International Energy Agency

Energy Policies of IEA Countries

Hungary

2011 Review

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Hungary

Regional co-operation is a vital element of Hungary's energy market and energy security policy. Hungary, which shares borders with seven countries, is well placed to improve regional energy security by catalysing the development of closely integrated regional markets for electricity and natural gas.

A country strongly dependent on natural gas imports, Hungary has taken several commendable steps to manage risks to its supply. It has enhanced storage capacity and diversified cross-border capacity, and is developing new supply routes. Hungary is also working hard to strengthen the regional electricity market through new interconnectors and market coupling.

Electricity demand within Hungary is expected to grow, while generating capacity is rapidly ageing. Investments are needed for grid improvements and generating capacity, both for increasing capacity (especially for low-carbon electricity) and replacing ageing plants. Ensuring predictable and attractive framework conditions for investing in energy infrastructure is crucial.

The government is considering additional nuclear power units. The extent to which nuclear power capacity will be expanded should be clarified without unnecessary delay, as it will have broad implications for the viability of other current and future base-load technologies.

Although per-capita energy consumption in Hungary is well below the OECD average, considerable potential remains for improving energy efficiency across all sectors. Measures to reduce consumption in the large existing building stock should be the government's top priority for energy policy. Gradually, Hungary should also replace broad subsidies for energy use with direct support to those in need.

9 789264 098220

(61 2011 06 1P1)
978-92-64-09822-0 €75

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INTERNATIONAL ENERGY AGENCY

The International Energy Agency (IEA), an autonomous agency, was established in November 1974. Its primary mandate was – and is – two-fold: to promote energy security amongst its member countries through collective response to physical disruptions in oil supply, and provide authoritative research and analysis on ways to ensure reliable, affordable and clean energy for its 28 member countries and beyond. The IEA carries out a comprehensive programme of energy co-operation among its member countries, each of which is obliged to hold oil stocks equivalent to 90 days of its net imports. The Agency's aims include the following objectives:

- 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.
- Find solutions to global energy challenges through engagement and dialogue with non-member countries, industry, international organisations and other stakeholders.

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France
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Ireland
Italy
Japan
Korea (Republic of)
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New Zealand
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The European Commission also participates in the work of the IEA.

International Energy Agency

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1. EXECUTIVE SUMMARY AND KEY RECOMMENDATIONS

EXECUTIVE SUMMARY

Energy policy features prominently in the economic recovery plan of the Hungarian government. It is seen as a key element in the country's efforts to promote green growth and job creation. Energy is to be supplied reliably and at a reasonable price.

Regional co-operation is a vital element of Hungary's energy market and security policy. Greater regional integration is unambiguously positive for security of supply; it increases diversity, improves liquidity and volumes, and increases access to flexible resources necessary to maintain system security at least cost.

The country depends on natural gas for a significant share of its TPES, 38% in 2010. Commendably, several projects to diversify supply sources and routes are under way. Hungary is also actively developing the regional electricity market, including through new interconnectors and market coupling. A country with seven neighbours, Hungary is well placed to continue to catalyse the development of closely integrated regional markets for electricity and natural gas. The IEA acknowledges the responsibility Hungary has shown in improving regional energy security and encourages it to carry on this work.

Natural gas provides an unusually high share of energy supply in Hungary and most gas comes from Russia through one route. Following the supply disruption in 2006, the government has taken several important steps to manage risks to natural gas supply. It has enhanced storage capacity (including strategic storage), is considering various options to diversify supply routes and is developing cross-border connections with neighbouring countries. Its gas-fired electricity capacity can to a large extent be switched to use oil. The IEA applauds Hungary's general approach to gas security.

As a specific response to the 2006 gas crisis, Hungary took the right decision to build a 1.2 billion cubic metres (bcm) strategic gas storage. Completed in 2010, the storage improves security of supply in the country and the neighbouring region. However, in June 2010 the government reduced the legal minimum stockholding level by half. This is at odds with the general goal of securing gas supplies. The government should reconsider this decision and use the strategic storage only for ensuring security of supply.

The government projects electricity demand to grow by around 25% by 2020, according to the December 2010 National Renewable Energy Action Plan. In order to meet the growing demand and to maintain security of supply, investments are needed for grid improvements and generating capacity, both for increasing capacity, especially for low-carbon electricity, and for replacing ageing plants. The government is also considering additional nuclear power plants as an option. The extent to which nuclear power capacity will be expanded has wide implications for the profitability of other current and future baseload technologies. The government should provide greater clarity on its preferred options for future electricity supply so as to allow market players to take the necessary investment decisions that deliver greater security of supply at least cost. The energy strategy to 2030 on which the government is working would be a tool for providing such clarity.

To meet the large investment needs in the power sector, or in any sector, favourable conditions are required. Experience from IEA member countries shows that stable, predictable and transparent laws and rules that are independently and objectively administered by credible and well-resourced regulatory institutions are needed to attract timely and least-cost investment capital. In contrast, frequent changes in regulations, increased government intervention on price setting and new taxes create regulatory risks that discourage investment. The government should ensure predictable and attractive framework conditions for investing in energy infrastructure.

Consumer prices for energy need to reflect costs. Freezing consumer prices for electricity, gas and district heat, or subsidising them, does not encourage efficient use. It may also discourage new companies from entering the Hungarian market and, in the long term, reduce investment in infrastructure development. The consequences of the economic crisis on low-income households should be dealt with using targeted social measures, instead.

Under the Kyoto Protocol, Hungary is obliged to reduce its greenhouse gas (GHG) emissions by 6% from base year to 2008-2012. The country is set to meet this target by a wide margin, as emissions in 2008 were around 37% below the base-year level and even lower in 2009. The real challenge comes after 2012. Hungary's GHG target for 2020 is +10% from the 2005 level for the sectors outside the EU Emissions Trading Scheme (ETS), while the ETS sector has an EU-wide -21% target from 2005 to 2020.

Meeting the 2020 targets calls for measures to limit emissions in all major sectors. Energy use in transport has increased rapidly since 1990, reflecting large latent demand for passenger cars under the pre-1990 Socialist regime, but also the country's active participation in international trade and the resulting growth in freight transport. Passenger car ownership remains at around two-thirds of the EU15 average. Energy use in the transport sector is set to grow fast, as economic recovery picks up. Transport is a crucial sector for long-term emissions reductions and energy security.

Emissions from power and heat generation are controlled under the EU-ETS. After 2012, emission allowances to this sector will in general be auctioned, but Hungary has the option of applying for a transitional free allocation of allowances to the power sector. Such free allocation should be used as an incentive for ambitious energy efficiency improvement at the eligible power plants.

Hungary has set an ambitious target for renewable energy use in 2020. The country has large potential for increasing biomass production for heat, power and transport fuel production. Higher use will help limit both CO_2 emissions and the need for energy imports, and thus also help improve security of supply. However, as competition for biomass resources to reach specific energy targets could disrupt the supply for other targets and affect GDP and employment, a full assessment of the biomass resource is needed.

Hungary, as all other countries, should continue the transition to a low-carbon economy. The country should look for ways to decarbonise its power and heat sector, followed by a decarbonisation of its transport sector. The IEA acknowledges Hungary's pragmatism in considering low-carbon forms of power generation, including nuclear and renewable energy, and encourages it to continue this way. Energy efficiency measures in all sectors should be promoted, for example through CO_2 taxes. Reducing the need for imported fossil fuels would also bring the country closer to meeting both its climate change and energy security objectives.

Although per-capita energy consumption in Hungary is below the EU average, there is still considerable energy efficiency potential across all sectors. Improving energy efficiency in the large existing building stock should be the government's top priority.

Energy efficiency could provide considerable win-win opportunities. A case in point is district heating which supplies energy to around one in five Hungarians. In brief, the district heating system needs to be modernised and the buildings where it is used made more energy-efficient. District heating companies are typically local monopolies and therefore have reduced incentives for being efficient. To prompt the companies to increase system efficiency, the government should consider introducing minimum efficiency standards for the district heating pipeline system. The government should also address non-technical issues, such as the administration and management of district heating companies to ensure quality service for customers.

It is also crucial to improve the efficiency of heat use, in particular in the prefabricated housing complexes dating from the Soviet era. The government could either subsidise investments in energy efficiency in buildings, for example by offering low-interest loans. Or it could oblige utilities to make such energy-saving investments and let them reap the resulting benefits. It should also maximise the use of favourably termed funding for such projects provided by the EU and the international financial institutions.

The majority of residential users are unable to adjust their heating consumption, as the system is old. Only about a quarter of dwellings are well controlled at present. The government should introduce obligatory metering and transparent billing for each household or commercial unit. Subsidies in the district heating sector need to be refocused. Instead of subsidising energy use, the government should subsidise energy efficiency improvements.

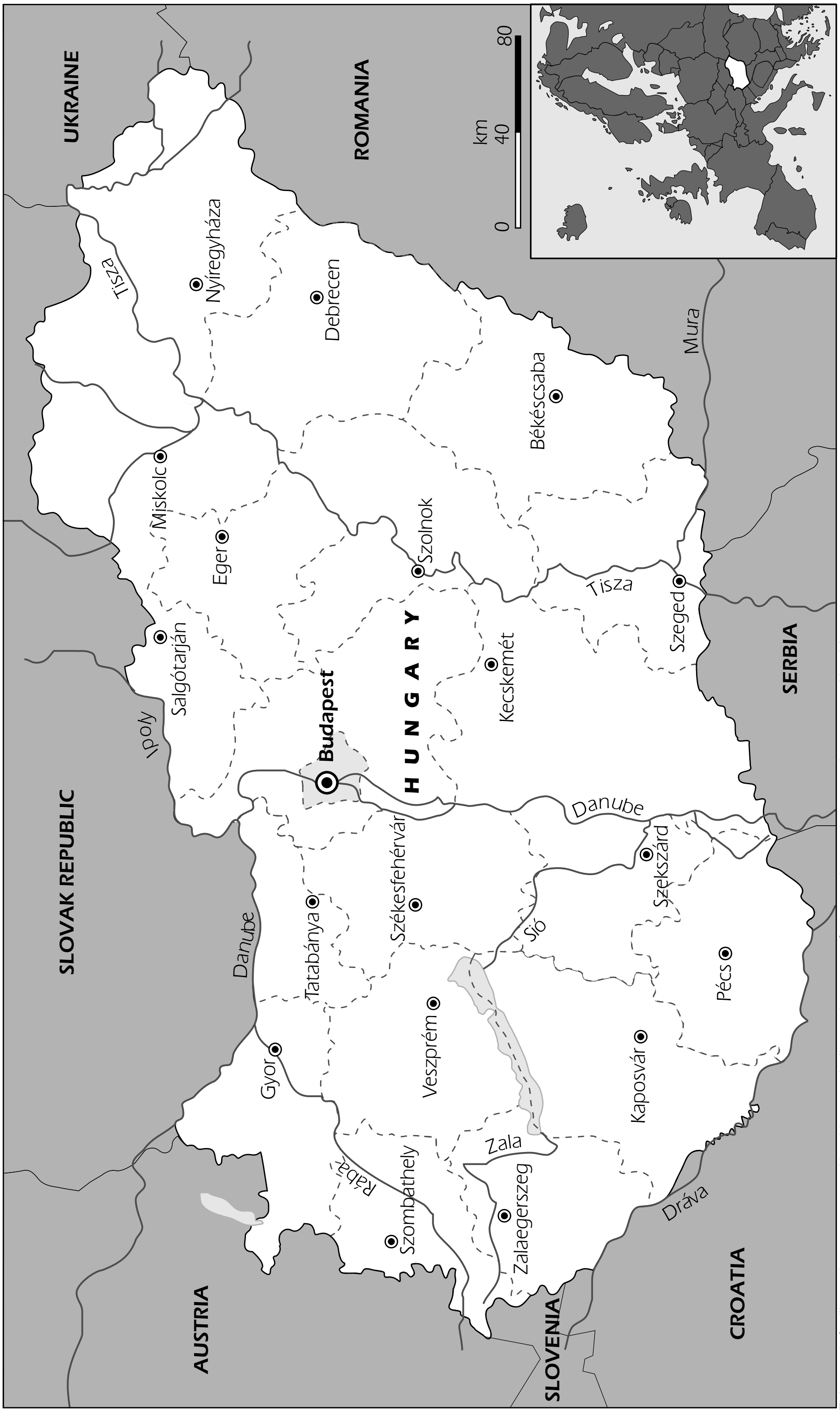
KEY RECOMMENDATIONS

The government of Hungary should:

- ☐ *Continue to play a leading role in regional energy market integration and to build on existing regional synergies to improve security and flexibility of energy supply.*
- ☐ *Provide clear guidance on its preferred options for future electricity supply; clarify the role of nuclear new build.*
- ☐ *Ensure predictable and attractive framework conditions for investing in energy infrastructure.*
- ☐ *Intensify efforts to improve energy efficiency in all sectors, also by abolishing subsidies for energy use and replacing them with direct support to those in need.*

PART I
POLICY ANALYSIS

Figure 1. **Map of Hungary**



This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

2. GENERAL ENERGY POLICY

Key data (2010 estimates)

Population: 10 million

GDP: USD 149 billion (2000 prices and PPPs), +20% since 2000

GDP per capita: USD 14 900 (OECD average: 26 900)

TPES: 25.4 Mtoe (natural gas 38%, oil 25%, nuclear 16%, coal 11%, renewables 8%), +0.2% on average per year since 2000

TFC: 17.8 Mtoe in 2009 (residential 31%, industry 25%, transport 25%, other 19%), +0.5% on average per year since 2000

Electricity generation: 37.4 TWh (nuclear 42%, natural gas 31%, coal 17%, combustible renewables and waste 7%)

Inland energy production: 11 Mtoe, imports 60% of total energy supply

COUNTRY OVERVIEW

The Hungarian Republic has an area of 93 000 km^2 and borders on seven countries: Austria, Croatia, Romania, Serbia, the Slovak Republic, Slovenia and Ukraine. The country is mostly flat, with low mountains on the Slovak border. Hungary has 10 million inhabitants. Population has slightly decreased over the past decade.

Hungary's economy is dominated by services, accounting for around two-thirds of the total. Industry's share was 31% in 2010 and agriculture contributed 3%. Exports are dominated by machinery and equipment, which made up three-fifths of the total in 2010.

Economic growth was relatively high, around 4% per year, from 2000 to 2006. After slowing down to around 1% per year in 2007-2008, it dropped by 6.7% in 2009, following the international financial crisis. In 2010, however, GDP turned to a 1.2% growth. GDP per capita is around 60% of the OECD average. The unemployment rate is slightly above 10% of the workforce.

Hungary is a parliamentary republic. Following several years of Socialist party rule, in the April 2010 general election, the centre-right Fidesz-Hungarian Civic Union (Fidesz) won 263 seats out of the 386 in the country's unicameral parliament. Fidesz has the strongest government mandate since the fall of communism, enabling it to pass or amend legislation without the need for political compromise. The next general election is scheduled for 2014. Hungary has been a member of the European Union since 2004.

SUPPLY AND DEMAND

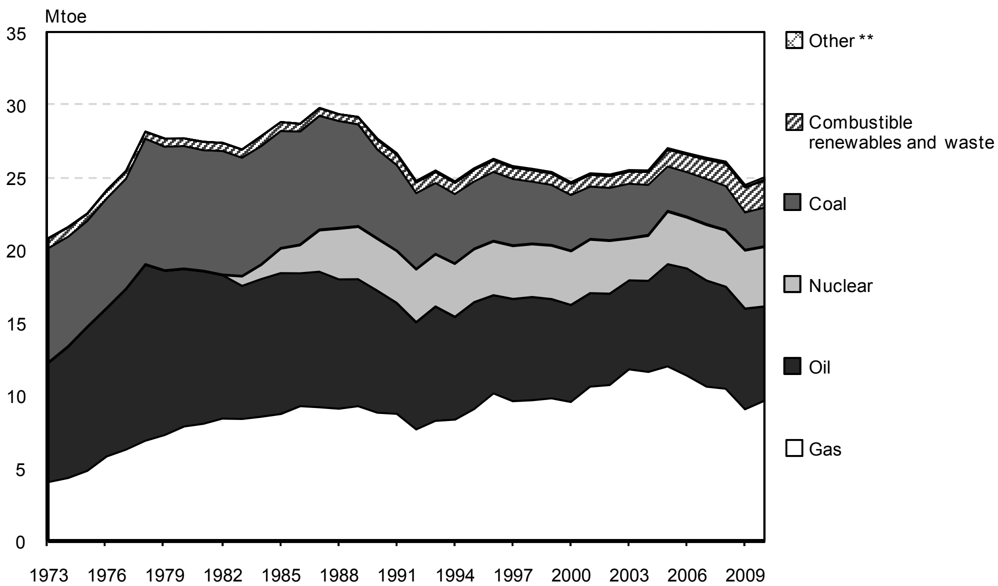
SUPPLY

Total primary energy supply (TPES) in Hungary was 25.4 Mtoe in 2010[1]. It has remained relatively flat since 1992. Over this period, GDP has grown on average by 2.3% per year. Economic growth and energy use have thus been decoupled, and energy intensity has decreased significantly.

Since 1986, natural gas is the largest primary energy source in Hungary. In 2010, it accounted for 38% of TPES, one of the highest shares among the IEA member countries, following the Netherlands, Italy and the United Kingdom. This share has increased from 31% in the early 1990s to a peak of 40% in 2007. The IEA average was 24% of TPES. In contrast, coal use has declined by half from 1992 and amounted to 2.7 Mtoe in 2010, or 11% of TPES (see Figure 2).

Oil is the second-largest energy source in Hungary, representing 6.4 Mtoe, or 25% of TPES, one of the lowest shares among the IEA member countries (see Figure 3). This share has remained fairly constant over the past two decades, as has the share of nuclear energy, at around 16% of TPES and 42% of total electricity generation.

Figure 2. **Total primary energy supply, 1973 to 2010***



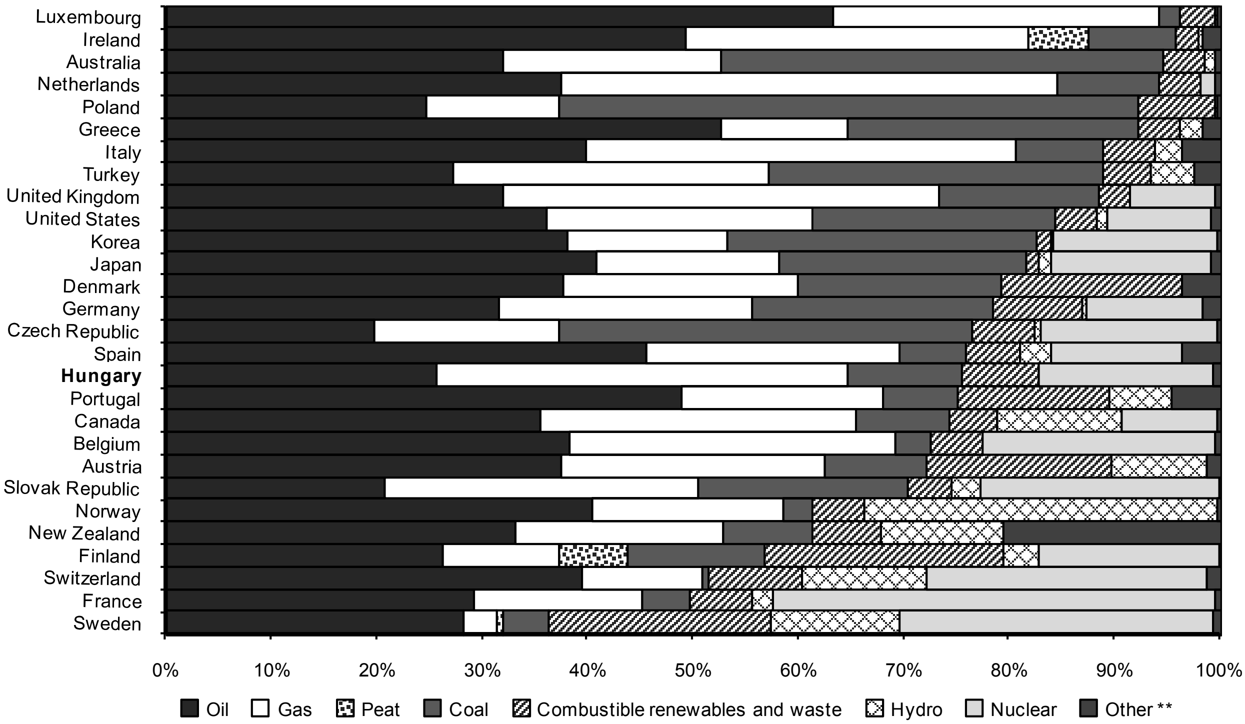
* Estimates for 2010.

** Other includes wind, solar, geothermal and hydro (negligible).

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2010 and country submission.

1. In this report, supply data for 2010 are estimates.

Figure 3. **Breakdown of total primary energy supply in IEA member countries, 2010***



* Estimates.

** *Other* includes geothermal, solar, wind and ambient heat used in heat pumps.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2010 and country submission.

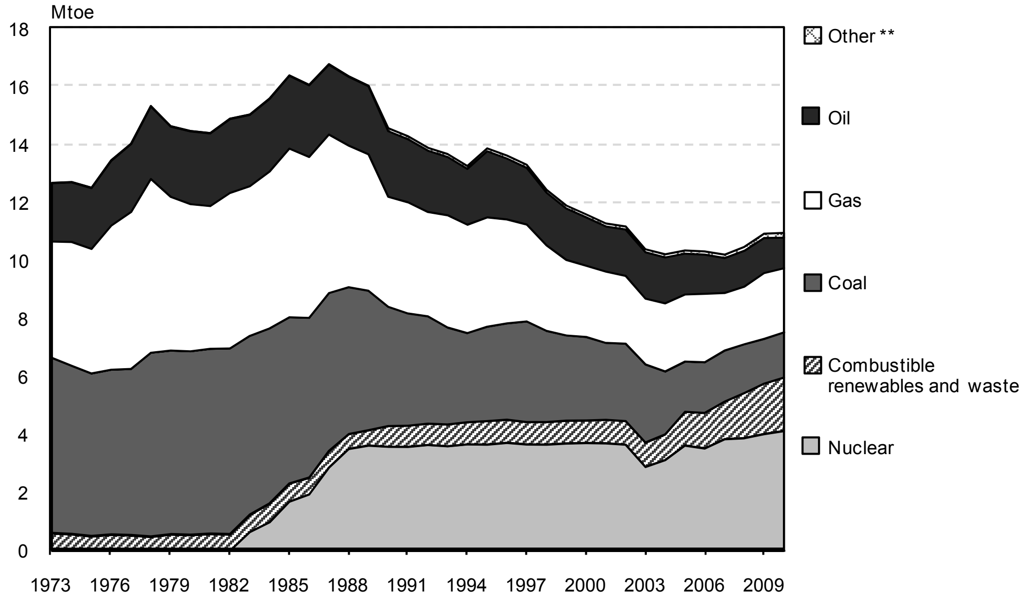
The share of renewable energy sources more than doubled from 3.4% in 2000 to 7.9% of TPES in 2010, slightly above the IEA average (7.7%). Biomass is the main renewable energy source, representing 1.8 Mtoe or 7.2% of TPES in 2010.

Energy supply has remained rather flat over the last two decades, but energy production has rapidly decreased (see Figure 4). In 1990, Hungary produced 15 Mtoe of primary energy, or 53% of its total supply, while in 2010 domestic production had fallen to 11 Mtoe, or around 43% of TPES.

DEMAND

In 2009, total final energy consumption (TFC) in Hungary was 17.8 Mtoe (see Figure 5). Since 2000, it has increased at an average rate of 0.5% per year. In 2009, the residential sector was the largest energy consumer, accounting for 31% of TFC. Transport accounted for a quarter of TFC and is expected to continue to grow faster than the other sectors. Final use of energy for heating and cooling purposes represents almost 50% of all primary energy, the third-highest share among the IEA member countries, after Poland and Turkey.

Figure 4. **Energy production by source, 1973 to 2010***

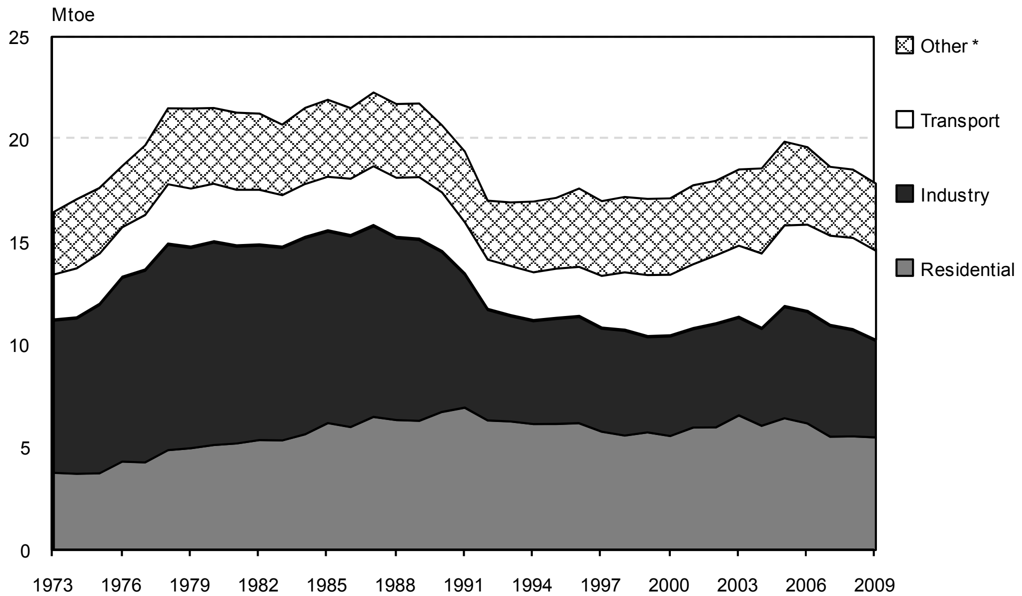


* Estimates for 2010.

** *Other* includes wind, solar, geothermal and hydro (negligible).

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2010 and country submission.

Figure 5. **Total final energy consumption by sector, 1973 to 2009**



* *Other* includes commercial, public service, agricultural, fishing and other non-specified sectors.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2010.

INSTITUTIONS

The **Ministry of National Development** is responsible for energy and climate policy within the government. It was established following the 2010 general election. The ministry is also responsible for managing state-owned assets, including in the energy sector.

The **Hungarian Energy Office** (HEO) is the energy regulator, with specific responsibility for electricity, natural gas and district heating. HEO was established in 1994. It has independent powers and competences, but remains under the supervision of the Minister of National Development.

The **Hungarian Competition Office** (GVH) monitors competition in all sectors of the economy, as well as mergers in the energy sector. The GVH gives expert advice and makes proposals relating to the governmental competition policy and to decisions of the government affecting competition. The GVH is independent of the government, but is controlled by the Parliament.

The **Hungarian Atomic Energy Authority** (HAEA) is the nuclear safety regulator. It is an organisationally and financially independent public administration body. It cannot be directed in its scope of authority as defined by law.

The **Hungarian Hydrocarbon Stockpiling Association** (HUSA) administers emergency stocks of oil and natural gas. The strategic reserves are held by this agency, which was established on the basis of Act IL of 1993 on the Emergency Stockholding of Imported Crude Oil and Oil Products. HUSA is overseen by the Ministry of National Development.

KEY POLICIES

Hungary's government has outlined its economic policies in the New Széchenyi Plan, adopted in January 2011. Under the heading *Renewal of Hungary – development of green economy*, energy is one of the seven programme areas for future growth. Detailed action is planned in the following six areas:

1. ***Energy policy at the service of economic growth and job creation***

- revision of the competitiveness of the electricity and gas market and the revision of the regulatory system;
- creation of a stable regulatory and investment environment;
- creation and maintenance of efficiency and economic competitiveness;
- promotion of regional energy sector integration with due regard to the interests of domestic participants;
- creation of a comprehensive energy efficiency programme;
- definition and promotion of potential growth sectors of the energy industry;
- concentration on technological progress and on research and development;
- price policy.

2. ***Security of supply and diversity of resources***

- balanced diversity of resources;

- diversity of acquisitions;
- strategic storage facilities;
- production and use of renewable energy sources;
- development of infrastructure, central role of the State;
- energy diversification of local governments and improving their energy efficiency.

3. Decreasing dependence on energy imports

- cutting overall gas consumption by rationalising and downsizing unjustified discounts on natural gas;
- supporting efforts towards energy efficiency;
- promoting projects aimed at replacing natural gas with renewable energy sources in heating systems;
- maintaining funding for high-efficiency, renewable energy-based electricity production.

4. The focused encouragement of the production and use of renewable energy sources

- revision of discounts on fossil fuels (*e.g.* discounts on gas consumption, carbon tax, etc.);
- overhaul of the actual support system (revision of investment support; preference of domestic added value, introduction of a green certificate);
- the support mechanism to promote the renewal of heating systems;
- facilitation of renewable energy producers' network connection.

5. Climate change, mitigation and adaptation

- reducing greenhouse gas emissions and promoting climate-friendly investments as well as projects which increase social acceptance and awareness of environmental protection issues.

6. Nuclear energy

- implementing an open information policy about the utilisation of nuclear energy;
- examining the possibility of prolonging the Paks nuclear power plant's operation licence, paying special attention to the intransigent enforcement of security requirements;
- considering, for the medium and long term, the building and operation of new nuclear reactors for the power plant.

CRITIQUE

Hungary's economy is emerging from the depths of the recession after a period of intense austerity. However, it faces considerable challenges not least because of its continuing high gas import dependence, its declining hydrocarbon production and limited market entry possibilities for new energy players, the ageing building stock and transport infrastructure, and the domestic district heating systems that are in need of major overhaul and account for a significant share of domestic gas demand.

Nevertheless, these same challenges offer unique opportunities for growth, major structural and market reform of the energy sector, significant potential for greening the economy using secure and sustainable measures while at the same time using the country's indigenous resources in the most cost and energy-efficient way. Hungary should take full advantage of its central geographical position and its good energy links with its neighbours to effect a step change in regional co-operation for mutual benefit.

The current government enjoys a comfortable majority and has already shown in its Széchenyi Plan its appetite for change. The government is to be congratulated for bringing together under a single reconstituted Ministry of National Development the former divisions dealing with energy, renewables and climate change issues that had been split across separate ministries. This will help ensure that existing and future strategies and delivery programmes are coherent across the energy and climate change sectors and reduce any inherent tensions between different programmes.

Any large-scale structural reform will clearly take time, will need acceptance by industry and the public at large and will require targeted, differentiated and explicit delivery programmes. Hungary should consider the extent to which such programmes, particularly those with potential for large efficiency gains and increased use of renewables, may best be delivered in partnership with industry and the private sector. Where there is potential for quick wins, these should form part of an overall energy and climate change strategy and be embedded in a fully developed result-focused implementation plan with accountable audit trails. Quick wins can help drive through changes if they are seen to be proportionate to the problem, are fair, transparent, cost-efficient, and market-based. They should be sustainable in the longer term and contribute to the three Es of Energy security, Economic growth and Environmental protection.

Since the last IEA in-depth review in 2006, Hungary has already improved its energy policy in several areas and should be congratulated for the way in which:

- it has tackled its heavy dependence on natural gas, in part by setting up and completing its strategic gas storage capacity (1.2 bcm) for use in a supply emergency, while continuing to explore the potential for using remaining (commercial) excess capacity in this storage (0.7 bcm) as well as exploring the potential for developing an additional 5 bcm in other storage caverns for use by neighbouring states;
- it has put in place or is planning additional cross-border interconnector links in both gas and electricity, and is continuing to assess Hungary's potential as an energy hub (though it is unclear at the present time if a full cost-benefit analysis has been carried out to examine both the upside and downside potential of developing further and expanding links with its neighbours);
- it is continuing to explore indigenous geothermal possibilities linked to its oil and gas exploration and production activities;
- it is continuing to explore ways in diversifying its energy mix and sources as well as routes;
- it is exploring the possibilities for mutual benefit security of supply packages with Croatia using pipeline connections and oil and gas storage capacities in both countries as backup stocks in case of supply failures;

- it has adopted a 14.65% target for the share of renewable energy in gross total final consumption in 2020, because of its considerable indigenous biomass potential (its EU target is 13% by 2020);
- it is continuing to explore the possibilities for pumped and battery storage to help manage future variability of demand so that inefficient coal would not be needed to balance demand;
- it has abolished long-term Public Purchase Agreements and started the process of gradually reducing the significant market share of the Hungarian electricity company MVM;
- it has completed power uprates to all four units at the Paks nuclear facility and is actively pursuing plans for extending their lifetime by 20 years through licensing with the Hungarian Atomic Energy Authority (subject to meeting all its stringent safety criteria), and plans are being developed for new build at Paks and on other potential sites; work is also progressing for long-term storage of high-level radioactive waste – some geological compatible rock structures have already been identified and detailed investigations have been initiated.

However, the review team has identified particular issues in the operation and management of Hungary's aged district heating systems in the domestic housing stock: there are still huge energy efficiency gains to be made in these buildings, particularly in the prefabricated buildings in some of the poorer communities. Despite government efforts over the past few years to improve insulation standards, much still needs to be done. There also appear to be considerable barriers and inflexibilities built into the way these district heating schemes are managed so that individual household units find it is often extremely difficult to opt out of expensive district heating arrangements and seek separate suppliers. The energy efficiency issues need to be addressed as a matter of urgency and the lack of market pricing in this sector remedied quickly.

The price of energy gives end-users the clearest signal to use it more efficiently. Prices that leave room for profit also encourage new companies to supply energy which improves overall energy security. The government's decision to set a moratorium on electricity and gas prices has the understandable intention of protecting vulnerable customers, but in all fairness it would be better to target these customers with direct social policy measures and avoid distorting the energy market. Experience from several IEA member countries shows that regulating end-user prices at a too low level leads to underinvestment in the sector, which may damage security of supply over the long term.

The approval and licensing process, in particular for electricity generated from renewable sources seems lengthy and overly complex and this may also apply for other energy infrastructure projects. This is an obstacle to increasing electricity generation from renewables, and a challenge to security of supply. It is also a hurdle for potential new entrants. A more rapid, more efficient and more transparent permitting process for investing in energy infrastructure would benefit the Hungarian energy users through increased competition and market efficiency, particularly in electricity. Therefore, the government should shorten and streamline the approval and licensing process.

There are also issues that need to be addressed with respect to the continuing subsidies for small cogeneration plants that produce combined heat and power (CHP) through the feed-in tariff system – regardless of whether they use fossil fuels or biomass as feedstock. Hungary is in an enviable position as regards the availability of biomass for cogeneration and indiscriminate subsidies on this scale are not providing appropriate incentives for improving renewable energy production on a sustainable basis or to put out the right signals to help meet Hungary's target for renewable energy use by 2020.

Hungary has a surplus of biomass that is exported and is price-competitive with gas. However, other less developed and price-competitive technologies could be better supported. Developing such a capability may have export potential given interdependencies of neighbouring markets.

RECOMMENDATIONS

The government of Hungary should:

- *Continue to play a leading role in regional energy market integration and to build on existing regional synergies to improve security and flexibility of energy supply.*
- *Continue to liberalise energy markets to create better conditions for the required investments in energy infrastructure; streamline and significantly shorten the approval and licensing processes for energy infrastructure projects, in particular for renewable energy.*
- *Develop social policies in such a way as to minimise and, where possible, eliminate distortion to energy markets; in this regard, consider the early lifting of the price moratorium for the household sector and in parallel consider using means-tested support for the socially vulnerable.*
- *Address, as a matter of urgency, the issues stemming from the current system of district heating to improve energy efficiency and quality of housing.*
- *Ensure that staffing of administrators engaged on energy policy is appropriate and that these administrators are in a position to accelerate implementation, monitoring and evaluation of energy-related strategies and action plans.*
- *Abolish feed-in tariffs for fossil fuels; ensure regulatory certainty of support schemes.*
- *Develop scenarios for the optimal energy supply mix, taking also into account energy security and climate change objectives.*

3. CLIMATE CHANGE

Key data (2009)

Total GHG emissions (excluding LULUCF): 66.7 Mt CO_2-eq, -41.5% from base year

2008-2012 target: -6% from base-year

CO_2 emissions from fuel combustion: 48.2 Mt (-1.2% on average per year since 2000)

Emissions by fuel: natural gas 43%, oil 36%, coal 21%, waste 0.7%

Emissions by sector: electricity and heat generation 32%, transport 26%, households 17%, industry 12%, other 13%

OVERVIEW

Hungary is a signatory to the United Nations Framework Convention on Climate Change (UNFCCC) and a party to the Kyoto Protocol. It has an individual target to reduce its greenhouse gas (GHG) emissions to an average of 6% below their annual average of 1985-1987 in the period 2008-2012, in absolute terms from 115.4 Mt CO_2-eq to 108.5 Mt CO_2-eq. Hungary is not part of the EU Burden-Sharing Agreement for the first commitment period of the Kyoto Protocol.

According to Hungary's national inventory submission to the UNFCCC, total GHG emissions in 2009 excluding land use, land use change and forestry (LULUCF), amounted to 66.7 Mt CO_2-eq, which is 41.5% less than the base-year emissions and 8.7% less than emissions in 2008. As a result, Hungary has a surplus of assigned amount units (AAUs) of tens of million tonnes of CO_2-equivalent. The country is expected to continue to exceed its Kyoto Protocol target up to 2012 by a wide margin.

Emissions have collapsed since the fall of the Soviet bloc and the subsequent restructuring of Hungary's economy, in particular its heavy industry. Since 1990, emissions have been reduced also through improving economic efficiency, switching from coal (lignite) to natural gas in heating and limiting industrial nitrous oxide (N_2O) emissions. In 2009, carbon dioxide (CO_2) accounted for 75.7% of GHGs, methane (CH_4) for 12.6%, nitrous oxides (N_2O) for 10.1% and the F-gases (hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride) for 1.6%.

Beyond 2012, as part of the effort-sharing of the EU GHG target of -20% from 2005 to 2020, Hungary will have to limit GHG emissions to 10% above their 2005 levels in the sectors outside the EU Emissions Trading Scheme (ETS). The ETS sector has a single EU-wide target of -21% from 2005 to 2020.

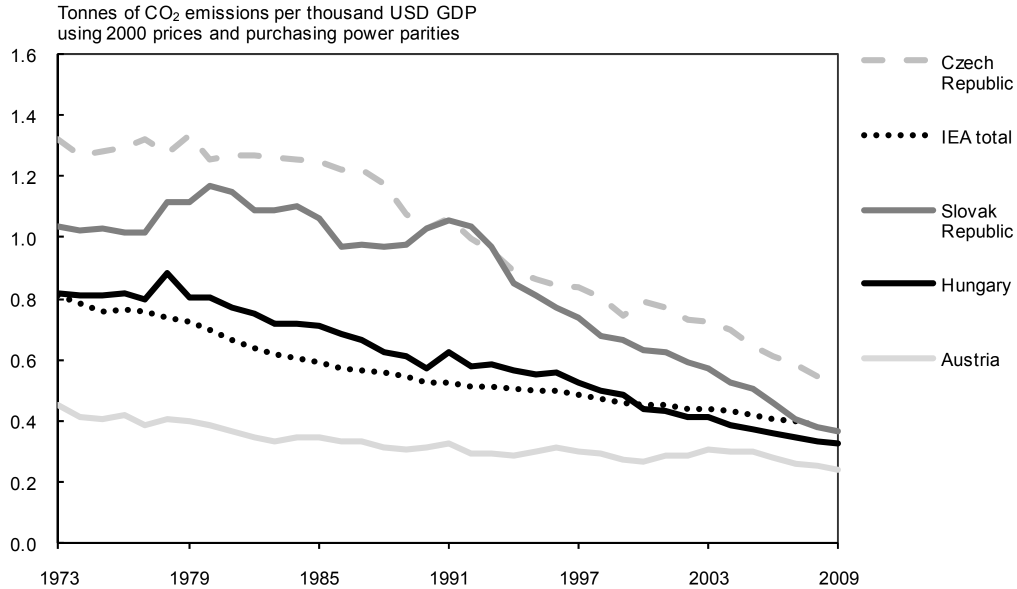
ENERGY-RELATED CO_2 EMISSIONS

In 2009, energy-related CO_2 emissions in Hungary totalled 48.2 Mt, 9% less than in 2007, and the lowest level in decades. Over the last decade, emissions have decreased by 6 Mt.

Energy use in Hungary produces relatively few CO_2 emissions. In 2009, emissions per GDP were 15% lower than the IEA average (see Figure 6). CO_2 emissions per capita amounted to 4.8 tonnes in 2009, less than half the IEA average of 10.5 t CO_2 per capita and the third-lowest among the IEA member countries (see Figure 7).

Hungary's low CO_2 emissions are linked to small shares of coal and oil in energy supply. Natural gas accounted for 43% of all energy-related CO_2 emissions in 2009, the second largest share among IEA member countries. Emissions from oil combustion provided 36% of the total, much less than the IEA average of 41%. Emissions from coal generated 21%, while the IEA average was 34%.

