International Energy Agency

Co-funded by the European Union

Tajikistan 2022

Energy Sector Review

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INTERNATIONAL ENERGY AGENCY

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Foreword

The International Energy Agency (IEA) is renowned for its energy policy review and guidance for its member countries and beyond since 1976, with the latest trends focusing on the countries' key energy transition and security challenges.

Tajikistan is one of the focus countries of the EU4Energy programme, which is being implemented by the IEA and the European Union along with the Energy Community Secretariat and the Energy Charter Secretariat.

The other EU4Energy focus countries are Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Turkmenistan, Ukraine and Uzbekistan. The programme is designed to support the goals and aspirations of its 11 focus countries to implement sustainable energy policies and foster co-operation on energy sector development. As part of this programme, the IEA conducts energy data, policy and sector reviews of each focus country, updating and extending the analysis contained in the IEA's 2015 regional review, *Energy Policies Beyond IEA Countries: Eastern Europe, Caucasus and Central Asia*.

Tajikistan is endowed with abundant water resources and relies almost exclusively on hydro for electricity generation. Electricity is an integral part of Tajikistan's economy, and its energy policy continues to focus primarily on alleviating annual winter shortages and providing the population with uninterrupted access to energy since its independence. The country's approach to mitigating its recurrent energy crisis has varied over the decades, depending on regional dynamics, and like its neighbours, remains affected by the breakup of Soviet-era regional interconnections and energy trade mechanisms that prioritised water use for irrigation on a regional level.

The government of Tajikistan has made commendable efforts in pursuing an ambitious national energy sector agenda, including the installation of additional generation capacity and upgrading aged energy infrastructure with the help of international donors and financial institutions as well as enhancing regional co-operation, reconnecting with regional economies and participating in large-scale regional projects. Noteworthy developments are the completion of the Sangtuda hydropower plants (900 megawatts), the continued construction of the Rogun hydropower plant, and the Central Asia-South Asia Electricity Transmission and Trade Project (CASA-1000), which aims to help Tajikistan and Kyrgyzstan export surplus summer electricity to the neighbouring countries of Kazakhstan, Uzbekistan, Afghanistan and Pakistan. Enhanced cross-border trade would allow Tajikistan to balance supply and demand despite the seasonal fluctuations of its hydropower-dominated electricity generation. The National Development Strategy through 2030 sets ambitious goals for energy sector development and plays an important role in the country's desired level of industrialisation, sustainable development and green growth.

The key to reaching the goals set by the Strategy through 2030 remains the successful implementation of ongoing energy sector reforms, aimed at unbundling the vertically integrated state monopolies and setting up an independent regulator to attract private-sector investment and increase efficiencies. This report backs the transformation of Tajikistan's energy system, which is capable of achieving energy sector development goals that will provide affordable, secure and clean energy for its population and neighbouring markets, while contributing to the region's energy transition and climate change goals.

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1. Executive summary

The Republic of Tajikistan (Tajikistan) is home to over 9.9 million people, over 70% of whom live in rural areas with their main source of income from agriculture – the country's largest sector. Tajikistan gained independence in September 1991, which was shortly followed by a five-year civil war, from May 1992 to June 1997. The decade after the civil war saw strong economic growth, with measurable progress in reducing poverty and expanding the economy. However, Tajikistan's rate of job creation has not kept pace with its growing population, leaving the economy vulnerable to external shocks. The National Development Strategy of the Republic of Tajikistan for the Period up to 2030 (the Strategy 2030) aims to increase domestic incomes by up to 3.5 times and to reduce poverty by half by the year 2030. This is achievable if Tajikistan succeeds in transforming its present growth model and offers the private sector increased opportunities to invest, create jobs and contribute to innovation and growth.

With abundant water potential from its rivers, natural lakes and glaciers, Tajikistan is almost exclusively reliant on hydro for electricity generation. It has some of the world's largest hydropower plants (HPPs): the Nurek HPP, commissioned in 1972, and Rogun HPP, currently under construction. Although Tajikistan is ranked eighth in the world for hydropower potential with an estimate of 527 terawatt-hours (TWh), the country's current hydro potential is only exploited at approximately 4%. The challenge to successful economic management is Tajikistan's high vulnerability to climate change and natural disasters. Just in the 25 years between 1992 and 2016, natural and climate-related disasters have affected an estimated 7 million of the country's people and caused gross domestic product (GDP) losses of around USD 1.8 billion.

Electricity is an integral part of Tajikistan's economy, and providing a clean, affordable and secure supply of electricity has been of paramount importance for the government since independence. Despite its energy potential, Tajikistan's energy sector is susceptible to supply shocks. The country's dependence on electricity generation from HPPs makes it prone to seasonal electricity shortages due to water level fluctuations in hydropower reservoirs, leaving an estimated 1 million people without reliable electricity supply during the winter months. While Tajikistan has been successful in providing universal access to electricity, the existing systems of its energy infrastructure function inefficiently. The large majority of hydro plants were built in the Soviet era and are ageing and require rehabilitation. Losses caused by the poor quality of the country's transmission and distribution systems have averaged 15.5% for the last two decades, in comparison, average losses in IEA member countries were below 7% of supply, and saw a steady decline in the same period. Meanwhile, Tajikistan's non-domestic sector experiences an average of six power outages per month.

Energy policy priorities in Tajikistan are aimed primarily at alleviating annual winter shortages and providing the population with uninterrupted access to energy. The country's approach to its energy crisis has been variable, depending on the political situation and

relationships with its neighbours. At present, the government plans to diversify energy sources (including by introducing non-hydro renewable energy), to rehabilitate and modernise existing energy infrastructure, and to increase energy saving as well as regional integration.

Tajikistan's connection to the Central Asia Power System (CAPS) was cut off in 2009 as a result of Uzbekistan's disconnection from the system, and gas supplies from Uzbekistan also ceased in 2013, amplifying the country's concern's regarding steady energy supplies. This threatened the country's energy security even further, forcing the government to internalise its energy policy and consider developing domestic energy resources, including coal, and to increase cooperation with other neighbours. From 2018 the export of natural gas from Uzbekistan to Tajikistan was restarted along with the export of Tajik electricity to Uzbekistan, and both countries are currently working on reconnecting Tajikistan's energy system to CAPS, with completion expected in 2023.

Energy security remains a national priority, and one of the government's prime aims to achieve this is by increasing electricity generation capacity to power industrial development, particularly aluminium production, and increase electricity exports. Central to achieving the aims of the Strategy 2030 is the Rogun HPP project, the construction of a 3 600-megawatt (MW) plant at a cost of almost USD 4 billion that is expected to be completed and commissioned by 2032. The project will make a significant contribution to the strategy's goal of poverty reduction and growth through reducing energy shortages and increasing hydropower exports. However, construction on such a scale creates social and economic risks including community displacement, changes in hydrological flow regimes and its impacts on livelihoods and wildlife habitats, which will have to be managed by the government in order to avoid instability.

Another aim is the diversification of electricity sources away from HPPs, which currently generate 90% of electricity. Other options for increased capacity, as indicated in the Strategy 2030, are renewables (solar, wind) and coal-fired power plants. Tajikistan's mineral resource endowment has not been fully assessed and its coal, oil and gas deposits are estimated to be moderate. Oil and gas production remains modest, and almost all the country's oil and gas needs for both residential and industrial uses are satisfied by imports. Coal mining, on the other hand, has been on the rise and it has seen a tenfold production increase in the last decade, reaching 2.1 million tonnes (Mt) of coal production in 2020. Coal has become a significant source of district heating in Dushanbe, following the commissioning of the Dushanbe-2 co-generation[1] plant, and further projects coal use in the district heating sector have been announced. Utilising Tajikistan's unexploited natural resources to meet energy security concerns and aiding the country's industrial development are the main drivers for the country's focus on coal sector development. The Strategy 2030 sets ambitious targets for coal production, reaching 10.4 Mt to 15.1 Mt by 2030.

Current and planned energy investments are in line with the government's strategies to increase the capacity of renewables for electricity generation. Hydropower accounts for 90% of electricity generation projects (or 9.2 gigawatts [GW]), while coal-fired electric power plants are only 6% of the total electricity generation projects. These combined projects would significantly help to offet the winter shortages and to reduce the energy supply imbalances between the summer and winter months. They would also contribute

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

to the Strategy 2030's target to increase electricity generation from 17.1 TWh in 2015 to 26.2 TWh in 2020, and 40.7 TWh to 45 TWh in 2030.

The government supports the development of renewable energy resources, which it considers environmentally friendly, and provides a range of financial and regulatory incentives. These measures are listed in various legal and regulatory acts, including the Renewable Energy Law and the Tax Code. These measures, however, have been insufficient for stimulating market formation. Lack of financing has held back the promotion of energy-efficient and renewable energy technology deployment in the power or heating sectors. Among key impediments for the sector's inability to attract investments are below-cost-recovery tariffs for electricity and heat and low revenue collection. Other factors are related to underdeveloped institutional capacity; absence of support mechanisms; and lack of awareness and knowledge within the industry, small and medium enterprises (SMEs) and the general population.

The country's potential for energy efficiency gains also remains largely untapped, and although progress is evident in developing energy efficiency policies and related legal and regulatory measures, in the building sector in particular, the available evidence suggests that existing rules are poorly implemented and enforced. A market for energy services and energy service companies (ESCOs) does not currently exist in Tajikistan. Minimum energy performance standards (MEPS) and other policies designed to improve the energy efficiency of appliances and energy-using equipment, including lighting, are partially adopted, and there is a need to develop a more comprehensive demand-side energy efficiency policy framework. The potential for efficiency gains in the industry and transport sectors is substantial as consumption continues to grow significantly, and responsibilities for enforcing energy efficiency policies and measures fall under multiple agencies and public bodies. The government's attempts to establish a dedicated public body dealing with energy efficiency and renewable energy market developments have failed on numerous occasions, due to the scarcity of public financing available for creating a dedicated fund to move these sectors forward.

The Strategy 2030, as well as water and energy sector policies and measures deriving from it, consider energy- and water-related research, development and deployment (RD&D) as the key to sustainable deployment and green growth; however, the financial support to these research fields remains considerably small. The government, however, encourages donor and private-sector participation in this field and continues to work closely with international partners, promoting the adoption of modern innovative technologies where possible.

There are a number of large-scale regional projects where Tajikistan is a participant country. The Central Asia-South Asia Electricity Transmission and Trade Project (CASA-1000), funded by the World Bank, is a major project which aims to help Tajikistan and Kyrgyzstan export summer surplus electricity to the neighbouring countries of Kazakhstan, Uzbekistan, Afghanistan and Pakistan. It is expected that CASA-1000, when operational, will integrate the electrical networks of Central and South Asia, allowing Tajikistan to benefit from increased electricity exports that will encourage further development.

Tajikistan is also a partner in wider regional projects for the development of oil and gas pipelines and electricity transmission, such as Line D of the Central Asia-China gas pipeline, one of the largest liquefied natural gas (LNG) megaprojects in the world, with major funding from the People's Republic of China (hereafter, "China") at a projected cost of USD 3 billion.

Tajikistan signed and ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1998 as a Non-Annex I (or non-industrialised) country. The country also signed and ratified the Kyoto Protocol in 2008 and the Paris Agreement in 2016/17. It reports on its commitments on a biennial basis, and its Fourth National Communication was approved in December 2021.

Tajikistan has been improving energy statistics data management and use over the past decades, as its Agency on Statistics under President of the Republic of Tajikistan (TajStat) works in close co-operation with regional and international partners enhancing data quality and reporting obligations. However, further human and financial resources are required for the agency to foster climate and demand-side data collection and development of energy efficiency indicators for sound policy making and tracking progress.

Key policy directions

The development of the country's energy sector is based on the Strategy 2030, which all other strategies and programmes must conform to. According to the Strategy 2030, the most significant general problems faced by the energy sector are the inefficient management of natural resources, resulting in higher environmental capacity of production (i.e. too many natural resources are being used in industry), environmental pollution and high production losses, especially in electricity generation, and insufficient electricity supply during the autumn and winter due to reduced water flow.

Specific priorities in the energy sector include ensuring access to a reliable supply of energy for all the population, particularly in the rural areas, through the effective use of domestic energy resources. This implies making hydropower the foundation of the economy and exploiting its potential to reduce poverty, provide social benefits and promote development of other sectors of the economy. Further development of small hydropower and other renewable energy sources (RES) is therefore envisioned, as is small business development. Another aim is to make Tajikistan, as a regional and world leader in potential stocks of hydropower, a model for its efficient development and use. It is hoped that a combination of power diplomacy and market mechanisms will attract the attention of foreign markets.

Energy security concerns led the government to turn to domestic coal development to account for future energy supply shortages, following severe winter energy crises in 2007-2008. While initially aimed at alleviating winter electricity and heat shortages, further disconnections from regional electricity and natural gas networks have also made it an ultimate alternative to natural gas use in the industry sector. The government therefore has created favourable conditions for sector development and incentivised industries to move to using domestic coal. This was further emphasised following the government's focus on national industrialisation, elaborated in a range of sectoral development programmes, including the Strategy 2030 and the Concept of Coal Industry Development for the Period up to 2040. Strategic policy priorities are focused on improving, modernising and expanding fixed industrial assets that are necessary in order to sustainably develop priority areas of economic security and the rational and effective use of the country's rich mineral resources.

Tajikistan aims to undertake several primary activities to reach these aims. It will promote its national interests as energy flows in Central and South Asia are optimised under the

CASA-1000 project, by developing its hydropower potential, restoring existing energy infrastructure and creating new infrastructure, and ensuring its effectiveness through economic and technological integration with regional energy systems. It will also develop legislation and regulations for energy saving and energy efficiency, and will stimulate modernisation and innovation in technology, promoting energy- and resource-saving technologies. Energy industry development will be based on diversifying fuel sources to smooth seasonal fluctuations in generation, and the electricity network will be modernised to reduce losses, increase energy supply reliability and expand opportunities to use a range of renewables.

Results anticipated by 2030 are:

- Development of the electricity sector according to a 10-10-10-10 concept: 1) installed capacity increased to 10 GW; 2) annual electricity exports boosted to 10 TWh; 3) electric power system capacity diversified by at least 10% through increased use of coal, oil, gas and RES other than hydro; and 4) electricity system losses reduced to 10%.
- Domestic power diversification based on coal and oil; creation of gas subsystems and development of RES.
- Highly reliable power supply for all citizens and industry; end of seasonal deficiencies.
- Increased energy efficiency and control in all sectors of the economy through implementation of energy saving technologies and efficiency measures; provision of 500 million kWh of electric power to the economy guaranteed annually.
- Engagement of adequately trained personnel for modern power and industrial management.
- Financial stability and transparency of the energy sector and increased investment appeal.
- Optimised fuel-energy balance owing to reduced energy resource imports and greater energy production from solar, wind, biological and geothermal sources.

According to the Strategy 2030, the energy and transport sectors need to become the primary drivers of national economic growth. The government has therefore initiated tariff increases for the past few years and has been phasing out cross-subsidisation. Tariffs still remain among the lowest in the Central Asian region, and the government will continue to raise them until they reach cost-reflective levels.

Progress to date

The government has been relaxing legislative and bureaucratic requirements for investors and has introduced green tariffs for small HPPs and purchase obligations for the state-owned utility Barqi Tojik. This has resulted in a surge in small HPP construction since 2007, with capacity reaching more than 130 MW (exceeding the projected level). While demand for small HPPs continues, negligible progress has been made in developing solar and wind energy.

In the electricity sector, the largest projects are the Rogun HPP on the Vakhsh River and the CASA-1000 project, a 500 kilovolt (kV) transmission line connecting Kyrgyzstan, Tajikistan, Afghanistan and Pakistan. The Rogun HPP, which will produce 3.6 GW at peak capacity and entirely eliminate winter shortages, was deemed feasible in 2014 and construction recommenced in 2016. The considerably higher electricity production when the first units come online will not only cover domestic demand but will also permit

increased electricity exports to Afghanistan and Pakistan, and possibly northward exports to Kyrgyzstan and Kazakhstan.

The government has also invested in the new Dushanbe-2 thermal power plant (TPP) (400 MW) and has updated heat supply pipelines in Dushanbe to reduce winter deficits and increase energy capacity. It has secured investments from the World Bank, the European Bank for Reconstruction and Development (EBRD) and the European Investment Bank (EIB) to reduce losses in the energy sector, particularly for the installation of smart meters in Dushanbe and Khujand.

Coal production has grown significantly since 2007 and is set to continue to grow as the government rehabilitates TPPs and builds new coal-fired generation. Additionally, the government has encouraged industries to switch from natural gas and oil to coal, resulting in strong demand and high year-on-year production growth.

Tajikistan is part of the gas pipeline route from Turkmenistan to China (Line D). The construction phase of this project has not yet begun, and negotiations among project countries continue. The new infrastructure would allow Tajikistan to export gas to China, and, according to the Tajik government, a number of private investors have shown interest in developing oil and gas production in the country in recent years.

In 2016, Tajikistan began preparation of its Fourth National Communication of the Republic of Tajikistan under the UNFCCC with assistance from the UN Development Programme (UNDP). This report was prepared based on the results of the Paris Agreement, and was formally approved in 2021.

Challenges ahead

Specific challenges facing Tajikistan's energy sector include the isolation of its energy supply system from those of other Central Asian countries, resulting in seasonal electricity deficiency and limited energy export potential, which has destabilised the country's energy and economic security. The World Bank estimates that Tajikistan's restricted electricity supply costs the country USD 200 million annually. The consequences of an unreliable energy supply are far-reaching: it is a barrier to attracting new customers; local energy resources are used inefficiently to make up the seasonal deficit of electricity; energy efficiency of production and consumption are low; the legal and regulatory framework for the energy industry lacks effectiveness; disproportionately low electricity tariffs are a barrier to the development of private business and favour expansion of a shadow economy, and do not encourage energy saving or efficiency; and weak diversification of generating sources (HPPs account for more than 90% of the general rated capacity of power plants) impairs the economic viability of solar, wind and biomass energy production.

As the economy's backbone, the energy sector is facing a number of challenges, most pressing of which are obsolete generation, transmission and distribution capacities which cannot be upgraded or replaced due to a lack of financing caused by low electricity tariffs and poor revenue collection. In April 2019, the government announced the Action Plan for Financial Recovery of Barqi Tojik (the state-owned utility), detailing plans for the unbundling of Barqi Tojik and establishing the Electricity Regulatory Authority, with a gradual increase of electricity tariffs with the aim of reaching a full cost recovery tariff by 2025.

The Government Decree No. 330 from June 2019 further detailed steps for energy sector reforms, based on which Barqi Tojik remains responsible for power generation while electricity transmission assets are transferred to the newly created Shabakahoi Intiqoli Barq and distribution assets go to the new Shabakahoi Taqsimoti Barq. Although unbundled, Barqi Tojik's low institutional capacity combined with the lack of attractiveness to private investors of the existing legal and regulatory framework pose major obstacles to creating a significant level of openness for trade in services and investment in the energy market. The government continues work to further amend the legal and regulatory framework to reflect the new business structure of the power sector and to advance steps establishing an independent energy regulator.

As a net oil importer, Tajikistan is highly exposed to oil supply disruptions. It does not appear to hold emergency oil stocks or related reporting mechanisms at present and would greatly benefit from building stocks to counter potential supply disruptions. It would also benefit from having a monitoring system in place, which would help the country take the necessary actions rapidly in case of supply disruptions and mitigate shocks to the economy.

Key recommendations

The government of Tajikistan should:

- Advance energy sector reforms, including restructuring of the state-owned electric utility Barqi Tojik, establishing an independent regulator, gradually increasing electricity and heat tariffs to full cost recovery levels and removing energy subsidies and moving to targeted social support for the most vulnerable.
- Continue encouraging cross-border electricity trading to optimise resource use and enhance energy security.
- Ensure that coal mining and coal-based industrial developments comply with best practice for environmental liability and adhere to the highest environmental and safety standards in all coal-fired generation and coal-based industrial developments.
- Consolidate and co-ordinate policies in the areas of district heating and cooling, oil, natural gas, coal, and energy efficiency fields, and support the development and demonstration of efficient, integrated systems to supply heating, cooling and electricity (trigeneration).
- Consider holding emergency oil stocks, with necessary legal and regulatory framework, including requirements for regular emergency response exercises to test system responsiveness in case of supply disruption.
- Enhance official energy statistics management and use as the basis of strategic policy directions and measuring progress. Support TajStat to increase data disaggregation and accuracy of energy end uses and to further align the production and dissemination of official energy statistics with international recommendations.
- Encourage closer co-operation between the greenhouse gas (GHG) inventory compiler and TajStat to further improve energy-related GHG reporting and analysis and the underlying energy statistics.

- Develop a more comprehensive demand-side energy efficiency policy framework, including building codes, passenger vehicle fuel efficiency standards, MEPS and labelling for appliances and energy-using equipment, and well-enforced audit requirements for industry.
- Foster using incentives for small renewable energy suppliers to encourage entrepreneurship and the establishment of small businesses in the energy sector.
- Create a designated entity in charge of energy-efficient and renewable energy market development.
- Formulate an integrated energy research and development (R&D) strategy based on close co-ordination with the Academy of Sciences and its public research institutions, relevant ministries, national enterprises, SMEs, international financial institutions (IFIs), and other bilateral or multilateral donors in the energy sector.

2. General energy policy

Key data

(2020)

Total energy supply (TES)*: 3.7 Mtoe (hydro 39.1%, oil 29.4%, coal 26.3%, natural gas 5.3%), +68.2% since 2010

TES per capita: 0.4 toe (world average 2019: 1.9 toe)

TES per unit of GDP: 105 toe/USD million PPP (world average 2019: 114 toe/USD million PPP)

Energy production: 2.5 Mtoe (hydro 61.8%, coal 37.3%, oil 1.0%, natural gas 0.02%), +63.6% since 2010

TFC: 3.1 Mtoe (electricity 42.8%, oil 34.4%, coal 16.2%, district heat 3.8%, natural gas 2.9%), +57.9% since 2010

* excludes electricity trade; data not available for bioenergy (e.g. fuelwood)

Country overview

The Republic of Tajikistan is a landlocked country situated in the southeast of Central Asia. The country covers an area of 141 400 square kilometres (km^2) and it borders Kyrgyzstan to the north (with a border of 988 kilometres [km]), China to the east (494 km), Afghanistan to the south (1 372 km), and Uzbekistan to the north and west (1332 km). It is separated narrowly from Pakistan by the Wakhan Corridor of Afghanistan.

The country is defined by an interconnecting system of three mountain ranges – the Pamir, Hissor and Tian Shan ranges – constituting 93% of the total area and ranging from 300 metres (m) to 7 495 m above sea in altitude. Almost half of the territory is at an elevation of 3 000 m. Seventy-two of Tajikistan's mountains are 6 000 m above sea level in altitude or higher. At 7 495 m, the highest is Ismoil Somoni Peak (Qullai Ismoili Somoni), located in the Pamir Mountains. The country is prone to frequent earthquakes as it lies in the active seismic belt that covers the entire southern Central Asia region. The mountain peaks are covered with snow throughout the year, and along with ice and glaciers cover 8 476 km^2 or about 6% of the country's total area, storing an estimated 576 cubic km (km^3) of fresh water. Meltwater from snow and glaciers feeds the river system of the Aral Sea Basin with a mean flow of 6 km^3 to 13 km^3 of fresh water per year, constituting approximately 10-20% of the basin's total river volume. Alpine lakes cover an area of over 680 km^2, with most located in the eastern part of the Pamir Mountains. There are an estimated 1 000 lakes, 80% of which lie at 3 000 m above sea level in altitude or higher.

The west of Tajikistan constitutes foothills and steppe land while in the south-west and north lie lowlands in river valleys, which include sections of the Fergana Valley, a fertile region shared with the neighbouring countries of Uzbekistan and Kyrgyzstan.

Figure 2.1 Map of Tajikistan

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

Tajikistan has a rich diversity of ecosystems, from hot, dry deserts to frozen mountains and glaciers. As a result, the country is rich in biodiversity, with a wide variety of animal and plant species. Flora varies by region, ranging from drought-tolerant grasses and low shrubs in the steppes to dense forests of coniferous trees in the mountains.

Tajikistan's climate is continental; however, the combination of varying elevations of the terrain and complex topography results in local and regional climate zones with extreme temperature differences, characterised by significant daily and seasonal fluctuations in weather conditions. There is a wide range in annual precipitation: from less than 100 millimetres (mm) in the eastern portion of the Pamir Mountains to 500 mm to 600 mm in the south in the Vakhsh River Valley to over 2 000 mm on the Fedchenko Glacier.

Tajikistan's economy is highly agrarian, notably cotton, potatoes, wheat and horticulture, and animal husbandry. Industry is less developed and includes mechanical engineering, production of aluminium, cement and vegetable oil, mineral fertilisers, textile and light industry, energy, and production of consumer goods. The country is rich in mineral deposits and although mining activity has been disrupted in recent years, gold continues to be mined. The region's comparative remoteness and isolation, minimal transport infrastructure, high-mountainous relief, and lack of access to the sea shape a largely unfavourable economic and geographical position.

Total GDP for 2019 was USD 8.3 billion –GDP per capita of USD 900 – and breaks down as follows: agriculture 20.9%, industry 21.2%, construction 11.7%, services 30%, transport

and communication 6.1%, and net product tax 9.8%. Public external debt reached USD 2.9 billion (40% of GDP) at the end of 2018 compared with 24% of GDP in 2014. The rate of real GDP growth fell to 6.2% in 2019 from 7.3% in 2018, with a further slowdown to 5.5-5.0% between 2020 and 2021 due to the weakening of the Russian economy and the negative impact of Covid-19 on world commodity prices. This has negatively affected remittances from migrant workers, a significant contributor to the economy, and this flow is expected to remain greatly reduced in the medium term during which the economy will be supported mainly by mining, manufacturing and construction. Of the working age population, 46% are in agriculture, 6.8% in industry, 8.6% in construction, 12.2% in trade and services, 4.6% in public administration, 4.1% in health care, 8.1% in education, and 9.3% in other sectors such as finance, communications and science.

Tajikistan is one of the ten countries with the fastest rate of poverty reduction in the last few decades – its poverty rate has fallen from 83% in 1999 to 26.3% in 2019, and the extreme poverty rate fell from 73% to 10.7%. Data from 2003 to 2018 reveal that the factors reducing poverty included wage increases, remittances from abroad and timely pension payments. The World Bank's Human Capital Index (HCI) for 2018 gives Tajikistan a world ranking of 57th out of 130 countries with an HCI of 0.53 (the index ranges between 0 and 1), the Human Development Index (HDI) for 2020 places the country 125th out of 187 countries with an HDI of 0.668, and the Gender Inequality Index for 2019 places it at 70th out of 162 countries, with a value of 0.314.

Energy security

Energy security in Tajikistan is critically unstable and therefore of central concern for the government. The country relies on hydropower for nearly all its electricity needs, but seasonal generation volatility means that there is a surplus of electricity during the summer and a shortfall during the winter. Existing generation capacity is not sufficient for the winter months, leaving much of the population subject to outages and with limited electricity access. Some of the remote regions of the country have no electricity or heating.

Electricity shortages have existed since the country gained its independence in 1991, and the system has been under increasing pressure as demand continues to grow. The main response to the winter shortages has been limitations on consumption, primarily affecting people in rural areas who represent around 70% of the population.

Additional risks to energy security come from an ageing infrastructure and a large number of generation facilities reaching the end of their lifespans. To maintain existing capacity, approximately 80% of Tajikistan's HPPs will need to be rehabilitated by 2030. The government is working mainly with the IFIs to secure projects and funding for these large-scale rehabilitations. Preliminary rehabilitation work on the giant Nurek HPP, as well as on the Kayrakum HPP, is ongoing.

Difficulties with regional co-operation is another factor that has compromised Tajikistan's energy security. With the suspension of the electricity interconnection to Uzbekistan (connecting to CAPS) in 2009, and disconnection from the Uzbekistan gas pipeline in 2013, the country had to curtail its reliance on energy imports in order to alleviate winter electricity shortages.

These regional circumstances have made the construction of a 500 kV north-south connection line within the country a necessity, and large industries have begun to use

more coal to avoid the consequences of natural gas shortages. The government aims to improve energy security by developing domestic energy resources (including large hydro), improving transmission and distribution networks, and strengthening regional integration with other neighbouring countries.

Construction of the Rogun reservoir on the Vakhsh River is one of the government's main projects at present – when operational, the Rogun HPP will have a capacity of 3.6 GW and will produce sufficient electricity to eradicate winter shortages. Construction of the plant began in the 1980s but was interrupted by political instability; after positive assessment by the World Bank, construction restarted in 2016.

The government also plans to develop energy sources other than large hydro to diversify the fuel mix and reduce volatility in electricity generation. Having sizeable coal deposits/reserves and a coal production history of more than a century, the government has turned to coal as an ultimate fuel in resolving severe electricity shortages in winter months, when water levels are too low for electricity production. Production of coal in 2020 reached 2.1 Mt, which is a tenfold rise from 2010. Coal has rapidly become a key energy source in Tajikistan (26.3% of total energy supply (TES) in 2020). Barqi Tojik constructed a new coal-fired power plant, Dushanbe-2 (400 MW capacity), and a new TPP is planned to be built by 2025 in Zarafshon. Over 130 MW of small hydro had been developed by the end of 2014, and other plans include converting heat generation plants from gas to coal and rehabilitating existing TPPs to improve efficiency.

Regional co-operation is also crucial, and the government is turning its focus to southern neighbours because Rogun HPP is intended to provide enough electricity for domestic consumption as well as for export to Afghanistan and Pakistan in the summer months, as specified under the CASA-1000 project. If both projects proceed, Tajikistan's significant involvement in regional co-operation would diversify its export markets.

In addition, Tajikistan has investment for reconnection to CAPS. From 2023 Tajikistan is expected to be connected to CAPS, which will bring greater stability to the electricity system of the country and wider region. These infrastructure projects will allow Tajikistan to not only export but to import electricity from Central Asia countries at the same time, increasing its energy security.

Energy supply and demand

Tajikistan's energy system depends primarily on hydroelectricity, coal and oil. Hydropower and coal are produced domestically whereas virtually all oil and gas must be imported to meet the demand. This also explains the high share of electricity in final consumption, as well as the increasing use of coal in both transformation and industries.

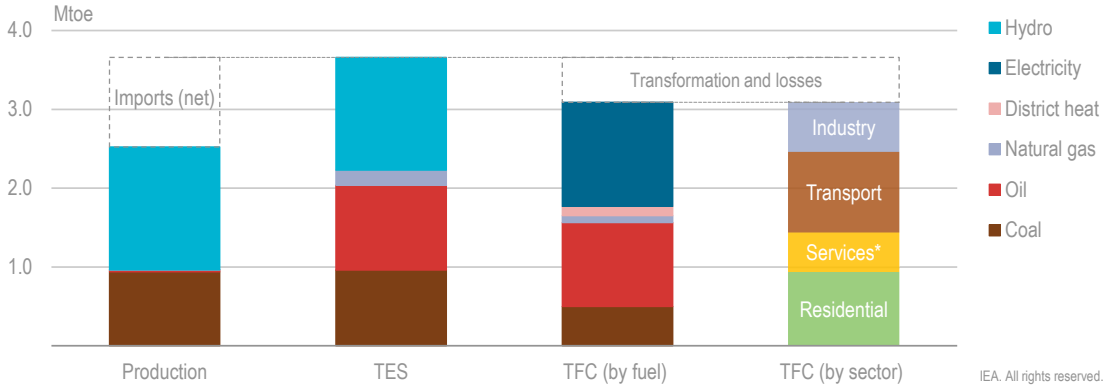
The importance of gas in the economy is low. Between 2013 and 2017 the imports were physically halted, but resumed in 2018. Several large hydroelectric plants generate over 90% of the electricity. Hydro capacity is soon to expand through the commissioning of the new units at the largest reservoir power plant, i.e. Rogun. As of 2022 no solar photovoltaic (PV) or wind capacity has been commissioned.

In 2020, TES was 3.7 million tonnes of oil equivalent (Mtoe), of which over two-thirds were covered by domestic energy sources. Fossil fuels (natural gas, coal and oil) accounted for around 60% of TES.

Total final consumption (TFC) was 3.1 Mtoe in 2020, of which electricity accounted for 43%, oil 34%, coal 16%, and the remaining 7% from natural gas and district heat. The share of electricity in Tajikistan's TFC is among the highest in the world. It is noteworthy that the contribution of bioenergy is not systematically tracked.

The energy consumption level was comparable in the transport sector (33% of TFC in 2020) and residential sector (30%). Industrial energy consumption is traditionally comparable to these, however it slumped almost 25% between 2019 and 2020, likely as a result of Covid-19. Services consumed 9% of TFC and agriculture 7%.

Figure 2.2 Overview of Tajikistan's energy system by fuel and sector, 2020



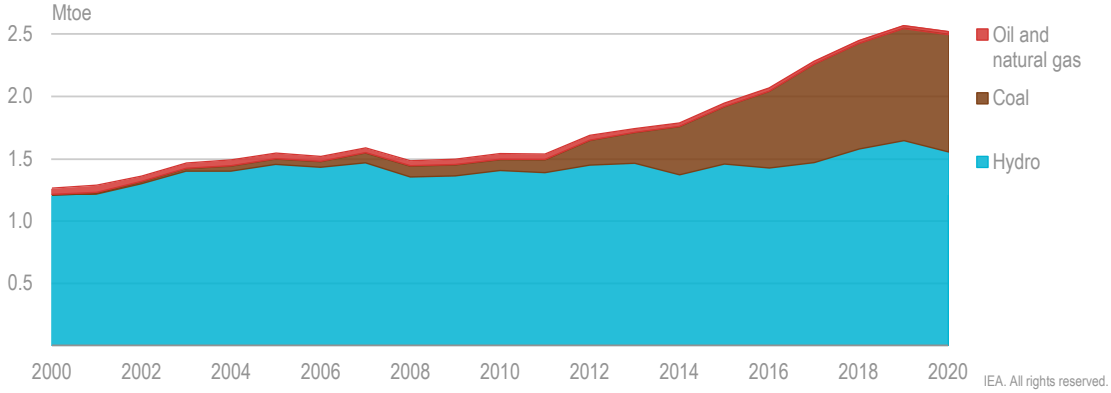
Tajikistan imports roughly one-third of its energy needs, mainly in the form of oil products.

* Includes commercial and public services, agriculture and forestry and unspecified energy consumption.
Note: Bunker fuels of around 0.03 Mtoe are not included in TES. Electricity exports accounting for 3.5% of TES (negative) are not shown in the chart.
Source: IEA (2022), *World Energy Statistics and Balances* (database), https://www.iea.org/data-and-statistics.

Energy production and domestic supply

Tajikistan's primary energy production amounted to 2.5 Mtoe in 2020. Domestic energy production mainly consists of hydro (62% of production in 2020) and coal (37%). Hydro generation has increased in recent years (+13% since 2015) as a result of capacity additions. Coal mining has increased from negligible quantities in 2010 to over 2 Mt (1.2 Mtoe) in 2019. Overall self-sufficiency has grown from around 60% of the TES in the early 2000s to almost 75% in 2019.

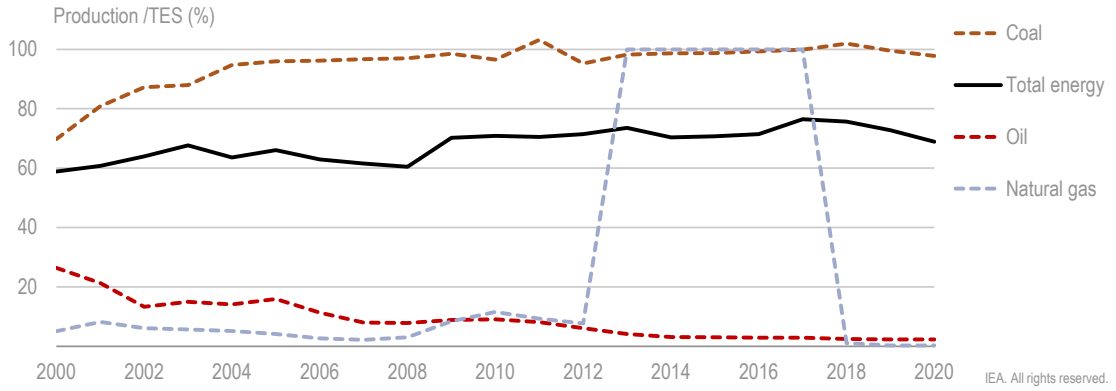
Figure 2.3 Primary energy production by source, 2000-2020



Hydroelectricity and coal are the main domestic energy sources.

Note: Data on bioenergy not available.
Source: IEA (2022), *World Energy Statistics and Balances* (database), https://www.iea.org/data-and-statistics.

