the sector, such as through affordable credits.

SUPPLY AND DEMAND

HEAT PRODUCTION AND CONSUMPTION

Total heat production from centralised district heating systems in Russia was about 1.6 billion gigacalories (Gcal)[1] in 2012, according to data from the energy forecasting agency APBE, marking an increase of more than 10% since 2000. Heat production from non-centralised systems was estimated at about 45 million Gcal in 2012. That same year, over 30% of heat or 484 million Gcal was produced by around 651 co-generation plants, and 56% was produced by roughly 73 600 heat-only boiler houses (HOBs). Co-generation from industrial plants represented about 8% of centralised heat production. In 2013, co-generation produced 499 million Gcal, down from 518 million Gcal in 2011.[2] Given the large share of co-generation in district heating generation, there is a strong interplay with the electricity market.

Fuel consumption for district heating systems is larger than for power generation – and represents around one-third of total primary energy consumption. The fuel mix of the district heating systems primarily consists of natural gas (around 60% – 72 billion cubic metres [bcm] in 2012), coal (around 20%) and oil products (5%). Renewables account for about 4% of total heat supply but are only rarely used for district heating. About 70% of the population, or about 100 million people, are connected to district heating systems, and on average, a Russian household consumes 15 gigacalories (Gcal/yr) to 18 Gcal/yr of heat. In addition, about 12.5 million houses are heated by burning wood, peat or coal.[3] The heating season for centralised district heating systems starts at different times and has varying lengths across Russia, depending on geography and local climate conditions, which has an impact on production and loss levels.

Production of district heating systems decreased by one-third in the 1990s, mainly due to a switch to individual boilers by industry (-49% of consumption between 1993 and 1999) and to decentralised individual heating by households. This results from the economic restructuring in the 1990s, but also from inefficient heat pricing structures, cross-subsidies and unreliable heat supplies. This trend whereby centralised district heating competes with individual systems has slowed down since the mid-2000s, but represents a vital challenge for the efficiency and viability of district heating systems as it creates overcapacity and increases supply costs and, ultimately, end-user prices. The Russian housing stock (total dwelling floor space) is increasing from year to year, rising from 2 787 million square metres (m^2) in 2000 to 3 271 million m^2 in 2011.[4] District heating production and consumption have nonetheless been flat in past years due to disconnections, and efficiency gains in new constructions partly offset the increase.

Industry structure

- **Wholesale generation companies** (Russian acronym OGKs):[5] Such OGKs result from the privatisation of RAO UES and include some of the country's biggest co-generation

1. 1 billion gigacalories = 4 185.8 PJ = 4 185 800 TJ.

2. Ministry of Energy of the Russian Federation, www.minenergo.gov.ru/activity/statistic/17359.html; www.minenergo.gov.ru/activity/statistic/10478.html.

3. IEA (2004), *Coming in from the Cold*, OECD/IEA, Paris.

4. www.gks.ru/bgd/regl/b12_12/IssWWW.exe/stg/d01/07-15.htm.

5. Optoviye generiruyuchie kompanii (Оптовые генерирующие компании [ОГК]).

plants located in the largest cities. These are mainly controlled by companies such as Gazprom Energoholding, which is the largest company in this area, accounting for about 10% of total production from district heating systems, and which also operates territorial generating companies (Russian acronym TGKs).[6] Other OGKs are owned by Inter RAO, Enel and E.ON.

- **TGKs**: These companies were created on the basis of regional assets formerly belonging to RAO UES, excluding large co-generation plants and hydroplants. They produce power in thermal power plants, but also heat in co-generation plants. The largest group operating TGKs is Gazprom Energoholding, in particular in Moscow where it owns Mosenergo.[7] The second-largest company in this segment is IES Holding. A number of smaller companies are also operating in this segment and producing 10 million Gcal/yr to 30 million Gcal/yr; these include Inter RAO, the Siberian Coal Energy Company, Fortum and Lukoil, for example. It is noteworthy that the Finnish company Fortum is the only foreign company active in this segment so far, producing about 22 Gcal/yr of heat and having invested EUR 2.5 billion in its Russian assets.
- **Others**, such as local industrial companies that supply heat to surrounding areas, often using small-scale co-generation plants or HOBs: These have started to be modernised using foreign technologies (small-scale co-generation plants working on biomass or condensing boilers), such as Bahkirenergo in Bashkortostan.
- **Municipal companies**: Owned by the different municipalities, these operate mostly small HOBs or small co-generation plants; public-private ownership has also developed as municipalities have leased their facilities to private companies that can operate these heat generation assets.
- **Distribution networks** have very different ownership schemes. Some are owned by large OGKs or TGKs, others by municipalities and operated by service companies. Municipal distribution companies sometimes can also collect payments and are responsible for the state of the municipal heat transmission system. Overall, the issues of ownership of the distribution networks and of the responsibility for payment collection are important, but the wide variety of structures is a challenge for policies addressing reforms in this sector.

KEY POLICIES AND LEGISLATION

INSTITUTIONS

The fact that the Russian heat sector is closely interlinked with the power sector, given the role of co-generation plants in power and heat supplies, requires institutional co-ordination between the Ministry of Energy and the Ministry of Construction, Housing and Utilities. Such co-ordination is also necessary in the area of housing, also involving the Ministry of Economic Development, especially to ensure that energy efficiency measures and results in the area of buildings are taken into account when designing modernisation schemes for district heating systems. Another fundamental aspect is that the government needs to closely co-ordinate tariff methodologies and frameworks with

6. Territorialniye generiruyuchie kompanii (Территориальные генерирующие компании [ТГК]).

7. Gazprom Energoholding produced 106.9 million Gcal in 2010, 100.2 million Gcal in 2011 and 102.5 million Gcal in 2012. http://energoholding.gazprom.ru/.

regional stakeholders that implement them to make sure that they are conducive to investments. Key institutions involved in district heating systems regulation include:

The **Ministry of Energy of the Russian Federation**: It carries out state policy and regulation in the sphere of the production of heat from co-generation plants and HOBs, especially the supply of thermal energy produced from co-generation, and for district heating schemes in cities over 500 000 inhabitants. The ministry also holds overall key responsibility for regulation and policies in the sphere of centralised district heating.

The **Ministry of Construction, Housing and Utilities**: This ministry was created at the end of 2013 and took over many functions from the Ministry of Regional Development on state services and state property management in the sphere of construction, urban development, housing services and utilities, in particular for cities with fewer than 500 000 inhabitants (especially small boilers and systems, as well as the heat distribution in buildings). The new ministry was in established on the basis of the Federal Agency for Construction and Communal Services, which sets construction norms. As such, this new ministry may play a role in the definition and implementation of policies, although at the time of writing, the ministry had not started its work.

The **Ministry of Economic Development** deals with energy efficiency regulations and sets the level of changes in regulated tariffs, especially in relation to inflation.

The **Federal Tariff Service** (FTS): as district heating is supplied under regulated tariffs, the FTS sets a framework for methodologies for calculating regulated heat tariffs, with a maximum and minimum price for each region, and controls these tariffs. This framework is set on a yearly basis. The FTS also sets limits for the heat price from co-generation plants with an installed capacity of 25 megawatts (MW) or more. The FTS also acts to regulate disputes among regional authorities, consumers and producers.

Regional energy commissions determine final heat tariffs within the limits set by the FTS. They do so in approving the investment programmes of regulated heat companies and determine their energy efficiency requirements, possibly including renewable energy. This gives them the opportunity to pursue ambitious modernisation policies, especially through energy efficiency action plans and through setting tariffs that allow a return on investments, even if this exceeds the federal limit. In practice though, for social and political reasons, these commissions can be reluctant to agree to price increases, especially if they exceed the federal limit.[8]

Municipal authorities are responsible for designing modernisation schemes for heat supply in cities with fewer than 500 000 inhabitants.

Non-governmental organisations and building envelope trade associations also play a co-ordination and advisory role, such as the Russian Heating Supply Partnership created in 2003.[9]

POLICY OBJECTIVES

The challenge of modernising Russia's district heating sector is of critical importance, and the government is well aware of this challenge. Russia has engaged in a modernisation process of its district heating systems. Objectives outlined in the Energy Strategy and other policy documents include:

8. Boute, A. (2012), "Modernizing the Russian District Heating Sector: Financing Energy Efficiency and Renewable Energy Investments under the New Federal Heat Law", *Pace Environmental Law Review*, Vol. 29, p. 746, http://digitalcommons.pace.edu/pelr/vol29/iss3/3.

9. http://nprt.rosteplo.ru/.

- maintaining Russia's district heating systems and supporting use of combined electricity and heat generation
- improving the energy efficiency of heat supply and consumption (in buildings) and reducing network losses from 20% in 2008 to 8% to 10% in 2030
- ensuring that tariffs are regulated on a long-term basis and reflect investment costs of energy efficiency measures, and these are implemented
- providing reliability, security and quality of heat supplies
- ensuring economic incentives for modernisation while protecting interests of consumers
- ensuring environmental safety
- developing the use of biomass and geothermal energy
- improving energy efficiency of buildings.

Box 11.1 Promoting co-generation: An example from the United Kingdom

The Russian government is aware of the need to promote co-generation. This is particularly important as it has many environmental and economic benefits. Experience from member countries of the International Energy Agency (IEA) highlights that there are options to support it. The IEA assessment of policies and measures that have worked across its member countries and other key partners in dialogue points to the need for governmental definition of high efficiency co-generation. The experience in countries such as the United Kingdom and in the European Union reflects great benefits from a clear definition and target. In an effort to raise the efficiency of co-generation plants, Article 11 of the European Union Co-generation Directive (2004/8/EC) – to be replaced by the new Energy Efficiency Directive – established a comprehensive legal framework for encouraging efficient co-generation development across the European Union. The directive defines high-efficiency co-generation by the energy savings obtained by combined production instead of separate production of heat and electricity. Energy savings of more than 10% qualify for the term "high-efficiency co-generation".

To maximise the energy savings and to avoid these savings being lost, the greatest attention must be paid to the functioning conditions of co-generation units.

In 2000, the CHP Quality Assurance scheme of the United Kingdom's government provided a methodology for assessing the quality of co-generation schemes in terms of their energy efficiency and environmental performance. Russia would benefit from such examples – especially given its massive installed capacity of industrial co-generation compared with many other countries. Assigning the responsibility for co-generation and district heating to a federal agency with regional branches may help address co-ordination and implementation issues in Russia. This federal agency could:

- collect co-generation and district heating data and measure the efficiency of co-generation plants
- support municipalities, especially smaller cities, in developing district heating modernisation schemes, in creating the most efficient regulatory scheme, and in attracting finance and investments, such as through concession
- instruct how to implement the single heat supply organisation model (see next section).

LEGAL AND REGULATORY FRAMEWORK

Framework for the modernisation of the district heating sector

Over the past five years, Russia has progressively developed a comprehensive framework for the modernisation of the district heating sector.

The 23 November 2009 Federal Law No. 261 "On Saving Energy and Increasing Energy Efficiency", and its amendments, is one of the three key pillars of this process. Further to introducing progressive mandatory heat metering, it has also required energy audits to be realised, including of heat generating assets. It has also mandated the government and the regional governments to develop energy efficiency programmes, including in the heat sector, with energy efficiency requirements for regulated companies.

The 2010 Federal Law "On Concessions" is a second pillar that could be further reinforced. It establishes a concession framework that could be used for private investors to take district heating assets in concession during a reasonable, longer-term period that could allow paying back modernisation investments. But most municipal entities appear to be reluctant to develop concession frameworks: In large cities with modern co-generation plants, the heat supply business appears to be profitable, and in small cities, there is hardly any interest from companies in concessions, especially since these small cities see a concentration of payment problems, very old infrastructure and an insufficient critical mass of customers. Moreover, private investors are concerned about the large number of obligations they would take on while the risk of regulatory, tariff and fiscal changes at the municipal, regional and federal levels is perceived as very strong and could jeopardise their investment.

The 27 July 2010 Federal Law No. 190, On Heat Supply, is the cornerstone of this reform and modernisation effort. This law introduced a comprehensive federal legal framework that regulates heat production, distribution and supply through general principles. It streamlines previous separate legislative acts into one comprehensive document, which is a key improvement. However, this law requires regulatory acts and sub-laws to be operational, as well as action plans for its implementation – about 20 subordinate regulatory acts had been adopted at the time of writing.[10]

Its stated objective is to ensure an energy efficient and environmentally safe heat supply; to foster the modernisation of assets and to prioritise co-generation plants; to attract consumers back into centralised systems and away from individual boilers; and to improve reliability and quality of heat supply. Key provisions include the following aspects:

- It defines economic relations among the supplier, transporter and customer and establishes that there needs to be contract regulation between the supplier and the end consumer and between the supplier and the transporter/distributor.
- It clarifies and simplifies rules for connecting to the network as well as procedures for phasing out district heating capital assets.
- It introduces the possibility of capacity payments to maintain reserve capacity.
- It mandates the development of Heat Supply Schemes by local authorities and federal authorities for large cities. These schemes are to outline plans for the coherent and

10. www.rosteplo.ru/zaktep.php.

efficient development of district heating systems, determining investment needs and development prospects, but experts view them as ill-conceived because they do not take into account all the specificities of a given city in terms of tariff restrictions, budget means and structure of consumers, for example, and cannot define financial and economic strategies on how to realistically plan investments and tackle the financing and execution of modernisation works. The Ministry of Energy is responsible for these schemes in cities with more than 500 000 inhabitants, and in smaller cities, municipalities bear the responsibility for developing them.