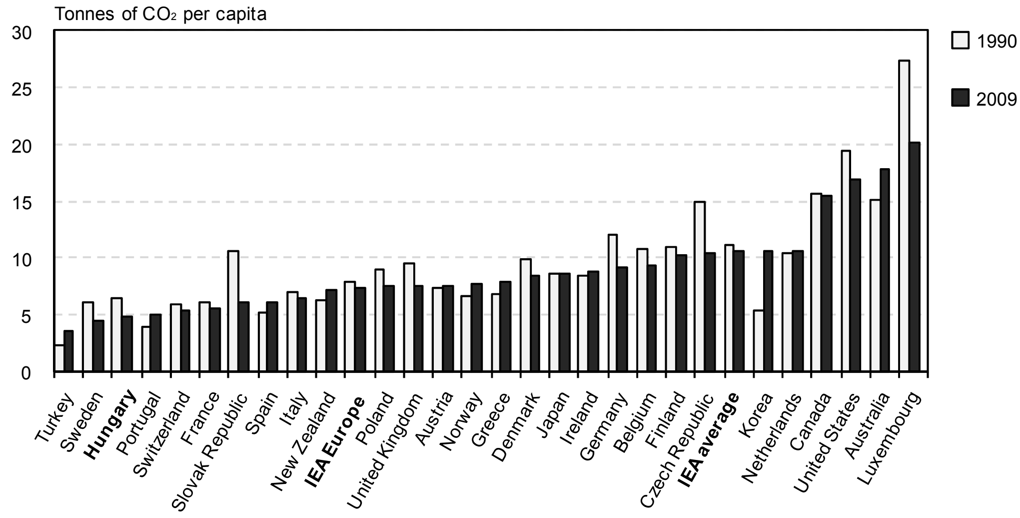
Figure 6. **Energy-related CO_2 emissions per GDP in Hungary and in other selected IEA member countries, 1973 to 2009**



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2010; *National Accounts of OECD Countries*, OECD Paris, 2010.

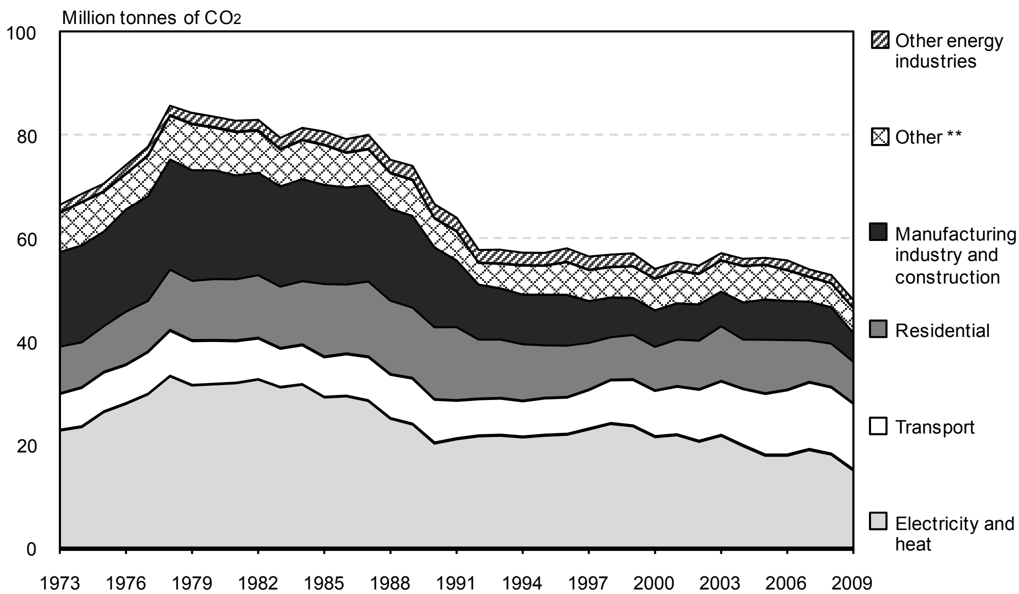
Looking at CO_2 emissions by sector, electricity and heat generation produced one-third of all emissions, followed by the transport sector with 26% and the residential sector with 17% (see Figure 8). Over the last decade, emissions from the electricity sector have gradually decreased, but this decrease has been offset by a 45% increase in emissions from transport from 2000 to 2009.

Figure 7. **Energy-related CO_2 emissions per capita in IEA member countries, 1990 and 2009**



Source: *CO_2 Emissions from Fuel Combustion*, IEA/OECD Paris, 2010.

Figure 8. **CO_2 emissions by sector*, 1973 to 2009**



* Estimated using the IPCC Sectoral Approach.

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

Source: *CO_2 Emissions from Fuel Combustion*, IEA/OECD Paris, 2010.

INSTITUTIONS

Following the 2010 general election and the appointment of the new government, Hungary has restructured the institutional set-up for climate change policy. The **Ministry of National Development** is in charge of climate policy in the country**.** It is also responsible for energy policy. Within the ministry, the work is delegated to the **State**

Secretariat for Climate and Energy Affairs. The latter also co-ordinates climate policy formulation within the government.

Within the State Secretariat, the work is done by the Deputy State Secretary for Development of Green Economy and Climate Policy which is divided in two departments - the Department of Green Economy and the Department of Climate Policy. The Energy Centre also plays a key role in the application of the legislative measures.

POLICIES AND MEASURES

OVERVIEW

The government is currently finalising an energy strategy to 2030, with updated scenarios for energy supply and energy-related CO_2 emissions. Under all scenarios, Hungary will remain a net seller of carbon credits to the international market for years to come.

Hungary's latest National Communication to the UNFCCC, its fifth, dates from 2009. The document outlines policies and measures, and includes three scenarios for GHG emissions to 2020, but these do not reflect the impacts of the economic crisis from 2008 on. In two scenarios - the *With Existing Measures* and *With Additional Measures* - GHG emissions without LULUCF would decrease from 2005 to 2020.

Hungary's current National Climate Change Strategy (NCCS) dates from 2008 and applies for the period 2008-25. It focuses on three main areas: mitigation, adaptation and awareness raising. The NCCS does not set quantified emission-reduction goals, but defines indicative objectives. This strategy will need to be revised, however, to reflect the changes in government policy and to correspond to the EU targets adopted since 2008.

EU EMISSIONS TRADING SCHEME (EU-ETS)

The EU-ETS established in 2003 by Directive 2003/87/EC is a mandatory cap-and-trade system covering CO_2 emissions from installations in nine energy-intensive sectors: combustion installations, refinery processes, coke ovens, metal ores, steel, cement, glass, ceramics, and cellulose and paper. The EU-ETS was launched in 2005 and its first commitment period ran until the end of 2007. The second phase covers 2008-2012. Installations in the EU-ETS can meet their obligations either by implementing emissions reduction measures of their own, by purchasing allowances from other installations covered by the EU-ETS, or by purchasing credits from the Kyoto Protocol's flexible mechanisms (Joint Implementation or Clean Development Mechanism).

For 2008-2012, Hungary is allowed to allocate 24.1 Mt of CO_2 allowances per year to the installations within the scheme. This is 20% less than in the 2005-2007 commitment period. Half of all allowances are allocated to power generation (see Table 1). This allocation compares to verified emissions from the EU-ETS sector in Hungary of 26.2 Mt CO_2 in 2008 and 21.5 Mt CO_2 in 2009. Around half of Hungary's total energy-related CO_2 emissions came from the EU-ETS sector in 2008.

The National Allocation Plan for 2008-2012 did not foresee any over-allocation, but the economic crisis since late 2008 has reduced emissions from the ETS sector, and installations, especially in process industry, will possibly be able to bank part of their quotas to the 2013-2020 phase.

Table 1. **Allocation of emission allowances and verified emissions in the emissions trading sector, 2005 to 2009**

(Mt CO_2)	**2005–2007**	**2005**	**2006**	**2007**	**2008**		**2009**	
	Annual allocation	**Verified emissions**			**Allocation**	**VE**	**Allocation**	**VE**
Power generation	16.9	15.4	15.2	16.3	12.4	15.3	12.1	12.5
Industry	13.4	12.1	10.6	10.3	11.7	10.9	11.5	9.0
Total	30.2	27.5	25.8	26.6	24.1	26.2	23.6	21.5

VE=verified emissions

Source: Ministry of National Development.

In addition to the free allowances, around 11 million allowances are set aside as a new entrants reserve for the whole period (averaging 2.2 million per year). The government will auction 2% of the allowances and also sets aside a Joint Implementation reserve of some 724 000 allowances to avoid double counting for those joint implementation (JI) projects approved until January 2008 (see Table 2).

Table 2. **EU-ETS allowance allocation under the 2008-2012 National Allocation Plan**

1. For existing installations of the sectors	Emission allowance unit / year
I/a. Electric power generation (including the joint implementation projects reserves to be deducted)	12 209 588
Joint implementation project reserve to be deducted	216 466
I/b. Residential and public institutions district heating production	1 518 933
I/c. Proprietary heating installation and industrial district heating	3 197 705
I/d. Sugar production	310 680
I/e. Natural gas transmission and storage	204 696
I/f. Biofuel production	5 122
II. Processing of mineral oil	1 282 403
III. Coking	98 707
IV-V. Blast roasting and sintering of metal ores, iron and steel production	1 568 984
VI/a. Cement production	2 125 516
VI/b. Lime production	429 401
VII. Glass production	306 952
VIII/a. Production of paving tiles	67 996
VIII/b. Production of roof tiles, bricks, refractory bricks	669 560
IX-X. Cellulose, paper and cardboard production	170 231
Overall free of charge allowance for existing installations	24 166 474
2. New entrants reserves annually in average	2 193 902
3. Joint implementation project reserve, the part to be added to the overall amount	507 480
4. Number of emission allowances not to be allocated free of charge.	548 476
5. Total added amount exclusive of the joint implementation project reserve	26 908 852

Source: Ministry of National Development.

From 2013, new rules for the EU-ETS will apply. For example, all allowances for the power sector will have to be auctioned, whereas the manufacturing industry will still receive part of its allowances for free, on the basis of stringent EU-wide benchmarks. However, ten new member countries, including Hungary, are eligible for temporary exemptions from the auctioning requirement for the power sector. In 2013, assuming the European Commission accepts Hungary's application for such a derogation, the country may allocate up to 70% of allowances to power producers for free, instead of auctioning them. Between 2014 and 2019, the quantity of free allowances must gradually decrease and reach 0% in 2020 so as to minimise the increase in electricity prices expected from the introduction of the CO_2 price in electricity prices.

In practice, Hungary will have to submit an application for free allocation to the European Commission by the end of September 2011. The application must be accompanied by a national plan of investments for modernising the power sector. The use of transitional free allocation for the power sector is conditional on investments to modernise electricity generation; member states have to ensure that investments are undertaken in retrofitting and upgrading the infrastructure, in promoting clean technologies and in diversifying the energy mix and sources of supply. The overall amount of these investments must match the market value of the allowances allocated free of charge.

DOMESTIC MEASURES OUTSIDE THE EU ETS

Domestic measures focus on promoting renewable energy and energy efficiency. Hungary must increase the share of renewable sources in gross final consumption of energy from 4.3% in 2005 to 13% in 2020. Lifetime extension of the Paks nuclear power plant and measures in the transport sector will also significantly help limit emissions. These policies and measures are discussed in more detail in other chapters of this report.

The 2010 National Renewable Energy Action Plan (NREAP) estimates that if it were fully implemented, CO_2 emissions in 2020 would be 5.65 Mt lower than without the measures. The measures in the NREAP apply to the use of gross final energy. In turn, measures on energy use in the transformation sector (*e.g.* power and heat generation and oil refining) are mostly within the EU-ETS. Some measures will, however, be included in the National Energy efficiency Action Plan that the government will have to submit to the European Commission by 30 June 2011. The overall non-binding EU target is to reduce energy use by 20% from the business-as-usual level in 2020.

In the National Energy efficiency Action Plan (NEEAP) prepared in 2007, the government estimated that, with existing measures, CO_2 emissions will be reduced by 4.9 Mt from the annual average in 2002-2006 to 2015 and by 5.5 Mt to 2020. The NEEAP also included additional measures that would reduce CO_2 emissions by 6.4 Mt to 2015 and by 9.3 Mt to 2020.

The lifetime extension of the Paks nuclear power plant will help avoid increasing emissions in the future in the EU-ETS area. Replacing electricity from Paks with electricity from fossil fuels would lead to emissions of 6 to 10 Mt per year, according to Hungary's fifth National Communication to the UNFCCC. However, in the EU, these emissions would be treated as part of emissions from the ETS sector and the generating companies would have to acquire emission allowances.

In the transport sector, private car ownership is set to increase from the current relatively low levels, while freight transport typically increases in tandem with GDP. CO_2 emissions from the sector increased by 46% from 2000 to 2008, when they accounted for 24% of all energy-related CO_2 emissions in the country. To limit future increases, the previous government adopted in 2007 a Unified Transportation Development Strategy, which lists measures on rail, road transport and urban and suburban transport. Hungary is subject to EC's regulation on new passenger car performance standards limiting CO_2 emissions for new passenger cars registered up to 2020. The country is also planning to increase electrification and biofuels use in the transport sector.

INTERNATIONAL MEASURES

Hungary is a major source of carbon credits and it may reasonably expect a surplus of assigned amount units (AAUs) of at least 150 million tonnes of CO_2-equivalent over the period 2008-2012. By the end of 2009, ten joint implementation (JI) projects had been approved in Hungary, representing a total expected emissions reduction of about 8 Mt CO_2-eq. The JI projects cover fuel switching to biomass, N_2O emissions reduction at a nitric acid plant as well as gas and biogas utilisation from abandoned landfills. The legal background for the application and approval procedures for JI projects is provided by Act LX of 2007 and Government Decree No. 323/2007.

The decree also established the Green Investment Scheme (GIS) to invest the revenues from the sale of AAUs in GHG mitigation activities. Among the types of programmes and projects financed under the GIS are thermal insulation, passive solar energy utilisation and fuel switching. At present, the operation of GIS is regulated by Decree 10/2009 (VII. 17). From 2008 to 2012, GIS is expected to provide hundreds of millions of US dollars for investments. Hungary holds large potential for further revenue from carbon credit sales beyond 2012, but this will depend on the development of the international carbon market and the stringency of Hungarian climate targets after 2012.

According to Hungary's fifth National Communication to the UNFCCC, submitted in 2009, the GIS framework will generate an estimated HUF 7.5 billion (around EUR 26.7 million)[2] per year from 2008 to 2012. In addition, the allowances sold under the international emissions-trading system were estimated to generate between HUF 3.3 and 3.7 billion (EUR 11.8 and 16.3 million). Energy savings resulting from GIS-funded projects were expected to reach HUF 30 billion (EUR 107 million) per year.

CRITIQUE

Under the Kyoto Protocol, Hungary is obliged to reduce its GHG emissions by 6% from base-year to 2008-2012. The country is set to meet this target by a wide margin, as emissions in 2008 were around 37% below the base-year level and even lower in 2009. The real challenge comes after 2012. Hungary's GHG target for 2020 is +10% from the 2005 level for the non-ETS sector, while the ETS sector has an EU-wide -21% target from 2005 to 2020. In a welcome development, Hungary is planning to prepare a strategy in 2011 on how to meet its 2020 GHG target. Such a strategy should be aligned with the 2030 energy strategy the government is working on. The Ministry of National Development is in charge of both energy and climate policies and is therefore well-positioned to promote more effective co-operation and co-ordination in preparing such a strategy.

Meeting the 2020 target calls for measures to limit emissions in all major sectors. Emission allowances in the EU-ETS sector after 2012 will in general be allocated at the EU level, but the government has the option of applying for a transitional free allocation of allowances to the power sector. Any free allocation should be used as an incentive for ambitious energy efficiency improvements at the eligible power plants.

Two-thirds of GHG emissions in Hungary come from outside the EU-ETS sector. The government should pay specific attention to transport and buildings, the largest CO_2 sources outside ETS sectors. Measures to improve energy efficiency and limit emissions

2. The average exchange rate of the Hungarian forint in 2009 was HUF 280.64 = EUR 1 or HUF 202.06 = USD 1.

from these sectors would help meet multiple goals in energy and economic policy and are discussed in more detail in Chapters 4 and 8 on Energy Efficiency and Renewable Energy respectively.

As reducing CO_2 emissions normally comes at a cost, Hungary would benefit from consistently using a cost-effectiveness criterion (HUF/tonne of CO_2 avoided) to prioritise its various policies and measures; this static measure should be complemented with a longer-term vision on future energy needs under a more stringent CO_2 constraint, consistent with the EU 2050 roadmap. Building on the momentum for green growth under the current government and capitalising on the many planned policies and measures on renewable energy and energy efficiency, the government could consider aiming at more ambitious GHG reductions than obliged by the European Union. This would also help the country avoid the risk of carbon lock-in over the next decade and increase its ability to meet more stringent targets beyond 2020.

Moving beyond the 2020 timeframe, Hungary, as all other countries, should continue the transition to a low-carbon economy. The country should look for ways to decarbonise its power and heat sector, followed by a decarbonisation of its transport sector. The IEA acknowledges Hungary's pragmatism in considering low-carbon forms of power generation, including nuclear and renewable energy, and encourages it to continue this way. Energy efficiency measures in all sectors should be encouraged, for example through CO_2 taxes. Reducing the need for imported fossil fuels would also bring the country closer to meeting both its climate change and energy security objectives.

Under the Kyoto Protocol, Hungary has received international carbon financing for energy sector projects through the Kyoto flexible mechanisms. The government should be commended for reinvesting the profits resulting from the use of these mechanisms in measures under the Green Investment Scheme, aiming at further reducing GHG emissions. However, as no international climate change agreement for post-2012 has been agreed, the country cannot count on the continued use of this funding source. The government should intensify efforts to find alternative sources of finance, including from EU funds, international financial institutions and the private sector.

RECOMMENDATIONS

The government of Hungary should:

- ☐ *Develop a medium- to long-term climate strategy, with a particular focus on limiting emissions from transport and space heating; consider more ambitious targets than required by the EU for GHG mitigation in the sectors outside the EU-ETS.*
- ☐ *Utilise revenues from the use of flexible mechanisms under the Kyoto Protocol to support, in a cost-effective manner, measures to further reduce greenhouse gas emissions.*
- ☐ *Intensify efforts to attract carbon finance from various sources, including via its Green Investment Scheme.*

4. ENERGY EFFICIENCY

Key data (2009)

Energy use per capita: 2.5 toe (OECD average: 4.3), -10% from 1990

Energy intensity: 0.16 toe per 1000 USD (OECD average: 0.16), -16.5% from 2000

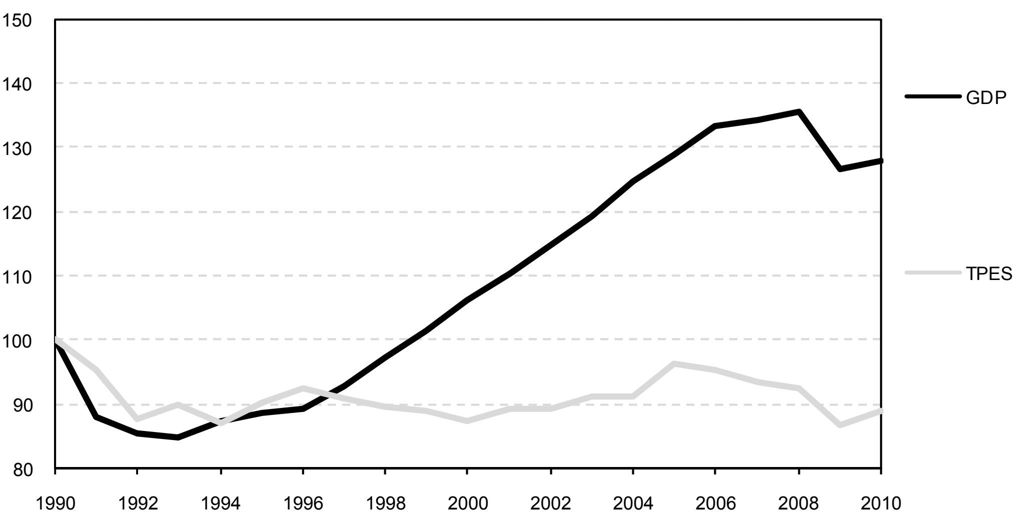
Total final consumption: residential sector 31%, industry 25%, transport 25%, services and agriculture 19% (OECD average: transport 33%, industry 31%, residential 20%, other 16%)

END-USE BY SECTOR

Since 1997, Hungary has experienced a decoupling of economic growth and growth in energy demand (see Figure 9). Energy intensity has decreased by more than a quarter over the past ten years and is now roughly equivalent to the IEA average. Historically, energy intensity in Hungary has been lower than in the Czech and Slovak Republics (see Figure 10).

Total final energy consumption was 17.8 Mtoe in 2009. Energy consumption grew slowly but steadily until 2007, when it dipped considerably, particularly in the residential sector, owing to the economic downturn (see Figure 11). The residential sector is the largest energy-consuming sector, using 5.5 Mtoe or nearly one-third of total final consumption (TFC) in 2009. Transport and industry each accounted for around 25% of TFC, while services and agriculture accounted for 3.4 Mtoe, or 19% of TFC.

Figure 9. **GDP and TPES evolution, 1990 to 2010***



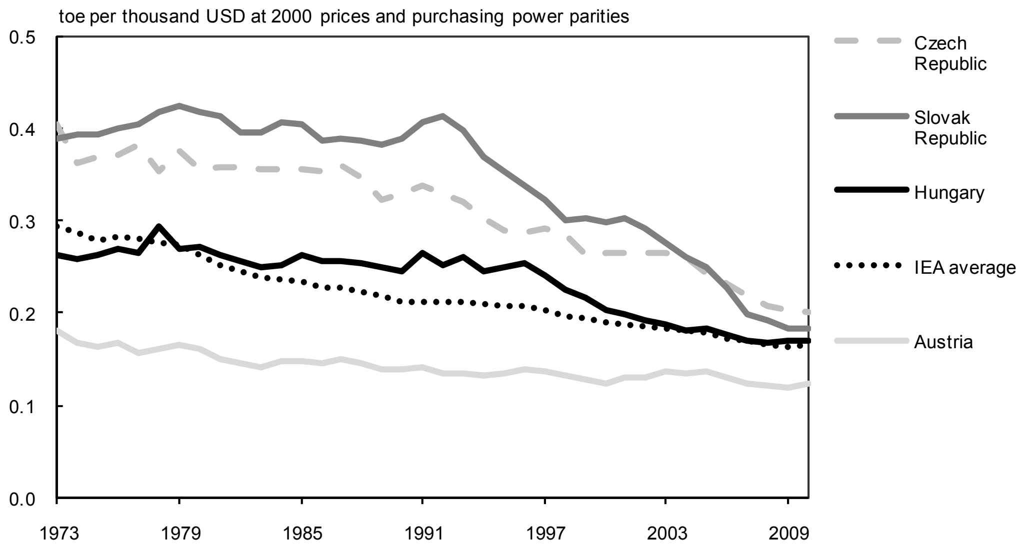
* Estimates for 2010.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2010; *National Accounts of OECD Countries*, OECD Paris, 2010 and country submission.

Energy demand grew in the transport sector in Hungary, on average by 4.3% per year from 2000 to 2009. In total, energy consumption in transport has risen by nearly 50% since 2000. The government expects growth to continue at this pace up to 2020 and the transport sector to become the largest energy-consuming sector by 2030. Oil accounted for 94% of total energy consumption in the transport sector in 2009. The government projects that this share will decline to 87% in 2030, as demand for biofuels rises from 4% today to 12% in 2030.

Following industry restructuring in the early 1990s, energy consumption in this sector has hovered around 5 Mtoe. In 2009, oil accounted for 41% of energy demand in this sector, natural gas for 28%, electricity for 17%, heat for 8% and coal for 5%. The Hungarian government expects the contribution of gas to rise steadily, and that by 2020 it will account for 38% of energy consumption in the industry sector.

Figure 10. **Energy intensity in Hungary and in other selected IEA member countries, 1973 to 2010***

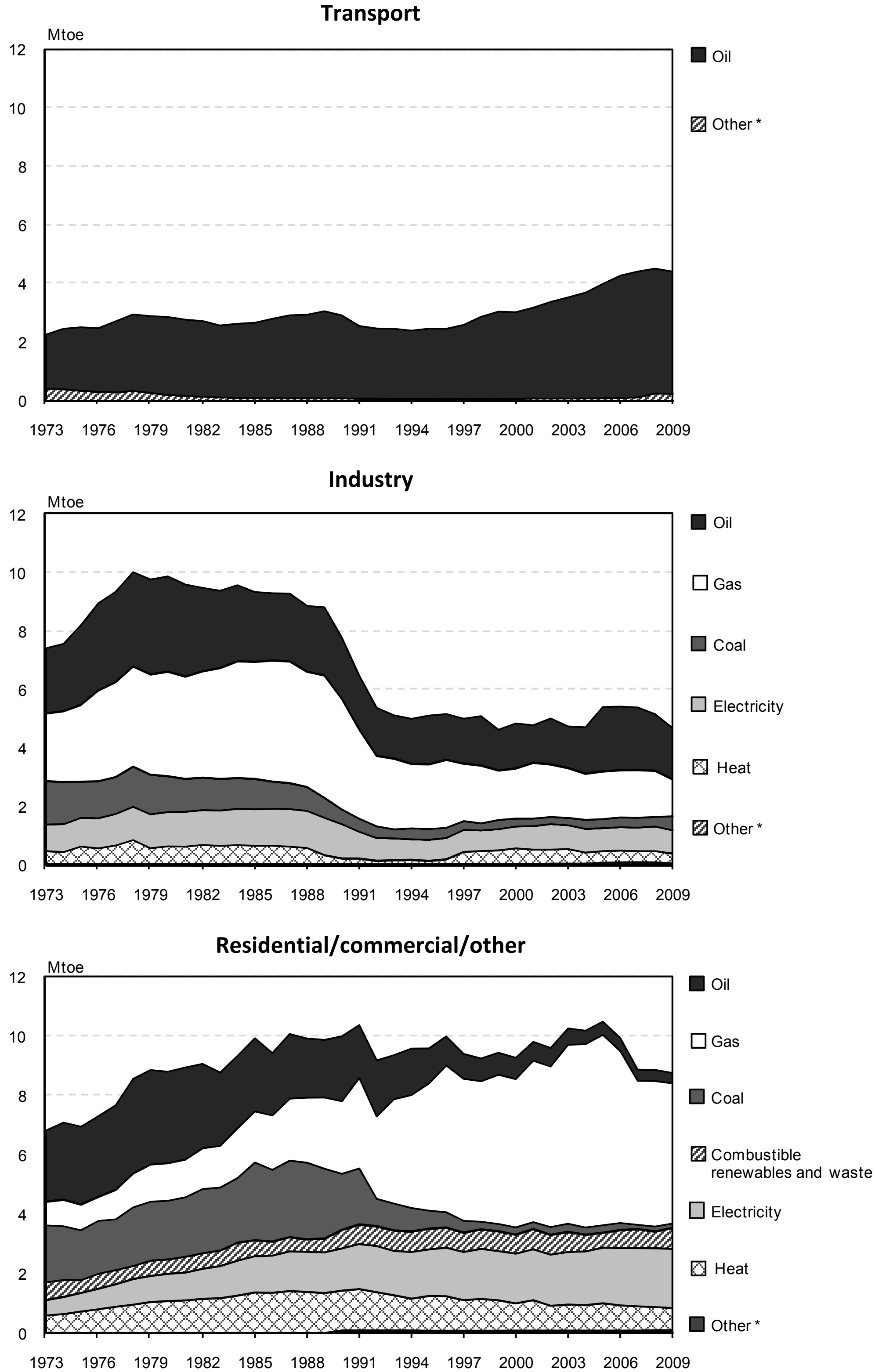


* Estimates for 2010.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2010; *National Accounts of OECD Countries*, OECD Paris, 2010 and country submission.

In the residential, commercial and agriculture sectors, energy consumption declined by 15% from 2005 to 2007 to 8.9 Mtoe and remained around that level in 2009. Natural gas accounts for over half of total energy consumption. This share is expected to fall, however, to 30% by 2030. In its scenarios, the government also expects demand for combustible renewables and waste to increase from 8% in 2009 to 29% in 2030. Energy demand in these sectors is expected to grow steadily over the next two decades, reaching the 2005 level by 2030.

Figure 11. **Total final consumption by sector and by source, 1973 to 2009**



* Negligible.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2010.

KEY INSTITUTIONS

The **Ministry of National Development** is responsible for drafting the National Energy efficiency Action Plans, implementing the policies and measures in the plans and monitoring their effectiveness. It is also in charge of international co-ordination on energy efficiency issues. The **Ministry of National Economy** is responsible for setting up long-term strategies for improving energy efficiency and for harmonising targets for improvement with climate targets.

The **Hungarian Energy Centre** was created in 2000 and is responsible for organising tenders for projects related to energy efficiency. There are a few thousand applicants annually. The Centre's major tasks are managing the energy statistics system, carrying out the technological and economic evaluation of energy efficiency projects and providing consultancy for these projects. The annual Energy Saving Programmes are also organised by the Energy Centre.

POLICIES AND MEASURES

EUROPEAN UNION POLICIES

Hungary's energy efficiency policies are guided by several EU regulations and directives. The Directive on Energy End-Use Efficiency and Energy Services (2006/32/EC) seeks to encourage energy efficiency through the development of a market for energy services and the delivery of energy efficiency programmes and measures to end-users. The directive requires member states to create action plans and meet an indicative target to reduce final energy use in the sectors outside the EU-ETS by 9% from the early 2000s to 2016. The EU has also adopted a non-binding target for 2020 to reduce primary energy use in the Union by 20% from baseline projections. The directive also sets the framework for measures such as financing, metering, billing, promotion of energy services, and obligations for the public sector. In addition, it requires member states to place energy efficiency obligations on energy distributors or retailers.

The Directive on the Energy Performance of Buildings (EPBD, 2002/91/EC) sets requirements for energy efficiency in building codes, including minimum energy performance standards and energy certificates. A recast of the EPBD (2010/31/EU) was adopted in May 2010 to strengthen the energy performance requirements and to clarify and streamline some provisions.

Requirements for energy labelling of household appliances are based on several directives adopted over the past 15 years which also include compulsory minimum energy efficiency requirements (2009/125/EC). The recast Directive Establishing a Framework for Setting Ecodesign Requirements for Energy-related Products (Ecodesign, 2009/125/EC) aims to improve energy efficiency throughout a product's life cycle. It applies to products that use energy and to products that have an impact on energy use, such as building components.

Recent EU transport policies aim to reduce CO_2 emissions from new passenger cars. In May 2009, the EU adopted Regulation EC/443/2009 to reduce CO_2 emissions from new passenger cars to reach a fleet average of 130 grammes (g) CO_2/km by 2015. From 2020 on, this limit will be 95 g CO_2/km. The regulation will be complemented by measures to further cut emissions by 10 g CO_2/km. Complementary measures include efficiency improvements for car components with the highest impact on fuel consumption, and a gradual reduction in the carbon content of road fuels.

Another EU transport development is related to tyre labelling requirements. Regulation EC/1222/2009 seeks to harmonise information on the energy performance of tyres, wet braking and external rolling noise. It will apply to EU member states from November 2012.

NATIONAL POLICIES

In accordance with the Directive on Energy End-Use Efficiency and Energy Services, the government adopted Hungary's National Energy efficiency Action Plan (NEEAP) in February 2008. The objectives of the plan are to align Hungary's energy policy initiatives with those of the European Union; find the most cost-effective solutions for utilising energy-saving potential; shape consumer awareness and influence the market in order to achieve long-term gains in energy efficiency; inform market players of the structure and time-frame of the plans; realise the EU's energy efficiency expectations for member states; and consider climate protection aspects. The plan focuses primarily on consolidating and expanding existing programmes. The objectives in the Action Plan affect the building stock in the residential and commercial sectors, household appliances, office equipment in the commercial sector, transport and haulage, and the non-energy-intensive industries. According to the government, implementation of the existing and planned energy efficiency measures in the Action Plan will decrease Hungary's energy consumption by 1% annually between 2008 and 2016.

The New Széchenyi Plan was launched on 15 January 2011, after the Hungarian government incorporated responses from small and medium-sized enterprises and local authorities on its initial consultative paper. The plan consists of seven priority areas, which collectively form a long-term strategic scenario to parallel the government's short-term economic recovery programme. The energy-related priority area in the Széchenyi Plan is the development of a green economy, *i.e.* renewable energy, biotech R&D and energy efficiency.

Directive 2006/32/EC requires member states to submit the second NEEAP by 30 June 2011 and the third Action Plan by 30 June 2014. The government is preparing the second NEEAP. The second NEEAP will review the previous Action Plan and harmonise measures across the EU 2020 Strategy, the New Széchenyi Plan and EU energy efficiency targets. The focus will be on launching measures to meet the 20/20/20 targets for reducing GHG emissions, increasing the share of renewables and enhancing energy efficiency.

Financial measures dominate in the household and industry sectors, while legal, normative measures dominate in the transport sector (*i.e.* mandatory communication of consumption norms, road taxes and registration taxes). Financial measures play a relatively small role in this sector.

Environment and Energy Operative Programme

The Environment and Energy Operative Programme (EEOP) for 2007-2013, which is related to the New Hungary Development Plan and approved by the European Commission, provides EU funding for projects in the sector, including EUR 253 million (around HUF 71 billion) for renewable energy and EUR 154 million (HUF 43 billion) for improving energy efficiency. To implement the programme, the National Development Agency (NFÜ) called for three tenders in autumn 2007. These were replaced with seven tenders at the beginning of 2009.

The measures in the EEOP related to energy efficiency are:

- third-party financing for energy efficiency development of buildings combined with the use of renewable energy sources;
- energy efficiency development of buildings and development of public lighting;
- energy development of the district heating sector.

BUILDINGS

Around 80% of flats in Hungary are owner-occupied, and local authorities have insufficient funds available for building refurbishment. Owners themselves are therefore largely responsible for any thermal modernisation investments. The Hungarian government has been very active in making funds available to support these kinds of investments.

In particular, the government has implemented a programme for the upgrading of the energy performance of buildings to modern standards through the application and enforcement of stringent building regulations, and easy access to capital. The regulatory environment was created under the Government Decree 264/2008 which requires the energy inspection of heat production equipment with an effective nominal performance of over 20 kW; air-conditioning systems with an effective nominal performance of more than 12 kW; and heating systems older than 15 years and with an effective nominal performance of over 20 kW. The objective of the energy inspection of heat production equipment and air-conditioning systems is to provide information about the energy efficiency of such equipment and systems. The energy inspection covers the review of documents, the identification of equipment and systems, the inspection of dimensioning, the checking of proper operation and adequate maintenance, and the definition of proposed modifications.

National Energy Conservation Programme

The National Energy Conservation Programme offers energy efficiency grants to households on an annual basis. In 2008, five different types of energy efficiency improvements were subsidised as part of the programme, each with different subsidy intensity (*i.e.* the percentage of the overall investment that is subsidised by the State):

- change or insulation of windows and doors: subsidy intensity of 15%, up to a maximum per dwelling of HUF 265 000 (EUR 944);
- improvement of heating and hot water supply (*e.g.* change of boiler): subsidy intensity of 20%, up to a maximum per dwelling of HUF 400 000 (EUR 1425);
- thermal insulation of existing buildings: subsidy intensity of 20%, up to a maximum per dwelling of HUF 400 000 (EUR 1425);
- complex energy efficiency improvement of buildings: subsidy intensity of 18%, up to a maximum per dwelling of HUF 720 000 (EUR 2566);
- use of renewable energy *(i.e.* biomass, geothermal energy, wind, waste, solar collectors and solar photovoltaic) for generating heat and/or electricity: subsidy intensity of 25%, up to a maximum per dwelling of HUF 1 000 000 (EUR 3 563).

The Panel-Block Apartment Programme

The Panel-Block Apartment Programme offers subsidies for the energy-efficient renovation of residential buildings built with prefabricated technology. The programme was launched in 2008 and it is now managed by the Ministry of National Development. This ministry finances the subsidy programme for qualifying buildings from the ministry's funds earmarked for housing purposes. Local government, building societies and communities of owners in a block of flats can apply for the loan, which can equal two-thirds of the renovation costs if the applicant is an owner community or local government, but cannot exceed HUF 800 000 (EUR 2 850) per apartment. The preferential loan is available at the Hungarian Development Bank. The state subsidy provided through the Panel-Block Apartment Programme can be used to pay for one-third of the investment costs up to HUF 400 000 (EUR 1 425). Two-thirds must be financed by the owner community or local government.

Green Investment Scheme

In 2009, two sub-programmes were initiated under the Green Investment Scheme (GIS) to facilitate energy rationalisation of residential buildings: *i)* the Climate-Friendly Home Panel Sub-Programme and *ii)* the Energy efficiency Sub-Programme. The objective of the sub-programmes is to provide investment grants for work that contributes to the reduction of residential energy consumption, moderating the overhead burdens for households and also reducing greenhouse gas emissions. Activities eligible for grants include energy efficiency improvements in buildings (*e.g.* heat insulation, replacement of doors and windows, and building engineering solutions), the modernisation of equipment and the use of renewable energy sources.

The key objective of the sub-programmes is the renovation of houses built by prefabricated technology to save energy through retrofitting. The prerequisite for receiving a subsidy in the GIS Panel Sub-Plan is that the buildings should have lower CO_2 emissions and be more energy-efficient once the project is completed. The subsidy is based on the results achieved by each project, *i.e.* the greater the reduction in energy consumption, the higher the subsidy. The system rewards the bidder depending on the complexity and efficiency of the project. Applications under the Energy efficiency Sub-Programme opened on 15 December 2009 and closed on 30 October 2010. Applications under the Panel Sub-Programme opened on 4 August 2009 and closed on 31 December 2009.

INDUSTRY

Several programmes have helped to improve industrial energy efficiency: installation of industrial cogeneration which is, on average, 20% to 25% more efficient; fuel switching to gas and electricity, as a result of the increasing demand for precise metering and process control; and soft loans for energy efficiency investments through the Energy efficiency Credit Fund. The Fund offers loans with preferential interest rates to projects up to 80% of the project expenses. The fund has been operating since 1991. The maximum amount of the loan is HUF 100 million (EUR 356 000). It is a revolving fund with the repayments on previous loans providing the funding for the new ones. Applications are submitted to the Energy Centre which has available funds of HUF 1 billion (EUR 3.56 million). Roughly HUF 700 million (EUR 2.5 million) can be allocated each year. Other financial resources can also be used. The main objectives of the fund are to reduce transformation losses, install state-of-the-art systems with low energy consumption, install cogeneration, introduce new production technologies and enhance thermal insulation.

The NEEAP calls for the promotion of energy service company (ESCO) investment projects. By the creation and further development of a regulatory environment, the State plans to establish the conditions for the operation of ESCOs. The NEEAP defines

ESCO enterprises and distinguishes them from other companies (*i.e.* determines the scope of their activities and legal status) and creates financing opportunities supporting their operation.

There are also voluntary agreements with energy-intensive sectors, including manufacturers of individual end-user appliances. Within the framework of these agreements, the groups commit themselves to reducing energy consumption, using more efficient energy supply technologies and developing products with better energy efficiency indicators. As remuneration for these undertakings, the government plans to provide favourable publicity to the groups signing the agreement, to grant exemptions from complying with mandatory rules and to provide financial support for the implementation of energy efficiency measures.

In the past, energy management experts were employed by large industrial enterprises and public institutions in Hungary. However, the regulation establishing the mandatory employment of energy management experts was revoked during the general economic liberalisation. In the absence of mandatory regulations, the majority of large enterprises eliminated the position of the energy management expert. Today, very few industrial enterprises and institutions employ such experts. New regulation, however, requires large industrial consumers to file energy consumption reports in order to enhance energy management in the industry sector. Consumers exceeding a certain level of annual energy consumption are bound by law to deliver a detailed report on their energy use or the improvement of their energy efficiency, draw up a work plan for the improvement of their energy efficiency and provide regular reports about the implementation of the work plan.

TRANSPORT

In 1995, road transport accounted for an estimated 62% of total freight transport, but, by 2008, this share was 78%. Over the same period, the volume of freight transport doubled, led by increases in international haulage. Growing demand for passenger car travel has also contributed heavily to energy demand in the transport sector. According to 2008 data from the European Commission, Hungary has 305 passenger cars per 1 000 inhabitants, up from 218 in 1995, but significantly below the EU15 average of 501. In total, the country has 800 000 more passenger cars than in 1995.

Table 3. **Modal split of passenger transport on land, 2008**

	Car	Bus	Train	Tram and metro
Share, %	59.8	25.1	3.3	11.8

Source: *EU Energy and Transport in Figures – Statistical Pocketbook* 2010.

Energy efficiency labelling of new cars has been in effect since 2002 (Decree 12/2002). Car dealers must display the consumption category for all cars sold, including type of fuel, fuel consumption and CO_2 emissions. More recent legislation (Decree 36/2007) puts vehicles into categories based on their weight (categories D1, D2, D3 and D4). A road usage charge is levied on vehicles according to the given vehicle category on major highways and national routes. The NEEAP calls for the continuation and extension of the road charges payable by heavy road vehicles. The plan also notes that additional savings could be achieved in the transport sector if other policies, not yet articulated, could be implemented. Such other measures could include:

- enforcing air pollution and energy consumption requirements when new motor vehicles enter into circulation (*i.e.* enforcement of the EU Regulation EC/443/2009 to limit CO_2 emissions from new passenger cars, initiation of a system of checking tyre pressures and energy-efficient air-conditioners);
- strengthening the energy aspect of environmental and traffic safety considerations in connection with the import of used vehicles;
- favouring motor vehicles with less fuel consumption and lower performance, when setting the vehicle registration tax and vehicle operating tax.

POWER GENERATION

The efficiency of Hungarian power plants is below the EU average. It is only the high penetration of cogeneration plants that prevents the average efficiency to be much further below the EU average. While there have been efficiency gains in the cogeneration plants, electricity- and heat-only plants have not seen a similar rise in efficiency. Gas-fired capacity expansions have in the past achieved a 65% to 70% efficiency. The efficiency of coal-fired power plants producing only electricity is, however, only some 30% to 38%. The switch away from coal-fired plants to more gas and biomass has recently slowed because of concerns over employment losses in the coal mining sector. The Hungarian government has provided considerable policy support for cogeneration plants, including through feed-in tariffs, but there are no policies or funding arrangements in favour of electricity- and heat-only plants. The EU-ETS provides a new tool for increasing power plant efficiency, both through carbon price and, in the case of Hungary and nine other new EU member states, through the conditions for allocating free allowances to the power sector from 2013 on. Plant efficiency is a main criterion for this free allocation (see Chapter 3 on Climate Change).

