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Uzbekistan Energy Profile

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Uzbekistan Energy Profile

Country overview

Located between the Amudarya and Syrdarya rivers, the Republic of Uzbekistan (Uzbekistan) covers an area of 448 978 km². The territory is bordered by Kazakhstan to the north and west, by Kyrgyzstan to the east and Tajikistan to the southeast, and by Turkmenistan and Afghanistan to the south. Its permanent population as of 1 January 2020 was 33.9 million, with 2.5 million residing in the capital, Tashkent (<https://www.gov.uz/uz>).

Most of Uzbekistan (about four-fifths) is occupied by plains, one of the main ones being the Turan Plain. The country's highest point (4 643 m) is in the spurs of the Tien Shan and Pamir mountain ranges in the east/northeast, and northern/central Uzbekistan is occupied by the Kyzylkum and Karakum deserts.

Uzbekistan's subsoil is rich in oil, gas, coal and uranium. For natural gas, it ranks 11th in the world for mining and 14th for reserves, and for uranium it is 6th for mining and 7th for explored reserves. It is also among the world leaders for producing and supplying reserves of certain minerals: gold, copper, phosphorites, molybdenum, etc. (<http://darakchi.uz/ru/68477>).

In 2019, Uzbekistan's gross domestic product (GDP) in current prices amounted to UZS 511 838.1 billion (USD 57.9 billion according to the Central Bank of the Republic of Uzbekistan's average annual exchange rate) – a 5.6% increase in real terms from USD 50.4 billion in 2018. According to World Bank estimates, Uzbekistan's 2018 GDP at purchasing power parity (PPP) was USD 282 billion (USD 1 = UZS 8 069 in 2018; USD 1 = UZS 8 839 in 2019). GDP per capita was UZS 15 242 000 (USD 1 724) in 2019, a 3.6% rise from 2018; it also rose in 2017 (+2.7%) and 2018 (+3.6%) (<https://stat.uz/ru>).

Uzbekistan has been implementing large-scale reforms in recent years to strengthen its energy industry. Problems are associated with high wear and tear on equipment as well as with the slow pace of infrastructure updates, faulty equipment operations, inadequate installations, and both gas pipelines and power lines that have exceeded their service life. The country's unstable financial situation and inadequate introduction of

resource- and energy-saving technologies have raised technological losses and made fuel and energy resource supply interruptions more frequent.

Key energy data

Supply

- Uzbekistan is one of the world's largest natural gas producers, annually producing around 60 billion cubic metres (bcm), of which 35-40 bcm are supplied by the Uzbekneftegaz joint-stock company (JSC). In 2019, production totalled 60.4 billion cubic metres (bcm).
- In 2019, gas condensate production amounted to 2.1 million tonnes (Mt) – equal to three times the conventional oil production in the same year. Conventional oil production peaked in the early 2000s and has since declined steadily.

Table 1 Uzbekistan energy production, 2017-19

Name	2017	2018	2019
Natural gas (mcm)	56 419.1	59 842.2	60 405.8
Gas condensate (kt)	1 951.0	2 142.9	2 098.3
Conventional oil (kt)	813.4	746.4	698.6
Coal (kt)	4 038.6	4 174.4	4 049.5

Notes: mcm = million cubic metres. kt = kilotonne (1 000 tonnes).

Source: State Statistics Committee of the Republic of Uzbekistan, <https://stat.uz/ru>.

Table 2 Explored reserves and extraction of basic energy resources in Uzbekistan

Mineral resource	Reserves	Extraction (2019)
Natural gas (bcm)	2 239.9	59.46
Oil and gas condensate (Mt)	178.1	0.698
Coal (Mt)	1 950.1	4.049
Uranium (kt)	96.7	3.6 (2017)

Source: <https://regulation.gov.uz/oz/document/2531>.

Imports/Exports

- Since the early 2000s, Uzbekistan has been exporting 10-15 bcm of natural gas annually (15 bcm in 2018: 8 bcm to China; 4.5 bcm to Russia; 2.5 bcm to Kazakhstan; and 500-550 mcm to other Central Asian countries).