Figure 2.4 Self-sufficiency (production/TES) by energy source, 2000-2020



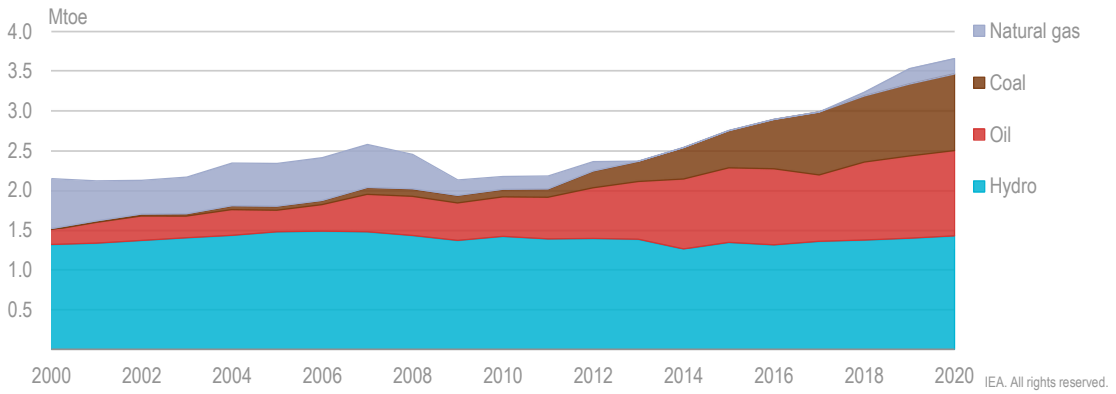
Virtually all oil and gas used in Tajikistan must be imported.

Note: Self-sufficiency is calculated by domestic production over TES. Values below 100% indicate that the country produces less than it consumes, making it a net importer of energy. For 2013-2017 there were no natural gas imports.
Source: IEA (2022), *World Energy Statistics and Balances* (database), https://www.iea.org/data-and-statistics.

TES stood at 3.7 Mtoe in 2019, an increase of 68% since 2010. Hydro accounted for 443% of TES, oil for 29% and coal for 26%. Natural gas covered only 5%.

Coal demand went from marginal in the early 2010s to a key energy source in TES in 2020. Similarly, oil consumption has more than doubled since 2010.

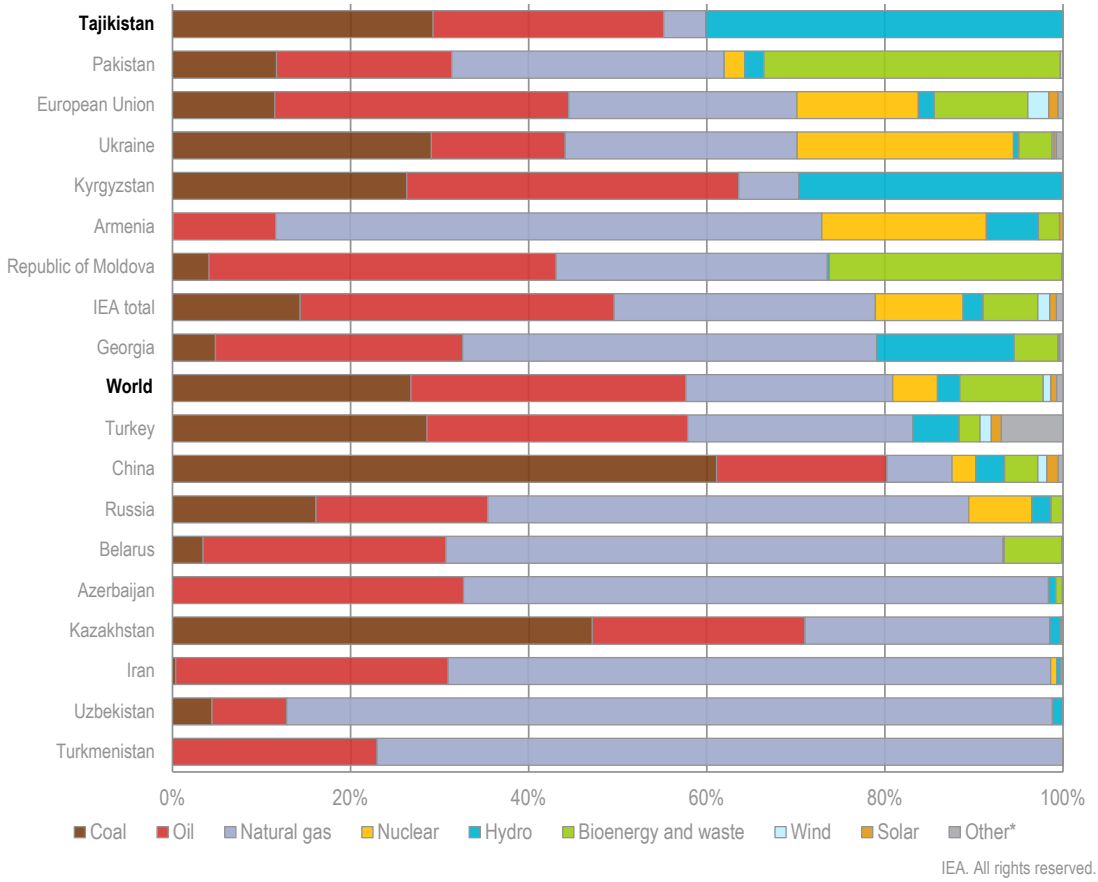
Figure 2.5 Total energy supply by source, 2000-2020



Tajikistan's TES increased by almost 70% between 2010 and 2020.

Source: IEA (2022), *World Energy Statistics and Balances* (database), https://www.iea.org/data-and-statistics.

Figure 2.6 Breakdown of total energy supply in selected countries, 2019



The share of hydro in Tajikistan's TES remains one of the highest in the world.

* Includes geothermal, primary heat, wave and ocean energy.
Note: Electricity trade not included.
Source: IEA (2022), *World Energy Statistics and Balances* (database), https://www.iea.org/data-and-statistics.

Tajikistan relies on hydro, coal and oil for its energy supply, and much less on natural gas. Although the share of coal in TES in Tajikistan is on the rise, the share of fossil fuels is still well below the world average.

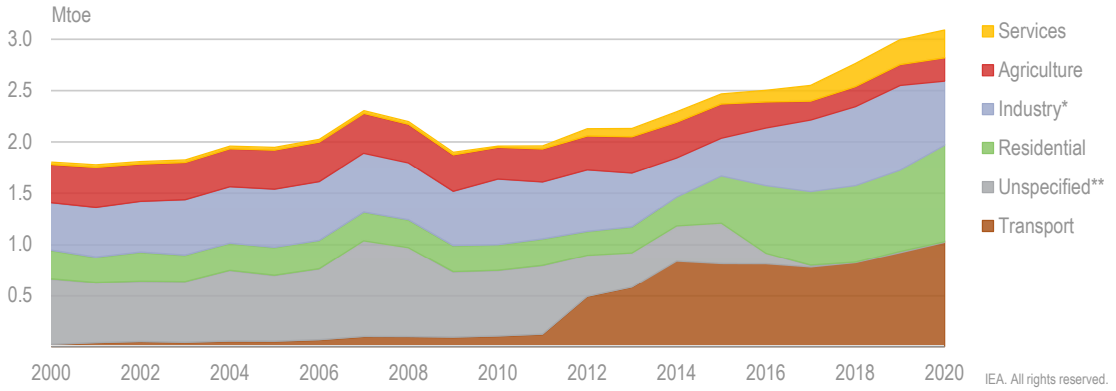
Energy consumption

Tajikistan's TFC amounted to 3.1 Mtoe in 2020, an increase of 58% since 2010. Demand in the residential, industry and transport sectors has seemingly grown, but uncertainty in the historical data hinders the trend analysis. In 2020, the residential sector consumed 33% of TFC, followed by transport (30%) and the industrial sector (20%). Services consumed 9% of TFC and agriculture 7%. Consumption in agriculture has decreased by 27% since 2010.

Fossil fuels (mainly oil and coal) accounted for 53% of the TFC in 2020. However, the share of electricity – 43% of TFC – is among the highest in the world. The domestic hydro resource has resulted in high rate of electrification in industry and residential sectors. Natural gas and district heat play only minor roles in the TFC (around 3-4% each). An

energy consumption survey conducted by TajStat in 2016 indicates the consumption of bioenergy, particularly by households, may be grossly underestimated.

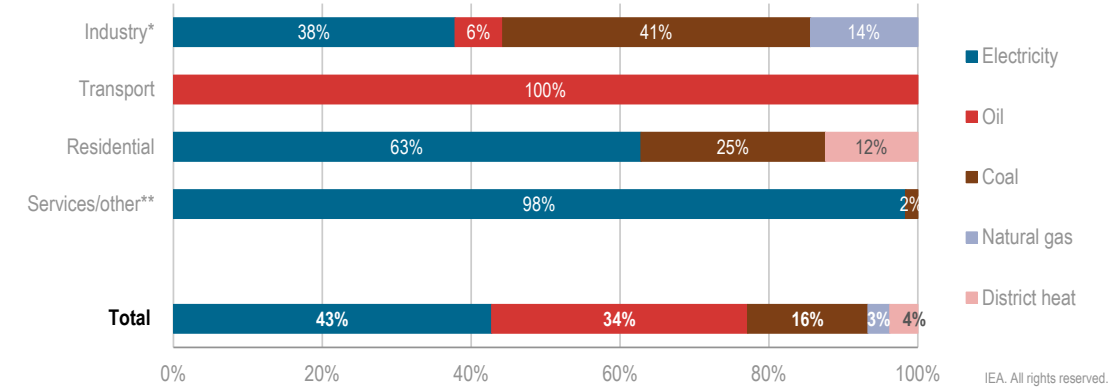
Figure 2.7 Total final consumption by sector, 2000-2020



Final consumption of energy has grown over 70% since 2000.

* Includes non-energy consumption.
** The relatively high share of unspecified energy consumption before 2015 hinders accurate sectoral analysis. Using expert estimates, unallocated liquefied petroleum gas (LPG) consumption was reallocated to the transport sector.
Source: IEA (2022), *World Energy Statistics and Balances* (database), https://www.iea.org/data-and-statistics.

Figure 2.8 Total final consumption by source and sector, 2020



Electricity is the main energy carrier in Tajikistan's final consumption.

* Includes non-energy consumption.
** Includes commercial and public services, agriculture and forestry, and unspecified consumption.
Note: For ease of readability, shares of less than 1% are not shown. Therefore, the sectoral totals may not add up to 100%.
Source: IEA (2022), *World Energy Statistics and Balances* (database), https://www.iea.org/data-and-statistics.

Energy sector governance

The Ministry of Energy and Water Resources (MEWR) is responsible for policies on energy, RES and energy efficiency; it also governs the oil and gas sector (http://mewr.gov.tj/ru/).

The Ministry of Industry and New Technologies regulates Tajikistan's coal industry and is responsible for setting coal sector development policy and overseeing its implementation (http://www.sanoat.tj/).

The Ministry of Economic Development and Trade is the central executive authority and participates in the development of state policy for all social and economic sectors of the country (www.medt.tj), and the Ministry of Justice analyses draft laws and submits them to the government for consideration (www.minjust.tj).

The Agency on Statistics under President of the Republic of Tajikistan (TajStat) is the main provider of energy statistics, as well as activity data required for the assessment of GHG emissions used in Tajikistan's reporting under the UNFCCC. It is responsible for household surveys, demographic statistics and a wide range of economic statistics, including surveys of enterprises and institutions, as well as prices, foreign trade, etc. (http://www.stat.tj/ru).

The Committee on Construction and Architecture under the Government is tasked with monitoring and enforcing energy efficiency standards in new construction (http://tajsohtmon.tj), and the Agency of Standardization, Metrology, Certification and Trade Inspection under the Government is responsible for the standardisation of energy products and energy efficiency measures (http://www.standard.tj).

The Committee on Environmental Protection under the Government is responsible for implementing environmental protection laws and managing forests, flora and fauna generally, protected areas and natural monuments, and water and air resources, and for ensuring compliance with environmental safety standards (www.hifzitabiat.tj). The Main Department of Geology under the Government regulates the use of minerals (http://www.gst.tj).

The Anti-monopoly Service under the Government reviews tariffs and is responsible for implementing state policy for the protection and development of competition. It is tasked with suppressing monopolistic activities and controlling advertising to protect consumers (http://www.ams.tj).

The state-owned open joint-stock company (OJSC) Barqi Tojik is the national company responsible for generation, the OJSC Shabakahoi Intiqoli Barq for transmission, and the OJSC Shabakahoi Taqsimoti Barq for distribution of electricity (http://www.barqitojik.tj/).

The National Coal Company, Angishti Tojik (the Tajik Coal), is the responsible state entity for operating state-owned companies and assets in the coal sector, overseeing the condition of state mining deposits, implementation of production licences, and operations of subsidiary enterprises.

The state-owned OJSC Tajiktransgaz is responsible for the generation, transmission and distribution of gas, and the OJSC Naftrason is the national entity responsible for production, transmission and distribution of oil.

The only district heat supply system currently operational is in the capital city, Dushanbe, where the city-owned OJSC Dushanbe Teploset (Dushanbe District Heating Company) is responsible for distribution and consumer relations.

Energy statistics

The collection, validation and dissemination of official energy statistics fall under the responsibility of TajStat. TajStat produces annual energy statistics regarding the production and consumption of energy commodities, as well as the external trade in such

commodities. Some of these data are available on the public domain. There is no dedicated staff specifically for energy statistics, but the relevant statistics are currently governed by different statistics departments.

Since 2017, data have been increasingly produced following relevant international methodologies and standards. TajStat also receives and processes data from a number of government bodies, notably the MEWR and the Ministry of Finance. The national statistics strategy until 2030 defines priority areas also for the development of energy statistics:

- shift towards electronic reporting
- implementing international best practices in the development of energy statistics
- national co-operation to improve commodity balances
- calculation of energy efficiency indicators, Sustainable Development Goals (SDGs).

TajStat has regular collaboration with the main (government) data users, building trust in and knowledge of the available data. The main national users of energy data include the MEWR and TajHydroMet, which is responsible for climate reporting under the UNFCCC. TajStat also co-operates and regularly shares energy data with international organisations, including the International Energy Agency (IEA), the United Nations Statistics Division (UNSD), and the Joint Organisations Data Initiative (JODI).

Energy efficiency indicators

Conducting a specific household energy consumption survey (e.g. every five years) to obtain disaggregated energy information within the residential sector would allow the development of important energy efficiency indicators, which in turn would greatly support any future energy efficiency policies and measures for buildings and the household sector.

Energy data management and use

The 2015 IEA review noted that Tajikistan “aims to adopt the IEA energy balance format” and recommended that it “develop energy efficiency indicators to monitor progress” (IEA, 2015). Since then, Tajikistan has improved energy demand data collection with support from the World Bank by developing and piloting three new surveys, including the first household energy consumption survey in 2016 (TajStat, 2018), which is to be commended.

While the survey indicated widespread use of fuelwood in households, consumption is currently not tracked systematically. This could be done by conducting a specific household energy consumption survey (e.g. every five years) to obtain disaggregated energy information on energy end uses. The obtained data would also support the development of energy efficiency indicators, which in turn would greatly support any future energy efficiency policies and measures for buildings and the household sector. In developing new surveys, it is important to take into account the lessons learned from the first one conducted in 2016.

The assessment of the annual energy statistics provided to the IEA shows a clear increase in the level of detail since the introduction of the new data collection. Continued adoption

of the international energy statistics methodology and standards[2] in data production and dissemination would further support developing a complete picture of the national energy landscape. This includes developing a national official energy balance that also incorporates all the survey results.

While some energy information is already available online, this could be complemented with the release of additional statistics on energy trade and commodity and energy balances in user-friendly formats on a dedicated section of the relevant websites.

The strategic priorities for energy statistics included in the national statistics strategy are all relevant. It will be useful to regularly update the strategy to reflect emerging needs. To support these directions, it would be important to resource a dedicated position/team responsible for compiling, validating and disseminating energy statistics inside TajStat. This would greatly facilitate expanding energy statistics production to include e.g. the official energy balance, energy efficiency indicators and improved co-operation at both the national and international levels.

Development of energy efficiency indicators is one of the strategic priorities of TajStat. This demanding exercise should benefit from the international best practice and be allocated proper staff resources with capacity-building opportunities. Most importantly, stakeholder co-operation (TajStat, MEWR, Ministry of Finance) is essential, given that energy efficiency cuts across all sectors of the economy.

No public information is available on oil stocks or the related reporting mechanisms in the country. Having a monitoring system in place would help the government take the right action rapidly in case of supply disruptions and thus cushion the shocks to the economy.

Assessment

While Tajikistan is endowed with abundant water resources, its hydropower has a clear seasonality with the summer maximum and winter minimum. Close to 90% of the installed generation capacity in Tajikistan is represented by HPPs. Recent analysis performed in support of the Intended Nationally Determined Contributions (INDC) confirmed that the county's wind power potential is also substantial, ranging from 30 TWh to 100 TWh per year. Despite good energy resource endowment since the 2010s, Tajikistan has experienced regular winter energy shortages due to the seasonality of hydropower. The country was cut off from the CAPS in 2009, and gas deliveries from Uzbekistan stopped in 2013. The situation has somewhat improved since 2016, after the launching of coal-fired generation and rehabilitation of the Dushanbe district heating system. In addition, from 2018, Uzbekistan restarted gas exports to Tajikistan while Tajikistan has resumed electricity exports to Uzbekistan.

In order to improve its energy security (i.e. to deal with HPP seasonality and natural gas shortages), Tajikistan has been actively adding coal-fired generation. The Dushanbe-2 co-generation plant (400 MW) was launched in 2014--2016 and uses domestic coal resources. The current proven coal reserves in the country are estimated at 375 Mt and include the Fan-Yagnob and Shurab coal basins. Coal extraction was steadily growing for

[2] United Nations Statistics Division (2018), *International Recommendations for Energy Statistics*, https://unstats.un.org/unsd/energystats/methodology/ires/.

the last ten years reaching 2 Mt in 2019 (more than ten times more than in 2010). The National Development Strategy calls for an increase in coal production to 15 Mt per year by 2030.

For oil and gas, the country primarily relies on imports, but it also has proven reserves of 120 Mt of oil and 880 Mt of gas. The Khoja Sartez field in the southern Khatlon Region and the Qizil Tumshuq deposit in the Kolkhozobod District of the southern Khatlon Region are currently producing hydrocarbons.

Along with hydropower, Tajikistan also has significant solar power potential (assessed at 25 TWh/year or 2 150 kilotonnes (kt) of oil equivalent, which exceeds the current power generation by all the sources) but it has been barely developed and is currently represented by a small number of residential projects (e.g. about 2 450 solar power units with a total rated capacity of 88.7 kilowatts [kW] were installed in 13 remote regions in 2009-2014 to provide electricity to residential and public facilities).

There is small potential for wind energy in Tajikistan, but its use as complementary to hydropower is justified in some regions. The strongest winds are observed in mountainous areas, where the landscape of the country finds the maximum wind speed and flows, as well as in the Sughd Region and the Rasht Valley, where wind speed is about 5-6 m/sec (Asia Wind Energy Association, 2022).

The Strategy 2030 aims to improve living standards through sustainable economic development via energy security and the efficient use of electricity, integrated water resource management, productive employment and the removal of limitations on connectivity. The government intends to achieve its energy goals by reducing electricity consumption through energy efficiency measures and energy source diversification, including renewable energy, leading to energy exports within the framework of an integrated regional grid.

The aim of this ongoing reform of the energy sector is the creation of an open market and the facilitation of trade with Tajikistan's neighbouring countries, primarily with Uzbekistan, Afghanistan and Pakistan. Although the unbundling of the national electricity utility Barqi Tojik into separate companies responsible for generation, transmission and distribution took place at the end of 2019, the reallocation of assets among the newly created entities remains incomplete and has delayed the introduction of targeted cost-reflective tariffs.

Low quality and unequally distributed power supply has had an especially heavy impact on the most economically disadvantaged groups of the population, mainly those employed in agriculture and living in remote areas, affecting their food security and nutritional status and lowering their living standards. Women, who make up a substantial part of the agricultural workforce and take the lead role in household, energy, water, waste management and childcare, have borne the brunt of this. The shortage of water and sanitation in particular puts an extra burden on women and girls under 15 years of age because they are the primary collectors of water and cleaners of sanitation facilities in rural households.

Recommendations

The government of Tajikistan should:

- Ensure compliance with the highest technical, environmental and social quality standards in developing new HPPs and adherence to stringent safety standards.
- Enhance legal and regulatory framework for social, environmental and economic impacts of energy projects, particularly to address the resettlement of local populations and measures to ensure higher-quality environmental and social impact assessments.
- Encourage development of all renewable energy sources to meet national strategy goals for 2030.
- Commit to clean coal development and adherence to strict environmental standards in support of the fast-paced growth of coal sector development and its industrial use, consistent with the country's climate change and sustainable development strategies, as well as with its economic, environmental and social policies.
- Maintain close co-operation with TajStat and continue to use official energy statistics as the foundation for analysis in strategic documents and when drafting new legislation.
- Provide sufficient resources (human and financial) for TajStat to expand the collection and online dissemination of energy data and support co-operation at both the national and international levels to develop staff capacity.
- Encourage TajStat to further align the production and dissemination of official energy statistics with international recommendations, particularly by increasing data disaggregation and accuracy of energy end uses.
- Engage with TajStat and other data providers and users to ensure all necessary energy information is available, accessible and accurate to all stakeholders, including the entity responsible for the GHG inventory.
- Expedite the development of energy efficiency indicators according to the international methodology to track the impact of sectoral energy efficiency policies (industry, transport, residential, services); envision a clear division of work covering energy efficiency monitoring among the relevant institutions, i.e. TajStat, MEWR, etc.
- Conduct household energy consumption surveys at regular intervals (e.g. every five years) to monitor energy efficiency policy implications in the residential sector and to increase the level of data disaggregation, particularly on biomass utilisation.
- Encourage TajStat to update the statistics strategy periodically to ensure continuous improvement of energy statistics.

References

Agency on Statistics under President of the Republic of Tajikistan, https://www.stat.tj/en

Agency on Statistics under President of the Republic of Tajikistan (2019), National Strategy for the Development of Statistics for the Period up to 2030, https://stat.ww.tj/files/nsds_to_2030.pdf

Asia Wind Energy Association (2022), Country Overview: Tajikistan, https://www.asiawind.org/research-data/market-overview/tajikistan, (accessed 17 June 2022).

EBRD (European Bank for Reconstruction and Development), System Upgrade: Delivering the Digital Dividend, Transition Report 2021-22, Country Assessments: Tajikistan, https://www.ebrd.com/publications/transition-report-202122-tajikistan

Stantec (2021), The European Union Global Technical Assistance Facility on Sustainable Energy: Support the Government of Tajikistan in Developing a Revised, More Ambitious NDC: Final Report, May 2021.

Human Development Report 2020, Briefing Note for Countries on the 2020 Human Development Report, Tajikistan, https://hdr.undp.org/sites/default/files/Country-Profiles/TJK.pdf

IEA (International Energy Agency) (2022), World Energy Statistics and Balances (database), https://www.iea.org/data-and-statistics (accessed 10 June 2022)

IEA (2015), Energy Policies Beyond IEA Countries: Caspian and Black Sea Regions 2015, Energy Policies Beyond IEA Countries, IEA, Paris, https://doi.org/10.1787/9789264228719-enhttps://www.iea.org/data-and-statistics

IEA (2014), Energy Efficiency Indicators: Essentials for Policy Making, https://www.iea.org/reports/energy-efficiency-indicators-essentials-for-policy-making

IMF (International Monetary Fund), Republic of Tajikistan, https://www.imf.org/en/Countries/TJK

Knoema, World Data Atlas, https://knoema.com/atlas/Tajikistan/topics/Economy/National-Accounts-Gross-Domestic-Product/Real-GDP-based-on PPP#:~:text=In%202020%2C%20real%20GDP%20based,was%2034%2C884%20million%20international%20dollars

Law No. 588, “On the state statistics”, Republic of Tajikistan, adopted on January 12, 2010.

Law on state forecasts, concepts, strategy and programs of social and economic development of the Republic of Tajikistan, No. 1544, August 3, 2018, https://cis-legislation.com/document.fwx?rgn=108953

TajStat (2018), Report on the Results of One-Off Sample Survey on ‘The State of the Energy Facilities and Efficiency of Use in 2016’, https://stat.ww.tj/publications/July2018/English.pdf

UNECE (United Nations Economic Commission for Europe) (2017), Tajikistan Environmental Performance Reviews: Third Review, Geneva, http://www.unece.org/env/epr

UNSD (United Nations Statistics Division) (2018), International Recommendations for Energy Statistics, https://unstats.un.org/unsd/energystats/methodology/ires

World Bank (2021a), Tajikistan’s Energy Sector to Benefit from World Bank Support (press release, 21 December 2021), https://www.worldbank.org/en/news/press-release/2021/12/21/second-phase-of-the-nurek-hydropower-rehabilitation-project

World Bank (2021b), Tajikistan Economic Update: Summer 2021, https://www.worldbank.org/en/country/tajikistan/publication/economic-update-summer-2021

World Bank (2021c), Tajikistan: Rebounding Economy, Challenges Remain, Country Economic Update Summer 2021, https://documents1.worldbank.org/curated/en/532641628870881778/pdf/Tajikistan-Rebounding-Economy-Challenges-Remain.pdf

World Bank (2019), World Development Indicators (database), https://datacatalog.worldbank.org/dataset/world-development-indicators

World Bank (2018a), Tajikistan Systematic Country Diagnostic: Making the National Development Strategy 2030 a Success: Building the Foundation for Shared Prosperity, http://documents.worldbank.org/curated/en/430741528356150691/pdf/126209-SCD-P160440-PUBLIC-TJK-SCD-WEB-v300518.pdf

World Bank (2018b), New Country Classifications by Income Level: 2018-2019 (blog), https://blogs.worldbank.org/opendata/new-country-classifications-income-level-2018-2019

World Economic Forum (2017), The Global Competitiveness Report 2017-2018, World Economic Forum, Geneva, http://www3.weforum.org/docs/GCR2017-2018/05FullReport/TheGlobalCompetitivenessReport2017%E2%80%932018.pdf

Worldometer, Tajikistan Population (Live) (database), https://www.worldometers.info/world-population/tajikistan-population, (accessed 12 April 2022).

https://commons.wikimedia.org/wiki/File:Un-tajikistan.png

3. Electricity

Key data

(2020)

Total electricity generation: 20.1 TWh (hydro 90.1%, coal 8.2%, natural gas 1.6%), +22.3% since 2010

Total generating capacity: Installed: 6.4 GW (5.7 GW HPP, 0.7 GW TPP)

Available: 4.7 GW (4.3 GW HPP, 0.4 GW TPP)

Electricity net exports: 1.5 TWh (imports 0.4 TWh, exports 1.9 TWh)

Electricity consumption: 15.4 TWh (residential 44.5%, services 20.3%, industry 17.8%, agriculture 17.0%, others 0.5%), +8.9% since 2010

Overview

Tajikistan's electricity supply relies on its abundant hydro resources. The electricity system is dominated by state-owned monopolies/enterprises, and the government sets all wholesale and retail prices. Electricity market reform is under way, unbundling the vertically integrated state monopoly and setting up an independent regulator to attract private-sector investment and increase efficiency. A national development strategy, sectoral programmes, and related legal and regulatory instruments have also been adopted and are being implemented.

Over the past decade, the government has actively pursued support from international donors to upgrade and modernise the country's existing aged infrastructure, but further investment is required to modernise and expand generation capacity and networks in order to guarantee security of supply and enable electricity demand growth.

Cross-border trade allows Tajikistan to balance supply and demand despite the seasonal fluctuations of its hydropower-dominated electricity generation. Tajikistan has significant near and long-term regional electricity trading opportunities. The electricity system interconnects with CAPS and with Afghanistan, and a new transmission line connecting Kyrgyzstan, Tajikistan, Afghanistan and Pakistan will allow country for a near - term flexible trading options within Central Asia and with Afghanistan and Pakistan, while *Cross-Border Electricity Trading for Tajikistan: A Roadmap*, IEA (2021), notes long-term regional trade opportunities also with China, India, Iran and Iraq.

Meanwhile, the country's significant solar and wind power potential could be harnessed to meet several energy-policy goals simultaneously, and the government has recently set a target for renewable energy to provide 10% of generating capacity by 2030.

The OJSC Barqi Tojik, formerly a vertically integrated state-owned utility, controlled generation, transmission, distribution and retail until 2021, when it was restructured to improve the operation of the power system. This was the key stage of an ongoing energy sector reform, which established separate transmission and distribution entities, leaving electricity generation and regional trade functions with Barqi Tojik. New utilities, OJSCs Shabakahoi Intiqoli Barq, responsible for transmission, and Shabakahoi Taqsimoti Barq, responsible for distribution, are fully established and operational since 2021. Pamir Energy, founded in 2002 as a public-private partnership by the government and the Aga Khan Fund for Economic Development, is responsible for generation, transmission and distribution in Gorno-Badakhshan.

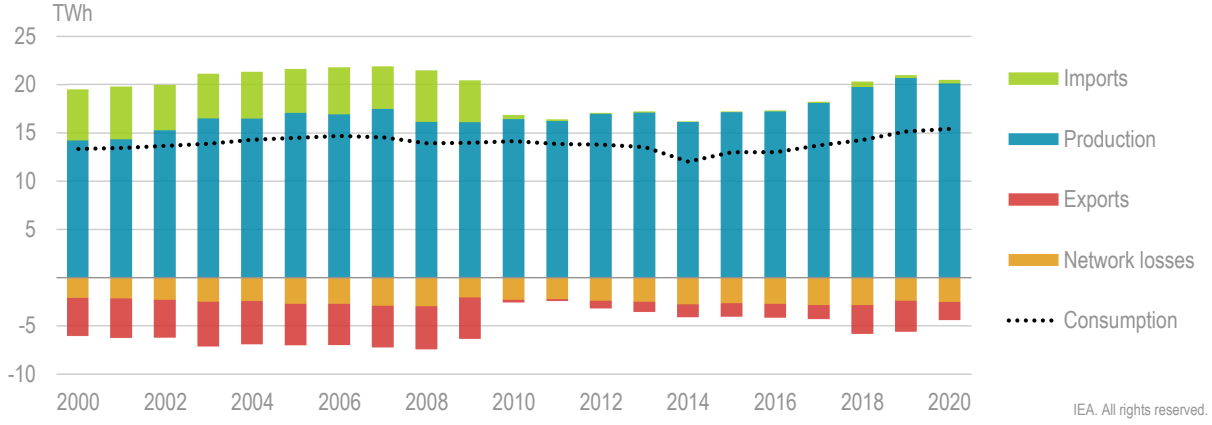
Supply and demand

In 2020 the country generated 20.1 TWh, while domestic demand was 15.4 TWh. Demand has grown almost 10% since 2010.

At the annual level Tajikistan is a net exporter of electricity, but there are seasonal shortfalls of supply.

The network losses calculated from the official energy statistics are relatively high, being 14.2% of the supply in 2020 and averaging 15.5% between 2000 and 2020.

Figure 3.1 Tajikistan's electricity supply, 2000-2020



Cross-border trade plays an important role in the Central Asian electricity system.

Note: Tajikistan was disconnected from CAPS in 2009, explaining the reduction in trade volumes since 2010. In 2018 it reconnected and initiated bilateral electricity trade with Uzbekistan.
Source: IEA (2022), *World Energy Statistics and Balances* (database), https://www.iea.org/data-and-statistics.

Capacity

Tajikistan's total installed electricity generation capacity in 2020 was 6.4 GW, of which 5.7 GW was HPP 0.7GW TPP, compared with the available 4.7 GW generation capacity, of which 4.3 GW (90%) was hydro-based and remaining 0.4 thermal.

Tajikistan has 11 large and medium HPPs and nearly 300 small HPPs (total capacity 132 MW). Most hydropower is produced by HPPs on the Vakhsh River, with a total capacity of approximately 5 GW producing 19 gigawatt-hours (GWh) per year. The largest

of these is the 3 GW Nurek hydroelectric facility, built on the Soviet-era Nurek Dam that was constructed between 1961 and 1980.

Table 3.1 Generation capacity in Tajikistan, 2020

	Type	Units	Installed capacity (MW)	Available capacity (MW)	Operator
Nurek	Reservoir	9	3 000	2 400	Barqi Tojik
Baypaza	Run-of-river	4	600	450	Barqi Tojik
Vaksh Cascade	Run-of-river		285	214	Barqi Tojik
Golovnaya		6			
Perepadnaya		3			
Central		2			
Varzob Cascade	Run-of-river		27	7	Barqi Tojik
Varzob-1		2			
Varzob-2		2			
Varzob-3		2			
Kayrakkum	Run-of-river	6	126	120	Barqi Tojik
Sangtuda-1	Run-of-river	4	670	670	UES
Sangtuda-2	Run-of-river	2	220	220	Sangob
Rogun	Reservoir	2	240	240	Barqi Tojik
Dushanbe-1 co-generation	Thermal	1	198	42	Barqi Tojik
Dushanbe-2 co-generation	Thermal	4	400	400	Barqi Tojik
Yavan co-generation (mothballed)	Thermal	1	0	0	Barqi Tojik
Pamir Energy (combined)			44		Pamir
Total			**5 810**	**4 763**	
of which: HPPs			5 168	4 321	
of which: thermal			598	442	
Shares:					
HPPs			*89%*	*91%*	
Thermal			*10%*	*9%*	

Note: UES = Unified Energy Systems
Source: Cross-Border Electricity Trading for Tajikistan: A Roadmap, IEA (2021)

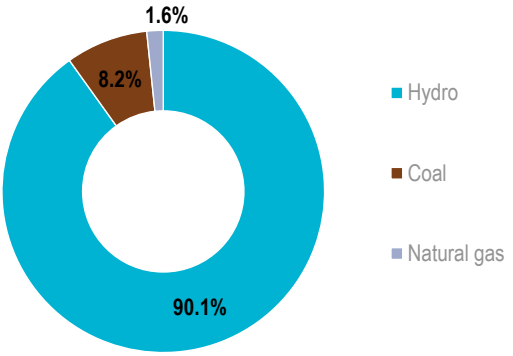
Hydro generation capacity further expanded with the opening of the Sangtuda-1 HPP in 2009 and the smaller Sangtuda-2 HPP in 2014, which add 900 MW of combined capacity. The government is also seeking aid from donor communities and foreign investors to maintain and increase capacity by rehabilitating the oldest and largest HPPs, particularly the Nurek and Qairaqqum facilities, which are currently ongoing.

The most significant HPP project development, expected to add significant generation capacity is the Rogun HPP. The first unit was commissioned and connected to the grid in November 2018, while second unit completed and put into production in September 2019. When all six units are built and operating, the Rogun HPP capacity will be 3 600 MW. Thermal power capacity represents around 10% of total generation capacity, and the Dushanbe-1 and Dushanbe-2 TPPs are also used in heat generation and centralised heating. The conversion of heat boilers from gas- to coal-fired and the rehabilitation of existing TPPs are planned to improve efficiency.

Generation

Gross electricity generation in 2020 was 20.1 TWh. A large majority – 90% – of this was generated from hydro, the rest being mainly from coal (8%) and natural gas (2%). While still relatively low, the share of thermal generation has grown rapidly. A new 400 MW coal-fired co-generation plant was commissioned in 2013, and natural gas was reintroduced in the electricity mix only in 2019 after the supplies had been cut off since 2013.

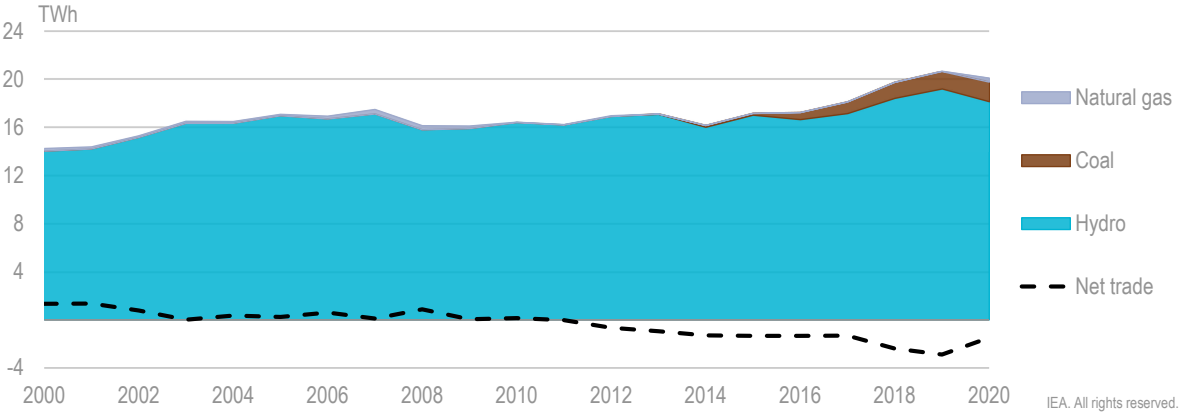
Figure 3.2 Electricity generation by source, 2020



Hydro is the key energy resource in Tajikistan.