CRITIQUE

Energy efficiency typically offers the least-cost solution to meeting the broader energy policy goals of energy security, economic growth and environmental protection. Hungary's 2008 National Energy efficiency Action Plan defines energy efficiency targets for the energy sector and policies and measures to meet them. The New Széchenyi Plan launched in January 2011 also includes energy efficiency targets. The government should ensure that both voluntary and mandatory energy efficiency measures are adequately monitored, enforced and evaluated. Working closely with the Energy Centre, it should also ensure that regular public reporting of monitoring activities is carried out, including instances of non-compliance.

In its second NEEAP, the Hungarian government should develop a detailed plan for the implementation of the policies and measures for energy efficiency, based on clear priorities and supported by targeted incentives. Energy service companies should be encouraged to offer energy management services to residential, commercial and industrial consumers. The government should also evaluate the cost-effectiveness of various policy options in order to determine the optimal mix for each sector.

Although per capita energy consumption in Hungary is below the EU average, there is still considerable energy efficiency potential across all sectors. The government should ensure that its energy efficiency policies are supported by adequate end-use information. This can be facilitated by substantially increasing efforts to collect energy end-use data across all sectors and for all fuels. The government should also intensify its efforts to increase public awareness through, for example, campaigns and education programmes. There are several government measures in place to support renovations and refurbishment of the existing building stock, but, given that a high percentage of the stock is still very inefficient, it is likely that public awareness of support mechanisms is low. The government could look to other IEA countries, such as France, that have experienced rapid gains in energy efficiency thanks in large part to raising consumer awareness of the issue.

In the Hungarian building sector, the volume of new construction is likely to remain low in the near term, but, despite this, ambitious minimum performance standards should be set on building components and, ideally, buildings themselves. The government could also offer tax breaks for more energy-efficient building components.

Improving energy efficiency in the large existing building stock should be the government's top priority. Providing incentives for energy efficiency improvements in buildings seems in principle easier in Hungary than in most other countries, because nine out of ten people own the home they live in, the highest share in IEA Europe. Buildings offer potential for huge energy efficiency gains, but the ownership structure of the inefficient prefabricated housing and the monopolistic nature of their district heating supply complicate the challenge. The energy efficiency issues need to be addressed as a matter of urgency.

The challenge is how to finance the much-needed retrofits. One solution would be the development of public-private partnerships. Energy efficiency investments should be encouraged through direct subsidies and state-supported loan schemes. The government could either subsidise capital costs for these investments, for example by offering low-interest loans. Or it could oblige utilities to make such energy-saving investments and let them reap the resulting benefits. It should also maximise the use of favourably termed funding for such projects provided by the EU and the international financial institutions. The government should also give priority to modernising heating systems in buildings. It is right to emphasise the use of heat pumps which could have a large potential for flexibility and efficiency improvements in the heat sector.

Transport is a crucial sector for long-term emissions reductions and energy security. Energy use in this sector has increased rapidly since 1990. The government has in recent years introduced a wealth of measures to tackle this trend. It should ensure that these measures are implemented in a timely manner. The government is also encouraged to monitor progress and revise measures as appropriate.

According to 2008 data from the EU Commission, Hungary has 305 passenger cars per 1 000 inhabitants, while the EU15 average is 501. Once the economy returns to growth, the number of passenger cars on the road will no doubt rise. This could undermine success in other areas of energy and climate policy. To avoid this, the government should promote greater use of low-emission vehicles in both the public and private sectors. This could be achieved through measures such as taxes on the purchase, registration and use of vehicles and motor fuels; increasing road and parking pricing; and reducing parking space. The government should also develop a fully integrated public transport system that offers a cheaper, more efficient, environment-friendly and viable alternative to private cars.

Hungary's energy-intensive industry is covered by the EU-ETS which strongly encourages improving energy efficiency. Small and medium-sized companies would, however, benefit from awareness-raising, energy audits and assistance in developing energy management capability. The government is encouraged to intensify its efforts in this sector.

In the transformation sector, gas-fired and coal-fired power plants with relatively low efficiencies remain common. Yet, there is no budgetary support for improving the efficiency of these plants. Although the upgrading of power plant efficiency is an investment decision for private owners, the government should consider ways to encourage these upgrades. Under the EU-ETS, Hungary may allocate emission allowances to the power sector for free, even after 2012, if it meets certain requirements by the European Commission. Hungary should use this tool to encourage and reward ambitious efficiency improvements in the power sector.

Finally, Hungary should continue efforts to fully implement the IEA recommendations for improving energy efficiency (see Box 1). In particular, it should consider bringing together its various policies and measures under a single national strategy on energy efficiency.

Box 1. **IEA 25 energy efficiency recommendations**

To support governments with their implementation of energy efficiency, the IEA recommended the adoption of specific energy efficiency policy measures to the G8 summits in 2006, 2007 and 2008. The consolidated set of recommendations to these summits covers 25 fields of action across seven priority areas: cross-sectoral activity, buildings, appliances, lighting, transport, industry and power utilities. The fields of action are outlined below.

1. The IEA recommends action on *energy efficiency* across sectors. In particular, the IEA calls for action on:

- Measures for increasing investment in energy efficiency.
- National energy efficiency strategies and goals.
- Compliance, monitoring, enforcement and evaluation of energy efficiency measures.
- Energy efficiency indicators.
- Monitori*ng* and reporting progress with the IEA energy efficiency recommendations themselves.

2. Buildings account for about 40% of energy used in most countries. To save a significant portion of this energy, the IEA recommends action on:

- Building codes for new buildings.
- Passive energy houses and zero-energy buildings.
- Policy packages to promote energy efficiency in existing buildings.
- Building certification schemes.
- Energy efficiency improvements in glazed areas.

../..

Box 1. **IEA 25 energy efficiency recommendations** (continued)

3. *Appliances and equipment* represent one of the fastest growing energy loads in most countries. The IEA recommends action on:

- Mandatory energy performance requirements or labels.
- Low-power modes, including stand-by power, for electronic and networked equipment.
- Televisions and set-top boxes.
- Energy performance test standards and measurement protocols.

4. Saving energy by adopting efficient *lighting technology* is very cost-effective. The IEA recommends action on:

- Best-practice lighting and the phase-out of incandescent bulbs.
- Ensuring least-cost lighting in non-residential buildings and the phase-out of inefficient fuel-based lighting.

5. About 60% of world oil is consumed in the *transport sector.* To achieve significant savings in this sector, the IEA recommends action on:

- Fuel-efficient tyres.
- Mandatory fuel efficiency standards for light-duty vehicles.
- Fuel economy of heavy-duty vehicles.
- Eco-driving.

6. In order to improve energy efficiency in *industry*, action is needed on:

- Collection of high-quality energy efficiency data for industry.
- Energy performance of electric motors.
- Assistance in developing energy management capability.
- Policy packages to promote energy efficiency in small- and medium-sized enterprises.

7. *Energy utilities* can play an important role in promoting energy efficiency. Action is needed to promote:

- Utility end-use energy efficiency schemes.

Implementation of IEA energy efficiency recommendations can lead to huge cost-effective energy and CO_2 savings. The IEA estimates that, if implemented globally without delay, the proposed actions could save around 8.2 Gt CO_2 per year by 2030. This is equivalent to twice the European Union's current yearly emissions. Taken together, these measures set out an ambitious road-map for improving energy efficiency on a global scale.

RECOMMENDATIONS

The government of Hungary should:

General energy efficiency

- ☐ *Develop a detailed implementation action plan, based on clear priorities and supported by targeted incentives.*
- ☐ *Ensure that both voluntary and mandatory energy efficiency-policy measures are adequately monitored, enforced and evaluated.*
- ☐ *Intensify efforts to increase public awareness, for example through campaigns and education programmes.*
- ☐ *Encourage energy service companies to offer energy management services to residential, commercial and industrial consumers.*

Buildings

- ☐ *Stimulate increases in the efficiency of the existing building stock and introduce strict energy efficiency standards for new build.*
- ☐ *Give priority to modernising heating systems in buildings, especially those linked to district heating systems.*

Transport

- ☐ *Promote larger use of low-emission vehicles in both the public and private sectors through measures such as taxes on vehicle purchase, registration, use and motor fuels; increasing road and parking pricing; reducing parking space.*
- ☐ *Develop a fully integrated public transport system that offers a cheaper, more efficient and environment-friendly alternative to private cars.*

Power generation

- ☐ *Consider ways to encourage energy efficiency improvements of existing power plants, including using an ambitious plant efficiency criterion for allocating free emission allowances under the EU-ETS.*

PART II
SECTOR ANALYSIS

5. OIL

Key data (2010 estimates)

Crude oil production: 0.72 Mt, -9% from 2009

Net crude oil imports: 5.8 Mt, +6% from 2009

Oil products: refinery output 8.5 Mt, imports 2.4 Mt, exports 2.8 Mt

Share of oil: 25% of TPES and 1.2% of electricity generation

Inland consumption: 7.2 Mt in 2009 (road transport 60%, industry 24%, transformation sector 8%, aviation 3%, agriculture 3%)

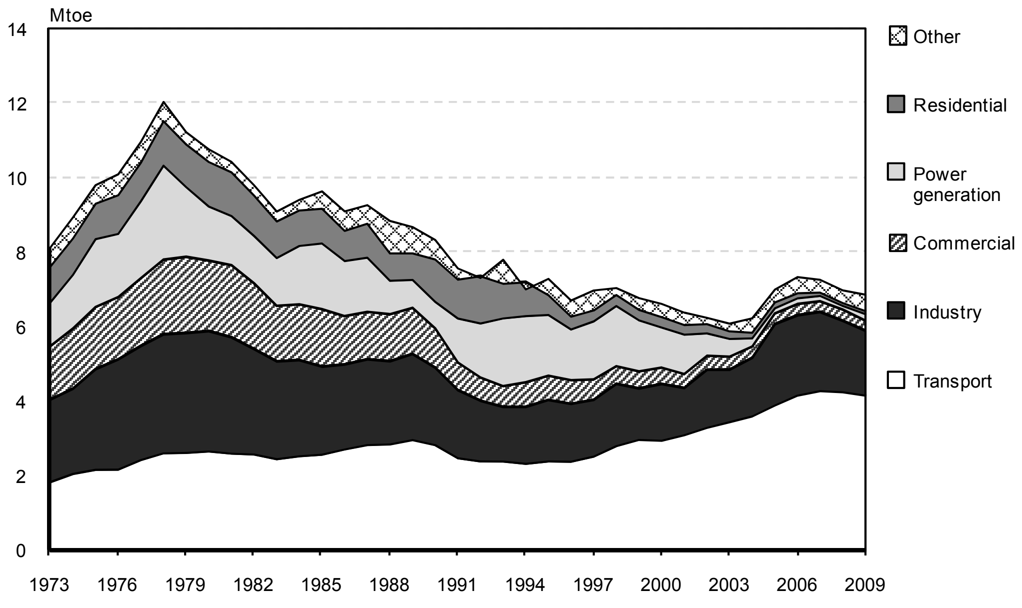
Consumption per capita: 0.7 t in 2009 (OECD average: 1.6 t)

SUPPLY AND DEMAND

SUPPLY

In 2010, Hungary's oil supply was 6.4 Mt, down from 6.9 Mt in 2009. Oil accounted for 25% of total primary energy supply (see Figure 12), a relatively stable share over the past years. Hungary has one of the lowest shares of oil in TPES among the IEA member countries, following its neighbours the Czech Republic (20% of TPES), the Slovak Republic (21%), and Poland (25%). The IEA average was 36% of oil in TPES in 2010.

Figure 12. **Oil supply by sector*, 1973 to 2009**



* TPES by consuming sector. *Other* 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: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2010.

Hungary has some oil reserves, mostly in the south-east of the country. According to the 2009 report of the Federal Institute for Geosciences and Natural Resources of Germany, proven reserves amounted to three million tons. Domestic crude oil production peaked in 1985, at 64 thousand barrels per day (kb/d) and is expected to continue its decline. In 2010, domestic production amounted to 14 kb/d (0.72 Mt per year), or 11% of total crude oil supply. The remaining part was almost entirely imported from Russia.

Oil products come from refineries in Hungary and in the neighbouring countries and in Central Europe. The majority of imports are supplied from OMV's Schwechat refinery in Austria. Additional important sources are Romania, the Czech Republic, Poland, Germany and Belarus.

DEMAND

While total oil supply in 2009 was at the 1994 and 2000 levels, oil use for transport has increased significantly, on average by 4.1% per year since 1995. Transport consumes 60% of total oil supply. Industry accounted for 24% of the total in 2009, a relatively constant share over the last decade. In contrast, oil use in the other sectors has declined markedly: power generation, residential and commercial services and agriculture sectors used 40% of oil supply in 1995, but only 5% in 2009. Of note, oil use for space heating is minimal.

The government expects the demand for oil products to grow by about 2% per year between 2010 and 2020. The main driver for growth in the future will be diesel use, which is expected to increase by about 3% to 4% yearly until 2020. Gasoline consumption will grow by 1.5% annually, partly because of increasing bioethanol blending, according to government estimates.

Dieselisation of the vehicle fleet is a continuing trend. At the end of 2009, 29% of all registered vehicles were diesel-fuelled, while 71% used gasoline. However, 53% of all new cars registered in 2009 were diesel-fuelled.

INFRASTRUCTURE

REFINING

MOL, the Hungarian Oil and Gas Company, is the owner of Hungary's three working oil refineries: Duna (Százhalombatta), Tisza (Tiszaújváros) and Zala (Zalaegerszeg). Crude oil distillation is concentrated in the Duna refinery, Tisza's role is hydrofinishing gas-oil and ETBE production. At Zala, bitumen is blown and blended.

The Duna refinery is located in Százhalombatta and has an 8.1 Mt/year crude oil distillation capacity. It is a complex refinery with deep conversion units, allowing a high yield of motor fuels from heavy and sour crudes. Diesel and gasoline desulphurisers were installed in 2005 to comply with the Euro V motor fuel regulation.

The crude oil processed at the Duna refinery mainly comes from Russian imports via the Druzhba pipelines and in smaller amounts from the MOL Group's own production in Hungary via a domestic pipeline. MOL owns and operates around 850 kilometres of crude oil transportation pipelines in Hungary, which supply refineries with crude oil.

The Tisza refinery is a smaller refinery located in Tiszaújváros and has a distillation capacity of 3 Mt/year which was mothballed in 2001 for cost reasons. The refinery is currently only undertaking diesel desulphurisation, MTBE production and gasoline blending.

The Zala refinery is another small refinery located in Zalaegerszeg and only produces bitumen. Its distillation unit with a capacity of 0.5 Mt per year was also mothballed in 2001.

MOL supplies the domestic market but also sells its motor fuels, heating gas-oil and bitumen in the neighbouring countries, in Central Europe and in South-East Europe.

STORAGE

The present operating depot system is the result of network optimisation. MOL does not have any plans to change the system in the near future, although there are some closed depots which can be put back into operation in a relatively short time. There are eight public storage terminals (custom's warehouses): Algyő, Csepel, Komárom, Pécs, Szajol, Székesfehérvár, Százhalombatta and Tiszaújváros for finished products. Crude storage tanks are located at Százhalombatta, Tiszaújváros and Fényeslitke. They include storage facilities for commercial and strategic stockholding purposes. All customers (wholesalers, white pumpers, end-users and industrial customers as well as its own retail network) are served from the above mentioned depots.

Crude oil stored at Tiszaújváros can be transported via pipeline to Százhalombatta. A few days' outage can be covered with the existing storage facilities; the industry does not have plans for more storage facilities.

PIPELINES

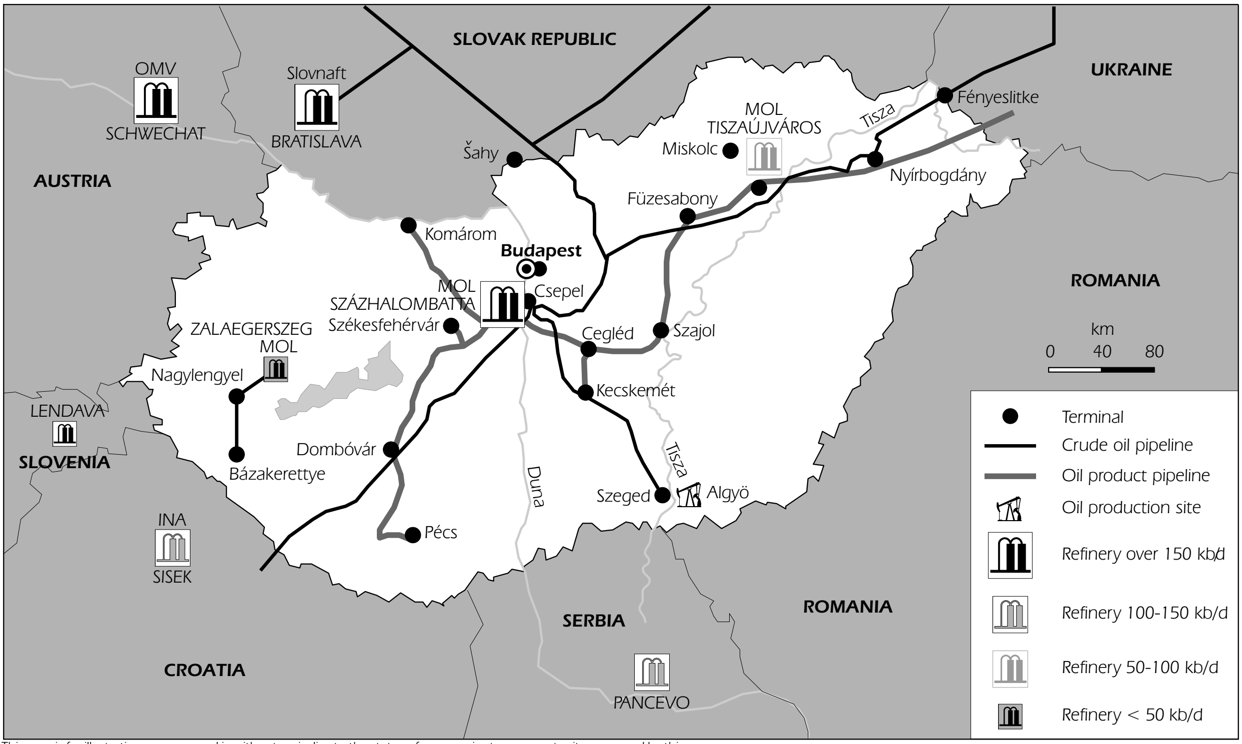
The Druzhba (Friendship) pipeline is Hungary's main crude oil supply channel. Originating in Russia and transiting the Ukraine, the section that terminates in Hungary is part of the Druzhba's southern branch. With a capacity of 160 kb/d (7.9 Mt/year), this pipeline is able to deliver Russian crude oil to the Duna and Tisza refineries. Hungary is also linked to a product pipeline coming from Russia's refining centres through Ukraine. This enables MOL to purchase gasoil feedstock from Russia for further processing.

The Adria pipeline, with a capacity of 200 kb/d (10 Mt/year), links the Duna refinery to the Croatian port of Omišalj. This pipeline was originally intended for delivering crude oil imports from Middle East or Africa to Hungary; however, it has mainly been used in the opposite direction, transiting Russian crude oil to the Sisak refinery in Croatia.

A further pipeline connection from the Duna refinery to Šahy (Slovak Republic) extends the Adria to the Slovak section of the Druzhba. This connection has a capacity of 90 kb/d (4.5 Mt/yr) and provides further flexibility in finding alternative supply routes in the event of an interruption of the normal supply.

Product exports from MOL refineries utilise barge transport on the Danube River as much as possible. MOL operates 1 200 km of internal product pipelines to supply the main depots: Székesfehérvár, Pécs, Komárom, Szajol and Tiszaújváros.

Figure 13. **Map of Hungary's oil infrastructure, 2010**



This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

Sources: IEA, Ministry of National Development.

MARKET STRUCTURE

MOL is the main oil company in Hungary. It operates upstream and downstream. MOL is listed on the Budapest stock exchange and has a diversified ownership structure, consisting mainly of other energy companies, banks and foreign and domestic institutional investors.

MOL and OMV of Austria are the largest wholesale companies in the region. MOL is expanding in a north-south direction, while OMV in an east-west direction. This expansion and ample import possibilities from neighbouring countries ensure a competitive wholesale market in Hungary.

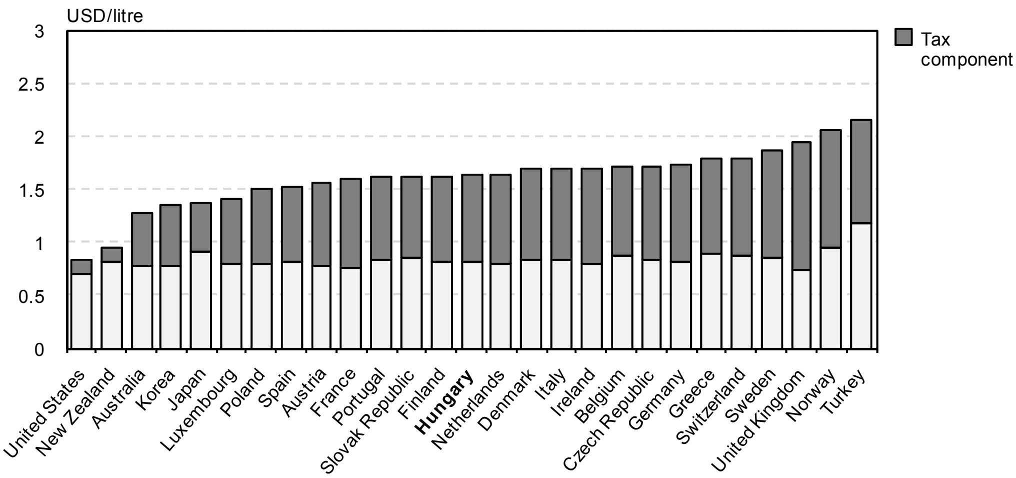
The retail market consists of numerous players. With 363 filling stations, MOL had the largest network. It was followed by Shell (249 stations), AGIP (183), OMV (178) and Lukoil (75). In addition, there are some 600 white stations in Hungary, *i.e.* small private companies with just a few stations. The retail market consolidated in previous years, as OMV bought Q8, BP and ARAL; AGIP bought Tamoil and ESSO; and Shell bought Tesco's supermarket stations.

PRICES AND TAXES

The oil products market is fully liberalised. Wholesale and retail prices are mainly influenced by the relevant quotation prices and exchange rates. These are driven by the global market fundamentals and expectations. Government control is light-handed and manifests itself through the level of excise duty, VAT and, in the case of motor fuels, a biofuels blending obligation.

Both diesel and gasoline prices in Hungary are close to the IEA median (see Figures 14 and 15). VAT on oil products is 25%, but it is paid by households only. All other users are refunded. Excise duty levels are set according to the EU Energy Taxation Directive. The bioethanol part of E85 fuel is fully tax-exempt. Excise taxes between light heating oil and diesel oil have been converged to reduce the incentive to use the former illegally to propel cars.

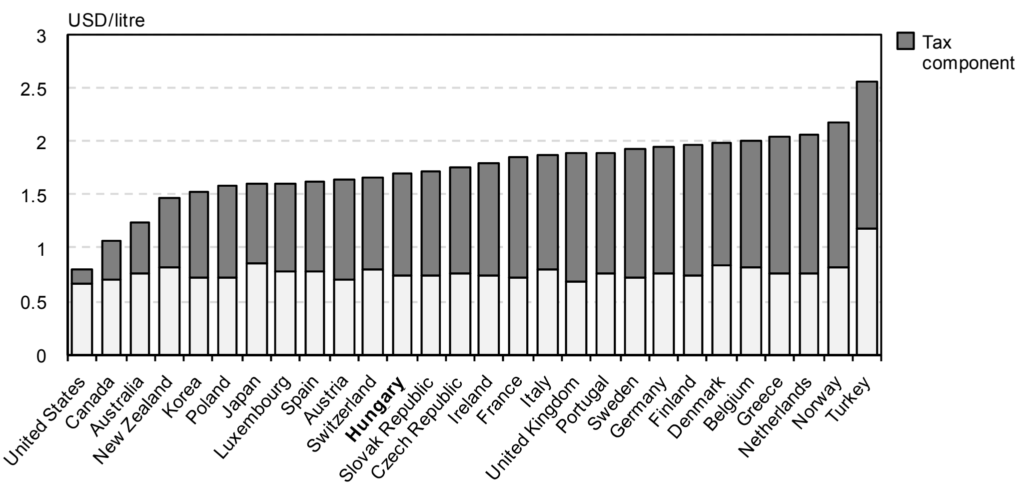
Figure 14. **IEA automotive diesel prices and taxes, fourth quarter 2010**



Note: data unavailable for Canada.

Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2011.

Figure 15. **IEA unleaded gasoline prices and taxes, fourth quarter 2010**



Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2011.

SECURITY OF SUPPLY

STOCKHOLDING REGIME

The emergency oil stocks are held by the Hungarian Hydrocarbon Stockpiling Association (HUSA), established on the basis of Act IL of 1993 on the Emergency Stockholding of Imported Crude Oil and Oil Products (see Table 4). HUSA is responsible for covering Hungary's full stockholding obligation as a member of the European Union and the IEA. Therefore, it must hold stock levels no less than 90 days of domestic consumption of the three main product categories (gasoline, middle distillates and fuel oil). In practice, the agency holds levels in excess of the minimum requirement. All strategic stocks must be available for withdrawal within 48 hours of the government's order for release. Hungary does not allow stock ticket arrangements.

HUSA is an independent not-for-profit company. It is financed by compulsory membership of all crude and oil product importers in Hungary: membership levies are proportionate to the percentage of oil the company imports. HUSA is also responsible for Hungary's emergency gas storage.

Hungary has a formal bilateral stockholding agreement with Slovenia to hold ex-territorial stocks. It has also signed a similar agreement with Italy in 2009. Bilateral agreements with Croatia and Romania are under preparation.

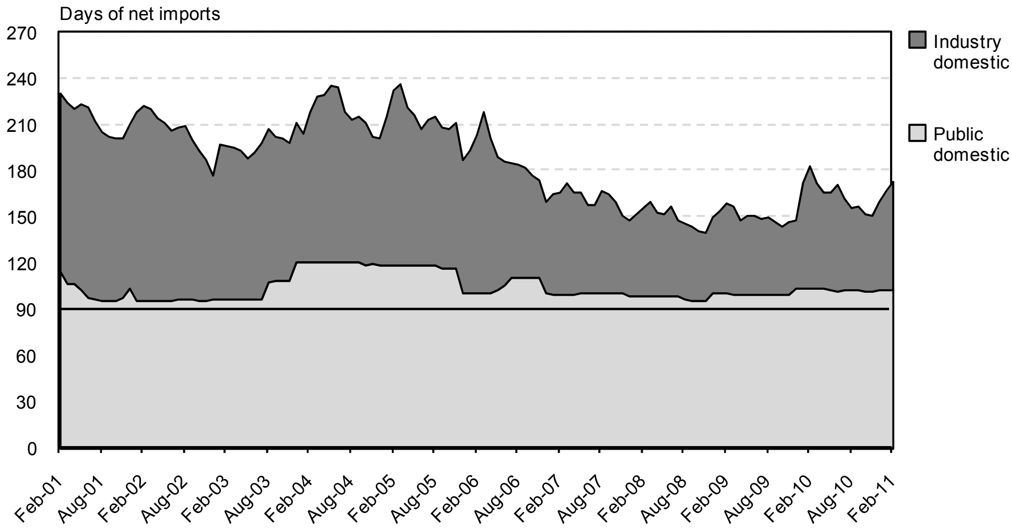
Hungary's oil stocks remain comfortably above the IEA's 90-day requirement, equalling 172 days of net imports in February 2011 (see Figure 16), of which 69 days were held by industry and 103 days are public stocks.

Table 4. **Legal basis for oil security measures in Hungary**

Legislation	Powers
The Act IL of 1993 on the Emergency Stockholding of Imported Petroleum and Petroleum Products as amended in 1997 and in 2004	**Emergency response organisations** The Act provides for the establishment and operation of a National Emergency Sharing Organisation under the supervision of the Ministry of National Development.
	Stockholding The Hungarian Hydrocarbon Stockpiling Association (HUSA) maintains, on behalf of member companies, stock levels no less than 90 days of domestic consumption of the three main product categories (gasoline, middle distillates and fuel oil).
	Implementation of stockdraw and other emergency measures The Act provides the Ministry of National Development with the statutory power to order the release of the security stockpiles in case of energy supply crises and when the EU, or the IEA, declares emergency measures.

Sources: *Oil Supply Security: Emergency Response of IEA Countries 2007*, IEA/OECD Paris, 2007; Ministry of National Development.

Figure 16. **Hungary's oil stocks and compliance with the IEA 90-day obligation, 2001 to 2011**



Source: IEA.

STOCK DRAWDOWN

In the event of a supply disruption, the drawdown of the stocks is ordered by the Minister of National Development, on the basis of consultations with members of the National Emergency Sharing Organisation (NESO). As HUSA is a member of NESO, the drawdown process can be started immediately.

Members of HUSA will have the right to buy from the governmental stock release a percentage of products that is proportionate to their membership levy of HUSA. They have 48 hours to declare their quota, after which those not drawing their right, or those who have not responded, forgo all access to the stockdraw. The minister then has the right to choose how to apportion the excess stock.

The time lag for physical delivery of stocks to market after a release decision depends on the type of stock released. In the case of crude oil stored at refineries, it would require several days. However, the bulk of products stocks is stored in commercial tank farms and delivery could be started within a couple of days. The time lag would be used to fulfil the stockdraw regulations (allocation for the member companies, signing commercial contracts, presenting bank guarantees, etc.).

CRITIQUE

Oil accounts for around 25% of TPES in Hungary in 2010, clearly below the IEA average of 36%, but still a significant share. In 2010, domestic crude oil production covers 11% of refinery demand, but the production level is in steady decline. The rest, almost 90% of the consumption, is imported from Russia via the Druzhba pipeline system. Because of the declining domestic production, import dependence is expected to grow further.

As geological surveys show, Hungary has only limited indigenous oil resources, yet experience from other oil-producing regions shows that frontiers can be pushed in certain circumstances. If one takes into account technology development and the likelihood of rising oil prices owing to an expected rise in energy demand globally, the prospects for continued oil production could be stimulating. The government should ensure a favourable regulatory framework for domestic crude oil production in order to optimise extraction levels.

Long-term demand for oil is difficult to predict and the market players need clear signals for investment planning. In this respect, the government should clarify the time schedule for gradually reaching the EU 2020 target of a 10% share of renewable sources for energy use in the transport sector. It should also reconsider the justification for the differing excise tax provisions for biodiesel and bioethanol, as only the latter is exempt from excise tax.

The Hungarian oil market is fully liberalised. Although MOL has the strongest position both in oil wholesale and retail, other companies can freely compete on the market on equal terms. The IEA acknowledges the work of the competition authority in carefully monitoring the market in order to ensure free and open competition. Thanks to the levelling-off of the excise tax differences between light heating oil and diesel oil, the incentive to use the former illegally to propel cars has disappeared.

The Hungarian oil stockpiling system complies both with IEA and EU requirements. The system is run by the Hungarian Hydrocarbon Stockpiling Association (HUSA, also responsible for strategic gas storage). HUSA's operational model seems to be sustainable without governmental subsidies, meanwhile the relevant legislation and the direct governmental control guarantees the proper level of preparedness in case of a supply disruption.

Hungary deserves applause for its efforts to ensure oil security in the region. It has signed bilateral stockholding agreements with Slovenia and Italy, while agreements with Croatia and Romania are under preparation.

In case of a lasting supply disruption in the conventional crude oil supply route, the Adria pipeline could serve as an alternative, giving direct access to the Croatian seaport Omisalj by the Adriatic Sea. Currently, as there is no government-level framework to regulate the use of the Adria pipeline, contractual congestion, limiting access to Adria, cannot be excluded. In such a case Hungary would remain without a sustainable backup crude oil supply route. Hungary and affected countries in the region should adopt the necessary common rules for the use of the pipeline.

RECOMMENDATIONS

The government of Hungary should:

- ☐ *Ensure a favourable regulatory framework for domestic crude oil production in order to optimise extraction levels.*
- ☐ *Work with the petroleum industry to ensure appropriate scheduling so as to achieve the EU 2020 target for renewable energy in transport; avoid distortions between duties and taxes on biodiesel and bioethanol.*
- ☐ *Continue to maintain its well-functioning hydrocarbon stockpiling practices.*
- ☐ *Continue efforts to access the Adria pipeline by establishing a government-level agreement with its Croatian counterpart.*

6. NATURAL GAS

Key data (2010 estimates)

Production: 2.87 bcm (-3.2% from 2009)

Share of natural gas: 38% of TPES and 31% of electricity generation

Net imports: 79% of supply, 9.4 bcm (9.5 bcm in 2009, from Russia 83%, France 7%, Germany 4%)

Inland consumption: 11.3 bcm in 2009 (residential 35%, power and heat generation 30%, commercial 17%, industry 13%, other 3%)

SUPPLY AND DEMAND

Natural gas has the highest share of total primary energy supply (TPES) in Hungary, 38% in 2010 and much higher than the OECD average of 24%. The government intends to diversify the supply sources for gas, but also to diversify its energy mix by decreasing the share of natural gas.

SUPPLY

Domestic gas production covered 22% of total supply in 2010, while almost 80% was imported, mostly from Russia. Domestic production had been relatively stable from 2007, at between 2.5 and 2.6 bcm. The country has proven reserves of 95 bcm, according to Cedigaz, corresponding to 38 years of current production. Gas production comes mostly from mature fields and is expected to decline over the coming decade.

Hungary also has unconventional gas resources - tight gas - but this potential remains very uncertain. Several companies, including MOL, ExxonMobil and Falcon, are involved in unconventional gas exploration, for example in the Makó Trough and the Békés Basin. However, most activities are at a very preliminary stage and it is too early to estimate whether unconventional gas could reverse the trend and by when. Unconventional gas production is encouraged by lower royalty rates (12%) than conventional gas production (up to 30%). However, the terms for new gas exploration contracts are determined case by case by the government, which may reduce predictability of the concession system.

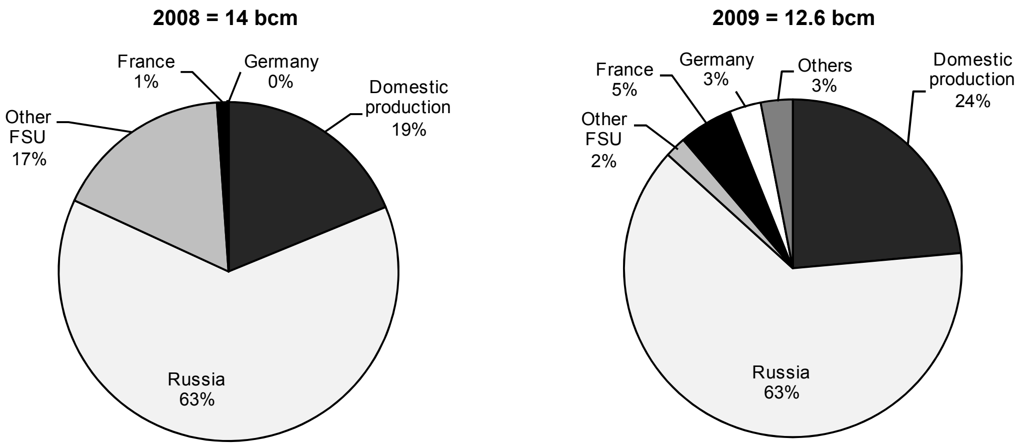
Net imports of gas in 2010 amounted to around 9.4 bcm, similar to 2009 levels and down from 11.4 bcm in 2008. Capacity at the entry points is booked under long-term contracts as follows:

- Panrusgas: 9 bcm/year until 2015;
- E.ON Ruhr Imports: 0.5 bcm/year until 2015;
- Gaz de France: 0.6 bcm/year until 2012.

As of 1 July 2010, 20% of the import capacity was reserved under short-term (annual, monthly, daily) capacity booking contracts.

In 2009, more than 80% of the imports came from Russia, with small amounts also coming from other former Soviet Union countries, France and Germany. Imports from Western Europe increased after 2008 (see Figure 17), as traders took advantage of cheaper spot gas from this region. Despite the Russia-Ukraine crisis in early 2009, Russia still supplied most gas and actually increased its share of total imports to Hungary.

Figure 17. **Natural gas supply by source, 2008 and 2009**



Source: *Natural Gas Information 2010.* IEA/OECD Paris, 2010.

DEMAND

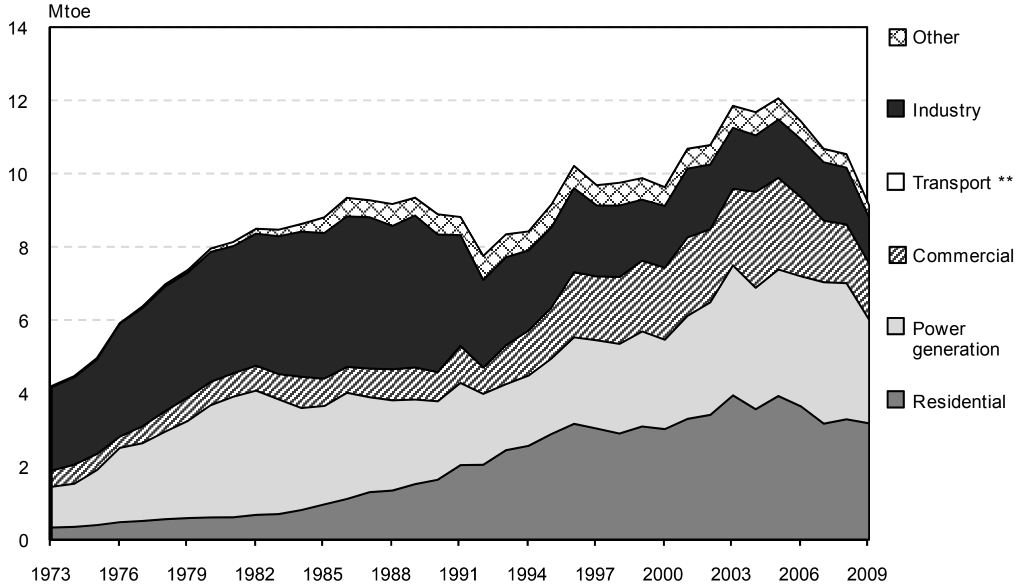
Gas demand has been declining over the past five years; in particular it dropped by 14% from 13.1 bcm in 2008 to 11.3 bcm in 2009 owing to the economic crisis, but partially recovered to 12.0 bcm in 2010.

By the time of writing (April 2011), the government was preparing a new energy strategy to 2030 which will revise the previous one to 2020 prepared in 2008. One of the key changes is that the 2008 strategy foresaw a slight increase of total gas demand to 16 bcm by 2020 from 13 bcm in 2008, while one of the scenarios of the draft new energy strategy foresees a stabilisation of gas demand to 9 or 10 bcm in the longer term.

The residential and commercial sector is the main user of gas in Hungary, accounting for just above half of total gas demand in 2009 (see Figure 18). The transformation sector accounted for around one-third, industry for 14% and other sectors for 3%. In 2009, the residential/commercial sector and power producers were particularly affected. Gas consumption in the power sector fell by 7% in 2008 and by 36% in 2009.

Future gas demand in Hungary faces considerable uncertainty. The residential sector has a high potential for energy savings (see Chapter 4 on Energy Efficiency). In the commercial sector, gas demand is expected to rapidly decline over the next decades, driven by energy efficiency improvements and the use of other energy sources. Consumption in power generation is expected to grow further as many new gas-fired plants are under construction or planned. However, these will be used mostly for mid-merit or peak purposes. Furthermore, new gas-fired plants often replace old ones, resulting in a net decline of gas demand, because of increased efficiency. Gas use in industry is expected to marginally increase to 2030, according to government scenarios.

Figure 18. **Natural gas supply by sector*, 1973 to 2009**



* TPES by consuming sector. *Other* includes other transformation and energy sector consumption. *Industry* includes non-energy use. *Commercial* includes commercial, public services, agriculture/ forestry, fishing and other final consumption.

** Negligible.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2010.

MARKET REFORM AND STRUCTURE

MARKET REFORM

Following the requirements in the second EU Gas Market Directive (2003/55/EC), the Hungarian gas market was fully opened to competition on 1 July 2007. More reforms were introduced in 2008, under the new Gas Act (Act 40). It removed regulation from the free market, keeping regulation only in universal services and significant market power (SMP) management. Similar reforms were undertaken in the electricity market. The public utility market was eliminated on 1 July 2009 and a universal supplier obligation was introduced for supplying small customers with a consumption of less than 20 cubic metres per hour as well as district heating companies until 30 June 2011.

The Hungarian Energy Office (HEO) is the regulator for natural gas. It approves the Network Code which provides for transparent and non-discriminatory access to the network for all user groups. The regulator's powers are, however, often limited to advising the Minister of National Development, who has the right to set the tariffs of system usage and connection and the price of universal supply. HEO closely co-operates with the Hungarian Competition Authority and the Hungarian Consumer Protection Authority. The co-operation is detailed in a joint agreement which is reviewed every year.

The third EU Gas Market Directive (2009/73/EC) forces Hungary to strengthen its energy regulator and give it more independence. The directive rules that national regulators must be legally distinct and functionally independent from any private or public entity; they must have a separate annual budget and adequate human and financial resources. Importantly, they must also have the power:

- to set or approve the transmission and distribution tariffs or their methodology;
- to enforce the consumer protection provisions; and
- to impose effective, proportionate and dissuasive penalties.