- On top of its domestic oil production, Uzbekistan imports additional crude oil for its refineries (around 30% of total input in 2018). Refining output satisfies domestic market demand and allows for small quantities to be exported (0.13 Mt in 2018).
- Uzbekistan's most important export destinations for energy commodities are China, Russia and Kazakhstan.
- Uzbekistan's current approved hydrocarbon reserves are forecast to last for 20-30 years (<https://www.gazeta.uz/ru/2019/07/12/gas-export/>).

Demand

- Total final energy consumption is around 30 Mtoe (29.5 Mtoe in 2018).
- The residential sector is the largest consumer, with a share of almost 40%, while the industry, transport and services sectors are each responsible for roughly 20%.
- Domestic gas consumption is approximately 39 bcm, including liquefied natural gas (LNG) used by half of consumers.
- Uzbekistan generated 61.6 terawatt hours (TWh) of electricity in 2019, mostly from natural gas (>85%). The share generated from coal is expected to increase in the future to around 10% (currently around 3%).

Table 3 Uzbekistan electricity consumption by sector, 2019

Sectors	Electricity consumption
Industry	40%
Population	23%
Agriculture	20%
Utility	13%
Transport	3%
Construction	1%

Source: Uzbekistan Ministry of Energy, <https://minenergy.uz/ru>.

Renewables

In Uzbekistan, HPP generation is counted as electricity produced from renewable energy sources (RESs).

Despite the country's considerable solar energy potential, it has no industrial-scale solar power plants. Furthermore, as wind potential has not been studied sufficiently, there are also no industrial-scale wind farms.

Uzbekistan is, however, taking measures to establish a legal framework for the development of this energy segment. The Law on the Use of Renewable Energy

Sources and the Law on Public-Private Partnerships have been adopted, as well as the Regulations for Connecting Businesses that Produce Electricity, Including from Renewable Energy Sources, to the Unified Electric Power System.

As solar, wind and biomass energy production shares are low, statistical agencies do not currently take them into account.

Energy sector governance

Executive

Ministry of Energy of the Republic of Uzbekistan

The Ministry of Energy was established by Presidential Decree No. UP-5646 of 1 February 2019 on Measures to Radically Improve the Management System of the Fuel and Energy Industry of the Republic of Uzbekistan.

It is responsible for regulating the production, transmission, distribution and consumption of electric and thermal energy and coal, as well as the production, processing, transportation, distribution, sale and use of oil and gas, and their products.

The Ministry of Energy's main tasks are to:

- Regulate the energy sector.
- Implement production-sharing agreements and supervise compliance.
- Attract private capital for the exploration and production of energy resources.
- Develop public-private partnerships (PPPs).
- Improve the tariff policy to facilitate the formation of a competitive business environment, increasing and diversifying energy production.

The Ministry of Energy is the body authorised to implement the unified state policy for RESs.

Uzbekenergo JSC was fundamentally restructured as part of the transition to modern methods of electricity production, transportation, distribution and sales, and three other JSCs were established based on the Uzbekenergo JSC model: the Thermal Power Plants company, National Electric Networks of Uzbekistan and Regional Electric Networks.

Ministry of Economic Development and Poverty Reduction

Formerly the Ministry of Economy and Industry, the Ministry of Economic Development and Poverty Reduction was established by Presidential Decree No. PP-4653 of 26 March 2020 on the Organisation of the Activities of the Ministry of Economic Development and Poverty Reduction of the Republic of Uzbekistan and its Subordinate Organisations.

The ministry's main objectives are to analyse and forecast macroeconomic indicators and development, based on proposed economic management market mechanisms and strategies to develop Uzbekistan's main industries (including energy) given the state of the economy, the foreign market situation, and trends in the global and regional economy. It also formulates strategies (models) for the country's industrial development based on the effective deployment of production forces, rations and food production.

Ministry of Innovative Development

Established by Presidential Decree No. UP-5264 of 29 November 2017, this ministry's primary objectives are to develop and implement innovations in state and public construction, taking into account long-term scenarios of the country's development; define the state's scientific, technical and innovation policy priorities; and approve state scientific and technical programmes for fundamental, applied and innovative research.

Ministry of Finance

This ministry co-ordinates efforts to ensure the financial stability of the basic sectors of the economy; improves pricing and the procedure for tariff-setting for certain types of goods and services; and strengthens payment discipline.