- It states the need to ensure the priority use of co-generation for district heating systems, but does not detail measures in order to strengthen their financial viability and competitiveness and incentivise their modernisation, especially in developing a more efficient balance between heat and electricity costs.
- It introduces three longer-term tariff methodologies and regulation that enable investors and operators to recover investments in modernisation – and introduces quality-of-service requirements in return. District heating companies can apply to Regional Energy Commissions for using one of these tariff methodologies yet the ultimate decision lies with these regional commissions. Another very positive recent trend is that policies and regulation, as outlined below, are moving towards largely excluding cost-plus as well as towards regulatory asset base (RAB) or alternative benchmarking pricing.

The single-tariff methodology currently used in Russia is valid for only one year: The **"cost-plus" methodology** provides for a remuneration based on the account balance including costs, revenues and investment needs, for the duration of one year. It is a strong obstacle to the modernisation of district heating systems as it does not incentivise investments; indeed, companies are encouraged to increase their energy input or inflate costs to justify higher operating costs and obtain higher revenues, especially since capital depreciation and maintenance are not fully covered. In no ways are companies incentivised to reduce their energy consumption and improve the efficiency of the heat supply system. In addition, as costs are established on a yearly basis, it does not provide any certainty as to the payback period for investments. Finally, the record shows that as district heating system heat tariffs are regulated, generators are unable to cover, in most cases, the full cost of heat supply, including modernisation of the capital assets. This factor has limited the capacity of heat companies to invest in modernisation and has reduced incentives for end users to invest in energy efficiency and reduce their heat consumption. However, this methodology is to be progressively phased out, especially after 2016. In its decree No. 760 dating from 13 June 2013, the FTS introduced the possibility of maintaining tariffs for five years following energy efficiency gains, yet the principle is not considered enough to drive investments.

Long-term tariff methodologies

The introduction of three long-term tariff methodologies marks a key improvement, as until then, the tariff regulation period was too short to allow any recovery of invested capital – whereas the principle of long-term tariffs enables investors to earn a reasonable return on capital and is key to ensuring the balance between the interests of consumers and producers. Indeed, this provides investors with some guarantee that they will be able to benefit from saved costs for a duration of at least five years. Should there be changes to the tariff structure, they would be entitled to budget compensations, yet the law also foresees exceptions which are vaguely outlined, such as the worsening of the economic situation, and which thus create uncertainty. The decree No. 1075 from 22 October 2012, On the Formation of Heat Tariffs, laid out details regarding heat distribution pricing mechanisms and their implementation. It has also introduced tariff adjustments based on the fulfilment of quality objectives. Moreover, law No. 291 from 30 December 2012 introduced the principle of a progressive and mandatory long-term price regulation as from 1 January 2016 on tariff regulation in the sphere of power, heat, gas, water supply and water disposal, in order to facilitate investments. It states that this long-term regulation is established for a period of at least five years, or at least three years if such tariffs are established for the first time.

1. **Tariff indexation of costs** (for at least five years): when prices reflect the costs of the preceding year with an index reflecting changes in fuel costs, for example. This is a combination of the cost-plus and RAB methodologies, based on a cost-based approach which integrates efficiency components in operating costs, and includes a norm on the profitability based on revenues and costs.

2. **Return on investment methodology** – RAB): sets a tariff for no less than five years after a first period of no less than three years (de facto first three years and then five years) and can be implemented as from January 2013 on the basis of results from heat supply schemes. It sets tariffs in a manner to recover operating costs (under certain efficiency and depreciation conditions) and investment costs, and allows a reasonable profit on the invested capital to be made – which a company has to negotiate directly with the Regional Energy Commission, which determines the rate of return on investments based on a minimum rate defined by the FTS (cost of debt plus cost of equity). This methodology can be introduced for boilers, organisations that entered a concession, co-generation plants or two-pipe transmission lines longer than 50 kilometres (km). Yet increases in the heat price for co-generation plants cannot exceed the level set by the FTS. There are also limitations to costs that investors can recoup through tariffs. By the end of 2013, the RAB methodology had been used only in the case of three companies. The FTS, in line with current legislation, is preparing for its implementation by January 2016 as part of a policy move towards long-term tariffs and away from the cost-plus methodology. A key challenge is that the often implied tariff increase may not be seen as politically acceptable.

3. **Comparative method** (the least used): establishes tariffs based on the cost structure of average existing cluster installations which are meant to serve as benchmarks, based on samples of similar organisations (installed capacity, fuel type used, capacity, etc.). This is to apply to small heat plants with a capacity below 10 Gcal per hour or to transmission lines below 50 km, and the effectiveness of this methodology to trigger investments will largely rely on the benchmarks retained. One of the objectives of this method is to avoid switching to individual boilers, which could be used as price benchmarks. The underpinning concept is that district heating companies should at least modernise their assets to a level over such an average benchmark.

Since 2013, the Ministry of Energy has also been working on a new, fourth long-term tariff methodology introducing a cap system based on the cost of an alternative individual boiler, with tariff levels that are currently being assessed and that could be around RUB 1 300 per gigacolorie (RUB/Gcal) to RUB 1 500/Gcal. This system would consist of the FTS defining such maximum cap tariffs for every region based on their geography, climate and type of fuel used. Some company estimates show that for some co-generation plants, tariffs would need to rise in a range of 10% to 20%. In systems supplied by an old individual boiler, often outdated where tariffs are already higher than those that would be established by this alternative cap method and which represent an important part of consumers, the tariff level would be maintained to provide an additional incentive for modernisation. It may be challenging to implement such a methodology in smaller, deprived cities unless there is an effective mechanism for access to financing and unless municipalities set the conditions for private investors to take over district heating systems, such as through concessions. The alternative boiler method could provide an efficient opportunity to foster modernisation investments in co-generation plants, if only there is a long-term predictability of these tariffs. Overall, this method in principle is to be welcomed to the extent that it reflects the fact that district heating systems are in competition with decentralised individual heat boilers, and thus it aims at reversing a trend whereby an increasing number of end users switch to individual boilers. Owners of co-generation plants or potential investors would have a clear incentive to reduce fuel input costs through efficiency gains and transmission losses.

The key is to quickly move away from cost-plus tariffs, and the government should reduce the number of tariff options available to simplify the framework. The comparative methodology with an individual boiler is certainly the most appropriate to foster modernisation of the co-generation plants and to modernise HOBs in larger cities. The RAB methodology, however, should be considered for some HOB systems, but would also need to be further adapted in order to allow for longer-term tariff predictability.

In any case, there would need to be a progressive, clear and transparent implementation of this new methodology in order not to create a sudden policy change that may impact already undertaken or planned investments. Finally, any further tariff reform will need to incorporate a large and visible quality-of-service component as consumers deserve the right to have strong guarantees on the quality of service (temperature, number of failures, type of failure and duration) and adequate compensation when these are not met, especially if prices are to rise. This is a condition for quality norms to satisfy consumers and to incentivise the modernisation of heat supply assets.

The tariff question also raises the issue of the contractual relations among heat producers, suppliers and end consumers, which has been regulated by the 27 July 2010 Federal Law No. 190 On Heat Supply but has not been implemented yet.

Russia's heat sector reforms would greatly benefit from a simplification of these commercial and contractual relations in the form of single heat supply organisations (ETOs)[11] that would either produce, buy, distribute or sell heat, sign contracts with end consumers, and be responsible for heat supplies and quality of service. These ETOs would be established in every municipality (there can be several ETOs in one city, depending on the centralised heat supply scheme) on the basis of the existing different heat generation and transmission systems.[12] This reorganisation would prove a very efficient way for consumers to have a direct, eased contact point for their heat supply and to enforce stricter standards of heat quality service, and it would also empower the heat generation companies, which would be a key part of the ETO, to define and implement modernisation schemes, including taking into account, if appropriate, the results from the heat supply schemes. Indeed, only these ETOs would be able to also take into account the current tariff situation in a particular region and municipality, and the current budget and financial situation in a particular region and municipality. ETOs would also have a direct interest in installing metering

11. In Russian, "edinaya teplosnabjayushaya organisatsia".

12. For more details, see legislative proposal outlining this proposal and addressing in particular how the ETOs should be established: http://minenergo.gov.ru/documents/razrabotka/17326.html.

devices and reducing heat consumption, as this would allow them to shut down the most inefficient plants and possibly also increase market share in gaining new customers who could be tempted to go for individual solutions.

THE MODERNISATION CHALLENGE: ENERGY-SAVING POTENTIAL AND QUALITY OF SERVICES

LOSSES AND SYSTEM INEFFICIENCIES

Russia's district heating capital assets are outdated and often obsolete. This results from a lack in investments and inadequate maintenance in the 1990s and 2000s, which in turn are due to a combination of factors, including: non-cost-reflective tariffs leading to revenues that do not cover full cost of sustainable district heating; lack of access to capital for modernisation; non-payments; rising fuel costs; lack of regulatory and other incentive; decreasing use of centralised heat; cross-subsidisation; and lack of predictability of tariffs.[13] According to the Energy Strategy to 2030, the energy-saving potential in the Russian district heating system is estimated to be 35% to 45%.

The potential to reduce losses in generation, transmission and distribution as well as end use is particularly large.

Indeed, it has been reported that 80% of Russian boilers are over 30 years old and 20% over 50 years old. According to data from the Ministry of Energy, the generation of 1 000 calories of heat requires 330 kilogrammes (kg) of energy input, compared with around an average of 220 kg for member countries of the Organisation for Economic Co-operation and Development (OECD). Many of these very old boiler houses could be modernised with a reasonable payback period based on current tariffs – but in many cases there is a lack of either financial resources or will to do so. In addition, over 50% of the 170 000 km of heat distribution pipelines are past their technical life expectancy, and 44% of transmission lines need to be replaced according to the Ministry of Construction, Housing and Utilities. According to Rosstat, in 2012, 29% of the heat distribution system is considered to be in critical condition and needs to be replaced. About 10% to 12% of pipes would need to be changed every year – although each year only about 1% of pipes are changed on average.[14] In 2013, this number increased to 2.7% according to Rosstat data, yet remains by far insufficient. Overall, the Ministry of Energy estimates that 65% to 70% of capital assets require replacement.

In total, losses (leakage, wasteful use) in the heat supply chain (which includes generation, transmission/distribution and end use) average 30% to 40%, and can even reach up to 60% in some cases, versus an average of 20% in OECD systems. Estimates from the Finnish company Fortum point to losses up to three times higher than in a similar system in Finland: 10% during generation, 30% during transportation and distribution, and 20% during consumption.[15] There are in particular massive energy losses in distribution, especially between substations and radiators, due to lack of insulation and leakages. On average, heat network transmission losses are in a range of 15% according to official data, compared with 5% to 10% for the OECD average. Yet in some regions and municipalities, heat network transmission losses can be over 40%.

13. For more details see IFC/World Bank (2008), *Energy Efficiency in Russia: Untapped reserves*, Washington D.C.

14. IEA (2009), *CHP/DH country profile, Russia*, OECD/IEA, Paris, ww.iea.org/media/files/chp/profiles/russia.pdf.

15. Fortum (2012), company presentation, "Modernizing Russian Heating Sector".

There are little data available to assess the efficiency of the HOBs, yet it can be assumed that most of them can be modernised through a viable investment in the current conditions, provided that there is access to financing and political will. Assuming a price of gas for a district heating generation company that is delivered for an average of USD 106 per 1 000 cubic metres (USD/m^3) to USD 110/1 000 m^3 in Russia, in a block of 1 500 apartments, each requiring an average of 15 Gcal/yr of heat output, the upgrade of an old HOB boiler with 65% efficiency could result in payback periods of less than three years. Old boiler efficiency can be improved by around 25% to achieve fuel efficiencies for condensing boilers that are 90% or higher. Total annual gas savings are around USD 75 000 per year with a total capital cost investment of around USD 225 000 or less.

The related opportunity cost for the Russian economy of non-modernisation is large.

The quality of heat supply can be very problematic: There are cuts in the heating season or heat supply temperature, or heat supply failures that can last several days, mostly due to problems in the transmission infrastructure. The Energy Strategy to 2030 mentions that in 2008, 27% of users face a heat supply cut-off at least once a year and recognises that the situation has been deteriorating in recent years. In the absence of thermostats and heat allocators, and due to the vertical one-tier pumping system in apartment buildings, opening the window, even in freezing temperatures, is the only way to regulate heat in apartments.