The gas transmission system is owned and operated by FGSZ Földgázszállító Zrt (FGSZ), part of MOL. The third EU Gas Market Directive (2009/73/EC) obliges member states to separate the transmission system operations of vertically integrated companies from their other operations. Hungary has chosen the independent transmission operator option for doing this and the Parliament amended the Gas Act accordingly in January 2010. Consequently, FGSZ may remain 100% owned by MOL, but will be subject to heavy regulation and permanent monitoring to ensure non-discriminatory system operation.

MARKET STRUCTURE

The Hungarian gas market used to be dominated by the vertically integrated incumbent MOL, which had activities in production, storage and wholesale, and had long-term supply contracts. In 2004, MOL's gas activities were split into upstream, wholesale, transmission and storage. The two units responsible for wholesale and storage - MOL Földgázellátó Rt. and MOL Földgáztároló Rt. – were acquired by E.ON Ruhrgas in 2006, subject to specific conditions imposed by the General Directorate for Competition of the European Commission. One of these conditions was the implementation of a gas release programme, with E.ON Ruhrgas auctioning annually 1 bcm on the gas market for a period of eight years (from 2006 to 2013). The wholesale entity has been renamed E.ON Földgáz Trade Zrt, a vertically integrated company of E.ON Ruhrgas, and the storage entity E.ON Földgáz Storage Zrt, which is legally unbundled. E.ON Földgáz Trade Zrt sold 10.4 bcm in 2009 for the supply of public utility consumers.

Overall, 30 trading licences have been issued, while 15 traders are active on the market. The most active of them has been EMFESZ Kft. The number of eligible customers in the competitive market increased almost 100-fold from 4 000 in 2008 to around 300 000 in early 2010, as residential users switched to EMFESZ.

Over time, however, EMFESZ ran into financial difficulties and could not pay the system-using charge to the FGSZ Co. (the transmission system operator). This led the TSO to suspend the system-using contract of EMFESZ at the beginning of January 2011. Consequently, HEO, the energy regulator, suspended the gas trading licence of EMFESZ for 90 days from 13 January 2011 to 13 April 2011 on the basis of Government Decree No. 48/2010. The decree ordered HEO to assign last-resort suppliers for EMFESZ's customers. HEO organised a call for bids for this purpose.

Since EMFESZ could not, until 13 March, improve the conditions that had led to the licence suspension, HEO repealed the gas trading licence of EMFESZ on 1 April. EMFESZ's customers were divided among the winners of HEO's call for bids to function as last-resort suppliers. Gas supply to former EMFESZ customers has continued uninterruptedly during this process and has been secured.

In addition to traders, there are also ten distribution companies, five of which are regional companies supplying more than 100 000 customers: E.ON KÖGÁZ Zrt, E.ON DDGÁZ Zrt, FÖGÁZ, TIGAZ and Égáz-Dégáz. In accordance with the second EU Gas Market Directive, the five large supply companies and natural gas distribution companies were legally unbundled in 2007.

There are two main approaches to wholesale trading in Hungary: OTC Border Point trading and trading on the newly established virtual point with regard to both standardised products (MGP and OTC trading, MGP 2). Because the number of significant players is relatively small (10 to 15) and the use of MGP is relatively expensive for less established players, liquidity on the virtual hub is very low. Liquidity on the virtual point will remain limited in the near future, yet with the involvement of smaller players the hub has a potential to fulfil a wider balancing role.

INFRASTRUCTURE

PIPELINES

Hungary's gas transmission network consists of more than 5 700 kilometres of high-pressure pipelines (see Figure 19). The network includes five compressor stations with a total installed capacity of 187 MW. The network is used to transport natural gas for Hungary's domestic consumption and for transit. Around 12 to 15 bcm are transported annually, while around 4.25 bcm are reserved for transit through the grid. FGSZ, the transmission system operator, submitted in 2010 a ten-year grid development plan for approval by the regulator.

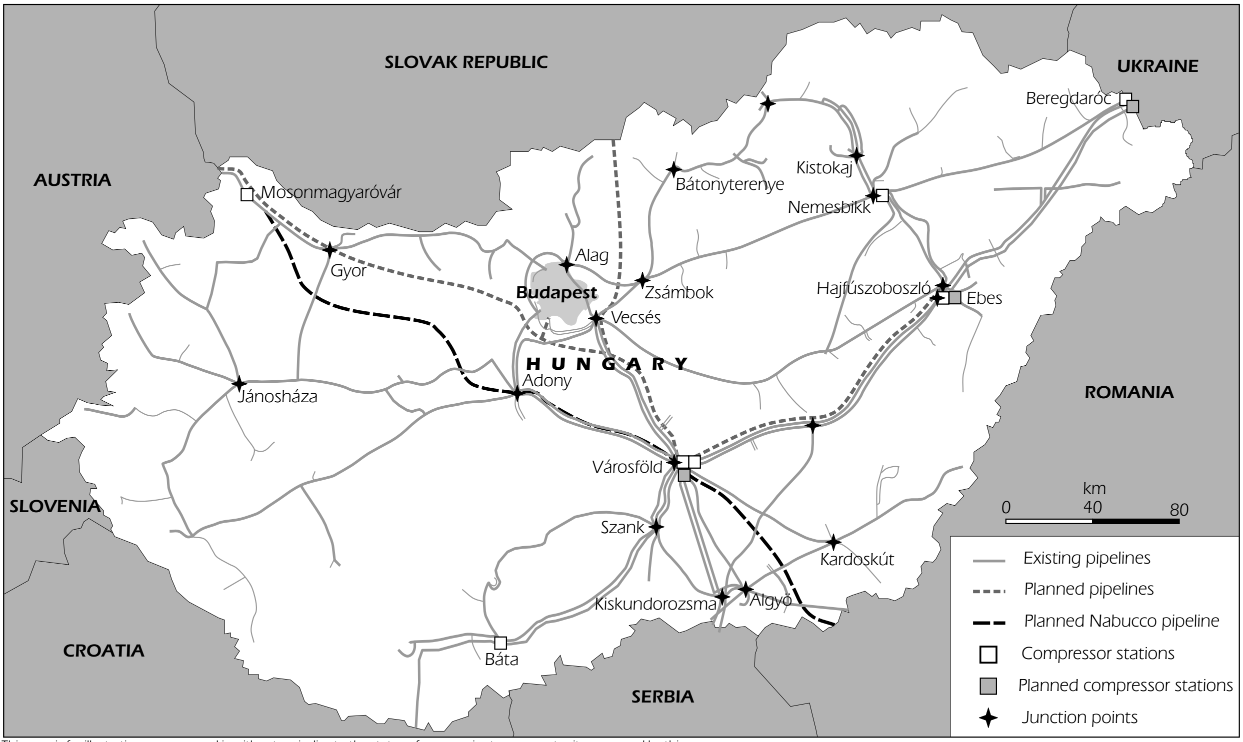
Existing and new entrants may apply for long-term capacities in the system every February. In case of congestion, an auction should be held. Short-term capacities may be booked as well, any time in the year. However, long-term capacity demands have priority over short-term capacity demands. If booked capacity is not nominated, the TSO has to offer available capacity to system users. An open-season procedure is used in case of new international pipelines or interconnectors. Companies can only book pipeline capacity if they have a gas purchase contract.

Hungary imports most of its gas from Russia via Ukraine at Beregdaróc (56.3 mcm/d), but also small amounts via Austria at Mosonmagyaróvár (12.1 mcm/d). Hungary is planning to enhance its import capacity as well as to diversify import routes and sources. Hungary is also a key transit country for Russian gas to South-East Europe and is intending to expand its general role as a transit country.

Hungary is a driving force in developing interconnections with neighbouring countries and regionally (see Table 5). The cross-border connection between Hungary and Romania was completed in 2010 and the one with Croatia has been in operation since the beginning of 2011. Unlike Hungary's pipeline connections with Austria and Ukraine, these pipelines can also be operated in reserve flow, although on the Romanian side investment in a compressor station is needed to fully materialise the reverse flow potential.

An open-season took place in 2010 for the connection with the Slovak Republic, but was not successful for flows from Hungary. In January 2011, the prime ministers of the two countries signed an agreement to build the EUR 100 million (HUF 28 billion) pipeline. The two-way connection is planned to be operational in 2015. An interconnection with Slovenia is also under study. Furthermore, Hungary is promoting the New European Transmission Systems (NETS) project to develop a regional network; this project is open for the countries and gas transmission companies of the region to join. Negotiations have also started on the possibility of creating a North-South gas corridor between Poland and Croatia, linking two planned LNG terminals.

Figure 19. **Map of the Hungarian gas transmission network**



This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

Sources: *Natural Gas Information 2010*, IEA/OECD Paris, 2010; FGSZ.

Table 5. **New and planned cross-border connections**

Project	Transmission capacity	Status of project
Hungary-Romania	1.5 bcm/y	Operational since 2010
Hungary-Croatia	6.5 bcm/y	Operational since 1 January 2011
Hungary-Slovakia	5 bcm/y	Open season launched by FGSZ and Eustream, but unsuccessful. Intergovernmental agreement early 2011. At the planning stage, Commissioning expected in 2015.
Hungary-Slovenia	Not announced	Feasibility study

Source: Ministry of National Development.

Hungary is currently considering ways to diversify its import sources through three pipeline projects – Nabucco, South Stream and AGRI - and an LNG terminal located in Croatia.

- The Nabucco project is to eventually transport 31 bcm/y from the Caspian region and the Middle East through a 3 900 km pipeline crossing Turkey, Bulgaria, Romania and Hungary and ending in Austria. MOL is one of the six companies in the Nabucco consortium, along with BOTAS, Bulgarian Energy Holding, OMV, RWE and Transgaz, each with a 16.66% share. The governments of the five transit countries signed an Intergovernmental Agreement (IGA) in July 2009. Hungary ratified the agreement in October 2009. The Nabucco consortium announced in May 2011 that it plans to start construction in 2013 and expects to see first gas flow in 2017.

- Regarding the 63 bcm/y South Stream project from Russia to South-East Europe through the Black Sea, the Hungarian government signed an intergovernmental agreement with Russia in 2007.
- The Azerbaijan-Georgia-Romania Interconnector (AGRI) project would combine a pipeline project from Azerbaijan to Georgia and the transport of LNG by tankers across the Black Sea. The three governments signed an intergovernmental memorandum in April 2010.
- An LNG terminal is planned in Croatia on Krk Island. The 10 bcm terminal is supported by E.ON, Total, OMV and Geoplin. INA, HEP and Plinacro are in talks to join the consortium, while MOL is studying the possibility to participate in the project, directly or through INA, as it could be connected to Hungary through Croatia.

STORAGE

Gas storage is crucial because of the high share of relatively inflexible residential demand. Hungary has six commercial storage facilities (see Table 6). E.ON Földgáz Storage owns five underground facilities which have a working capacity of 4.34 bcm and a withdrawal capacity of 55.2 mcm/d. MMBF has a 0.7 bcm commercial storage at Szöreg. All commercial storage may be accessed by third parties. In addition to commercial storage, since January 2010 Hungary has a strategic storage facility at Szöreg, with a 1.2 bcm working capacity and a withdrawal rate of 20 mcm/d.

Table 6. **Commercial gas storage facilities**

Facility	Operator	Working capacity (mcm)	Withdrawal rate (mcm/d)
HAJDÚSZOBOSZLÓ	E.ON Földgáz Storage	1 440	20.2
KARDOSKÚT	E.ON Földgáz Storage	280	2.9
PUSZTAEDERICS	E.ON Földgáz Storage	340	2.9
ZSANA	E.ON Földgáz Storage	2 170	28.0
MAROS – I	E.ON Földgáz Storage	110	1.2
SZOREG	MMBF	700	5.0

Source: Hungarian Energy Office.

SECURITY OF SUPPLY

Hungary depends strongly on one source of supply and one supply route. Following disruptions in 2006 and 2009, the government decided to enhance security of gas supply. The key elements of Hungary's gas security policy are the diversification of supply sources and routes, the development of infrastructure to support such diversification and the expansion of underground storage capacity, including a dedicated strategic storage facility.

Daily demand in winter is typically 65 to 70 mcm, while the record demand is 89.4 mcm, reached in 2005. Normal winter demand is usually met as follows: imports 42 mcm/d, domestic production 8 mcm/d and storage withdrawal 20 mcm/d. The storage withdrawal capacity and imports vary according to the shippers demand. Currently, import capacity stands at 68.3 mcm/d, domestic production can reach 10.5 mcm/d and storage withdrawal 74 mcm/d, including 20 mcm/d of strategic storage. Hungary can therefore meet its gas demand even if part of the infrastructure were unavailable.

Act 26 of 2006 on security natural gas stockpiling required the construction of a 1.2 bcm underground storage facility by 2010. This came on top of an existing 200 mcm of strategic storage held in E.ON's facilities. The storage was to have a withdrawal rate of 20 mcm/d for at least 45 days. The stockpile aims to protect households as well as customers who cannot switch to other energy sources. MOL won the tender for the construction of the facility. The Hungarian Hydrocarbon Stockpiling Association (HUSA) and MOL established MMBF Zrt to own and operate the storage facility which was completed in 2010. The gas is owned by the Stockpiling Association.

In June 2010, the Gas Act was modified. The act lowers the strategic gas stockholding obligation from 1.2 bcm to between 0.6 and 1.2 bcm, depending on the decision of the Minister of National Development. The modification seems to have been motivated by the desire to influence prices for customers under universal service.

The Hungarian Natural Gas Law defines demand restrictions in the event of a supply disruption, on the basis of rule 265/2009 (XII.1.) The first category consists of consumers who can reduce consumption and switch to other fuels within four hours. They have a capacity of 760 167 m^3/h, also publicly available on the TSO's website. The Hungarian Electricity Law (2007/LXXXVI) defines the power plants with alternative fuel options. They have booked around 10% to 12% of total gas supply capacity.

PRICES AND TARIFFS

The GKM Decree 105/2005 concerning the price regulation of natural gas served as a basis for system use charges and the public utility end-user charges until 30 June 2009. Following the new Gas Act in 2009, large users buy gas at market prices instead of administrative prices (therefore not regulated prices). They must choose their supplier among several traders. The Gas Act also changes the calculation of residential gas prices. Small users stay with the universal service providers replacing public utility suppliers. Small users include households, customers of the category 20 to 100 m^3/h and also district heat plants, which have not entered the free market.

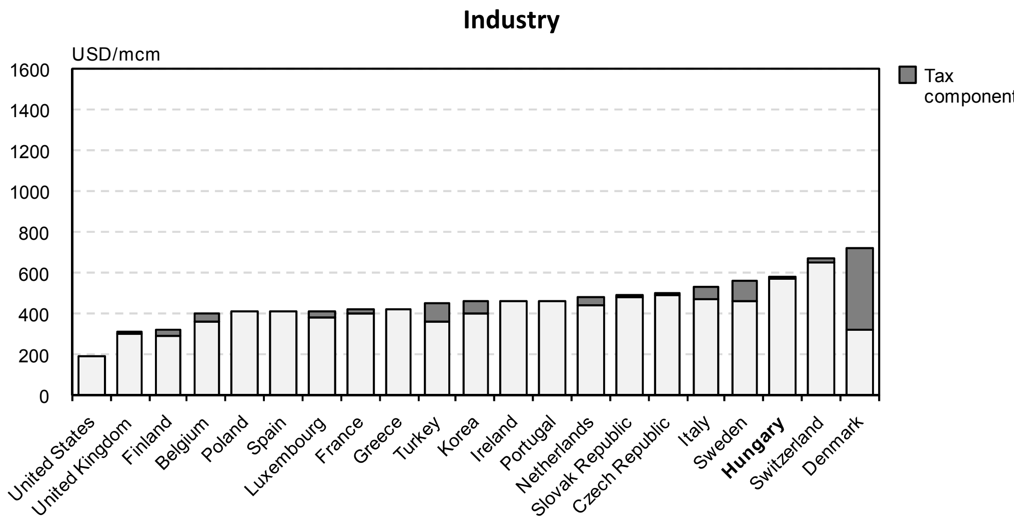
Universal service must be ensured by applying reasonable, easily and clearly comparable and transparent tariffs. The calculation method for the benchmark prices and the maximum sales margin are determined by the Minister of National Development, after a proposal from the regulator. Prices may be revised on a quarterly basis. The regulator monitors whether prices comply with the decree. It may decrease the end-user prices (price components) for universal service if wholesale natural gas prices decrease – even without any request from universal service providers.

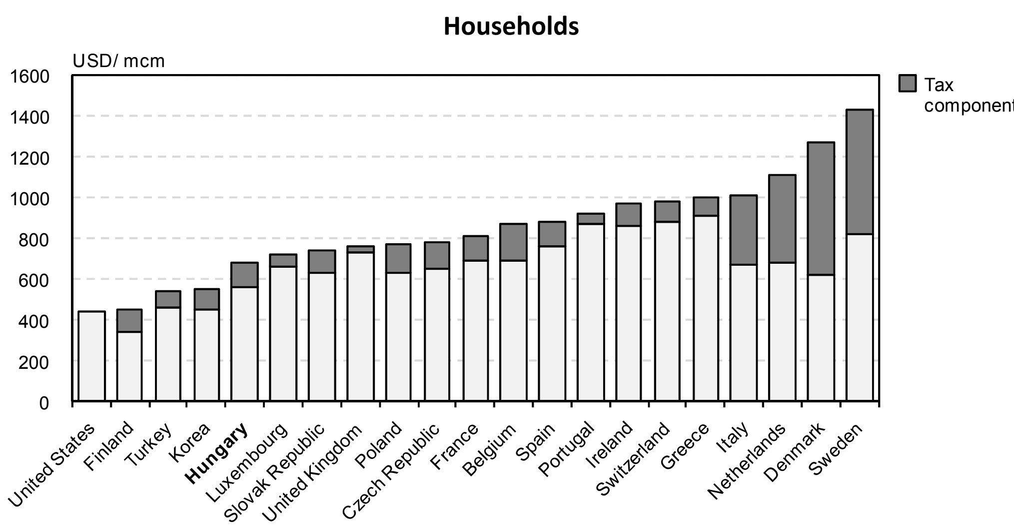
The monopolistic activities, such as transmission, storage and distribution are regulated by ministerial decrees, and the minister determines charges upon the regulator's proposal. Transmission and storage charges are revised annually, but distribution charges quarterly. Regarding transmission, there are entrance and exit charges in HUF/(m^3/h)/year and a volume charge in HUF/m^3. In order to promote the use of storage and recognise the varying flexibility of domestic and cross-border entry points, varying entrance charges were introduced for each entry point from July 2009.

Gas prices for industry were relatively high in 2009 compared to other OECD countries, but declined by 25% from third quarter 2009 to third quarter 2010, reflecting the impact of lower oil prices on import prices. However, prices for households are rather low compared to other countries (see Figure 20).

As the Gas Act was modified in June 2010, the right to determine the universal supplier's end-user prices was transferred to the Ministry of National Development. The modified Gas Act states also that as long as the minister does not determine the new prices, the universal supplier's end-user prices cannot be changed (a moratorium on end-user prices). Consequently, gas prices were not changed between 1 April 2010 and 1 January 2011, when new tariffs came into force. In April 2011, prices for residential users were frozen again. Such a price moratorium is an issue, because it does not give gas users incentives to invest in energy efficiency measures, and can cause difficulties to suppliers if they cannot recover their procurement costs. For example, end-user prices did not fully cover the costs of imported gas in 2008 and 2009.

Figure 20. **Natural gas prices in IEA member countries, 2009**





Note: Tax information unavailable for the United States. Data unavailable for Austria, Australia, Canada, Germany, Japan, New Zealand and Norway.

Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2010.

CRITIQUE

Natural gas is the largest primary energy source in Hungary, accounting for 38% of TPES in 2010. It is therefore understandable that Hungary wishes to diversify its energy mix to reduce dependence on gas. However, future gas demand and the role of gas in the future energy and power mix remain to be clarified. In the previous long-term forecasts up to 2020, gas demand was expected to increase slightly from around 13 bcm in 2008 to around 16 bcm. Obviously, the economic crisis has considerably changed the long-term demand outlook and it is now understood that gas demand could stabilise at around 9 or 10 bcm, which is significantly lower (by 45%) than previous forecasts. In order to give solid ground for future investments in transmission and storage, more clarity must be given to investors.

Hungary also needs to clarify the future role of gas in power generation. In the short and medium-term, most power plants under construction are gas-fired. However, investments in new power plants suffer from contradictory messages: the preference for cheap generation sources, in particular in the current period of low prices, and the requirements for more flexibility. Gas-fired plants are a source of flexibility, also highly efficient, and emit less CO_2 than coal-fired plants, but their costs depend strongly on the price of gas. Any plans to significantly increase nuclear power capacity have a direct impact on the profitability outlook for gas-fired power plants. Therefore, the sooner the government confirms its plans, the better. Owing to the high share of electricity imports (around 10% of total supply), the government should consider future electricity supply from both the national and the regional perspectives.

Hungary depends mostly on one supplier, Russia, and was affected by the supply crises in 2006 and 2009. In order to be better prepared, Hungary has taken several commendable steps. It has enhanced storage capacity (including strategic storage), is considering various options to diversify supply routes (Nabucco, South Stream, AGRI pipelines or links to Adria LNG in Croatia) and is developing cross-border connections with neighbouring countries. One interconnection exists with Romania and another with Croatia; others with the Slovak Republic and Slovenia are under consideration. Hungary is also an important transit country to South-East Europe. Therefore, Hungary is improving security of supply at both national and regional levels. The country's role in developing the regional market and enhancing interconnections are commendable. Particular attention should nevertheless be paid to the cost-effectiveness of these measures to improve regional security of supply, so that the costs would not fall disproportionately on Hungarian consumers. If economically justified, bidirectional interconnectors should be preferred in order to enhance national and regional security of supply. Moreover, interconnections with Western European countries (based on existing pipelines) should be investigated in order to gain access to cheaper spot gas supplies.

As a response to the 2006 gas crisis, Hungary took the laudable decision to build a 1.2 bcm strategic gas storage. Completed in 2010, the storage improves security of supply in the country and the neighbouring region. Without the 1.2 bcm in the storage, Hungary would be more vulnerable to a supply disruption. It is therefore surprising that in June 2010, Hungary changed legislation to reduce the minimum stockholding level by half. Such a decision contributes to undermining gas security in a country that has done so much to improve it in recent years. The government should reconsider this decision and confirm that the strategic storage can only be used for ensuring security of supply.

Gas prices need to reflect procurement, transmission, distribution and storage costs. Price caps and/or subsidies give the wrong signal by reducing unilaterally regulated end-user gas prices for small users. This does not encourage gas users to invest in energy efficiency measures or to reduce their gas consumption. It may also discourage new companies from entering the Hungarian gas market and, in the long term, reduce investment in infrastructure development. The consequences of the economic crisis on low-income households should instead be dealt with through targeted social measures.

Market liberalisation has been increasing, following the full market opening in July 2007. The number of traders in the competitive market has increased, but in 2009, they supplied only 8% of end-use volume, while E.ON Földgáz Trade Zrt supplied the rest to public utility consumers. The number of eligible customers entering the competitive market increased notably from 4 000 in 2008 to around 300 000 in early 2010, as residential users switched to EMFESZ Kft. Since July 2009, universal service providers supply small users who have not chosen to change supplier. Therefore, regulated and market prices coexist in this market segment with the option to reverse from market price to universal service. For the reasons outlined in the previous paragraph, Hungary should consider gradually removing regulated prices, while monitoring end-user prices charged by the suppliers.

RECOMMENDATIONS

The government of Hungary should:

- ☐ *Clearly define Hungary's position regarding the use of gas in key sectors – power generation and cogeneration.*
- ☐ *Continue efforts to diversify supply sources and routes, with a special focus on enhancing regional market development with fair burden-sharing of costs.*
- ☐ *Avoid price caps and/or subsidies and move the sector progressively towards market-based prices; consider other ways to support low-income households.*
- ☐ *Reconsider the decision to reduce the minimum stockholding level of the strategic storage and limit the use of the storage to securing gas supply.*

7. COAL

Key data (2010 estimates)

Production: 9 Mt of brown coal (lignite and sub-bituminous coal)[3]

Net imports: 1.8 Mt of hard coal (from Ukraine 50%, Czech Republic 27%, Russia 11%, Poland 10%), 0.3 Mt of brown coal (Czech Republic 67%, Russia 26%)

Share of coal: 11% of TPES and 17% of electricity generation

Inland consumption: In 2009 electricity and heat generation 71%, industry 8%, residential 6%, other 15%

SUPPLY AND DEMAND

SUPPLY

Coal supply was 2.7 Mtoe in 2010, or 11% of total primary energy supply. Coal supply has declined steeply from 8 Mtoe in 1985, on average by 4.1% per year (see Figure 21). Supply has declined across all sectors, particularly in the residential and commercial sectors which accounted for 32% of coal consumption in 1985, but only 5.6% in 2009.

Hungary's domestic coal production is today limited to lignite and amounted to 9 Mt in 2010. All lignite is used at power and cogeneration plants. Sub-bituminous coal imports represented 0.3 Mt or 3% of total brown coal supply. The Czech Republic provided 67% of total brown coal imports and Russia 26%. All hard coal is imported. In 2010, the main suppliers were Ukraine (50% of the total), the Czech Republic (27%), Russia (11%) and Poland (10%).

According to the 2009 report of the Federal Institute for Geosciences and Natural Resources of Germany, Hungary has 276 Mt of hard coal reserves and 2 633 Mt of lignite reserves. A major mining area is the Mátra field, 90 km to the east of Budapest. Extraction is concentrated at the two opencast mines of Bükkábrány and Visonta. A 935 MW Mátra power plant is located at Visonta. Lignite from Bükkábrány, some 60 km away from Visonta, is transported to the power station by rail. In order to improve mine productivity, a project to build a new compact excavator was started in mid-2007 but has been shelved following the economic crisis. Sub-bituminous coal is also produced at the underground Márkushegy mine.

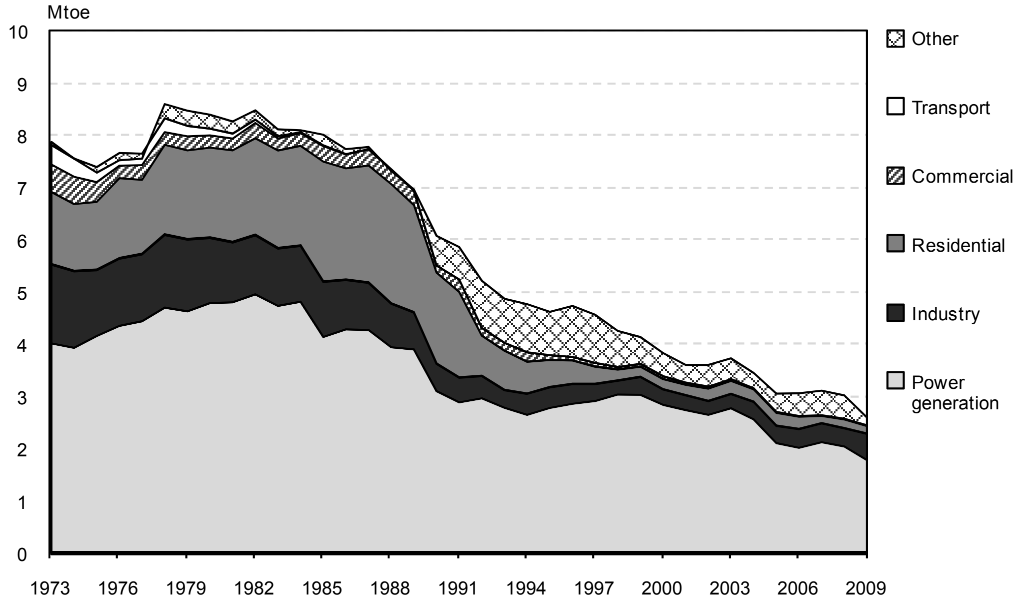
DEMAND

Power generation is the largest coal user, consuming 1.8 Mtoe in 2009, or 71% of total coal supply. Coal-fired generation amounted to 6.4 TWh, or 17.9% of electricity supply in 2009. This is one third lower than a decade ago when coal generated nearly 10 TWh (or 27% of total electricity. Power plants use domestic lignite, while the steel industry is the largest user of hard coal.

3. All coal with a gross calorific value of 5 700 kcal/kg (23.9 GJ/t) or less on an ash-free but moist basis.

Hungary's 1.4 GW (gross) of coal-fired capacity dates mostly from the 1960s and early 1970s and many power plants will see their operation licence expire by the mid-2010s. The EU's air pollution legislation means that many of them will not longer be used after 2015. Uncertainty prevails also over the conditions for free allocation of EU-ETS emission allowances after 2012. The plants also generally have a low average thermal efficiency. In recent years, several coal-fired power plants have been converted to co-firing biomass and smaller coal-fired plants have been entirely switched to biomass.

Figure 21. **Coal supply by sector*, 1973 to 2009**



* TPES by consuming sector. *Other* 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: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2010.

Plans for new state-of-the-art coal-fired plants had been drawn, but following the economic crisis and a decline in electricity demand, retail price freeze and higher taxes, they have been dismissed. For example, in November 2010 RWE decided to cancel plans for a 440-MW lignite-fired power plant at Mátra. In January 2011, MVM cancelled its plans to invest in coal-fired capacity.

SUBSIDIES

In 2005, the European Commission agreed to a restructuring package under which the Hungarian government grants state aid for coal production to the Vértes power plant, the owner of the Márkushegy mine, and to the Oroszlány power plant. The state aid was to total HUF 64.3 billion (EUR 229 million) over the period 2004-2010. The yearly aid declined from HUF 12 billion (EUR 43 million) in 2004 to HUF 7.0 billion (EUR 25 million) in 2010, forcing the company to adapt (*e.g.* by increasing its capacity to co-fire biomass). The government also directly supports mine closures and rehabilitation of mining areas. The aid is financed by electricity consumers through the electricity tariff and a levy modelled on the German "Coal Cent" since January 2006.

At the beginning of 2011, the Vértes power plant was under bankruptcy proceedings and its future remained open. In 2010, the EU member states decided to continue state aid for coal production until the end of 2018. Aid may only be granted to mines which will be closed by 2018.

CRITIQUE

Coal provided 11% of TPES in 2010. Coal use has been declining for the past quarter century and this decline is expected to continue. Domestic lignite is used in power generation and it generated 17% of all electricity in 2010. Future use of coal in the power sector will be challenged by pollution control and climate change legislation, but increasing power plant efficiency would improve its competitiveness. However, investments in new plants would have to be large and the conditions do not seem to be favourable for them at the moment, judging by the several projects for new coal-fired power plants that have been cancelled lately.

Electricity demand has dropped and end-user prices have been frozen. Taxes on power companies have increased. Allocation of free emission allowances in the EU-ETS after 2012 remains open, but would in any case require investments to improve plant efficiency. All these reasons reduce, at least in the short term, incentives to invest in coal-fired power capacity. The government should assess the future role of coal in electricity supply, taking into account security of supply and the long-term objective to decarbonise the power sector. Incentives to encourage efficient coal use, including through modern clean coal technologies, should be considered.

Hungary has considerable coal resources. Lignite production at the opencast mines appears profitable and free of direct subsidies. However, lignite mining received indirect subsidies in the form of tax exemptions and a reduced mining duty. Coal production at the underground Márkushegy mine is uneconomical and the host company is under bankruptcy proceedings. At current coal and power prices, the EU’s decision to extend state aid to coal production from 2010 to 2018 would prolong mine life by a few years, but on condition that the mine will be closed by 2018. The government should continue to phase out subsidies for cost-inefficient and uncompetitive coal production.

RECOMMENDATIONS

The government of Hungary should:

- ☐ *Assess the future role of coal in electricity supply, taking into consideration efficiency of use, security of supply, the need to reduce CO_2 emissions over the long term and the potential provided by clean coal technologies.*
- ☐ *Continue to phase out both direct and indirect subsidies for coal production, including lignite.*

8. RENEWABLE ENERGY

Key data (2010 estimates)

Share of renewable energy: 7.9% in TPES and 8.7% in electricity generation (IEA average: 7.7% and 17.7%), up from 3.4% and 0.8% in 2000

Combustible renewables and waste: 7.2% of TPES and 6.7% of total electricity generation

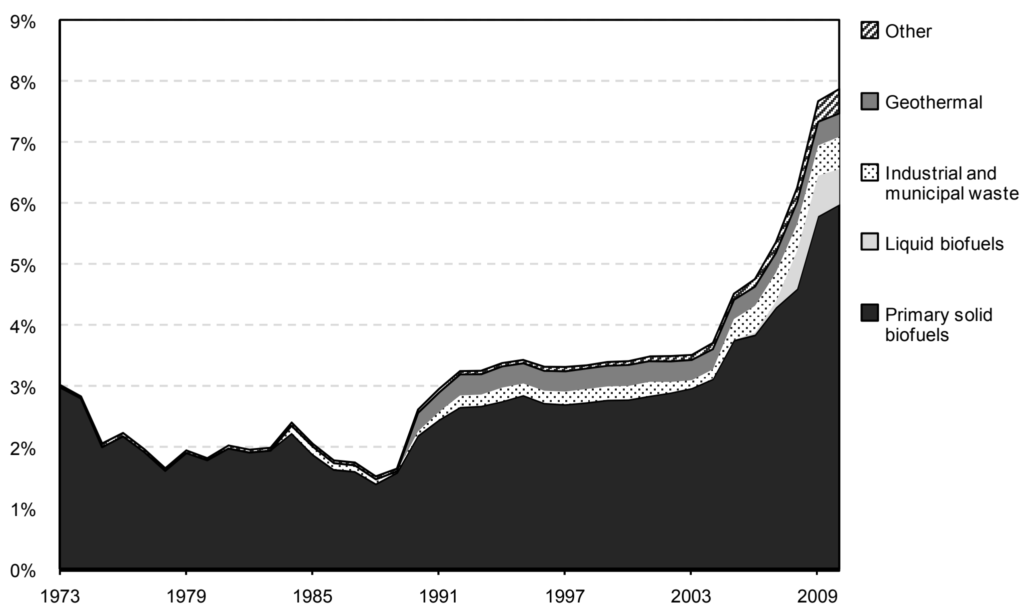
Geothermal: 0.4% of TPES

Other renewable energy: 0.3% in TPES and 1.9% in electricity generation

SUPPLY AND DEMAND

Growth in the use of renewable energy sources accelerated in Hungary over the past decade. In 2003, total renewable energy supply was 0.9 Mtoe or 3.5% of TPES. By 2010, supply had doubled, reaching 2 Mtoe, and renewables accounted for 7.9% of TPES (see Figure 22). The share of renewables in TPES in Hungary lies slightly above the IEA average (see Figure 23). From 2003 to 2010, Hungary experienced the third fastest growth (+117%) in the use of renewables, after Ireland and Germany. The average increase among IEA countries was 30% over the same period.

Figure 22. **Renewable energy as a percentage of total primary energy supply, 1973 to 2010***



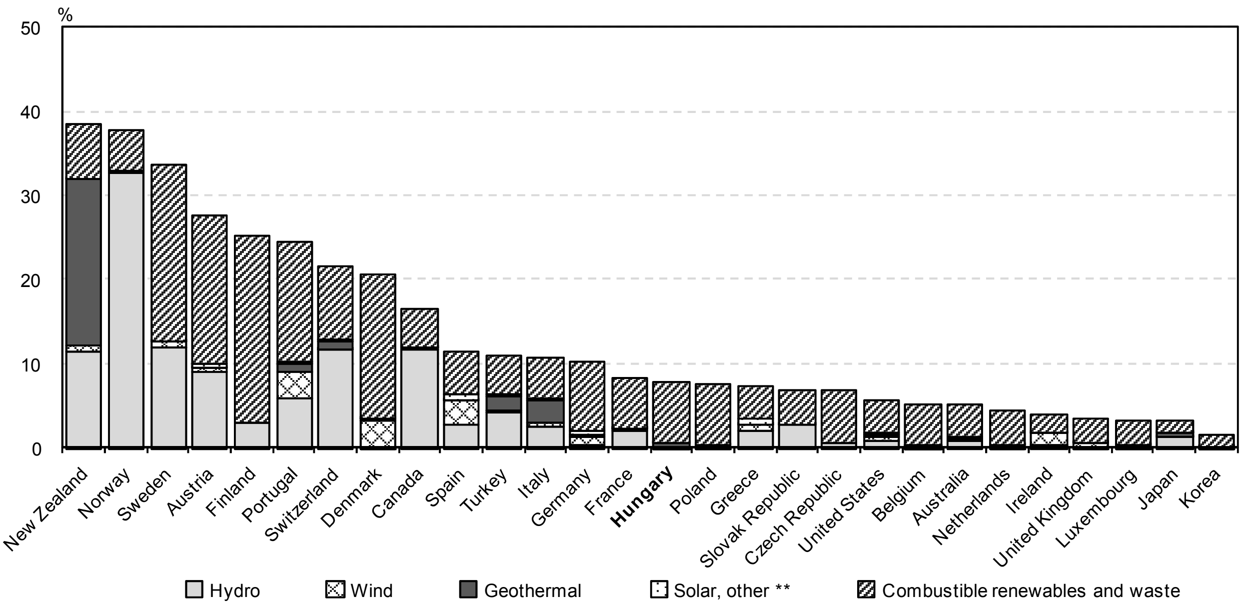
* Estimates for 2010.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2010 and country submission.

Combustible renewables and waste, consisting of primary solid biomass, liquid biomass and industrial and municipal waste, dominate renewable energy use. Solid biomass, *i.e.* wood and agricultural waste, accounted for 76% of total renewable energy supply in 2010 and production was 1.5 Mtoe in 2010. Around half of total primary solid biomass supply is used for electricity production, while the other half is used for heating in the residential sector. Liquid biomass represented 9% of the total, while industrial and municipal waste from renewable sources accounted for 6%. Geothermal energy represented 5% of total renewable energy supply and biogases, wind, solar and hydropower accounted for the remaining 4%.

The Hungarian government expects renewable energy supply to roughly double from 2010 to 2020 to meet the country's EU target concerning the share of renewable sources in gross final consumption of energy in 2020 (see below under Policies and Measures). Biomass is expected to account for most of the increase in renewable supply.

Figure 23. **Renewable energy as a percentage of total primary energy supply in IEA member countries, 2010***



* Estimates.

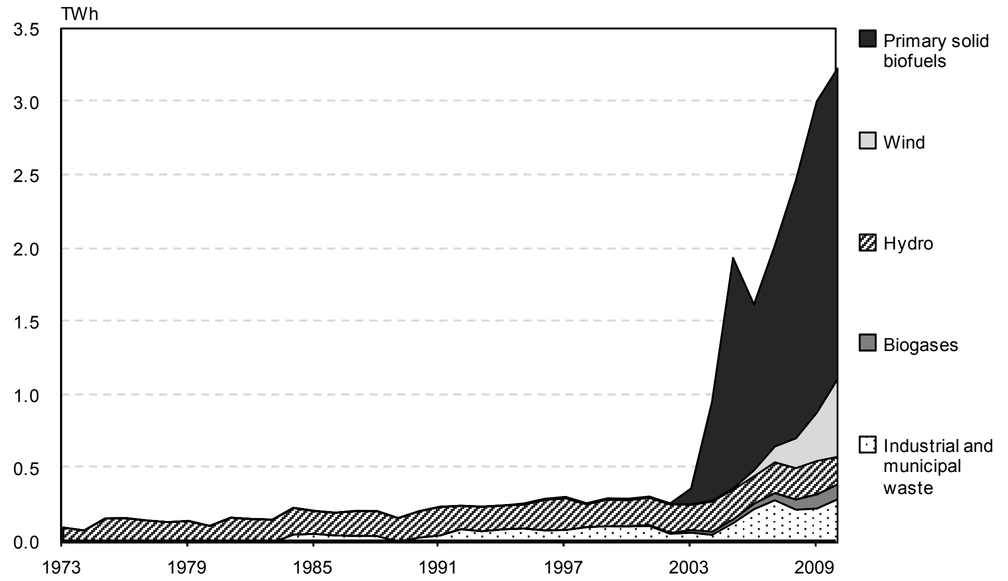
** *Other* includes tide and wave and ambient heat used in heat pumps.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2010 and country submission.

Electricity generated from renewable sources was 3.2 TWh in 2010, or 8.7% of total generation in Hungary (see Figure 24). This share is far below the IEA average (17.7%), but rising fast, from 5.1% in 2007 and 6.2% in 2008 (see Figure 25). The government projects electricity generated from renewable sources to reach 4.1 TWh in 2020.

Electricity generation from solid biomass amounted to 2.5 TWh in 2010, while wind power generated 0.5 TWh and hydropower 0.2 TWh. Hungary is a relatively flat country with little wind, so potential for hydro and wind power is limited. Small amounts of power were generated from waste and biogas.