Source: IEA (2022), *World Energy Statistics and Balances* (database), https://www.iea.org/data-and-statistics.

Figure 3.3 Electricity generation by source, 2000-2020

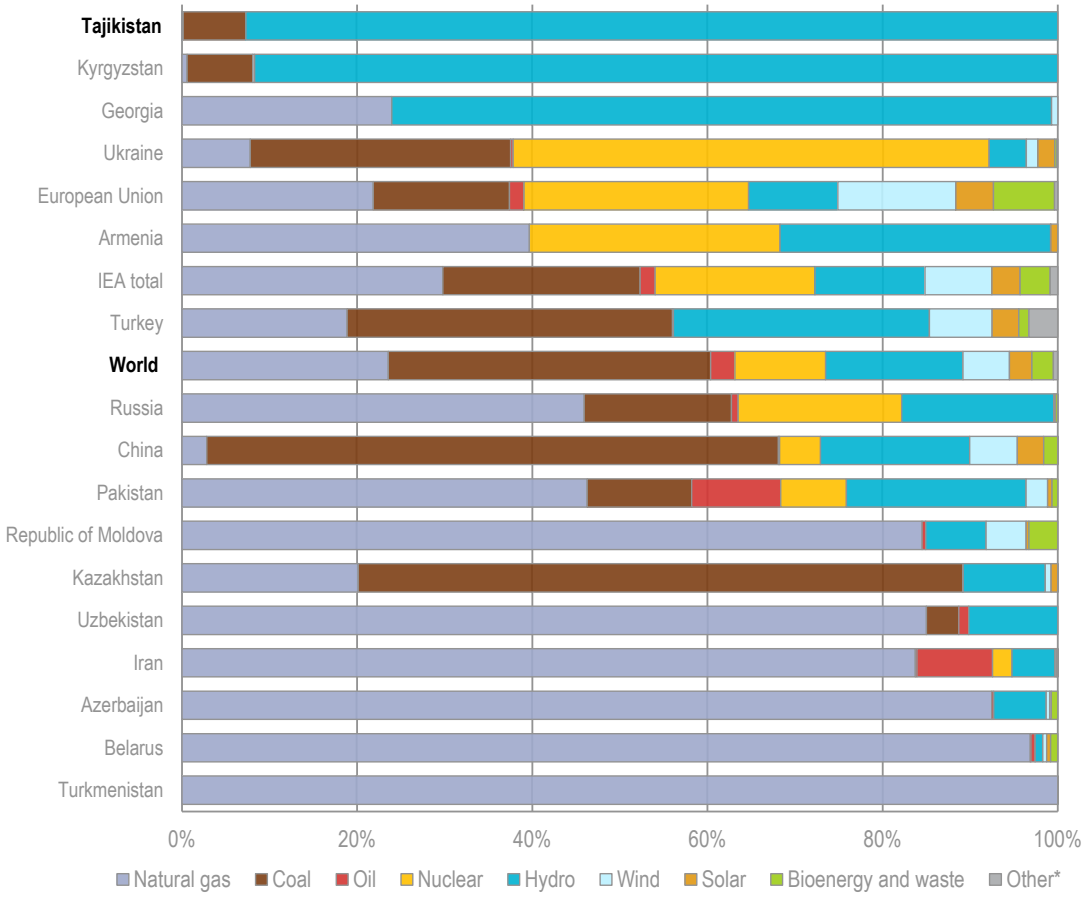


Electricity generation has increased by over 40% since 2000.

Source: IEA (2022), *World Energy Statistics and Balances* (database), https://www.iea.org/data-and-statistics.

Total annual power generation has increased 3.7 TWh, or over 20% since 2010, with similar increases in electricity generated from coal and hydro (1.7 TWh each). The rest is attributed to natural gas.

Figure 3.4 Electricity generation by source in selected countries, 2019



* includes geothermal, electricity from heat, wave and ocean power and other power generation (e.g. from fuel cells).
Source: IEA (2022), World Energy Statistics and Balances (database), https://www.iea.org/data-and-statistics.

Table 3.2 General characteristics of power plants in Tajikistan

Number	Name		Installed capacity (MW)	Available capacity (MW)	Year of commissioning
1	Nurek HPP		1 995	1 950	1972, 1979
			1 005	800	
2	Rogun HPP		3 600	240	2018
3	Boygozi HPP		600	550	1985
4	Sangtuda-1 HPP		670	670	2008
5	Sangtuda-2 HPP		220	220	2011
6	Golovnaya HPP		240	170	1962
7	Kayrakkum HPP		126	124	1956
8	Dushanbe-1 TPP		198	130	1961
9	Yavan TPP		120	0	Not active
10	Dushanbe-2 TPP		400	400	2016
11	Tsentralnaya HPP		15.1	12.8	1964
12	Perepadnaya HPP		29.95	26.3	1958
13	Varzob Cascade HPPs	HPP-1	9.5	9.5	1937
14		HPP-2	14.4	5	1949
15		HPP-3	3.52	1.5	1952

Source: In-depth review submission 2022.

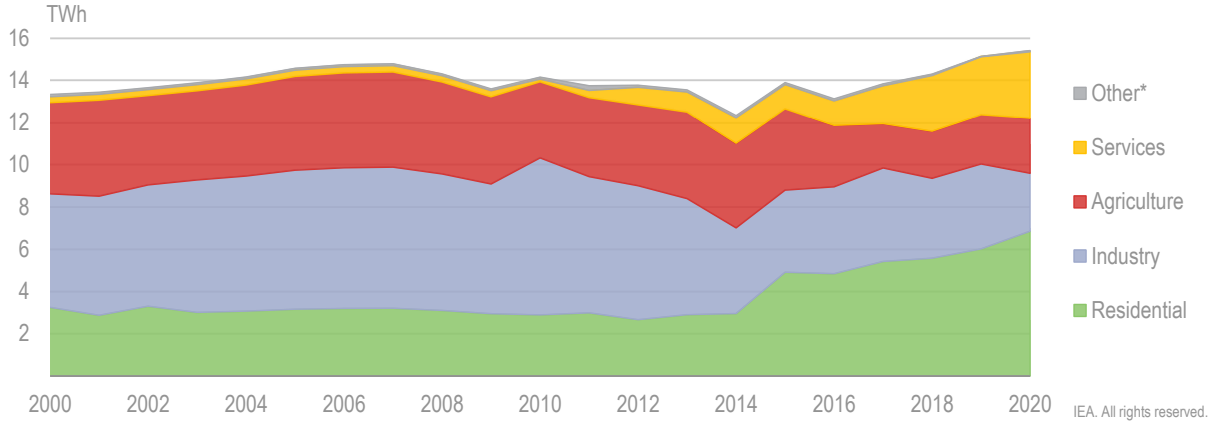
Consumption

Electricity consumption in 2020 was 15.4 TWh, an increase of almost 10% since 2010. The residential sector accounted for the largest share of consumption at 44%, up 40% since 2015.

While in 2020 consumption shares in industry (18%) and services (20%) were roughly equal, their demand patterns are opposite: industry consumption has shrunk by 29% since 2015 whereas consumption in services has almost tripled (+174%) in the same time period. Agriculture – mainly irrigation – consumed 17% of the total and has also contracted notably since 2015 (-32%).

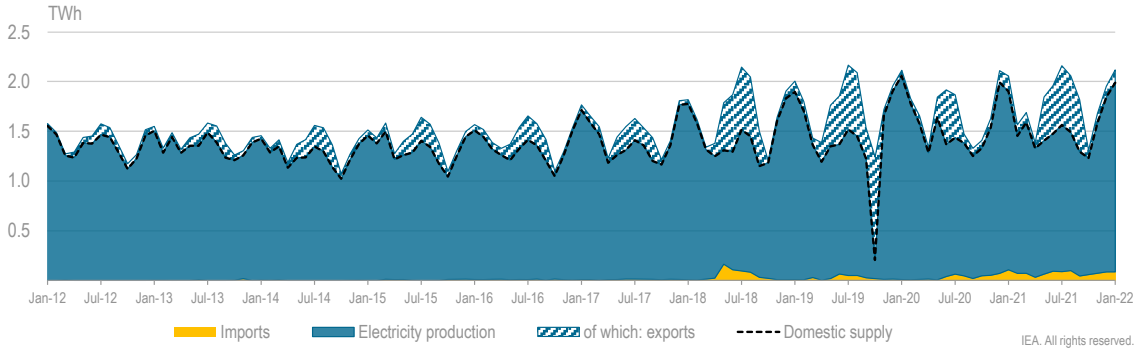
Given that the majority of the electricity is generated via hydro, energy sector own use is very low (0.4%). While transport has always presented only a fraction of electricity consumption (<1%), it is worth noting that only since 2015 consumption has decreased by 79%.

Figure 3.5 Electricity consumption by sector, 2000-2020



* Includes energy sector own use and transport.
Notes: TWh = terawatt-hour (billion kWh). The accounting methodology for electricity statistics changed in 2015. Therefore, the historical trends may not be comparable with recent data.
Source: IEA (2022), *World Energy Statistics and Balances* (database), https://www.iea.org/data-and-statistics.

Figure 3.6 Tajikistan's monthly electricity supply, January 2012-January 2022



Domestic electricity demand shows a seasonal pattern peaking in January and in July.

Source: TajStat (2022), Real economy indicators (database)

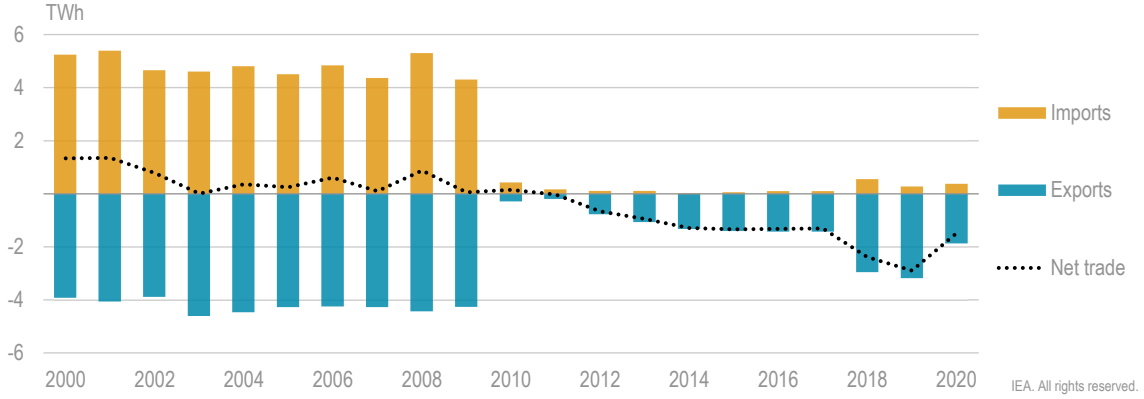
Electricity demand in Tajikistan features seasonal peaks, one occurring towards the end of the year and another during July-August, the latter due mainly to crop irrigation. The rising use of air conditioners, combined with expected hotter summers, could lead to a more pronounced summer peak in the future.

Imports and exports

In 2020, Tajikistan exported 1.9 TWh and imported 0.4 TWh, resulting in net exports of 1.5 TWh.

Tajikistan was disconnected from CAPS in 2009, which explains the reduction in trade volumes since 2010. In 2018 it reconnected and initiated bilateral electricity trade with Uzbekistan.

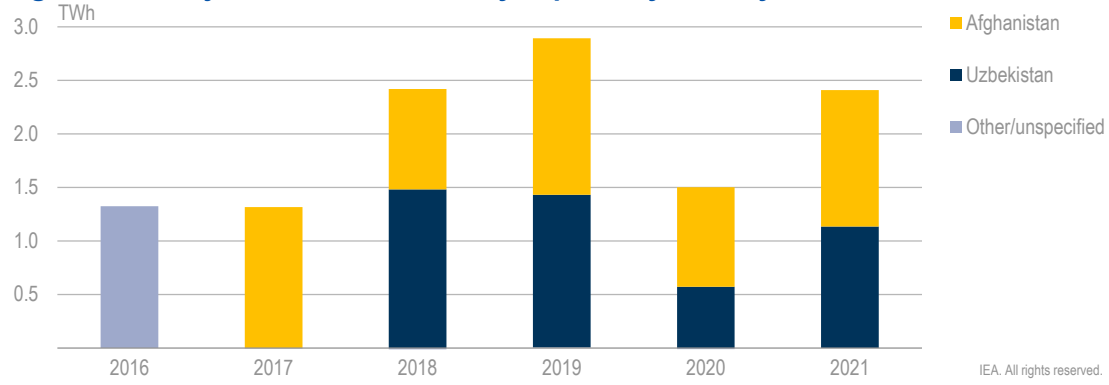
Figure 3.7 Tajikistan's electricity trade, 2000-2020



Source: IEA (2022), *World Energy Statistics and Balances* (database), https://www.iea.org/data-and-statistics.

The resumption of the connection with Uzbekistan saw Tajikistan export -2.41 TWh in 2021: 1.14 TWh to Uzbekistan and 1.27 TWh to Afghanistan.

Figure 3.8 Tajikistan's net electricity exports by country, 2016-2021



Notes: Data represent the difference between the annual imports and exports to a country. Annual net trade with Kyrgyzstan is negligible and not shown in the chart.
Source: IEA (2022), *World Energy Statistics and Balances* (database), https://www.iea.org/data-and-statistics (source for 2021 data).

The aim is to increase exports by 10 TWh by 2030. Through CASA-1000, exports to Pakistan are projected to reach a minimum of 3 TWh; however, the project's infrastructure

offers the potential to export up to 10 TWh. At the same time Tajikistan is set to be connected CAPS via Uzbekistan in 2023, which will give Tajikistan access to the regional market.

Additionally, exports to Afghanistan will increase through the construction of the new Rogun-Kabul 500 kV line – currently exports to Afghanistan are via the 220 kV Sangtuda-Puli Khumri line.

Sector structure

The MEWR is responsible for the country's water and energy resources, managing water and energy policies to plan the development of these resources, their management and regulation, capacity building, and exercising state control over the rational use and protection of water resources. MEWR is responsible for facilitating investment and concession agreements in the energy sector and co-ordinating activities of the ministries and agencies involved in water resources, and it acts as the authority and leading body in the national dialogue on policy related to integrated use of water resources.

The Ministry of Industry and New Technologies regulates Tajikistan's coal industry and is responsible for setting coal sector development policy and overseeing its implementation.

The Ministry of Economic Development and Trade is responsible for strategies for socio-economic development, working with state programmes to develop internal and external investments. It is the regulator for Barqi Tojik's tariffs through its Anti-monopoly Committee, and is also responsible for developing sectoral and regional development programmes, and principles and mechanisms for economic reform.

The Ministry of Finance is responsible for assigning the budgets for state-owned companies and other organisations and processing debts and financing from multilateral institutions.

TajStat is the central statistical office and is responsible for collecting, compiling and disseminating data and surveys on demographics, prices and enterprises.

The state company OJSCs Barqi Tojik is the electric utility responsible for generation, the OJSC Shabakahoi Intiqoli Barq, responsible for transmission, and the OJSC Shabakahoi Taqsimoti Barq, responsible for distribution. These companies are responsible for generating, transmitting and supplying all of the country's electricity, except in the Gorno-Badakhshan Autonomous Region, and for managing imports and exports of electricity.

The public-private company Pamir Energy is responsible for generation, transmission, distribution and retail of electricity in the Gorno-Badakhshan Autonomous Region.

The CASA-1000 Intergovernmental Council was established by the governments of Tajikistan, Kyrgyzstan, Afghanistan and Pakistan to develop the implementation and operation of the CASA-1000 electricity transmission project, to agree on common policies and regulation, and adoption of technical, safety and environmental standards. The council is also responsible for selecting the operator of the transmission system.

The Interstate Commission for Water Coordination of Central Asia was created by Tajikistan, Kazakhstan, Kyrgyzstan, Turkmenistan and Uzbekistan and is the interstate

body responsible for decisions on common management of interstate allocation and use of water resources, including establishing regional water policy, water consumption limits and large reservoir regulation.

The Coordination Electric Power Council of Central Asia (CPC) is responsible for consulting on co-ordinating power grid operations across Central Asia, bringing together grid operators from Tajikistan, Kazakhstan, Kyrgyzstan and Uzbekistan. Turkmenistan was a member until it disconnected in 2003 from CAPS to operate in parallel with Iran. The CPC draws up agreements for operating concepts, decisions and rules to ensure cost-effectiveness and reliability for the region's energy systems, and approves methodologies, rules, instructions and regulations for their interaction. It is the governing body of the Coordinating Dispatch Centre Energiya.

The Coordinating Dispatch Centre (CDC) Energiya is an operating and dispatch institution governed by the CPC and is based in Uzbekistan. The power flow co-ordinator is responsible for calculating transfers between the countries of Central Asia in the Central Asian Power System. Originally funded by all of Central Asia's countries, the withdrawal of Turkmenistan and Tajikistan reduced the co-ordinating activities.

Energy legislation in Tajikistan is primarily covered by the Law on Energy of 2000, which makes the government responsible for developing the energy sector on all levels, including investment and concessions, pricing and tariffs, and controlling use of fuels and renewable energy resources. Further energy legislation includes the Law on Renewable Energy Resources (2010) and the Law on Energy Saving (2013).

Market reforms

The government planned restructuring of state-owned OJSC Barqi Tojik, a vertically integrated utility that controlled generation, transmission, distribution and selling electricity for over a decade. Its Decree No. 431 On an Individual Plan for the Restructuring of Barqi Tojik, adopted in 2011, and the Resolution No. 234, passed in 2018, provided the basis for unbundling Barqi Tojik into three separate entities in 2019-2021. As a result, OJSCs Shabakahoi Intiqoli Barq was incorporated as an entity responsible for operating the transmission network, and Shabakahoi Taqsimoti Barq, as operator of distribution networks across the country, except for the Gorno-Badakhshan Autonomous Region. Barqi Tojik maintained responsibility for electricity generation and its export and import. The government is planning to approve a sector escrow account for the unbundled utilities, where cash flow will be fixed.

The next stage of energy sector reform is establishing an independent regulator and introducing a new tariff methodology, aiming at bringing electricity tariffs gradually to cost recovery levels. Until then the Anti-monopoly Committee under the Ministry of Economic Development and Trade continues to set energy prices and electricity tariffs. Since tariffs have previously not been linked to service cost, a new tariff methodology, set up in 2017, was introduced to increase electricity tariffs in increments, with the aim of cost recovery by 2025 by means of fixing a required income for generation, transmission and distribution assets – the Sangtuda-1 and 2 HPPs and Pamir Energy have separate investment agreements. The following years, 2018 and 2019, saw the introduction of incremental tariff increases; however, the 2020 increase was postponed due to the Covid-19 global pandemic.

Policy framework

As a strategic industry, the aim for the power sector in the National Development Strategy 2030, launched in 2016, is for Tajikistan to become energy independent via its 10-10-10-10-500 concept:

- 10 GW increase in installed capacity
- 10 TWh increase in annual electricity exports
- 10% reduction in technical grid losses
- 10% diversification of electricity generation: 90% hydro, 10% other sources
- 500 GWh in energy savings from energy efficiency measures.

A number of laws on investment were streamlined to help achieve these targets, with those covering the power sector being: On Privatisation of State Property, passed in 1997, updated in 2017; On Production Sharing Agreements (2008); On Credit Histories (2009); Concessions (2011); On Public-Private Partnerships (2012); and On Investment Agreements (2016). Their mechanisms include:

- income tax exemptions based on amount invested
- tax and customs benefits for relevant machinery and equipment for energy production
- legal status for the investor, such as right to transfer profits abroad
- capital protection, with legal frameworks, partnership and investment agreements.

It is only comparatively recent that developments facilitating private-sector participation in the power sector have appeared. As the first public-private partnership, Pamir Energy is a concession agreement to serve Gorno-Badakhshan. In 2009, Sangtuda-1 HPP was commissioned and is operated by the Russian Federation's (hereafter, "Russia") Unified Energy Systems, and in 2011 Sangtuda-2 HPP was commissioned and is operated by Iran's Sangob – both hydro projects were carried out under a build-own-operate-transfer arrangement.

Infrastructure investments and cross-border trade

The main investments in energy generation are the starting operation of the first two components of Rogun HPP (own finance) and Dushanbe-2 for 400 MW (credits from China).

The rehabilitation of ageing HPPs built during the Soviet era is under way for the Nurek HPP (multi-donor investors led by the World Bank), Qayraqqum HPP (EBRD and EIB) and Sarband HPP.

Figure 3.9 Map of regional electricity interconnections

Source: USAID (2015), Central Asia Electric Grid.

Loss-reduction projects are being carried out in Khujand, Dushanbe and Bokhtar, funded by EBRD, the World Bank and the Asian Development Bank (ADB).

The list of potential energy projects for investment for 2021-2025 has not yet been released, but one of the new directions for investment is solar panel development. Uzbekistan's production of solar panels with a generation price of less than USD 0.02 has inspired the other countries in Central Asia to look at the potential of developing solar. In Tajikistan, the World Bank and ADB are now working on feasibility studies for solar power in Sughd Region.

Security of supply

For the past two decades, Tajikistan has faced winter electricity shortages, a situation that worsened in 2009 when the country's energy system was disconnected from CAPS. To address this situation and to increase energy security, the new HPPs Sangtuda-1 and Sangtuda-2 were built and are now operating, the new 400 MW TPP Dushanbe-2 started operation, and new lines have been constructed.

The government's investment continues with the construction of the Rogun 3 600 MW HPP, with two components already operating. The full commission of Rogun HPP will increase its generation capacity by 50-60%, and construction of a bigger reservoir will also help to guarantee supply during the whole year, including winter. In the capital, feasibility studies are under way for the development of a new TPP Dushanbe-3.

The rehabilitation of HPPs built during the Soviet era, particularly Norak and Qayroqqum, comes under measures intended to improve the energy system's resilience, which also include programmes to reduce losses – such as smart metering in Dushanbe and Khujand – as well as demand by improving energy efficiency and introducing energy-saving technologies, although roll-out is slow.

New lines are being constructed to improve transmission, distribution and load system, particularly Regar-Sangtuda and Rogun-Sangtuda, Tajikistan has also planned the construction of new electric circuits for larger power transmission rings, which will avoid power outages in case of emergency on certain power lines.

In 2022, Tajikistan is also planning to complete its part of CASA-1000, where full operation will not only provide opportunities for export but will also strengthen the country's electricity system via connecting the Datka-Sugd 500 kV line with Kyrgyzstan.

Tajikistan will also reconnect to CAPS in 2023 via Uzbekistan, which will strengthen the electricity system of Central Asia and provide an excellent opportunity for the future functioning of Central Asian market.

In addition, Tajikistan upgraded outdated substations with modern technologies and installed emergency recovery systems, that are connected to dispatch services through an automated control system (ACS) in order to avoid system failures.

In terms of transport sector, Tajikistan encourages adoption of electric mobility, using country's own electricity resources in order to tackle increased transport fuel prices and to reduce import dependency.

When importing gas became increasingly difficult, Tajikistan turned to developing fossil fuel production – coal. Over a 20-year period, production has increased 100-fold, and by 2040 this is projected to increase by a factor of 7, totalling 15 Mt per year.

System integration of renewable energy

In Tajikistan the current installed capacity of solar and wind is less than 1 MW – solar, wind and micro hydro power stations working off grid.

More than 90% of Tajikistan's electricity production is from hydro, with the remaining 10% from coal and gas, therefore the difficulties associated with variable renewable energy integration are not an issue in Tajikistan's electricity system.

Since the grid situation in the Sughd Region is complicated by increasing demand and consumption, Barqi Tojik and Shabakahoi Intiqoli Barq plan to update grids and to install new capacity in the region linked to an ongoing feasibility study for solar stations. If the project goes ahead, the national transmission company will invest in upgrading the grid to incorporate electricity from the new source.

Prices and tariffs

While the process of separating Barqi Tojik is being completed, the price for electricity is calculated by Barqi Tojik according to the cost method, in co-ordination with the Anti-monopoly Service and approved by government resolution. The cost of electricity varies according to consumer categories as outlined in the following table.

Table 3.3 Tariffs for electricity and heat

N	Group of consumers	The tariff according to the government decree from 22 June 2019 Diram (1/1000 somoni) per kWh
1	Industry group	55.14
2	State Unitary Enterprise (SUE) "TALCO" -from 1 May to 30 September -from 1 October to 30 April	 7.20 13.57
3	Non-industry group - Subgroup A (commerce sector and non-industry) - Subgroup B (budget sector) - Subgroup B (schools, which do not belong to budget sector)	 55.14 22.66 33.25
4	Communal group	22.66
5	Electricity transport	22.66
6	Agriculture sector	55.14
7	Irrigation and agriculture pump stations from 1 October to 30 April from 1 May to 30 September	 22.66 7.87
8	Population	22.66
9	Electricity boilers	136.62

Note: TALCO = Tajik Aluminium Company.
Source: In-depth review submission 2022.

The cost of electricity does not cover Barqi Tojik's expenditure, which negatively affects the entity's financial situation. One of the measures to improve this is to increase tariffs and cut subsidies. Tariffs have hitherto been subsidised both for the population and for large consumers such as TALCO and the agricultural sector, in particular irrigation pumping stations. At the moment, the government with development partners is developing a new tariff methodology and creating an independent regulator that will set prices intended to pay for the costs of production, transmission and distribution of electricity.

Assessment

Based almost entirely on hydropower – with relatively little thermal generation – Tajikistan's energy sector faces the main challenges of seasonal shortages/surpluses and the financial viability issues of Barqi Tojik. A number of institutional reforms have been introduced by the government aimed at addressing these challenges, which include restructuring the vertically integrated state-owned utility, implementing energy efficiency laws and measures, and updating the sector's regulatory and tariff regimes.

The country's hydroelectric power is based on its abundant water resources: the Amu Darya and Syr Darya rivers have a total length of 28 500 km, while the glaciers have a total volume of 845 km³ (MEWR, 2021a). According to 2019 data, 93% of electricity generation was from hydro and 7% was from coal-fired capacity. Since there are currently few other sources for heating other than electricity, this accentuates winter peak demand and deficits.

Installed generation capacity in Tajikistan today is 5 810 MW, of which 3 000 MW comes from the Nurek hydro facility, about 2 210 MW from various run-of-river hydro plants, and just under 600 MW from co-generation plants. As the state utility, Barqi Tojik owns and operates the majority of the electricity system except for the Gorno-Badakhshan Autonomous Region, where the owner and operator is Pamir Energy according to a concession agreement, and the HPPs Sangtuda-1 and Sangtuda-2. There exist a large number of power plants and transmission lines that were built during the Soviet era which are ageing and require rehabilitation.

The OJSC Barqi Tojik is the main owner and operator of the electricity sector. Owned by the state, the company is a vertically integrated utility that controls generation, transmission, distribution and retail. Among the recent restructuring measures implemented to improve the operation of the power system, the most significant moves are: the financial unbundling of Barqi Tojik for transmission, distribution and retail, based on Decree No. 431, on Individual Plan for the Restructuring of Barqi Tojik, passed in 2011; and establishing separate legal entities for the transmission network operator and the distribution network operator for the country except for the Gorno-Badakhshan Autonomous Region, based on Resolution No. 234, passed in 2018.

The appointment in 2020 of the heads of these legal entities was followed in 2021 by the registration of the operating entities as the OJSCs Shabakahoi Intiqoli Barq, responsible for transmission, and Shabakahoi Taqsimoti Barq, responsible for distribution, while Barqi Tojik keeps responsibility for electricity generation and export/import. Pamir Energy, founded in 2002 as a public-private partnership by the government and the Aga Khan Fund for Economic Development, is responsible for generation, transmission and distribution in Gorno-Badakhshan.

The Anti-monopoly Committee of the Ministry of Economic Development and Trade administratively sets energy prices and electricity tariffs as they arise. Since tariffs have previously not been linked to service cost, a new tariff methodology was set up in 2017 to increase electricity tariffs incrementally with the aim of cost recovery by 2025 by means of fixing a required income for generation, transmission and distribution assets – the Sangtuda-1 and 2 HPPs and Pamir Energy have separate investment agreements. Then 2018 and 2019 saw the introduction of incremental tariff increases; however, the 2020 increase was postponed due to the Covid-19 global pandemic.

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Recommendations

The government of Tajikistan should:

- ☐ Continue progress on power sector reforms:
  - > Support effective unbundling of Barqi Tojik and complete establishment of an escrow account for the unbundled utilities.
  - > Accelerate establishment of an independent regulator.
  - > Support timely development of competitive electricity wholesale and retail markets, overseen by an independent regulatory body with clear duties and appropriate powers, to enable third-party access to the grid on non-discriminatory terms and to help attract private-sector investment.
  - > Advance cost recovery efforts through tariff reform with an appropriate strategy to handle current subsidies.
  - > Consider providing the regulatory authority the ability to compel relevant data reporting from utilities on a regular basis.

- ☐ Consider the case for privatising elements of the country's generating capacity and developing public-private partnerships to promote competition and operational efficiency.
- ☐ Develop a transparent electricity tariff-setting methodology that will incentivise investment in efficient power sector development and RD&D.
- ☐ Develop and introduce a framework for short- and long-term generation, transmission, distribution and supply security, supported by targets and indicators to measure progress.
- ☐ Prepare a plan to develop ancillary services, including storage and demand-side response, to maintain network stability and security.
- ☐ Expedite the adoption of a network code for the electricity system, including rules and standards for variable renewable energy integration.
- ☐ Continue encouraging cross-border electricity trading to optimise resource use and enhance energy security.

References

ADB (Asian Development Bank) (2021), Republic of Tajikistan: Power Sector Development Program, Updated Project Administration Manual, https://www.adb.org/sites/default/files/project-documents/53315/53315-001-pam-en_0.pdf.

ADB (2017), Tajikistan Power Sector Development Master Plan, https://mewr.tj/wp-content/uploads/files/Power_Sector_Master_Plan-Vol1.pdf.

Anti-monopoly Service, Republic of Tajikistan, http://www.ams.tj

Barqi Tojik, Generation, http://barqitojik.tj/about/dependents/generation

EBRD (European Bank for Reconstruction and Development) (2022), Tajikistan – Transition Report 2021-22: System upgrade, https://www.ebrd.com/publications/transition-report-202122-tajikistan.

EBRD (European Bank for Reconstruction and Development) (2020), Tajikistan Energy Efficiency Framework, London,

https://www.ebrd.com/what-we-do/project-information/board-documents/1395294441448/Tajikistan_Energy_Efficiency_Framework_Board_Report.pdf?blobnocache=true

IEA (International Energy Agency) (2022), World Energy Statistics and Balances (database), https://www.iea.org/data-and-statistics. (accessed 10 June 2022)

IEA (2021), Cross-Border Electricity Trading for Tajikistan: A Roadmap, IEA, Paris, https://www.iea.org/reports/cross-border-electricity-trading-for-tajikistan-a-roadmap/tajik-context.

Max Bell School of Public Policy (2020), Planning for Power Purchase Agreement Negotiations: Republic of Tajikistan, July 2020, https://www.mcgill.ca/maxbellschool/files/maxbellschool/_policy_lab_2020_-_planning_for_power_purchase_agreement_ppa_negotiations_in_the_republic_of_tajikistan.pdf

Ministry of Energy and Water Resources (web page), http://mewr.gov.tj/ru

http://barqitojik.tj/about/dependents/generation/OECD (2019), Tajikistan's sustainable infrastructure investments, Sustainable Infrastructure for Low-Carbon Development in Central Asia and the Caucasus, December 2019, https://www.oecd-ilibrary.org/environment/sustainable-infrastructure-for-low-carbon-development-in-central-asia-and-the-caucasus_d1aa6ae9-en

President of the Republic of Tajikistan (2018), Послание Президента Республики Таджикистан Маджлиси Оли Республики Таджикистан [Message of the President of the Republic of Tajikistan to Majlisi Oli of the Republic of Tajikistan], http://www.prezident.tj/ru/node/19089.

TajStat (2022), Real Economy Indicators, 2012-2022, https://stat.ww.tj/library/en/real_economy_indicators.xls

UNDP Human Development Reports, Tajikistan, https://hdr.undp.org/en/countries/profiles/TJK#

World Bank (2013), Tajikistan's Winter Energy Crisis: Electricity Supply and Demand Alternatives, http://siteresources.worldbank.org/ECAEXT/Resources/TAJ_winter_energy_27112012_Eng.pdf

4. Coal

Key data

(2020)

Coal production: 2.1 Mt (0.94 Mtoe, 96% hard coal), +945% since 2010

Net trade: Negligible, average share of coal supply 1.9% (2010-2020)

Share of coal: 37.3% of domestic energy production, 26.3% of TES, 8.2% of electricity generation, 16.2% of TFC

Coal consumption by sector: 1.2 Mtoe (electricity and heat generation 48.0%, industry 26.8%, residential 24.2%, other/unspecified 0.9%)

Overview

Coal has rapidly become a key source of TES in Tajikistan (26.3% in 2020), after having a share below 10% in 2012. It is the second-largest source of electricity production (8% in 2020) and accounts for most of Tajikistan's carbon dioxide (CO_2) emissions from fuel combustion (53% in 2020). Domestic coal production has increased notably in the last decade, by over tenfold, partially driven by demand from the coal-fired power plant commissioned in 2015. As of 2022, coal trade plays only a minor role.

Energy security concerns and problems related to seasonality of the hydropower generation in Tajikistan amplified the significance of exploiting the country's rich coal reserves. The government considers the coal industry one of the most important structures of the fuel and energy complex and set ambitious goals to support sustainable production and industry development that has a history of over a century in the country.

The National Development Strategy to 2030 and the Concept of Coal Industry Development for the Period up to 2040 provide forecasts and related implementation measures for developing the country's coal sector in two stages, from 2019 to 2029 and from 2030 to 2040, including the following areas:

- growth of potential at the first stage until 2030 from 2.6 Mt to 5 Mt and at the second stage to 15 Mt, open-pit mining would account for 41.7% of coal production, from 94% in 2018, and underground mining would make up 58.3% of coal production, up from 6% in 2018"
- creation of new jobs in mining and related industrial fields, with an increase of employment by over 2.2 times, from 1 648 to 3 650, at the first stage and 5.5 times, to 9 064 people, at the second stage
- increase of value-added tax (VAT) payments by 3.4 times at the first and by 13.8 times at the second stage
- increasing the level of industrial and environmental safety indicators and standards in the industry.

Implementing these targets is carried out in accordance with the Laws on Coal and on State Forecasts, Concepts, Strategies and Programs of Socio-Economic Development, as well as on the Strategy 2030, the Concept of Coal Industry Development for the Period up to 2040, the Strategy for the Development of Industry of the Republic of Tajikistan for the Period up to 2030 and government resolution No. 523 On the Concept of Industrial Development of the Republic of Tajikistan.

Resources

Tajikistan is endowed with sizeable coal reserves. According to official data (Tajiki Ministry of Industry and New Technologies, 2022), there are 21 coal deposits with total reserves of 3.6 billion tonnes of anthracite, bituminous coal and lignite. This includes estimated reserves of 73.4% (2 656 Mt), preliminarily estimated reserves of 17.8% (641.5 Mt) and industrial reserves of 8.8% (317.2 Mt) of coal with high calorific value.

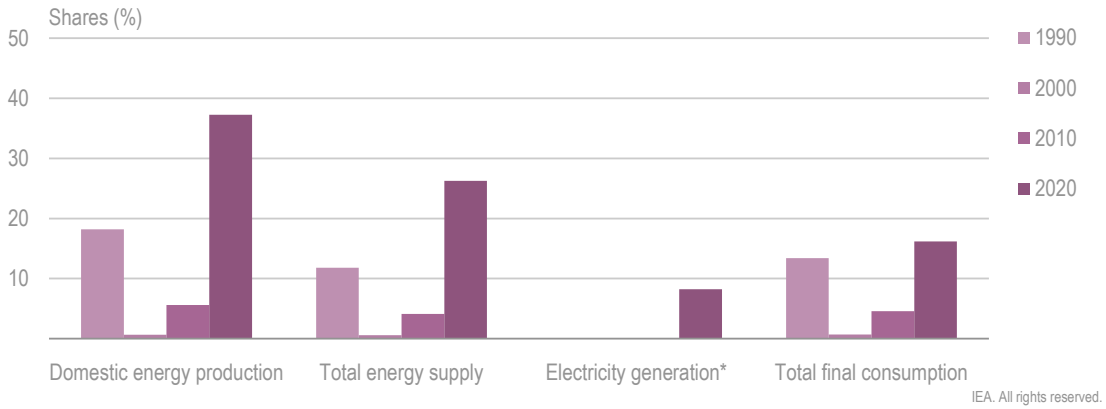
The government considers utilising the country's rich coal reserves as the key to energy security and industrial development. Its long-term strategy aims for the stable expansion of the coal industry to support socio-economic development and industrial production of coal to boost power and heat generation, the chemical industry, production of building materials, coal-synthetic gas, and mineral fertilisers. The Concept of Coal development pledges support to attract investments in modern technologies and allows for a wide range of ventures for creating new enterprises for the extraction and processing of coal reserves, strengthening the state budget and improving the welfare of the country's population.