Facing the necessity of investing in modernising these ageing centralised systems, there are two main options: either upgrade systems and focus on generation, transmission/ distribution and end use, or shut them down. For the latter case, this can be done either partially for some housing blocks or areas that are too distant or where the infrastructure is too old, or totally, replacing them with stand-alone condensing boilers (see Box 11.2).

Box 11.2 Strategic approach to district heating modernisation

The overall objective should be to dramatically reduce building heating demand in Russia, since it is very high due to older inefficient buildings and a severe cold climate. Looking at the barriers associated with upgrading district heating networks, including supply companies, network companies, and building owners/operators, to pursue a fully integrated network upgrade that includes building efficiency is challenging. "Ownership" of an overall systems-level perspective has not yet been piloted in Russia. Thus, the trend to pursue individual building solutions that are independent of the district network may be an excellent direction to take, but needs to be co-ordinated within district heating schemes.

Strategic planning should determine which networks in densely populated areas have the potential for dramatic improvement with more efficient supply; modern, smaller and well-insulated piping; and end-use building efficiency that allows for much smaller heating capacity that results in lower operating temperatures and lower flow rates, but same improved level of comfort. These systems could become the networks that offer renewable energy sources such as biomass (e.g. wood pellets) in the future. At the same time, other parts of the network or some networks that do not appear to be viable for the future should be planned for obsolescence. Thus, establishing areas where the network will not be maintained after a certain period, while providing funding to allow for individual building systems to be adopted, can spur greater holistic system perspectives that will reduce costs and improve efficiency. This can include installing micro-co-generation plants, as is the case for example in the Mytishinskaya heating system in the Moscow oblast.

Box 11.2 Strategic approach to district heating modernisation (continued)

With significant effort globally towards zero-energy buildings, Russia appears to be lacking in setting a similar goal. An integrated approach can allow for building envelope investments to be made that will likely have a longer service life than heating equipment while allowing for significant reduction in the capacity of the heating systems. This reduces the equipment cost and helps pay for the building envelope modifications, such as improved controls, submetering, and improvements to the overall building envelope (floors, roofs, walls and windows). In addition to monetary savings, these also provide improved comfort and reduced health impacts for occupants. Solutions for heating equipment for individual buildings include condensing boilers with minimal heat loss, small-scale co-generation, and ground-source heat pumps.

Most recent condensing boiler technologies have led to important improvement in efficiency of stand-alone boilers and a reduction of costs of their installation and operation. Heat supply schemes in Russia are meant to analyse how best to modernise systems, yet the benefits of partly or totally shutting down some centralised systems, instead of conducting some possibly more expensive modernisation investments, should be fully assessed, especially in areas connected to gas or where biomass could be available. Condensing boilers and furnaces utilise the latent heat of water to increase system efficiency.

Hot gases are passed through a second heat exchanger to condense water vapour produced in the combustion process. As the water vapour is condensed, heat is transferred back to the system return, which lowers the combustion temperature gradient. Remaining gases are expelled through a fan-assisted balanced flue. The efficiency of a typical non-condensing boiler or furnace is 70% to 84% (very old boilers and furnaces can have efficiencies as low as 60%), whereas condensing boilers and furnaces typically have efficiencies above 90%. In addition, as these boilers are installed either in a building or close to a building or block of buildings, losses in transmission are marginal. Natural gas is the most common fuel used with condensing boilers, but they can also operate using fuel oil or liquefied petroleum gas.

Finally, the installation of building-level automated metering and regulation substations (in Russian, “individualnye teploviye punkty”) is a fundamental element in improving billing, heat supply quality and efficiency via an improved management and control of hot water flows. These two-pipe systems, installed either in basements or nearby the main apartment building, can lead to a reduction of up to 30% of heat consumption for a single apartment building, as shown in the case of the Mytishinskaya heating system in the Moscow oblast.

Sources: IEA (2013), *Transition to Sustainable Buildings: Strategies and Opportunities to 2050*, OCED/IEA, Paris, pp. 155-157; IEA (2013), *Technology Roadmap for Energy Efficient Building Envelopes*, OCED/IEA, Paris; www.m-teploset.ru/individualny-teplovye-punkty; www.m-teploset.ru/mini-tec.

METERING

Russia’s district heating sector is characterised by insufficient heat metering – only 40% of commercially sold heat is metered and only about 30% of users have meters. In general, buildings are not equipped with thermostats and meters, so that billing is rarely based on actual energy use.

Since the mid-2000s, legislative obligations were put in place to deploy metering for both production and consumption of heat, but no real progress has been made. The 2009 Law No. 261, On Energy Efficiency, contains the obligation to meter heat by mid-2012 for any object consuming more than 0.2 Gcal/yr, a requirement to install heat meters in new buildings at apartment level for new construction started after January 2012, and a requirement for public buildings to install meters by 1 January 2011. This law's goal is for ultimately about 75% of heat centrally supplied to be metered at building level, as about 25% of consumers are exempt from this obligation due to their low consumption. The law specifies that district heating companies have to fund the installation of building-level meters based on credits or their own funds, and that costs can be transferred to households during five years. In multi-apartment buildings, homeowner associations or management companies can also install them, yet this is not working as it should. There have been discussions over rapidly increasing heat bills in buildings with no meters to incentivise metering, yet this has proven to be ineffective given that many consumers simply cannot afford to pay higher bills. Implementation thus has not happened.[16] Pilot projects in Tchelyabinsk, Orenburg, Ekaterinburg, Krasnoyarsk, Tomsk, St. Petersburg and Voronej were recently developed to install meters and regulators. Yet overall, the objectives laid out in this law are far from being achieved.

The law sets up penalties to foster the installation of meters: As from January 2015, financial sanctions on apartments and buildings without meters can be imposed, with higher coefficients imposed on norm-based bills, with a maximum of 10% increase for every six months up to a maximum increase of 1.6 times.

A challenge is that consumption-based billing, once meters have been deployed, would in some cases reduce the volume of heat charged by district heating companies and raise the issue of who would then cover costs related to losses in the system. Indeed, the regulated norm of losses is 5% to 6%, but real losses are much higher. This underlines the need for parallel investments in the modernisation of heat generation and transmission infrastructure. Yet in most cases, the normative-based billing underestimates real consumption of buildings so that district heating supply companies in fact have an interest in meters being deployed. Indeed, the level of the norm-based heat tariff varies largely from region to region and is often deliberately set at a low level for political and social reasons by Regional Energy Commissions. In practice, it appears that these building-level meters are thus often illegally shut down because norm-based consumption appears to be cheaper than effective consumption-based heating, because the real level of consumption can be underestimated.

Apartment-level metering in old constructions – a majority of apartment buildings were built before 1970 – is often much more expensive than establishing building-level substations, as in these old buildings and apartments, a brand-new parallel heat distribution column may need to be installed as the current stand-alone vertical one-pipe circuit does not allow for individual metering.[17] In these circumstances, the combination of building-level heat measures and thermostats, and automated systems, is the most effective solution for old housing blocks, coupled with apartment-level heat allocators that make it possible to estimate consumption for individual apartments. These simple and inexpensive devices can allow for equitable allocation of heat costs within a building when total building

16. Korppo, A. and N. Korobova (2012), "Modernizing residential heating in Russia: End-use practices, legal developments and future prospects", in *Energy Policy*, Vol. 42, March, pp. 213-220.

17. See IEA (2004), *Coming in from the Cold*, OECD/IEA, Paris.

consumption is metered.[18] There has been important technical progress over recent years in this area, such as low-cost micro-sensors or controls.

For new buildings constructed as from January 2012, the installation of individual heat meters at apartment level is mandatory. However, households do not see economic benefits from adding insulation or upgrading windows; the same applies for construction companies.

PAYMENTS

In a country where heat is vital to the population during several months of the year and where 11% of the population has revenues below the defined minimum,[19] the level of heating bills is socially and politically a sensitive issue. In large cities, the growing middle class can afford to pay rising bills, but the situation is more problematic in smaller towns with lower income levels, more unemployment and a larger share of retired people, and where heat is supplied by municipality-owned HOBs. In many cases, non-payment problems are not related to households but rather to non-transparent municipal management companies. Every heating season, the Ministry of Interior and the General Prosecutor and Rosfinmonitoring deal with the debt problems, as industries, municipal companies/ structures and home management companies that collect bills from households do not pay for heat, and some other consumers do not pay their debts to heat generation companies. Total debts per heating season are in a range of EUR 1 billion to EUR 2 billion. Disconnecting non-paying customers is banned by law and is technically impossible; in apartment buildings, cutting the heat supply to one apartment without cutting the heat supply to the whole building cannot be done. Overall, there are currently no proper means to collect payments from non-paying customers. However, there are legislative proposals to improve the payment rate and address this challenge. Options include imposing penalties for non-payments, and direct payments from end users to district heating companies and setting up separate accounts to collect heat bills which automatically transfer payments to heat generation and distribution companies, thus prohibiting municipal or residential management companies from controlling these funds.

TARIFFS AND CROSS-SUBSIDIES

Regulated tariffs for heat are different from region to region, from municipality to municipality, and even within the different cities, depending on the type of district heating system. Within the framework and limits defined by the FTS, Regional Energy Commissions set heat prices and adopt heat tariffs for a given year. These tariffs can have large differences across the regions, depending on the geography, the region, the type of generation asset in place and the fuel input, as well as other factors. They typically vary in a range of RUB 1 300/Gcal to RUB 3 000/Gcal of heat (EUR 30 per gigacalorie [EUR/Gcal] to EUR 70/Gcal), and heat companies obtain a price of heat in general between RUB 800 and RUB 1 500.[20] The lowest tariffs are usually found in cities where large co-generation plants are operating and where wholesale gas prices are comparatively lowest. Average heat prices per square metre over the past ten years have consistently been increasing at levels above inflation rates. Overall, Russians consume about 0.33 gigacalories per square metre

18. Evans, N. and V. Roshchanka (2012), *Playing Hot and Cold: How Can Russian Heat Policy Find Its Way Towards Energy Efficiency?,* US Department of Energy, October, www.pnnl.gov/main/publications/external/technical_reports/PNNL-21695.pdf.

19. www.gks.ru/free_doc/new_site/population/bednost/tabl/2-06.htm.

20. The tariffs for each region can be accessed on the website of the FTS: www.fstrf.ru/tariffs/info_tarif.

per year (Gcal/m^2/yr) of heat compared with 0.11 Gcal/m^2/yr in Finland, but they pay roughly the same for it. The key challenge is thus to reduce heat consumption and output and to raise tariffs when needed to spur necessary investment. At the same time, tariffs vary strongly from region to region, city to city, and even area or street to street, which is confusing for end users and does not bring trust into centralised district heating systems, which adds to the fact that quality of service is often insufficient, if not poor, and is undermining end-user confidence and satisfaction.

District heating companies submit information on their costs and operating expenses, and regional energy authorities then approve them and set tariffs. The level of tariffs is transparent on the website of the FTS, but at the regional level, these would often benefit from being more available and transparent to end users. Social considerations play a key role in this process, and the difference between the tariffs and the costs agreed with the district heating companies is covered by subsidies or cross-subsidies. The press also frequently reports that this system allows corruption at local and regional levels, as there can be illegitimate levels of costs included in tariffs, leading to kickbacks and illegal money transfers among the different involved stakeholders.

The interest of Regional Energy Commissions is nonetheless to ensure maximum affordability, while also facilitating investments in modernisation of assets to improve their efficiency and the quality of supplies and to reduce their environmental impact. In some cases, when it is necessary to recover costs from the implementation of investment obligations, Regional Energy Commissions can set higher tariffs than the federal limits,[21] also including the costs of biomass or other renewables.[22] This is a clear instrument that empowers these authorities to foster modernisation efforts in district heating systems. However, political decisions by the government can interfere, as with the 2013 presidential decisions to limit tariff increases of utility services to the level of inflation for the period 2014-16.

Overall, tariffs are norm-based rather than based on actual use, due to the lack of systematic metering: single-rate, one-tier tariffs per gigacalorie of heat supplied where revenues depend on the amount of heat produced; and double-rate, two-tier tariffs which contain a component for the heat output and a distinct component for the installed capacity of heat installations. This reduces incentives to increase heat output in order to increase revenues or recover costs. Households pay their heat bill according to the size of the flat in square metres, the heating norm, and the heating methodology and conditions retained in a particular region, and not on actual heat service provided.

Finally, challenges relate to cross-subsidies. Three types can be identified:

- Cross-subsidies between different groups of customers. Usually large industrial consumers pay higher tariffs than small industrial customers and households. This is to protect inefficient small and medium-sized companies and to avoid further disconnections from households.
- Cross-subsidies between heat producers. A very typical situation is that municipalities (or regional authorities) own heat generation assets (such as boilers) or distributors and grant them much higher tariffs than needed.

21. Boute, A. (2012), "Modernizing the Russian District Heating Sector: Financing Energy Efficiency and Renewable Energy Investments under the New Federal Heat Law", *Pace Environmental Law Review*, Vol. 29, p. 746, http://digitalcommons.pace.edu/pelr/vol29/iss3/3.