Ministry of Investment and Foreign Trade

Established in accordance with Presidential Decree No. 5643 of 28 January 2019, this ministry is the successor to the Ministry of Foreign Trade and the State Committee for Investments.

It is responsible for implementing the unified state investment policy; co-ordinating efforts to attract foreign investments, primarily direct investments; co-operating with international financial institutions and foreign governmental financial organisations; and devising and co-ordinating unified state policies on foreign trade and international economic co-operation.

Ministry of Construction

The Ministry of Construction was established by Presidential Decree No. PF-5392 of 2 April 2018 on Measures to Radically Improve the System of Public Administration in the Construction Sector.

It implements a unified state scientific and technical policy in the field of engineering and technical research for urban planning and construction to increase productivity, reduce construction and installation costs, and introduce innovative energy-efficient and energy-saving projects and solutions into construction.

Legislative and regulatory framework

Uzbekistan has adopted a number of laws related to energy: the Law on the Rational Use of Energy (April 1997); Law No. 312-II on Production Sharing Agreements (7 December 2001); Law No. 444-II on Subsoil (13 December 2002); Law No. ZRU-225 on Electric Power Engineering (9 September 2009); Law No. ZRU-370 on Joint Stock Companies and Protection of Shareholders' Rights (6 May 2014); Law No. ZRU-537 on Public-Private Partnerships (10 May 2019); and Law No. ZRU-565 on Peaceful Uses of Nuclear Energy (9 September 2019).

On 21 May 2019, Uzbekistan adopted Law No. ZRU-539 on the Use of Renewable Energy Sources. It defines privileges and preferences for RES use, including fee payment exemptions:

- for manufacturers of renewable energy installations, all types of taxes for five years from the date of the company's state registration
- property tax for renewable energy installations and land tax for the areas occupied by these installations (rated capacity of at least 0.1 MW), for ten years from the commissioning date
- land tax for persons using renewable energy on residential premises with complete disconnection from existing energy networks, for three years from the month RES use commences.

The Legislative Chamber of the *Oliy Majlis* (Supreme Assembly) of the Republic of Uzbekistan adopted a new version of the Law on the Rational Use of Energy in April 2020. The law stipulates that the Ministry of Energy is authorised to implement a unified state policy on rational energy use, applicable to all economic sectors and social facilities.

The Ministry of Energy is also required to develop mechanisms to encourage the introduction of energy-efficient and energy-saving technologies, including in production processes, and to monitor them accordingly.

Uzbekistan's most important reform document is the **Strategy of Action for the Five Priority Development Areas of Uzbekistan in 2017-2021**, adopted 7 February 2017. The five-year strategy has five main directions: 1) state and social system improvement; 2) rule of law and judicial and legal system reform; 3) economic development and liberalisation; 4) social development; and 5) security, religious tolerance, interethnic harmony and foreign policy.

The investment climate in Uzbekistan has improved significantly in recent years, as the International Finance Corporation (IFC) reported in *Doing Business 2018*. For the “ease of doing business” indicator, Uzbekistan ranked 74th out of 190 countries (in 2013, it was 154th out of 185).

In addition, efforts to improve its rating on the “taxation” indicator, which considers taxes and mandatory contributions as well as the administrative burden of businesses, raised Uzbekistan from 161st place in 2013 to 78th in 2018.

Its ranking for the “receiving credit” indicator also moved from 154th in 2013 to 55th in 2018 thanks to key measures to expand credit availability through banking structures for entrepreneurial activities and housing construction. Lending procedures were also simplified and modern customer service systems in banks were created (<https://finance.uz/index.php/ru/fuz-menu-economy-ru/2888-investitsionnyj-klimat-uzbekistana-mezhdunarodnye-rejtingi-regionalnyj-i-otraslevoj-aspekt>).

Judiciary

Uzbekistan's judicial system consists of a constitutional court, a supreme court, Uzbekistan's highest economic court, the supreme court of the Republic of Karakalpakstan, the economic court of the Republic of Karakalpakstan, and regional and Tashkent-district city and economic courts.

In accordance with the constitution (Article 108) and the Law on the Constitutional Court, the Constitutional Court of the Republic is the highest judicial body of constitutional control and therefore judges cases on the constitutionality of legislative and executive acts.