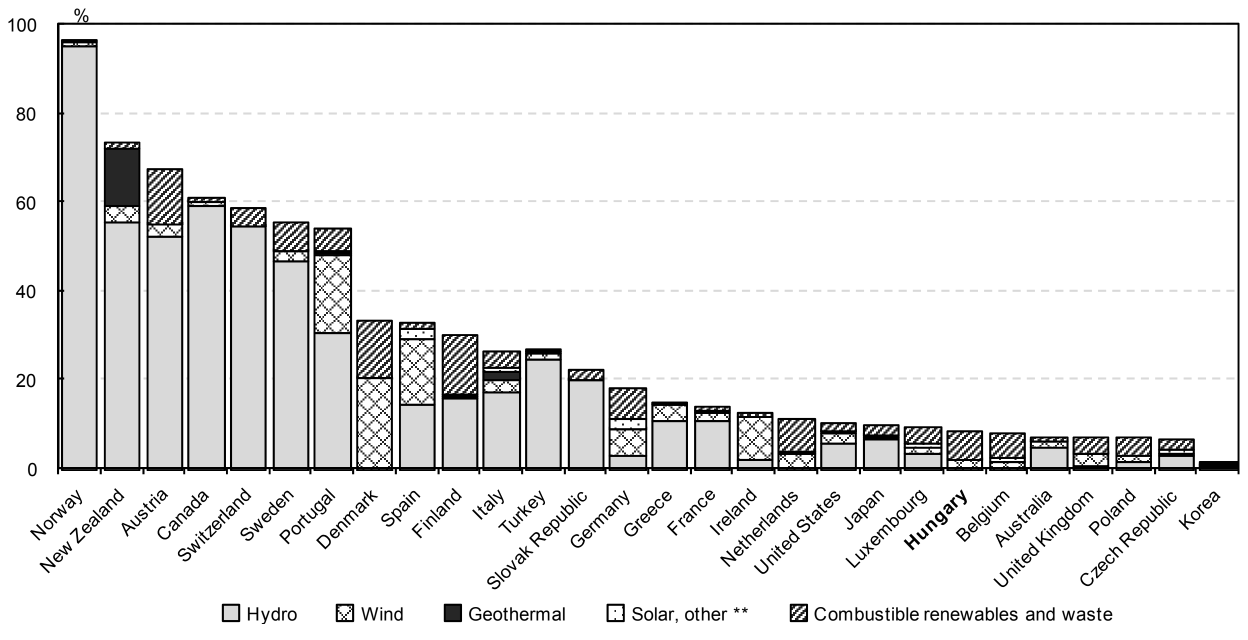
Figure 24. **Electricity generated from renewable energy sources, 1990 to 2010***



* Etimates for 2010.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2010 and country submission.

Figure 25. **Electricity generation from renewable energy as a percentage of all generation in IEA member countries, 2010***



* Estimates.

** *Other* includes tide and wave and ambient heat used in heat pumps.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2010 and country submission.

Total solar thermal installed surface was estimated to be 100 000 m^2, or 70 MW_{th}. Solar photovoltaics capacity installed in Hungary was only 1 MW_p in 2009. Hungary, however, is the largest user of geothermal energy for heating in the EU, producing 221 thousand tonnes of oil equivalent (ktoe) - from 614.6 MW_{th} of installed capacity - in 2009. This geothermal heat is mainly used in thermal establishments and public swimming pools, greenhouses and district heating systems.

POLICIES AND MEASURES

After accession to the European Union, Hungary was required to apply the provisions of Directive 2001/77/EC on producing electricity from renewable energy sources. The Accession Treaty set out national indicative (non-binding) targets for the proportion of electricity produced from renewable sources. Hungary reached the target for 2010 in 2005, largely thanks to the contribution of biomass-fired electricity generation. The 2001 directive has since been superseded by a New Renewable Energy Directive (2009/28/EC). The directive requires each member state to increase its share of renewable energy in gross final consumption of energy in order to raise the overall share in the EU to 20% in 2020. A 10% share of renewable energy in transport is also included within the overall EU target.

The Directive 2009/28/EC sets Hungary a binding national overall target for renewable sources to provide 13% of gross final consumption of energy in 2020. The government has opted to go beyond this and set a target of 14.65% by 2020. Support mechanisms that will be put in place to meet the targets are outlined in the December 2010 National Renewable Energy Action Plan (NREAP, see below), an obligation under Directive 2009/28/EC. The NREAP supersedes the Hungarian Renewable Energy Strategy (2007-2020) which was approved by the Parliament in April 2008 and set the target for renewable energy sources at 13% to 15% of TPES in the Policy Scenario and 11% to 13% in the Business-as-Usual (BAU) Scenario.

By the time of writing (April 2011), the Hungarian government was preparing a long-term energy strategy to 2030, which will include recommendations for the sustainable production of biomass and the utilisation of bioenergy, among others.

Renewable energy also features prominently in the government's economic recovery plan (the New Széchenyi Plan). One of the seven key areas of the plan is "Green Hungary", which will aim to develop a green economy through the promotion of renewable energy and energy efficiency.

The key areas driving Hungary's renewable energy policy are:

- *Security of supply*: Hungary is highly dependent on energy imports but, given its renewable resource potential, can improve energy security by increasing the share of renewable energy sources.
- *Environmental sustainability and climate protection*: The use of renewable energy sources reduces CO_2 emissions. In the NREAP, environmental and conservation aspects are taken into account as criteria for the measures regarding financing schemes.
- *Agriculture and rural development*: Hungary has favourable agro-ecological conditions. With attention to sustainability criteria, renewables can contribute to the retention and creation of agricultural jobs. The use of biogas and by-products from other wastes from agriculture and forestry could result in additional income for farmers and producers, and reduce demand for fossil fuels.

- *Development of a green economy*: The use of renewable energy sources, in close co-ordination with energy conservation and energy efficiency programmes, could constitute the basis for a new (green) sector of the economy.
- *Contribution to community goals*: Surpluses in the green industry, environmental industry, agriculture, rural development, the SME sector and employment can be promoted through the utilisation of renewable energy sources.

NATIONAL RENEWABLE ENERGY ACTION PLAN

Under Directive 2009/28/EC, each EU member state is required to submit a National Renewable Energy Action Plan (NREAP) to the European Commission. Although Hungary has an obligatory minimum target of 13% by 2020, the government has set a higher target, 14.65% for the share of renewable energy in gross final energy consumption. According to government estimates, this share was 7.4% in 2010.

As most EU countries, Hungary's NREAP prioritises solid biomass as a means to achieve the 2020 target. Most of the additional renewable energy capacity will be provided for by new biomass power plants.

The national target includes specific targets for several technologies. Some 16 MW of hydropower is expected to be installed by 2020. Water management, environmental protection and nature conservation will be given priority in developing these power stations. There is significant potential to increase the role of geothermal energy in heat supply, and the government expects another 57 MW_e by 2020. There are no specific targets for solar energy.

In terms of volume, energy produced from solid biomass is expected to contribute the most to achieving the renewable energy target. Additional production is expected to be nearly 19 petajoules (0.45 Mtoe) in 2020. In addition to improving the efficiency of existing high-capacity power plants, the targets will be achieved by expanding the use of biomass for local heat generation and developing small- and medium-capacity combined heat and power generating systems.

The projections in the NREAP indicate that renewable energy supply will become more diversified, as the share of biomass is projected to decrease to 62% in 2020 from over 80% today. The largest increase will be in the use of geothermal and solar energy and heat pumps.

The measures of the National Action Plan concern the following public tasks:

- drafting a new act on sustainable energy management in 2011;
- restructuring the implementation of existing aid schemes and making aid simpler and more efficient;
- launching an independent energy support scheme (co-financed by the EU) between 2014 and 2020;
- a comprehensive revision of the mandatory off-take scheme for renewable electricity;
- examination of the possibilities for subsidising heat from renewable sources;
- facilitating a more active participation in direct EU support and other support schemes;

- review of the incentives incorporated into energy regulations for buildings (in accordance with Directive 2010/31/EC);
- review of spatial plans, creation of regional energy concepts;
- establishment of green forms and programmes of financing (green bank);
- review and simplification of regulatory and authorisation systems and procedures;
- drafting awareness-raising programmes and information campaigns (integrated information programmes);
- launching educational and training programmes based on renewable and alternative energy sources and energy efficiency;
- launching employment programmes in the field of renewable energy sources;
- launching programmes for developing the related industries;
- encouraging research and development and innovation incentive programmes;
- programmes and measures for spreading second-generation bio- and alternative fuels;
- drafting an agricultural energy programme;
- preparing the administrative staff taking part in regulatory and authorisation procedures in relation to renewable energy and related fields.

Box 2. **Final energy consumption: differences between IEA and EU methodologies**

Directive 2009/28/EC on New Renewable Energy introduced a target for the EU as a whole to increase the share of renewable energy to 20% of gross final energy consumption by 2020. It also set specific binding targets for each EU member state. While the IEA annually publishes detailed energy statistics and energy balances for all EU countries, its methodology differs from the one in the directive. The IEA publications, including this study, report the countries' *net* total final energy consumption (TFC). Therefore, the share of renewable energy in "gross final energy consumption" is not directly available in the IEA statistics. In the directive, "gross final consumption of energy" is defined as energy commodities delivered for energy purposes to industry, transport, households, services, agriculture, forestry and fishing. In particular, the EU definition does, but the IEA definition does not include the consumption of electricity and heat by the energy sector for electricity and heat production, losses of electricity and heat in distribution and transmission, and consumption for international aviation. On the other hand, IEA TFC includes non-energy use, but the EU TFC does not. More information about the IEA statistics can be found at http://www.iea.org/stats/index.asp.

POLICIES BY SECTOR

Electricity

The NREAP sets the target of a 10.9% share for renewable energy in electricity generation in 2020. A new legal framework was set up under the Electricity Act of 2007 (2007/LXXXVI) which substantially increased support for renewables in electricity generation. The new law made it possible to sell electricity produced from renewables or by cogeneration for a set feed-in tariff. The feed-in tariff for cogeneration also applies to power plants running on fossil fuels. The tariff structure differs by technology, installed capacity, power plant efficiency and the return on investment. A feed-in tariff was also established for renewables from waste. The Hungarian Energy Office sets the amount of electricity from renewable energy sources that can be sold with a feed-in tariff. The Electricity Act also gave the government the right to define a start date for a green certificate system. If such a system were to be created, the feed-in tariffs would be removed.

In the NREAP, the planned transformation of the mandatory off-take (MOT) scheme (see Chapter 10 on Electricity) will be complemented in 2011 by a review of price subsidies to fossil fuels, the possible introduction of green certificates, simplification of the official licensing procedures and measures to facilitate the connection of electricity produced from renewable energy sources to the grid.

Heating and cooling

According to the government, the share of renewable energy in the production of heating and cooling was 9% in 2010. The NREAP sets the target of 18.9% for 2020. The energy efficiency of Hungarian buildings is below the EU average, and thus, their reconstruction and modernisation represents significant potential to realise gains in efficiency (see Chapter 4 on Energy Efficiency). Buildings are estimated to account for 40% of Hungary's total energy consumption, and approximately two-thirds of this is used for heating and cooling. The heating of buildings is also one of the largest sources of CO_2 emissions. Thus, the government is planning to launch a comprehensive energy programme for buildings in 2011 as a part of the New Széchenyi Plan. The aim of the buildings programme will be to provide a single framework for the energy modernisation of buildings, the promotion of energy efficiency and the wider use of renewable energy sources. The programme includes financing (support programmes), regulatory (specifications, standards), and awareness-raising and information exchange sub-programmes.

One of the most widely applicable types of renewable energy sources in Hungary are heat pumps. These use terrestrial heat (ground heat, hydrothermal and aerothermal energy), which is available almost everywhere in the country. In the NREAP, rapid development is expected in the demand for heat pumps, which have benefited from a preferential tariff since April 2010.

Transport

According to the government, the share of renewable energy in total transport fuel demand was 3.7% in 2010, far short of the non-binding 5.75% target of the EU Directive on Biofuels (2003/30/EC). In the NREAP, the government has set a target for 2020 of a 10% share of renewable energy in transport fuel demand.

Hungary has significant biomass resources and, according to estimates from experts at the Hungarian Institute of Agricultural Engineering, the 2020 target could be met from the production of first-generation biofuels, while at the same time ensuring that food and feed targets are also met. The limitation to the use of biofuels in Hungary is vehicle engine technology. The government plans to financially support the uptake of vehicles that are capable of running on higher ethanol blends, primarily in the public transport sector. Biogas for transport will also be supported. Research and development will be supported for second-generation biofuels, in order for these liquids to increase penetration in the longer term. Today, ethanol accounts for about 70% of biofuels production in Hungary.

In 2009, the tax relief for biofuels mixed with petrol and diesel was abolished. It was replaced by a marketing obligation (imposing heavy fines in the case of failure to fulfil this obligation). The mandatory percentage that fuel producers, importers and distributors are obliged to market is put forth in the implementation decree of Act XCVII of 2010 on the promotion of the use of renewable energy for transport purposes and the reduction of greenhouse gas emissions from energy used in transport. The Hungarian standards allow for the distribution of E85, the bioethanol component of which is exempt from excise tax. According to Directive 2009/28/EC, the future production of biofuels must meet sustainability criteria. Development of these criteria for Hungary is in progress and implementation is proposed by end-2011.

FINANCING AND PROJECT DEVELOPMENT

The three pillars of support to renewable energy sources in Hungary are investment financing, feed-in tariffs and biofuel obligations. At the State level, the financing available for renewable energy sources includes:

- direct production (market) support for electricity and heat;
- investment support;
- interest rate subsidies, loans provided by state-owned financial institutions, refinanced credit programmes and guarantees for market loans;
- indirect production incentives, such as favourable tariffs, mandatory admixture ratios and tax benefits.

Investment support is also provided from EU operational funds.[4] The total amount for the Environment and Energy Operative Programme (2007-2013) in 2010 was about EUR 250 million (HUF 70 billion). The Environment and Energy Operative Programme (EEOP), "Increasing the Use of Renewable Energy Sources", supports the use of biomass for CHP, the production and use of biogas from biological waste, the use of geothermal energy, the installation of heat pump systems, the use of solar energy and hydropower, the installation of wind turbines not feeding power to the grid, the installation and modernisation of community district heating systems using renewable energy sources, as well as the preparation of solid fuels from renewable sources (*e.g.* the production of pellets and briquettes). Given the limited capacity for the electricity grid to accept wind power, support under the EEOP is only provided for wind power projects with a maximum capacity of 50 kW. Investors can obtain support through tender schemes. The amount of

4. See www.inforse.dk/europe/Structuralfunds/SF_Hungary_07-13.htm for more information.

support varies from 10% to 80%. Support is provided only for the portion of the investment which cannot be recouped under market conditions. This methodology takes into account the support for electricity from renewable sources which is incorporated into the off-take price of the electricity, and only provides investment support to projects which cannot be recouped even when selling at such a subsidised price.

Another scheme in the EEOP (*Renewables-based Electricity Generation, Heat and Electricity Cogeneration and Biomethane Production)* supports cogeneration and electricity generation from renewables. The scheme also supports the production of biomethane which can be fed into the natural gas network. Support is provided in the form of non-refundable grants. Grants range from a minimum of HUF 1 million (EUR 3 560) to a maximum of HUF 1 billion (EUR 3.56 million). The extent of support ranges from 10% to 70%, depending on location or income-generating potential.

Third-party financing for energy modernisation of buildings combined with renewable energy utilisation is also provided for in the EEOP. The goal of this scheme is to reduce energy consumption in public buildings through the modernisation of the electrical, lighting and heating systems and combining such modernisation with the use of renewable energy. Eligible applicants under the scheme are organisations providing third-party financing, as well as energy service companies (ESCOs), which themselves fund energy modernisation projects in such a manner that the service charge for using the project can be funded primarily from the savings achieved by the end-user. Support is provided in the form of non-refundable grants. Grants range from a minimum of HUF 3.5 million (EUR 12 470) to a maximum of HUF 200 million (EUR 712 000). The extent of support available under this scheme is 35%.

The feed-in tariff system in Hungary was modified in 2008 in favour of smaller plants and plants providing district heating. The central government does not control the budget for the system. Rates are to be adjusted yearly in line with the inflation rate.

The Hungarian government intends to implement a green taxation system in the central budget in 2011. This will be facilitated by the creation of a "Green Bank" to manage renewables and climate-related financing issues. The government also plans to reform the mandatory feed-in tariff system and set a feed-in tariff for renewable heat. Compared to other EU countries, the feed-in tariff system in Hungary has not suffered from cost overruns. However, the scheme is not as effective as in other countries at supporting small-scale systems. The government is currently examining the benefits and disadvantages of the system and plans to implement a reformed system in 2012.

The "Energy Centre" in Hungary is a non-profit organisation owned by the Ministry of National Development. It is the agency responsible for improving energy efficiency and expanding the use of renewable energy. The Energy Centre manages most of the statistical issues related to energy, manages subsidies and loans for energy efficiency and renewable energy sources, arranges information and public awareness campaigns and prepares the government's strategy for energy efficiency and renewable energy sources. The Energy Centre manages the EU tender schemes and the EEOP.

CRITIQUE

The share of renewables in energy demand in Hungary has increased impressively over the past decade. The government has set an ambitious target of increasing the share to almost 15% of gross final energy consumption by 2020, nearly two percentage points higher than its EU obligatory target. The National Renewable Energy Action Plan (NREAP) of Hungary presents a wide array of measures aimed at meeting the national target. Renewable energy also features prominently in the government's New Széchenyi Plan for economic recovery.

In the past, Hungary's success in increasing the use of renewable energy has depended almost entirely on bioenergy for heat, electricity and transport fuels. The country's fields and forests are well suited for producing biomass for various purposes, including energy. Given the technology-specific targets in the NREAP, domestically produced biomass is also expected to account for most of the increase in renewable energy use in the future. Whether increasing biomass supply is the most cost-effective way for Hungary to increase renewable energy use, however, should be based on an analysis of the economic, social and environmental impacts of exploiting its potential for energy. As competition for biomass resources to reach specific energy targets could disrupt the supply for other products and affect GDP and employment, a full assessment of the biomass resource is needed, also employing economic, environmental and policy-effectiveness indicators, such as toe/ha, HUF/toe, CO_2 emissions/km travelled, and investment costs in terms of HUF/t CO_2 avoided.

An area worth serious consideration is biomass use in cogeneration. Increasing the use of biomass in cogeneration plants would reduce the need for fossil fuels and help meet the EU 2020 target. Gas dependence would decrease and energy security would improve. In practice, such a transition to low-carbon heating could be facilitated by introducing a CO_2 tax on heating fuels. Such a tax incentive has proved very successful in Sweden where most towns and cities have district heat from cogeneration plants and where biomass is the main cogeneration source. At the same time, the government should encourage increases in power plant efficiency. It should also consider a larger role for more decentralised use of biomass in power and heat generation.

While biomass will account for most of the increase in renewable energy supply in the period to 2020, the NREAP does foresee a decline in the *share* of biomass in overall renewable energy supply, from over 80% today to some 60% in 2020. The government should assess technical, economic and environmental potential for other resources, such as geothermal and solar energy and wind and hydropower. These assessments should include the costs of investments that are needed for enabling the Hungarian electricity network to handle larger volumes of variable power.

Since 2001, the government has subsidised electricity generation from renewable sources through feed-in tariffs. It is contemplating switching to a green certificate scheme from the current system. This decision should be based on a careful consideration of all potential outcomes. The IEA encourages the government to take an objective look at the cost-effective potential for renewable electricity in the country. Often, improving the design of existing policy support schemes is more effective than a switch to a different policy scheme.

The government should also ensure that any future system maximises flexibility, while providing predictability to reduce investor risk. Depending on the development of the recently established power exchange HUPX, the feed-in tariff could be provided in the form of a decreasing premium on the spot market price – the higher the spot price, the lower the feed-in tariff needed. Such a premium system, which is used in Spain, would provide some revenue guarantees, but also long-term downward pressure on prices. Alternatively, the government could consider a quota obligation with tradable certificates, possibly differentiated by technology and linked to green certificate systems in other countries. Such systems are used in several IEA member countries, including Denmark, Sweden and Poland.

In addition to feed-in tariffs for renewable energy, the government also subsidises cogeneration from non-renewable sources (by the time of writing in April 2011). As part of its review of fossil fuel subsidies, the government should consider abolishing this particular subsidy as soon as possible.

Several IEA member countries have experienced feed-in tariff budget overruns and subsequent abrupt reductions in tariff levels. When reviewing the renewable support system, the government should either limit the absolute spending on individual technologies or limit the share of individual technologies in total spending on feed-in tariffs to avoid cost overruns in the case feed-in tariffs are raised.

The Hungarian government has issued several calls for tender for renewable energy projects, asking project developers to submit bids to develop such projects. The winning parties will be offered standard long-term purchase contracts while the price will be determined competitively within the tender procedure. Tendering allows for incorporation of additional conditions, *e.g.* regarding local manufacturing of technology. A disadvantage of tenders, however, is the risk that the project could turn out to be more expensive than predicted when drafting the bid, or that the project will not be bankable after all. This might lead to the granted project not being realised. In several countries, such as Ireland and the United Kingdom, the overall number of projects actually implemented following a tender has been very low. These countries abolished their tender schemes. Hungary could benefit from a careful examination of the experiences with tender schemes in other countries, when evaluating its own schemes.

RECOMMENDATIONS

The government of Hungary should:

- ☐ *Assess the cost-effective potential for a combination of heat, transport fuels and electricity from renewable sources in meeting the 2020 target; revise policy and incentive systems accordingly.*
- ☐ *Consider strongly increasing production from a variety of biomass resources for energy purposes, but only if it is merited by a full assessment of the optimum use of the resource.*
- ☐ *Consider increased use of biomass in district heating, where appropriate; consider progressive taxation of fossil fuel use for heating and abolish feed-in tariffs for cogeneration electricity produced from fossil fuels.*
- ☐ *Consider the cost-effectiveness and technology mix of the existing feed-in tariff system and, when modifying the system or introducing an alternative one, for example a premium system or a tradable certificate system, ensure that any future system maximises flexibility, while providing predictability to reduce investor risk.*

9. NUCLEAR ENERGY

Key data (2010 estimates)

Number of plants and reactors in operation: one nuclear power station with four reactors

Installed capacity: 1.9 GW

Gross electricity generation: 15.8 TWh

Share of nuclear: 16% of TPES and 42% of electricity generation

OVERVIEW

Hungary has a long and successful history with nuclear power. Four nuclear power plants (NPPs) with Soviet-designed VVER-440/V-213 pressurised water reactor (PWR), currently in operation at the Paks nuclear power station (NPS), supply over 40% of the electricity generated in the country (43% in 2009). Electricity generated at the Paks NPS is low-cost and free of greenhouse gas emissions. Plant details are listed in Table 7.

The four 440 MW_e (gross) PWRs were brought into service successively through the 1980s with an expected service lifetime of 30 years. All units have been modified and upgraded to Western European reactor safety standards and power output has been increased to 500 MW_e (gross) over the course of two upgrades. During the last few years, the Paks NPS has been preparing for a lifetime extension of 20 years for each of the four units. Preliminary work to add new reactors has also been undertaken.

The Paks NPS is owned and operated by the joint stock company Paks Nuclear Power Plant Ltd. established in 1992. The state-owned Hungarian Power Companies Ltd. (MVM) controls virtually all of the stock (>99%), with very minor shares held by MVM's parent, State Asset Management Ltd. and local authorities. The government retains a "golden share" in the company.

Table 7. **Nuclear power plants in operation in Hungary**

Name	Type	Net capacity (MW_e)	Commissioning date	Electricity generation in 2010 (TWh net)	Lifetime electricity Generation through to 2010 (TWh net)
Paks 1	PWR	470	1982	3.7	90.7
Paks 2	PWR	473	1984	3.7	80.5
Paks 3	PWR	473	1986	3.8	79.9
Paks 4	PWR	473	1987	3.3	79.4
Total		**1 889**		**14.5**	**330.5**

Sources: International Atomic Energy Agency (IAEA) PRIS database, OECD Nuclear Energy Data, 2011.

Nuclear activities are regulated by the Hungarian Atomic Energy Authority (HAEA), an autonomous regulatory agency. The government has no influence or input into HAEA's licensing decisions. PURAM (Public Agency for Radioactive Waste Management) is the organisation established to take responsibility for spent fuel storage, radioactive waste management and decommissioning of nuclear facilities.

DEVELOPMENT HISTORY

Performance records show that the Paks NPS has had a successful operational history. The four units have been run efficiently, obtaining a lifetime capability factor (the ratio of the available energy generation over a given time period to the reference energy generation over the same time period) of 84.7%, placing them in the top ten of the world (IAEA's PRIS database). This factor has been increased to between 86.1% and 87.7% from 2007 to 2009.

All units have been modified and upgraded to Western European safety standards. A comprehensive safety evaluation of the units was completed in 1994 and upgrades to systems between 1996 and 2002 brought the reactors to standards equivalent to NPPs of similar age in Europe and elsewhere. During the same period, efficiency was enhanced through reconstruction of the secondary loop and turbine replacements, increasing the original gross output of 440 MW_e to 470 MW_e. A second power uprate between 2006 and 2009 raised gross power to 500 MW_e. Modifications carried out during scheduled outages for each unit included the introduction of a new type of fuel assembly with higher enrichment, modernisation of the in-core monitoring system, reconstruction of the primary pressure control system and modification of the turbine and its control system. Today, the four units have a combined gross generating capacity of 2 000 MW_e, and a net capacity of 1 889 MW_e.

The most important modification in the most recent power uprate is the new fuel. Because enrichment levels have been increased, both the amount of fresh fuel required and the amount of spent fuel discharged will decrease. Another important feature of the new fuel is its burnable poison content, which is designed to increase operational safety. The introduction of the new fuel assemblies is to proceed step by step according to the international practice, requiring a licence from the Hungarian Atomic Energy Authority (HAEA) at each step. Mixed core use (*i.e.* present and new fuel types together), beginning with Units 3 and 4 and progressing to all four units in 2010, is the initial phase of a four to five year transition period. The licence in principle for this process was issued in 2009. Surveillance and control of operation will receive increased attention during this period. A preliminary assessment of the results of the deployment of the test fuel assemblies shows that the new fuel can be handled and operated under present technical conditions at the Paks NPS.

REGULATION

Nuclear activities are regulated by the Hungarian Atomic Energy Authority (HAEA), an autonomous regulatory agency. The government has no influence or input into HAEA's licensing decisions. Recommendations for legislative changes to regulatory requirements and licensing decisions by HAEA are enacted by the Hungarian Parliament.

A key objective of the HAEA is to ensure that the local population, environment and operating personnel do not suffer any harm from the operation of a nuclear installation.

It also works to raise the standard of safety culture, within both its own organisation and the organisations that it supervises.

The HAEA is an organisationally and financially independent public administration body. It cannot be directed in its scope of authority as defined by law. The Minister of National Development, acting on behalf of the government, supervises the HAEA independently of its portfolio.

HAEA staffing and compensation follow Hungarian public service rules and regulations. Given current austerity measures in the Hungarian public service, retaining experienced regulatory staff may become a challenge for HAEA since countries developing nuclear energy, particularly those without past experience and expertise, are actively recruiting regulators by offering competitive compensation packages.

SAFETY

In the more than two decades of operation, all four units have been run safely with only one serious incident and a second incident of note. Neither incident resulted in fatalities or exposure of workers or local residents to unsafe levels of radiation, either within and outside the Paks NPS.

Like other nuclear facilities, the plant was built and is operated under a defence in-depth principle. Pursuant to the regulations of the governmental decree, the Nuclear Safety Code is revised and updated every five years. This was most recently done by HAEA in 2008. Owing to the measures and modifications implemented in the power uprating programme, the safety of the Paks NPP has been further enhanced, resulting in the reduction by an order of magnitude of the probability of core damage due to internal initiating events, compared to the initial assessment.

Pre-Installation Safety Analysis and Preliminary Safety Analysis reports were prepared early in the construction and operation of the Paks NPS. In addition, a comprehensive safety review was undertaken between 1992 and 1995 in order to assess the safety of the NPS and, to bring it in line with prevailing standards, periodic safety reviews are conducted. In addition, special attention has been paid to utilising international experience. By the end of 2009, a total of 34 international reviews had been conducted at the Paks NPS.

Site assessments have also included research, conducted with the assistance of IAEA officials, to evaluate earthquake risk. Hungarian territory is not particularly seismically active and large, severe earthquakes are rare. The value considered in the original design was 6 on the Medvedev-Sponheuer-Karnik (MSK) intensity scale based on historic earthquake records (where 6 is described as "…strong, with isolated cracks on ground", equivalent to a magnitude 5.2 earthquake on the Richter scale). Although stronger earthquakes are known to occur in the region (MSK 8, or 6.7 on the Richter scale at the epicentre), they have been less frequent (once every 40 to 50 years). Historical experience, combined with detailed geological and geophysical studies at the site and its surroundings, and micro-seismic monitoring (in place since 1995), have not indicated a need to change the original design specifications since they are considered sufficiently robust to protect the plant from earthquake damage.

The Paks NPS is situated adjacent to the Danube River in order to source significant volumes of water needed to operate the facility. If all four units are in operation during the autumn season, some 10% to 11% of the total flow of the river can be removed by

Paks for cooling. Using a once-through system design, water used for cooling is returned to the Danube at a warmer temperature than the river water. Licence requirements specify that the return water temperature cannot exceed 14°C if the river water temperature is below 4°C, and the maximum return water temperature cannot exceed 30°C at a distance 500 metres from the point of entry. Monitoring of return water temperatures shows that these limits have not been exceeded.

Statistical analyses of floods indicate that the probability of a flood reaching a level of 96.36 mB and 95.62 mB (above Baltic Sea level) in icy waters and ice-free waters, respectively, is 10^{-4}/year (0.01%). The landfill level of the power plant site has been defined as 97 mB, some 40 cm higher than the flood control dyke in the vicinity of the power plant and 24 cm above the highest water level calculated to occur once every ten thousand years.

INCIDENTS OF NOTE

On 10 April 2003, an INES level 3 (serious) incident occurred while fuel from unit 2 was being cleaned. During a scheduled maintenance shut-down, 30 fuel assemblies had been removed from the reactor and placed under approximately 10 metres of water in a fuel cleaning tank, adjacent to the fuel pool. Cleaning was required because of the build-up of magnetite deposits on the fuel assembly cladding that affected the flow of coolant, in turn reducing power output. Initial indications of increased radiation levels during the cleaning process led operators to suspect that a fuel assembly was leaking due to the cleaning process. However, during an inspection performed several days later, it was revealed that most of the fuel had suffered heavy damage due to insufficient cooling in the fuel cleaning tank.

At the request of the Hungarian government, the IAEA conducted an independent expert mission and determined that a poor cleaning tank design, combined with a weak safety analysis and inadequate operational oversight had contributed to the incident. Unit 2 remained shut down into 2004 as further safety analyses were conducted and regulatory oversight was performed. Significant resources were devoted to the recovery operations and to the prevention of a similar event. Unit 2 was returned to service in August 2004, but shut down again in October 2006 in order to remove the damaged fuel assemblies. Following the successful removal of the damaged fuel assemblies, unit 2 was restarted at the end of 2006.

On 4 May 2009 an incident occurred in the reactor hall of unit 4 during a planned outage when a wire cable holding a self-powered neutron detector broke and fell onto the working area, affecting the decontamination tank for control rod drivers. All staff in the reactor hall was evacuated as a precautionary measure and no injuries occurred.

PLANS FOR FURTHER DEVELOPMENT

Nuclear power has a high level of public and political support in Hungary. The Paks NPS is the largest source of greenhouse gas emission-free electricity generation. With the government’s plan to reduce carbon emissions in electricity generation and the need to replace ageing generating facilities, initiatives to increase plant lifetime operation at Paks and to possibly build additional NPPs are under way.

Over the course of the past few years, the Paks NPS has been preparing for a lifetime extension of 20 years beyond the original 30-year design lifetime. The lifetime extension programme (LEP) is to be carried out in a sequential fashion as each unit reaches the end of its original 30–year operational lifetime, beginning with the first unit in 2012. Working closely with the regulator, staff at the Paks NPS have conducted analyses and prepared submissions to the Hungarian Atomic Energy Authority outlining actions required for lifetime extension. Owing to the depth and detail of the preliminary work, it is anticipated that the LEP will proceed smoothly for all four units. This is important, because the lifetime extension of the Paks NPPs is a key element of energy supply in the country given its significant baseload electricity generating capacity.

On 14 November 2008, a LEP licence application for the Paks NPS was formally submitted to HAEA. The conditions necessary for execution of the LEP were approved in June 2009 and simultaneously further activities and tasks were identified. Preparatory work continued through 2010.

In recognition of the positive aspects of this source of electricity generation in Hungary, Paks is preparing for the possible addition of as many as two new nuclear reactors at the site. In 2009, Parliament overwhelmingly supported a decision in principle to begin preparations for the construction of new units, initially at the Paks site where up to an additional 2 GW_e could be accommodated. Preparations for the construction of new Paks units have been ongoing since, such as site activities undertaken in 2010 to obtain an environmental licence, public communication and engineering, financial and legal analyses. The timely addition of new nuclear units will enhance security of energy supply and form a fundamental part of the government's long-term plan to decarbonise the electricity sector in Hungary.

FUEL CYCLE FACILITIES

Hungary currently has no nuclear fuel production infrastructure (uranium mining, refining, conversion, enrichment and fuel fabrication facilities) and no reprocessing facilities. Nuclear fuel for the four Paks reactors is purchased exclusively from the Russian Federation and a strategic reserve of two years of fuel supply is maintained at the NPS.

Between 1956 and 1997, uranium was mined at the underground Mecsek mine by the state-owned (until 1992) Mecsek Ore Mining Company, producing a total of just over 21 000 tonnes of uranium (tU). Until an ore-processing plant became operational at the site in 1963, all ore was shipped to the Sillimae metallurgy plant in Estonia. After 1963, uranium concentrates produced at the processing plant were shipped to the former Soviet Union. The mine was closed in 1997 because of poor market conditions. Remediation activities began the following year and were completed in 2008. Ongoing treatment of contaminated water from the mine and tailings ponds results in the collection of about 1 to 3 tU (metal) per year.

With generally increasing prices since 2003 and prospects of rising demand, uranium exploration and mine development activities were restarted in many countries, including Hungary. In 2009, Australian-based Wildhorse Energy signed a co-operation agreement with Mecsek-Öko and MECSEKÉRC, Hungarian state-owned companies that are currently responsible for uranium mining, exploration and rehabilitation activities. The intent of this agreement is to work towards the resumption of uranium mining in the Mecsek Hills. Wildhorse Energy is continuing exploration activities with the aim of defining a sufficiently large resource base to support commercial mining operations.

WASTE MANAGEMENT

POLICY AND LEGISLATION

The Hungarian Atomic Energy Act (Act CXVI, 1996) states that long-term radioactive waste management and decommissioning of nuclear facilities are the state's responsibility and that the work is to be carried out by a national radioactive waste management organisation appointed by the government. In 1998, the Public Agency for Radioactive Waste Management (PURAM) was established to carry out these tasks.

In accordance with the polluter-pays principle, radioactive waste management activities are financed by the entities generating the wastes. To finance these activities, the Atomic Energy Act directed the establishment in 1998 of the Central Nuclear Financial Fund (the Fund). Since its formation, the Fund has been accumulating capital through tax-like instalments made by waste generators. Managed by HAEA and supervised by the Ministry of National Development, the Fund is strictly segregated. That is, according to the relevant act on the rules of national finance it is to be used only for the purposes specified in the Atomic Energy Act. Hence, the government is bound by law to use the Fund only for waste management activities defined in the act. The Fund is authorised to finance tasks pertaining to the final disposal of radioactive waste, interim storage and final disposal of spent fuel and the decommissioning of nuclear facilities.

The largest contributor to the Fund is Paks as the main waste producer. It is required to make annual payments during the operational lifetime of the NPS. Radioactive wastes in significantly smaller quantities are also generated by research institutes as well as health, industrial and agricultural institutes and laboratories. Each year, in course of the preparation of the next national budget, a well-defined cost estimate mechanism is applied in order to determine the next annual payment from Paks and other waste producers. One portion of the annual payment is used to cover activities planned for the following fiscal year, while another portion is accumulated in the Fund for future liabilities. In order to ensure that the Fund maintains its value, the government contributes to the Fund an amount that is calculated on the average assets of the Fund in the previous year using the average base interest rate of the Hungarian Central Bank in that year.

By the end of 2010, some EUR 630 million (around HUF 177 billion) had been accumulated in the Fund. Expenditures from the Fund in 2011 to finance the ongoing programme of waste disposal are expected to amount to some EUR 62 million (HUF 17.4 billion).

LOW- AND INTERMEDIATE-LEVEL RADIOACTIVE WASTE

In 2005, after a decade spent finding an acceptable site for a new low- and intermediate-level radioactive waste (L/ILW) repository, the Hungarian Parliament approved in principle the construction of the National Radioactive Waste Repository in the vicinity of Bátaapáti village (Tolna County). This facility is designed to accommodate the safe disposal of L/ILW arising from the operation and the subsequent decommissioning of the Paks NPPs. In addition to the ongoing underground research activities, both the licensing procedure and the preparation for construction began in 2006. An environmental licence was issued in 2007 and the construction licence for the surface facilities and four underground disposal vaults was issued in 2008. By October 2008, surface buildings were completed and an operating licence was issued.

The operating licence for the surface facilities authorises the interim storage of 3 000 drums (each with a capacity of 200 litres) containing solid low-level radioactive waste, principally from the Paks NPS. The first contingents of waste were delivered by the end of 2008 and by the end of 2009 a total of 1 600 waste drums were loaded into the storage hall of the repository. The first two underground disposal vaults are planned to be put into operation around 2012 after the operating licence is extended to cover future disposal activities.

Institutional L/ILW is being disposed of in the Radioactive Waste Treatment and Disposal Facility located in Püspökszilágy, some 30 km from Budapest. This facility was completed in late 1976 and began receiving wastes in 1977. By the end of 2004, the original capacity of the storage facility had been reached. The safety of the facility was assessed from 2002 to 2005 and upgrade work is ongoing. This work, combined with some repackaging of wastes in the facility, has created additional disposal capacity which will host low and intermediate level wastes from plants other than nuclear.

HIGH-LEVEL RADIOACTIVE WASTE

In the early phase of the development of Paks, spent fuel from the NPS was sent back to the then Soviet Union for reprocessing after three years in cooling pools with no requirement for Hungary to take back the recovered reusable material or waste products. Between 1989 and 1998, a total of 2 331 spent fuel assemblies were shipped back to the Soviet Union and subsequently the Russian Federation.

Changes to the reprocessing contracts, along with political and economic changes in Europe and the Soviet Union in the late 1980s, underlined the need for the development of a domestic alternative to this process. As a result, in 1991 a decision was taken to develop an interim spent fuel storage facility near Paks. The strategy then adopted by Hungary, like other countries with NPPs, is to store spent fuel assemblies removed from the reactor for 50 years in a dry storage facility (after a minimum of three years in cooling ponds), followed by disposal in an underground, purpose-built geological repository.

To this end, an interim facility to store the spent fuel, with a modular vault design (by GEC Alstom, UK), was constructed in the vicinity of the Paks NPS. It has been receiving irradiated fuel assemblies since 1997. The capacity of the first and second stages of the facility (a total of 16 storage modules, each with a capacity of 450 assemblies) provides sufficient space for the number of spent fuel assemblies arising from 16 years of operation of the NPS. At the end of 2009, a total of 6 067 assemblies were stored in the facility. The stepwise enlargement of the facility through the construction of additional modules continues. By the end of 2011, a further four storage modules (modules 17 to 20) are to be added. The necessary subsoil stabilisation work was undertaken in 2009 and construction of the modules began in 2010.

A programme to develop a solution for the disposal of high-level long-lived radioactive wastes and spent fuel (not recognised as waste according to current regulation) was approved by HAEC in November 1995. The initial work, carried out by Atomic Energy of Canada Limited and the Mecsek Ore Mining Company, involved *in situ* investigations of a clay formation accessible through underground workings in the uranium mine. Although the geology of the site was considered suitable for the disposal of spent nuclear fuel, the closure of the uranium mine in 1998 brought underground investigations to an end and a proposal to construct an underground research centre at the site was rejected.

PURAM then developed a nation-wide research programme of geological and geophysical mapping, as well as shallow and deep boring, in order to identify a suitable location for an underground research laboratory at a potential site for the disposal of high-level radioactive wastes. This programme was accepted in 2003 and launched in 2004.

The research programme confirmed that the Boda aleurolit clay in the western Mecsek Mountains, the site of previous investigations, was a suitable geological formation for the disposal of long-lived radioactive wastes and spent fuel assemblies because of its favourable hydro insulation and isotope-binding properties. Investigations continue at this site in parallel with a public consultation programme. The ongoing life extension programme for the Paks NPS stimulated a review of this programme, including the timing of implementation and reconsideration of the option of returning spent fuel to the Russian Federation for reprocessing.

The fuel assemblies utilised in research and training reactors differ in many aspects from the fuel assemblies used in the Paks NPS. At the Atomic Energy Research Institute (KFKI AEKI), spent fuel assemblies from the Research Reactor of Budapest (RRB) are housed in two on-site storage pools. Shipment of the first part of the RRB spent fuel to Russia took place in 2008 and the transition from highly enriched fuel (36%) to low enriched fuel (20%) is ongoing. Possible further return shipments could create sufficient space for the interim storage of the remaining spent fuel assemblies generated until the end of the lifetime of the RRB in 2023.

With respect to the 100 kW training reactor at the Institute of Nuclear Techniques of the Budapest University of Technology and Economics (BME NTI), it is possible that return shipments of the irradiated fuel assemblies to the Russian Federation could be made together with the spent fuel assemblies from the RRB. However, no decision has been taken.

ISSUES OF NOTE

As directed in relevant sections of the Atomic Energy Act, both PURAM and Paks have created and operate a programme of public outreach in order to provide information and, in the case of radioactive waste repositories, consultation with communities near established repositories or potential host sites. Owing to the good safety record, the efficient operation of the facility and the outreach and education efforts of the industry, the Paks NPS enjoys strong public and political support.

PURAM has been and remains active in these public consultations. Its ongoing public consultation programme concerning the waste facilities described above spans 36 municipalities and 86 700 citizens. Public consultations on all aspects of the nuclear fuel cycle are an important component of communication, public understanding and, ultimately, the success of nuclear power programmes.

A mock reactor in the Paks Maintenance Training Centre, constructed with never-used parts of abandoned installations, is a unique training facility. It has all the key components in place: a 250-tonne pressure vessel, a steam generator, circulation pumps, piping and other such internals. These are identical with those in working units, although never used or contaminated.