22. IFC/World Bank (2012), *Financing Renewable Energy Investments in Russia: Legal Challenges and Opportunities*, Russia Renewable Energy Program, Washington D.C.

- Cross-subsidies between heat and energy. When co-generation produces both heat and energy, there must be some economic solution to how to divide costs between these two products. The methodology exists but very often, regulatory decisions are made in favour of heat consumers – who get low tariffs – which results in very high inefficiency of co-generation in the energy market. In turn, because they produce heat and power, these co-generation plants are eligible during some periods to be in the priority order for capacity supply in the wholesale market and then benefit from higher electricity tariffs. An ongoing cross-subsidy is that in summer, co-generation plants are typically paid for a capacity of 205 MW, while in winter when more heat is sold, the remuneration covers only about 180 MW, thus creating an artificial limit.

These cross-subsidies have been progressively removed in many cities in past years. The many remaining ones are an obstacle to investments. The government was preparing a heat market reform to be implemented in 2014 in order to end this system of cross-subsidies.

ASSESSMENT

Russia's heating sector is facing a massive and urgent need for modernisation and the more this is postponed, the more overwhelming and unmanageable the challenge will be, which will jeopardise the country's energy, social and economic security. Centralised district heating systems are also increasingly facing the challenge of disconnections, especially as end-user prices have been increasing while the low quality of service has not improved. The district heating sector modernisation is a complex undertaking, because it involves different private and public stakeholders at federal, regional and municipal levels; because heat supply is vital for the population; because of the tremendous amount of investments needed; and because the infrastructure in the sector is so diverse, ranging from large co-generation plants to small HOBs, and the close interrelation between heat and power markets.

Russia has made good progress over the past few years in developing a legislative and regulatory framework that can enable modernisation investments. In particular, the Federal Heat Supply and Energy Efficiency laws indicate that the challenges are being recognised, especially in providing opportunities to set tariff guarantees that incentivise efficiency and modernisation investments. Subsequent regulatory acts have also paved the way to include the setting of long-term tariffs and quality of service. Nonetheless, a number of additional steps need to be taken to foster the modernisation process. Indeed, the modernisation and reform of Russia's district heating systems needs to be accelerated and implemented through a stronger prioritisation.

Market organisation: The establishment of ETOs would make the district heating sector more efficient and more transparent, and would foster the ability to conduct modernisation investments. Appropriate measures should be taken quickly to facilitate this market reorganisation.

Policy co-ordination and implementation: The implementation of the present legal framework has an insufficient track record: large-scale private investments have not happened yet and the required sub-legislation has not all been put in place to ensure that the regulatory framework is effective. The government, in close co-ordination with regional and municipal stakeholders, should now prioritise implementation of legislation and set clear objectives, year by year, with a clear and transparent mechanism to review progress and to address challenges and make adjustments. This would require that responsibilities be clearly identified to oversee and co-ordinate this process at the highest governmental level and to implement these measures at lower levels, and that institutional co-ordination be ongoing. District heating modernisation schemes are a useful instrument in principle, yet to be effective, they need to target generation, transmission, building-level metering and end-use efficiency at the same time through a system approach. Integrating the end-use segment – and related potential energy efficiency upgrades in building – plays a key role in avoiding overcapacity and overinvestment, as has been the case in some Central European countries.[23] Moreover, there is a need to find specific mechanisms and define specific plans for small cities with small HOBs and for small district heating systems, especially because municipal planners often lack the capacity to formulate investment programmes. There need to be clear benchmarks to assess whether new construction should be connected to existing district heating systems or not and whether existing housing blocks, located at far distances for example, should be disconnected and equipped with small-scale stand-alone condensing boilers instead. Strong and effective co-ordination between heat and power policies, and between heat and building policies, will thus be essential in this regards. Ultimately, if duly implemented, ETOs should be well-placed to determine how best to optimise and modernise the local district heating schemes.

Energy service contracts are largely underused, pointing to obvious deficits, gaps, and regulatory and economic challenges. Reasons include lack of metering, an insufficient record of contract compliance, huge costs for prequalification for projects for public buildings for due diligences and assessments, and high costs to bid for projects. Energy service companies (ESCOs) can play a key role in modernising district heating generating assets, but would need to be further supported.

The government has prioritised the development of co-generation plants, which is a welcome step, yet concrete and effective measures would need to be defined and implemented, starting with removing all remaining cross-subsidies between heat and power to have a clearer and fairer distribution of costs between heat and power. The government could adopt benchmarks for the separate production of heat with a high energy efficiency factor, depending on the primary fuel input, and measures should promote the construction of high-efficiency industrial co-generation. Overall, modernisation of industrial co-generation plants should be quicker to achieve given the economic interests and investment capacities of these companies.

Tariff methodologies, levels and periods, and metering: On the end-use side, norm-based billing should be progressively but urgently eliminated and replaced with metered consumption-based billing, as international experience shows that this is essential to promote energy efficiency and cost reductions, improve transparency, and give consumers more control over their heat bill. The government is rightly prioritising heat metering at the building level for old constructions, but it needs to ensure that implementation is happening on a large scale and that no heat end user has exemptions from metering. There must be greater and quicker penalties for not installing meters or for the non-functioning of building-level metering and regulation substations.

The government should also prioritise the installation of thermostats at apartment levels. The mandatory installation of building-level meters by district heating companies or building service companies should be enforced, by providing financial support on the one hand, and by setting clear fines and penalties in the case of non-compliance on the other hand. At the same time, apartment owners or homeowner associations should be

23. IEA (2004), *Coming in from the Cold*, OECD/IEA, Paris.

empowered and mandated to pay for the installation of apartment-level regulators. Finally, for new constructions, the installation of apartment-level meters and heat thermostats should be mandatory.

The success of this reform process will also depend on the capacity and support of customers to monitor and reduce their heat consumption and costs, under the assumption that efficiency gains will outweigh the increase in heat costs.

In addition, in order to make possible initial price increases more acceptable, there should be full transparency, through website posting, to allow public review of tariffs and modernisation and investment plans. Vulnerable households should benefit from separate social support redistribution policies enabling them to allocate more money to heat expenses.[24]

Including further quality components in the end tariff would help to limit disconnections, to encourage payment for services, and to put pressure on heat generation and distribution companies to make investments. The implementation of a system to respond to complaints alongside a definition of fines for failing to meet specific heat quality supply standards would indeed push ETOs to undertake investments. Setting up a separate system of centralised, automated and transparent heat billing accounts would also help to ease the non-payment problem. Households would pay their heat bills into a special account not controlled by the heat service or management company, but for example by the regional administration. Access to these sums would be strictly regulated and controlled to avoid any improper management and to make sure that the heat generation company is paid on time and the correct amount. The government should learn from the experience of pilot projects currently implemented in this area and quickly deploy this countrywide.

Further policy measures are needed to support investments in demand-side technologies and the raising of public awareness about energy efficiency and its advantages. These investments would create the option to proceed to consumption-based, cost-reflective heat production, tariff structure and billing, which will provide incentives for energy efficiency. These actions would also build a pathway to further liberalisation of the district heating sector in the future in order to incentivise the necessary investments. In many cases, the modernisation of the district heating sector will hardly avoid an initial unit cost and tariff increase; ultimately, however, heating costs should decrease due to lower consumption based on energy efficiency improvements in buildings and invoicing based on real consumption, temperature adjustments and the possibility of adjusting consumption.

As for tariff regulation and methodologies, it is essential to ensure that cost-plus tariff setting is effectively and quickly removed. The individual stand-alone boiler benchmarking which is currently being developed is a very sound approach. RAB methodology could also be used and implemented where appropriate. The possibility for heat producers to benefit from five-year tariffs based on the RAB methodology provides for a much-improved basis to incentivise investments in the modernisation of district heating systems. However, in many cases, five years is not long enough to recoup large investments and enable cost-tariff optimisation, which are in the interest of both the investor and the consumer. International experience shows that longer-term tariff structures of ten years at least can offer the guarantees investors need and lower the risks on capital investment to district heating, and decrease the demand for short-term tariff increases. This includes

24. How to address energy poverty: see the 2011 IEA publication *Evaluating the Co-Benefits of Low-Income Energy-Efficiency Programmes*: www.iea.org/publications/freepublications/publication/name,3991,en.html.

the confidence from investors that guarantees will be implemented and can be trusted. Tariffs should not contain elements of cross-subsidisation on either the production or the consumption side. In addition, there should be an attractive scheme for accelerated depreciation to further encourage investments. Finally, the law on concessions should be tailored so as to include guarantees on long-term tariffs and to allow investments to be made in district heating systems using the concession scheme and the RAB tariff methodology.

Another important aspect that is missing in the current modernisation effort is the potential for municipal or industrial waste-to-energy use, although it was a stated objective of the Energy Strategy to 2030. There need to be incentives to use cheaper renewable sources – industrial or municipal waste or pellets – when available.

Federal and regional financial support: Given the massive investment needs and the urgency of the situation in many cities, there is a need for greater financial support from the federal level: current funds allocated for energy efficiency projects are a good start but are unlikely to have any meaningful impact. The system is theoretically sound: 50% of the subsidy comes from the federal budget and is allocated by the Ministry of Energy, on the condition that the regional government give a similar amount to a given project and that private investments de-multiply this initial subsidy. Yet only RUB 5 billion per year until 2020 (about EUR 115 million) was allocated for the period from the federal budget, which is below the real needs to effectively help trigger investments in the modernisation of generation and transmission infrastructure, especially since not all these funds will go for to modernise district heating sector infrastructure. In addition, there is a need for affordable financing for district heating companies and service companies or homeowner associations (for meters), such as through a dedicated state fund or state bank, alongside a bank guarantee system that should be developed to allow municipalities, especially in economically less prosper regions, to access affordable credit.

Regions play a key role in implementing energy efficiency policies and developing action plans and programmes. The efficient implementation of the new heat law and the energy efficiency law to an important extent depends on regional regulatory and policy intervention, especially for issues such as metering, tariff setting to encourage investment and developing action plans. Regional shortcomings include the lack of indicators and less expertise. Regions should set up dedicated budgets and funds for investments in the efficiency of district heating systems, which could be financed through their budget and special levies and taxes, for example.

RECOMMENDATIONS

The government of the Russian Federation should:

- *Make district heating modernisation a strategic governmental priority and take a system-based approach that includes deep building upgrades, zero-energy buildings for new construction (which are autonomous), deployment of metering, energy efficiency gains in generation and distribution, and benefits from stand-alone systems where centralised systems either are too worn out, are too distant and/or could be shut down.*
- *Rapidly deploy a policy and regulatory framework that is conducive to large-scale investments:*
    - *phase out completely the cost-plus tariff methodology and effectively move to tariff methodologies and regulation that incentivise investments, especially the comparative individual boiler methodology*

- *guarantee longer-term tariffs, over five years, and predictable regulation to investors*
- *eliminate all remaining cross-subsidies and implement effective mechanisms to remove the non-payment problems*
- *set the conditions for affordable capital access and the development of ESCOs for efficiency investments in the generation, distribution and end-use segments*
- *move to an ETO model to facilitate investments in infrastructure and strengthen the responsibility of the organisation versus the end consumer.*

- ☐ *Enforce the deployment of meters: building-level automated meters and regulators for old constructions and apartment-level meters for new constructions.*
- ☐ *Develop state-of-the-art technologies and innovations, especially in generation, transmission and metering/regulation, and strive to become a leader in the modernisation of district heating systems in Former Soviet Union countries.*

PART III
ENERGY TECHNOLOGY

12. ENERGY TECHNOLOGY RESEARCH AND DEPLOYMENT

Key data (2012 estimated)

Russia's R&D spending: USD 37 billion, +130% since 2002

Share in GDP: 1.4%

Private sector share in total R&D spending: 33%

SME share in total R&D spending: 2%

R&D per capita: USD 260

Innovative products in total Russian volume of production: 12.4%

Total domestic expenditures for education as a share of GDP: 4.8%

Sources: Ministry of Energy; OECD (2013), *OECD Economic Surveys: Russian Federation*, OECD Publishing, Paris.

OVERVIEW

The government is aware of its shortfall in support for energy technology and innovation compared with other countries, and has made strong statements at the highest political level on its intent to modernise and spur innovation of its economy and energy sector. Russia's overall Strategy for Innovative Development of the Russian Federation to 2020, approved in 2011, provides a framework to address Russia's innovation gap in all sectors. A Presidential Council on Economic Modernisation and Innovative Development and the Intergovernmental Commission on Technological Development were established to oversee this effort. Under the innovation goals specific to the energy sector, Russia aims to develop domestic technology capabilities, and to reduce gaps between science and the energy sector, in areas such as enhanced oil recovery, coalbed methane (CBM) and gas-to-liquids (GTL) technologies, and bioenergy.

Russian governance on energy technology research and deployment (R&D) is complex in nature, leading to difficulties and delays in its effective implementation, especially given the need to effectively co-ordinate among federal government authorities, regional and local administrations, as well as private stakeholders. Overall, the Russian approach to R&D is top-down, and small and medium-sized enterprises (SMEs) are not sufficiently involved while state-owned companies would further benefit from increasing their inadequate financial effort towards R&D.