The economic court system includes Uzbekistan's highest economic court, the economic court of the Republic of Karakalpakstan, and regional courts. The courts exercise judicial power by resolving economic disputes among enterprises, institutions and organisations of all forms of ownership. The Supreme Economic Court of the Republic of Uzbekistan is the highest judicial authority for economic legal proceedings.

Key policies

Uzbekistan is implementing comprehensive measures to deepen structural reforms, modernise and diversify basic sectors of the economy, and balance the socioeconomic development of its territories.

Presidential Decree No. PP-4477 of 4 October 2019 approved the **Strategy for the Transition of the Republic of Uzbekistan to the Green Economy for the Period 2019-2030**. The strategy has many objectives within several priority areas (<https://lex.uz/docs/4539506>):

Electricity

- reconstruct and modernise generating capacities of existing power plants with the introduction of highly efficient technologies based on combined-cycle and gas turbine units
- improve main power network configurations and modernise them to increase power system stability
- implement organisational and technical measures, including optimising modes, reactive power compensation and electricity network schemes
- increase automation of technological processes, reduce electric energy consumption for transportation and distribution
- finish equipping power consumption systems with automatic control and metering devices.

Thermal energy

- introduce new technologies for generating thermal energy, including co-generation technologies for central boilers and coal-fired steam turbine power units based on ultra-supercritical steam parameters
- modernise and reconstruct outdated boiler house equipment
- utilise exhaust gas heat from turbocharger units
- formulate optimal heating network configuration and modernisation

- use modern insulating materials in reconstructing and modernising heating networks
- automate, dispatch and optimise heat generation and transportation systems, taking the number of consumers into account
- equip consumers with modern metering devices
- use solar collectors for heating water in boiler rooms.

Oil and gas

- reduce natural gas losses in the production, processing, transportation and distribution stages by upgrading compressor stations, low- and medium-pressure gas distribution networks, and the gas transportation system with effective technologies for monitoring hydrocarbon resource losses (i.e. a supervisory control and data acquisition [SCADA] system)
- introduce modern gas distribution and metering technologies
- reduce greenhouse gas (GHG) emissions during the processing and storage of oil and petroleum products
- reduce GHG emissions from the combustion of associated petroleum gases once processes for their utilisation and advanced processing have been introduced
- introduce alternative energy sources at oil and gas production facilities
- deploy waste gas heat recovery for power generation.

Implementation targets

- reduce specific GHG emissions per unit of GDP by 10% of the 2010 level
- double the energy efficiency indicator and reduce the carbon intensity of GDP
- further develop RESs, raising their share in total electricity generation to more than 25% by 2030
- ensure that the entire population and all economic sectors have access to modern, inexpensive and reliable energy supplies
- modernise the infrastructure of industrial enterprises, ensuring their sustainability by raising energy efficiency at least 20% and applying clean and environmentally safe technologies and industrial processes more widely
- expand the production and use of more energy-efficient and eco-friendly motor fuels and motor vehicles, as well as develop electric transport.

Table 4 Uzbekistan generating capacity targets to 203

Indicator	Forecast generating capacity increase (MW)					Share of electricity generation (%)	
	2019	2020	2021	2022	2023-30	2018	2030
Total	1 074.1	886.8	1 961.5	2 061.6	14 017.8	100	100
Traditional energy	1 050	1 807	1 777	2 259.4	10 910.2	90	75
<i>Including capacity withdrawal</i>	-	1 060	320	740	4 280	-	-
Total renewable energy sources	24.1	119.8	504.5	542.2	7 387.6	10	25
Hydropower	24.1	119.8	204.5	42.2	1 487.6	10	11.2
Solar power	-	-	300	400	4 300	-	8.8
Wind power	-	-	-	100	1 600	-	5

New renewable generation facilities (solar, wind and hydropower plants) with a total capacity of over 8 400 MW are planned for construction to increase the share of RES in total electricity generation to 25%.

Plus, construction of Uzbekistan's first nuclear power plant (NPP) with a capacity of 2 400 MW, which is also expected to help stabilise the country's energy supply, began in autumn 2019 (Presidential Decree No. PP-4422 of 22 August 2019, <https://lex.uz/ru/docs/4486127>).