Supply and demand

Production

Tajikistan's coal production increased from 0.2 Mt in 2000 to 2.1 Mt in 2020. A large majority, around 96% of the production, consists of bituminous coal.

Figure 4.1 Share of coal in Tajikistan's energy system, 1990-2020

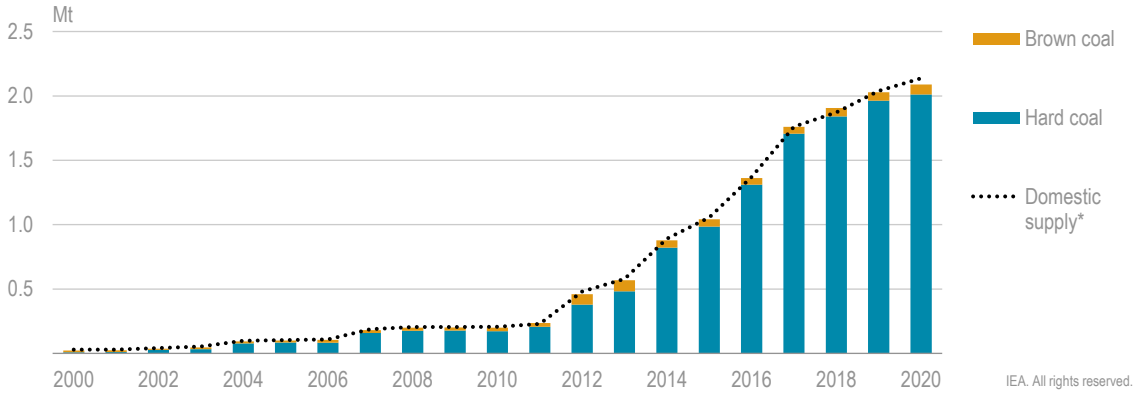


Coal's importance in the energy system has increased in the last decade.

* Coal use for electricity generation started in 2015.
Source: IEA (2022), *World Energy Statistics and Balances* (database), https://www.iea.org/data-and-statistics.

The rapid growth in production created competitive development of state and non-state enterprises operating in the coal sector. In 2018 coal mining by state-owned enterprises amounted to 55%, with the remaining 45% private sector; 94% of all production was open-pit and 6% underground.

Figure 4.2 Tajikistan's coal production, 2000-2020



Coal production has seen over a tenfold increase in the last decade.

* Small quantities of coal imports and exports are not shown.
Notes: Hard coal includes anthracite and other bituminous coal; brown coal includes sub-bituminous coal and lignite.
Source: IEA (2022), *World Energy Statistics and Balances* (database), https://www.iea.org/data-and-statistics.

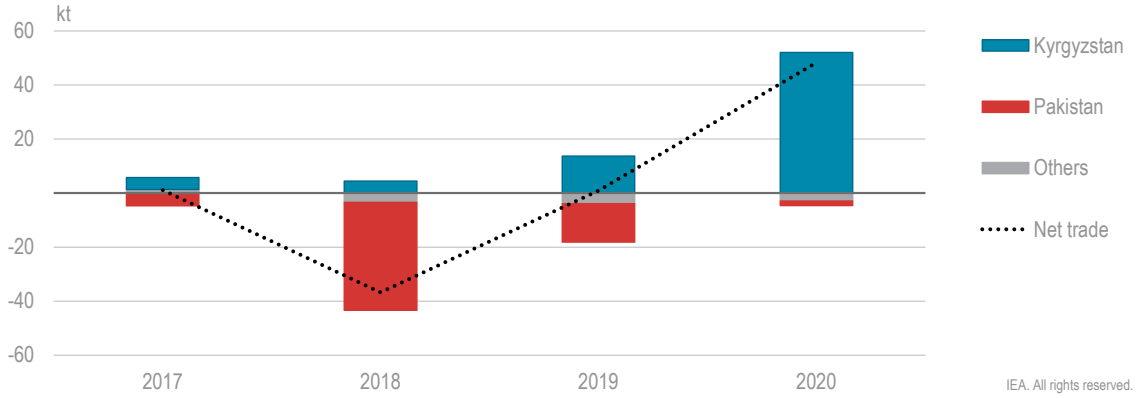
According to the Ministry of Industry and New Technologies, by 2019 only 11 enterprises were operating out of an initial 18 licence holders, as 7 of them could not have their exploration licence renewed due to insufficient production. The steady increase in coal production was due to employing modern machinery and equipment, 96.7% of which goes to the following five companies: industrial enterprises Fon-Yagnob 43.9% and Ziddi 9.7%; to TALCO-Resource Ltd 20.3%; to the KMT Ltd 19.8%; and to OJSC Angisht 3.1%, and which also make a significant contribution to the development of the sector.

Trade

The contribution of Tajikistan's coal trade to domestic supply is limited, averaging 2% of supply between 2010 and 2020. Coal is both imported and exported with neighbours, likely linked to transport logistics.

[2019 ministry data] Sales of coal in this period amounted to 1.960 Mt, including 51.6% to the Power and Heating Centre-2 in Dushanbe, 31.3% to industrial enterprises, 13.2% to the residential sector, 3.0% of budgetary institutions and 0.9% for exports.

Figure 4.3 Tajikistan's hard coal trade, 2017-2020



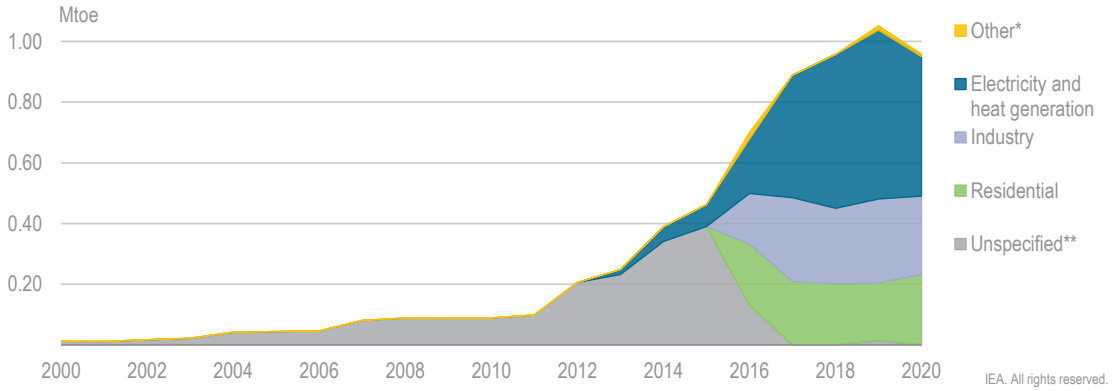
Coal trade represents only a fraction of the supply.

Note: Hard coal includes anthracite and other bituminous coal.
Source: IEA (2022), *World Energy Statistics and Balances* (database), https://www.iea.org/data-and-statistics.

Consumption

Coal demand was 2.1 Mt (0.96 Mtoe) in 2020 (an increase of over tenfold since 2010). Bituminous coal accounts for over 95% of the demand, the rest consisting of lignite. Most coal (48% of the total) was used for electricity and heat production, 26% by industry and 24% in the residential sector. Other reported consumption was minuscule. In 2020, coal provided 8% of Tajikistan's electricity.

Figure 4.4 Coal demand by sector, 2000-2020



Coal consumption has increased in several key sectors.

* Includes commercial and public services, transport, agriculture and forestry.
** Includes industry and residential use until 2015.
Source: IEA (2022), *World Energy Statistics and Balances* (database), https://www.iea.org/data-and-statistics.

According to the Ministry of Industry and New Technologies, in 2018, the joint-stock company (JSC) Dushanbe-2 TPP consumed 831 kilotonnes (kt) (or 46.8% of the total sales of coal); industrial enterprises, 708.9 kt (40%); residential, 145.6 kt (8%); public institutions, 55.3 kt (2.7%); and exports, 44.4 kt (2.5%).

The total supply of coal to Dushanbe-2 TPS in 2019 increased further and amounted to over a million tonnes, which included replenishment of 2019/20 autumn-winter storage for Heating Plant 2 and the boiler house Sharqi. On implementation of the government Order

No. 117 "On timely preparation of economic and social sectors of the country for regular and effective activities in the autumn-winter period 2019-2020", adopted on 29 March 2019, the ministry reported a delivery of 92% of planned storage volumes, despite the availability of coal reserves in the warehouses of coal mining company Fon-Yagnob. Coal storage reserves, taking into account the balance of 2018 in the warehouses of coal enterprises as of 1 January 2020, is more than 440 kt.

Coal mining policy

The Strategy 2030 specifies accelerated industrialisation as one of the country's top priorities. The government's attempt to create favourable conditions for reviewing, improving, modernising and expanding fixed industrial assets and sustainably developing priority areas of economic security has been further elaborated in sectoral development programmes, including the Strategy of Industry Development for the Period up to 2030, adopted on 25 March 2018. The Concept of Coal Industry Development for the Period up to 2040, approved by government resolution No. 436 on 30 August 2019, further elaborates on long-term prospects and development priorities as well as the role of rational and effective use of the country's rich mineral resources in delivering national strategic goals.

The Coal Industry Concept proposes a plan to reach target indicators of the Strategy 2030, implemented in two phases between 2019-2029 and 2030-2040, and projects an increase of coal production by 7.6 times (compared with 2016) or 10.4 Mt by 2030, and an increase of 11 times or 15 Mt by 2040.

The Coal Concept places great importance on stable development and technological modernisation of the coal industry, and subsequent supply diversification of industrial enterprises as one of the key features for the country's steady economic development. It encourages coal market development on a competitive basis to boost private entrepreneurial initiatives, creating favourable investment conditions, and contributing to an increase in both domestic consumption and exports of coal and a range of coal products.

Sector structure

The Ministry of Industry and New Technologies is the government entity responsible for coal policy setting and overseeing its implementation from 2013.

The national coal company, Angishti Tojik (the Tajik Coal), is the responsible state entity for operating of state-owned companies and assets in the coal sector, overseeing the condition of the state mining deposits, implementing production licences and operating subsidiary enterprises, including the Ziddi Coal Mine.

Dushanbe-2 TPP, a subsidiary of Barqi Tojik, is the largest consumer of coal produced in Tajikistan at present. It is a 400 MW subcritical coal-fired co-generation station in the capital city of Tajikistan, supplied from Ziddi coal deposits. Construction of the first stage of two 50 MW units commenced in November 2012, following the signature of an intergovernmental agreement between Tajikistan and China, and were commissioned in

2014. The second stage of constructing two 150 MW co-generation plants started in September 2014, and the two new units were commissioned in December 2016.

Coal prices are regulated by market (or contract) and the government bars coal subsidies to encourage competitive development of the coal industry in Tajikistan.

R&D and technology development

The Coal Concept highlights that the industry development depends on the successful use of mature advanced technologies and refers to a range of programmes and policies for directions of innovative industrial development for fuelling country's economy. It refers to the Programme of Innovative Development of the Republic of Tajikistan for 2011-2020, approved by government decree No. 227 on 30 April 2011, as the main instrument supporting the deployment of modern technologies for increased productivity and competitiveness, ensuring sustainable use of energy resources and ensuring environmental safety of industrial development.

The scientific and technical policy in Tajikistan's coal industry should be aimed at activating innovation processes, introducing new technologies, developing the national scientific and technical potential, eliminating obstacles between science and production, and attracting and introducing new foreign technologies and international quality standards into production. The main directions of technology development and strengthening the scientific and technical base of the coal industry are:

- Improvement of the regulatory framework of the coal industry (technical regulation, testing facilities for mining equipment, mining transport).
- Development of projects to improve the existing technology and introduce modern equipment for coal mining, enrich and integrate development of deposits, and increase surplus value when setting prices for coal products.
- Strengthening the production base of industrial enterprises using sectoral grant funds, contracting companies and attracting foreign investment.

In Tajikistan's coal mining industry there is an acute shortage of highly qualified specialists, especially in the field of development, adaptation and management of innovative technologies and mining, as well as carrying out sound economic analysis of domestic and neighbouring/foreign markets for the implementation of new scientific and technical developments in production. The Coal Concept tasks academic and sectoral research institutions and institutions of higher education with encouraging preparation of the professional fleet and intensifying the practice of commercialisation of innovative projects.

Assessment

Coal mining continues to break records in Tajikistan. This fast-paced increase in production and trade leads to the generation of industrial waste and a substantial increase in emissions, and affects the environment.

Industry representatives, supporting the development of the coal sector, call the full-fledged transition to this fossil fuel "a spirit of the times" and stress that without utilising coal in energy, chemical and other industrial sectors, the republic has limited development

prospects. The authorities prefer to emphasise new jobs and benefits for the economy, but are silent about the environmental and social consequences.

Representatives of the scientific community and environmental organisations call for the return to coal (or coal renaissance) to be a short-term solution to pressing economic problems, point to its far-reaching consequences, and note the responsibility to the environment and future generations. Concerns are also raised about implementation of rushed policy measures being at odds with the best industry standards. Creating favourable conditions attracted investments in “dirty fuel”, despite environmental and social risks, and they are pressing for transparency and adherence to the highest standards at all stages of sector and related industry developments.

The government needs to place a high importance on regular environmental monitoring of the main areas of coal mining and processing, as well as solving issues of effective use of its resources. Fast-paced developments, however, risk the negative results of excessive coal mining, production waste increases, and the soil layer becoming rough and the atmosphere polluted, unless given highest-priority attention in the future.

Policy documents require strict adherence to national environmental norms and regulations, including the Subsoil Act, in place as well as international standards relating to the extraction and processing of projected subsoil reserves.

Recommendations

The government of Tajikistan should:

- Adhere to the highest environmental and social standards in fostering coal sector developments, consistent with the Strategy 2030 and broader long-term energy, industry and coal sector strategies.
- Ensure decisions are based on fair assessment of costs and transparent accountability, barring cross-subsidies between power producers and coal mines, providing the private sector an opportunity to develop and compete in this fast-paced national coal market expansion.
- Restructure the public sector, targeting privatisation in the medium term and focusing on competitiveness: closing unprofitable mines and/or tendering mines with higher potential for new licences, directing investment towards profitable mines, optimising use of mining assets and avoiding overstaffing of mines, etc.
- Given the implications for local air quality, establish a comprehensive strategy to phase out direct, small-scale coal use in the residential sector in rural areas, and replace it with cleaner sources, as well as use world-class technology for coal power plants.
- Establish a stakeholder consultation process to examine social and environmental concerns surrounding existing and new mining undertakings.
- Address the social and environmental impacts of coal mine operations and/or closures, in accordance with the best practices worldwide. Address social impacts and ensure retraining coal miners in case of mine closures.

- Employ strict environmental regulation and ensure adherence to the highest environmental and safety standards in all coal-fired generation and coal-based industrial developments.
- Seek unreserved support to RD&D in the coal sector and promote technology adaptation to fit the national characteristics of coal sector development and sustainable economic developments and green growth.
- Continue evaluating mineral deposits to encourage investments required for achieving the country's economic goals for increased gross industrial output and related employment.
- Develop, together with industry, options to facilitate coal-fired power plants to meet the air quality requirements to the highest industrial standards and prepare for the eventual reduction in coal-fired capacity by replacing it with renewable energy, without hindering security of electricity (energy) supply.
- Encourage specialised education and training of engineers and technical specialists, aimed at adding a highly professional workforce to the country’s developing coal sector, capable of managing state-of-the-art clean coal technologies and conducting innovative activities aimed at minimising the environmental risks of coal use.

References

CABAR (Central Asian Bureau for Analytical Reporting) (2021), Is it possible to give up coal in Tajikistan?, https://cabar.asia/en/is-it-possible-to-give-up-coal-in-tajikistan

Department of Geology, Republic of Tajikistan, http://www.gst.tj

Dushanbe District Heating Company, Dushanbe City Council, http://www.dushanbe.tj/ru

Dushanbe-2 power station, https://gem.wiki/Dushanbe-2_power_station, (accessed April 2022)

End Coal, Global Coal Plant Tracker, https://globalenergymonitor.org/projects/global-coal-plant-tracker/ (accessed 10 June 2022).

Geological and Mineral Resources Map of Tajikistan, https://geoportal-tj.org/deposits/, (accessed April 2022).

Idrisov, T. (2020), Tajikistan's coal dilemma, CABAR, https://cabar.asia/en/tajikistan-s-coal-dilemma.

IEA (International Energy Agency) (2022), World Energy Balances 2020 (database), www.iea.org/statistics (accessed 10 June 2022).

Little Earth (2017), Review of the coal sector in Tajikistan, CEE Bankwatch Network, December 2017, https://bankwatch.org/wp-content/uploads/2017/12/Tajikistan-coal.pdf

Ministry of Economic Development and Trade, Republic of Tajikistan, www.minjust.tj

Ministry of Industry and New Technologies, Republic of Tajikistan, http://www.sanoat.tj/

Ministry of Industry and New Technologies (2019), Summarizing the activities of enterprises in the coal industry in 2019, Ministry of Industry and New Technologies, Tajik section, http://sanoat.tj/?page_id=105 (accessed April 2022).

Order of the Government of the Republic of Tajikistan of August 30, 2019 No. 436, The concept of development of coal industry in the Republic of Tajikistan for the period till 2040, https://cis-legislation.com/document.fwx?rgn=118905

Rasht power station, https://gem.wiki/Rasht_power_station, (accessed April 2022)

Shurab power station, https://gem.wiki/Shurab_power_station, (accessed April 2022)

TajStat (National Statistics Office of Tajikistan) (2019), Energy Balance of Tajikistan 2018, TajStat, Dushanbe.

Umarov, T (2020), China looms large in Central Asia, 30 March 2020, Carnegie Endowment for International Peace, https://carnegiemoscow.org/commentary/81402 (accessed April 2022).

Usmonov, F. (2019), Trends of Tajikistan coal sector, UNECE, https://unece.org/sites/default/files/2021-10/23.%20Usmonov%20-%20Trends%20of%20coal%20sector%20of%20Tajikistan.pdf https://unece.org/sites/default/files/2021-10/23. Usmonov - Trends of coal sector of Tajikistan.pdf

5. Gas

Key data

(2020)

Domestic production: negligible **(**< 1 mcm, -97.0% since 2010)

Net imports: 0.23 bcm, +29.4% since 2010 (supplies were cut off from 2013-2017)

Share of natural gas: 5.3% of TES, 1.6% of electricity generation, 2.9% of TFC

Gas consumption by sector: 0.23 bcm (power generation 86.0%, industry [non-ferrous metals] 9.5%, unspecified 4.5%)

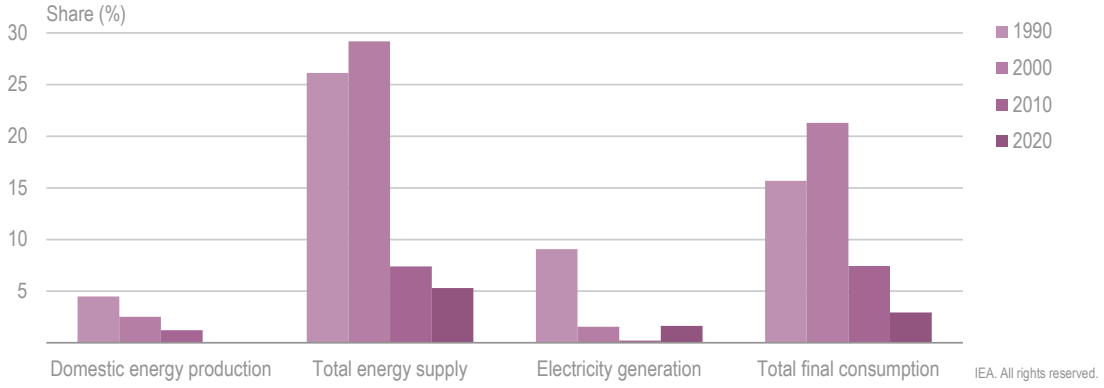
Overview

Natural gas played a limited role in Tajikistan's energy system before the supply interruption in 2013, the share in TES being under 10%.

Tajikistan has negligible domestic gas production, so all demand is covered by imports, all of which come from neighbouring Uzbekistan.

Since the resumption of the supply in 2018, gas has been increasingly used in power generation and the non-ferrous metal industry.

Figure 5.1 Share of natural gas in Tajikistan's energy system, 1990-2020



The role of natural gas in the economy has been low in the last decade.

Source: IEA (2022), *World Energy Statistics and Balances* (database), https://www.iea.org/data-and-statistics.

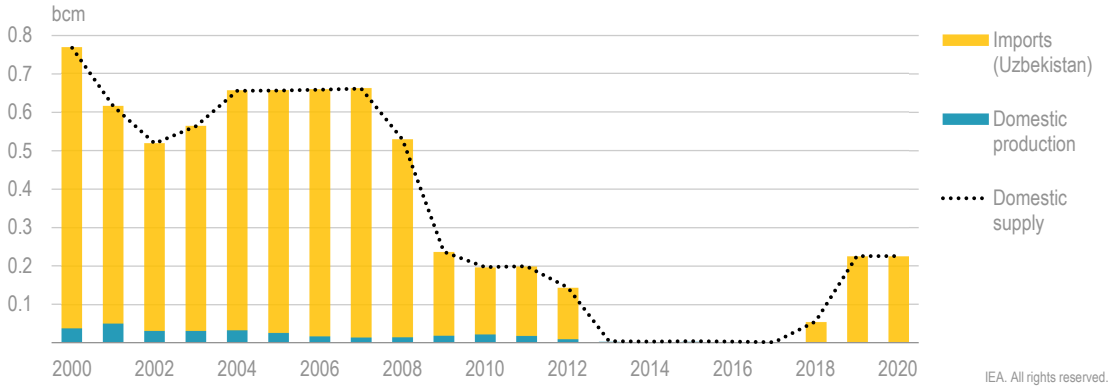
Supply and demand

Imports

Tajikistan's natural gas production is negligible, so all supplies must be imported. Uzbekistan is the sole supplier of natural gas to the country. In 2020, 0.23 billion cubic metres (bcm) were imported through the pipeline.

Tajiktransgas imports natural gas from Uzbekistan and sells directly to Dushanbe-1 TPP and TALCO.

Figure 5.2 Natural gas supply by source, 2000-2020



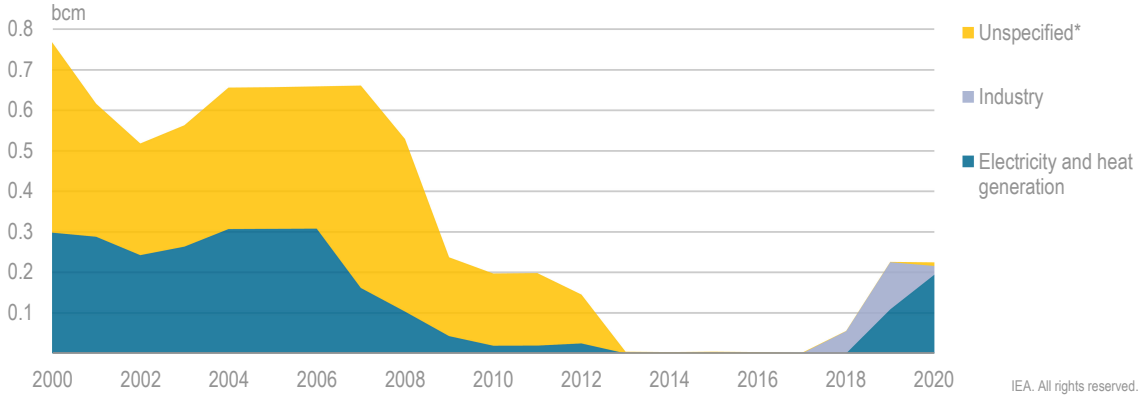
Virtually all demand is met by imports from Uzbekistan.

Source: IEA (2022), *World Energy Statistics and Balances* (database), https://www.iea.org/data-and-statistics.

Consumption

Domestic consumption of natural gas was 0.23 bcm in 2020. Since the resumption of gas imports in 2018, the main gas-consuming sectors are power generation (86%) and the non-ferrous metal industry (i.e. TALCO) (10%). Detailed consumption data are not available for the period prior to the supply disruption, limiting the sectoral consumption analysis.

Figure 5.3 Natural gas consumption by sector, 2009-2020



Natural gas consumption was halted in 2013 and resumed only in 2018.

* The share of unallocated gas consumption of the total was notable in Tajikistan in the past, limiting the sectoral analysis.

Source: IEA (2022), *World Energy Statistics and Balances* (database), https://www.iea.org/data-and-statistics.

Exploration and production/upstream

The natural gas sector is mainly owned and operated by the state. While the MEWR is responsible for sectoral policy, OJSC Tajiktransgaz carries out exploration and production activities and has a few production-sharing agreements (PSAs) with foreign investors.

In 2008, the first-ever PSA between the government of Tajikistan and Tethys Petroleum Limited was signed. The PSA provided 34 785 km^2 (8.6 million acres) to Tethys subsidiary Kulob Petroleum Limited in south-western Tajikistan, covering Kulob Square, a large, high-prospect but relatively unexplored region. It also covered Hatlon Square and the area surrounding Dushanbe, with more than 50 prospective sites.

In June 2013, Tethys, Total and China National Petroleum Corporation (CNPC) signed a PSA to develop the Bokhtar field and create the Bokhtar Operating Company (BOC). The government also added four more prospective fields with a total area of 1 186.37 km^2 when BOC was created. Total and CNPC each hold a 33.335% stake, and Tethys retained 33.33%.

The government, in its questionnaire submission, reported 762 000 cubic metres in 2021.

Gas transportation and transit infrastructure

The government also supports construction of the Line D gas pipeline, part of the Central Asia-China pipeline system that is to transit gas from Turkmenistan via Uzbekistan, Tajikistan and Kyrgyzstan to China. Line D is to be about 1 000 km long, with 425 km in Tajikistan. The Chinese government plans to finance the project.

Gas market structure

The gas sector is owned and operated by the state through the transmission system operator (TSO) and 11 regional distribution system operators (DSOs), which are also retailers. Tajiktransgas is the gas importer and TSO, and it operates the central dispatch. The DSOs have been financially unbundled from Tajiktransgas since 2009 and are in state ownership. The government is planning to privatise the gas sector by selling the DSOs, but none have been sold to date, partly due to a lack of rules on third-party access.

Institutional and regulatory framework

OJSC Tajiktransgas is responsible for the transmission of gas distribution for the entire country. Petroleum Sugd, JSC Naftogas and BOC are engaged in gas exploration and production; JSC Gazprom Neft in gas import and distribution; and JSC Allat in gas import and distribution.

The Trans-Tajik Gas Pipeline Company (TTGP) was established by Tajiktransgas and CNPC for the construction of the Tajik Line D section of the Turkmenistan-China pipeline.

The natural gas pipelines in Tajikistan are ageing, and Tajiktransgas maintainsthe pipeline from Uzbekistan to Dushanbe-1 TPP and TALCO. As for LPG, the infrastructure is fairly new and in very good condition.

Gas imports, solely from Uzbekistan, remain small, although there are plans to increase it in coming years, if plans for construction of additional co-generation stations are commissioned.

Prices

The current price for Uzbekistan gas imports for over 200 mcm is set at USD 100 per cubic metre. Tajikistan subsidises natural gas imports from Uzbekistan with electricity.

Barqi Tojik resells it, without subsidies, to its two main customers, Dushanbe-1 TPP at USD 151.79, and to TALCO at USD 141.81.

LPG is imported mainly from Kazakhstan at market price and is distributed and sold in Tajikistan without subsidies.

Assessment

Tajikistan started providing natural gas to its population in 1958. In the same year, the Department for Gasification under the Ministry of Public Utilities of the Tajik Soviet Socialist Republic and the Dushanbegaz gas utility were established. In 1959, liquefied gas storage tanks were constructed in Navobod, Rudaki District, and in Gafurov, Sughd Region. Liquefied gas was imported from refineries in Bashkorostan, Tatarstan and Orenburg in Russia, while natural gas was supplied from Uzbekistan.

The connection of the population and industries to natural gas networks reached 90% in cities and 55% in rural areas of southern and northern parts of Tajikistan, where gas was primarily used as a heat source for households. By the 1990s, gas consumption reached 1.8 bcm a year. In 2013, the natural gas supply from Uzbekistan was cut off, forcing domestic and industry customers to switch to alternative fuels, such as coal, fuel oil and liquefied gas.

The natural gas supply from Uzbekistan was restored in 2018, following the signature of an agreement on enhanced economic co-operation that included reinstating natural gas supply to Tajikistan. Currently, natural gas is used by large enterprises such as the Dushanbe-1 TPP co-generation plant and TALCO. In 2021, the gas supply to Tajikistan totalled 236 120 cubic metres. Feasibility studies for construction of a new gas-fired Dushanbe-3 are under way, and if construction gets the green light, the government plans to increase natural gas imports from Uzbekistan to up to 1 bcm to satisfy the country’s growing demand for natural gas.

The restoration of natural gas supplies from Uzbekistan offers Tajikistan an opportunity to return to a cleaner alternative to the country’s growing coal industry and help reduce its rising greenhouse gas emissions as well as the industry’s negative environmental impact on livelihoods and wildlife habitat. This move would be in line with the Strategy 2030, which envisages the diversification of the country's electric energy system capacity by at least 10%, amongst other sources of energy including gas and renewable energy.

There are multiple benefits to reintroducing natural gas use in households and/or small and medium enterprises (SMEs) originally designed for natural gas use. However, this move will require significant investment in network rehabilitation, which could be achieved with substantial sector reforms aimed at removing subsidies, establishing cost recovery tariffs and opening the natural gas market.

Recommendations

The government of Tajikistan should:

- Continue fulfilling gas transit obligations.
- Support sector restructuring and creation of a gas market, as gas imports increase.
- Assess feasibility for the construction of a new gas-fired TPP in Dushanbe and to the extent possible in other urban settlements, primarily for heat supply.
- Ensure that any data collected from household and industry are passed on to TajStat in a timely manner.

References

Dushanbe District Heating Company, Dushanbe City Council, http://www.dushanbe.tj/ru

Department of Geology, Republic of Tajikistan, http://www.gst.tj

IEA (International Energy Agency) (2022), World Energy Statistics and Balances (database), https://www.iea.org/data-and-statistics. (accessed 10 June 2022)Ministry of Energy and Water Resources, Republic of Tajikistan, http://mewr.gov.tj/ru

Order of the Government of the Republic of Tajikistan of August 1, 2006 No. 364, "About approval of the List of buildings, constructions, the equipment and other property, plant and equipment (funds) of the state companies which provision in lease irrespective of term is performed in coordination with authorized state body" (as amended on 28 December 2006). https://cis-legislation.com/document.fwx?rgn=14702

6. District heating

Key data

(2020)

District heat generation: 7.2 PJ/0.17 Mtoe (coal 77.6%, natural gas* 22.4%), +128% since 2000

District heat consumption**: 0.17 Mtoe

* Output estimated based on natural gas inputs
** Data on distribution losses and detailed consumption not available

Overview

Total district heat generation was 0.17 Mtoe in 2020, the main energy source being coal (78% share of the total in 2020). District heat utilisation has ramped up rapidly since the commissioning of the Dushanbe co-generation plant in 2013. Prior to 2013, some district heat was generated with natural gas, but it was stopped in 2013 due to the lack of supply. Gas use for district heat production was restored in 2019, following the re-establishment of natural gas supplies from Uzbekistan.

District heating is available only in Dushanbe, which has a population of around 778 500. A total of 2 950 buildings are connected to the system in Dushanbe, but due to the condition of the network, heat is provided to only 1 073 houses/multistorey buildings, 104 schools and hospitals, and 137 enterprises and organisations. The system does not have meters at the generation facilities or interfaces between the transmission and distribution systems or at customer level. The total length of the district heating network is 423 km, currently with 64 pumping stations. In addition, there are 11 heat-only boilers which are operated by Dushanbe District Heating Company personnel that provide heat to dedicated heat users such as hospitals and schools.

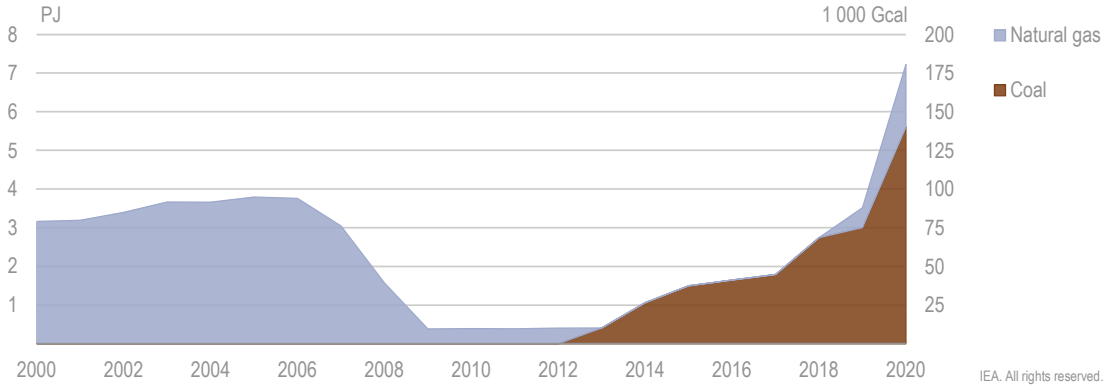
The government made it mandatory (Decree 364, August 2016) for all new buildings to be connected to district heating. This factor, along with the developing heat network, is stimulating construction of new co-generation plants. The government is planning to develop a third co-generation plant in Dushanbe by 2030.

No data are available on heat losses in the network. Therefore, the reported consumption of heat equals the production. All heat was reportedly consumed in the residential sector.

Generation

Heat is generated from four sources: Heating Plant 1 (natural gas/mazut), Heating Plant 2 (coal), West Hear Station (natural gas/coal) and East Heat Station (natural gas/coal). All of these heat-generating sources are owned by the state national energy company OJSC Barqi Tojik. The State Unitary Enterprise Dushanbe District Heating Company, 100% owned by the City of Dushanbe, is the entity responsible for distribution of the heat in Dushanbe. Barqi Tojik generates the heat and delivers it to the pumping stations, a point of the delineation of responsibility between Barqi Tojik and Dushanbe District Heating from where the company distributes heat to its customers.

Figure 6.1 Heat generation by source, 2000-2020



Almost 80% of district heat is derived from coal.

Note: PJ = petajoules; Gcal = gigacalories.
Source: IEA (2022), *World Energy Statistics and Balances* (database), https://www.iea.org/data-and-statistics.

Supply and demand

District heating is available and operational only in Dushanbe, where its district heating system is made up of a co-generation plant and numerous large and small boiler houses. Nevertheless, Dushanbe's daily electricity consumption, which in the summer totals 5 million kWh, prior to district heating supply infrastructure rehabilitation saw increases in the winter to 15 million kWh because the population uses electric devices for heat when the centralised heating system is not functioning.

The government has therefore invested heavily in rehabilitation to improve heat supplies in Dushanbe in recent years, and thereby reduce overall winter electricity deficiencies in Tajikistan. An East heat station has been constructed and the West heat station was rehabilitated, while an additional 400 MW power plant was also built and most heat pipelines have been rehabilitated. Simultaneously, the population is legally obliged to restore radiators in apartments to receive heat from the centralised heating system to reduce electricity consumption. Reducing consumption quickly is imperative: in 2017, Tajikistan exhausted its power supply by mid-January, whereas in previous years the supply had lasted until February/March. Since 2017, there has been no official winter electricity shortage for the residential sector in Tajikistan.

Table 6.1 Dushanbe heat supply

No.	Plant	Electricity capacity MW	Heat capacity Gcal per hour	Type of fuel
1	Dushanbe-1	198	357	Natural gas
2	Dushanbe-2	400	234	Coal
3	West Heat Station		210	Natural gas
			20	Coal
4	East Heat Station		60	Natural gas
			10	Coal

The heat supply in Dushanbe is provided by TPP1, TPP2, and the West Heat and East Heat Stations. Dushanbe-1 (mazut and gas) and Dushanbe-2 (coal) as well as the West and East Boilers are owned by the generation company Barqi Tojik

Source: In-depth review questionnaire submission 2022.

Dushanbe-1 (mazut and gas) and Dushanbe-2 (coal) as well as the West and East Boilers are owned by the generation company Barqi Tojik. The only district heating network in the country exists in Dushanbe, and therefore this belongs to the state-owned company Dushanbe District Heating Company.

District heating infrastructure modernisation

According to the official data, around 3 000 buildings are connected to the central heating supply in Dushanbe. Increasing the city's connection to heat supply is continuing, and the government on 30 May 2015 adopted the Resolution "On the implementation of additional measures to provide the population and various socio-economic sectors of the city of Dushanbe with heat". According to this document, the Administration of Dushanbe, the OJSC Barqi Tojik and the Committee for Architecture and Construction under the Government of the Republic of Tajikistan, while granting permits for new facilities in Dushanbe, will take into account the mandatory connection to the centralised heating networks, along with the city administration's strong efforts to connect existing administrative and residential buildings to the networks. The responsible state bodies are actively involved in this process, and preventive work by the population is also being carried out to repair radiators at their own residences.