The components were originally manufactured for VVER-440 reactors intended for NPPs in former East Germany and Poland that were never built. The result is a mock reactor that serves as a maintenance training centre for plant operators, the first of its kind for this type of reactor. Its use has improved overall safety culture and practices in the plant and all organisations involved in nuclear power in Hungary.

The Training Centre is especially important because these reactors were not designed to easily accommodate regular safety inspections and maintenance, as is normally required. Because parts of the core area cannot be reached easily, remote controlled devices have been developed to perform these tasks. The full-size core provides a realistic training experience that allows maintenance staff to develop and practice routines before doing so on the operating reactors. This preparation allows them to work quickly and accurately on the operational reactors, minimising time and radiation exposure. The facility is also used to train recruits to replace plant workers reaching retirement age and is available for training technicians from other countries with similar operating VVERs.

In 2008, HAEA initiated the development of the Hungarian Nuclear Knowledge Base (HNKB) to archive, update and put to use knowledge accumulated over the years of nuclear energy use in Hungary. The HNKB will be of benefit to both present and future generations, including regulators, the licensees of nuclear facilities and the research and engineering community. The HNKB includes design documents for facilities, as well as Hungarian, foreign and international legislation, standards, regulatory documents and research reports, plans and training materials pertinent to nuclear energy. The pilot project started in September 2008 and was initially meant for HAEA inspectors. Other participants will be invited to contribute to and use the HNKB after clarification of copyright issues and development of co-operation agreements. The project is supported by the IAEA.

CRITIQUE

Good progress has been made in nuclear energy in Hungary since the last IEA in-depth review. The Paks NPS has completed upgrading all four reactors to 500 MW_e (gross) each, as planned. It has also worked with the HAEA to assess and develop plans for regulatory approval to extend the operational life of each of the four units from 30 to 50 years. With all lifetime extension documents developed with and approved by HAEA, the lifetime extension licence is planned to be applied for one year before each reactor would be retired from service according to its originally expected operational lifetime. For Paks-1, this is to be done in 2011.

Given the key role that these facilities play in the production of electricity in Hungary, the success of the lifetime extension programme is vital in order to meet near-term domestic energy demand. Given the country's success with nuclear power, it is now in the initial stages of planning for the construction of new reactors. Construction of new reactors to replace the Paks units (expected to be retired from service in the 2030s following lifetime extension) will be required if Hungary's long-term energy policy goals of providing a secure supply of competitively priced electricity while minimising carbon emissions are to be achieved.

The independence of HAEA has been further strengthened since the last IEA review in 2006. The strong operating record of the Paks NPS is a credit to the plant operators and the performance of HAEA. With lifetime extensions being implemented and new build plans being formulated, regulatory capacity and competence will need to be maintained.In order to continue its operations with highly qualified and experienced professionals, HAEA should be in a position to offer internationally competitive compensation to its staff in order to retain experienced personnel in the country. Hungarian public service rules and regulations on staffing and compensation may hinder HAEA in doing so.

The accident at the Fukushima Daiichi NPP in Japan has in several countries prompted a reconsideration of developing nuclear power. The member states of the European Union, including Hungary, have decided to rigorously examine safety standards at currently operating NPPs. The work conducted by employees at Paks and the HAEA has prepared the facility well for such scrutiny. This is important, given that continued operation of the Paks NPS is crucial to Hungary's electricity supply and that the government is planning a large role for nuclear power in the country's long-term energy strategy.

RECOMMENDATIONS

The government of Hungary should:

- ☐ *Develop a timetable identifying key decision points in the process to build new nuclear generating capacity and focus government efforts on adhering to the schedule in order to facilitate the timely addition of this capacity.*
- ☐ *Ensure that the independence, competence and authority of the HAEA are not compromised by reorganisations.*
- ☐ *Work with HAEA to ensure that the regulatory agency has all the tools required to maintain adequate staffing and the required levels of expertise, particularly as the process to prepare for the construction of new nuclear units goes forward.*
- ☐ *Ensure that further development of nuclear energy, whether in terms of lifetime extension, current operation or new build, incorporates lessons learned from international experience, including any changes in procedures and safety regulations that may arise as a result of the accident at the Fukushima Daiichi NPP in Japan.*

10. ELECTRICITY

Key data (2010 estimates)

Installed capacity: 9.2 GW

Total electricity generation: 37.4 TWh, +6% from 2000

Peak demand: 6.6 GW

Electricity generation mix: nuclear 42%, natural gas 31%, coal 17%, combustible renewables and waste 7%, oil 1%, wind and hydro 1%.

SUPPLY AND DEMAND

SUPPLY

In 2010, total electricity generation reached around 37 TWh (Figure 26). Following the economic crisis, in 2009 electricity generation was 36 TWh, 10% lower than the all-time record of 40 TWh, reached in 2008. In the boom years from 2004 to 2008, electricity generation had increased by 19%.

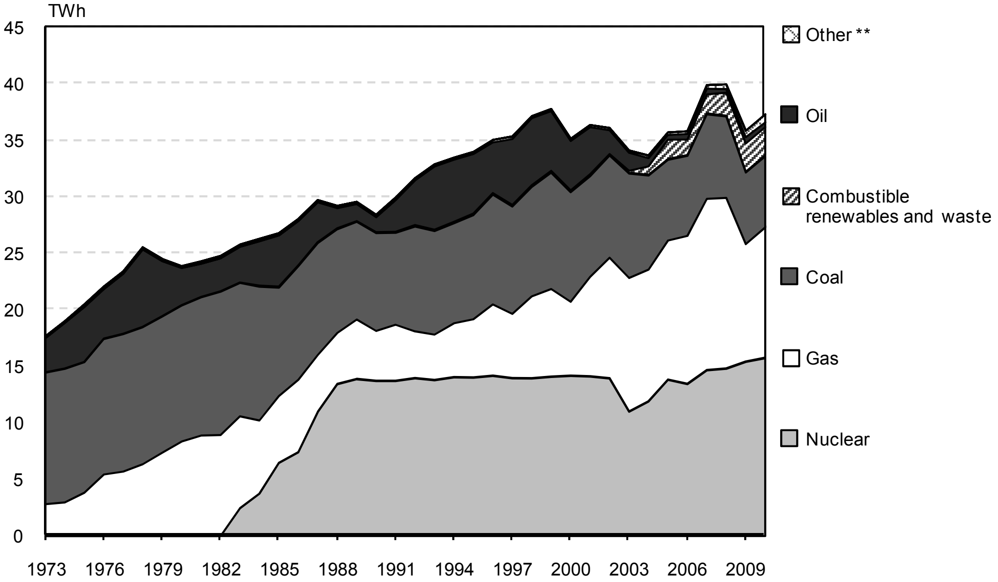
Nuclear power accounted for 42% of total electricity generation in 2010. Natural gas was the second-largest source with 31%, followed by coal (17%), and combustible renewables and waste (7%); wind and hydropower contributed a negligible share of the total. Over the last years, natural gas use for electricity generation has increased markedly, from 6.6 TWh in 2000 to 15.2 TWh in 2008. It dropped to 10.4 TWh in 2009, but increased to 11.6 TWh in 2010. The large drop in 2009 reflects the role of Hungarian gas-fired capacity as the marginal producer in the region where an economic downturn affected electricity demand in all countries.

In its scenarios from 2010, the government foresees electricity supply to increase until 2030 at an annual rate of 2.7%. This growth should primarily come from nuclear and gas-fired power plants, while coal is expected to decline in share. Electricity from biomass and waste is foreseen to increase marginally. The 2010 scenarios will be updated as part of the 2030 energy strategy which is expected to be adopted in 2011.

A significant share of electricity supply in Hungary is imported. In 2010, the net imports of 5.2 TWh provided 14% of total supply. Imports reach a higher share at peak electricity use. For example, in summer 2009, imports covered 30% of peak demand.

Most electricity imports to Hungary come from two countries: in 2009, the Slovak Republic supplied 6.0 TWh and the Ukraine 2.7 TWh (see Figure 27). On the other hand, Hungary also exports large amounts of electricity, mainly to Croatia (3.3 TWh in 2009) and Serbia (1.3 TWh). In total, cross-border trade in electricity amounted to around 40% of total electricity supply, much higher than the IEA average of 7%.

Figure 26. **Electricity generation by source, 1973 to 2010***

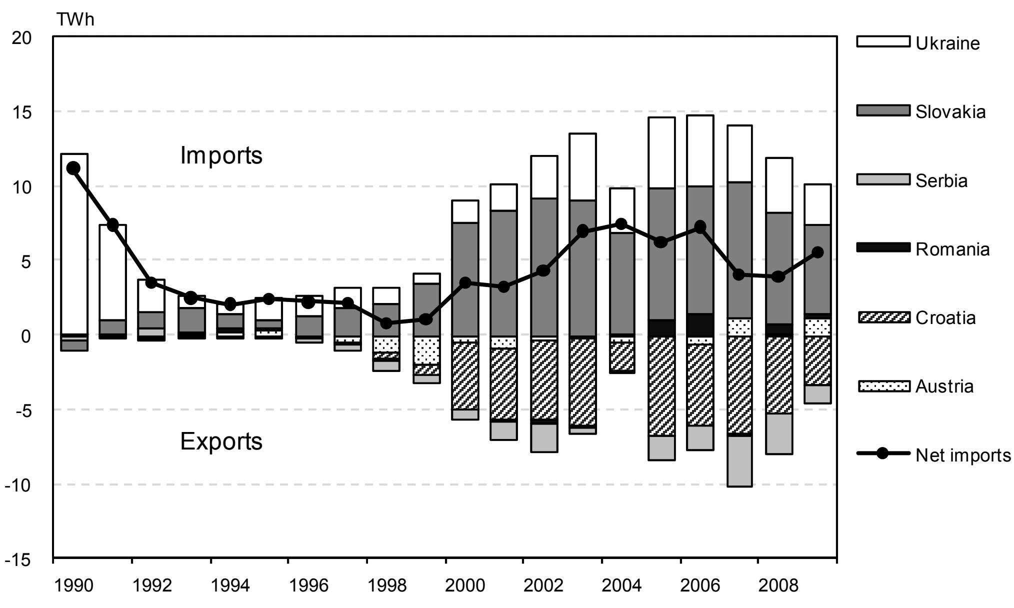


* Estimates for 2010.

** Negligible.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2010 and country submission.

Figure 27. **Electricity trade, 1990 to 2009**



Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2010.

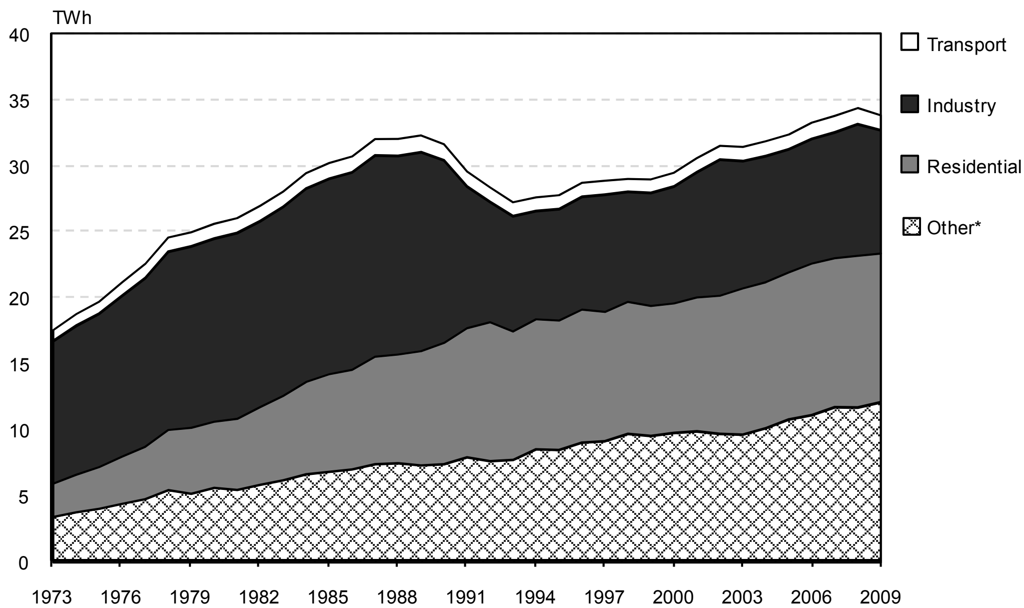
DEMAND

Electricity demand has steadily increased from the mid-1990s, growing on average by around 1.6% per year over the last decade (see Figure 28). In 2009, electricity demand dropped because of the economic crisis, but still remained higher than in 2007. In its

National Renewable Energy Action Plan (NREAP), which was adopted in December 2010, the government projects electricity use to increase from 41.5 TWh in 2009 to between 51.5 and 53 TWh in 2020.

Electricity demand is divided between three main sectors. Commercial and public services (other) were the largest electricity consumer in 2009, with 11 TWh, or one-third of the total. This sector has grown faster than any other, at 2.4% per year over the last decade. The residential sector also accounted for nearly one-third of electricity demand, while industry, with 9.3 TWh in 2009, accounted for 27%. The transport sector consumed about 1 TWh in 2009.

Figure 28. **Electricity consumption by sector, 1973 to 2009**



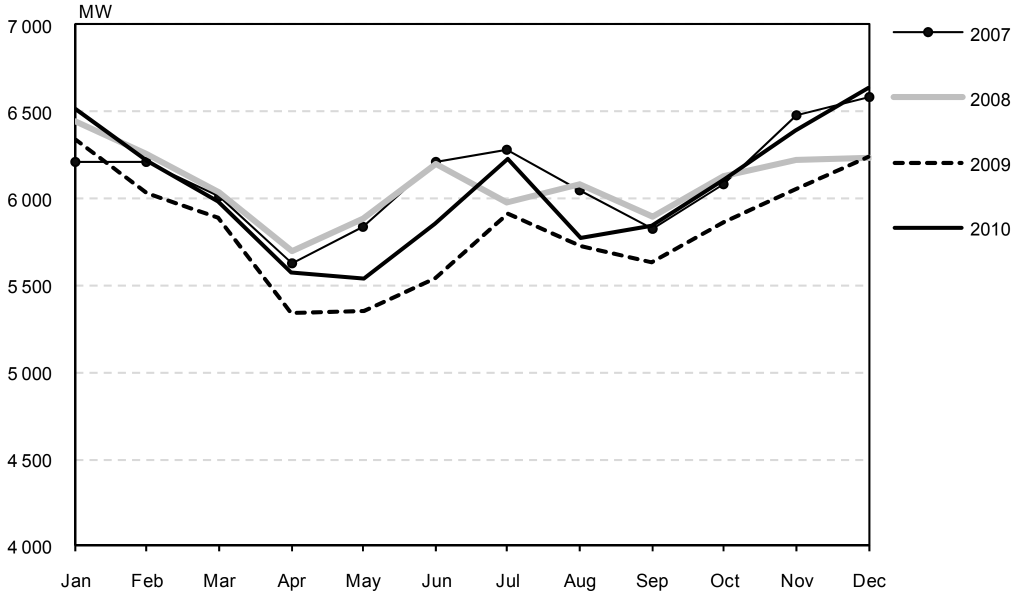
* *Other* includes commercial, public service, agricultural, fishing and other non-specified sectors.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2010.

Electricity consumption per capita is relatively low in Hungary. At 3.5 MWh in 2009, it was 17% higher than in 2000, but less than half the OECD average of 7.5 MWh per capita in 2009. The government expects electricity consumption per capita to continue to increase to 2020 and beyond.

Electricity demand typically peaks in winter, but the summer peak is reaching closer to the winter peak level, mainly owing to the increasing use of air-conditioning (see Figure 29). In 2010, the winter peak reached 6 600 MW, up from 6 000 MW in 2001. The summer peak in 2010 was 6 200 MW, up from 5 000 MW in 2001.

Figure 29. **Monthly peak demand, 2007 to 2010**



Source: MAVIR.

GENERATING CAPACITY

In 2009, total installed capacity amounted to 9 200 MW (see Table 8). Hungary has 19 power plants of over 50 MW that account for 85% of total capacity. By fuel type, gas-fired plants account for the largest share of total capacity, 59%. By law, they must be dual-fired with oil and hold oil stocks. Nuclear power has the second-highest share in capacity (22%) but the largest in electricity generation (43%). All nuclear power in Hungary comes from the Paks nuclear power station whose four units have a capacity of 2 000 MW. Coal-fired capacity amounts to 15% of the total, down from 24% in 2000. Renewable energy capacity is targeted to grow over the next decade to meet a 2020 target of 10.9% of total generation (see Chapter 8 on Renewable Energy).

As of August 2010, an additional 1 500 MW of gas-fired capacity was being planned or under construction, as well as 700 MW of coal-fired capacity and 120 MW of renewable power capacity. Since then, however, several power companies have delayed or cancelled their projects because of increased uncertainty over project profitability. In October 2010, the government introduced a crisis tax of 1.05% on the annual net revenues of energy companies and extended a temporary 8% tax on the profits paid by energy suppliers and traders (the so-called Robin Hood tax). Also, retail electricity prices were frozen in summer 2010.

A major factor affecting decisions to invest in new capacity outside the feed-in tariff regime is the future role of nuclear power in Hungary. In addition to the lifetime extension at the Paks NPS, the government has been planning for one or two new reactors, but as of April 2011, had not confirmed such plans. The size and timeframe of possible nuclear new build projects will have a strong impact on the viability of other capacity projects, especially gas- and coal-fired ones.

Owing to the large share of nuclear power and cogeneration, Hungary’s electricity system has a relatively low level of generation flexibility. As a remedy, new power plants are required to have a frequency regulation capability so that they can help balance load fluctuations by increasing or decreasing generation at short notice. MAVIR, the transmission system operator (TSO), is seeking the possibility of including storage within its system. Another feasible option in integrating regional systems would be to build pumped storage in the neighbouring countries.

The low level of flexibility also reduces the amount of variable power that the system can safely handle. On the basis of its recent assessment, the TSO has also limited operation licences to wind power generators to 330 MW by 2009. The National Renewable Energy Action Plan outlines 750 MW as acceptable capacity for 2020, unless further storage is developed.

Table 8. **Gross electricity generating capacity by dominant energy source*, 1990 to 2009**

(MW)	**1990**	**1995**	**2000**	**2005**	**2006**	**2007**	**2008**	**2009**
Coal	2 014.0	1 960.0	1 891.0	1 514.5	1 510.3	1 514.5	1 562.5	1 367.0
Gas/oil (dual-fired)	3 290.8	3 375.9	3 996.3	5 045.5	5 070.7	5 181.6	5 284.5	5 421.6
of which: gas engines	0.0	0.0	0.0	385.4	499.9	514.4	528.1	600.4
Nuclear power	1 760.0	1 840.0	1 851.0	1 866.0	1 866.0	1 940.0	1 970.0	2 000.0
Hydropower	48.0	48.0	48.0	51.5	51.2	51.4	53.1	53.1
Wind power	0.0	0.0	0.0	17.5	28.3	64.7	134.1	203.3
Other renewable energy and waste	64.5	64.5	69.0	92.9	93.2	93.5	96.3	118.1
Total**	**7 177.3**	**7 288.4**	**7 855.3**	**8 588.0**	**8 619.8**	**8 845.6**	**9 100.4**	**9 163.1**

* The alignment of the power stations is based on the biggest share (*i.e.* dominant) of the energy source used.

** Installed capacity.

Source: Hungarian Energy Office.

REGULATORY AND LEGAL FRAMEWORK

Electricity market legislation in Hungary is based on EU directives and regulations. The second Electricity Market Directive (2003/55/EC) was transposed into the 2007 Electricity Act (Act 86), which entered into force in January 2008. The act fully opened the retail market to competition, abolishing the system where public utility service and free market coexisted. The Act introduced universal service as a default service to provide regulated supply to the eligible customers who do not wish to enter the free market (see below under Market Design and Industry Structure).

In 2008, following a decision by the European Commission, Hungary also abolished long-term power purchase agreements (PPAs), thereby enabling more competition in the wholesale market (see Box 3). National legislation transposing the third Electricity Market Directive was adopted in March 2011. It includes three options for separating the transmission system operations from the other operations of vertically integrated companies (unbundling) and leaves it up to the companies in question to choose among the options. Currently, the TSO is part of MVM, the state-owned dominant player in the power sector.

Box 3. **Termination of the long-term power purchase agreements**

During the restructuring and privatisation process of the electricity sector in the mid-1990s, the government introduced long-term (15- to 20-year) power purchase agreements (PPAs) as an incentive for investors in generating assets. PPAs were signed between 1995 and 2001 with generators and MVM. They had a fixed sales volume and a fixed price which guaranteed an 8% to 10% return. The PPAs covered about 70% of domestic electricity generation.

Hungary became a member of the European Union in 2004, and under the new legal framework, the PPAs were regarded as a significant obstacle to market liberalisation by preventing market entry. The European Commission saw PPAs potentially as a form of state aid and opened a formal investigation in 2005. In June 2008, it closed the investigation and concluded that PPAs with MVM and the ten generators were indeed illegal (Decision 2008/C 223). The Commission ordered the termination of the agreements within six months from the decision.

Hungary terminated the PPAs by Act 70 of 2008. On the basis of the Act, MVM renegotiated with the generators and concluded new PPAs for five to eight years and with prices that better reflect market conditions.

The Hungarian Energy Office (HEO) is the regulator for electricity, as well as for natural gas and district heating. It is overseen by the Ministry of National Development. Since its establishment in 1994, HEO's primary tasks have included licensing of electricity generation, transmission and distribution network projects. HEO also approves the Hungarian Grid Code on the proposal of MAVIR, the transmission system operator.

The regulator's powers are, however, often limited to advising the Minister of National Development, who has the right to set the network tariffs and the price of universal supply. HEO's responsibility is to propose these tariffs. Its role will be strengthened in the future, because the EU's third Electricity and Natural Gas Market Directives oblige member states to grant larger independence and wider powers to regulators (see Chapter 6 on Natural Gas).

As the market has become more liberalised, HEO has dedicated more resources to activities such as consumer protection and market monitoring to ensure fair and competitive functioning of the electricity market. HEO co-operates closely with the Hungarian Competition Authority, including on identifying dominant market players.

Under the Electricity Act's Significant Market Power (SMP) clause, HEO can identify a dominant position on a relevant market. The Act gives HEO the power to order players with SMP to reduce potential market abuse capability. HEO has used the SMP clause to limit MVM's market power in the generation, wholesale and ancillary services segments of the market (see below under Market Design and Industry Structure).

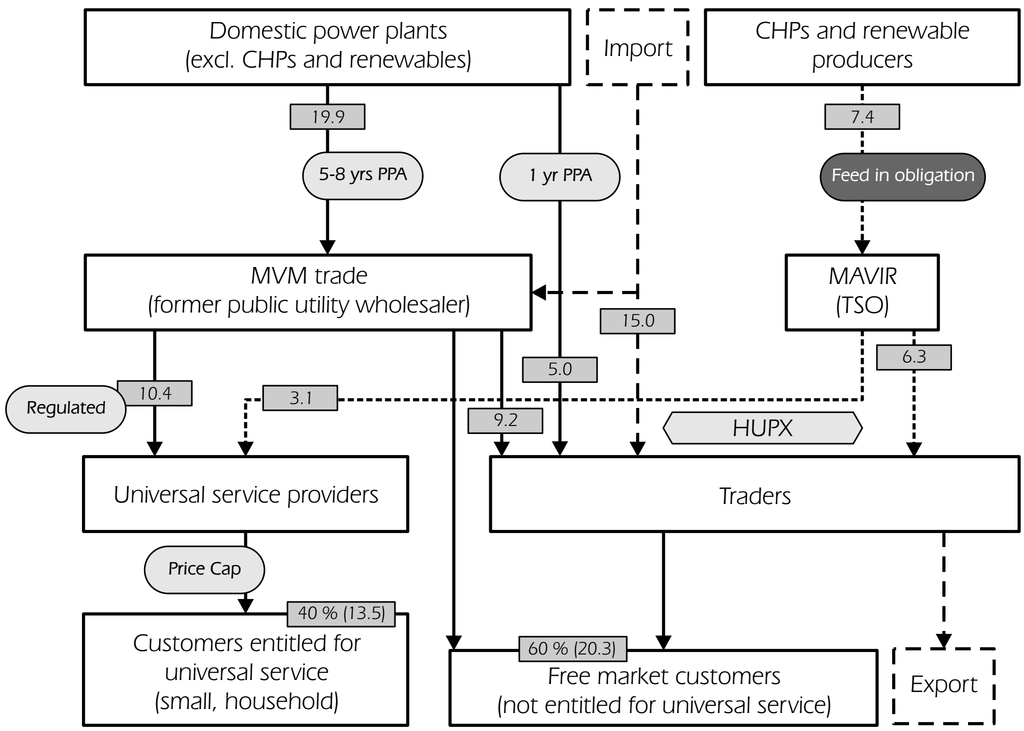
MARKET DESIGN AND INDUSTRY STRUCTURE

GENERATION AND THE WHOLESALE MARKET

The Hungarian wholesale electricity market combines competitive and regulated elements (see Figure 30). The major players are MAVIR as the TSO, MVM as the largest generator and the largest supplier to the public service providers, six companies acting as DSOs and public service supply companies simultaneously, the generation companies and the electricity trading companies.

The state-owned MVM is the dominant company in the Hungarian electricity sector (see Figure 31). MVM owns the Paks NPP and other generating capacity. It directly accounts for 46% of domestic generation. It also has five- to eight-year power purchase agreements with several large generators, such as AES, EDF, GDF and RWE, following the abolishment of long-term PPAs in 2008 (see Box 3). MVM Trade is the sole supplier to the universal service providers and also the largest domestic supplier to traders. In total, it purchased 62% of domestic production in 2009. In the liberalised segment of the retail market, MVM Partner is the fourth-largest supplier. Finally, MVM fully owns MAVIR, the transmission system operator, which in turn owns the transmission assets and the power exchange HUPX.

Figure 30. **Electricity market structure**



Notes: Transaction volume is in 2009 and unit is TWh.

CHP = combined heat and power through cogeneration.

Sources: HEO, IEA.

The second-largest portion of domestic generation, 23% in 2009, is electricity generated under the feed-in tariff system for cogeneration and renewable energy generators. The system combines obligatory off-take and premium prices (see below under Feed-in obligation). MAVIR purchases all electricity at regulated prices and then distributes the tariff costs among the universal service providers and free market traders.

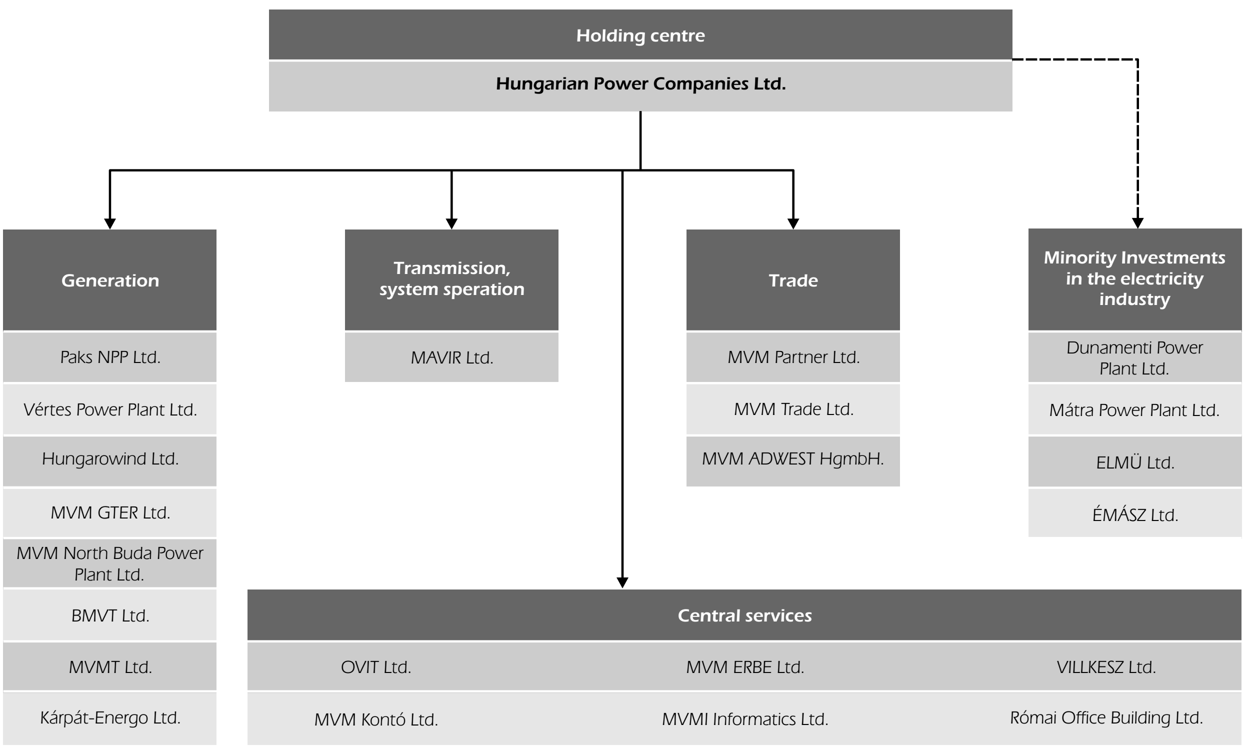
Because around 85% of electricity generation in Hungary is thus either for MVM (a combination of PPAs and its own generation) or under the feed-in tariff system, new entrants have had little space for accessing the domestic power market, and the liquidity of the wholesale market has remained low. Traders have turned to imports for supply. In 2009, more than 40% of electricity purchases by traders were from imports.

In the liberalised part of the wholesale market, electricity is mostly traded through bilateral contracts between domestic generators and wholesale traders. Since July 2010, however, Hungary has had a wholesale spot market, the Hungarian Power Exchange (HUPX). It is owned and operated by MAVIR, the TSO. HUPX provides day-ahead auctions with delivery on the Hungarian TSO zone. Trading volume has increased month by month and by March 2011 had reached an average of 8.6 GWh per day. The number of market participants had reached 27.

In addition to the spot market, MAVIR also operates a balancing market. It invites tenders from generators for reserve capacity and, on the basis of the daily bid of reserves, dispatches economically contracted generators for balancing the system. Ancillary service prices for imbalance service portion are set every 15 minutes, reflecting variable costs of generation.

MVM's dominant position in several segments of the electricity market has prompted HEO to use the Significant Market Power (SMP) clause to limit it. In June 2008, HEO ordered MVM Trade to hold transparent capacity auctions with price limits. As a remedy, MVM has to sell capacity at domestic plants to traders in order to reduce market dominance and increase liquidity at the wholesale market. HEO has also applied SMP regulation to MVM's supply to universal service providers by limiting its four-year contract prices. In the ancillary services market, MVM has been subject to SMP regulation with an obligation to cost-based bidding to the TSO.

Figure 31. **Structure of the MVM group**



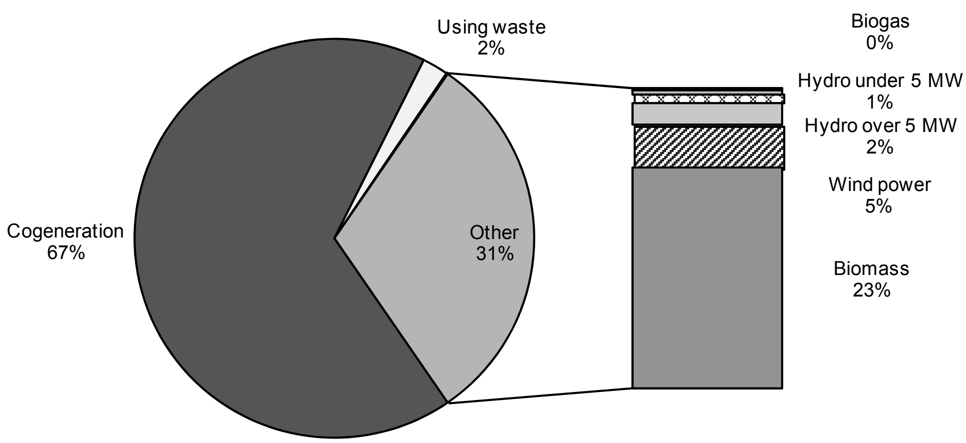
Source: MVM.

FEED-IN OBLIGATION

Hungary grants feed-in tariffs for electricity generation from cogeneration plants and also from renewable energy sources. MAVIR has an obligation to purchase all electricity generated under the feed-in tariff system at a price specified by law. MAVIR allocates the electricity and the purchase costs to traders and universal service providers proportionately. Electricity sold this way accounted for 23% of total sales from domestic power plants and increased by 12% from 2008. Feed-in tariffs amounted to HUF 78.9 billion (EUR 281 million) in 2009. More than two-thirds of the electricity was generated at cogeneration plants. The majority of these plants are gas-fired and smaller than 100 MW in capacity (see Figure 32). Financial support to cogeneration reached HUF 54.6 billion (EUR 195 million) in 2009, or 70% of total support. Thus, the current feed-in obligation mainly supports gas-fired cogeneration.

As most cogeneration plants are connected to a district heating network, the operation pattern of these plants over a year is typically dominated by heat demand. In fact, monthly generation from cogeneration reaches around 600 GWh in winter season from December to March, while only 200 GWh are generated during summer. Although the summer peak demand is nearing the winter peak level, more than 20% of total domestic generation is not necessarily contributing power supply in summer. This can be one of the reasons why import dependence of Hungary's electricity system is high in summer, even though total installed capacity is much higher than current peak demand.

Figure 32. **Electricity generation under the feed-in tariff system by technology, 2009**



Note: CHP = combined heat and power through cogeneration.

Source: Hungarian Energy Office.

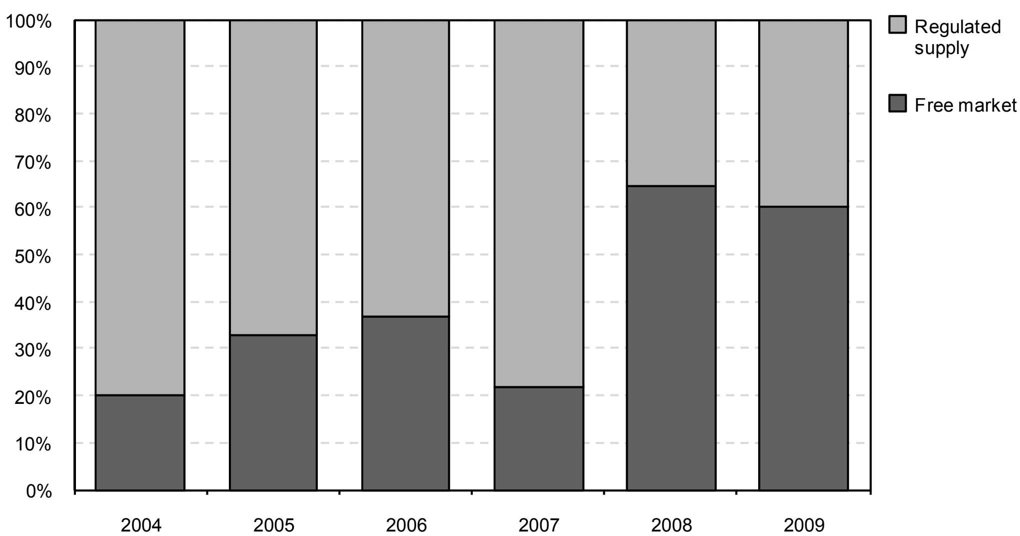
HEO has recently analysed in detail the effectiveness of the feed-in tariff system and concluded that tariffs should not be granted to cogeneration after 2015. Licences for cogeneration plants that started operation before 2008 were to expire by the end of 2010, but HEO extended them until 2015, at the latest, on the basis of the investment recovery period. As a result, it expects obligatory electricity purchases from cogeneration plants to decrease from 4.6 TWh in 2009 to 0.8 TWh in 2015.

RETAIL MARKET

Before the end of 2007, about 80% of retail electricity was supplied under public utility supply, a form of regulated service. In January 2008, public utility supply was replaced by universal service for which only households and other small customers are eligible. Prices are determined by the Minister of National Development on the proposal of HEO. The new system significantly reduced the share of regulated supply in total electricity, from 78% in 2007 to 36% in 2008 (see Figure 33). The transition to the universal service was coupled with a nearly 10% price rise which generated many complaints in 2008. The government then amended the law to make public institutions eligible customers. This increased the share of regulated supply to 40% of total supply in 2009. The government also partially scaled back the tariff increase.

Universal service is provided by four licensees that are owned by three large European companies: EDF, E.ON and RWE. These also own and operate Hungary's six distribution networks. Universal service providers are the exclusive suppliers within their licensed areas and their affiliates have held a strong position also among the free market segment customers. Thus, these three companies accounted for 77% of retail electricity sales in 2009, slightly down from 81% in 2008. The remaining 23% was supplied by companies not connected to the distribution companies, among them MVM Partner, MVM's trading subsidiary, with a 6% share. The universal service providers purchase electricity at regulated prices. Around three-quarters of the total is supplied to them by MVM and the rest by MAVIR through the feed-in tariff system.

Figure 33. **Breakdown of retail electricity supply by type of contract, 2004 to 2009**



Note: Regulated Supply: 2004-2007: Public Utility Service, 2008-2009: Universal Service.

Source: Hungarian Energy Office.

In principle, eligible customers entitled to universal service can choose a supplier in the free market, but in practice they have not done that, because traders cannot compete at current universal service prices. The traders have understandably focused on large customers. Moreover, in June 2010, Parliament decided to amend the Electricity Act to freeze electricity and gas prices for universal services until a new price calculation regime is set. The time frame of the price moratorium was not announced.

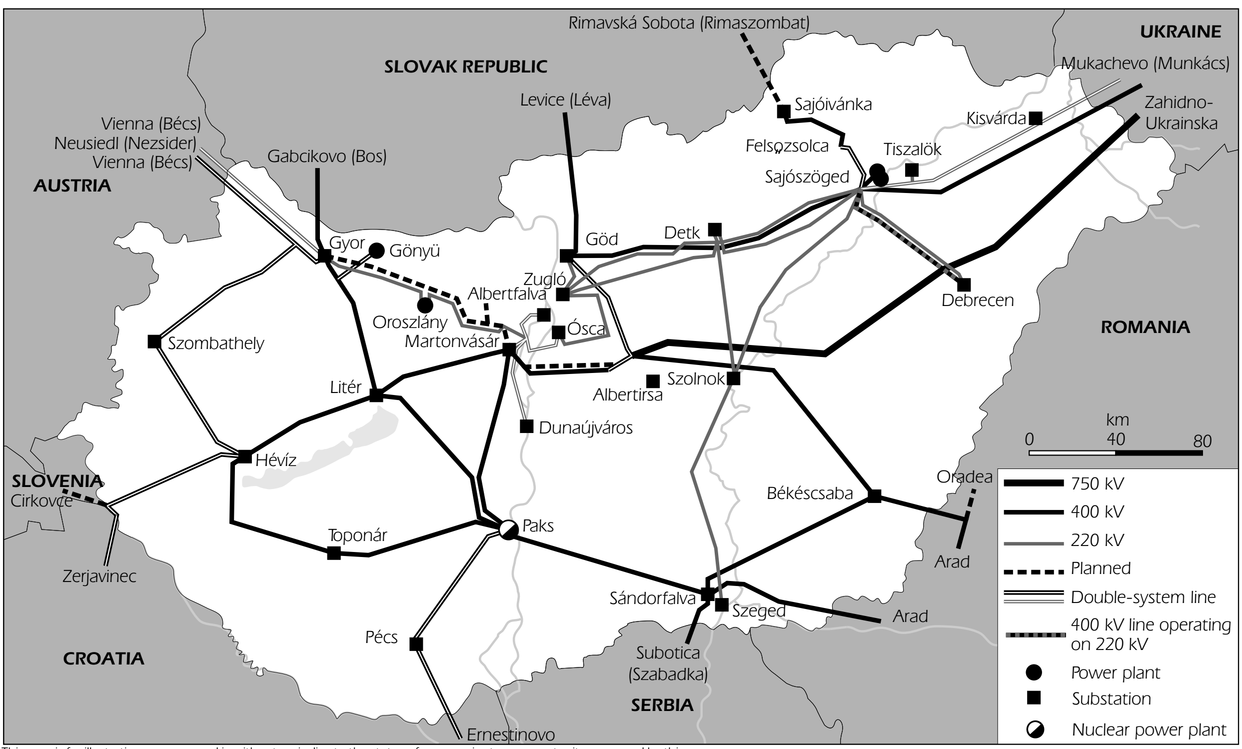
TRANSMISSION

TRANSMISSION SYSTEM

The Hungarian transmission system consists of around 10 000 km of high-voltage lines. The system includes a 750 kV single circuit interconnection line from the Ukraine. The others are 400 kV and 220 kV (see Figure 34).

MAVIR has been the transmission system operator since 2006. It owns and operates the transmission network and is responsible for the security of electricity supply. MAVIR was once directly owned by the government as the independent system operator (ISO), but became the TSO through reintegration to MVM. The operation of MAVIR has been separated from the other business activities of MVM, but it shares corporate support functions, including finance and accounting, with the rest of the MVM group. The regulator sees that the independence of system operation has been weakened by the reintegration, especially on financial and decision-making aspects. Following the adoption of the third EU Electricity Market Directive (2009/72/EC), MAVIR as an independent transmission operator (ITO) may remain owned by MVM, but will be subject to heavy regulation and permanent monitoring to ensure non-discriminatory system operation.

Figure 34. **Map of the transmission network, 2010**



This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

Source: Ministry of National Development.

As the entity responsible for security of supply, MAVIR submits a System Development Plan every two years to HEO for approval, as prescribed in the Electricity Act. Regarding long-term planning, as a member of the European Network of Transmission System Operators for Electricity (ENTSO-E), MAVIR has submitted its data for ENTSO-E's Ten-

Year Network Development Plan so that ENTSO-E may assess the development of the domestic and cross-border network in the context of Continental Central-East region and Continental South-East region in Europe.