Energy statistics

Uzbekistan's State Statistics Committee carries out its activities in accordance with the Law on State Statistics of 12 December 2002, Presidential Decree No. PP-3165 of 31 July 2017 on Measures to Improve the Activities of the State Statistics Committee of the Republic of Uzbekistan, and the Presidential Decree on Additional Measures to Ensure Openness and Transparency of the Public Administration, as Well as to Increase the Number of Statistics.

The Statistics Committee has become active in international forums in recent years. It shares official national energy statistics with the International Energy Agency and is keen on adopting international methodologies.

As a result, Uzbekistan released a pilot energy balance in 2019 following the United Nations Statistics Division's *International Recommendations for Energy Statistics* guidelines. Increasing amounts of energy data are also being published in the energy section of the statistics website in several user-friendly formats.

Chapter 1. Energy security

Resource endowment

Uzbekistan's significant hydrocarbon potential allows it to implement long-term projects. According to expert estimates, the country has one-third of all Central Asia's mineral resources, and in terms of gas production it is among the world's 20 leaders.

As of 1 January 2018, the State Mineral Balance of the Republic of Uzbekistan included 244 hydrocarbon deposits (oil, gas and condensate), 38 radioactive metal deposits, and seven coal and shale oil deposits.

According to the State Committee for Geology and Mineral Resources, explored reserves of oil and gas condensate contain 178.1 Mt; natural gas 2 239.9 bcm; and coal 1 950.1 Mt. In 2018, the Organization of the Petroleum Exporting Countries (OPEC) estimated Uzbekistan's oil reserves at 594 million barrels of natural gas and 1 564 trillion cubic metres (tcm) of natural gas (<http://www.xn-----7kcbmkfaolw0acwp3ak9a0lg.xn--p1ai/zapasi-gaza-v-mire>).

Hydrocarbon exploration and production will be expanded for further oil and gas industry development. To this end, work has intensified at the most promising sites in the Bukhara-Khiva, Ustyurt, Surkhandarya and Fergana regions. Exploration work is also being carried out jointly with the world's leading oil and gas companies on poorly studied investment blocks. Partners include Socar (Azerbaijan), British Petroleum (United Kingdom), Total (France), Lukoil, Gazprom and Tatneft (Russia), Mubadala (United Arab Emirates), and ONGC (India).

In response to growth in hydrocarbon consumption, industry investments of about USD 9.8 billion are planned for 2019-30, including USD 3.5 billion for geological prospecting and USD 6.3 billion to increase natural gas production (Ministry of Energy, <https://minenergy.uz/ru/lists/view/28>).

Coal production in Uzbekistan is carried out by Uzbekugol JSC at the Angren brown coal field, and Shargunkumir JSC mines the Shargun and Baisun underground deposits.

Uzbekistan's shale oil reserves are estimated at 47 billion tonnes (Bt) at a depth of up to 600 m, at Baisun, Jam, Urtaulak, Sangrento, Aktau, Uchkir and Kulbeskan. The main

shale oil deposits are in the Kyzylkum desert and in the Baisun mountains (Tashkent Institute of Chemical Technology, <http://library.ziyonet.uz/ru/book/84797>).

Uzbekistan also has significant uranium deposits and is seventh among the few countries in the world that produce it. Within the region, Kazakhstan, Ukraine, and Russia are the only other producers, with Kazakhstan being the largest producer in the world. Uzbekistan has 47 kt of uranium reserves and 74 kt of resources, with 121 kt of remaining potential. Its reserves account for 12.3% of the total of these four countries, and 2.2% of total reserves globally.

Energy security and diversification

In recent years, consistent work has been carried out on integrated fuel and energy industry development and energy source diversification to meet the ever-increasing demand for energy resources.

At the same time, however, inefficient geological explorations, investment projects and pricing have resulted in energy resource supply deficiencies and have worsened the financial situation of oil and gas enterprises.

Thus, with an 8% increase in natural gas production over the last 20 years, production by domestic enterprises fell 29%; confirmed natural gas reserves decreased 4% in 2008-18; and the average replacement rate for natural gas reserves in the past 5 years was about 70%.

Due to insufficient financing and a lack of material and technical resources, natural gas production growth in 2017-18 was only 42% of what had been predicted. Uzbekistan's outdated and non-transparent management system (which combines regulatory functions and commercial activities) hinders the introduction of modern management of oil and gas enterprises, which would increase their financial stability and profitability (Presidential Decree No. PP-4388 of 9 July 2019, <https://lex.uz/docs/4410281>).