At the same time, outside the city of Dushanbe small boiler houses are used which provide heat, mainly to public buildings as well as some multi-apartment houses. In most cases, each small boiler house serves from one to three buildings and is operated by the state unitary enterprise (SUE) Khojagi Manzili va Komunali. The company covers territories outside Dushanbe. Previously, it owned 56 small boiler houses, however only 9 of them are still in working order. Most small boilers were originally designed to use gas as fuel, but they were transferred to coal because of the lack of natural gas and its high price. As a result, the efficiency of these boiler houses has significantly decreased – to around 40-50% – while local pollution has increased due to inefficient flue gas cleaning systems (where they exist). Despite rehabilitating a number of boiler houses in recent years (for example, in Gissar, Khujand, Rudaki and Vakhdat), the degraded condition or dismantling of the in-house heating infrastructure creates a serious impediment to the renewal of heat supply.

In addition, small boiler houses (with an estimated installed capacity of 0.6 Gcal/hour to 4 Gcal/hour) working off coal or electricity are owned and operated by a number of state-funded institutions. Only 182 of the more than 1 000 state-owned boilers are in working order.

Households not connected to the central heating systems (CHS) and living in apartment buildings rely mainly on electricity to meet their heating needs, while private homes produce about one-third of their total heat using electricity, wood and coal. According to World Bank data, for the country as a whole the most common main source of heat supply is coal or biomass stoves used by more than 74% of all households, followed by electricity (18%), individual boilers and CHS. In urban areas, about 48% of households use electricity for heating, followed by ovens (37%), individual boilers and CHS. The use of inefficient and polluting coal or biomass furnaces has a detrimental effect on human health and the environment.

In particular, according to the World Health Organization, Tajikistan is among the 25 countries with the highest rates of morbidity due to indoor air pollution – it is one of the few countries in which indoor air pollution causes more deaths and disabilities than smoking. In 2010, 64 out of every 100 000 deaths were attributed to indoor air pollution due to the use of solid fuels, which was the third-highest cause of death in Tajikistan. It should also be noted that at present some IFIs (World Bank, GIZ [the German Agency for International Cooperation]) are advancing new energy-efficient stoves/furnaces in the country that should significantly reduce indoor air pollution, and for this purpose they are developing affordable financial portfolios for the population through local microfinance organisations.

According to the Agency for Forestry under the Government of the Republic of Tajikistan, over the last 50 years the volume of forests has decreased by more than 70%. The government is taking special measures to prevent uncontrolled deforestation and avoid possible ecological catastrophe. This deforestation has meant that during the wintertime, local populations in the rural areas, who do not have permanent access to electricity and cannot cut down trees, face high costs of wood supplies. In this regard, in Tajikistan there is currently a lack of alternatives to coal use during winter in the rural areas.

There is a general lack of information on energy consumption from the consumer side. According to the Agency on the Statistics under the President of Tajikistan, there is particularly a vacuum for obtaining information on energy consumption at household level – it is difficult to keep track of how much energy each household uses to meet its own needs. Moreover, information is practically absent at the level of the regions where the population usually uses coal, wood and biomass (mainly animal dung) for heating. In this regard, at the moment TajStat together with the World Bank is developing a sample questionnaire which should level out this information vacuum.

Following developments in recent years, and actions the government took to replace district heating with coal, it is evident that heat supply in Dushanbe for the foreseeable future will be provided predominantly by coal-based TPPs and boiler stations. Coal is also very popular in those regions with limited access to electricity.

Regarding renewable heat, electricity continues to be one of the main sources for heating (95% of electricity production is from HPP). Wood use is limited because of laws restricting unauthorised deforestation and the high price of wood. The use of biomass (mainly animal dung) is also very popular in Tajikistan.

Regulation and prices

The subsidised price for the population in 2021 for heating was TJS 1 18 (Tajikistan somoni) per square metre (including VAT). For state-funded organisations it was TJS 98 67 for 1 Gcal (excluding VAT). Other consumers pay TJS 113 46 for 1 Gcal (excluding VAT).

Assessment

Access to reliable and affordable heat supply is essential for the welfare of the population and the provision of public services in Tajikistan. Given the cold climate and long winters, which stretch from three to more than six months, access to reliable heat supply services in the country is linked to pressing needs. Heat supply provided by the (CHS) dramatically decreased after the country gained independence in 1991, with the subsequent collapse of regional energy co-operation in Central Asia.

In the past, around 35% of urban households consumed heat from the CHS that existed in Dushanbe, Khujand, Kulob, Chkalovsk, Yovon and Qurgon-Teppa. In Dushanbe and in Yovon, heat supply was provided by TPPs and large boiler houses, while in other cities only large boiler houses, working mainly on natural gas, were used in heating. With the exception of Dushanbe, Tajikistan's CHS were decommissioned and dismantled in the 1990s and early 2000s due to rising gas prices, interruptions in gas supplies from Uzbekistan and the obsolete CHS infrastructure, caused by inadequate investment and lack of appropriate maintenance.

Currently the CHS covers only about 3.5% of urban households. These are mainly households living in Dushanbe, where the central hearing (CH) is operated by TPP-1, TPP-2 and the large East and West Boiler houses (heat stations). In addition, small central heating systems are available in cities such as Vakhdat, Vose, Gissar, Zafarobod, Rudaki, Temurmalik and Khujand. Heating in these cities is carried out by small thermal boilers. In general, the remaining systems of the country's CHS are in unsatisfactory condition due to their age, lack of investment in overhaul and modernisation, inadequate maintenance, and provision of untreated water (in particular during the 1990s). As a result of the deterioration in reliability of the CHS, many of the urban households that were previously connected to the CHS have dismantled their radiators and heating pipes. This creates serious difficulty for the renewal of heat supply, even after the overhaul of the heating plants.

Most of the remaining assets of the CHS are operated for only a small fraction of their designed capacity and are characterised by high losses, increasing pollution and low efficiency, in part due to the transition from gas to coal without the use of modern flue gas cleaning systems.

Low tariffs are also a significant contributor to the ageing of the heating sector. Tariffs for heat and electricity are much lower than the level of cost recovery; as a result, heat supply companies operate at a loss and do not have sufficient funds to ensure proper maintenance and overhaul. This leads to the continuous obsolescence of assets, inefficiencies, poor quality of service and deterioration in the reliability of heat supply. As

a result, the heating sector has become highly dependent on direct subsidies from state or municipal budgets that are used to cover more than 50% of the estimated revenues of the sector.

As a result of the deterioration in district heating services, most households in urban areas use electricity for heating, which highlights the shortage of electricity during the winter when high dependence on the use of electricity for heating is one of the key factors for increasing electricity consumption in this period. In Dushanbe alone, until 2016 electricity consumption in the winter months more than doubled in comparison with the summer months. In combination with the unsatisfactory condition of the ageing energy infrastructure and the low generation of hydroelectric power in winter, this increase in electricity demand exacerbates the shortage of electricity in winter.

According to World Bank data, in view of the limited choice of alternative fuel sources and lack of access to CHS or reliable electricity supplies, more than a third of urban households use inefficient and polluting coal or biomass furnaces. Outside of Dushanbe, around 37% of urban households use traditional coal and wood stoves, which are associated with detrimental social consequences due to their low efficiency and exposing people to smoke and particulate matter indoors. These inefficient heating methods also force the population to spend more on fuel than they would spend using more efficient alternative heating options. The cost of solid fuels accounts for around 10% of all urban household expenditure and about 15% of all rural household expenditure.

The energy efficiency of residential and public buildings is unsatisfactory, exacerbating the gap between actual heat supply and the needs of subscribers. The age of housing stock, inadequate maintenance and lack of proper insulation combine to create extremely high heat loss and low comfort in many buildings. To meet the need to ensure a stable heat supply to residential and public buildings requires a set of investments – both from the heat supply enterprises and from the consumers of thermal energy.

Under these conditions of electricity deficit in Tajikistan, electric space heating puts the greatest pressure on winter peak electricity demand. According to experts, switching away from electric heating to district heating fired by alternative fuel in Dushanbe alone means that district heating can phase out 47% of electricity consumption in winter. In this regard, the government has begun to invest in the restoration of central heating to improve energy efficiency, and investments have primarily gone to the capital where energy consumption is highest.

The government has invested large sums for the rehabilitation and improvement of heat supply in Dushanbe in recent years, thereby seeking to reduce winter deficiency in Tajikistan. In particular the capital has seen the construction of the East Heat Station, rehabilitation of the West Heat Station, construction of the 400 MW Dushanbe-2 and the start of the process of rehabilitation of the city’s heat pipelines. At the same time the government has introduced legislation requiring the population of Dushanbe to rehabilitate their own radiators and main pipes in the buildings. All these measures have contributed to reducing the energy shortage in Tajikistan, particularly since 2017 when the power supply was completely exhausted by the middle of January, while the winter power limit for the previous few years lasted to February and March.

Recommendations

The government of Tajikistan should:

- Develop a regulatory framework for the heating sector, one that promotes cost-effectiveness, competition, efficiency and flexibility, including through sector integration, and encourages investment for these purposes. Achieving these ends would involve:
  - Transitioning to a system of cost-reflective consumption-based energy tariffs, which would enable heating sector to fully recover its costs and compete on equal terms in the electricity and heat markets.
  - Introducing efficiency improvement targets for heating sector.
  - Encouraging private investment to modernise and rehabilitate district heating.
- Consolidate and co-ordinate policies in the areas of district heating and cooling, oil, natural gas, coal, and energy efficiency, and support the development and demonstration of efficient, integrated systems to supply heating, cooling and electricity (tri-generation).
- Improve the energy efficiency of district heating through policies and programmes to:
  - Replace old and inefficient boilers with modern ones.
  - Replace old pipes with modern, pre-insulated ones.
  - Install meters throughout the system – from boiler exit meters to building-level heat meters – and introduce compulsory apartment-level metering for new buildings.
  - Install energy controls, including individual heating substations and temperature-regulating valves.
  - Facilitate the establishment of ESCOs.

References

Dushanbe District Heating Company, Dushanbe City Council, http://www.dushanbe.tj/ru

Dushanbe Teploset (Dushanbe District Heating Company), http://www.dushanbe.tj/ru

EBRD (European Bank for Reconstruction and Development) (2021), Dushanbe district heating project, https://www.ebrd.com/work-with-us/projects/psd/49375.html.

EBRD (2019), Tajikistan Dushanbe District Heating Modernisation, Stakeholder Engagement Plan, https://www.ebrd.com/what-we-do/project-information/environment-social-info-documents/1395296791251/GrCF2_W2_-_Dushanbe_District_Heating_Project_SEP.pdf?blobnocache=true

IEA (International Energy Agency) (2022), World Energy Statistics and Balances (database), https://www.iea.org/data-and-statistics. (accessed 10 June 2022)

Ministry of Industry and New Technologies, Coal Industry, Republic of Tajikistan, http://sanoat.tj/?page_id=1184

Order of the Government of the Republic of Tajikistan of August 1, 2006 No. 364, “About approval of the List of buildings, constructions, the equipment and other property, plant and equipment (funds) of the state companies which provision in lease irrespective of term is performed in coordination with authorized state body” (as amended on 28 December 2006). https://cis-legislation.com/document.fwx?rgn=14702

7. Oil

Key data: Oil

(2020)

Domestic production: negligible **(**25 kt, -18% since peak production in 2012)

Crude oil imports: small volumes from Kyrgyzstan and Uzbekistan since 2018 (10 kt in 2020)

Oil product imports: 1.1 Mt (25.5 kb/d), +104.3% since 2010

Share of oil: 1.0% of domestic energy production, 29.4% of TES, 34.4% of electricity generation, 34.4% of TFC

Consumption by sector: 1.1 Mt (road transport 86.5%, international bunkers 2.5%, industry 11.0%)

* Total energy supply does not include oil used for international bunkering

Overview

Tajikistan produces and refines small quantities of crude oil, but the large majority – over 95% – of the demand is satisfied by oil products.

Oil reserves, like other mineral resources are under state ownership and almost all exploration and production are operated by the state. While the MEWR is responsible for sectoral policy, OJSC Naftrason carry out exploration and production activities. They have PSAs with numerous foreign investors.

In 2008, the first-ever PSA between the government of Tajikistan and Tethys Petroleum Limited was signed. The PSA provided 34 785 km^2 (8.6 million acres) to Tethys subsidiary Kulob Petroleum Limited in south-western Tajikistan, covering Kulob Square, a large, high-prospect but relatively unexplored region. It also covered Hatlon Square and the area surrounding Dushanbe, with more than 50 prospective sites.

In June 2013, Tethys, Total and CNPC signed a PSA to develop the Bokhtar field and create the BOC. The government also added four more prospective fields with a total area of 1 186.37 km^2 when BOC was created. Total and CNPC each hold a 33.335% stake, and Tethys retained 33.33%.

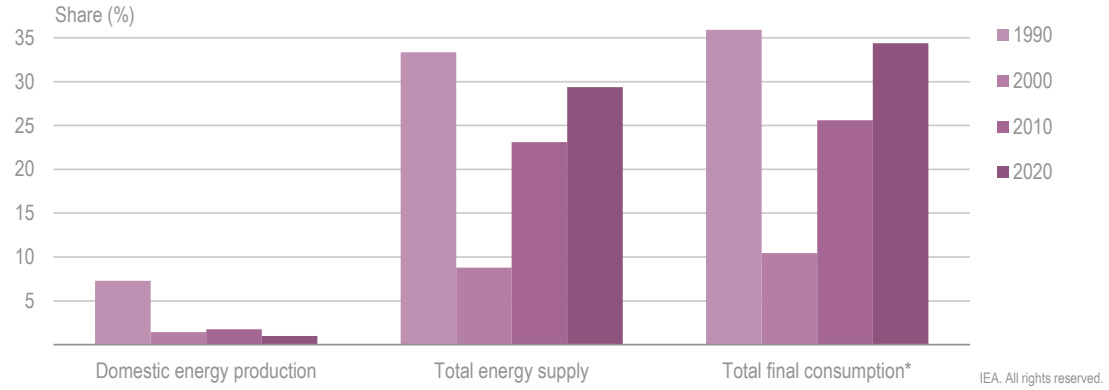
Other, smaller private investors in Tajikistan's oil and gas sector include CJSC Somon Oil; 90% of its equity belongs to the Swiss company DWM Petroleum AG, and the other 10% belongs to Anavak LLC. Somon Oil, operating under a PSA since May 2012, is finishing research work on two platforms: Western Sufatog in the Asht district on the border with

Uzbekistan, and Kayrokum B field near the Kayrokum reservoir. In the prospective areas of Navobod and Obchai Kalacha, 2D seismic surveying was carried out over a distance of 123 km. The company has declared investments of TJS 2.5 million, and is investing USD 6.2 million in exploration of prospective fields in north-western Tajikistan.

Oil has the second-largest share in the final consumption, one-third of the demand. Similar to many countries, a majority of the oil is consumed in the transport sector. Specific to Tajikistan is that the main road fuel is in fact LPG. Oil has never been used in power generation.

Tajikistan currently has no known emergency stocks of crude or oil products, though importers and sellers maintain some commercial stocks.

Figure 7.1 Share of oil in Tajikistan's energy system, 1990-2020



The share of oil in Tajikistan's energy system is high, almost 30% of TES and 35% of the TFC.

*Includes non-energy use.
Note: Oil has never been used in electricity generation.
Source: IEA (2022a), *World Energy Statistics and Balances* (database), https://www.iea.org/data-and-statistics.

Supply and demand

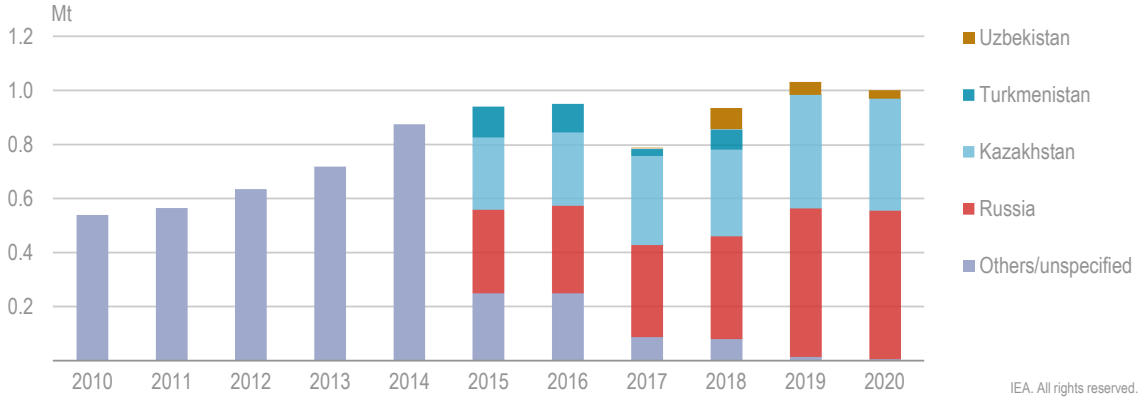
The first oil processing facility was commissioned in 2013 with the design capacity of 100 kt per year. However, the facility has operated at only around 25% of its capacity since then. A construction of a larger refinery with 1 200 kt/year design capacity started in 2014 in the Dangara Free Economic Zone was fully equipped and completed in 2018. Taking the refinery into operation is expected to commence once satisfactory raw material supply agreements are reached. Negotiations are reported to be held with companies from Iran, Kazakhstan and Russia. The refinery has been built by Tajik-Chinese joint venture TK-Oil and is expected to produce diesel fuel, as well as low-octane gasoline AI-80, AI-92 and construction bitumen at the initial stage. The next stage envisages production of European brands of gasoline – Euro-4 and Euro-5, as well as liquefied gas, diesel fuel, paraffin and construction bitumen.

As a result, a large majority of the demand for oil products is met by imports. Oil products represented one-third of Tajikistan's total final consumption in 2020.

Imports

Tajikistan imports oil products mainly from Russia and Kazakhstan, in 2019-2020 over 90% of the total. Almost all LPG is imported. In 2020 Tajikistan consumed 420 759 271 kg of LPG, of which 380 143 604 kg was imported from Kazakhstan, 28 478 153 kg from Uzbekistan and 11 957 514 kg came from domestic production. Diesel and motor gasoline are imported mainly from Russia, with minor additional quantities from Turkmenistan, Uzbekistan and Kyrgyzstan. Most oil products arrive by road.

Figure 7.2 Tajikistan's oil product imports by country, 2010-2020



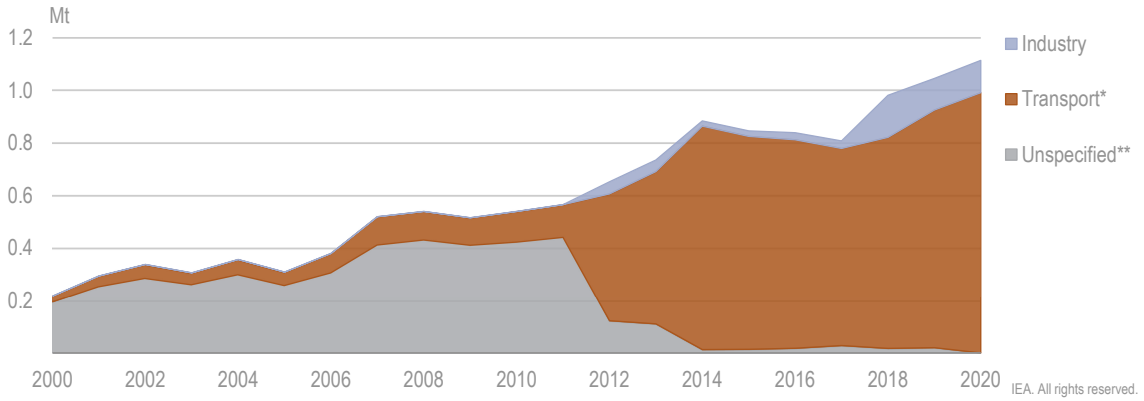
Virtually all demand is met by imports, mainly from Russia and Kazakhstan.

Notes: Data by country available since 2015.
Source: IEA (2022a), *World Energy Statistics and Balances* (database), https://www.iea.org/data-and-statistics.

Consumption

LPG, motor gasoline and diesel form the bulk of product imports and consumption (85% in 2020).

Figure 7.3 Oil consumption by sector, 2000-2020



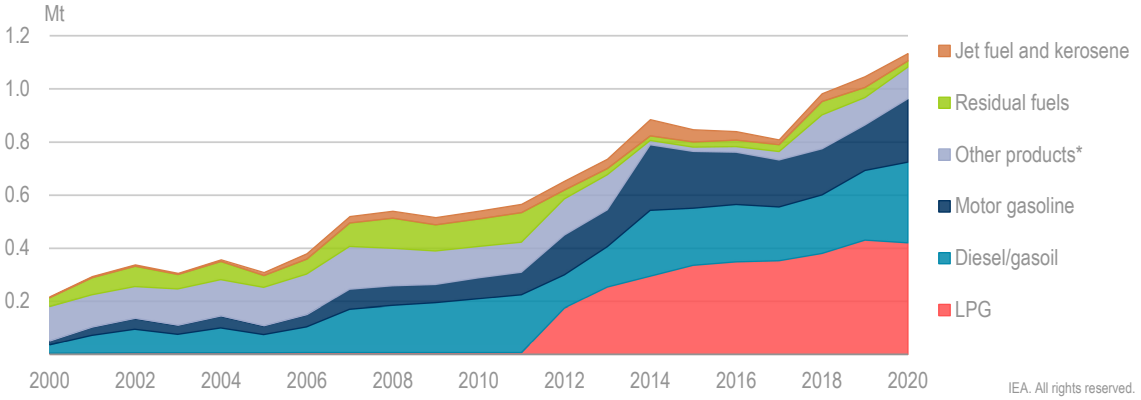
Oil product consumption has grown rapidly, more than doubling since 2010.

* Includes bunker fuels for international aviation bunkers.
** Includes majority for the transport consumption until 2011.
Source: IEA (2022a), *World Energy Statistics and Balances* (database), https://www.iea.org/data-and-statistics.

Tajikistan has one of the world's highest levels of LPG consumption in the transport sector (44%), though nearly all vehicles running on LPG are also able to use motor gasoline. High utilisation is explained by the price difference to the usual road fuels (see Figure 7.5).

Given that electricity production is mostly based on hydro, no oil is used in the generation. Lack of detailed demand data on oil products prevents a detailed sectoral analysis.

Figure 7.4 Oil consumption by product, 2000-2020



Oil product consumption mostly consists of transport fuels.

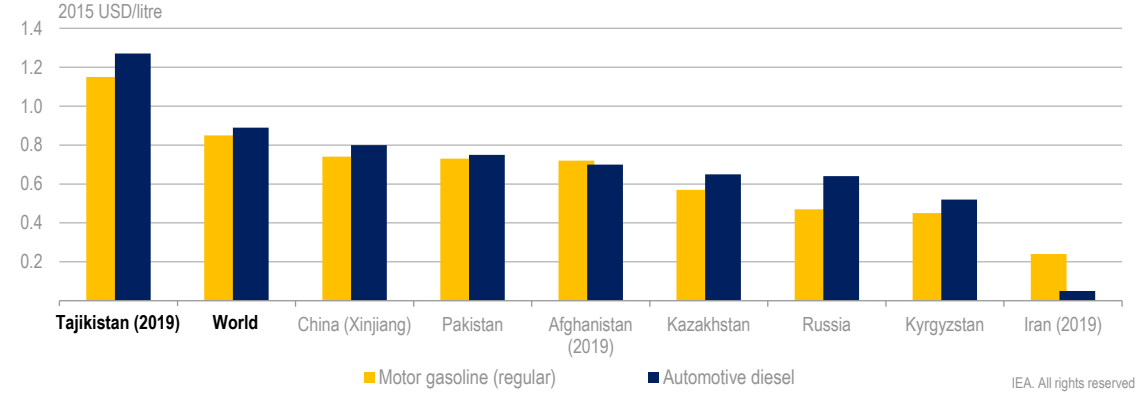
* Includes lubricants, bitumen, petroleum coke and unspecified oil products. LPG likely included in this category until 2011.
Note: Total consumption includes international aviation bunkers, and excludes international marine bunkers.
Source: IEA (2022a), *World Energy Statistics and Balances* (database), https://www.iea.org/data-and-statistics.

Oil market structure

Prices and taxes

Due to the fact that oil products are mainly imported, the government does not control oil product prices, while the Anti-monopoly Agency is responsible for regulating retail sales in order to prevent high prices.

Figure 7.5 Transport fuel prices in selected countries, 2020

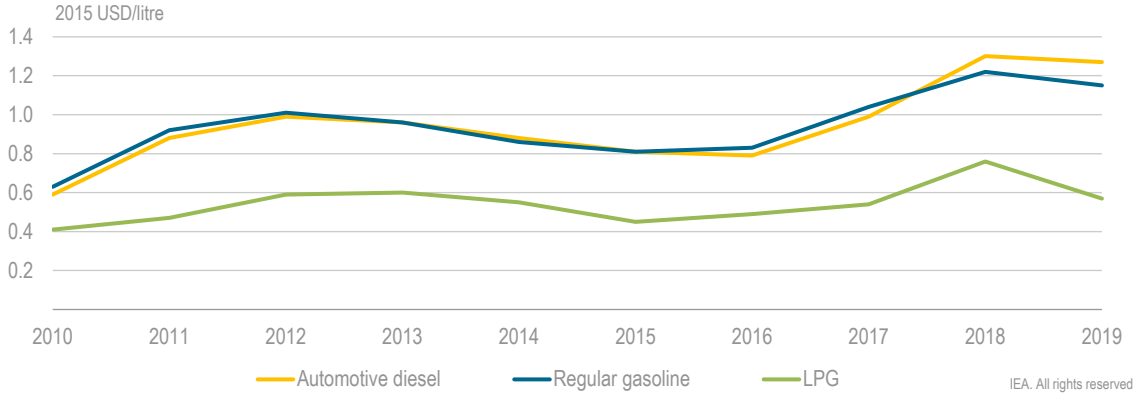


Prices for gasoline and automotive diesel in Tajikistan are the highest in the region.

Notes: Constant 2015 USD. When recent data were not available, the year for the latest data was indicated in the chart. Price data not available for Uzbekistan and Turkmenistan.
Source: IEA (2022b), *World Energy Prices* (database), https://www.iea.org/data-and-statistics/data-products?filter=prices.

Because almost 100% of oil products are imported, the government does not provide any subsidies. Russia does not impose an export tax for Tajikistan provided that the total volume is less than 830 000 tonnes.

Figure 7.6 Main transport fuel prices in Tajikistan, 2010-2019



LPG is significantly less expensive than gasoline and diesel.

Source: IEA (2022b), *World Energy Prices* (database), https://www.iea.org/data-and-statistics/data-products?filter=prices.

Assessment

The Tajikistan oil sector is quite small, with only a few companies owning licences for upstream activities. Although there are two refineries, with only one in operation currently, the economic rationale for domestic refining remains unclear, as these refineries are unable to run at full capacity throughout the year. Higher fuel-quality specifications have also made it difficult for these refineries to operate, as it is unlikely that they have invested in the complex secondary units needed to meet these new standards.

There are a range private companies operating as both wholesalers and retailers in Tajikistan's downstream market, and the presence of multiple companies in both the wholesale and retail fields suggest that the licensing regime does promote competition.

Tajikistan relies almost fully on imports to satisfy its fuel needs, mainly with Russian and Kazakhstani refineries supplying the vast majority of total imports. While Tajikistan has officially transitioned to Euro 5-specification motor fuels, some Euro-3 and -4 fuel is still being imported.

Tajikistan does not appear to hold emergency oil stocks or related reporting mechanisms at present. As a net oil importer, it is therefore highly exposed to supply disruptions and would greatly benefit from building stocks to counter potential supply disruptions. Having a monitoring system in place would help the country take the right action rapidly in case of supply disruptions and thus mitigate the shocks to the economy.

The various emergency response systems of IEA member countries reflect differences in oil market structure, geography and national emergency response policy. Establishing oil stockpiles is undeniably time-consuming and requires domestic market changes and significant financial resources, especially if it is necessary to build up domestic storage capacity and acquire large volumes of crude oil or petroleum products. However, holding emergency oil stocks is very economically beneficial because it is a crucial tool for mitigating the economic damage caused by an oil supply disruption. Preventing the harmful price spikes associated with disruptions to oil supplies avoids the payment of substantial import costs and GDP losses (IEA, 2018).

There are different ways to set up and finance a stockholding system, depending on whether compulsory stocks are held as government/agency stocks or under an obligation on industry. Financing must cover two principal sets of costs: expenses involved in setting up emergency stocks, and those of administering and maintaining the stocks.

Some options for regional co-operation, such as cross-border stockholding arrangements and joint stockpiling models, are flexible and pragmatic near-term alternatives.

In addition to establishing emergency oil stockholding, Tajikistan would also need to put emergency response procedures in place in case of a supply disruption. To test and strengthen these procedures, Tajikistan would need to run an emergency response exercise with regular intervals, advisably every two years, as industry standard.

Improving the quality and timeliness of monthly oil data is also a critical aspect of oil supply security and is essential for building up and monitoring the maintenance of emergency oil stocks. Tajikistan should therefore ensure that adequate attention and resources are given to monthly oil data collection. More complete annual oil data, including stock changes, are also needed to construct a complete description of the country's energy situation, so sharing timely data on oil product imports and stock levels with TajStat (responsible for the national energy balance) is important.

Recommendations

The government of Tajikistan should:

- Set up and/or strengthen monitoring processes to ensure that oil product imports meet the legal specifications and should increase transparency on the fuel specifications of imports.
- Develop an approach for holding emergency stocks and organise development of necessary legal and regulatory framework, including requirements for regular emergency response exercises to test system responsiveness in case of a supply disruption.
- Ensure that any data collected are passed on to TajStat in a timely fashion.

References

Asia-Plus (2022a), Сколько нефтепродуктов закупил Таджикистан в 2021 году и у кого, 16 February 2022, https://asiaplustj.info/ru/news/tajikistan/economic/20220216/skolko-nefteproduktov-zakupil-tadzhikistan-v-20221-godu-i-u-kogo

Asia-Plus (2022b), «Барки точик» назвала семерку крупных должников за электроэнергию, 15 February 2022, https://asiaplustj.info/ru/news/tajikistan/economic/20220215/barki-tochik-nazval-semerku-krupnih-dolzhnikov-za-elektroenergiyu

Asia-Plus (2022c), Долги «Барки точик» к началу 2022 года достигли почти 2,9 миллиардов долларов, 14 February 2022, https://asiaplustj.info/ru/news/tajikistan/economic/20220214/dolgi-barki-tochik-k-nachalu-2022-godu-dostigli-pochti-29-milliardov-dollarov

Asia-Plus (2020), The work of a large oil refinery in Tajikistan is postponed due to lack of raw materials, 18 September 2020, https://www.asiaplustj.info/en/news/tajikistan/economic/20200918/the-work-of-a-large-oil-refinery-in-tajikistan-is-postponed-due-to-lack-of-raw-materials

Department of Geology, Republic of Tajikistan, http://www.gst.tj

IEA (International Energy Agency) (2022a), World Energy Statistics and Balances (database), https://www.iea.org/data-and-statistics. (accessed 10 June 2022)

IEA (2022b), World Energy Prices (database), https://www.iea.org/data-and-statistics/data-products?filter=prices. (accessed April 2022)

Ministry of Energy and Water Resources, Republic of Tajikistan, http://mewr.gov.tj/ru/

Radio Free Europe/Radio Liberty (2013), Tajik president launches new oil refinery, 20 July 2013, https://www.rferl.org/a/tajikistan-president-oil-refinery/25051882.html

8. Energy, environment and climate change

Key data

Total GHG emissions without LULUCF* (2014): 9.1 $MtCO_2$-eq, -64.3% since 1990, +12.8% since 2010

GHG emissions without LULUCF* by sector (2014): Agriculture 49.9%, energy 27.9%, industrial processes 12.7%, waste 9.6%

Total GHG emissions with LULUCF* (2014): 7.6 $MtCO_2$-eq, -x% since 1990, +14.7% since 2010

Energy-related CO_2 emissions (2020):

CO_2 emissions from fuel combustion: 7.3 Mt CO_2 (+215% since 2010, -34.2% since 1990)

CO_2 emissions by fuel: Coal 52.6%, oil 41.1%, natural gas 6.3%

CO_2 emissions by sector: Transport 40.2%, electricity and heat generation 28.5%, industry 18.1%, residential 12.8%, other/unspecified 7.8%

CO_2 intensity (CO_2 emissions per GDP): 0.21 kg CO_2/USD (2015 PPP) (world average 2019 0.26)

* Land use, land-use change and forestry. For non-Annex I countries of the Kyoto Protocol, recent GHG data availability is limited. The latest national inventory covers 2004-2014.

Notes: The overall GHG data are from *The First Biennial Report of the Republic of Tajikistan on Inventory of Greenhouse Gases under the UN Framework Convention on Climate Change* (2004-2014); energy-related CO_2 emissions are from the IEA (IEA, 2022a) (1990-2020).

Overview

Tajikistan is a non-Annex I Party to the UNFCCC, and it is applying the “common but differentiated responsibilities”, thus, contributing by far more than its initial responsibilities assumed to the Convention. Tajikistan committed to report on its commitments on a biennial basis through the Biennial Update Report until 2023 and the Biennial Transparency Report from 2024. Both reports will, according to the requirements of the UNFCCC, communicate the updated GHG inventory and the implementation of the relevant mitigation efforts to fulfil the mitigation targets of the country. Tajikistan has ratified both the Kyoto Protocol and the Paris Agreement. The updated Nationally Determined Contribution (NDC) of the Republic of Tajikistan goes in line with the GHG emissions trajectories towards 2050 and onwards that correspond to keeping global warming in line with the global long-term goal of the Paris Agreement.

Tajikistan has one of the lowest rates of GHG emissions in Central Asia; nonetheless, it is extremely vulnerable to the impact of climate change, which poses a huge challenge for a

landlocked mountainous territory that is dependent on natural resources while exposed to natural disasters such as flooding and earthquakes. As climate change exacerbates existing problems and creates new risks for national development goals, the government is creating sustainable transformational initiatives in different economic sectors that will address the economic and societal impacts of climate change, focusing on enhancing the adaptive capacity of both the communities and economic sectors to build climate resilience across Tajikistan.

Climate change has added to the existing challenges and vulnerabilities, and this has taken a central position within the framework of the new Sustainable Development Goals after 2015, which include improving efficiency in use of water resources, building resilience of settlements, adopting urgent action on climate change adaptation and mitigation, protection of terrestrial ecosystems, reversing land degradation, and prevention and elimination of causes of natural disasters. Unequal regional development means that there are significant differences in the quality of services available to urban and rural populations. The rural population is more vulnerable to environmental degradation, and there are marked differences in the level of social infrastructure development between the regions. In addition, the relatively high demographic pressure in rural areas creates further inequality of employment and income.

CO_2 emissions from fuel combustion

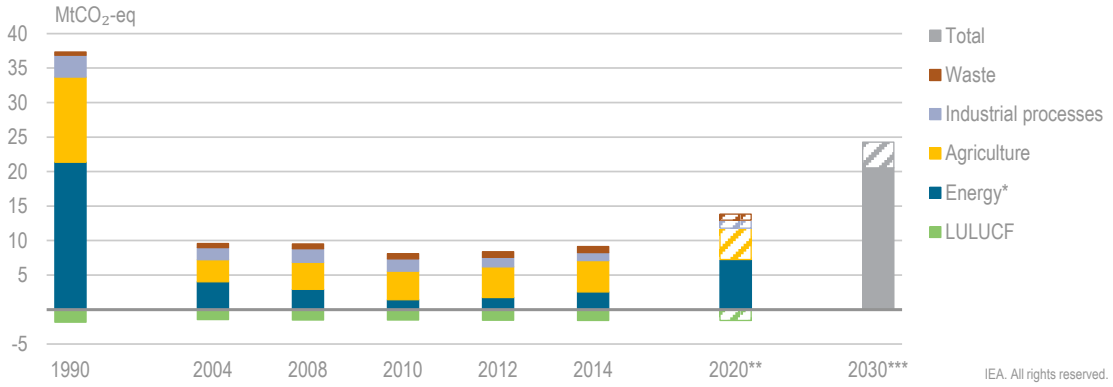
Unlike in many other countries, the share of energy-related GHG emissions has historically been relatively low in Tajikistan, mainly explained by hydro-based electricity generation. However, the emissions from fuel combustion have increased fast since 2015 when the new coal-fired power plant was commissioned.

Tajikistan's overall GHG emissions have increased by over 10% since 2010, reaching 9.1 Mt of CO_2 equivalent ($MtCO_2$-eq) in 2014, not including emissions related to land use and forestry.