Hungary's national transmission network does not experience critical congestion, while the cross-border connections sometimes do. However, mid-term assessment by ENTSO-E indicated a necessity to strengthen the 400 kV network in Hungary, mainly because of expected demand growth. In response, MAVIR is planning several projects to strengthen the network, including cross-border connections, to meet growing demand and accommodate new generating capacity.

CROSS-BORDER INTERCONNECTIONS

Hungary is a major transit country for electricity. Its electricity system is interconnected with all of its neighbouring countries, except Slovenia: Austria, the Slovak Republic, Ukraine, Romania, Serbia and Croatia, with a large capacity compared to the size of the system (see Table 9). In 2009 and 2010, cross-border connections were increased by the commissioning of the second 400 kV line with Croatia and the second 400 kV line with Austria. An interconnection with Slovenia is under construction.

Electricity transit is mainly from north to south. Since Hungary lies between the Central-Eastern and South-Eastern regions in the European electricity system, maintaining and expanding interconnection capacity is a long-term concern for both Hungary and the entire region. A project under consideration would add one more 400 kV cross-border connection with the Slovak Republic towards 2020 to strengthen north-south flow capability.

One of the concerns in Hungary is ageing infrastructure and the need to replace network assets. The 750 kV substation Albertirsa in Hungary, connected to the line from Ukraine, is reaching the end of its expected lifetime around 2012. However, any plans for replacing it are still under consideration, mainly because it is unclear whether the investment for importing from Ukraine would be viable.

Table 9. **Cross-border interconnections, 2010**

Country	Transmission line	Net transfer capacity (from/to)
Slovak Republic	2x400 kV	1250/800 MW
Ukraine	1x750 kV, 1x400 kV, 2x220 kV	450-1100 MW
Romania	2x400 kV	600 MW
Serbia	1x400 kV	600 MW
Croatia	2x400 kV (double circuit each)	600/1000 MW
Austria	2x400 kV, 2x220 kV	500 MW
Slovenia	Under construction	

Source: Ministry of National Development.

Interconnection capacities are allocated through explicit auctions. MAVIR conducts yearly, monthly and daily capacity auctions in co-operation with neighbouring TSOs. It has contributed to the establishment of the capacity auction offices with TSOs from neighbouring countries. MAVIR is planning to introduce intra-day auctions. The ultimate goal is market coupling (implicit capacity auctions) for regional market integration.

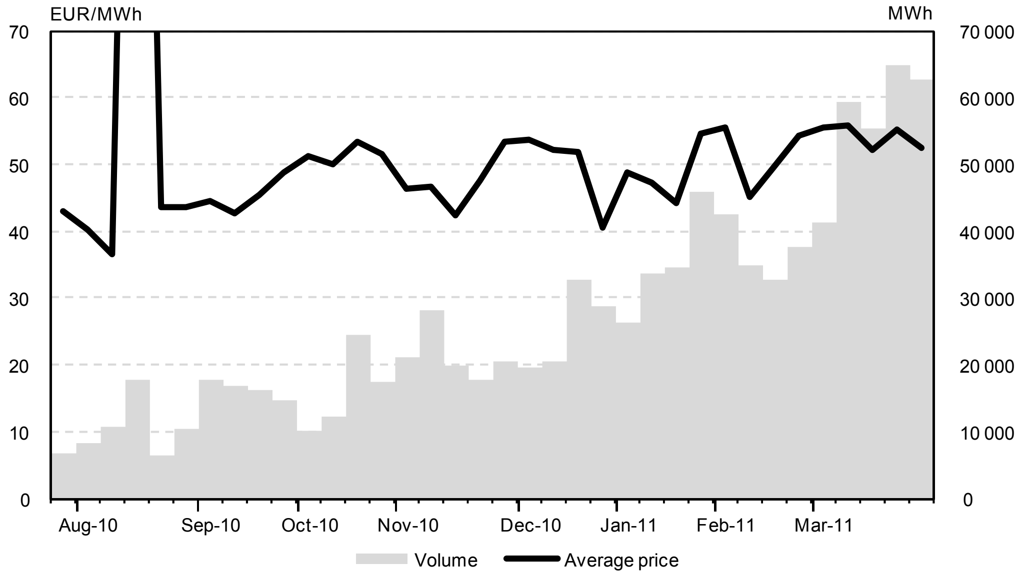
PRICES AND TARIFFS

Electricity prices are partially set by the market and partially regulated by the Ministry of National Development. The ministry sets prices for transmission, distribution and, under the universal service system, end-user tariffs for households and small businesses. The network tariffs follow the minimum cost principle to promote efficiency and are set for a four-year period at a time. However, the government revised the tariffs in autumn 2010, in the middle of the price regulation period 2009-2012. For generation, regulated feed-in tariffs are granted to electricity from renewable sources and cogeneration plants.

WHOLESALE PRICES

Before the launch of HUPX in July 2010, import prices and auction prices of MVM Trade gave the main price signals for the Hungarian wholesale market. Mainly because of large interconnection capacity with neighbouring countries, price spreads with neighbouring electricity markets such as Energy Exchange Austria (EXAA) are relatively small, even though the trading volume at HUPX is still low as a share of free capacity. Wholesale prices in Hungary are strongly affected by neighbouring markets and gas prices, as a large share of domestic generation is gas-fired. From its launch in July 2010 until the end of the year, the average price for baseload at HUPX was EUR 53.2 (HUF 14 900) per MWh and for peak load EUR 68.33 (HUF 19 200) per MWh (see Figure 35).

Figure 35. **Weekly average prices and trading volumes on the HUPX power exchange, July 2010 to March 2011**



Note: On Monday, 16 August 2010, prices settled at EUR 1 147 /MWh (HUF 322 000). This is not shown in the figure.

Source: HUPX.

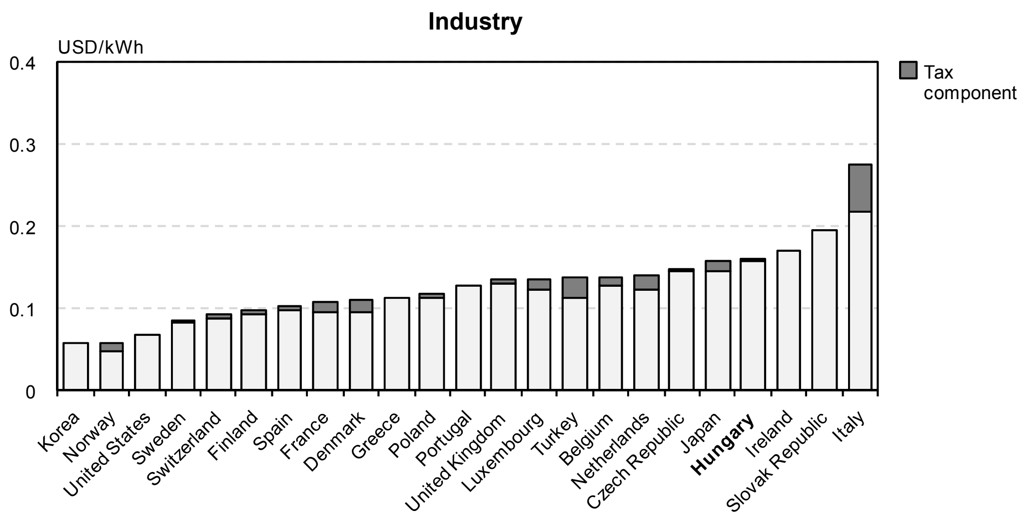
RETAIL PRICES

In 2010, electricity prices to industrial customers in Hungary were the fourth-highest among the IEA member countries, while prices to households were close to the median (see Figures 36 and 37). Households are under regulated pricing, the universal service. The energy portion of the universal service price is determined by the regulated wholesale price of electricity sold by MVM Trade to the universal service providers and the allocation of the feed-in obligation costs. Within the universal service, discounted energy and distribution charges apply for heat pumps and other renewable energy devices.

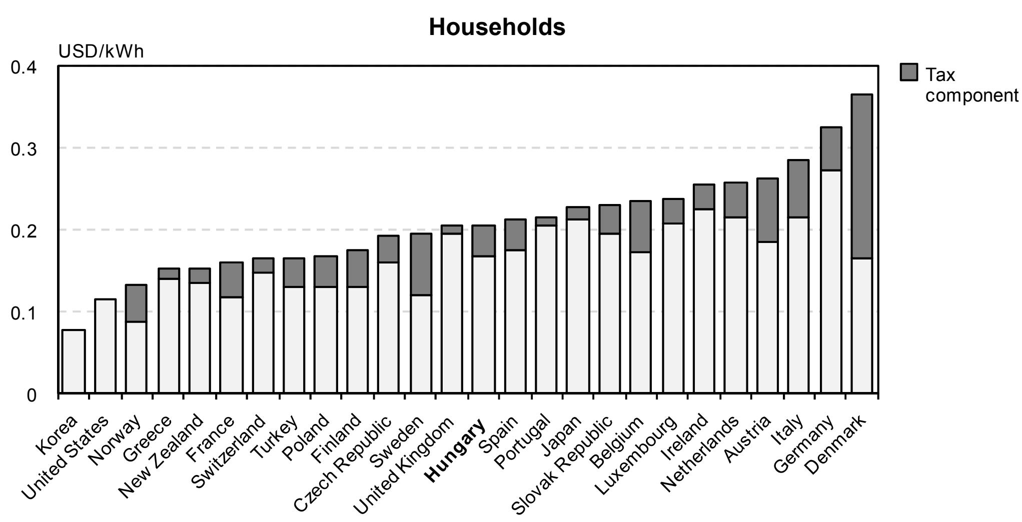
In June 2010, the government decided to freeze the universal service prices, even if higher gas prices were to significantly increase generating costs. Even before the prices were frozen, HEO had concluded that it was difficult for traders to compete in the household sector.

Real-time pricing is not applied in Hungary, but efforts continue to introduce it through smart metering. HEO has prepared a detailed study concerning the feasibility, technical and economic criteria for introducing smart metering and a modification of the Energy Act is being prepared to this end.

Figure 36. **Electricity prices in IEA member countries, 2010**



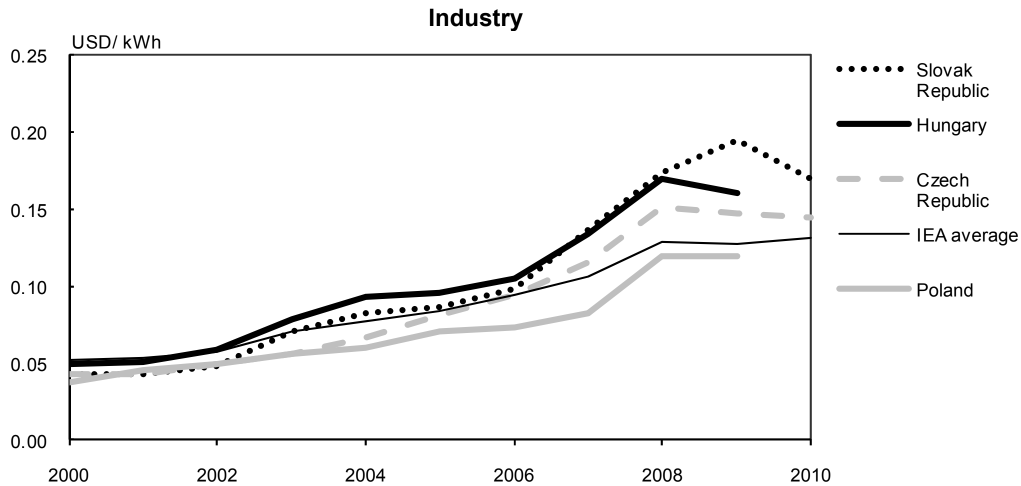
Note: Tax information unavailable for Korea and the United States. Data unavailable for Australia, Austria, Canada, Germany and New Zealand.

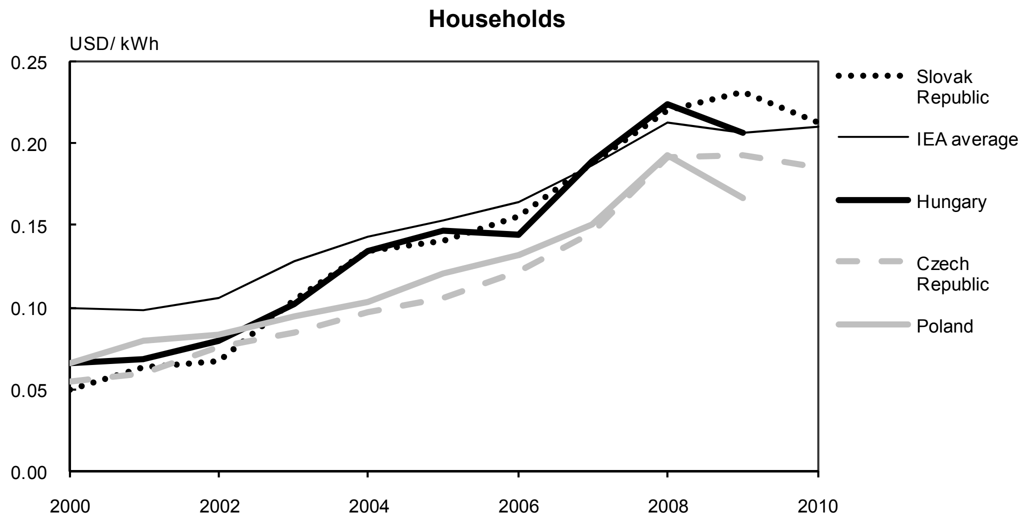


Note: Tax information unavailable for Korea and the United States. Data unavailable for Australia and Canada.

Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2011.

Figure 37. **Electricity prices in Hungary and in other selected IEA member countries, 2000 to 2010**





Source: *Energy Prices and Taxes*, IEA/OECD, Paris 2011.

Table 10. **Annual average electricity prices, 2006 to 2010**

(HUF/kWh)	2006	2007	2008	2009	2010
Wholesale	12.01	14.10	17.69	19.00	18.61
Non-residential	26.16	28.80	28.14	31.94	26.93
Residential	25.27	28.81	32.18	34.00	36.83
Residential (with taxes)	30.32	34.57	38.62	41.67	46.03

The figures for 2006 and 2007 (in the public supply system) do not show the effect of the obligatory takeover (support of cogeneration and renewables). (At that time it used to be included in the system operation charge as a separate item.)

Source: Ministry of National Development.

CRITIQUE

Hungary has made considerable efforts to reform the market in recent years. One of the noteworthy actions taken was moving away from the single-buyer model. Following the European Commission's request, Hungary's termination of long-term PPAs and renegotiation between generators and MVM for shorter and more competitive contracts were positive steps. However, MVM still dominates about two-thirds of the wholesale market through renegotiated contracts and, less so, through imports from neighbouring countries. It is reasonable that HEO obliges MVM to auction its capacity under the Significant Market Player (SMP) regulation. However, this regulatory remedy for the domestic market is not sufficient, even though the regional market context is gaining importance through import capacity, since MVM holds a strong position in the market even after the auction. Thus, eliminating domestic market dominance is a prerequisite for achieving true competition and, therefore, an efficient and reliable electricity system at least cost.

Another major achievement is the establishment of the Hungarian Power Exchange (HUPX). For the time being, it provides day-ahead transactions only, but holds the potential for offering more diversified products in the future. More efficient price signals will be crucial in the mid- to long-term for attracting efficiently timed, sized and located investments, which are needed to ensure security of supply.

The full opening of the retail market to competition in 2008 is another notable improvement. However, the vast majority of households remains under the default regulated service. There has been little switching to competitive service providers to date. In contrast, competition over large customers has been relatively successful since the market opening in 2004. Even though narrowing the eligibility for universal service supply was sensible, the regulated prices at both the wholesale and retail levels have limited the transparency of cost-reflection and often distorted the market. Therefore, regulated price should be avoided or made truly cost-reflective.

The recent government decision to impose a price moratorium for household customers threatens to undermine the previous market reform efforts. Capped prices will not reflect supply costs and will encourage household customers to stay under universal service. Moreover, the distorted prices reduce incentives for using electricity efficiently and the potential for developing more flexible and innovative forms of demand response over time. Instead, the government should introduce social policy measures to manage equity and access concerns rather than resort to policies that distort energy prices and undermine price signals for efficient investment, operation and end-use.

Regarding security of supply, the life extension process of the Paks NPP is a welcome development. The Hungarian electricity system will include nuclear power for at least the next twenty years, which also helps to limit CO_2 emissions. However, a fundamental issue of low flexibility in the electricity system has not been solved and remains a concern for the security of supply. Enhancing flexibility of the electricity system will improve reliability and allow for more effective integration of variable renewable power generation, such as biomass cogeneration and wind power, at least cost. One way to increase system flexibility is through closer regional market integration. The IEA encourages the government to continue efforts to that end.

One of the causes for inflexibility in the system is the feed-in tariff for electricity from cogeneration. As the government has analysed, the current feed-in tariff helps to increase natural gas use, because of low efficiency criteria and a high feed-in tariff with obligatory off-take. The tariff has also reduced the flexibility of the system, because of heat supply. This calls for changes to the current feed-in tariff system. For example, as air-conditioning demand is rapidly increasing in summer and heat demand is increasing in winter, more efficient and flexible technology, such as heat pumps and storage, should be considered to solve current problems with balancing of electricity and heat supply. Investments to this end could be promoted through redesigning the feed-in tariff system.

The government projects electricity demand to grow by around 25% by 2020. In order to meet this growing demand and to maintain security of supply, investments are needed for grid improvements and generating capacity, both for increasing capacity, especially for green electricity, and for replacing ageing plants. The government is also considering additional nuclear power plants as an option. This has wide implications for the profitability of other current and future baseload technologies, in particular gas and coal plants. The government should provide greater clarity and predictability around an objective-based policy framework in order to allow market players to take the necessary investment decisions that deliver greater security of supply at least cost.

To meet the large investment needs in the power sector, favourable conditions are needed. Experience from IEA member countries shows that stable, predictable and transparent laws and rules that are independently and objectively administered by credible and well-resourced regulatory institutions are needed to attract timely and least-cost investment capital. In contrast, frequent changes in regulations, increased government intervention on price setting and new taxes create regulatory risk that discourages investment.

Hungary has benefited from its geographical location as an interface between central Europe and the Balkan region with its ample interconnection capacity. It can import cheap electricity, rather than operate inefficient domestic plants, and export to the Balkan countries. Greater regional integration is unambiguously positive for security of supply: it increases diversity, improves liquidity and volumes, and increases access to flexible resources necessary to maintain system security at least cost. The key qualification here relates to network congestion, especially at peak times. Recent assessment by ENTSO-E shows negative remaining domestic capacity in summer and this makes import capacity all the more crucial for electricity supply.

Close co-operation with neighbouring countries is essential for Hungary's security of supply. Robust regional electricity trade brings competitive pressure to the Hungarian market and helps improve economic efficiency. Co-operation towards regional market integration benefits both Hungary and the whole region. Following the establishment of HUPX, market coupling with neighbouring power exchanges could and should be achieved as soon as possible. More flexible arrangements for allocating interconnection capacity, including leaving significant capacity for market coupling, and co-ordinated shorter gate-closure time will increase the flexibility of the Hungarian system, improve security and promote more efficient trade. Therefore, intensifying co-ordination and harmonisation of market rules, system operation and regulation with neighbouring countries is greatly encouraged.

Although radio ripple control measures have been broadly implemented, considerable scope remains to promote more active demand-side response. Deploying smart meters will provide greater incentives for customers to use energy wisely in response to the electricity prices and has the potential to support the development of innovative retail products to help more effectively harness demand response.

Another way of enhancing flexibility is the development of system regulation capacity within Hungary. The ancillary service market is one of the options to promote the use of existing flexible capacity or the development of new capacity, including pumped storage plants, in a cost-effective manner. It will give a proper price signal for flexible generating capacity. However, the regulator must carefully design this market so that the frequency control ancillary services can be provided competitively by domestic generators or generators in neighbouring countries in order to avoid market dominance by any single company.

RECOMMENDATIONS

The government of Hungary should:

- ☐ *Increase competition in the wholesale market by further reducing the dominant position of MVM.*
- ☐ *Avoid price caps and/or end-use subsidies and move the sector progressively towards cost-reflective market-based prices; consider other ways to support low-income households.*
- ☐ *Clarify mid- to long-term plans for the sources of electricity supply and ensure attractive conditions for investments.*
- ☐ *Enhance the flexibility of the Hungarian electricity system to achieve security and economic efficiency of supply by:*
  - *accelerating regional market integration with neighbouring countries through flexible usage of existing interconnection capacity, and, as appropriate, its expansion;*
  - *intensifying the deployment of demand-side response measures, for example through more differentiated tariffs, measures to improve the competitiveness of retail markets especially for households and small commercial customers, and the use of smart meters;*
  - *promoting the development of more efficient and flexible generating capacity.*

11. HEAT

Key data (2009)

Share of heat in final consumption: 48% (OECD average 36%)

Heating mix: natural gas 67%, commercial heat 13%, combustible renewables and waste 10%, oil 6%, coal 4%

Share of cogeneration: 72% in total commercial heat production (OECD average 80%)

SUPPLY AND DEMAND

FINAL HEAT CONSUMPTION

In 2009, Hungary consumed 8.6 Mtoe of energy in the form of heat, or nearly half of total final consumption (TFC). At 48% of TFC, heat consumption was much larger than final energy consumption of transport fuels[5] (25% of TFC) and electricity (16% of TFC) (see Figure 38). Among the OECD member countries, Hungary has one of the highest shares of heat in TFC, while Poland with 54% has the highest. According to government forecasts, the share of transport fuels in TFC will increase to 2030, while the share of heat will decline to 45% of TFC.

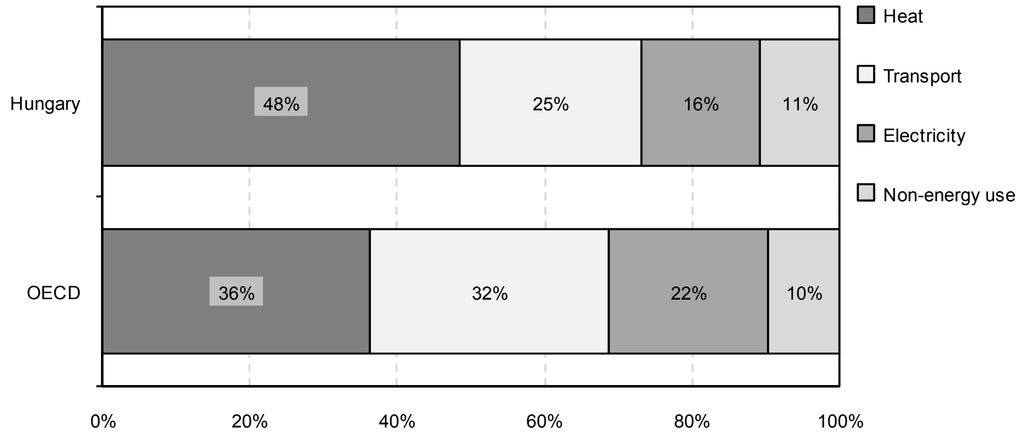
Heat consumption per capita in Hungary is below the OECD average. In 2008, heat consumption per capita was 0.9 toe, about equivalent to per-capita consumption of heat in Norway, although Norway has the lowest share of heat in total final consumption among the OECD member countries. This reflects the overall low energy consumption per capita in Hungary.

Demand for heat in the residential sector accounts for 50% of total heat consumption. Industry accounted for 20%, or 1.7 Mtoe in 2009. Industrial heat consumption has decreased dramatically since 1990 and is now far less important than in other OECD member countries. The industry share of total heat demand was 41% on average among OECD countries in 2009 (see Figures 39 and 40).

The heat market in the residential sector in Hungary is dominated by gas. Out of a total of 3 122 localities, about 93% are connected to the gas market. In general all cities and the majority of villages are connected. In urban areas, natural gas competes with district heating but until recently district heating had a competitive disadvantage due to pricing policies. For example, in 1997, out of over 36 000 new dwellings, only about 1 000 were connected to district heating. Electricity and oil products are rarely used for heating. In rural areas, coal and wood-fired boilers are erected in places without natural gas, but in the majority of areas, natural gas, if available, is preferred.

5. The relative importance of heat compared to fuel for transport results from the rather low motorisation rate in Hungary. In 2008, the country had 305 passenger cars per 1 000 inhabitants, the third-lowest rate in the EU, after Romania and the Slovak Republic. The EU15 average was 501.

Figure 38. **Breakdown of final consumption of energy by source in Hungary and the OECD, 2009**

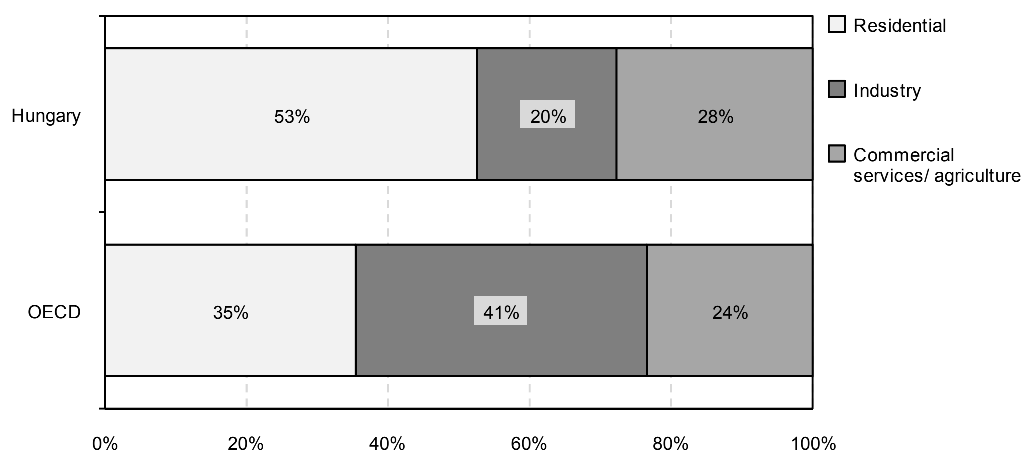


Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2010.

The fuel mix in final heat consumption in Hungary differs significantly from the OECD average (see Figure 41). Natural gas accounts for 67% of heat consumption compared with 51% in OECD countries, on average, while commercial heat accounts for 13%, compared with 5% in the OECD. In neighbouring countries with high heat consumption, *e.g.* the Slovak Republic, Poland and the Czech Republic, coal is the major fuel, whereas in Austria and Germany oil is used for heating purposes.

Renewable energy sources account for about 10.7% of heat consumption in Hungary, similar to the OECD average. Combustible renewables and waste are the main contributors with 0.8 Mtoe or 9.6% of total heat consumption in 2009, and remain the most promising[6] source for development in Hungary. Solar heat is not expected to contribute significantly to the fuel mix.

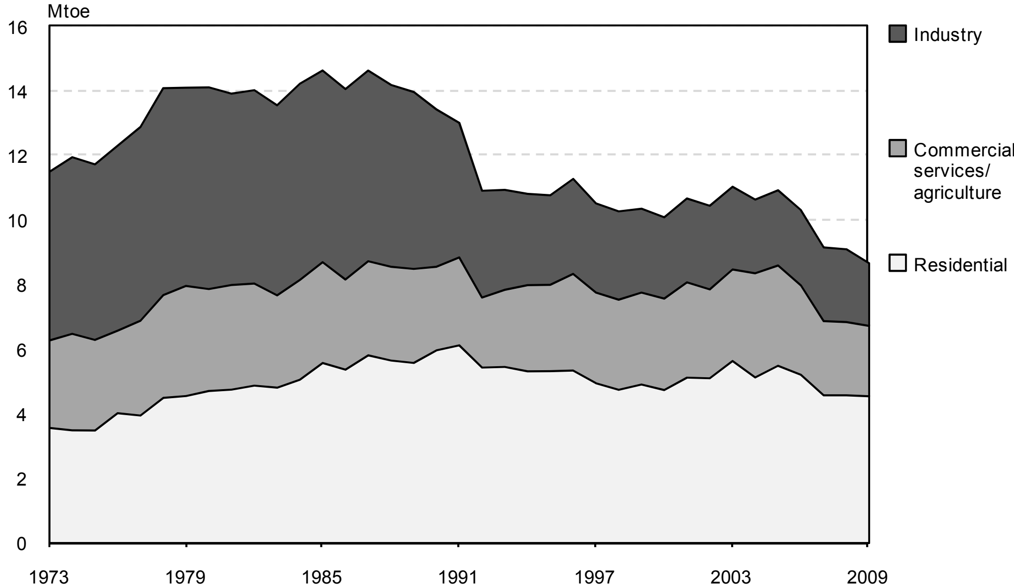
Figure 39. **Breakdown of final consumption of heat by sector in Hungary and the OECD, 2009**



Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2010.

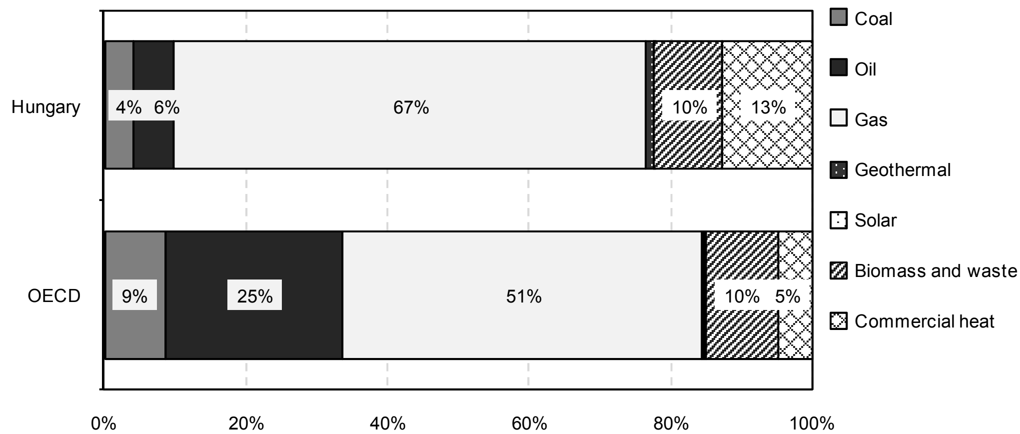
6. According to Eurostat, the home ownership rate in Hungary is among the highest in OECD Europe, 92% compared to 66% on average in OECD Europe in 2001. This could prove to be a barrier to higher penetration of renewable energy sources for heat in the residential sector owing to high upfront costs.

Figure 40. **Final consumption of heat by sector in Hungary, 1973 to 2009**



Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2010.

Figure 41. **Breakdown of final consumption of heat by source in Hungary and the OECD, 2009**



Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2010.

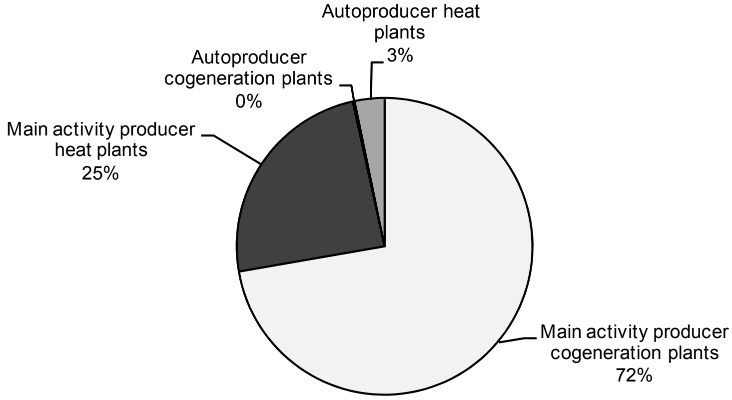
COMMERCIAL HEAT PRODUCTION

In 2009, commercial heat production (also known as district heating) amounted to 1.2 Mtoe (around 52 PJ) in Hungary, representing 13% of total heat consumption. Commercial heat demand has been declining over recent years. In 2009, it was 8% lower than in 2008.

The main heat production comes from cogeneration plants, representing 72% of total commercial heat production (Figure 42). In OECD countries, this share is on average 80%.

Only a very small amount of heat, 731 TJ or 1.4% of production is generated from nuclear and geothermal sources, the large remaining part comes from fuel combustion processes. Natural gas is by far the main fuel used for heat generation, in cogeneration and heat-only plants (see Figure 43). The only renewable energy sources used for commercial heat generation are municipal wastes and wood wastes, amounting to 2 201 TJ in 2009, or 4.1% of total heat generated.

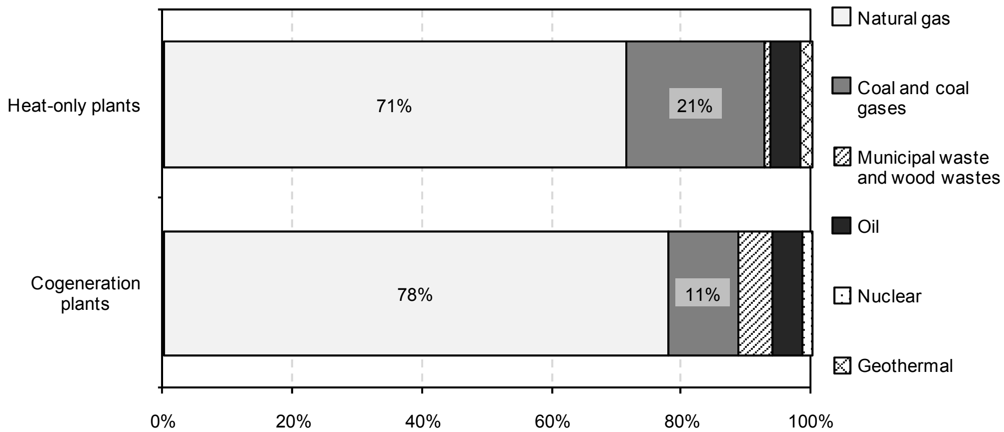
Figure 42. **District heat production by plant type, 2009**



Note: CHP = combined heat and power through cogeneration.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2010.

Figure 43. **District heat production by source, 2009**



Source: *Energy Balances of OECD Countries, IEA/OECD Paris*, 2010.

DISTRICT HEATING SECTOR

About 650 000 households in Hungary (16% of the total) are connected to district heating networks. A further 26% of households receive heat via single building or single apartment central heating systems, while 57% rely on individual room heaters and water heaters. The share of natural gas in district heating has risen over the last decade and now stands at nearly 80%.

In 2007, about 78% of cogenerated heat was supplied to the district heating network. Hungary's power generation sector is notable for the widespread use of combined heat and power. All except six of the power plants deliver more heat than electricity. Such wide use of cogeneration would normally be associated with high levels of efficiency but, unfortunately, this is not the case in Hungary. The systems are generally in a poor state of repair, with distribution losses of over 20% occurring in some systems.

Heat losses are such that many households find they cannot rely on the district heating system to provide all of their space heating and hot water requirements. Until recently, cross-subsidies in gas pricing meant that district heat cost up to 30% more than heat from individual gas boilers. Many households have therefore switched to natural gas for their heat and hot water requirements. Recently, disconnections from district heating have been growing at a faster rate than connections. Some 4 000 households disconnected from the district heating network in 2007, compared with 1 000 new connections. In addition, new building codes apply stricter rules for buildings connected to the district heating network than for individually heated dwellings.

More than 75% of district-heated buildings were constructed as prefabricated buildings with high heat losses. Most of them do not offer the possibility for individual regulation of heating. The dwellings are owned by the occupants but the buildings are usually owned by a condominium. Residents assume that the high heat losses are a result of the district heating network and not due to their building's prefabricated technology. There are state funds for refurbishment of buildings but typical dwellers of buildings with district heating have low incomes which make it difficult for them to invest in their homes. Energy costs are about 10% to 20% of annual income on average, but in cold winter months, some retired couples spend more than half of their income on heat. This is the reason for many disconnections.

Industrial customers have also tended to switch away from district heating networks, further damaging the financial viability of the heating companies. Because of the closure of many obsolete industries and residential disconnections, the public and commercial sectors are the only growing market for district heating today.

Urgent investment is needed in system refurbishment in order to reverse these trends, enabling heating companies to hold on to existing customers. However, the past policies and price formulation in the heat market in Hungary did not encourage such investments.

Recognising the need for a united voice to represent the district heating sector, the district heating companies have formed the Hungarian Association of Heating Enterprises (MaTáSzSz), whose members now account for 60% of Hungary's heat production. The association has campaigned for improvements in regulatory and pricing structures, particularly with a view to creating a better environment for cogeneration.

KEY POLICIES AND LEGISLATION

EU POLICIES

The EU Combined Heat and Power (CHP) Directive (2004/8/EC) creates a framework for the promotion and development of high-efficiency cogeneration, in order to increase energy efficiency and improve security of supply. The directive entered into force in February 2004 and member states have been obliged to begin its implementation since 2007. Member states must produce reports covering analysis of the condition of CHP in their own countries, promote CHP and show what is being done to promote it, report on and remove barriers, and track progress of high-efficiency cogeneration within the energy market. The Directive on the Energy Performance of Buildings (2002/91/EC) promotes the improvement of the energy performance of buildings within the EU through cost-effective measures (see Chapter 4 on Energy Efficiency). With respect to heat, this directive requires that regulation be set up to oversee the inspection of boilers and heating systems in member states.

The Renewable Energy Directive (2009/28/EC) sets a target for 20% of gross final energy in the EU to come from renewable sources in 2020. Renewable heat had never been included in binding EU targets before. Along with cooling, heat accounts for around half of all EU energy consumption, but only 10% comes from renewable sources at present. While the Directives on CHP and on the Energy Performance of Buildings promote efficient heating, there have been few real drivers for renewable heat. The current share of renewables in the heating and cooling market is dominated by small-scale domestic wood burning, but the European Commission estimates that biomass and cogeneration stations, as well as solar and geothermal sources, could double this proportion of renewables in heating and cooling by 2020.

Over the longer term, the European Commission is starting to formulate a low-carbon energy strategy for 2050, in which rationalising the heat market will be a priority. Until recently, EU policies have largely ignored the role of heat, focusing instead on electricity production and the transport sector. Cogeneration and district heating will be featured strongly in new energy action plans scheduled to be presented in 2011.

NATIONAL POLICIES AND PRIORITIES

Currently, Hungary does not have a national district heating development programme and all new power plants in the preparation phase or under construction are planned with condensing mode. The energy policy strategy adopted in 2008 does not include priorities or targets for district heating. While the National District Heating Act of 2005 regulated the relations between market actors in the district heating sector, it does not provide special support for district heating nor does it establish a programme for its development.

According to the National District Heating Act of 2005 (replacing the 1998 District Heating Act), district heating production and supply are licensed activities. The Act strengthens consumer protection and provides for more effective metering. On the other hand, the Act is very weak in expanding the use of planning for district heating networks by municipalities. The most important part of the legislation is the regulation of the relationship between supplier and consumer, including the right of disconnection. The new Act gives the Hungarian Energy Office the power to set heat prices and to control the heat price contracts between heat producer and heat supplier. The more recent 2008 District Heating Competitiveness Act expands these powers (see below).

In order to ensure the transparency of district heat supply prices, the 2005 District Heating Act defined the scope of financial data and associated technical information to be disclosed by district heat suppliers. In order to improve the information supply to household customers, district heat suppliers supplying 1 000 or more households are obliged to establish a website with the required information.

In order to increase the share of renewable energy in gross final energy consumption from 4.3% in 2005 to 13% in 2020, as specified in the EU Renewable Energy Directive, the Hungarian government has made specific provisions in its Renewable Energy Utilisation Action Plan to 2020. A support scheme for heat from renewable energy sources has been legislated and is being implemented since October 2010. Recognising the need to modernise the district heating infrastructure under the Environment and Energy Operational Programme for the period 2007-2013, HUF 6 billion (EUR 21 million) will be used under the tender scheme “satisfying local heating and cooling needs through renewable energy sources”. The aim of the scheme is to spread renewables-based energy production that results in less environmental impact, and to increase the share of renewable energy sources in heat generation. The financing was available in 2009-10 and provided by the European Regional Development Fund and the budget of the Hungarian government. A second tender scheme, "renewables-based electricity generation, cogeneration and biomethane production" also aims to increase the role of heat based on renewable energy sources. Financing for this scheme was HUF 10 billion (EUR 35.6 million) in 2009-10 and provided by the European Regional Development Fund and the budget of the Hungarian government.

INDUSTRY STRUCTURE AND REGULATORY FRAMEWORK

In 2007, there were 92 district heating utilities with a total capacity of 9 722 MW_{th}. District heating capacity in Hungary is very modest compared with other Central and Northern European countries. For example, Poland had 540 district heating utilities with over 620 000 MW_{th} capacity in 2007.

In most instances, local municipalities are the owners of district heating utilities in Hungary. They own the entire district heating supply chain except for heat production. In the past, they were also responsible for setting the price and most of the utilities were managed as non-profit entities. Thus, very little investment was made in the modernisation of the district heating network. Municipalities in the capital, the metropolitan municipality, are obliged to ensure the district heat supply of facilities that are supplied by district heat through one or more licensees.

Large power plants produce the heat and have a monopoly on supply. In the past, the price of this supply was negotiated between the supplier and the municipality. As of 2009, the Hungarian Energy Office (HEO) now sets the price.

HEO regulates heat prices. It also regulates and supervises heat production of electric power stations and cogeneration companies producing more than 0.5 MW. The establishment of district heat production facilities is subject to a licence only over a heat output of 5 MW. Licensing competence is distributed between the municipalities and the HEO. All district heat generators that also generate electricity must apply for a licence, while district heat generating activity without electricity generation falls under the authority of municipalities.

The regionally competent local government is responsible for ensuring the district heat supply of the establishments supplied with district heat. Most of the district heat supply companies are owned by local governments; the licensing authority is the notary of the local government; the heat prices and charges are determined by the representative council of the local government; therefore the entire chain is in the hands of the local government, except for the power plant generation of district heat.