Calculations show that electricity consumption will double by 2030, which will require the commissioning of new TPPs with a total capacity of 7.9 GW over the next ten years.

Renewable energy produced mainly by HPPs currently accounts for slightly more than 10% of the country's total electricity production. Despite their significant potential, RESs such as solar and wind power are not being fully exploited.

The government aims to: construct solar and wind power plants with a total capacity of 8 GW by 2030; attract investors; and raise HPP capacity to 1 935 GW (<https://stat.uz/ru/press-tsentr/novosti-uzbekistana/8251-obsuzhdeny-zadachi-po-razvitiyu-elektroenergetiki-v-2020-godu>).

Oil and gas industry investment policy should aim to attract foreign investments in highly developed technologies to diversify the industry and ensure in-depth processing of oil and gas resources.

Energy infrastructure and investment

Electricity and heat

Uzbekistan fully meets its electricity and heat needs from its own energy resources. It also owns a significant part of the installed capacity of Central Asia’s unified energy system.

The Ministry of Energy centrally manages the technological process of electricity production, distribution and consumption through its **Thermal Power Plants, National Electric Networks of Uzbekistan** and **Regional Electric Networks** JSCs.

In 2018, the Thermal Power Plants JSC generated 56.3 billion kWh of electricity and supplied 7.5 million Gcal of thermal energy. The total installed capacity of TPPs in Uzbekistan is more than 14.1 GW with annual production of more than 70 billion kWh.

Table 5 Uzbekistan electrical and thermal energy production

Production	2017	2018	2019
Electricity (TWh)	60.3	62.9	63.5
Heat (PJ)	120.0	119.7	131.7

Source: State Statistics Committee of the Republic of Uzbekistan, <https://stat.uz/ru>.

Uzbekistan’s estimated generating capacity is currently 15.9 GW, with thermal power plants (TPPs) making up 88% or 14.0 GW, and hydropower plants (HPPs) making up the remaining 12% or 1.9 GW.

Table 6 Installed capacity of power plants (MW)

Power plant type	2018 Power plant capacity	2019 Power plant capacity
The Republic of Uzbekistan	14 191.4	15 939.4
Thermal power plants (TPP) and Combined heat and power plants (CHP)	12 276.5	14 031.9
Hydropower plants (HPPs)	1 914.9	1 907.5

Source: State Statistics Committee of the Republic of Uzbekistan http://web.stat.uz/open_data/ru/

The main source of generation is 11 TPPs, including 3 central heating and power plants. Modern, energy-efficient power units account for 2 825 MW, or 25.6% of total TPP capacity. In 2019, TPPs were responsible for 89.6% of total electricity generated and the total capacity of power units operating during the peak hours of a single electric power system was 8.6 GW.

Table 7 Uzbekistan TPP electricity production, by plant

#	Plants	TPP electricity production
1	Syrdarya	21%
2	Navoi	17%
3	Talimarjan	16%
4	Novo Angren	15%
5	Tashkent	12%
6	Others	19%

Table 8 Uzbekistan TPP heat production, by plant

#	Plants	TPP heat production
1	Fergana	24.1%
2	Navoi	22.7%
3	Muborak	19%
4	Tashkent	18.3%
5	Others	15.9%

Source: <https://tpp.uz/rukovod.html>.

The National Electric Networks of Uzbekistan JSC transmits electricity from the Thermal Power Plants JSC's generating sources to the distribution and marketing enterprises of the Regional Electric Networks JSC via 35-kilovolt (kV) to 500-kV main networks, which include:

- power stations – 77 units with a total capacity of 22 830 mega-volt amperes (MVA)
- power lines – 9 768 km.

Electricity distribution and delivery to consumers within Uzbekistan is carried out through distribution networks of 0.4-110 kV, including:

- power stations of 35-110 kV – 1 626 units with a total capacity of 20 421 MVA
- power lines of 35-110 kV – 28 642 km
- transformer stations – 75 534 units with a total capacity of 13 933 MVA
- power lines of 0.4-10 kV – 223 987 km.