Excluding the early 1990s, the share of energy-related GHG emissions has been relatively low, ranging from 42% to 28% between 2004 and 2014, in contrast to the global average of around 75%. In the terminology of the UNFCCC this includes fuel combustion for both energy production and use (e.g. energy consumption in industry, transport and households), as well as fugitive methane emissions.[3] Since 2015, these emissions – mainly CO_2 from coal combustion – have risen notably, over 70% until 2020. Natural gas imports recommenced in 2018, so fugitive emissions of methane are likely to increase as well, although they have not been quantified recently.

[3] In addition to energy, GHG sectors used by the Intergovernmental Panel on Climate Change (IPCC) include industrial processes and product use; agriculture, forestry and other land use; and waste.

Figure 8.1 Tajikistan's greenhouse gas emissions by sector, 1990-2030

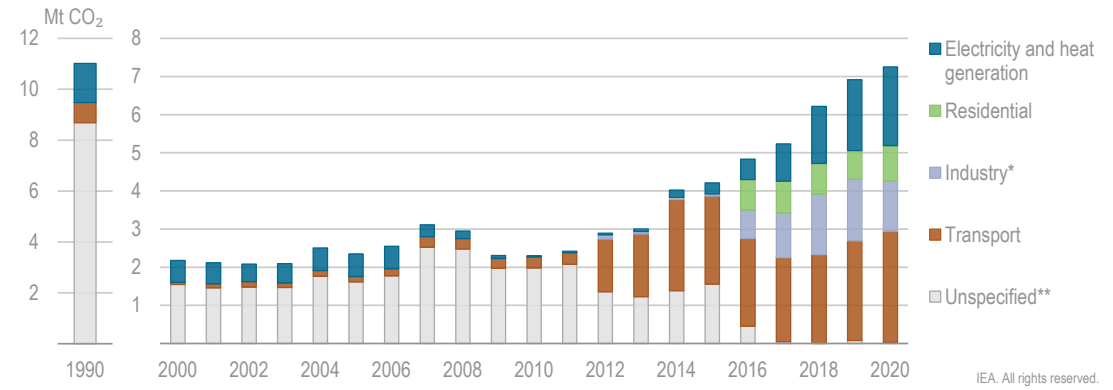


The share of energy-related emissions has grown since the coal-fired power plant was commissioned in 2015.

* Includes fuel combustion (for power and heat generation, and for industry, transport, residential and commercial energy consumption), fugitive emissions from fuels and energy industry own consumption.
** CO_2 emissions from fuel combustion estimated by the IEA; other emissions assumed equal to 2014.
*** Tajikistan's unconditional target for 2030 is not to exceed 60-70% of the 1990 GHG emissions (striped area), the conditional target being 50-60%.
Note: Data for the latest years may not be available for non-Annex I parties to the Kyoto Protocol.
Sources: Agency for Hydrometeorology under the Committee on Environmental Protection under the Government of the Republic of Tajikistan (2018), *The First Biennial Report on Inventory of Greenhouse Gases under the UNFCCC*; Government of Tajikistan (2021), *The Updated NDC of the Republic of Tajikistan.*

In 2020, Tajikistan's CO_2 emissions from fuel combustion were 7.3 Mt CO_2. This was over 30% lower than in 1990. However, uncertainty around the early 1990s energy consumption data does not allow for detailed analysis of the emissions pattern changes. Historically most electricity – over 99% – has been generated with hydropower that has no direct CO_2 emissions, but since 2015 thermal power generation has increased, notably contributing to the growth of CO_2 emissions from fuel combustion.

Figure 8.2 Tajikistan's CO_2 emissions from fuel combustion by sector, 1990-2020

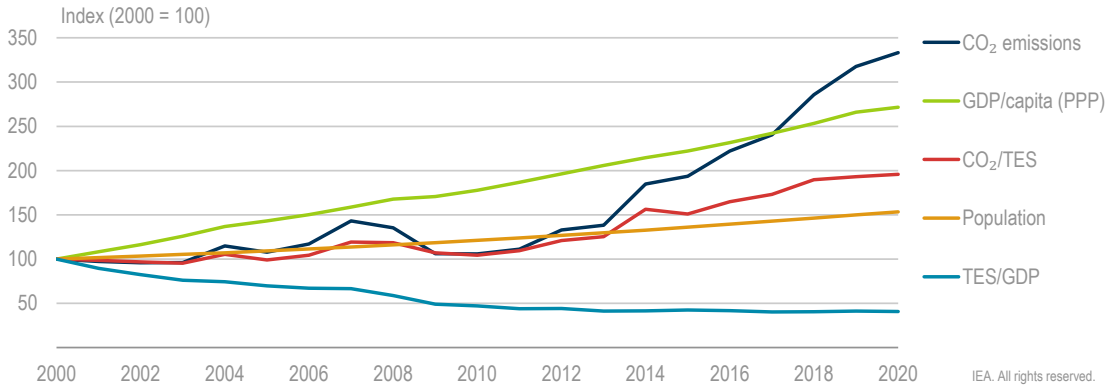


CO_2 emissions have increased almost four times since 2000.

* Includes CO_2 emissions from combustion in construction and manufacturing industries.
** Emissions are estimated from the available energy consumption data where details mainly for transport, residential and industry are not available for all the years.
Source: IEA (2022), *Greenhouse Gas Emissions from Energy* (database), https://www.iea.org/data-and-statistics.

Total CO_2 emissions increased over threefold (+233%) between 2000 and 2020, while the economy measured per capita less than tripled (+170%). Globally the opposite is observed, where the economic growth outpaces that of the emissions, i.e. decoupling. An explaining factor could be that the increased emissions are mainly the result of the increased share of fossil fuels used in power generation since 2015. The additional electricity generated still mainly dampens the seasonal electricity deficits; therefore, the added net value to the economy is limited.

Figure 8.3 Energy-related CO_2 emissions and main drivers in Tajikistan, 2000-2020

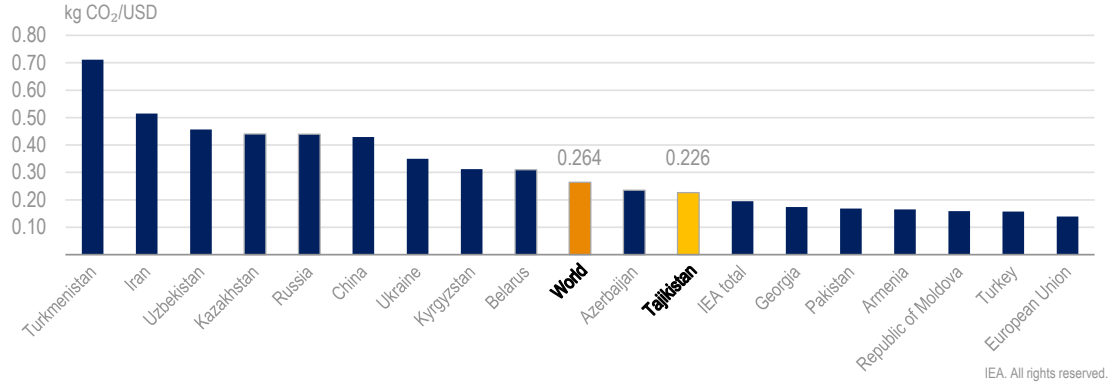


Increase in CO_2 emissions outpaced the economic growth in 2015.

Note: GDP in constant 2015 USD and PPP.
Source: IEA (2022), *Greenhouse Gas Emissions from Energy* (database), https://www.iea.org/data-and-statistics.

Tajikistan's CO_2 intensity of 0.21 kg CO_2 per USD of economic output (kg CO_2/USD) (2015 PPP) was just below the world average of 0.26 in 2019.

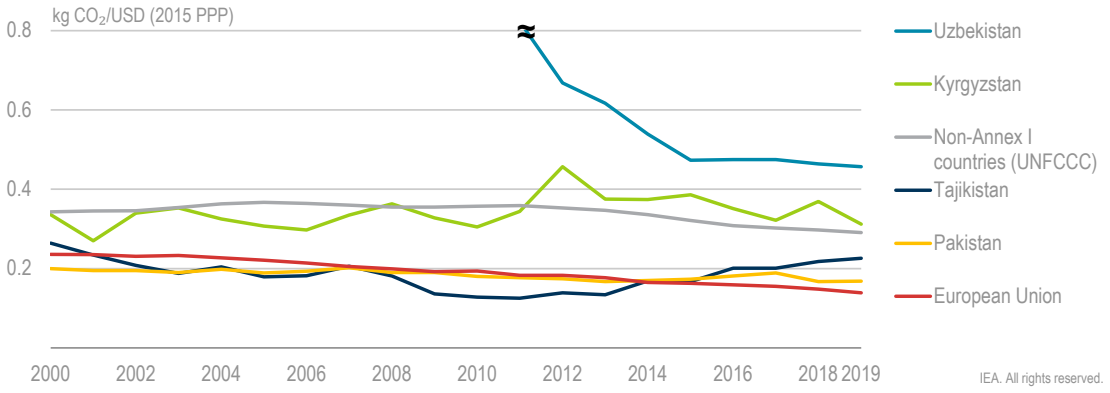
Figure 8.4 CO_2 intensity in Tajikistan and selected countries, 2019



Tajikistan's CO_2 intensity is 14% below the world average.

Note: Real GDP in USD 2015 prices and PPP.
Source: IEA (2022), *Greenhouse Gas Emissions from Energy* (database), https://www.iea.org/data-and-statistics.

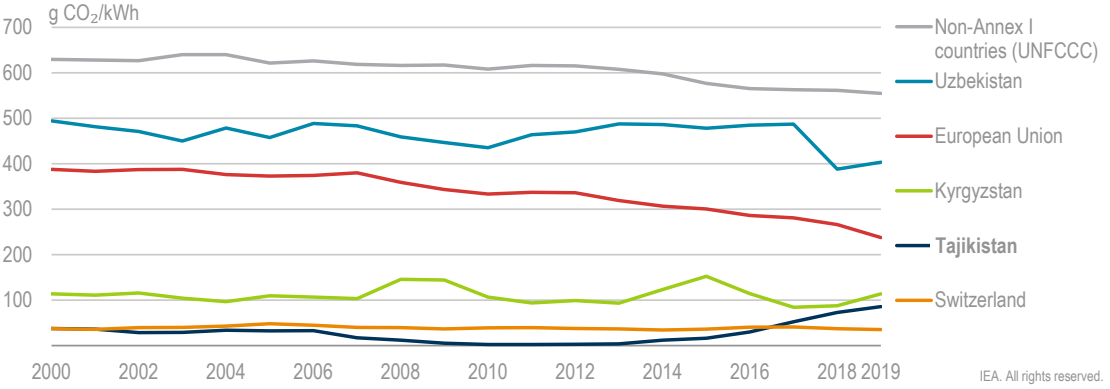
Figure 8.5 CO_2 intensity in Tajikistan and selected countries, 2000-2019



Tajikistan's CO_2 intensity has been on the rise since 2010, mostly due to increased coal consumption in power generation.

Source: IEA (2022), *Greenhouse Gas Emissions from Energy* (database), https://www.iea.org/data-and-statistics.

Figure 8.6 CO_2 intensity of power and heat generation in Tajikistan and selected countries, 2000-2019



While still relatively low, the CO_2 intensity of Tajikistan's energy mix has been on the rise since 2010, mostly due to increased coal consumption in power generation.

Note: g CO_2 = grammes of carbon dioxide.
Source: IEA (2022), *Greenhouse Gas Emissions from Energy* (database), https://www.iea.org/data-and-statistics.

Institutional framework

The Committee for Environmental Protection under the Government of Tajikistan (CEP) is responsible for policies on co-ordinating climate change adaptation by the country's sectoral ministries and departments. The CEP also leads the National Strategy for Adaptation to Climate Change of Tajikistan for the Period until 2030 (NSACC-2030), and is the National Designated Authority for the Green Climate Fund.

The Agency for Hydrometeorology under the CEP is responsible for preparation of biennial inventory of GHG (GHG Inventory) reports and prepared the *First Biennial Report of the Republic of Tajikistan on Inventory of Greenhouse Gases* in 2018.

TajStat contributes to the preparation of the GHG Inventory.

The government produced the updated NDC for Tajikistan with experts from the ministries and departments and the help of international financial institutions and donor agencies and adopted it in October 2021.

Tajikistan aims to tackle the societal and economic impacts of climate change on vulnerable groups of the population by increasing community resilience. Tajikistan's regional and municipal institutions are key to implement adaptive measures with co-ordinating state bodies and institutions implementing climate change adaptation programmes, all of which are accountable to the government.

Climate change policy

Tajikistan joined the UNFCCC in January 1998. It is also party to the Kyoto Protocol, ratified on 29 December 2008. The Tajik government signed the Paris Agreement on 22 April 2016 and ratified it on 20 March 2017.

Following the signature of the Paris Agreement and submission of Tajikistan's first NDC, the government adopted a range of strategic documents, programmes and concepts that directly or indirectly address climate change mitigation and adaptive measures.

The Strategy 2030 was launched in 2016 as a roadmap for economic development with measures to reduce the impact of climate change including: use of non-traditional (renewable) energy sources, minimising the impact of transportation on the environment and human health, encouraging green employment, and expanding environmental entrepreneurship and the environmental services market with state support.

The NSACC-2030 was launched in 2019 as a strategic document for achieving the goals of the Paris Agreement and a roadmap for identifying the risks, threats and adaptation measures for climate change. In it, the government identifies four key sectors as being climate-sensitive and priorities for development: energy, water, transport and agriculture. The NSACC-2030 lays out adaptation measures and actions for key sectors of the economy, and recommends mechanisms and sources of financing.

The NSACC-2030 was approved by governmental Order 482/2019 as a risk assessment of the sudden and prolonged negative effects of climate change, focusing on agriculture and land use, and recommends sectoral adaptation actions.

The Medium-Term Development Programme of Tajikistan for 2016-2020 (MDP 2016-2020) sets out the key measures for reducing climate change impact by improving access to natural resources and their rational management and use, creating legal mechanisms for protection, providing financial support and meeting the needs for new technologies, developing a green economy and preventing climate change risk, developing sources of renewable energy, modernising transport at all levels, constructing six hydropower plants (700 kWh), and reconstructing 700 km of highways.

The Medium-Term Development Programme of Tajikistan for 2021-2025 (MDP 2021-2025) was approved in 2021 by governmental decree No. 168 with sections focused on environmental protection, climate change and natural disasters. The adoption of NSACC-2030 strengthens the mechanisms for deploying capacity-building processes on climate change adaptation for employees of authorised bodies and civil servants,

recommends the development of gender-sensitive indicators for climate change, and formulates sectoral measures for climate change adaptation.

Climate change adaptation measures detailed in the submission of the first NDC were also aimed at sectoral programmes, strategies and plans, including:

- The Programme for Reforming the Water Sector of Tajikistan for 2016-2025 contains adaptation measures through the development of a long-term strategy for the use and protection of water resources in five river basins, development of seasonal and annual plans for the distribution and management of water resources in river basins, restoration of irrigation infrastructure and improvement of conditions for its maintenance and operation, and introduction of new water-saving technologies.
- The National Strategy of Tajikistan on Disaster Risk Reduction for 2019-2030 contains adaptation measures through ensuring access of all stakeholders to disaster risk information, integrating disaster risk management into development processes, and improving mechanisms for disaster preparedness and response.
- The Strategy for the Development of Industry in Tajikistan for the Period up to 2030 contains mitigation and adaptation measures through the introduction of new technologies for reducing emissions of hazardous substances into the atmosphere, saving raw materials and energy resources.
- The State Target Programme for the Development of the Transport Complex of Tajikistan for the Period up to 2025 aims at extending the transport infrastructure life cycle to increase its resilience to climate change, with the goal of bringing transport infrastructure in line with international environmental standards.

Mitigation

Tajikistan communicated its INDC under the Paris Agreement in 2015, which became the country's National Development Contribution (NDC) upon ratification of the Paris Agreement in 2017. In just a few years, Tajikistan has taken ambitious steps to sustainable change through development of the national regulatory framework and implementation of a range of projects and interventions.

Unlike the first NDC, the updated NDC includes the changes for unconditional reduction in GHG emissions for 2030 and a goal for conditional reduction of GHG, as well as strengthening the focus on adaptation. The updated NDC is also improved significantly by including a broader scope of participants from line ministries, academia, international organisations, donors, non-government organisations, business representatives and the media, and it benefits from their continued support during the implementation process. Despite its economic circumstances and geography, Tajikistan has opted for ambitious targets and measures in order to achieve its transition to a low-carbon and climate-resilient development in a sustainable manner. Tajikistan is keen to achieve progress towards implementing the Sustainable Development Goals (SDGs) at the national level by integrating the aims of the 2030 Agenda into the updated NDC.

The NDC's revision process covers the following key sectors identified as national priorities: agriculture, energy, forestry and biodiversity, industry and construction, and transport and infrastructure.

The latest updates on NDCs detail these as mitigation contributions to be implemented by the country and conditional contributions to rely on appropriate international financial and technical support, technology transfer, and capacity building. This combined package of support will accelerate Tajikistan's mitigation efforts and adaptation practice.

The unconditional NDC for reducing GHG emissions is not to exceed 60-70% of GHG emissions in Tajikistan from the reference year of 1990 by 2030.

The conditional NDC, dependent on significant international funding and technology transfer, is not to exceed 50-60% GHG emissions in Tajikistan from the reference year of 1990 by 2030.

The adaptation of these measures reflects a broader understanding of the country's high vulnerability to climate change, setting out five strategic sectors and 27 lines of action.

The updated NDC contains the scope and criteria used to realise Tajikistan's ambition through the adaptation and mitigation efforts of its initial NDCs. Furthermore, the updated NDCs also include information on the initial elements for establishing an Enhanced Transparency Framework as outlined by Article 13 of the Paris Agreement. The principal objective is to support sustainable and efficient development taking into consideration climate change, environmental and socio-economic challenges.

Adaptation

Finding solutions for the current and future societal and economic impact of climate change in Tajikistan lies in promoting effective adaptive measures and working against maladaptation across the economy's priority sectors, while strategic documents, programmes and approaches have been adopted to implement adaptive measures to mitigate climate change.

The Strategy 2030 lays out the roadmap for the country's future economic development and will contribute to reducing climate change through adaptive measures that include increasing renewable energy sources, minimising transport sector impact on the environment and developing green employment.

The NSACC-2030 was launched in 2019 as a consolidated strategic document for climate change adaptation. National consultation for the strategy identified adaptation priority sectors centred on vulnerability and development: energy, water resources, transport and agriculture; and cross-cutting areas: health, education, gender, youth, migration, environment and emergencies.

The NSACC-2030 takes the goals of the Strategy 2030 along with the provisions of other key strategic plans – the MDP 2021-2025 and the preliminary results of the Fourth National Communication of Tajikistan under the UNFCCC (2021), other sectoral programmes and plans, research by development partners, and the results of specialist consultations from key ministries and departments to define long-term adaptation measures for the key sectors of the economy of energy, water resources, agriculture and forestry, transport and infrastructure, industry, and construction, and for the cross-sectoral sectors of education, health, migration, environmental protection and gender. Based on extensive data, the following adaptation measures have been formulated for the economy's major sectors.

Key adaptation measures in the **energy sector** include:

- Development of short-term impact models and effective adaptation options for extreme weather conditions such as droughts.
- Raising the level of sector specialists' qualifications in methods of assessing climate risk and vulnerability.
- Taking measures to ensure infrastructure security.
- Revision of maintenance procedures and measures to improve safety of transmission and distribution networks from climate events.
- Development of networks of small HPPs and widespread development of other RES in the remote mountainous and rural regions.
- Strengthening hydropower potential and increasing the reliability factor taking into account the effects of climate change (increase in maximum floods or decrease in run-off).

Adaptation measures for the **use of water resources**, addressing future water scarcity, include:

- Increasing the efficiency of water use, recycling, processing and demand management.
- Strengthening the capacity of water users' associations.
- Stricter regulation of wastewater treatment and discharge, providing backup systems for water resource storage management.
- Improvement of groundwater management.
- Widespread application of the principles of integrated water resources management.
- Rehabilitation of irrigation systems and drainages to improve reclamation of saline lands and wetlands.
- Use of effective irrigation methods (drip irrigation).
- Improvement of the water flow forecasting system.
- Development of national measures for adaptation and resilience to climate change in the water sector.

In the transport sector, adaptation measures include bringing construction codes in line with international standards, improving transport infrastructure and introducing regulations for fuel-efficient vehicles. In the industry, transport and cross-sectoral sectors, adaptation measures here apply the concepts of environmental protection to encourage a green economy and to align sustainable development with the rest of the economy's sectors, creation of early-warning systems for the adoption of protective measures, prevention of damage and loss, and arranging community and media campaigns on climate change and disaster risk management.

Energy and environment

Energy production and transmission is vulnerable to climate change and related extreme weather events. The interconnectedness of the country's energy and water systems means that variations in rainfall, increased risk of drought, reduced snow cover and varying snowmelt times can adversely affect energy production and delivery.

Climate change means that other sectors, agriculture in particular, would adversely be affected by climate-related droughts, declining rain-fed agriculture, declining yields and production, and crop failures and loss of livestock. Changes in precipitation and temperature are likely to reduce forest productivity and to increase natural hazard risks such as forest fire. These trends are also contributing to changes in the regional distribution of forests, narrowing production zones for alpine species, and increasing incidence of pest and disease. The transport sector can be affected by climate change because of inefficient infrastructure, vulnerable to increased rainfall, and frequent flooding can accelerate degradation of road infrastructure.

Using risk indicators, climate change impacts and existing adaptive potential, the most vulnerable regions to climate change have been identified as the central mountainous regions, followed by the more populated southern mountains and lowland regions (Khatlon Region) and by the northern slopes of Zeravhsan and Turkestan (Sughd Region).

Air quality

According to World Health Organization guidelines, air quality in Tajikistan is considered unsafe. The World Health Organization (WHO) Ambient (outdoor) air quality database, by country and city update 2022, with the latest data from Tajikistan from 2019, shows that the country's annual mean concentration of PM2.5 (fine particles) is 71.52 microgrammes per cubic metre (μg/m^3), exceeding the recommended maximum of 10 μg/m^3 (WHO, 2022).

Increasing levels of air pollution, particularly in the cities, contribute to increased incidence of acute and chronic respiratory illness and allergies and increased deaths and illnesses from hazardous chemicals and pollution. Mortality attributed to household and ambient air pollution in Tajikistan was 81.1 per 100 000 in 2019.

Given that city-specific air quality data are not currently available, the main contributors to poor air quality in Tajikistan include vehicle emissions, aluminium processing plants and power generation.

Assessment

Tajikistan's high dependence on climate-sensitive sectors of the economy is a factor that increases the country's vulnerability to climate change and extreme weather events. Preliminary reports indicate that average annual temperature in Tajikistan is set to increase between 0.2°C to 0.4°C by 2030, and average annual rainfall will decrease by 5% by 2050.

Through consultations with key ministries and government departments, the NSACC-2030 has identified the energy, water resources, agriculture and transport sectors as being most susceptible to climate change.

Principal risks and impacts of climate change on these sectors were ranked using the benchmarks found in the Strategy 2030, NSACC-2030, the MDP 2016-2020, the draft MDP 2021-2025, sectoral strategies and programmes, and consultations with academia, civil society, relevant ministries and departments, and development partners.

The ultimate long-term goal for Tajikistan's development is the improvement of living standards through ensuring sustainable economic development. In order for this to succeed, the Strategy 2030 details a number of strategic development goals to be implemented over the following 15 years: ensuring energy security and efficient use of electricity; breaking the communication deadlock and transforming the country into a transit country; ensuring food security and access of the population to quality food; expansion of productive employment.

To improve the situation in the transport sector, the State Target Programme for the Development of the Transport Complex of the Republic of Tajikistan up to 2025 was adopted. According to this programme, the total gross emissions of pollutants by vehicles into the atmosphere is 43.5% of the total emissions in the country. In order to reduce the impact of negative factors on the environment caused by increasing motorisation and the contribution of other modes of transport, the programme provides for a range of measures aimed at their substantial reduction, in particular: the development of a network of highways and improving the quality of their maintenance; transfer of a proportion of vehicles to environment-friendly types of motor fuel, primarily natural gas; the use of equipment that reduces the harmful effects of fuels on the atmosphere; improvement of road surfaces through the use of polymers, technical regulations and arrangement of highways; removal of transit highways and roads with freight traffic from residential areas; bringing transport infrastructure to international standards on environmental parameters; application of new types of mixtures and compounds in air conditioners and refrigerated wagons in place of freon; re-equipping the aircraft fleet with new-generation aircraft and upgrading the air traffic management system; installing soundproof barriers and grassed and planted areas; and creation of safety barriers where needed on roadsides.

Recommendations

The government of Tajikistan should:

- Encourage closer co-operation between the GHG Inventory compiler and TajStat to further improve energy-related GHG reporting and analysis and the underlying energy statistics.
- Enhance natural resources management, efficiency and resilience and stimulate energy generation from solar and wind (renewable) sources.
- Increase energy efficiency, and security of power supply and water supply, and achieve integrated water resources management.
- Support the creation of a transparent and fair electricity market, which will be attractive for the deployment of renewable energy projects through private-sector participation, and able to cope with the requirements of an efficient regional power market.

- Signal the creation of a strong water-energy-food nexus in Tajikistan through the establishment of efficient interaction and improved co-ordination among stakeholders in the energy and water sectors.
- Support activities to address the reduction of GHG emissions and improve climate change mitigation (due to more efficient use of energy), promote investments in energy efficiency and renewable energy in housing and industry, sensitise in favour of energy efficiency and renewable energy measures, and ensure fair and equal access for vulnerable groups and enhanced gender equality.
- Create the conditions for attracting investments in energy efficiency and renewable energy.
- Convert the economy into a modern, resource-efficient and competitive economy and build inclusive and equitable partnerships to reduce (energy) poverty and support sustainable development.
- Enable increased financing and investment for just transitions, phase out finance for fossil fuels, promote gender equality and strengthen dialogue with civil society organisations.
- Embrace a green, digital and inclusive economy, business and other services, including digital and green entrepreneurship.
- Create a business environment conducive to the development of micro, small and medium-sized enterprises and innovation, in selected sectors, with a particular focus on green economy and digitalisation.

References

Agency for Standardisation, Metrology, Certification and Trade Inspection, Republic of Tajikistan, http://www.standard.tj

Agency on Statistics under President of the Republic of Tajikistan (TajStat), http://www.stat.tj/ru

Committee on Construction and Architecture, Republic of Tajikistan, http://tajsohtmon.tj

Committee on Environmental Protection, Republic of Tajikistan, www.hifzitabiat.tj

IAMAT, Tajikistan air pollution, https://www.iamat.org/country/tajikistan/risk/air-pollution#

IEA (International Energy Agency) (2021), Greenhouse Gas Emissions from Energy Data Explorer, IEA, Paris, https://www.iea.org/articles/greenhouse-gas-emissions-from-energy-data-explorer

IQAir, Air quality near Dushanbe, Tajikistan (database), https://www.iqair.com/tajikistan/dushanbe

Mustaeva, N. et al. (2015), Tajikistan: Country situation assessment, CAREC (Regional Environmental Centre for Central Asia), https://carececo.org/upload/02/eng_CSA_Tajikistan.pdf

National Development Strategy of the Republic of Tajikistan for the Period up to 2030 (2016), https://nafaka.tj/images/zakoni/new/strategiya_2030_en.pdf

NDC Registry, Tajikistan, United Nations Climate Change, https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Tajikistan%20First/NDC_TAJIKISTAN_ENG.pdf

World Health Organization Air Quality Database 2022, https://www.who.int/publications/m/item/who-air-quality-database-2022

World Health Organization (2021), WHO Global Air Quality Guidelines: Particulate Matter (PM 2.5 and PM 10), Ozone, Nitrogen Dioxide, Sulfur Dioxide and Carbon Monoxide, https://apps.who.int/iris/bitstream/handle/10665/345329/9789240034228-eng.pdf

World Health Organization (2020), Health-related SDG targets in Tajikistan: implementation of policies and measures for health and well-being, Progress Report 2020, https://www.euro.who.int/__data/assets/pdf_file/0010/459946/Health-related-SDG-targets-in-Tajikistan-eng.pdf

9. Energy efficiency

Key data

(2020)

TFC: 3.1 Mtoe (electricity 42.8%, oil 34.4%, coal 16.2%, district heat 3.8%, natural gas 2.9%), +57.9% since 2010

Consumption by sector: transport 33.1%, residential 30.4%, industry 20.2%, transport 28.9%, services 8.8%, agriculture 7.3%

TFC per capita: 0.32 toe (world average 2019: 1.30 toe)

Energy intensity (TFC/GDP): 89 toe/USD million PPP (world average 2019: 78 toe/USD million PPP)

Energy consumption

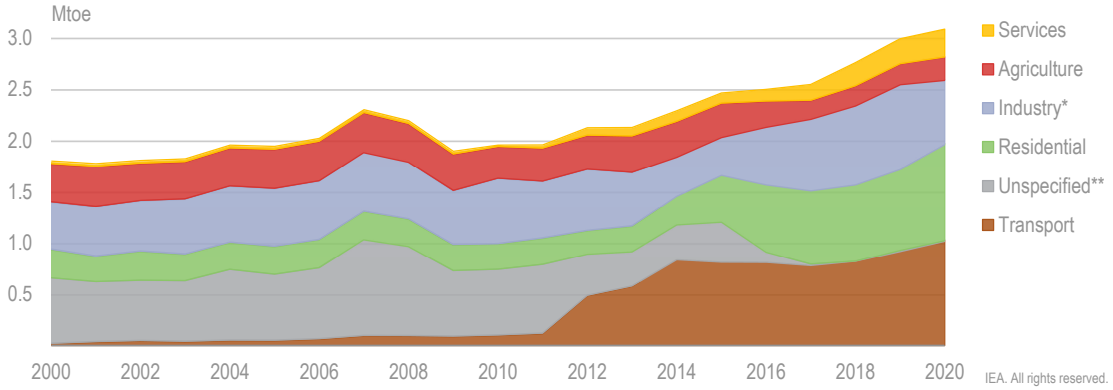
Tajikistan's TFC amounted to 3.1 Mtoe in 2020, having grown rapidly over the last decade (+58% since 2010). The comparable data suggest[4] residential consumption has grown most rapidly in recent years, more than doubling since 2015, and was the largest energy-consuming sector in 2020 (33% of TFC). Road transport consumption – accounting for 30% of the TFC – has also doubled in the period for which data are available (+108% between 2012 and 2019). Industry consumption accounted for 20% in 2020, decreasing by almost 25% y-o-y. The remainder is consumed in services (9%) and agriculture (7%).

Electricity accounted for over 40% of TFC in 2020, followed by oil (34%) and coal (16%). Natural gas and district heat consumption is marginal with both having shares between 3-4% of the TFC.

The official statistics do not systematically report bioenergy (mainly fuelwood) consumption. However, analysis based on the first energy consumption survey conducted in 2016 by TajStat indicates fuelwood is in fact the primary energy source in the residential sector by a large margin, even compared with electricity (TajStat, 2018). Additional surveys are necessary to properly quantify the baseline consumption. The dominance of electricity across the sectors is explained by hydro being the only domestic energy source besides fuelwood.

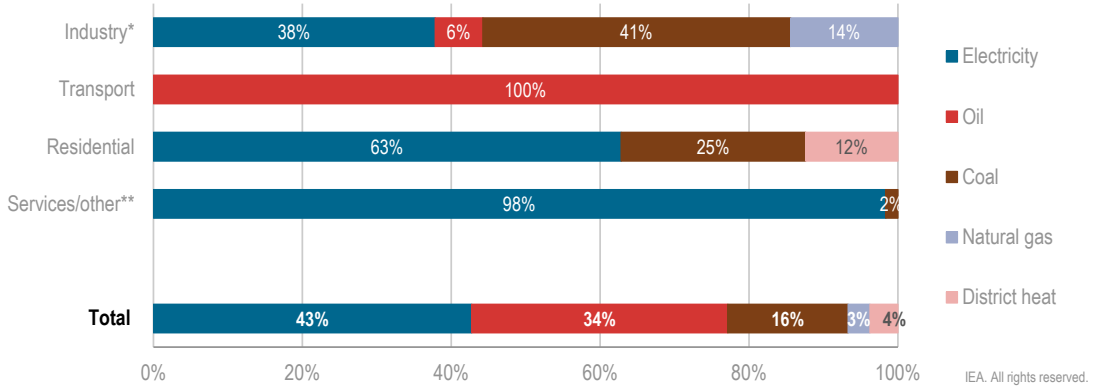
[4] Tajikistan began aligning national data with international methodology and standards in 2015. Historical trends may not be fully compatible with recent data.

Figure 9.1 Total final consumption by sector, 2000-2020



* Includes non-energy consumption.
** The relatively high share of unspecified energy consumption before 2015 hinders accurate sectoral analysis. Using expert estimates, unallocated LPG consumption was reallocated to transport sector for 2012-2020.
Source: IEA (2022), *World Energy Statistics and Balances* (database), https://www.iea.org/data-and-statistics

Figure 9.2 Total final consumption by source and sector, 2020

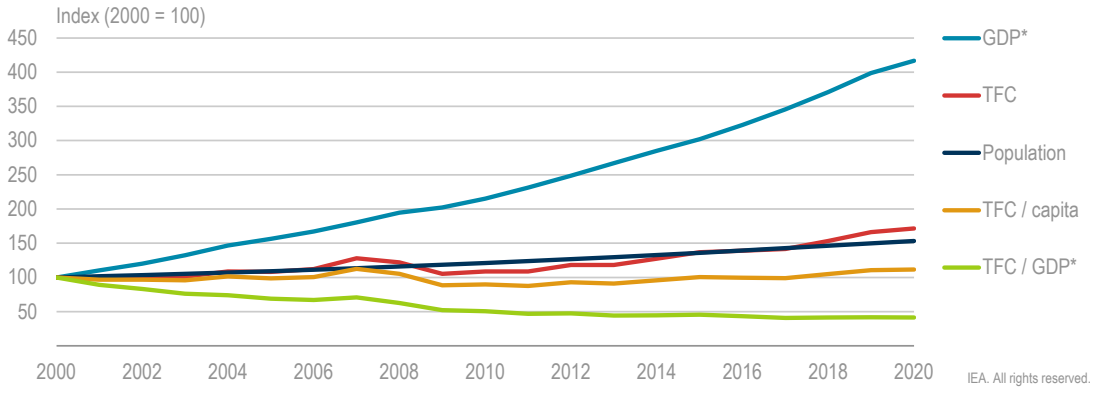


* Includes non-energy consumption.
** Includes commercial and public services, agriculture, forestry and unspecified consumption.
Note: For ease of readability, shares of less than 1% are not shown. Numbers may not add up to 100%.
Source: IEA (2022), *World Energy Statistics and Balances* (database), https://www.iea.org/data-and-statistics

Tajikistan's energy intensity has decreased notably in recent decades (-59% in 2000-2020). This is due to GDP growing over fourfold during the period, whereas energy consumption (measured by TFC) less than doubled.

In 2020, Tajikistan's energy intensity per unit of GDP at PPP was 89 tonnes of oil equivalent (toe) per million USD, above the world average of 78 toe per million USD (in 2019). Measured as TFC per capita, Tajikistan's energy intensity was 0.32 toe in 2020, 75% below the world (2019) average of 1.30 toe.

Figure 9.3 Drivers for energy consumption and energy intensity, 2000-2020



The link between economic growth and energy consumption is not very strong in Tajikistan.

* Expressed in constant 2015 USD billion and PPP.
Source: IEA (2022), *World Energy Statistics and Balances* (database), https://www.iea.org/data-and-statistics

Trends by sector

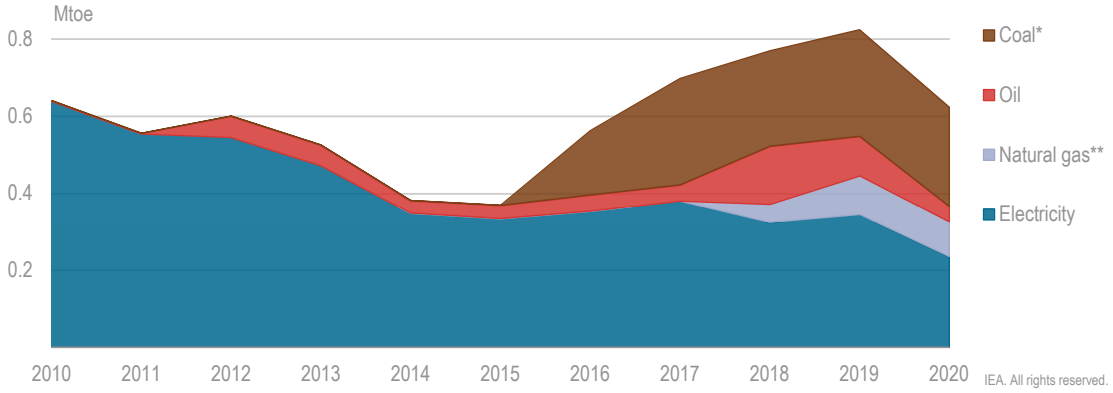
Since 2015, demand has grown across the sectors, but has been fastest in the residential sector. As result, transport and residential consumption are roughly responsible for equal shares, around 30% in the final consumption. Industry consumption dropped notably in 2020, the share being 20% of TFC. The rest (16%) of TFC is accounted for by services and agriculture. Sectoral analysis is limited because comparable statistics are available only since 2015.