Before 2009, the Minister of Transport, Telecommunication and Energy gave its opinion on the prices of district heat supply. This practice, however, was abandoned after 1 July 2009. Under the District Heat Competitiveness Act (amending the District Heat Act of 2005); the authority of HEO was extended to setting residential district heating prices. Previously, HEO did not have any powers, responsibility, or any means of influence in connection with district heat supply, quality of district heat supply, district heat prices and charges. In 2009, district heat suppliers submitted to HEO requests on residential district heat price change with regard to 25 settlements. The majority of the requests aimed to decrease charges. In 2009, 19 cases were closed by resolution, including one initiating a price increase, which was rejected.

PRICES AND TARIFFS

Until recently, the prices applied in various district heating networks differed significantly from case to case in both their structure and rate. For an average size flat, the annual charge for district heat ranged between 80% and 120% of the national average. In the tariff system of some suppliers, the basic charge varied from 30% to 50% of the annual charge. These differences could be justified only in part by the different conditions of service. Therefore, since 1 July 2009, HEO has inspected both the pricing of the district heat suppliers and the pricing of the thermal heat between the generator and the supplier.

District heating competes with gas in the heat market. In the past, district heating has had difficulty competing with gas because the gas pricing system preferred small and individual gas customers compared with large ones. At the beginning of 2009, natural gas prices for small customers (individual dwelling heating) and large ones (heating power plants and heat-only plants) were virtually the same – around EUR 10 (around HUF 2 800) per GJ. On the other hand, district heating end-user prices for dwellings were nearly twice as high as heat prices for heat from power plants for district heating utilities. Total heating costs with district heating were over 100% higher than the costs of central and individual gas heating.

In 2010, the VAT imposed on district heating was reduced from 20% to 5%. This reduction was aimed at improving the competitiveness of district heat supply compared with central heating.

The government recently passed legislation to cap the price of district heating from 15 April 2011. According to the law, district heating prices will be pegged at current levels until new prices are decreed by the Ministry of National Development. The Association of Hungarian District Heating Providers as well as several local governments have expressed concerns that the government's proposal to control district heating prices will cause considerable losses for district heating companies.

FUEL POVERTY

In recent years, the prices of fuels have risen faster than inflation rates in Hungary. According to surveys, 80% of Hungarians spend more than 10% of their income on their energy bills. This is considered the international threshold for "fuel poverty". Fuel poverty exists if people are unable to heat their homes to an acceptable level or cannot afford adequate energy services. At least 1.5 million Hungarians declare that they are suffering from fuel poverty; 15% of the population state that they are unable to heat their homes to the required level, which is the sixth-largest proportion in Europe. Hungary also has Europe’s highest share of customers chronically in arrears with their utility bills, at 18% of all households.[7]

The Hungarian government spends a substantial portion of its budget on gas and district heating subsidies. The specific energy consumption per square meter of Hungarian dwellings is the third highest in the European Union. Hungary is the only EU member state where the heating energy efficiency index deteriorated in recent years. About 25% of Hungarian dwellings suffer from damp walls, mould and leaking, which is the fifth largest share in Europe.[8]

7. Herrero, Sergio Tirado and Diana Ürge-Vorsatz, “Fuel poverty in Hungary: a first assessment”, Department of Environmental Sciences and Policy, Central European University, Center for Climate Change and Sustainable Energy Policy, 2010.

8. *Ibid*.

CRITIQUE

The Hungarian government has recently enacted laws and decrees aimed at enhancing the competitiveness of the heat market and expanding the role of renewable energy sources for heat. This is commendable but the government is encouraged to give much more priority to heating issues in the energy policy agenda. As in most IEA member countries, in Hungary, improving the efficiency and lowering the environmental impact of heat production and consumption has been a low priority in the past, compared with measures in the electricity and transport sectors. A successful strategy on heat should integrate the entire energy chain from generation to end-use, including measures impacting efficiency, infrastructure and planning. Such a strategy could build on the success of other IEA member countries which, with comprehensive and consistent policies, have dramatically increased efficiency in the heating market, *e.g.* Denmark, Sweden, Austria and Finland.

District heating is provided from local heat plants to large blocks of flats in Budapest and other major cities. About 650 000 households, around one in five Hungarians, are heated that way. Most of this form of heating was installed some 40 years ago and the system is in need of modernisation. Indeed, such a modernisation creates win-win opportunities through the potential for higher energy efficiencies.

District heating companies are typically local monopolies and therefore have reduced incentives for being efficient. More and more owner-occupied blocks are breaking off the district heat system, because they are unsatisfied with the price and quality of the district heat supply. This should be a good incentive for the companies to improve the quality of their service. To prompt them to increase system efficiency, the government should consider introducing minimum efficiency standards for the district heating pipeline system.

Improving the efficiency of heat use is crucial. As mentioned in Chapter 4, encouraging energy efficiency improvements in buildings seems in principle easier in Hungary than in most other countries, because nine out of ten people own the home they live in – the highest share in IEA Europe. On the other hand, the ownership structure of the inefficient prefabricated housing and the monopolistic nature of their district heating supply complicate the challenge. The government could either subsidise capital costs for these investments, for example by offering low-interest loans. Or, it could oblige utilities to make such energy-saving investments and let them reap the resulting benefits. It should also maximise the use of favourably termed funding for such projects provided by the EU and the international financial institutions.

The majority of residential users cannot adjust their heating consumption, as the system is old. Only about a quarter of dwellings are well controlled at present. When economically feasible, the government should introduce obligatory metering for each household or commercial unit, whether owner-occupied or rented. It should also introduce transparent billing at household level based on individual consumption and collection processes. This can be carried out in several ways and in many EU member states, this is the responsibility of the energy utilities. This control would need to be regulated and the government should also consider creating a public awareness campaign to increase the chance of energy efficiency measures actually being implemented.

Subsidies in the district heating sector need to be refocused. In 2009, around half of the flats heated by natural gas or district heating received energy cost subsidies. By spring

2011, all end-user prices had been capped. In their recent study, Herrero and Ürge-Vorsatz found that the subsidies were claimed unlawfully in about one case in four. At the same time, the administration of these subsidies costs almost as much as the government spends on energy efficiency investments (excluding the panel building programmes). The significant amount spent per year on subsidies should instead be spent on improving energy efficiency, which would also be a way to help reduce fuel poverty. The fuel subsidies need to be gradually phased out while the system is being transformed. The solution is not to directly subsidise fuel prices but to improve the weak quality and low energy efficiency of buildings. It is essential to provide more significant funding for this through an adequate incentive system. Support for low-income households to meet their energy needs is important, but it is also necessary to move more and more away from energy-cost subsidies towards supporting investments in energy efficiency.

RECOMMENDATIONS

The government of Hungary should:

- ☐ *Give higher priority to heat on the national energy policy agenda.*
- ☐ *Give priority to modernising heating systems in buildings, especially those linked to district heating systems; consider redirecting subsidies from the use of heat to modernising these systems and introduce stronger financial incentives for efficiency improvements.*
- ☐ *Consider introducing minimum efficiency standards for the district heating pipeline system.*

PART III
ENERGY TECHNOLOGY

12. RESEARCH AND DEVELOPMENT

Key data (2009)

Government energy R&D spending: HUF 1 540 million (USD 7.6 million), +133% since 2000, renewable energy projects receiving 81% of funding

Share in GDP: 0.06 per 1 000 units of GDP (IEA average 0.7)

R&D per capita: USD 0.8 per capita (IEA average: 20.3)

OVERVIEW

Research and development (R&D) are attracting increasing focus in Hungary. The government's economic recovery plan, the New Széchenyi Plan, was launched in January 2011. It contains the following two main goals for innovation policy:

- The R&D and knowledge intensity of the Hungarian economy must be widely increased by supporting innovative companies with high growth potential operating in the processing and service sectors, increasing the innovation and absorption capacity of small and medium sized enterprises (SMEs), developing innovative clusters and joining national and international knowledge sources and markets necessary for innovation.
- Hungary's fragmented knowledge infrastructures (research institutes, universities) must be strengthened and their competences must be improved in order to contribute to the strategic realisation of national economic goals substantially and in a measurable way.

The government is planning to revise the new national system of R&D and innovation and adopt a new strategy in 2012. Following the adoption of the New Széchenyi Plan, the government will develop sectoral research and development priorities, including for the energy sector. A general goal is to increase the share of spending on R&D per GDP. Specifically in the energy sector, the Plan states the need to focus on technological development and R&D.

In the meantime, the 2007-2013 mid-term strategy for science, technology and innovation policy applies. It includes the following goals:

- Expansion of companies' R&D activities;
- Establishment of internationally recognised R&D, innovation centres and research universities;
- Enhancing of the regions' research, development and innovation (RD&I) capacity;
- Establishing a knowledge market which works on the principles of performance recognition, and competition through the globalisation of knowledge production and dissemination;

- Investing in large scientific facilities, primarily in the regional centres and the development poles, reducing regional differences (regional cohesion);
- Increasing yearly R&D expenditure, above all as a result of growth in corporate expenditure.

Meeting these strategic goals relies on the following general actions:

- Focusing of intellectual and financial resources, optimisation of utilisation;
- Increasing economic and societal implementation of R&D results;
- Strengthening of regional innovation.

The Ministry of National Economy is in charge of the implementation structure for R&D. The state minister and a government commissioner are responsible for innovation policy. The main organisations implementing and managing energy R&D programmes are the National Office for Research and Technology (NKTH) and the National Development Agency (NFÜ).

The National Office for Research and Technology (NKTH) is responsible for the day-to-day implementation of the government's science, technology and R&D policy. Its duties are to provide a new framework for the national innovation system and to promote R&D that will boost the Hungarian economy. The NKTH was jointly established by the Minister of Education and the Minister of Economy and Transport. The NKTH also supports the setting-up of technology platforms and innovation clusters, the establishment of Innovation Cluster Centres (ICC) in charge of co-ordination and of the research, development and implementation activities of the participating organisations.

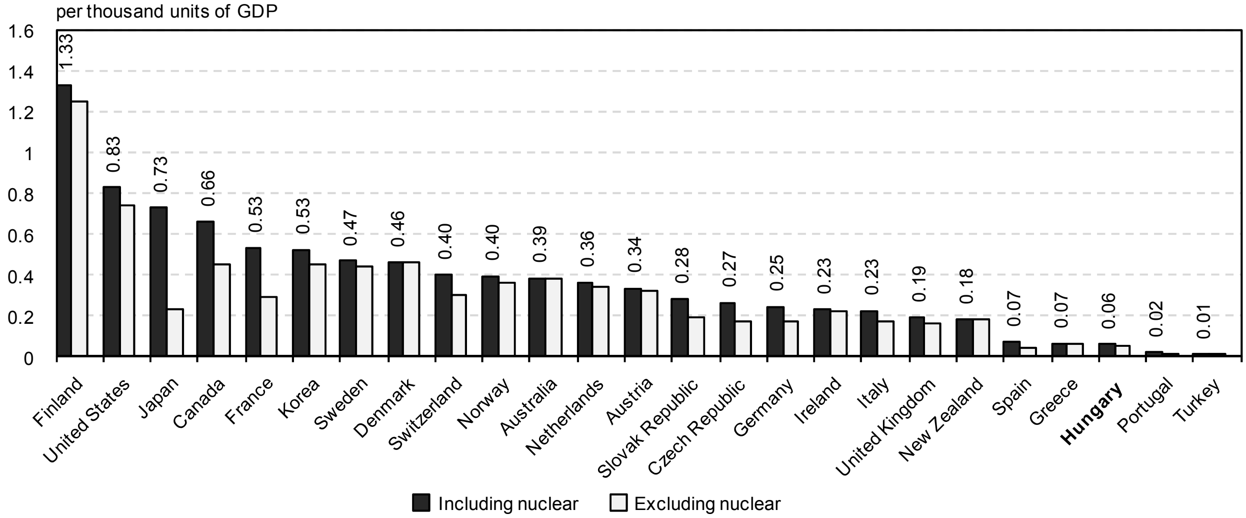
Hungary finances energy R&D through various programmes: NFÜ's Economic Operative Programme (funded by the EU Structural Funds), NKTH's National Technology Programme, Regional Programmes and energy-related Technology Platforms (funded by the Research and Technology Innovation Fund) that all include energy as part of their programme design. International programmes with Hungarian participation that are exclusively energy-related are FP7's (Framework Programme 7) Energy thematic priority, the Intelligent Energy Europe programme under the Competitiveness and Innovation Framework Programme, EUREKA's EUROGIA+ cluster and Energy Knowledge and Innovation Community of the European Institute of Technology. Hungary seeks to align its national programmes' priorities with those that are set out in the above mentioned programmes.

FUNDING

According to the Central Statistics Office of Hungary, 42% of total R&D expenditure in 2009 came from the government. The private sector provided 46.4% of the total and foreign sources, including the EU, the remaining 11.6% These shares have been relatively stable over the preceding three years.

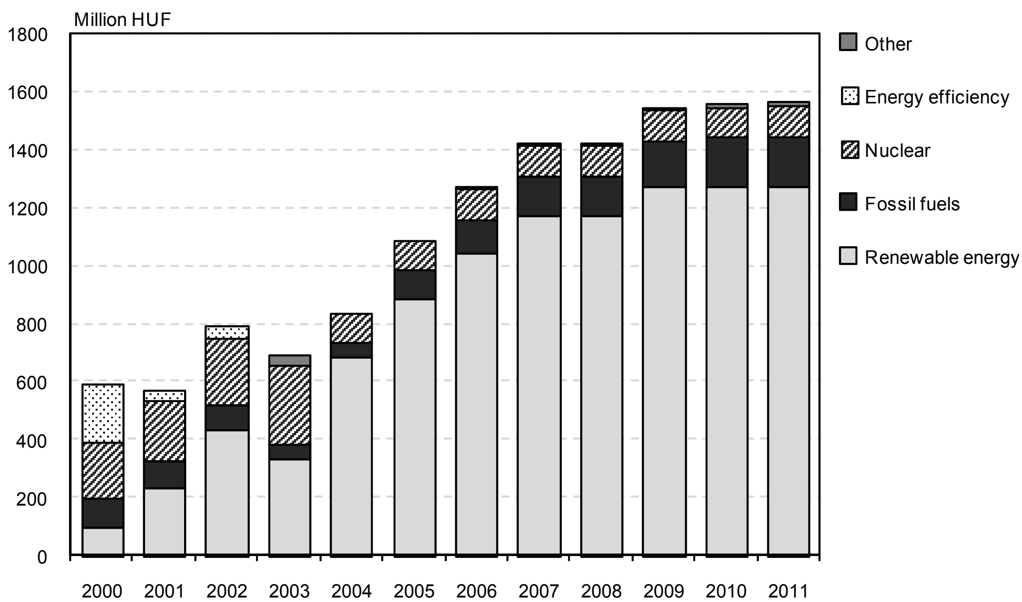
Government spending on energy research, development and demonstration (RD&D) has more than doubled since 2000 to HUF 1 540 million (EUR 5.48 million) in 2010 (see Figure 44). The share of RD&D funding in GDP has increased over the last decade, but with HUF 0.06 spent on energy RD&D for every HUF 1000 of GDP, remains at the third-lowest level among IEA member countries, only ahead of Portugal and Turkey (respectively 0.02 and 0.01 per 1 000 units of GDP).

Figure 44. **Government spending on energy RD&D per GDP in IEA member countries, 2009**



Sources: *OECD Economic Outlook*, OECD Paris, 2010 and country submission.

Figure 45. **Government spending on energy RD&D by sector, 2000 to 2011***



* Estimates for 2010 and 2011.

Sources: *OECD Economic Outlook*, OECD Paris, 2010 and country submission.

Government funds energy R&D almost exclusively on three sectors: renewable energy, fossil fuels and nuclear power (see Figure 45). More precisely, in 2010, the renewable energy sector received HUF 1 265 million (EUR 4.5 million), or 81% of the total RD&D funding, and the large majority (HUF 1 240 million, around EUR 4.4 million) was spent on biomass and waste projects for transport, heat and electricity, while the rest, HUF 25 million (EUR 89 000), was spent on wind energy. The fossil fuel sector received HUF 170 million (EUR 606 000) for enhanced research on oil and gas production, and nuclear fission projects received HUF 105 million (EUR 374 000).

INTERNATIONAL COLLABORATION

A large part of public funding for R&D in Hungary comes from the European Union. This is also reflected in the dominance of EU projects in Hungary's international energy R&D collaboration.

Hungary actively participates in international R&D collaboration programmes. In the FP7's energy priority, Hungary received nearly EUR 9 million (HUF 2.5 billion) funding, more than any other country in EU12 (the twelve member states that joined the EU after 2003).

Hungary participates in newly established initiatives, *e.g.* the Fuel Cell and Hydrogen joint technology initiatives, industrial initiatives within the Framework Programme 7, EUREKA programme's EUROGIA+ cluster and the Energy Knowledge and Innovation Community of the European Institute of Technology that aim to enhance the design and management of energy-related R&D programmes.

Participation in international collaborative activities minimises burdens, multiplies resources and results, and raises national R&D capabilities. Broader international collaboration would help Hungary acquire and adapt the best available technologies to suit national circumstances and to increase national R&D capabilities, for example through greater participation in the IEA Implementing Agreements.

CRITIQUE

Hungary is facing significant energy and environment policy challenges. The possibilities provided by effective energy R&D policy should be fully explored. In this context, the government is planning a new RD&I strategy. Considering the importance of technological challenges in energy policy, quick planning and implementation will be needed.

Hungary has traditionally invested little in R&D by international comparison, so it is commendable that the government has been increasing the energy R&D budget over the past few years. However, Hungary's overall performance in terms of energy R&D expenditure as a percentage of GDP is still well below IEA averages. Hungary should consider further increases linked to the ambitions of its energy strategy. Given the limited public resources for energy RD&D, the cost-effectiveness of the R&D programme needs to be enhanced.

The Hungarian government should seek to enhance consistency between its energy policy and energy R&D programmes. In order to promote the effective funding and rapid deployment of new energy technologies, stronger co-ordination among relevant organisations, in particular the Ministry of National Development, the Ministry of National Economy and the National Office for Research and Technology, will be necessary. Energy issues are becoming increasingly linked with other policy areas, such as transport, agriculture and regional development. Similarly, R&D in these sectors will become more multidisciplinary and closer co-operation between the different ministries and research institutions is warranted.

It is essential to focus on areas where Hungary has a competitive advantage or specific needs. For example, the government is forecasting a significant increase in combustible renewables in TPES and biofuels in the transport sector. Considering their natural and social conditions, biomass and biofuels should be a priority area for R&D.

A major impediment to the effective cost-benefit analysis – and the ultimate optimisation – of R&D programmes is the lack of reliable data on R&D activities and the allocation of funding. It is important that the government develops and applies methods to review energy R&D policies and spending to ensure that they are cost-effective and in line with overall energy policies.

It is commendable that Hungarian universities are developing courses and programmes in energy technology. The country has a relatively strong academic base in general and would now benefit from closer public-private collaboration on energy technology. To promote the deployment of new energy technologies, further efforts will be necessary for increasing engagement with the private sector in the energy R&D area, with a view to sharing information, financing R&D activities and commercialising R&D outcomes. International co-operation is also an effective way to optimise R&D spending. Hungary could further enhance its international activities in its priority areas, including joining IEA Implementing Agreements in these areas.

In addition to contributing to a more sustainable energy system, energy R&D offers opportunities for new economic activity and job creation. The government should consider strategic use of energy R&D activities in key technology development areas like biomass and biofuels.

RECOMMENDATIONS

The government of Hungary should:

- ☐ *Consider increasing public spending on energy R&D and develop a strategic and concrete energy R&D implementation framework by building on the country's strengths and linking the focus of public R&D funding with the projections for the future energy mix, such as biomass/biofuels and geothermal energy.*
- ☐ *Develop procedures and processes for monitoring and evaluating progress in energy R&D in order to maximise the cost-effectiveness of public spending.*
- ☐ *Encourage stronger co-ordination between the government bodies responsible for science and technology policy and energy and industrial policy.*
- ☐ *Promote energy-related R&D activities by industry, including through fiscal incentives and partnerships between government, industry and academia with a view to sharing information, financing R&D activities and commercialising R&D outcomes.*
- ☐ *Consider stronger co-operation between industry and the universities on developing courses and degrees.*

PART IV
ANNEXES

ANNEX A: ORGANISATION OF THE REVIEW

REVIEW CRITERIA

The *Shared Goals*, which were adopted by the 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 C.

REVIEW TEAM

The in-depth review team visited Hungary from 8 to 12 November 2010. The team met with government officials, energy suppliers, interest groups and various other organisations. This report was drafted on the basis of these meetings, the government response to the IEA energy policy questionnaire and other information. The team is grateful for the co-operation and assistance of the many people it met during the visit, the kind hospitality and willingness to discuss the challenges and opportunities that Hungary is facing. The team wishes to express its sincere appreciation to the staff of the Ministry of National Development, in particular Dr. Miklós Poós, Director-General, and staff from the Hungarian Permanent Representation to the OECD, in particular Mr. Gergely Várkonyi, Energy Advisor, for their unfailing helpfulness throughout the review process. The team also wishes to express its gratitude to Mr. Pál Kovács, Deputy Junior Minister for Energy, for his hospitality and personal engagement in briefing the team on energy policy issues.

The members of the team were:

IEA member countries

Ms. Gill CAMPBELL, United Kingdom (team leader)
Ms. Sinem ÇAYNAK, Turkey
Mr. Milosz KARPINSKI, Poland

IEA non-member country

Mr. Shuong ZHANG, China (special observer)

European Commission

Mr. Adam SZOLYAK

OECD Nuclear Energy Agency

Mr. Robert VANCE

International Energy Agency

Mr. Ulrich BENTERBUSCH
Ms. Anne-Sophie CORBEAU
Mr. Shinji FUJINO
Mr. Akira YABUMOTO
Mr. Miika TOMMILA (desk officer)

Miika Tommila managed the review and drafted Chapters 1 to 3, 5, 7 and 12 of the report. Teresa Malyshev drafted Chapters 4, 8 and 11, Anne-Sophie Corbeau drafted Chapter 6, Robert Vance drafted Chapter 9 and Akira Yabumoto drafted Chapter 10. Georg Bussmann drafted statistics-related sections for most chapters. Many other IEA colleagues have provided helpful comments, including André Aasrud, Robert Arnot, Ulrich Benterbusch, Doug Cooke, Carlos Fernandez Alvarez, Shinji Fujino, Rebecca Gaghen, Elena Merle-Beral, James Simpson, Laszlo Varro and Dennis Volk.

Georg Bussmann and Bertrand Sadin prepared the figures. Karen Treanton, Davide D'Ambrosio and Alex Blackburn provided support on statistics. Muriel Custodio, Jane Barbière and Madeleine Barry managed the production process. Viviane Consoli provided editorial assistance. Marilyn Ferris helped in the final stages of preparation.

ORGANISATIONS VISITED

Gaz de France GDF

Greenpeace

Hungarian Atomic Energy Office

Energy Centre

Hungarian Energy Office

Hungarian Petroleum Association

Hungarian Hydrocarbon Stockpiling Association

MAVIR

Ministry of National Development

Ministry of Rural Development

MOL, the Hungarian Oil and Gas Company

MVM, Hungarian Power Companies Ltd.

National Technical Research Office

Nuclear Waste Management Plc

Paks Nuclear Power Plant

Technical University of Budapest

ANNEX B: ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY		1973	1990	2000	2008	2009	2010E	2020
TOTAL PRODUCTION		**12.70**	**14.59**	**11.62**	**10.50**	**11.00**	**10.98**	**11.47**
Coal		6.05	4.12	2.89	1.69	1.56	1.57	1.50
Peat		-	-	-	-	-	-	-
Oil		2.02	2.27	1.68	1.25	1.21	1.06	0.80
Natural Gas		4.03	3.81	2.47	2.01	2.29	2.23	1.60
Biofuels & Waste[1]		0.59	0.70	0.76	1.54	1.78	1.83	3.50
Nuclear		-	3.58	3.71	3.88	4.03	4.12	3.79
Hydro		0.01	0.02	0.02	0.02	0.02	0.02	0.02
Wind		-	-	-	0.02	0.03	0.05	0.04
Geothermal		-	0.09	0.09	0.10	0.10	0.10	0.20
Solar		-	-	-	0.00	0.01	0.01	0.02
TOTAL NET IMPORTS[2]								
Coal	Exports	0.11	-	0.13	0.29	0.16	0.28	-
	Imports	1.74	1.63	1.21	1.70	1.11	1.40	0.80
	Net Imports	1.63	1.63	1.08	1.42	0.95	1.12	0.80
Oil	Exports	0.91	1.50	1.78	3.31	2.30	2.70	3.50
	Imports	7.38	7.93	6.99	9.27	7.91	8.47	10.55
	Int'l Marine and Aviation Bunkers	-0.05	-0.16	-0.23	-0.28	-0.24	-0.23	-0.28
	Net Imports	6.42	6.27	4.98	5.68	5.38	5.54	6.77
Natural Gas	Exports	0.01	0.02	0.07	0.02	0.07	0.19	-
	Imports	0.17	5.19	7.35	9.32	7.91	7.91	8.34
	Net Imports	0.15	5.17	7.28	9.30	7.83	7.72	8.34
Electricity	Exports	0.09	0.19	0.52	0.76	0.47	0.40	0.16
	Imports	0.49	1.14	0.82	1.10	0.94	0.85	0.47
	Net Imports	0.40	0.96	0.30	0.34	0.48	0.45	0.31
TOTAL STOCK CHANGES		**-0.02**	**0.07**	**-0.25**	**-0.75**	**-0.77**	**-0.38**	**-**
TOTAL SUPPLY (TPES)[3]		**21.28**	**28.66**	**25.00**	**26.46**	**24.86**	**25.44**	**27.68**
Coal		7.91	6.10	3.85	3.04	2.56	2.70	2.30
Peat		-	-	-	-	-	-	-
Oil		8.15	8.35	6.63	6.99	6.73	6.44	7.57
Natural Gas		4.17	8.91	9.65	10.56	9.15	9.74	9.94
Biofuels & Waste[1]		0.64	0.66	0.76	1.52	1.76	1.84	3.50
Nuclear		-	3.58	3.71	3.88	4.03	4.12	3.79
Hydro		0.01	0.02	0.02	0.02	0.02	0.02	0.02
Wind		-	-	-	0.02	0.03	0.05	0.04
Geothermal		-	0.09	0.09	0.10	0.10	0.10	0.20
Solar		-	-	-	0.00	0.01	0.01	0.02
Electricity Trade[4]		0.40	0.96	0.30	0.34	0.47	0.45	0.31
Shares (%)								
Coal		*37.2*	*21.3*	*15.4*	*11.5*	*10.3*	*10.6*	*8.3*
Peat		-	-	-	-	-	-	-
Oil		*38.3*	*29.1*	*26.5*	*26.4*	*27.1*	*25.3*	*27.3*
Natural Gas		*19.6*	*31.1*	*38.6*	*39.9*	*36.8*	*38.3*	*35.9*
Biofuels & Waste		*3.0*	*2.3*	*3.0*	*5.8*	*7.1*	*7.2*	*12.6*
Nuclear		-	*12.5*	*14.8*	*14.6*	*16.2*	*16.2*	*13.7*
Hydro		-	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
Wind		-	-	-	*0.1*	*0.1*	*0.2*	*0.1*
Geothermal		-	*0.3*	*0.3*	*0.4*	*0.4*	*0.4*	*0.7*
Solar		-	-	-	-	-	*0.0*	*0.1*
Electricity Trade		*1.9*	*3.3*	*1.2*	*1.3*	*1.9*	*1.8*	*1.1*

0 is negligible, - is nil, .. is not available

Note: 2010E data are estimates, and 2020 data are government forecasts submitted in October 2010.

Unit: Mtoe

DEMAND							
FINAL CONSUMPTION	**1973**	**1990**	**2000**	**2008**	**2009**	**2010E**	**2020**
TFC	**16.53**	**20.73**	**17.18**	**18.58**	**17.84**	**..**	**20.49**
Coal	4.08	2.40	0.54	0.52	0.35	..	0.40
Peat	-	-	-	-	-	..	-
Oil	6.46	7.12	5.20	6.56	6.36	..	7.23
Natural Gas	2.80	6.20	6.69	6.47	6.09	..	5.49
Biofuels & Waste[1]	0.62	0.62	0.69	0.84	1.00	..	2.30
Geothermal	-	0.09	0.08	0.09	0.09	..	0.19
Solar/Other	-	-	-	0.00	0.00	..	-
Electricity	1.51	2.72	2.53	2.95	2.85	..	3.55
Heat	1.06	1.59	1.45	1.16	1.09	..	1.34
Shares (%)							
Coal	*24.7*	*11.6*	*3.1*	*2.8*	*2.0*	..	*2.0*
Peat	-	-	-	-	-	..	-
Oil	*39.1*	*34.3*	*30.3*	*35.3*	*35.7*	..	*35.3*
Natural Gas	*17.0*	*29.9*	*38.9*	*34.8*	*34.1*	..	*26.8*
Biofuels & Waste	*3.7*	*3.0*	*4.0*	*4.5*	*5.6*	..	*11.2*
Geothermal	-	*0.4*	*0.5*	*0.5*	*0.5*	..	*0.9*
Solar/Other	-	-	-	-	-	..	-
Electricity	*9.1*	*13.1*	*14.7*	*15.9*	*16.0*	..	*17.3*
Heat	*6.4*	*7.7*	*8.4*	*6.2*	*6.1*	..	*6.5*
TOTAL INDUSTRY[5]							
Coal	1.57	0.52	0.29	0.35	0.21	..	0.30
Peat	-	-	-	-	-	..	-
Oil	2.22	2.08	1.53	1.92	1.78	..	1.01
Natural Gas	2.22	3.76	1.70	1.56	1.21	..	1.69
Biofuels & Waste[1]	0.02	0.00	0.06	0.12	0.12	..	0.15
Geothermal	-	-	-	0.00	0.00	..	-
Solar/Other	-	-	-	-	-	..	-
Electricity	0.92	1.18	0.76	0.85	0.74	..	0.94
Heat	0.46	0.23	0.52	0.36	0.33	..	0.33
Shares (%)							
Coal	*21.2*	*6.7*	*6.0*	*6.7*	*4.8*	..	*6.8*
Peat	-	-	-	-	-	..	-
Oil	*29.9*	*26.8*	*31.5*	*37.2*	*40.7*	..	*22.9*
Natural Gas	*30.0*	*48.3*	*35.0*	*30.2*	*27.6*	..	*38.3*
Biofuels & Waste	*0.3*	-	*1.2*	*2.3*	*2.6*	..	*3.4*
Geothermal	-	-	-	-	-	..	-
Solar	-	-	-	-	-	..	-
Electricity	*12.5*	*15.2*	*15.6*	*16.5*	*16.8*	..	*21.2*
Heat	*6.2*	*3.0*	*10.7*	*7.0*	*7.5*	..	*7.4*
TRANSPORT[3]							
OTHER[6]							
Coal	2.13	1.88	0.25	0.17	0.14	..	0.10
Peat	-	-	-	-	-	..	-
Oil	2.41	2.20	0.73	0.38	0.35	..	0.50
Natural Gas	0.58	2.44	4.99	4.90	4.88	..	3.80
Biofuels & Waste[1]	0.60	0.62	0.63	0.55	0.71	..	1.45
Geothermal	-	0.09	0.08	0.09	0.09	..	0.19
Solar/Other	-	-	-	0.00	0.00	..	-
Electricity	0.52	1.43	1.69	2.00	2.01	..	2.55
Heat	0.60	1.36	0.93	0.79	0.76	..	1.01
Shares (%)							
Coal	*31.2*	*18.8*	*2.6*	*1.9*	*1.6*	..	*1.0*
Peat	-	-	-	-	-	..	-
Oil	*35.3*	*22.0*	*7.8*	*4.3*	*3.9*	..	*5.2*
Natural Gas	*8.5*	*24.4*	*53.7*	*55.2*	*54.5*	..	*39.6*
Biofuels & Waste	*8.8*	*6.1*	*6.8*	*6.2*	*8.0*	..	*15.1*
Geothermal	-	*0.9*	*0.9*	*1.0*	*1.0*	..	*2.0*
Solar/Other	-	-	-	-	-	..	-
Electricity	*7.6*	*14.3*	*18.2*	*22.5*	*22.5*	..	*26.6*
Heat	*8.7*	*13.6*	*10.0*	*8.9*	*8.5*	..	*10.5*

Unit: Mtoe

DEMAND							
ENERGY TRANSFORMATION AND LOSSES	**1973**	**1990**	**2000**	**2008**	**2009**	**2010E**	**2020**
ELECTRICITY GENERATION[7]							
INPUT (Mtoe)	**6.36**	**9.62**	**10.19**	**10.48**	**9.59**	**..**	**10.98**
OUTPUT (Mtoe)	**1.52**	**2.45**	**3.03**	**3.44**	**3.09**	**3.21**	**3.72**
(TWh gross)	17.64	28.44	35.19	40.03	35.91	37.38	43.23
Output Shares (%)							
Coal	*66.0*	*30.5*	*27.6*	*18.0*	*17.9*	*16.9*	*16.4*
Peat	*-*	*-*	*-*	*-*	*-*	*-*	*-*
Oil	*17.2*	*4.8*	*12.5*	*0.9*	*1.8*	*1.2*	*1.1*
Natural Gas	*16.2*	*15.7*	*18.8*	*37.9*	*29.0*	*31.1*	*39.3*
Biofuels & Waste	*-*	*0.1*	*0.3*	*5.1*	*6.8*	*6.7*	*8.1*
Nuclear	*-*	*48.3*	*40.3*	*37.0*	*43.0*	*42.2*	*33.5*
Hydro	*0.6*	*0.6*	*0.5*	*0.5*	*0.6*	*0.5*	*0.4*
Wind	*-*	*-*	*-*	*0.5*	*0.9*	*1.4*	*1.0*
Geothermal	*-*	*-*	*-*	*-*	*-*	*-*	*-*
Solar	*-*	*-*	*-*	*-*	*-*	*0.0*	*-*
TOTAL LOSSES	**5.40**	**7.78**	**7.80**	**7.87**	**7.02**	**..**	**7.19**
of which:							
Electricity and Heat Generation[8]	3.65	5.41	5.51	5.70	5.23	..	5.91
Other Transformation	0.72	0.28	0.32	0.38	0.14	..	0.18
Own Use and Losses[9]	1.03	2.08	1.97	1.79	1.65	..	1.11
Statistical Differences	**-0.65**	**0.15**	**0.01**	**0.02**	**-0.00**	**..**	**-**
INDICATORS	**1973**	**1990**	**2000**	**2008**	**2009**	**2010E**	**2020**
GDP (billion 2000 USD)	31.11	44.62	47.38	60.45	56.40	57.07	82.35
Population (millions)	10.43	10.37	10.21	10.04	10.02	9.99	9.68
TPES/GDP[10]	0.68	0.64	0.53	0.44	0.44	0.45	0.34
Energy Production/TPES	0.60	0.51	0.47	0.40	0.44	0.43	0.41
Per Capita TPES[11]	2.04	2.77	2.45	2.64	2.48	2.55	2.86
Oil Supply/GDP[10]	0.26	0.19	0.14	0.12	0.12	0.11	0.09
TFC/GDP[10]	0.53	0.47	0.36	0.31	0.32	..	0.25
Per Capita TFC[11]	1.59	2.00	1.68	1.85	1.78	..	2.12
Energy-related CO_2 Emissions (Mt CO_2)[12]	66.6	66.7	54.2	53.0	48.2	..	50.2
CO_2 Emissions from Bunkers (Mt CO_2)	0.2	0.5	0.7	0.8	0.7	..	0.8
GROWTH RATES (% per year)	**73-79**	**79-90**	**90-00**	**07-08**	**08-09**	**09-10**	**10-20**
TPES	4.8	0.1	-1.4	-1.0	-6.0	2.3	0.8
Coal	1.2	-3.0	-4.5	-2.9	-15.7	5.4	-1.6
Peat	-	-	-	-	-	-	-
Oil	5.5	-2.7	-2.3	-3.9	-3.7	-4.4	1.6
Natural Gas	10.0	1.7	0.8	-1.3	-13.3	6.4	0.2
Biofuels & Waste	-2.6	1.7	1.5	15.2	15.6	4.5	6.6
Nuclear	-	-	0.4	1.0	4.1	2.2	-0.8
Hydro	6.3	1.3	-	-	11.1	-20.0	-
Wind	-	-	-	100.0	55.6	64.3	-1.4
Geothermal	-	-	-	11.6	-	1.0	7.5
Solar	-	-	-	33.3	25.0	20.0	12.8
TFC	4.5	-0.4	-1.9	-0.7	-4.0	..	..
Electricity Consumption	6.0	2.2	-0.7	1.7	-3.4	..	..
Energy Production	2.4	-0.0	-2.3	2.7	4.8	-0.2	0.4
Net Oil Imports	7.0	-3.9	-2.3	-5.1	-5.3	3.1	2.0
GDP	4.3	1.0	0.6	0.8	-6.7	1.2	3.7
Growth in the TPES/GDP Ratio	0.5	-0.9	-1.9	-1.8	0.7	1.1	-2.8
Growth in the TFC/GDP Ratio	0.3	-1.3	-2.4	-1.6	2.9	..	..

Note: rounding may cause totals to differ from the sum of the elements.

Footnotes to Energy Balances and Key Statistical Data

1. Biofuels and waste comprises solid biofuels, liquid biofuels, biogases, industrial waste and municipal waste. Data are often based on partial surveys and may not be comparable between countries.
2. In addition to coal, oil, natural gas and electricity, total net imports also include biofuels and waste.
3. Excludes international marine bunkers and international aviation bunkers.
4. Total supply of electricity represents net trade. A negative number in the share of TPES indicates that exports are greater than imports.
5. Industry includes non-energy use.
6. Other includes residential, commercial, public services, agriculture, forestry, fishing and other non-specified.
7. Inputs to electricity generation include inputs to electricity, cogeneration and heat plants. Output refers only to electricity generation.
8. Losses arising in the production of electricity and heat at main activity producer utilities and autoproducers. For non-fossil-fuel electricity generation, theoretical losses are shown based on plant efficiencies of approximately 33% for nuclear and 100% for hydro, wind and photovoltaic.
9. Data on “losses” for forecast years often include large statistical differences covering differences between expected supply and demand and mostly do not reflect real expectations on transformation gains and losses.
10. Toe per thousand US dollars at 2000 prices and exchange rates.
11. Toe per person.
12. “Energy-related CO_2 emissions” have been estimated using the IPCC Tier I Sectoral Approach from the Revised 1996 IPCC Guidelines. In accordance with the IPCC methodology, emissions from international marine and aviation bunkers are not included in national totals. Projected emissions for oil and gas are derived by calculating the ratio of emissions to energy use for 2009 and applying this factor to forecast energy supply. Future coal emissions are based on product-specific supply projections and are calculated using the IPCC/OECD emission factors and methodology.

ANNEX C: 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 hydro power, make a substantial contribution to the energy supply diversity of IEA 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 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 countries, 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 in Paris, France.)

*Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Korea, Luxembourg, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, Turkey, the United Kingdom, the United States.

ANNEX D: GLOSSARY AND LIST OF ABBREVIATIONS

In this report, abbreviations and acronyms are substituted for a number of terms used within 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.

AAU	assigned amount unit
bcm	billion cubic metres
bpd	barrels per day
CCGT	combined-cycle gas turbine
CCS	carbon capture and storage
CDM	clean development mechanism (under the Kyoto Protocol)
CH_4	methane
CHP	combined heat and power through cogeneration
CO_2	carbon dioxide
DH	district heating
EC	European Commission
ESCO	energy service company
ETBE	ethyl tertiary butyl ether
EU	European Union
EU-ETS	European Union Emissions Trading Scheme
GDP	gross domestic product
GHG	greenhouse gas
GJ	gigajoule, or 1 joule x 10^9
GW	gigawatt, or 1 watt x 10^9
GWh	gigawatt-hour
HAEA	Hungarian Atomic Energy Authority
HAEC	Hungarian Atomic Energy Commission
HEO	Hungarian Energy Office
HUF	Hungarian forint (on average in 2009, HUF 1 = EUR 0.00356 and USD 0.00494)
HUFX	Hungarian Power Exchange
IAEA	International Atomic Energy Agency
IEA	International Energy Agency
JI	Joint Implementation (under the Kyoto Protocol)

kV	kilovolt, or one volt x 10^3
kWh	kilowatt-hour, or one kilowatt x one hour, or one watt x one hour x 10^3
LNG	liquefied natural gas
MAVIR	Hungarian Power System Operator Company
mcm	million cubic metres
MOL	Hungarian Oil and Gas Company
Mt	million tonnes
MTBE	methyl tertiary butyl ether
MVM	Hungarian Power Companies Ltd.
MW	megawatt of electricity, or 1 Watt x 10^6
MWh	megawatt-hour = one megawatt x one hour, or one watt x one hour x 10^6
N_2O	nitrous oxide
NPP	nuclear power plant
PPA	power purchase agreement
PPP	purchasing power parity
PURAM	Public Agency for Radioactive Waste Management
R&D	research and development
RD&D	research, development and demonstration
RD&I	research, development and innovation
RRB	Research Reactor of Budapest
TFC	total final consumption of energy
toe	tonne of oil equivalent, defined as 10^7 kcal
TPA	third-party access
TPES	total primary energy supply
TSO	transmission system operator
TW	terawatt, or 1 watt x 10^{12}
TWh	terawatt x one hour, or one watt x one hour x 10^{12}
UNFCCC	United Nations Framework Convention on Climate Change
VAT	value-added tax

IEA PUBLICATIONS, 9, rue de la Fédération, 75739 PARIS CEDEX 15
PRINTED IN FRANCE BY SOREGRAPH, JULY 2011
(612011061P1) ISBN: 9789264098220