Most components of power grid facilities have a service life of more than 30 years, including 66% of main and 62% of distribution networks, 74% of substations and more than 50% of transformer stations. This is one of the reasons that electrical energy losses during transportation and distribution are increasing. Average technological losses in the main networks is 2.72%, and 12.47% is lost in the distribution networks.

Within the electricity networks of the territorial units, 14 distribution and sales enterprises operating as JSCs under the Regional Electric Networks JSC manage electricity sales. The enterprises' balance sheets register more than 250 400 km of power transmission lines and 1 700 substations with a voltage of up to 110 kV inclusive.

Uzbekistan has adopted the **Concept of Providing the Republic of Uzbekistan with Electricity for 2020-2030**, which aims to:

- Increase generating capacity from 12.9 GW to 29.3 GW by 2030.
- Raise electricity production from 63.6 billion kWh to 120.8 billion kWh.
- Reduce natural gas consumption from 16.5 bcm to 12.1 bcm.
- Reduce electricity transmission losses to 2.35% and distribution losses to 6.5% (1.85 times less than the 2019 level).
- Decommission 6.4 GW of morally and physically outdated power units at TPPs.

Uzbekistan is expected to implement major investment projects worth about USD 35 billion.

Measures in the heat and power industry will make it possible to ensure the introduction of modern energy production technologies based on highly efficient combined-cycle and gas turbine units, raising power unit efficiency to 60%.

Construction of the country's first NPP (2.4-GW capacity) has begun.

As part of the transition to a “green” economy, installing modern solar and wind power plants with a total capacity of 6.7 GW is a priority for electricity industry development.

To ensure electricity supply stability, it is also necessary to build 2 700 km of 220-500 kV transmission lines as well as nine new substations, which will require an investment of USD 2.4 billion.

Reconstruction and modernisation of 39 600 units of transformer substations and 140 900 km of transmission lines in 110/35/10/0.4 kV distribution networks is also required, at a cost of USD 9.9 billion.

New power plants with a total capacity of 15 GW are planned, to be financed solely through direct investments in the amount of USD 17.3 billion. All stations except the HPPs, the NPP and several regulatory power plants are to be built through direct investment.

New plants to be constructed include: a combined-cycle power plant (CCPP) in the Syrdarya region, to be built in two stages of 1 300 MW each; a 850-MW CCPP unit in the Tashkent region, by the Turkish company Cengiz Enerji; a 900-MW CCPP unit in the Surkhandarya region, by the Turkish company Yildirim Enerji; CCPP units 3 and 4

(650 MW each), to expand the Navoi TPP; and regulatory power plants based on combined-cycle and natural gas-piston engines.

Natural gas consumption is to fall from 16.5 bcm to 12.1 bcm, while coal combustion will increase from 4.1 Mt to 8.5 Mt annually.

Fuel	2019	2025	2030
Natural gas (mcm)	15.8	12.7	12.1
Coal (Mt)	3.6	8.5	8.5
Fuel oil (kt)	2 044	50	50

Uzbekistan's district heating system was laid out in 1950-70 based on an open water intake scheme and dependent connections to buildings' heating system networks. Such district heating systems, which are not expensive to install but costly to operate, are characterised by short operational lifetimes and excessive consumption of network water and thermal energy.

As a result of significant boiler equipment and network deterioration, Uzbekistan's current heat supply system does not provide optimum loading of heat sources. This makes the work of heat supply companies more challenging and threatens the stability of continuous heat and hot water supplies for consumers (<https://nuz.uz/ekonomika-i-finansy/22552-uzbekistan-vlozhit-v-razvitie-sistemy-teplosnabzheniya-17-trln-sumov.html>).

Hydropower

Uzbekhydroenergo JSC provides about 10% of Uzbekistan's total electricity production. The hydropower sector is made up of 40 HPPs, both reservoir and run-of-river, with a total capacity of 1.91 GW.

Mode of Operation	Number of Plants	Capacity (MW)
Run-of-river	30	512
Large	4	307
Mini	26	205
Reservoir	10	1400
Total	40	1912

Source: State Statistics Committee of the Republic of Uzbekistan http://web.stat.uz/open_data/ru/

Uzbekistan's hydropower potential is estimated at 27.5 billion kWh per year, and the utilisation factor for the country's hydropower potential is 27%.