Industry

The industrial sector consumed 0.62 Mtoe in 2020, equivalent to 20% of TFC. While detailed data are available only for recent years, it can be concluded that coal has become an increasingly important energy source, having the largest share (41%) of the sectoral consumption in 2020. While still covering 38% of the energy needs, the absolute consumption of electricity by industries has decreased. Oil consumption has allegedly grown, but its consumption is historically likely underestimated. Natural gas consumption has increased from a nearly non-existent level since 2017/2018 when Tajikistan's import infrastructure was recommissioned.

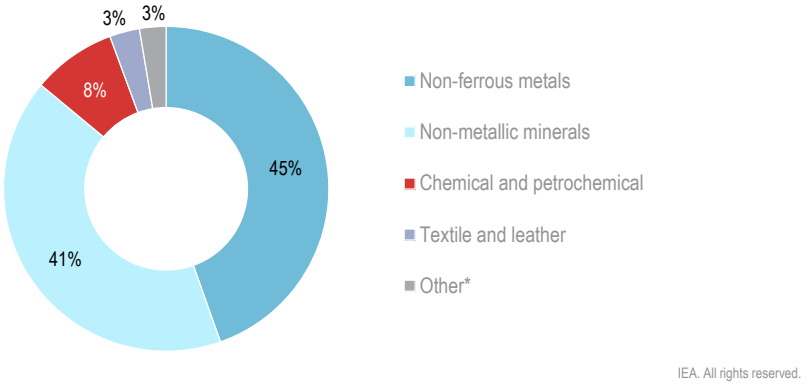
Non-ferrous metals (mainly aluminium/TALCO) and non-metallic minerals dominate manufacturing energy demand. Aluminium smelting mainly requires electricity whereas non-metallic mineral industries solely utilise coal.

Figure 9.4 Total final consumption in the industrial sector by source, 2010-2020



* Import connections of natural gas were re-established in 2018
** Details on coal consumption in industry available since 2016.
Note: Includes non-energy consumption.
Source: IEA (2022), *World Energy Statistics and Balances* (database), https://www.iea.org/data-and-statistics

Figure 9.5 Share of consumption in manufacturing industries by activity, 2020

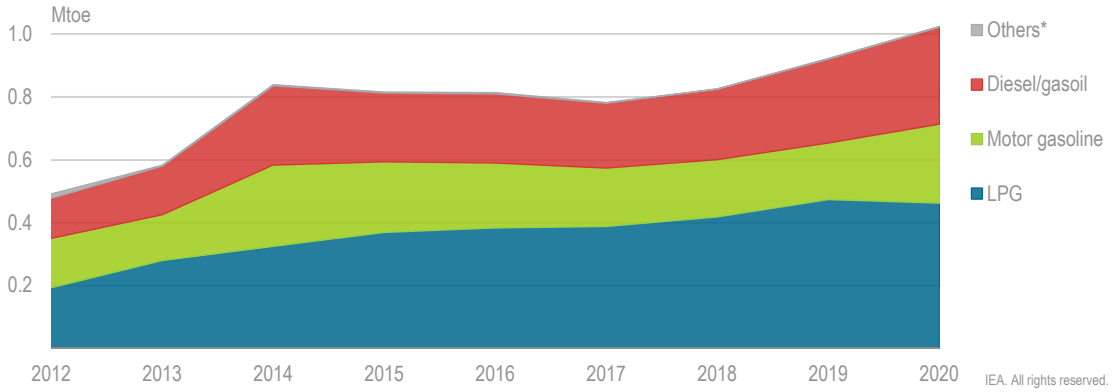


*Includes food and tobacco; paper, pulp and printing; iron and steel; machinery, wood and wood products; and unspecified industrial consumption.
Note: Manufacturing excludes mining, quarrying and construction. It also excludes non-energy uses.
Source: IEA (2022), *World Energy Statistics and Balances* (database), https://www.iea.org/data-and-statistics.

Transport

In 2020, the transport sector consumed 1.02 Mtoe (33% of TFC). While limited data are available for the sector, consumption seems to have more than doubled between 2012 and 2020. Similarly, only limited information is available on the vehicle stock, but the consumption of LPG indicates Tajikistan has globally the highest share of LPG consumption in road transport, almost 50%. Imports of LPG grew rapidly in the early 2010s. The remaining sectoral consumption consists of diesel (30%) and motor gasoline (25%). Electricity consumption is negligible.

Figure 9.6 Total final consumption in transport sector by fuel, 2012-2020

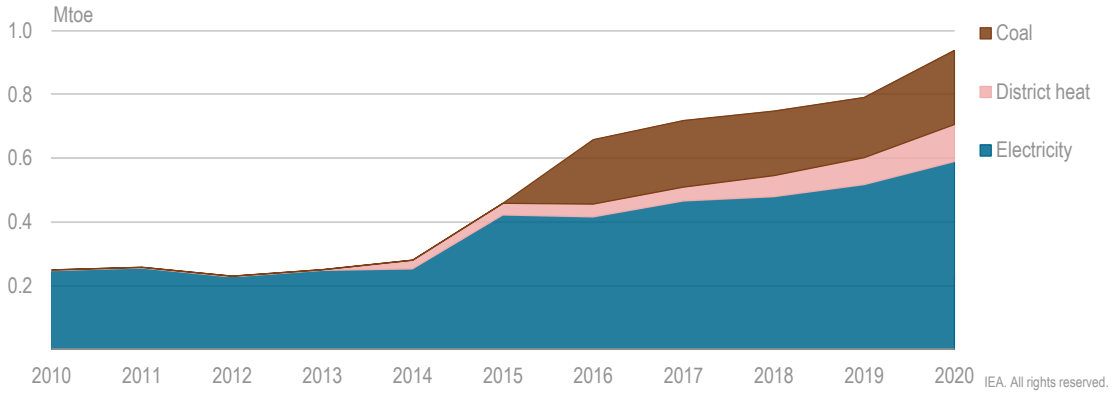


* Includes natural gas and electricity; not visible at this scale.
Notes: Comparable data available since 2012. Transport sector demand excludes international aviation and navigation.
Source: IEA (2022a), *World Energy Statistics and Balances* (database), https://www.iea.org/data-and-statistics.

Residential

The residential subsector consumed 0.93 Mtoe in 2020, accounting for 30% of TFC in the country. Since comparable data for residential sector are available (i.e. since 2016), the sectoral energy consumption has grown by 43%. It consists mainly of heating (both space and water) which fluctuates annually with outdoor temperatures.

Figure 9.7 Total final consumption in residential sector by source, 2010-2020



Note: Data included in the official energy balance differ from the survey results: bioenergy and oil product consumption is not reported, whereas district heat is included. TajStat endeavours to repeat the survey in the future to increase the level of disaggregation and to include the missing information in the national energy balance.
Source: IEA (2022), *World Energy Statistics and Balances* (database), https://www.iea.org/data-and-statistics.

The survey conducted by TajStat in 2016 was Tajikistan's first effort to assess energy consumption in households. While not including estimates for energy consumption by end use (e.g. water or space heating), the survey for the first time quantified the weights of different energy sources. The results are shown in Table 9.1.

Table 9.1 Resource consumption in Tajik households by type, 2016

Energy source	Total (TJ)	Urban (TJ)	Rural (TJ)	Fuel share in total (%)	Share of urban (%)	Share of rural (%)
Fuelwood	42 421	8 263	34 158	*46.4*	*19.5*	*80.5*
Electricity	17 445	10 101	7 344	*19.1*	*57.9*	*42.1*
Coal	8 155	1 964	6 191	*8.9*	*24.1*	*75.9*
Cattle manure	7 075	1 024	6 051	*7.7*	*14.5*	*85.5*
Mazut	5 413	5 413	-	*5.9*	*100.0*	-
LPG	4 771	1 873	2 899	*5.2*	*39.2*	*60.8*
Petrol and diesel	3 478	1 130	2 348	*3.8*	*32.5*	*67.5*
Cotton husks	2 497	184	2 313	*2.7*	*7.4*	*92.6*
Corn leaves	217	35	182	*0.2*	*16.1*	*83.9*
Wood pellets	21	5	16	*0.0*	*25.0*	*75.0*
Bushes	11	7	4	*0.0*	*62.5*	*37.5*
Kerosene	8	2	7	*0.0*	*20.0*	*80.0*
Total	**91 511**	**30 000**	**61 511**	***100.0***		

Note: TJ = terajoule.
Sources: Adapted from TajStat (2018); data converted from reporting units to common unit using default conversion factors form International Recommendations for Energy Statistics (UNSD, 2018).

Services/agriculture

The remaining 16% of TFC consists mainly of services, agriculture and unspecified energy consumption. While the ability to conduct further sectoral analysis is limited given the lack of data, it seems energy consumption in agriculture is on a decreasing trend whereas consumption in services is increasing. This is plausible given the general tendency of the global structural shift away from the primary sector towards a more service-oriented economy.

Policies and measures

While efforts to develop policies and measures on energy efficiency date back to at least 2002, when the first Law on Energy Savings was adopted, Tajikistan is still at an early stage of developing a comprehensive set of policies and measures to improve demand-side energy efficiency across key sectors, e.g. buildings, industry and transport.

A basic legislative framework for energy efficiency is in place, as discussed in the next section. However, important pillars such as implementing measures that ensure polices are adopted and enforced are missing or pending, and there is generally a lack of reliable data to assess the success of policies. Energy efficiency improvements in Tajikistan are also focused heavily on the supply side, notably power system investments to reduce significant losses in ageing transmission and distribution infrastructures.

Tajikistan's relatively nascent demand-side energy efficiency framework and prioritisation of supply-side efficiency are inevitably linked to the country's level of economic development, access to energy and population distribution. Nearly 50% of Tajik families live below the poverty line, and nearly three-quarters of the country's population reside in rural areas, in many cases with limited access to grid-supplied electricity and gas, whereby alternative fuels such as kerosene, gasoline, firewood, coal and manure are used for cooking and heating (ADB, 2022).

In this context, the use of subsidies to reduce the cost of energy, and in particular electricity, have been used to alleviate poverty notably for households in urban areas with access to grid-supplied electricity. Despite reform efforts dating to at least 2012, tariffs for electricity do not cover the cost of providing energy services in Tajikistan, leading to an underinvestment in energy infrastructure that has increased transmission and distribution losses as well as power outages (ADB, 2022; IEA, 2021). In addition, subsidised tariffs create a disincentive for households to invest in more efficient equipment, e.g. appliances and lighting, while lessening the urgency to design and implement energy efficiency policies and measures that reduce end-use energy demand.

Legislative framework

According to official statements, energy efficiency remains a central theme in Tajikistan's energy policy, as reflected in the Strategy 2030, for example, which was adopted in 2016 and covers the period until 2030 (though again with a focus on supply-side energy savings potentials). An overarching framework, the Sustainable Energy for All Tajikistan 2013-2030, is also in place, and contains an objective to improve energy efficiency across all sectors and end uses by 20% by 2030, compared with 2013 levels. However, little information is available on progress towards this target.

The main legislative pillar for energy efficiency in Tajikistan is the 2013 Law on Energy Savings. While relatively general, the law sets out the legal and institutional framework for energy efficiency, along with basic principles, definitions, competencies and scope, and calls for the establishment of a National Fund for Renewable Energy Sources, Energy Saving and Energy Efficiency (Energy Charter, 2013).

In addition, it provides principles for the efficient and rational use of fuel and energy resources considering production, technological, environmental and social conditions. The law also aims to support and stimulate the use of efficient technologies, materials and equipment, alongside better planning, and implementation of energy efficiency measures. Energy efficiency standards for the power sector and appliances were also adopted in 2014.

Numerous important bylaws and pieces of secondary legislation needed for the implementation of the law are still under consideration, however, including energy performance standards for building envelopes, rules for conducting energy audits and various standards for technical systems.

Institutional framework

The main body responsible for energy efficiency, notably the implementation of measures, is the MEWR, which has established an inter-institutional working group for the development of bylaws related to energy efficiency. There is no dedicated energy efficiency agency or other agency devoted to clean energy in Tajikistan. The Ministry of Economy has some responsibility for energy efficiency as part of the development of the country's wider economic strategy, including the Strategy 2030 and SDGs.

A technical committee was established in 2012 as part of Tajikstandard Agency to develop national standards based on European and Russian standards, notably in buildings and

energy-using products, although standards set by this committee are mainly voluntary unless otherwise mandated by specific technical regulations (Energy Charter, 2013). The Committee for Construction and Architecture plays an important role in terms of developing building codes, with support from the Agency for Standardization, Metrology, Certification and Trade Inspection.

TajStat is responsible for energy efficiency data collection, while experts point to significant challenges in terms of the availability of data to support policy and financial initiatives, for example, as well as a lack of information on international trends against which to benchmark progress.

Buildings

Regulatory provisions related to buildings are included in the overarching 2013 Law on Energy Efficiency and Energy Savings, which mandates that both new buildings and existing buildings that have undergone a major retrofit must comply with energy efficiency requirements and be equipped with metering technology, with energy passports to be issued as evidence. The law also stipulates that energy efficiency requirements for buildings need to be reviewed every five years. Public authorities are also required to conduct energy audits of their facilities.

Several of the buildings provisions of the 2013 law have not been fully implemented due to pending or stalled bylaws that are still under review by committees, in particular the Agency for Standardization, Metrology, Certification and Trade Inspection. Among the bylaws under consideration are minimum requirements for new building envelope performance along with other technical standards, rules and procedures for conducting energy audits; measures to promote energy efficiency in existing buildings; and a methodology to develop energy performance certificates for buildings.

In addition to such specific and technical measures, any efforts to advance buildings energy efficiency in Tajikistan are likely to be closely tied to the improved provision of heat. Except for the capital, Dushanbe, where a handful of district and central heating infrastructures are operational, none of Tajikistan's urban centres have working central heating systems, either in residential or in commercial or public buildings. In the absence of access to district heating, households in urban areas primarily use hydro-generated electricity to heat their homes, with frequent power cuts undermining thermal comfort in cold winter months, while wood, coal and dung are used in a majority of rural homes (Energy Charter, 2013).

To address this issue, the resolution "On the implementation of additional measures to provide the population and various socio-economic sector of the city of Dushanbe with heat" was adopted by the government in 2017. The resolution contains provisions for mandatory connection to heat networks for any new construction and requires the city of Dushanbe to make "strong efforts" to connect existing administrative and residential buildings to central heating networks.

Energy use in buildings has increased considerably in Tajikistan since 2012. Meanwhile, the energy efficiency potential of Tajikistan's buildings is high, with average per square metre energy usage (kWh/m2) in multifamily dwellings being double that of Germany, for example (C2E2, 2015). Overall, improving the energy efficiency of the buildings sector in Tajikistan is complicated by several challenges, including the poor state of existing

buildings, insufficient finance, lack of implementing measures and normative legislation, and insufficient co-ordination between responsible authorities.

Appliances and energy-using equipment

The 2013 Law on Energy Saving and Energy Efficiency contains requirements for all purchased and imported appliances and energy-using equipment, such as household appliances and computers, to be labelled and sold with information on energy performance. This requirement also extends to building materials and industrial technologies. Despite these measures, Tajikistan does not have a comprehensive framework for MEPS in place, with a number of specific technical standards still pending adoption.

To date, the main area of progress in terms of improving the energy efficiency of equipment has been in lighting, where a ban on the use of incandescent lamps has been in place since 2009. The ban was accompanied by a support scheme that provided efficient lamps to just under 250 000 households. No data are available on the results of this scheme in terms of achieved savings, and enforcement mechanisms are missing to ensure incandescent lamps are not still available to consumers.

Transport

Except for an import ban on older models, Tajikistan currently does not have energy efficiency policies and measures in place for passenger and light-duty vehicles, such as fuel economy standards. Based on available data, road transport emissions have doubled since 2012 and represent nearly 45% of Tajikistan's total GHG emissions, despite a targeted move to increase the use of LPG as part of an overarching transport strategy as cited below. Tajikistan's passenger vehicle stock is increasingly outdated; automobiles provide 85% of all transport services in the country. Roads are also generally in a poor condition, reducing vehicle fuel efficiency.

Efforts to improve the transport sector have been in place since at least 2011 as part of the State Target Programme for the Development of the Transport Complex of the Republic of Tajikistan until 2025. While the programme is comprehensive and features a range of measures including highways development and maintenance as well as investments in buses for public transport, little evidence is available to date on the impact of these measures in terms of reduced transport energy demand and GHG emissions.

Industry

While the industrial sector has historically been the largest energy consumer in Tajikistan, its consumption is now at par with the buildings and transport sectors following significant demand growth in these sectors since 2012. Nonetheless, industry still accounts for nearly one-third of total consumption and presents significant energy efficiency potential, with most installations built during the Soviet era. An audit of the country's largest energy consumer, the TALCO aluminium plant, which consumes 25-40% of Tajikistan's total electricity, identified energy savings potentials of more than 20% (World Bank, 2012).

In terms of legislative provisions on industrial efficiency, as noted previously, the 2013 Law on Energy Efficiency and Energy Savings requires industrial technologies to include technical details and labels with information on energy performance, and most industrial facilities are required to undergo energy audits, though these are not considered

mandatory, and enforcement is lacking. In general, energy efficiency measures in industry require further support through robust implementing provisions. Subsidised electricity tariffs for industry also undermine the business case for investments in energy efficiency improvements.

Financing and cross-cutting measures

As noted above, the 2013 law calls for the establishment of a dedicated fund for energy savings. To date, this fund has not been established.

In the absence of an in-country funding mechanism for energy efficiency, multilateral organisations, and IFIs such as the EBRD and the ADB, play an important role in supporting energy efficiency improvements in Tajikistan. The ADB's Access to Green Finance Project that ran from 2013 to 2020, for example, supported energy efficiency awareness-raising and microfinance loans to enable households to purchase "green energy" solutions, such as more efficient cooking stoves and heating units. At the same time, the EBRD has also opened a credit line for citizens who want to implement energy-efficient technologies in their own homes (EBRD, 2017).

A market for energy services and ESCOs does not currently exist in Tajikistan.

Assessment

Energy consumption

Historical data on consumption trends across economic sectors are sporadic or missing, and data collection according to international norms has been in place only since 2015, complicating efforts to analyse consumption trends over time.

Based on available data, energy consumption has increased considerably over the past decade in buildings, notably the residential subsector, and in the transport sector. Industry sector energy demand remains strong and constitutes one-third of TFC.

Legislative and institutional framework

While basic energy efficiency legislation has been in place for nearly a decade in Tajikistan, accompanied by overarching strategies and programmes, implementing provisions and secondary legislation are missing. Lax enforcement of existing rules remains an issue across all sectors.

There is no dedicated agency or institution with authority over the development and implementation of energy efficiency measures in Tajikistan, with responsibilities spread across ministries and subcommittees, creating challenges in terms of central co-ordination.

Policies and measures across sectors

All sectoral energy efficiency legislation in Tajikistan is contained in the 2013 Law on Energy Savings, with no comprehensive sector-specific laws in place.

Buildings sector policies are relatively comprehensive, covering building passports, MEPS for new buildings and audit requirements. However, secondary legislation provisions are missing and there is little evidence to suggest these, and other building efficiency measures, are being implemented effectively.

Similarly, while MEPS and other policies designed to improve the energy efficiency of appliances and energy-using equipment, including lighting, have been adopted in Tajikistan, available evidence suggests that existing rules are poorly implemented and enforced.

In the transport sector, where demand and emissions are increasing despite a shift to LNG, efficiency policies are limited.

Concerning the industry sector, dedicated policies including energy audit requirements are included in the 2013 Law on Energy Savings. Like trends in other sectors, however, important implementing provisions are missing, and enforcement is lax.

Subsidised tariffs for electricity create barriers to effective policy development and implementation, notably across the buildings and industry sectors, and undermine the business case for investments in more energy-efficient technologies.

Financing and cross-cutting measures

While a dedicated fund for energy savings is cited in the 2013 Law on Energy Savings, such a fund has yet to be established. Tajikistan relies on support from international lenders for investments in energy efficiency improvements, and a market for energy efficiency services has not been developed in the country.

Recommendations

The government of Tajikistan should:

- Ensure the full implementation of the 2013 Law on Energy Efficiency and Energy Savings through the adoption of all implementing measures and standards.
- Develop a more comprehensive demand-side energy efficiency policy framework, including building codes, passenger vehicle fuel efficiency standards, MEPS and labelling for appliances and energy-using equipment, and well-enforced audit requirements for industry.
- Improve ministerial co-ordination on energy efficiency and consider the creation of a dedicated agency or department to oversee the development and implementation of energy efficiency policies and measures, alongside improved data collection.

References

ADB (Asian Development Bank) (2022), Tajikistan: Access to Green Finance Project, Mandaluyong, https://www.adb.org/sites/default/files/evaluation-document/774551/files/pvr-0346.pdf

C2E2 (Copenhagen Centre on Energy Efficiency) (2015), Accelerating Energy Efficiency: Initiatives and Opportunities – Eastern Europe, the Caucasus and Central Asia, https://c2e2.unepdtu.org/kms_object/accelerating-energy-efficiency-initiatives-and-opportunities-eastern-europe-the-caucasus-and-central-asia-english-version

EBRD (European Bank for Reconstruction and Development) (2020), Tajikistan Energy Efficiency Framework, London, https://www.ebrd.com/what-we-do/project-information/board-documents/1395294441448/Tajikistan_Energy_Efficiency_Framework_Board_Report.pdf?blobnocache=true

EBRD (2017), Milestone for pioneering EBRD climate credit line in Tajikistan, London, https://www.ebrd.com/news/2017/milestone-for-pioneering-ebrd-climate-credit-line-in-tajikistan.html

Energy Charter (2013), In-Depth Energy Efficiency Review Tajikistan, https://www.energycharter.org/fileadmin/DocumentsMedia/IDEER/IDEER-Tajikistan_2013_en.pdf

IEA (International Energy Agency) (2022), Tajikistan Country Profile, https://www.iea.org/countries/tajikistan

IEA (2021), Cross-Border Electricity Trading for Tajikistan: A Roadmap, https://www.iea.org/reports/cross-border-electricity-trading-for-tajikistan-a-roadmap

IRENA (International Renewable Energy Agency) (2021), Tajikistan Energy Profile, https://www.irena.org/IRENADocuments/Statistical_Profiles/Asia/Tajikistan_Asia_RE_SP.pdf

Ministry of Energy and Water Resources, Republic of Tajikistan, http://mewr.gov.tj/ru

TajStat (Tajikistan Statistical Agency) (2018), Report on the results of one-off sample survey on 'The state of the energy facilities and efficiency of use in 2016'.

UNDP (United Nations Development Programme) (2011), Energy Efficiency Master Plan for Tajikistan, https://www.undp.org/content/dam/tajikistan/docs/library/UNDP_TJK_Energy_Efficiency_Master_Plan_for_Tajikistan_Eng.pdf

World Bank (2012), TALCO Energy Audit: Improved efficiency could help solve winter electricity shortages, Fact Sheet, https://www.worldbank.org/content/dam/Worldbank/document/tj-talco-energy-audit-fact-sheet.pdf

10. Renewable energy

Key data:

(2020)

Total renewable energy supply: 1.6 Mtoe (42.7% of TES); all hydropower, bioenergy data not available*

Total renewable electricity supply: 18.1 TWh (90.1% of electricity generation): all hydropower

World renewable energy shares (2019): 13.8% of TES and 26.0% of electricity generation

* Bioenergy (e.g. solid biofuels) consumption in the residential sector is not systematically tracked

Overview

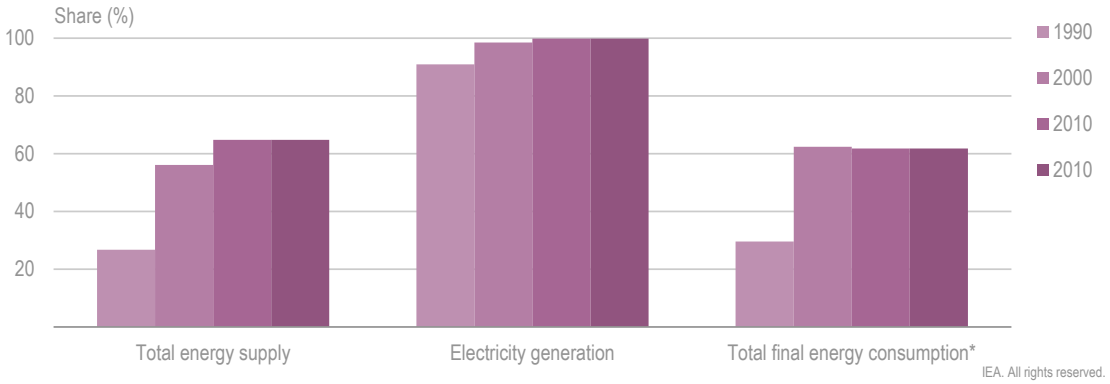
In Tajikistan more than 95% of energy is generated in large hydropower stations. In the Strategy 2030 adopted in 2016, the goal is to diversify the generation sources by 10%, including through RES. The Strategy 2030 also points out the need to create conditions for the development of RES, in particular for "further development of small hydropower and other RES to reduce poverty and ensure access of the population, especially the rural population, to social benefits, and for the overall development of the economy, small business." Attention is paid in the Strategy 2030 to reduce the share of imported energy resources through the development of RES.

Supply

The share of RES in Tajikistan's TES is among the highest in the world due to large hydropower resources and a high rate of electrification. Between 2000 and 2015 around 99% of electricity was generated with hydro, the share being above 90% still in 2020. With the upcoming capacity additions [Rogun], the share is likely to increase again. The dominance of hydropower in RES leads to similarities in the patterns of RES in TES and in TFC.

According to the available data, hydropower accounts for all of the total renewable energy supply in the country. However, the household energy consumption survey conducted in 2016 revealed the magnitude of bioenergy (mainly fuelwood) use that is almost on par with the hydro contribution to the TES (1.2 Mtoe versus 1.6 Mtoe). Wind power and solar PV are yet to be introduced to the Tajikistan's energy system.

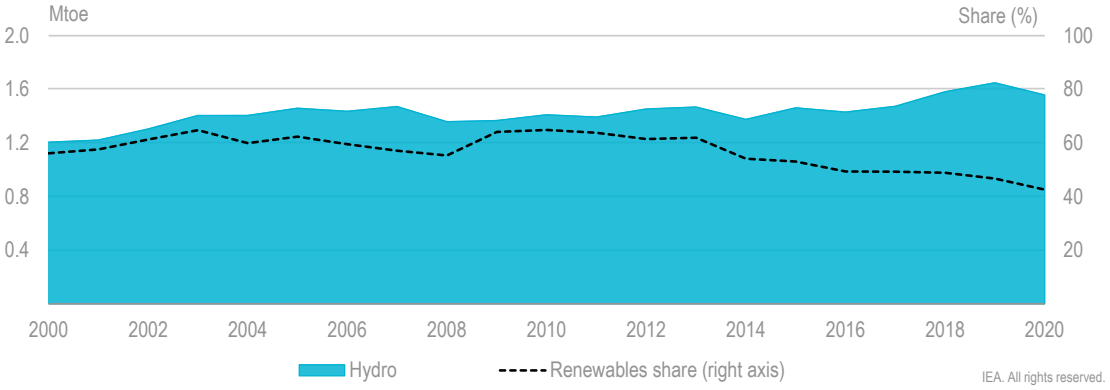
Figure 10.1 Renewable energy shares in Tajikistan's energy system, 1990-2020



Hydroelectricity has a key role in Tajikistan's energy system.

* Includes direct use in TFC and indirect use through electricity and heat consumption.
Source: IEA (2022), *World Energy Statistics and Balances* (database), https://www.iea.org/data-and-statistics.

Figure 10.2 Renewable energy in Tajikistan's total energy supply, 2000-2020



Hydropower is currently the only source of renewable electricity in Tajikistan.

Note: Data not available for bioenergy consumption (see discussion on bioenergy below).
Source: IEA (2022), *World Energy Statistics and Balances* (database), https://www.iea.org/data-and-statistics.

Data on bioenergy consumption in Tajikistan are not available on a regular basis. However, the statistics agency conducted a one-off survey in 2016 (TajStat, 2018) to assess energy consumption in the households. The results are shown in Table 10.1 below.

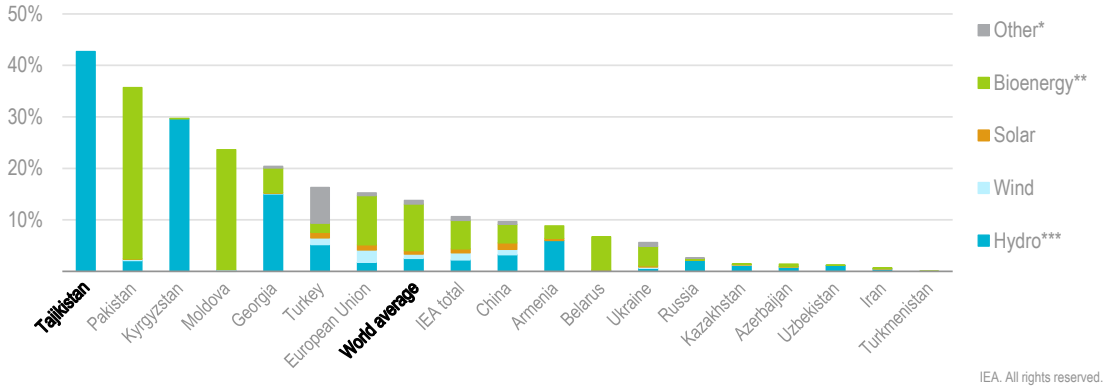
Table 10.1 Consumption of energy resources in Tajikistan households, 2016

	Mtoe
Fuelwood	1.01
Other solid biofuels*	0.23
Electricity	0.42
Coal	0.19
Oil products	0.33

* Includes cattle manure, cotton husks, corn leaves, wood pellets and bushes.
Source: Adapted from TajStat (2018), Report on the results of one-off sample survey on the state of the energy facilities and efficiency of use in 2016; data converted from reporting units to common unit using default conversion factors form IRES (UN, 2018).

According to the survey data, the households depend heavily on solid biofuels, for around 60% of their needs. This quantity is not currently accounted for in the official country TES and once added will have a direct impact on the share of renewables in the TES and TFC (SDG 7.2). It is encouraged to repeat the survey at regular intervals and develop methodology to estimate the bioenergy consumption in between surveys. The resulting information would allow the government to plan policies and measures for more sustainable use of biomass in the country.

Figure 10.3 Renewable energy share of total energy supply in selected countries, 2019

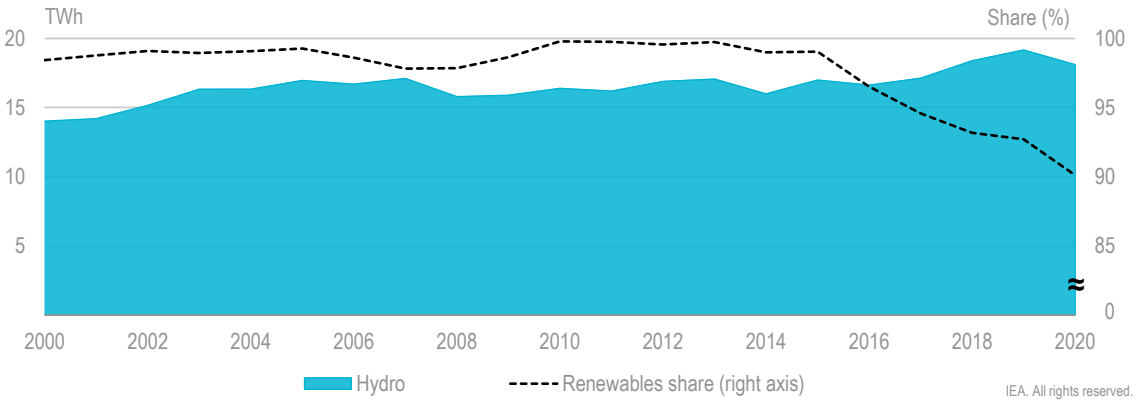


* Includes geothermal, primary heat, and wave and ocean energy.
** Includes, solid, liquid and gaseous biofuels and renewable waste.
*** Excludes pumped storage.
Source: IEA (2022), *World Energy Statistics and Balances* (database), https://www.iea.org/data-and-statistics.

Renewable electricity generation

Of the available electricity generation capacity of 4.7 GW, 4.3 GW were HPPs (see generation capacity in the Electricity section, Table 3.1). In 2020, renewable energy (all hydro) accounted for 90% (18.1 TWh) of its electricity generation.

Figure 10.4 Renewable energy in Tajikistan's electricity generation, 2000-2020



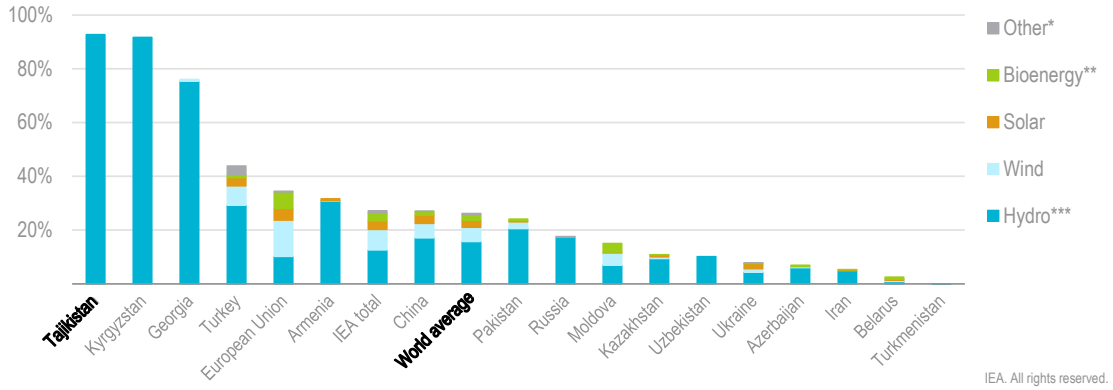
While still high, the share of renewable electricity has decreased.
Source: IEA (2022), *World Energy Statistics and Balances* (database), https://www.iea.org/data-and-statistics.

More than 90% of energy production in Tajikistan comes from hydro, meaning that Tajik energy is relatively green. Additionally, the price for electricity is relatively low due to the

fact that most power plants were built during the Soviet era, and the social factors that need to be taken into account when determining tariffs.

In the Renewable Energy Development and Small Hydropower Plants Construction Programme for 2016-2020, preliminary information is provided in the form of a table on the list of projects that have most potential and are open to attract investment, along with available data on wind potential in certain regions – all this information is publicly accessible. The programme indicates the availability of preliminary feasibility studies for RES facilities, accessible on the MEWR site.

Figure 10.5 Renewable energy share in electricity generation in selected countries, 2019



* Includes geothermal, primary heat and wave and ocean energy.
** Includes, solid, liquid and gaseous biofuels and renewable waste.
*** Excludes pumped storage.
Source: IEA (2022), *World Energy Statistics and Balances* (database), https://www.iea.org/data-and-statistics

The MEWR has further plans to develop a potential energy facilities cadastre, and currently is focusing on stimulating a study on wind potential in line with the new opportunities that exist in this sector, with the current available information measured at low altitudes. Detailed studies on solar are being conducted with development partners (World Bank, ADB, US Agency for International Development [USAID]), particularly on evaluating the potential for solar panels in the Sughd Region in order to attract investors through auction. The most extensive information available is for small hydropower, since most gauges existing since Soviet times continue to function.

Grid access

The national grid is regulated by the Law on Licensing of Separate Types of Activities and the Regulation. For the construction of RES power plants, licences need to be obtained from the Committee on Construction and Architecture and MEWR. These can be granted relatively quickly and do not require much documentation to be supplied.

According to the Law on the Use of Renewable Energy Sources, “power grid operators and wholesale consumers are required to purchase energy from renewable energy sources on the basis of an agreement while maintaining the established balance of production and quality of energy from renewable energy sources”. The law goes on to state that “connecting to energy networks of energy producers from renewable energy sources is carried out on a preferential basis in accordance with the legislation of the Republic of Tajikistan”. However, only the RES stations managed by Pamir Energy (founded in 2002 as a public-private partnership by the government and the Aga Khan

Fund for Economic Development) are connected to a common and/or regional energy network. For a variety of reasons, the country's remaining small stations work outside the energy system. Although this is a sector that is well regulated by law, in practice many stations are not connected to the system.