Russia has established a comprehensive support infrastructure for innovation (including special economic zones, knowledge cities, tech parks, business incubators, technology transfer hubs and federal scientific equipment pools) and various institutes and territorial innovation clusters, including the Innovation Centre at Skolkovo. Thirteen energy-related technology platforms have been created with a focus on public-private partnerships to enhance the oil recovery index, tap Russia's huge bioenergy potential, increase the share of distributed power and nuclear power, and introduce smart grids and technologies for cleaner and more efficient thermal power generation, as well as others. Although these platforms are only in their initial phases, they can provide the structure and momentum needed for more rapid R&D and knowledge transfer in these areas and foster co-ordination among federal and regional governments, industry, and academia. The government and key stakeholders are also involved in many international activities, including with the International Energy Agency (IEA). To support these objectives and measures, Russia's spending on energy R&D has increased, more than doubling since 1998, and the government agrees that this trend should continue.

Against the backdrop of an economic slowdown and existing technological progress in all these key energy technologies in emerging economies and member countries of the Organisation for Economic Co-operation and Development (OECD), Russia needs to speed up and deliver on its energy R&D objectives. This requires ensuring that the political, institutional and regulatory framework is effective and delivers competitive innovative technologies addressing not only domestic energy sector needs, but also demand in foreign markets. The government needs to continue prioritising this effort, assessing progress and removing obstacles as the process will take time.

POLICIES

R&D OBJECTIVES

In 2009, the then-president announced policies aiming to modernise the country's economy and placed innovation as a national priority. Repeated statements at the highest political levels made it clear that the government recognised the technology and innovation gap the country faced in relation to its counterparts in the Group of Twenty (G20) and among the other BRICS countries (Brazil, India, the People's Republic of China and South Africa) and global industrial and commercial competitors.

With a focus on removing this innovation and technology gap, in December 2011, the government approved its Strategy for Innovative Development to 2020. This over-arching strategy is a roadmap aimed at setting the Russian economy on an innovation-based development track by 2020. By mid-2013, an evaluation report was prepared by the Ministry of Economic Development to assess the progress that had been made to date and the challenges that still lay ahead. The report outlined the following achievements:

- the establishment of a modern system of innovation development institutes, including pre-seed and seed financing institutions, venture funds with state participation, the Rusnano Corporation, and the state corporation Bank of Development and External Economic Activity (Vneshekonombank)
- the provision of financial support to leading higher educational establishments, together with accelerated capacity-building with the goal of forming a "core" of no less than five internationally competitive higher education schools entering the world's top 100 leading universities by 2018
- the broadening of the scope of the National Research Centre "Kurchatov Institute" as well as preparatory work on a network of national research centres in priority areas of science and technology development in Russia
- the establishment of innovative activity support infrastructure, including special-status economic zones for technology development and deployment with significant

privileges for innovative companies, technology parks, business incubators at universities, technology transfer centres and centres for shared use of leading-edge technologies

- the introduction of a competitive procedure for determining and developing innovative clusters
- the establishment of a new Russian "territory of innovations" at the Innovation Centre Skolkovo near Moscow that enjoys a legal regime aimed at minimising administrative barriers and tax burdens for resident companies
- the realisation of innovative development programmes in Russia's largest state-owned energy companies
- the support of activities to develop and enhance co-operation among business, science and education, including creation of technology platforms
- an improved legal and fiscal framework for innovative activities.

The report also pointed to the many challenges still facing Russia in its drive to a more innovative economy. Russian experts in the field raised many concerns going forward about improving the entrepreneurial climate in Russia and reducing the bureaucratic barriers to R&D and commercialisation of innovations. The key challenges underscored by survey results in the report included:

- the low level of innovation competences among scientists
- the inferior technological and marketing development of some projects declared innovative
- the low demand for innovation from the real economy and the system of public procurement
- the ineffective system of tax exemptions and relief for R&D
- the gaps in Russia's legal framework to protect intellectual property.

Russia's energy R&D policy is based directly on three underlying government strategies: the Russian Energy Strategy to 2030 (November 2009, with a revision to 2035 expected in 2014); the Strategy on Energy Efficiency and Energy Industry Development (April 2013); and the presidential decree No. 899, On Priority Directions for Innovative Development of the Russian Federation in the Sphere of Energy Efficiency, Energy Saving and Nuclear Energy (7 July 2011). Government support for research and innovation in the field of energy is carried out within the framework of the Federal Target Programme (FTP) Research and Development on Priority Directions of the Scientific-Technological Complex of Russia for 2014-20.

The broad goals of the 2014-20 strategy are to reduce Russia's dependence on imported equipment and technologies, to reduce gaps between science and the energy sector, and to overcome the challenges facing Russia's energy sector to ensure the country's energy security. Focus areas include oil and gas production, CBM production and safety, commercialisation of GTL technologies, development and commercialisation of the country's vast renewable resources, and reduction of consumption and greenhouse gas (GHG) emissions through energy efficiency.

A system of five-year FTPs (Research and Development in Priority Areas of Science and Technology Development for 2002-06, Research and Development in Priority Areas of the Russian Science and Technology Sector Development for 2007-12, and National Technology Basis for 2007-11), overseen by the Ministry of Energy and the Ministry of

Education and Science, was approved to implement the current and prior energy strategies. However, over the 1990s and 2000s, these programmes were very top-down and bureaucratic. The programmes also lacked the framework conditions to kick-start a vibrant and effective R&D network in Russia after the economic breakdown during the years of perestroika and the financial crises over the 1990s, which led to decaying equipment, unemployment and higher wages in other sectors. This drove large numbers of researchers away from science and technology or out of Russia altogether to countries where their work was valued, such as Germany, the United States and Canada. The prescriptive nature of Russia's regulatory system – a legacy of its Soviet past – further reduced the incentive and drive for innovation by industry, largely dominated by monopolies and large state-owned enterprises (SOEs).

A presidential decree dated 7 July 2011 defines the basic guidelines for the development and realisation of scientific-technological and innovation policy in such fields as energy efficiency and energy saving, climate change, adaptation to climate change needed to accelerate economic growth, and strengthening national environmental and energy security of Russia. It sets out priority areas of science, technology and engineering in four categories: energy efficiency, energy saving and nuclear energy; technologies of new and renewable energy sources (RES), including hydro energy; technologies for energy-saving transportation systems, distribution and consumption of heat and electricity; and technologies for energy efficient production and transformation of energy to organic fuel.

Box 12.1 International experience on best practices to foster R&D

OECD experience has shown that state companies are not very entrepreneurial. They are good at copying and scaling up, but real innovation and technology development generally happens at small companies.

Indeed, in a 2006 report, the World Bank and the Higher School of Economics assessed available data and concluded that Russian firms operating in a more competitive environment spend substantially more on R&D, while monopolistic firms innovate the least. Available data on Russia's energy sector in 2013 corroborate to some extent this finding. Preliminary analysis points to an increase in R&D spending by key state-owned companies as well as the private sector and SMEs.

However, the dominance of large SOEs and monopolies in Russia's energy sector remains a structural impediment to a vibrant R&D system in the near to medium term.

Recent OECD analysis of best practice across its 34 member countries has concluded that the key impediments to innovation and effective R&D policy implementation are barriers to competition and entrepreneurship, high corruption, and poor law enforcement (including intellectual property law). Evidence about the importance of good framework conditions for R&D activity is abundant and most innovation policy initiatives are likely to prove inefficient in their absence. In this regard, competition is a key driver of innovation and productivity growth. Improving the business climate, with a special stress on stimulating competition, is considered by the OECD as a crucial step towards increasing innovation in Russia.

Source: OECD (2011), *OECD Reviews of Innovation Policy: Russian Federation 2011*, OECD Publishing; Goldberg, I. (2006), "Competitiveness and the Investment Climate in Russia: An Assessment by the World Bank and the Higher School of Economics", Moscow, presented to the 10th annual St. Petersburg International Economic Forum, 12-14 June 2006.

The Governmental programme of the Russian Federation "On Energy Efficiency and the Development of Energy" developed by the Ministry of Energy and approved on 3 April 2013,[1] envisions support measures for innovative development of the energy sector. Mechanisms include the support for state companies to implement innovative development programmes, perform strategic research, create and introduce new generation nanomaterials and nanotechnologies, and establish corporate venture funds to support the development of innovative infrastructure for the energy sector.

FUNDING AND EVALUATION

Over the period 1998-2008, Russian gross domestic expenditures on R&D almost doubled (constant prices), placing Russia among the top countries in terms of growth in R&D spending. Although impressive at first sight, this growth reflects more the extent of the economic and financial crisis over the 1990s and its effect on R&D budgets. In 1990, Russian expenditures on R&D represented more than 2% of gross domestic product (GDP), yet in 2013 it is expected to represent only 1.5% of GDP (USD 38.5 billion), up from 1.4% in 2012. The Strategy for Innovative Development sets an objective of increasing R&D spending to 2.5% to 3% of GDP by 2020. This would bring Russia more in line with average OECD R&D spending of 2.2%.

Nearly three-quarters of Russia's R&D spending is carried out by publicly funded or directed institutions, mostly generated from the federal budget. Russian sources estimate the share of corporate-funded R&D expenditures at about 20% of total.[2]

Table 12.1 R&D expenditures of key Russian energy companies (RUB billion/percentage of revenues)

	2010	2011	2012
Gazprom	7.0/0.19%	7.9/0.16%	7.7/0.15%
Lukoil	0.12/0.11%	0.14/0.10%	0.16/0.11%
Rosneft	3.0/0.16%	8.6/0.32%	9.9/0.32%
Inter RAO	x	2.0/1.4%	x
SUEK	x	x	x

Note: SUEK = Siberian Coal Energy Company; x = not applicable.

Source: Calculations based on data from Annual Reports from Gazprom, Lukoil, Rosneft, Inter RAO, and SUEK.

On average, top Russian companies invested 0.2% of their annual revenues in R&D, compared with 2% to 3% in most foreign companies. Russia's leading energy companies appear to allocate only a marginal share of their total revenues to R&D as shown in Table 12.1, which highlights the relatively low level of R&D expenditures by key Russian energy companies since the Strategy for Innovative Development was adopted. The first phase of the Strategy (2011-13) prioritises direct administrative stimulation of large-sized companies in the public sector and natural monopolies to create and implement innovation-oriented programmes.[3] By April 2013, 60 of Russia's largest SOEs had begun

1. http://minenergo.gov.ru/upload/iblock/afc/afc90b96ec0fef29f2ededabb6a4a131.pdf (accessed on 14 December 2013).

2. www.rusventure.ru/ru/programm/analytics/docs/Report_2_EN.pdf.

3. *Ibid.*

implementing their five- to seven-year programmes of innovative development. These companies account for 25% of the country's GDP and one-third of industrial production. These SOEs were instructed by the government to increase their R&D spending over the next five years to levels in line with spending of the largest foreign companies.

The Ministry of Economic Development recommended programmes to focus on production, energy efficiency, environmental safety and product quality. Combined, the 60 SOEs are expected to invest RUB 6 trillion between 2011 and 2015. Already, R&D spending grew by almost 60% in 2011 compared with 2010, from RUB 137 billion to RUB 214 billion. In many cases, SOEs are actively involving research institutes and participating in technology platforms. This is the case for the largest Russian energy companies, including Gazprom, Rosneft and Inter RAO.

All SOEs implementing innovative development programmes must provide an annual progress report to the government with evaluation results based on quantitative indicators. Gazprom's 2012 report on the progress with the Gazprom Innovative Development Programme concluded that the expected efficiency of innovative technologies developed by Gazprom in 2012 would amount to RUB 2 for every rouble invested. The programme has key performance indicators on which the results are evaluated. Examples of these indicators are project operational costs (which decreased by 1.28% in 2012 due to application of innovative technologies), specific energy consumption for process needs (which decreased by 4.85%), and specific GHG emissions (which decreased by 4.1%).[4] This type of reporting and evaluation is a positive step forward in raising transparency and building on success and learning from failures. That being said, the trend in Gazprom's R&D spending has declined over time and is nowhere near the government's stated goal of reaching an expenditure-to-revenue ratio of 2.5% to 3.0% at its largest companies in line with the R&D expenditures of the largest foreign companies.

INSTITUTIONAL FRAMEWORK

Federal institutions

Russia’s institutional framework for governing R&D comprises a number of institutions and advisory bodies, with varying responsibilities for policy and funding.

The Ministry of Education and Science of the Russian Federation is the federal executive body that implements the state scientific and technical policy. Universities are subordinate to this ministry and must have their development programmes and directions for scientific research approved by it. The Ministry of Energy plays a lead role in decisions on R&D priorities and direction in what concerns the energy sector. In 2013, the Ministry of Energy established an Advisory Council on the Development of Innovation in the Oil and Gas Sector. The council acts as a platform for the preparation of proposals on priority directions for scientific and technological development of the Russian oil and gas sector, the development of roadmaps, and the improvement of regulatory and legal frameworks. The platform involves leading Russian and international oil and gas companies, experts, and educational institutions. The council supports the realisation of the main priorities of the Strategy for Innovative Development of Russia to 2020, namely, to increase Russia's oil recovery

4. www.gazprom.ru.

index to 47%, to increase Russia's hydrocarbon resource base by 39 billion tonnes, and to increase the share of offshore hydrocarbon production to 5% of total Russian production.