System integration of variable renewable resources

Most renewable energy sources in Tajikistan are based on water resources. The number of solar and wind power stations is not high and they operate off grid. At the same time, many of the existing small HPPs operate irregularly due to the fact that flow is not always adequate for electricity generation. It follows that the synergy of technologies for electricity generation is highly relevant to Tajikistan, and while there are few studies in this area, USAID is working towards the installation of solar and water technologies in Gorno-Badakhshan.

Developing a cross-sectoral approach

Up to 2016, heating in winter throughout Tajikistan, including the capital Dushanbe, was by electricity (generated mainly by hydro). After the Dushanbe-2 coal-fired plant began operating, centralised heating was restored in the city. Restoration of centralised heating in other cities will be highly expensive, hence the government does not plan to extend this beyond the city of Dushanbe within the next five years at least. At the same time, the rest of Tajikistan is mainly heated through electricity, biomass and coal.

Meanwhile, in Dushanbe projects are being implemented with EBRD to finance the private sector (mostly sports facilities), providing loans to establish RES and implement energy-efficient measures. If this initiative is successful, it will also be applied to other private sectors to offset the government not investing in the restoration of centralised heating outside Dushanbe in the near future.

Electromobility

The State Target Programme for the Development of the Transport Complex of the Republic of Tajikistan up to 2025 sets out targets for electrifying Tajikistan's transport sector. In the medium term, the government plans to create trolleybus parks, traction substations and traction networks in the cities of Kurgan-Tyube and Kulyab, in addition to granting preferential loans for international transport companies to be able to purchase vehicles that meet international standards.

Rising passenger numbers combined with the natural increase in the population provides the rationale to invest in the creation of a trolleybus suburban line in the directions around the cities of Vakhdat, Tursunzade, Gissar district and Somoni village of Rudaki District, as well as the cities of Kurgan-Tube and Sarband.

The programme also sets out plans for the purchase of a large number of passenger buses and trolleybuses, as well as the introduction of programmes to remodel the transport sector, in particular the GLONASS satellite navigation system, aimed at improving and efficient use of vehicles.

Policies and measures

The Strategy 2030 sets the task to improve the "state of housing and communal services (housing and communal services) of settlements (water supply, sewerage, gas, heat, electricity, collection and utilisation of domestic waste)", which in particular will help solve a number of environmental problems. In order to optimise the environmental situation in the transport sector, it is proposed to develop and enforce environmental requirements for transport. The Strategy 2030 also looks at the implementation of energy-efficient technologies in production: the provision of rational production models will be achieved through the introduction of new energy- and resource-saving technologies, reducing waste and CO_2 emissions, thus creating opportunities for green employment.

The incorporated common mechanisms in the Strategy 2030 are described in greater detail in sectoral programmes (Action Plans), in particular in the Programme for the Development of Renewable Energy Sources and Construction of Small Hydroelectric Power Plants for 2016-2020, which specifies the RES facilities that need to be built and proposes a mechanism for obtaining more accurate figures on the potential for RES and the elimination of unnecessary administrative barriers.

Assessment

The government supports development of RES by providing a range of financial incentives, also promulgated in the Law on RES of Tajikistan. It considers developing RES as environmental and/or energy-saving activities and provides details of appropriate benefits for legal entities and individuals, engaged in developing renewables. The tax code provides details of financial incentives based on the size of finances and volumes of production for legal entities and individual entrepreneurs engaged in the production of energy from renewable energy sources. Article 242 of the tax code states: "Released from payment of royalty for water use of water bodies for the purpose of generating electricity at a capacity of energy generating objects of not more than 1 000 kW." According to Article 312 of the Tax Committee under the Government, it is possible to be granted additional incentives for the construction of HPPs.

While the government currently has a strict price policy for electricity, it is working on a new tariff methodology and the establishment of an independent regulator. Moreover, the country's largest region, the Gorno-Badakhshan Autonomous Region (or Kuhistani Badakhshan Autonomous Region), is able to set its own tariff in a region where electricity is entirely from small hydro and the price is higher in comparison with the other regions.

The coupling of the electricity, heat, cooling and transport sectors is highly significant for Tajikistan. Until 2016, all of the country, including Dushanbe, was heated in the winter months using electricity (mainly hydro). Only after the Dushanbe-2 coal-fired plant began operating was central heating restored in the city. The restoration of central heating in other cities will involve huge costs, meaning that for the next five years at least the government does not plan to extend this beyond Dushanbe, and the rest of the country remains heated mainly through electricity, biomass and coal.

A lack of financing is holding back the promotion of energy efficiency and renewable energy in the power sector, the main causes being low tariffs and low revenue collection,

underdeveloped institutional capacity, absence of support mechanisms, and lack of awareness and knowledge within the industry, SMEs and the general population.

Recommendations

The government of Tajikistan should:

- Evaluate the economic potential of renewable energy and use the assessment results to design an action plan to take advantage of that potential.
- Implement renewable energy targets, taking into account the cost-effectiveness of all available policy options and the need for consistency with electricity market reform measures.
- Develop and implement programmes to install solar collectors, batteries and other independent renewable energy technologies in remote parts of the country to ensure cost-effective access to energy in those areas.
- Foster using incentives for small renewable energy suppliers, to encourage entrepreneurship and the establishment of small businesses in the energy sector.
- Clarify and streamline the authorisation and licensing process for new RES plants by establishing a single point of contact.
- Define a transparent communication strategy for contentious RES projects and support project developers with awareness-raising campaigns and stakeholder involvement.
- Develop and apply a methodology for comprehensive resource assessment and identification of RES potential to select the best locations for RES plants, taking environmental and social impacts into account.
- Develop and apply a methodology for comprehensive resource assessment and identification of RES potential to select the best locations for RES plants, taking environmental and social impacts into account.

References

ADB (Asian Development Bank) (2022), Tajikistan: Access to Green Finance Project, Validation Report, https://www.adb.org/sites/default/files/evaluation-document/774551/files/pvr-0346.pdf

ADB (2020), Proposed Grants and Technical Assistance Grant, Republic of Tajikistan: Power Sector Development Program, https://www.adb.org/sites/default/files/project-documents/53315/53315-001-rrp-en.pdf

Barqi Tojik, Projects, http://www.barqitojik.tj/activity/projects/305

CABAR (Central Asian Bureau for Analytical Reporting) (2021), Renewable energy of Tajikistan: Why is it important for the country, but not a priority?, https://cabar.asia/en/renewable-energy-of-tajikistan-why-is-it-important-for-the-country-but-not-a-priority

EBRD (European Bank for Reconstruction and Development) (2021), Tajikistan – Transition Report 2021-22: System Upgrade, https://www.ebrd.com/publications/transition-report-202122-tajikistan

IEA (International Energy Agency) (2022), World Energy Statistics and Balances (database), https://www.iea.org/data-and-statistics

IEA (2021), Cross-Border Electricity Trading for Tajikistan: A Roadmap, https://www.iea.org/reports/cross-border-electricity-trading-for-tajikistan-a-roadmap.

Ministry of Energy and Water Resources, Republic of Tajikistan, http://mewr.gov.tj/ru/

Republic of Tajikistan, Ministry of Foreign Affairs (2019), The energy sector of Tajikistan: Key indicators, https://mfa.tj/en/main/view/185/the-energy-sector-of-the-republic-of-tajikistan

TajStat (2018), Report on the results of one-off sample survey on the state of the energy facilities and efficiency of use in 2016.

World Bank (2013), Tajikistan's Winter Energy Crisis: Electricity Supply and Demand Alternatives, https://documents1.worldbank.org/curated/en/500811468116363418/pdf/Tajikistans-winter-energy-crisis-electricity-supply-and-demand-alternatives.pdf

11. Energy research, development and demonstration

Overview

The Academy of Sciences of Tajikistan established the Centre for the Innovative Development of Science and New Technologies aimed at research, development and implementation of innovative projects and new technologies, particularly in the energy sector. A major RES project is developing solar energy potential, with a particular focus on the aluminium industry.

Within the Academy of Sciences institutions, there are research units that specialise in energy technologies. The Institute of Water Problems, Hydropower and Ecology specialises in research on energy and energy efficiency, ecology and water resources. The SUE Nurofar was established as a technological research, documentation and design institute for energy structures in Tajikistan. The SUE TojikNIIGiM (Institute of Water Engineering and Amelioration) operates under the MEWR to research energy efficiency, with a focus on pump stations. In 2017, the Russian state-owned nuclear energy company Rosatom and the Academy of Sciences signed an agreement for co-operation in the peaceful use of nuclear energy, with the aim of designing and operating research nuclear reactors in Tajikistan including the restoration of the Argus aqueous homogenous mini reactor – one of only two in the world.

The government has provided limited financial support for RD&D in the energy sector, particularly RES, but it has been working closely with international partners, promoting adoption of modern innovative technologies where possible.

Several private projects for developing local producers of the equipment for small hydroelectric power stations are being developed in Tajikistan: two local producers, the CJSC Energoremont and the SUE Tojiktekstilmash, have begun to make turbines for small HPPs to hand over on a turnkey basis.

Legal and institutional basis

The government is updating the Law on the Technological Park, which was first adopted in 2010 by the Ministry of Industry and New Technologies to develop high-tech parks. As an inducement to attract investors, there are proposals to reduce tax for information technology companies. The ministry and TALCO are also looking at developing an industrial technical park, an initiative that will bring together several relevant projects in one place.

Several Tajik universities – including Tajik Technical University, Tajik National University, Technological University of Tajikistan, Institute of Energy and Russian-Tajik Slavonic University – have technical parks within their own premises connected to their specific academic areas.

Funding

Research and development institutions in Tajikistan, both public and private, are operating on limited state budgets, mainly covering the cost of scientific staffs and some minor on-site research projects. The technical institutes under ministry control usually benefit from government programmes that release budgets for the construction of national projects.

These organisations have limited budgets, which come mainly from the government for the purpose of paying professional staff and funding small research projects. The Academy of Sciences has a limited budget of its own for researchers, while the universities have budgets for developing practical and research centres within their premises.

Public institutions, including the Academy of Sciences, research departments of state universities, Tajik Technical University, the Institute of Energy, and other scientific institutes under the ministries such as Nurogar and TojikNIIgim, as well as private enterprises, such as Sistemavtomatika, Energoremon and Tajiktekstil-mash, have been actively searching for external donor funding for developing R&D projects. Funding for major R&D projects has mainly come from the IFIs World Bank, ADB, USAID and Japan International Cooperation Agency (JICA).

The government support to R&D is more policy oriented, as it recognises the role of modern technology and innovation in reaching the country's developmental goals, although state financial support to the sector is very limited. The government's work with donor organisations in supporting R&D programmes is ongoing, but there are calls for synchronising programme support and for scaling up the number of projects researched, developed and/or deployed in Tajikistan.

Private-sector involvement

Private-sector spending on energy technology R&D and innovation is responsible for a number of private projects for developing local producers of equipment for small HPPs. Two local producers are the CJSCs Energoremont and Tojiktekstilmash, which have started making turbines for small HPPs in Tajikistan, which they hand over on a turnkey basis.

The OJSC Sisatemavtomatika is developing several projects with the support of the government and donors. The RES Association of Tajikistan, within Sistemavtomatika, with UNDP has established the National Centre for the Implementation of Renewable Energy Sources and Energy Efficiency in Dushanbe, with the main task of training specialists in RES and energy efficiency technologies, in particular solar energy, energy saving, energy efficiency and energy-saving technologies. A regular operational resource centre and exhibition hall has been created where information on modern RES and energy efficiency technologies is provided by the centre's specialists. The exhibition hall displays equipment for solar energy systems and equipment for low energy consumption.

With the support of donors, Sistemavtomatika provides training in solar collector manufacture (water heaters) for women in rural areas. Other projects include such projects as supporting an orphanage with USAID within the framework of the Implementation of Energy Efficiency Measures for the Water Supply System of the Tanobchi Orphanage, Temurmalik District, Khatlon Region, Tajikistan. This project was particularly aimed at updating the infrastructure of the water supply and distribution system of the orphanage, reducing water losses and increasing energy efficiency of the pumping station and quality of drinking water.

As part of training specialists, USAID has supported the Training Certified Energy Audit and Energy Management Specialists project in co-operation with the US Association of Energy Engineers.

The members of the RES Association of Tajikistan are involved in surveys of the solar and wind potential of the country. They have calculated the monthly and annual averages of solar radiation on horizontal and inclined surfaces based on data from a range of cities, determining average annual solar production from solar panel output, and providing the different optimal orientations and tilt angles of solar panels for each city.

Assessment

Currently the World Bank and ADB are planning to support research for solar in Sughd Region, where the government is planning to construct solar stations through auction, which will provide an opportunity for the private sector to invest. USAID is also financing energy efficiency technologies for the evaluation of solar radiation.

In 2021, the Academy of Sciences together with Japanese research institutes (Science and Technology Research Partnership for Sustainable Development [SATREPS]) started the Construction of a Decarbonized Heat Energy Supply System Using Groundwater Resources, a project which aims to contribute to regional stabilisation and global warming countermeasures by improving the energy situation through focusing on the abundant groundwater resources in Tajikistan, which are affected by severe differences in temperature and insufficient deposits of oil and gas.

Over five years, the following three areas of research will be carried out through constructing and disseminating an advanced ground source heat pump (GSHP) system for arid regions (Tajikistan model) that integrates information and communication technologies such as artificial intelligence: the development of groundwater flow and heat transport models based on field surveys, GIS data and artificial intelligence, and the construction of geothermal and groundwater heat utilisation potential maps; implementation of long-term heating and cooling tests using a demonstration plant with multimodal measurement and artificial intelligence; and institutional design for dissemination of the Tajikistan model.

The first two areas are intended to develop an optimal geothermal heating and cooling system based on artificial intelligence and which will be reflected in the institutional design. In addition, in collaboration with each stakeholder, a system plan will be developed that includes the industrialisation of the GSHP system, employment creation and a financing scheme for its introduction.

Noteworthy projects and research areas including other collaborative efforts

In 2022, a new project financed by the World Bank and ADB has started to assess the use of relatively cheap solar energy in Tajikistan, with results to be released in the near future. Additionally, a Japanese-funded project on groundwater resources is a unique project for Tajikistan and has the possibility to be used as a model for other countries in region. Another project that could be used as a model is the completion in 2020 of the Murghob solar power plant with USAID support in the mountains of Gorno-Badakhshan (it is the country's highest town at 3 650 metres above sea level); it generates solar in the winter when the new hydro plant, opened in 2018 with KfW support, loses efficiency.

Demonstration and commercialisation

The open joint-stock company (OSJC) Sistemavtomatika in partnership with the universities runs a technical lab which provides opportunities for the population to evaluate finance implications.

UNDP-supported projects include two local producers, Energoremont and Tojiktekstilmash, which have begun to make turbines for small HPPs and hand over these hydroelectric power stations on a turnkey basis.

UNDP has also helped to set up a pilot project in rural Jamoat Burunov which included the rehabilitation of two units of the Nurofar small HPP; refurbishment of the hospital, school and kindergarten; construction of a mini-dairy; refurbishment of a pumping station; construction of a small greenhouse; and establishment of the operator who was responsible for operation and management and collecting fees. This integrated approach measurably improves community living conditions and contributes to poverty eradication far more than only constructing an energy source – here a small HPP. Surveys conducted after the project have shown the importance of community involvement.

Recommendations

The government of Tajikistan should:

- Formulate an integrated energy R&D strategy based on close co-ordination with the Academy of Sciences and its public research institutions, relevant ministries, national enterprises, SMEs, IFIs and donors in the energy sector. Include in the R&D strategy:
  - a mixture of base financing and competitive project-based granting
  - support for innovative SMEs and start-ups
  - support for research on climate change and adaptation in the energy sector
  - measures to further develop university technology parks
  - include measures to ensure continued co-operation for effective implementation of such strategy.
- Establish a framework to develop infrastructure and knowledge related to sustainable technologies, especially energy efficiency and renewable energy, in the R&D strategy.
- Facilitate access to available technology transfer options offered by climate funds, IFIs and donors; build up relevant policy capacity; and promote the development of relevant projects.
- Track public energy-related R&D funding in detail (e.g. by technology and energy source) to inform energy-related R&D policy decisions.
- Membership in international RD&D projects and platforms, for the water-energy nexus and the clean coal sector, in particular.

References

Atomnaya Energiya (2017), Ядерный реактор “Аргус” в Таджикистане реанимируют для мирных целей, http://www.atomic-energy.ru/news/2017/03/02/73193

Centre for Innovative Development of Science and New Technologies, National Academy of Sciences of Tajikistan, http://www.cidsnt.tj

Ministry of Energy and Water Resources, Republic of Tajikistan, http://mewr.gov.tj/ru

National Academy of Sciences of Tajikistan, http://www.anrt.tj/index.php/ru/instituty-issledovaniya/otdelenie-fiziko-matematicheskih-himicheskih/institut-vodnykh-problem-gidroenergetikii-ekologii

UNDP (United Nations Development Programme) (2017), Technology transfer and market development for SHP in Tajikistan, UNDP, https://www.tj.undp.org/content/tajikistan/en/home/operations/projects/environment_and_energy/technology-transfer-and-market-development-for-shp-in-tajikistan

ANNEX A: Review criteria and acknowledgements

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.

Acknowledgements

This Tajikistan Energy Sector Review 2022 was written by Thea Khitarishvili, in co-operation with Markus Fager-Pintilä, who prepared the graphs and drafted the sections related to statistics, and Armin Mayer, who drafted the Energy Efficiency chapter.

Anna Petrus organised and coordinated the review process, in cooperation with Talya Vatman, Policy Programme Manager of the IEA led part of the EU4Energy Programme.

Special thanks go to the Government of Tajikistan and its Ministry of Energy and Water Resources and the Agency on Statistics under the President of the Republic of Tajikistan for their energy sector review questionnaire submission and for their feedback, and to Furugzod Usmonov, EU4Energy Country Expert for Tajikistan, for his in-country co-ordination and input.

The report benefited from comments and feedback from Rebecca Gaghen, Head of the Europe, Middle East, Africa and Latin America Division.

Thanks go to the IEA Communications and Digital Office for their assistance in producing the report, particularly to Erin Crum who carried editorial responsibility.

ANNEX B: Energy balances and key statistical data

Tajikistan

Energy balances and key statistical data

Unit: Mtoe

SUPPLY		1990	2000	2010	2017	2018	2019	2020
TOTAL PRODUCTION		**2.03**	**1.26**	**1.54**	**2.28**	**2.45**	**2.57**	**2.52**
Coal		0.37	0.01	0.09	0.79	0.84	0.90	0.94
Peat		-	-	-	-	-	-	-
Oil		0.15	0.02	0.03	0.02	0.02	0.02	0.02
Natural gas		0.09	0.03	0.02	0.00	0.00	0.00	0.00
Biofuels and waste[1]		-	-	-	-	-	-	-
Nuclear		-	-	-	-	-	-	-
Hydro		1.42	1.21	1.41	1.47	1.58	1.65	1.56
Wind		-	-	-	-	-	-	-
Geothermal		-	-	-	-	-	-	-
Solar/other		-	-	-	-	-	-	-
TOTAL NET IMPORTS		**3.28**	**0.88**	**0.63**	**0.70**	**0.79**	**0.96**	**1.14**
Coal	Exports	0.18	-	0.00	0.00	0.02	0.01	0.00
	Imports	0.44	0.00	0.00	0.00	0.00	0.01	0.02
	Net imports	0.26	0.00	0.00	0.00	-0.02	0.00	0.02
Oil	Exports	0.06	0.02	0.02	-	-	-	-
	Imports	1.70	0.19	0.53	0.83	0.99	1.06	1.08
	Int'l marine and aviation bunkers	-0.02	-0.00	-0.03	-0.02	-0.03	-0.04	-0.03
	Net imports	1.62	0.17	0.48	0.82	0.96	1.01	1.05
Natural gas	Exports	-	-	-	-	-	-	-
	Imports	1.30	0.60	0.14	-	0.05	0.19	0.19
	Net imports	1.30	0.60	0.14	-	0.05	0.19	0.19
Electricity	Exports	0.49	0.34	0.02	0.12	0.25	0.27	0.16
	Imports	0.59	0.45	0.04	0.01	0.05	0.02	0.03
	Net imports	0.10	0.11	0.01	-0.11	-0.21	-0.25	-0.13
TOTAL STOCK CHANGES		**-**	**-**	**-**	**-**	**-**	**-**	**-**
TOTAL SUPPLY (TES)[2]		**5.31**	**2.15**	**2.18**	**2.99**	**3.24**	**3.53**	**3.66**
Coal		0.63	0.01	0.09	0.79	0.83	0.90	0.96
Peat		-	-	-	-	-	-	-
Oil		1.77	0.19	0.50	0.84	0.98	1.04	1.08
Natural gas		1.39	0.63	0.16	0.00	0.05	0.19	0.19
Biofuels and waste[1]		-	-	-	-	-	-	-
Nuclear		-	-	-	-	-	-	-
Hydro		1.42	1.21	1.41	1.47	1.58	1.65	1.56
Wind		-	-	-	-	-	-	-
Geothermal		-	-	-	-	-	-	-
Solar/other		-	-	-	-	-	-	-
Electricity trade[3]		0.10	0.11	0.01	-0.11	-0.21	-0.25	-0.13
Shares in TES (%)								
Coal		*11.8*	*0.6*	*4.1*	*26.3*	*25.6*	*25.5*	*26.3*
Peat		-	-	-	-	-	-	-
Oil		*33.4*	*8.8*	*23.1*	*28.1*	*30.4*	*29.4*	*29.4*
Natural gas		*26.1*	*29.2*	*7.4*	*0.0*	*1.5*	*5.5*	*5.3*
Biofuels and waste[1]		-	-	-	-	-	-	-
Nuclear		-	-	-	-	-	-	-
Hydro		*26.7*	*56.1*	*64.8*	*49.3*	*48.9*	*46.7*	*42.6*
Wind		-	-	-	-	-	-	-
Geothermal		-	-	-	-	-	-	-
Solar/other		-	-	-	-	-	-	-
Electricity trade[3]		*1.9*	*5.3*	*0.6*	*-3.8*	*-6.3*	*-7.0*	*-3.5*

0 is negligible, - is nil, .. is not available. Please note: rounding may cause totals to differ from the sum of the elements.

Unit: Mtoe

DEMAND							
FINAL CONSUMPTION	**1990**	**2000**	**2010**	**2017**	**2018**	**2019**	**2020**
TFC	**4.68**	**1.80**	**1.96**	**2.55**	**2.76**	**3.00**	**3.09**
Coal	0.63	0.01	0.09	0.49	0.45	0.49	0.50
Peat	-	-	-	-	-	-	-
Oil	1.68	0.19	0.50	0.84	0.98	1.02	1.06
Natural gas	0.73	0.38	0.15	0.00	0.05	0.10	0.09
Biofuels and waste[1]	-	-	-	-	-	-	-
Geothermal	-	-	-	-	-	-	-
Solar/other	-	-	-	-	-	-	-
Electricity	1.53	1.14	1.21	1.18	1.22	1.30	1.32
Heat	0.11	0.08	0.01	0.04	0.07	0.08	0.12
Shares in TFC (%)							
Coal	*13.4*	*0.7*	*4.6*	*19.1*	*16.3*	*16.3*	*16.2*
Peat	-	-	-	-	-	-	-
Oil	*35.9*	*10.5*	*25.6*	*32.8*	*35.3*	*34.1*	*34.4*
Natural gas	*15.7*	*21.3*	*7.4*	*0.0*	*1.7*	*3.4*	*2.9*
Biofuels and waste[1]	-	-	-	-	-	-	-
Geothermal	-	-	-	-	-	-	-
Solar/other	-	-	-	-	-	-	-
Electricity	*32.6*	*63.4*	*61.9*	*46.5*	*44.3*	*43.4*	*42.8*
Heat	*2.4*	*4.2*	*0.5*	*1.7*	*2.4*	*2.8*	*3.8*
TOTAL INDUSTRY[4]	**0.99**	**0.46**	**0.64**	**0.70**	**0.77**	**0.82**	**0.62**
Coal	-	-	-	0.28	0.25	0.28	0.26
Peat	-	-	-	-	-	-	-
Oil	-	0.00	0.00	0.04	0.15	0.10	0.04
Natural gas	-	-	-	-	0.05	0.10	0.09
Biofuels and waste[1]	-	-	-	-	-	-	-
Geothermal	-	-	-	-	-	-	-
Solar/other	-	-	-	-	-	-	-
Electricity	0.99	0.46	0.64	0.38	0.33	0.35	0.24
Heat	-	-	-	-	-	-	-
Shares in total industry (%)							
Coal	-	-	-	*39.6*	*32.2*	*33.6*	*41.4*
Peat	-	-	-	-	-	-	-
Oil	-	*0.2*	*0.1*	*5.9*	*19.5*	*12.3*	*6.4*
Natural gas	-	-	-	-	*6.1*	*12.1*	*14.4*
Biofuels and waste[1]	-	-	-	-	-	-	-
Geothermal	-	-	-	-	-	-	-
Solar/other	-	-	-	-	-	-	-
Electricity	*100.0*	*99.8*	*99.9*	*54.6*	*42.3*	*42.0*	*37.9*
Heat	-	-	-	-	-	-	-
TRANSPORT	**0.29**	**0.02**	**0.10**	**0.78**	**0.83**	**0.92**	**1.02**
OTHER[5]	**3.40**	**1.31**	**1.21**	**1.07**	**1.17**	**1.25**	**1.44**
Coal	0.63	0.01	0.09	0.21	0.20	0.21	0.24
Peat	-	-	-	-	-	-	-
Oil	1.41	0.17	0.41	0.01	0.00	0.00	0.00
Natural gas	0.73	0.38	0.13	0.00	0.00	0.00	0.00
Biofuels and waste[1]	-	-	-	-	-	-	-
Geothermal	-	-	-	-	-	-	-
Solar/other	-	-	-	-	-	-	-
Electricity	0.52	0.67	0.57	0.80	0.90	0.95	1.08
Heat	0.11	0.08	0.01	0.04	0.07	0.08	0.12
Shares in other (%)							
Coal	*18.5*	*0.9*	*7.4*	*19.6*	*17.4*	*16.7*	*16.7*
Peat	-	-	-	-	-	-	-
Oil	*41.4*	*12.8*	*33.8*	*1.3*	*0.0*	*0.1*	*0.0*
Natural gas	*21.6*	*29.2*	*11.1*	*0.1*	*0.0*	*0.0*	*0.1*
Biofuels and waste[1]	-	-	-	-	-	-	-
Geothermal	-	-	-	-	-	-	-
Solar/other	-	-	-	-	-	-	-
Electricity	*15.3*	*51.3*	*47.0*	*75.0*	*77.0*	*76.4*	*75.2*
Heat	*3.3*	*5.8*	*0.8*	*4.0*	*5.6*	*6.7*	*8.1*

0 is negligible, - is nil, .. is not available. Please note: rounding may cause totals to differ from the sum of the elements.

Unit: Mtoe

DEMAND							
ENERGY TRANSFORMATION AND LOSSES	**1990**	**2000**	**2010**	**2017**	**2018**	**2019**	**2020**
ELECTRICITY GENERATION[6]							
Input (Mtoe)	1.96	1.37	1.42	1.68	1.89	2.07	1.97
Output (Mtoe)	1.56	1.23	1.41	1.56	1.70	1.80	1.73
Output (TWh)	18.15	14.25	16.44	18.11	19.74	20.96	20.10
Output Shares (%)							
Coal	-	-	-	*5.4*	*6.8*	*7.0*	*8.2*
Peat	-	-	-	-	-	-	-
Oil	-	-	-	-	-	-	-
Natural gas	*9.1*	*1.6*	*0.2*	-	-	*1.5*	*1.6*
Biofuels and waste[1]	-	-	-	-	-	-	-
Nuclear	-	-	-	-	-	-	-
Hydro	*90.9*	*98.4*	*99.8*	*94.6*	*93.2*	*91.5*	*90.1*
Wind	-	-	-	-	-	-	-
Geothermal	-	-	-	-	-	-	-
Solar/other	-	-	-	-	-	-	-
TOTAL LOSSES	**0.63**	**0.35**	**0.22**	**0.39**	**0.48**	**0.54**	**0.57**
of which:							
Electricity and heat generation[7]	0.40	0.15	0.00	0.12	0.20	0.27	0.24
Other transformation	0.09	0.00	0.00	0.00	0.01	0.01	0.01
Own use and transmission/distribution losses	0.14	0.20	0.21	0.27	0.27	0.25	0.31
Statistical differences	**-**	**-**	**0.00**	**-0.05**	**0.00**	**-0.00**	**0.00**
INDICATORS	**1990**	**2000**	**2010**	**2017**	**2018**	**2019**	**2020**
GDP (billion 2015 USD)	7.79	2.60	5.60	8.99	9.65	10.37	10.84
Population (millions)	5.28	6.22	7.53	8.88	9.10	9.32	9.54
TES/GDP (toe/1000 USD)[8]	0.68	0.83	0.39	0.33	0.34	0.34	0.34
Energy production/TES	0.38	0.59	0.71	0.76	0.76	0.73	0.69
Per capita TES (toe/capita)	1.00	0.35	0.29	0.34	0.36	0.38	0.38
Oil supply/GDP (toe/1000 USD)[8]	0.23	0.07	0.09	0.09	0.10	0.10	0.10
TFC/GDP (toe/1000 USD)[8]	0.60	0.69	0.35	0.28	0.29	0.29	0.29
Per capita TFC (toe/capita)	0.89	0.29	0.26	0.29	0.30	0.32	0.32
CO_2 emissions from fuel combustion ($MtCO_2$)[9]	11.0	2.2	2.3	5.2	6.2	6.9	7.3
CO_2 emissions from bunkers ($MtCO_2$)[9]	0.0	0.0	0.1	0.1	0.1	0.1	0.1
GROWTH RATES (% per year)	**90-00**	**00-10**	**10-17**	**17-18**	**18-19**	**19-20**	**00-20**
TES	-8.6	0.1	4.6	8.3	9.2	3.6	2.7
Coal	-32.5	22.0	36.5	5.3	8.9	6.5	24.4
Peat	-	-	-	-	-	-	-
Oil	-20.1	10.3	7.6	17.3	5.4	3.6	9.1
Natural gas	-7.6	-12.7	-51.8	4796.1	308.7	0.0	-5.7
Biofuels and waste[1]	-	-	-	-	-	-	-
Nuclear	-	-	-	-	-	-	-
Hydro	-1.6	1.6	0.6	7.4	4.2	-5.5	1.3
Wind	-	-	-	-	-	-	-
Geothermal	-	-	-	-	-	-	-
Solar/other	-	-	-	-	-	-	-
TFC	-9.1	0.8	3.9	8.4	8.4	3.2	2.7
Electricity consumption	-2.9	0.6	-0.3	3.3	6.3	1.6	0.7
Energy production	-4.6	2.0	5.8	7.3	4.9	-1.9	3.5
Net oil imports	-20.2	10.8	8.0	17.8	5.6	3.6	9.5
GDP	-10.4	8.0	7.0	7.3	7.5	4.5	7.4
TES/GDP	1.9	-7.3	-2.2	1.0	1.6	-0.9	-4.4
TFC/GDP	1.4	-6.6	-2.9	1.0	0.9	-1.3	-4.3

0 is negligible, - is nil, .. is not available. Please note: rounding may cause totals to differ from the sum of the elements.

Footnotes to energy balances and key statistical data

1. Data on consumption of (solid) biofuels is not systematically collected in Tajikistan.
2. Excludes international marine bunkers and international aviation bunkers.
3. Total supply of electricity represents net trade. A negative number in the share of TES indicates that exports are greater than imports.
4. Industry includes non-energy use.
5. Other includes residential, commercial and public services, agriculture/forestry, fishing and other non-specified.
6. Inputs to electricity generation include inputs to electricity, CHP and heat plants. Output refers only to electricity generation.
7. 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 100% for hydro, wind and solar photovoltaic.
8. Toe per thousand US dollars at 2015 prices and exchange rates.
9. "CO_2 emissions from fuel combustion" have been estimated using the IPCC Tier I Sectoral Approach methodology from the 2006 IPCC Guidelines. Emissions from international marine and aviation bunkers are not included in national totals.

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 Paris, France.)

* Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Korea, Lithuania, Luxembourg, Mexico, 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 the abbreviations used.

Acronyms and abbreviations

ADB	Asian Development Bank
BOC	Bokhtar Operating Company
CAPS	Central Asia Power System
CASA-1000	Central Asia-South Asia Electricity Transmission and Trade Project
CEP	Committee for Environmental Protection under the Government of Tajikistan
CJSC	closed joint-stock company
CNPC	China National Petroleum Corporation
CO_2	carbon dioxide
CPC	Coordination Electric Power Council of Central Asia
EBRD	European Bank for Reconstruction and Development
EIB	European Investment Bank
ESCO	energy service company
GDP	gross domestic product
GHG	greenhouse gas
GIZ	German Agency for International Cooperation
GSHP	ground source heat pump
HCI	Human Capital Index
HDI	Human Development Index
HPP	hydropower plant
IEA	International Energy Agency
IFI	international financial institution
INDC	Intended Nationally Determined Contribution
IPCC	Intergovernmental Panel on Climate Change
JODI	Joint Organisations Data Initiative
JSC	joint-stock company
LLC	limited liability company
LNG	liquefied natural gas
LPG	liquefied petroleum gas

LULUCF	land use, land-use change and forestry
MDP	Medium-Term Development Programme
MEPS	minimum energy performance standards
MEWR	Ministry of Energy and Water Resources
NDC	Nationally Determined Contribution
NSACC-2030	National Strategy for Adaptation to Climate Change of Tajikistan for the Period until 2030
OJSC	open joint-stock company
PPP	purchashing power parity
PSA	production-sharing agreement
PV	photovoltaic
R&D	research and development
RD&D	research, development and deployment
RES	renewable energy sources
SATREPS	Science and Technology Research Partnership for Sustainable Development
SDG	Sustainable Development Goal
SMEs	small and medium enterprises
SUE	state unitary enterprise
TajStat	Agency on Statistics under President of the Republic of Tajikistan
TALCO	Tajik Aluminium Company
TES	total energy supply
TFC	total final consumption
TPP	thermal power plant
TSO	transmission system operator
TTGP	Trans-Tajik Gas Pipeline Company
UNDP	UN Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNSD	United Nations Statistics Division
USAID	United States Agency for International Development
VAT	value-added tax

Units of measure

bcm	billion cubic metres
g	gramme
Gcal	gigacalorie
GW	gigawatt
GWh	gigawatt hour
kb/d	thousand barrels per day
km	kilometre
km^2	square kilometre
km^3	cubic kilometre
kt	kilotonne
kV	kilovolt
kW	kilowatt
kWh	kilowatt hour
m	metre
mcm	million cubic metres
mm	millimetre
Mt	million tonnes
$MtCO_2$	million tonnes of carbon dioxide
$MtCO_2$-eq	million tonnes of carbon dioxide-equivalent
Mtoe	million tonnes of oil equivalent
MW	megawatt
PJ	petajoule
TJ	terajoule
toe	tonne of oil equivalent
TWh	terawatt-hours

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Typeset in France by IEA - June 2022
Cover design: IEA

Tajikistan 2022

Energy Sector Review

This International Energy Agency (IEA) energy sector review of Tajikistan was conducted under the auspices of the EU4Energy programme, which is being implemented by the IEA and the European Union, along with the Energy Community Secretariat and the Energy Charter Secretariat.

With abundant water potential from its rivers, natural lakes and glaciers, Tajikistan is almost exclusively reliant on hydro for electricity generation. It is home to some of the world's largest hydropower plants and is ranked eighth in the world for hydropower potential with an estimated 527 terawatt-hours (TWh). Currently only 4% of the country's hydro potential is exploited. Tajikistan's geographic proximity to some of the world's fastest-growing energy markets means that investing in developing its hydropower potential can contribute to regional energy security and the clean energy transition, in addition to addressing Tajikistan's high vulnerability to climate change and natural disasters.

Coupled with the IEA roadmap on cross-border electricity trading for Tajikistan, published in October 2021, this report aims to give a holistic overview of Tajikistan's energy sector and to assist policy making at all levels in order to facilitate the effective delivery of the National Development Strategy for 2030 and its ambitious goals, which include increasing hydropower generation capacity by 10 gigawatts and raising annual electricity exports by 10 TWh. It also supports government efforts for ongoing energy sector reforms, aimed at restructuring the state-owned vertically integrated electric utility with financial viability issues, introducing market mechanisms to alleviate power sector challenges and updating its regulatory and tariff regimes.

The report commends the government of Tajikistan for setting clear goals for its national development strategy and the subsequent sectoral development programmes, caveats the introduction of domestic coal as a key support for national energy security structures, and advocates for the introduction of other renewable sources and enhanced regional co operation for achieving energy security and sustainable development goals.

International Energy Agency

Co-funded by the European Union