The Presidential Council on Modernisation of the Economy and Innovative Development of Russia was established by the Decree of the President of the Russian Federation No. 878 of June 2012. It is the legal successor to the Russian Federation's Presidential Commission on Modernisation and Technological Development of the Economy. This council acts as an advisory body to the president, providing proposals on priority setting for modernisation of the economy and innovative development of Russia, including the development of state regulation and support measures. It provides a forum for discussion at all levels of government (federal, regional, local) as well as with public associations and scientific and other organisations. The council co-ordinates the activities in this area at all levels of government, business and expert communities. It also co-ordinates project implementation of territorial clusters for the promotion of R&D, and commercialisation of results.

Russia's presidential commission on the Strategy of Development of the Energy Sector and Environmental Safety was established to co-ordinate the activity of federal, regional and local government executive bodies and industry in the development and realisation of state energy policy priorities and on the preparation of measures aimed at policy implementation to ensure compliance with industrial and energy safety requirements, and rational use and effective production of the country's mineral and natural resources. To this end, the commission is mandated to develop key directions to improve the technical and legal regulatory system and to co-ordinate and oversee their effective implementation.

In September 2013 a new Russian federal law came into force that stipulates substantial reforms of the Russian Academy of Sciences (RAS). Within the framework of this reform, in October 2013 the Federal Agency for Scientific Organisations (FASO) was created. FASO will take over the management of the institutes and the vast property of the RAS. In December 2013 the government established the Russian Science Foundation to provide financial and organisational support for research, training researchers, and leading research teams.

Finally, a Consultative Council on the Innovative Development of Russia's Oil and Gas Sector has been established and met several times in 2013 providing a useful way for government to consult with Industry – both Russian and foreign investors.

Development institutes

A system of development institutes was established in Russia to help support innovation and the deployment of leading-edge technology. The key objective of these institutes is to resolve market failures and to serve as a catalyst for private investment in priority sectors and branches of the Russian economy. In the absence of ideal framework conditions, these development institutes strive to create conditions conducive for development of infrastructure that provides access to necessary financial and information resources for companies operating in priority sectors of the economy. This system includes pre-seed and seed financing institutions, venture funds with state participation, the Rusnano Corporation, and the state corporation Bank of Development and External Economic Activity (Vneshekonombank). By 2013, numerous development institutes operated in Russia, including:

- the Investment Fund of the Russian Federation
- the State Bank for Development and External Economic Activity (Vneshekonombank)

- the joint-stock company (JSC) Russian Venture Company
- the JSC Agency for Housing Mortgage Credits
- the Russian Nanotechnology Corporation
- the Fund to Promote Reforms in the Housing and Utility Sector
- the Russian Agricultural Bank
- Rosagroleasing
- the Russian Fund for Information and Communication Technologies
- the Fund to Promote Development of Small Enterprises in the Sphere of Science and Technology.

Technology platforms and territorial innovative clusters

Technology platforms and innovative clusters are relatively new instruments of government innovation policy in Russia aimed at connecting major stakeholders of the innovation system. Russian technology platforms are public-private partnerships in the area of scientific, technical and industrial development, which provide for the development and realisation of long-term priorities within a specific sector of the economy. The stakeholders of the technology platform (including scientific and business community as well as consumers) share a common long-term vision for the industry or sector. Together, through the platform, they aim to combine efforts and focus them on the most promising innovative projects from the viewpoint of potential demand. The 27 technology platforms were established in August 2010 in accordance with the decision of the Russian Government's Commission on High Tech and Innovation (Protocol No. 4), while the 25 territorial innovative clusters were initiated by the same body in August 2012 (No. DM-P8-5060). Clusters play a similar role but bring together stakeholders from a specific region.

These instruments were adapted to the Russian context based on best practice from abroad. The European Union (EU) technology platform served as a key model in designing Russia’s. However, while the European model is led by industry in a bottom-up approach, the Russian technology platforms follow a government-led, top-down approach in terms of priorities and regulation. The key participants of the platforms are universities and government research institutes with a focus on development of R&D projects searching for research funding. Due to the lack of financial incentives, there is less of a role for large, state-owned companies to play. The Russian central government also chose the 25 territorial innovative clusters. Although this was done on a competitive basis, these clusters often have no history and were picked simply based on stated intentions of stakeholders to create a cluster in this or that territory. As a result, instead of complementing and building on one another, the platforms and clusters often do not co-ordinate or work together.

The technology platforms conduct scientific research within the framework of the FTP Research and Development in Priority Areas for Development of Science and Technology Sector in Russia. Financing for this research is from the Russian Fund for Technological Development and the president’s grants to young scientists. Although these platforms are only in their initial phases, they provide the structure and momentum needed for more rapid R&D and deployment of new technologies in these areas.

Of the 32 technology platforms created to date, 13 are energy-related:

- Deep processing of hydrocarbon resources, co-ordinated by the JSC VNIPIneft:
  The platform's 100 members seek to improve the environment for innovation in this area by co-ordinating efforts among companies active in R&D and thereby reducing costs and broadening the possibilities of work on new and innovative technologies. It provides the government with a long-term outlook for R&D and co-ordinates government funded R&D in this field. It also seeks to form international alliances with leading-edge companies around the world active in this area, and to enhance training in this area.

- Technologies for production and use of hydrocarbons, co-ordinated by Gubkin Russian State University of Oil and Gas:
  The platform's 62 members are working on developing a roadmap for R&D with the aim of creating conditions for technological modernisation of Russia's petroleum and gas processing and petrochemical industries. They seek to raise the competitiveness of this industry by supporting the deployment of leading-edge technologies through the establishment of infrastructure and mechanisms of co-operation between scientific and private stakeholders. It also seeks ways to support public-private partnership financing of pilot projects and to create a vibrant research sector in this area, including a focus on training of experts.

- Small-scale distributed energy, co-ordinated by the Energy Forecasting Agency (APBE):
  The platform's almost 200 members seek to support and speed up innovation to move Russia from a centralised large-scale electricity system to one that also includes smaller local electricity providers to meet the specific needs of consumers in local areas to enhance the energy security at the national level. Members perform R&D on new distributed power technologies with an outlook to accelerate the deployment of these small-scale units to local populations not connected to the central grid and to consumers who prefer to opt out of the Russian wholesale electricity market.

- Environmentally friendly thermal power industry of high efficiency, co-ordinated by the Open JSC All-Russia Thermal Engineering Institute (JSCVTI):
  The platform's 19 members seek to support the realisation of scientific and technological goals set out in the Russian Energy Strategy to 2020 through innovation of new high-efficiency, ecologically clean technologies for power and heat generation and for the modernisation of existing technology to meet world standards. It also seeks to train specialists in this field to raise their level of expertise. VTI is working on a technology roadmap and co-ordinated with the IEA, which released its High-Efficiency, Low-Emissions roadmap in 2012.

- Smart energy system of Russia, co-ordinated by the Russian Energy Agency:
  The platform's 165 members support innovation and modernisation of Russia's energy sector, looking at international best practice, instruments and mechanisms to introduce smart grids and ecologically clean and secure energy systems in Russia. The platform has worked with the IEA in this area and joined the IEA Implementing Agreement in this field in 2012, providing the platform with easy access to international experts and best practice. The platform also works with IEA member countries in bilateral co-operation efforts in this area.

- Prospective technologies for renewable energy, co-ordinated by RusHydro:
  The platform's 62 members seek to support and co-ordinate R&D and innovation of key renewable technologies and to stimulate state and private investment and support to bring pilot projects to the deployment stage. It also works on the regulatory

framework to meet the government's stated goal of having renewable energy producing 4.5% of Russian electricity generation by 2020. Members also seek to enhance training to raise the qualifications and expertise in this field.

- Technology platform of solid mineral resources, co-ordinated by the JSC SUEK:
The platform seeks to co-ordinate efforts to modernise the sector through more effective and co-ordinated R&D on energy efficient and energy-saving technologies from inception to the commercialisation stage to enhance the recovery of solid minerals in Russia in a more effective and efficient way, raising productivity, labour productivity and the industry's competitiveness on export markets.
- Bioenergy, co-ordinated by the National Research Centre "Kurchatov Institute":
The platform's 44 members seek to develop a technology roadmap for the realisation of a national bioenergy industry integrated with other sectors of the Russian economy as well as global export markets. The platform works on a strategy and programmes for R&D encompassing all parts of the value chain, from scientific research stages to pilot projects to commercialisation and deployment of competitive technologies. It also seeks to stimulate mechanisms to attract investment, both national and international, as well as various government and private sector support measures. It also seeks to enhance training through universities and business fora, a challenge this sector faces given the lack of experts in this field in Russia. The platform works closely with regional governments given the importance placed on bioenergy at the local level in terms of job creation and agricultural waste management. The platform has joined the IEA Bioenergy Implementing Agreement, providing Russian experts with better access to an international network for leading-edge R&D collaboration and best-practice regulatory frameworks. It is working closely with the IEA on a how-to guide to implement its national roadmap.

In addition to those mentioned above, there are several very specialised platforms related to energy:

- Biotech-2030 (co-ordinator: "RT-Biotechprom", Lomonosov Moscow State University; energy-related activity field: bioenergy, biofuel)
- closed nuclear fuel cycle with fast reactors (co-ordinator: Rosatom; energy-related activity field: nuclear power plant)
- controlled thermonuclear fusion (co-ordinator: Rosatom, Troitsk Institute for Innovation & Fusion Research; energy-related activity field: thermonuclear fusion)
- environmental technology development (co-ordinator: all-Russia non-governmental organisation Russian Geographical Society; energy-related activity field: eco-efficiency and energy-saving technology)
- development of ocean (co-ordinator: the JSC Concern Morinformsystem-Agat, United Shipbuilding Corporation, Concern Marine Underwater Weapons; energy-related activity field: more efficient use of oceans, including energy resources).

Skolkovo Innovation Centre

Construction of the Skolkovo Innovation Centre – a Russian version of the United States' Silicon Valley – began in 2010 as one of the major drivers of economic modernisation amid the range of efforts to diversify the country's economy away from the oil and gas industry. It was created under a decision by Dmitry Medvedev, at the time the Russian president. The centre ran into various problems in 2013 with charges of corruption and changes in management. As of the publication of this review, the presidential administration is committed to further developing the innovation hub. Skolkovo has attracted many major international high-tech companies, including Cisco Systems, Nokia, Samsung, Schlumberger and Siemens. Participants enjoy a profit tax rate of 0% on the first RUB 1 billion of revenues, an exemption from the value-added tax, a 0% corporate property tax and land tax rate, and the basic Russian personal income tax rate of 13%.

Within the framework of the Skolkovo project, five innovative clusters were established to promote R&D and deployment of technologies in the sphere of information technologies, biomedicine, energy efficiency, nuclear and space. The energy efficiency cluster supports innovations and breakthrough technologies targeting reduction of energy consumption by the industry, residential and utility sectors as well as municipal infrastructure projects. The major objective of the nuclear technology cluster is the support of non-energy applications and the transfer of technologies to other sectors. The Skolkovo Fund provides grants to innovative start-up companies on a competitive basis. Winning R&D and innovative tenders are selected by a panel of experts, including international experts, and a key factor is the outlook for deployment and commercialisation in the project's business plan. The fund provides project support in the commercialisation of technologies, through networking and marketing consultation.

Regular audits of projects are undertaken to ensure that projects are meeting milestones and keeping to stated business plans. In 2010, the first of three grants was made. By the end of 2012, 167 grants had been made, equivalent to RUB 8.4 billion and co-financing of an additional RUB 5.7 billion. Energy efficiency projects made up 22% of these grants. At the time of publication of this review, it was too early to evaluate the effectiveness of these grants. However, the Skolkovo Fund grant includes provisions for a regular review and audit.[5]

Universities and research institutes

In 2012, there were more than 1 100 higher education institutions in Russia. None, however, ranked in the top 200 universities worldwide in an annual survey released in October 2013. President Vladimir Putin, in 2012, called for a major reorganisation of Russian universities, including closure of 20% of the least effective higher education institutions. Federal Law 217, relating to business ventures carried out by public scientific and educational institutions, passed in 2009, could stimulate commercialisation of important basic science and research by universities through partnerships with industry and the private sector. Before 2009, Russian higher education institutions had no effective legal means of transferring technologies from research to commerce, nor was there any financial return from the intellectual property emanating from research. As a result, there has historically been a low share of patents registered by higher education institutions (less than 8% of total in 2008). In addition, the governmental decree adopted 9 April 2010 No. 218, relating to measures of state support for the development of co-operation of Russian higher education institutions and organisations implementing complex projects on high-tech products manufacturing, sets a framework for giving out grants. Following these measures, the share of patents had risen to 20% by 2012. There is also clear evidence of increased co-operation between higher education institutions and Russia's large SOEs.

5. http://community.sk.ru/.

Another important role higher education institutions play is in the advanced and ongoing training of human resources to increase their qualifications and skills. Indeed, if Russia is to meet its ambitious target to produce 4.5% of its electricity using renewable sources by 2020 and to meet its objectives for reducing energy intensity by deploying energy efficiency in buildings and industry, the number of experts in wind, solar, bioenergy, building envelopes, energy management and small hydro technologies will need to grow much more quickly than is currently thought possible by Russian experts in the field. A significant change in higher education and awareness-raising of the public will be necessary if Russia is to meet this and the whole range of innovative goals across the energy sector and the Russian economy as a whole.

During 2012, various advanced training programmes were put in place at higher education institutions in the framework of the Strategy for Innovation. An example is the Presidential Programme for Advanced Training in Engineering 2012-14, in which 164 education programmes in 51 training institutes were chosen in a competitive selection of programmes for re-education of engineers. The system of continuous training continues to advance in Russia as part of the implementation of programmes for the development of Russia's leading universities and the higher education institution strategic development programme, as a guiding principle and part of the FTP in education for 2011-15.[6]

INTERNATIONAL COLLABORATION

Multilateral activities

Russia is a member of a range of international partnerships and fora focused on efficient and environmentally safe energy production and use, and on environmental protection:

- the Carbon Sequestration Leadership Forum
- the Earth System Science Partnership
- the Global Bioenergy Partnership
- the Global Methane Initiative
- the International Council on Large Electricity Systems
- the International Partnership for Hydrogen and Fuel Cells in the Economy
- the International Partnership for Marketing of Unconventional Methane Resources (Methane to Markets Partnership)
- the 3Rs (Reduce, Reuse, Recycle) Initiative.

The Ministry of Education and Science represents Russia in these international partnerships and initiatives. At the working level, Russian scientists from various government institutes perform R&D work with foreign partners within the framework of international partnerships and multilateral international initiatives, bilateral co-operation within existing intergovernmental agreements, and co-operation with international organisations and structures. Russia should consider taking full advantage of its participation in international partnerships through more active and regular attendance of meetings, institutional co-ordination, and strategic integration in relevant domestic and international energy sector agendas.

6. www.rusventure.ru/ru/programm/analytics/docs/Report_2EN.pdf.

Dialogue is also developing in the sphere of RES between Russia and countries in the Association of Southeast Asian Nations (ASEAN) under its Financial Facility. Russia could also consider being an observer or member in the International Renewable Energy Agency (IRENA), which would be beneficial as the country is starting to develop its renewable energy potential. Preparatory work has also been completed on the Global Environmental Facility and the World Bank's Russian Programme of Renewable Energy Sources Development. The preparatory phase of the Development of the Renewable Energy Sector Power Sector in the Russian Federation and CIS Countries, a project of the United Nations Economic Commission for Europe (UNECE), has been completed and now the next phase is under way. Russia is also a party to the ITER project to build a fusion energy pilot plant.

The Russian Ministry of Energy and the IEA signed a Memorandum of Understanding (MoU) in 1994, and energy technology was an integral part of this co-operation. In 2008, the IEA signed an MoU on energy technology co-operation with the Federal Agency for Science and Innovation. Following the government reorganisation in 2010, the Ministry of Education and Science of the Russian Federation took over the obligations of the Federal Agency for Science and Innovation.

Russia (through the Ministry of Education and Science and Inter RAO) regularly attends meetings of the IEA Committee on Energy Research and Technology as an observer.

By 2013, Russia had joined nine of the IEA Implementing Agreements, or international technology groups, bringing together scientists and experts from IEA member and partner countries and the private sector to reduce duplication and costs of energy technology R&D and accelerate deployment of new technologies.[7] In more recent years, since the heightened political focus on modernisation and innovation, Russia has shown more interest in Implementing Agreements related to energy efficiency and renewables, joining those focusing on modelling (2010), industrial efficiency (2010) and smart grids (2012). The IEA continues to stress the important benefits to Russia in leveraging international expertise by joining more of the IEA Implementing Agreements, especially those in the sphere of energy efficiency and renewables. This international network of experts in key energy technology fields could support the work of Russia's energy technology platforms and regional clusters.

Russia and the IEA International Low-Carbon Energy Technology Platform have carried out joint activities. In 2010, Russia co-chaired the IEA Technology Platform's major conference in Moscow, bringing together experts and scientists from Russia and the Implementing Agreements in the areas of clean coal technologies and efficient coal combustion technologies, carbon capture and storage (CCS), technologies for the use of RES, optimisation of power supply, new technologies and fuels for transport, hydrogen technologies, and analysis and forecasting of energy outlooks. In 2012, in co-operation with the Russian Technology Platform on Bioenergy, the IEA Technology Platform discussed creation of a how-to guide on bioenergy, a guide for creating a national roadmap.

Bilateral co-operation

Russia actively leverages international co-operation with the European Commission Framework programmes, with 17% of participants in energy co-operations representing Russia. However, the EU-Russia Energy Technology Centre, which was to stimulate co-

7. See IEA website for more details: www.iea.org/techno/index.asp.

operation between Russian and EU energy companies, to promote RD&D of advanced energy technologies and to help attract investment to finance priority projects in Russia's energy sector, has stopped working. The centre, established in 2002 within the framework of the EU-Russia Energy Dialogue, reinforced work on energy security and reliability through the alignment of standards and norms, as well as through improvement of maintenance practices.

Russia in the 2000s also developed bilateral co-operation with leading countries in various energy technology fields – such as Germany (Rudea) and France (Russian-French Centre on Energy Efficiency). Yet it appears that these experiences have, for various reasons, not reached their full potential in terms of attracting investments and fostering experience and best-practice sharing.

Outside of Europe, noteworthy examples include India (nuclear, hydrocarbons and power).

ASSESSMENT

Over the past few years, Russia has strengthened its energy R&D efforts. The government should be commended for its regular increase in funding for energy R&D, and for forming the institutional framework, including establishing public-private partnerships, technology platforms and territorial innovative clusters, venture capital funds, seed companies, and obligations on SOEs to increase R&D expenditures and to interact with other newly created innovative infrastructure and existing higher education institutions. A frequent, transparent and systematic monitoring and evaluation system to assess the progress and results of these recently created bodies and obligations could help Russia refine priorities and emphasis in areas where it has a competitive advantage. The government also needs to quickly take the appropriate steps to address ongoing deficits and gaps identified in the Strategy for Innovative Development to 2020.

Moreover, similar consultative bodies such as the Consultative Council on the Innovative Development of Russia’s Oil and Gas Sector could be successfully used across all priority energy sectors – not only oil and gas – to speed up the pace of innovation by removing overly prescriptive regulatory barriers hindering technological advances.

Russia’s government spending on R&D as a percentage of GDP has more than doubled since 1998 to an expected 1.5% in 2013. Based on the objectives of the Strategy for Innovative Development to 2020, R&D expenditures are set to increase to 2.5% to 3% of GDP with over 50% financed by the private sector (from the current 10% to 20%). Yet this is an ambitious target for any country to accomplish in such a short time frame, and the challenge is even greater in Russia, where large SOEs have traditionally invested only a small share of revenues into R&D, due to a lack of incentives. The government has created technology platforms and innovation clusters to remedy this, though given that they are driven by national priorities without consultation with the private sector, private sector engagement is weak. While increasing R&D spending to international levels, Russia should also look at importing existing best available technologies or working with international partners to modify existing technologies for local context.

The link between research universities and corporation needs to be strengthened, to build on the progress made in this area to date through the technology platforms and regional clusters. The government has put in place regulations to remove these barriers, and developments since 2012 have been promising. The lack of vibrant SMEs and the relatively low level of support provided to this segment's R&D efforts remain an outstanding problem, especially since Russia's energy sector is dominated by SOEs, given the important role SMEs play in driving competition and innovation in OECD member countries.

Key priorities for energy-related R&D work should be closely linked to the country's energy and economic strategies and seek to support Russia's efforts to benefit from more secure, affordable and sustainable energy supplies for domestic consumption or foreign exports. Bioenergy is such an area, alongside those identified in the eight energy-related technology platforms. This strategic R&D focus could also go to upgrades of Soviet-era apartment buildings; to renewable energy technologies for isolated, off-grid areas; to small co-generation plants[8] and waste-to-energy projects in connection with district heating modernisation projects; and to smart electricity technologies. Given that Russia will continue being an important coal consumer, focusing on clean coal technologies and CCS would help position Russia in the development and use of key technologies of the future. Overall, though, existing technologies should be used to reduce development costs and speed up deployment, and the focus should in particular go to areas where international R&D still has gaps. International co-operation through technology platforms is another key to success in these developments. Furthermore, Russia's involvement in CCS demonstration projects would lead to a sharing of learning costs and knowledge and help ensure the longer-term competitiveness and sustainability of Russia's electricity generation assets in a carbon-constrained world as it begins a major drive to modernise and upgrade ageing and obsolete capacity.

The government's focus on higher education and recognition of the need to step up training and adapt curricula to match the fast pace of global technological change and innovation is a positive step towards implementation of its energy R&D strategies. More co-ordination may be needed among the various levels of government as well as between technology platforms and territorial innovation clusters to ensure that limited financial and human resources are utilised in the most effective way possible. If Russia is to move on to an innovative path to economic growth, the demand for highly qualified experts in the various fields will increase exponentially.

International collaboration in R&D has continued to be a priority with respect to public and corporate energy R&D in Russia. International engagement is an integral part of the government's Strategy for Innovative Development including nine IEA Implementing Agreements. More active participation in the IEA Implementing Agreements could accelerate access to expertise and leverage Russia's efforts to meet its ambitious innovation goals in the energy sector, in particular those focusing on energy efficiency (buildings, industry, transport) and renewable energy technologies. The international experience of the IEA in creating energy technology roadmaps and overcoming R&D challenges could help Russia leapfrog in key areas where it has a competitive advantage. Continued active collaboration with international energy companies can serve to quicken the pace of R&D of leading-edge technologies, and current partnerships between Russian and foreign companies in Skolkovo need to be continued and further encouraged.

8. Co-generation refers to the combined production of heat and power.

RECOMMENDATIONS

The government of the Russian Federation should:

- ☐ *Assess results of current R&D policies and programmes, such as the technology platforms and innovation clusters, and take appropriate measures to ensure quick progress and competitive and innovative research outputs on the basis of feedback from stakeholders and international best practice;*
- ☐ *Continue to adjust and prioritise the energy-related R&D projects in line with changing energy requirements in Russia and technology developments.*
- ☐ *Continue its plan in the Strategy for Innovative Development to increase government and private sector funding for R&D to 2.5% to 3% of GDP.*
- ☐ *Increase focus on expert-level training, higher education and public awareness-raising in low-carbon energy technologies.*
- ☐ *Foster the role of SMEs in energy-related R&D through improved regulations and financial incentives.*
- ☐ *Expand public-private partnerships in technology innovation and R&D to spur deployment of domestic or foreign best available and/or new technologies.*
- ☐ *Continue to promote bilateral and international engagement with experts and scientific communities to benefit from international expertise and best practice.*

PART IV
ANNEXES

ANNEX A: ORGANISATION OF THE REVIEW

REVIEW CRITERIA

The Shared Goals, which were adopted by the International Energy Agency (IEA) Ministers at their 4 June 1993 meeting in Paris, provide the evaluation criteria for the in-depth reviews conducted by the IEA. The Shared Goals are presented in Annex B.

REVIEW TEAM AND PROCESS

The in-depth review team visited Moscow from 14 to 19 July 2013 to hold discussions with government officials, energy companies, non-governmental organisations and other stakeholders. The IEA Secretariat drafted this report based on those discussions and subsequent meetings during follow-up visits to Moscow in autumn 2013 and in early 2014 as well as on the official response to the IEA policy questionnaire and other information provided by the government authorities of Russia. Available data are from the Russian statistical submission for the year 2011 (data for 2012 had not been submitted at the time of writing), and for the years 2012 and 2013, the IEA used different sources: data provided by the Russian Energy Agency (REA) and data provided by companies or other sources. When information from official Russian sources was not available, the team relied on alternative sources. The team wishes to express its sincere appreciation to Ilya Galkin, director of the International Cooperation Department at the Ministry of Energy of the Russian Federation, for supporting this review. The team and IEA Secretariat also wish to thank in particular the REA, namely its deputy director, Kirill Gadzatsev, for leading the entire process of the preparation of the in-depth review and Iya Bordyuzhenko for co-ordinating the preparatory work and her responsiveness, support and work throughout the review process. The IEA Secretariat also wishes to express its gratitude to the member countries which financed this review, as well as to the many stakeholders met who offered their time and shared their expertise for this review. The review team finally expresses its appreciation to the International Finance Corporation (IFC) Russia Renewable Energy Program for its in-depth guidance on the renewables sector in the person of Anatole Boute.

This report is primarily based on information available as of March 2014.

This publication is produced under the authority of the Executive Director of the IEA, Maria van der Hoeven.

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ORGANISATIONS VISITED

Ministry of Energy

Russian Energy Agency (REA)

Ministry of Education and Science

Ministry of Natural Resources and Environment

Federal Anti-monopoly Service (FAS)

Federal Tariff Service (FTS)

State Duma

Energy Forecasting Agency APBE

Institute for Energy Strategy

Institute of Energy and Finance

Analytical Center of the Government of the Russian Federation

National Research Center "Kurchatov Institute"

Petromarket Research Group

Energy Research Institute of the Russian Academy of Sciences

JSC Russian Grids

Russian Bioenergy Platform

IFC

Gazprom

Inter RAO

Lukoil

Market Council

Novatek

Rosatom

Rosinformugol

Rosizol

Rosneft

RusHydro

Sberbank

SUEK

United States Embassy in Moscow

British Embassy in Moscow

French Embassy in Moscow

Italian Embassy in Moscow

Argus

Enel

E.ON

ExxonMobil

Fortum

Fenice

Petroleum Advisory Forum (PAF)

PwC

Shell

Total

Wintershall

EBRD

WWF

ANNEX B: INTERNATIONAL ENERGY AGENCY "SHARED GOALS"

The member countries* of the International Energy Agency (IEA) seek to create conditions in which the energy sectors of their economies can make the fullest possible contribution to sustainable economic development and to the well-being of their people and of the environment. In formulating energy policies, the establishment of free and open markets is a fundamental point of departure, though energy security and environmental protection need to be given particular emphasis by governments. IEA countries recognise the significance of increasing global interdependence in energy. They therefore seek to promote the effective operation of international energy markets and encourage dialogue with all participants. In order to secure their objectives, member countries therefore aim to create a policy framework consistent with the following goals:

1. Diversity, efficiency and flexibility within the energy sector are basic conditions for longer-term energy security: the fuels used within and across sectors and the sources of those fuels should be as diverse as practicable. Non-fossil fuels, particularly nuclear and hydropower, make a substantial contribution to the energy supply diversity of IEA member countries as a group.

2. Energy systems should have the ability to respond promptly and flexibly to energy emergencies. In some cases this requires collective mechanisms and action: IEA member countries co-operate through the agency in responding jointly to oil supply emergencies.

3. The environmentally sustainable provision and use of energy are central to the achievement of these shared goals. Decision makers should seek to minimise the adverse environmental impacts of energy activities, just as environmental decisions should take account of the energy consequences. Government interventions should respect the Polluter Pays Principle where practicable.

4. More environmentally acceptable energy sources need to be encouraged and developed. Clean and efficient use of fossil fuels is essential. The development of economic non-fossil sources is also a priority. A number of IEA member countries wish to retain and improve the nuclear option for the future, at the highest available safety standards, because nuclear energy does not emit carbon dioxide. Renewable sources will also have an increasingly important contribution to make.

5. Improved energy efficiency can promote both environmental protection and energy security in a cost-effective manner. There are significant opportunities for greater energy efficiency at all stages of the energy cycle from production to consumption. Strong efforts by governments and all energy users are needed to realise these opportunities.

6. Continued research, development and market deployment of new and improved energy technologies make a critical contribution to achieving the objectives outlined above. Energy technology policies should complement broader energy policies. International co-operation in the development and dissemination of energy technologies, including industry participation and co-operation with non-member economies, should be encouraged.

7. Undistorted energy prices enable markets to work efficiently. Energy prices should not be held artificially below the costs of supply to promote social or industrial goals. To the extent necessary and practicable, the environmental costs of energy production and use should be reflected in prices.

8. Free and open trade and a secure framework for investment contribute to efficient energy markets and energy security. Distortions to energy trade and investment should be avoided.

9. Co-operation among all energy market participants helps to improve information and understanding, and encourages the development of efficient, environmentally acceptable and flexible energy systems and markets worldwide. These are needed to help promote the investment, trade and confidence necessary to achieve global energy security and environmental objectives.

(The "Shared Goals" were adopted by IEA Ministers at the meeting of 4 June 1993 Paris, France.)

*Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, the Republic of Korea, Luxembourg, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States.

ANNEX C: GLOSSARY AND LIST OF ABBREVIATIONS

In this report, abbreviations and acronyms are substituted for a number of terms used by the International Energy Agency. While these terms generally have been written out on first mention, this glossary provides a quick and central reference for many of the abbreviations used.

°C	degree Celsius
AEM	Atomenergomash
ASEAN	Association of Southeast Asian Nations
ATS	Administrator of the Trading System
bbl	barrel
bcm	billion cubic metres
bcm/yr	billion cubic metres per year
BOO	Build-Own-Operate
BRELL	Belarus-Russia-Estonia-Latvia-Lithuania
Bt	billion tonnes
$BtCO_2$-eq	billion tonnes of carbon dioxide-equivalent
Btoe	billion tonnes of oil-equivalent
CAP	Comprehensive Action Plan
CAPEX	capital expenditure
CBM	coalbed methane
CCGT	combined-cycle gas turbine
CCS	carbon capture and storage
CDRF 2009	Climate Doctrine of the Russian Federation for the period until 2020
CFS	Centre for Financial Settlements
CHP	combined heat and power
CIS	Commonwealth of Independent States
CNG	compressed natural gas
CO^2	carbon dioxide
CSP	concentrated solar power
DAM	day-ahead market
DPM	*Dogovor o Predostavleny Moshnosty:* the mandatory contractual obligation for new generation capacity to ensure adequacy during the transition period
ECA	Energy Credit Agency
EHV	extra-high-voltage
EOR	enhanced oil recovery
ERU	emission reduction unit
ESCO	energy services company
ESPO	Eastern Siberia-Pacific Ocean

ETO	single heat supply organisation
EU	European Union
EUR	euro
EUR/Gcal	euros per gigacalorie
EUR/MW	euros per megawatt
EUR/MW/month	euros per megawatt per month
EUR/MWh	euros per megawatt hour
EUR/W	euros per watt
FAS	Federal Anti-monopoly Service of the Russian Federation
FASO	Federal Agency for Scientific Organisations
FBR	fast breeder reacto
FCFZ	free capacity flow zone
FEC	fuel and energy complex
FEED	front-end engineering design
FFA	free-flow area
FFMS	Federal Financial Markets Service
FID	final investment decision
FNR	fast neutron reactor
FOB	free-on-board
FSK	Federal Grid Company
FSU	Former Soviet Union
FTP	Federal Target Programme
FTS	Federal Tariff Service
FYP	Five-Year Plan
Gcal	gigacalorie
Gcal/m^2/yr	gigacalories per square metre per year
Gcal/yr	gigacalories per year
GDP	gross domestic product
GHG	greenhouse gas
GS	guaranteed supplier
Gt	gigatonne
GTL	gas-to-liquids
GTS	gas transmission system
GW	gigawatt
G2O	Group of Twenty
HLW	high-level waste
HOB	heat-only boiler house
IAEA	International Atomic Energy Agency
IEA	International Energy Agency
IFC	International Finance Corporation
IOC	independent oil company
IPS	interconnected power systems
IRENA	International Renewable Energy Agency
IRRS	Integrated Regulatory Review Service
IUEC	International Uranium Enrichment Centre

JI	joint implementation
JSCVTI	Open JSC All-Russia Thermal Engineering Institute
kb/d	thousand barrels per day
KfW	Kreditanstalt für Wiederaufbau
kg	kilogramme
km	kilometre
km^2	square kilometre
KOM	competitive selection of capacity
kopeks/kWh	kopeks per kilowatt hour
kt	kilotonne
kV	kilovolt
kVA	kilovolt ampere
kWh	kilowatt hour
kWh/yr	kilowatt hours per year
$kWh/m^2/yr$	kilowatt hour per square metre per year
LEU	low-enriched uranium
LNG	liquefied natural gas
LPG	liquefied petroleum gas
LTO	long-term operation
LULUCF	land use, land-use change and forestry
LWGR	light water graphite-moderated reactors
m	metre
m/s	metres per second
m^2	square metre
m^3	cubic metre
mb	million barrels
mb/d	million barrels per day
mcm	million cubic metres
MET	mineral extraction tax
MoU	Memorandum of Understanding
Mt	million tonnes
Mt/yr	million tonnes per year
Mtce	million tonnes of coal-equivalent
$MtCO_2$	million tonnes of carbon dioxide
$MtCO_2$-eq	million tonnes of carbon dioxide-equivalent
Mtoe	million tonnes of oil-equivalent
MW	megawatt
NGL	natural gas liquid
NGV	natural gas vehicle
NOHD	new offshore hydrocarbons deposit
NO_x	nitrogen oxide
NPP	nuclear power plant
OECD	Organisation for Economic Co-operation and Development
OGK	wholesale generation company

OPEC	Organization of the Petroleum Exporting Countries
OPEX	operational expenditure
OREM	energy and capacity wholesale market
PM	particulate matter
PPA	power purchase agreement
PPP	purchasing power parity
PRMS	Petroleum Resources Management System
PSA	production sharing agreement
PV	photovoltaic
PWR	pressurised water reactor
R&D	research and development
RAB	regulatory asset base
RBMK	high power channel-type reactor (*reactor bolshoy moshchnosti kanalny*)
REA	Russian Energy Agency
RES	renewable energy sources
RGC	regional generation company
RUB	Russian rouble
RUB/Gcal	Russian roubles per gigacalorie
RUB/kcm	Russian roubles per thousand cubic metres
RUB/L	Russian roubles per litre
RUB/MW	Russian roubles per megawatt
RUB/MW/month	Russian roubles per megawatt per month
RUB/MWh	Russian roubles per megawatt hour
RUB/t	Russian roubles per tonne
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SC	supercritical
SMEs	small- and medium-sized companies
SO	service operator
SO_2	sulphur dioxide
SOE	state-owned enterprise
t	tonne
tcm	trillion cubic metres
tCO_2/USD 1 000 GDP PPP	tonnes of carbon dioxide per one thousand US dollars of gross domestic product at purchasing power parity
TFC	total final consumption
TGK	territorial generating company
toe	tonnes of oil-equivalent
toe/capita	tonnes of oil-equivalent per capita
toe/USD 1 000 PPP	tonnes of oil-equivalent per one thousand US dollars of purchasing power parity
TPES	total primary energy supply
TWh	terawatt hour
UES	unified energy system

UK	United Kingdom
UNECE	United Nations Economic Commission for Europe
UNFCCC	United Nations Framework Convention on Climate Change
UNPG	Unified National Power Grid
UPS	united national power system
US	United States
USC	ultra-supercritical
USD	US dollars
USD/bbl	US dollars per barrel
USD/bcm	US dollars pr billion cubic metres
USD/kcm	US dollars per thousand cubic metres
USD/km	US dollars per kilometre
USD/kW	US dollars per kilowatt
USD/L	US dollars per litre
USD/1 000m^3	US dollars per one thousand cubic metres
USD/t	US dollars per tonne
USD/W	US dollars per watt
USD/yr	US dollars per year
VAT	value-added tax
VIOC	vertically integrated oil company
VVER	Vodo-Vodyanoi Energetichesky Reaktor: a series of pressurised water reactor designs
W	watt
WEO 2013	*World Energy Outlook 2013*
WTO	World Trade Organization
YNAD	Yamal-Nenets Autonomous District
y-o-y	year-on-year

IEA Publications
9, rue de la Fédération, 75739 Paris cedex 15

Printed in France by IEA, June 2014

(612014111E1) ISBN 9789264211506; ISSN 2307-0889

Cover design: IEA. Photo credits: © GraphicObsession.

Energy Policies Beyond IEA Countries

Russia 2014

Russia's energy sector plays an essential role for the Russian economy, its energy security and global hydrocarbon supplies. Russia holds among the world's largest resources of gas, oil and coal. Its liquids production has reached historical highs, yet major additional upstream investments and technology upgrades will be needed to sustain these levels in the long term. Its gas production is also at high levels, with Gazprom being the dominant producer, and with other companies now taking significant roles. Since the last IEA review of Russia's energy policies in 2002, the power sector has also liberalised considerably.

The Russian economy remains largely inefficient, with twice as much energy used per GDP compared with IEA member countries. Ambitious energy efficiency policies have been introduced but have not led to significant improvements so far. At the same time, the electricity and district heating infrastructure is ageing and requires rapid investments. Attracting these investments from private domestic and foreign companies will require further regulatory, tariff and fiscal changes as well as a strong focus on policy implementation. Russia's overall energy sector would benefit considerably from a more competitive, market-oriented environment.

While a number of policies aimed at modernising the energy sector and increasing its efficiency and sustainability are being developed or implemented, further reforms are needed. In 2014, Russia is preparing a new Energy Strategy to 2035 – offering a timely look at these challenges and opportunities.

This review analyses the energy policy challenges facing Russia and provides critiques and recommendations for further policy improvements. It is intended to help guide the country towards a more sustainable energy future.

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(61 2014 11 1E1)
978-92-64-21150-6 €60