Uzbekistan has 62 projects planned for 2020-30, including construction of 35 HPPs with total capacity of 1 537 MW and modernisation of 27 existing HPPs to raise capacity by 186 MW. Total HPP capacity is therefore expected to be 3 785 MW by 2030, with electricity generation of 13.1 billion kWh (2.2 times more than in 2019).

Oil and natural gas

The oil and gas industry covers the entire chain of oil and gas operations, from geological exploration, oil and gas field development, drilling and production to hydrocarbon processing, petroleum product production, oil, gas and chemical equipment, and supplying petroleum products to consumers.

Roughly 30 industrial enterprises operate in Uzbekistan's oil and gas industry, producing such products as motor gasoline, diesel fuel, jet fuel, various types of oils, fuel oil, bitumen, polyethylene of various brands, natural gas and LNG, oil and gas chemical equipment, gas equipment, etc.

Uzbekistan's oil and gas investment policy aims primarily to attract foreign investment in highly developed technologies to diversify the industry and ensure in-depth processing of oil and gas resources.

Strategic facilities such as the Ustyurt Gas Chemical Complex, the Kandym Gas Processing Complex and a number of others have become operational in the past five years, and implementation of major strategic projects on deep hydrocarbon processing continues.

A synthetic liquid fuel production plant is planned to be commissioned in 2020. It will process 3.6 bcm of natural gas annually to produce 1.5 Mt of high-quality synthetic fuel complying with Euro-5 requirements.

Additionally, a new Concept for the Implementation of an Investment Project to Expand the Production Capacity of the Shurtan Gas Chemical Complex has been developed. With implementation of this project, the polymer production plant's capacity will increase from 125 kt to 500 kt (i.e. by four times), offering opportunities for further petrochemical industry development.

The Bukhara Oil Refinery Modernisation investment project is also to be implemented soon, which will ensure the production of high-quality oil products that meet Euro-5 standards.

Coal

Uzbekistan has proven coal reserves of 1 537 Mt of brown coal and 45.9 Mt of stone coal, and total forecast resources amount to more than 5.7 Bt.

Coal production in Uzbekistan is carried out by the Uzbekugol, Shargunkumir and Apartak JSCs. Uzbekugol extracts the coal and supplies it to consumers through its seven coalmining and auxiliary branches: the Angren mine, the geological prospecting expedition branch, the RGTO repair plant for mining and mining equipment, Kumirkurilish, Kumirenergo, Belazkumir and Alokakumir.

Uzbekugol produces up to 4.5 Mt of coal annually. The main consumer of coal fuel is the electricity sector, which accounts for more than 85% of total coal consumption. Solid coal fuel is also used by industries and in social and communal buildings, and by the general population.

Nuclear power

In accordance with the 19 July 2018 Presidential Decree on Measures for the Development of Nuclear Energy in the Republic of Uzbekistan, the Agency for the Development of Nuclear Energy (Uzatom Agency) was established, its main tasks and activities being:

- Preparing proposals on state policy priorities for the peaceful use of nuclear energy, including the development of legal and regulatory instruments.
- Developing and implementing state programmes to develop nuclear energy in Uzbekistan, and attracting investment, including foreign investment, to implement nuclear energy projects.
- Concluding agreements and contracts for designing, constructing and operating nuclear power facilities with modern technologies and equipment that meet international industrial and environmental safety requirements.
- International co-operation and collaboration with the International Atomic Energy Agency, the European Atomic Energy Community and other international organisations.

More than 80 highly qualified specialists, including foreign ones, are currently working in the Uzatom Agency system. To implement Uzbekistan's NPP project, the NPP Construction Directorate was established under the Uzatom Agency.

On 7 September 2018, the governments of Uzbekistan and Russia signed an agreement to co-operatively construct an NPP in Uzbekistan. The document provides for the construction of a 2 400-MW Generation III+ NPP with two VVER-1200 light-water power reactors. The site selected is near the Lake Tuzkan Aidar-Arnasai system of lakes.

In accordance with Presidential Decree No. PP-4165 of 7 February 2019, the Concept for the Development of Nuclear Power in Uzbekistan for 2019-2029 and the roadmap for its implementation were approved. Law No. ZRU-565 of 9 September 2019 on the Use of Atomic Energy for Peaceful Purposes was also adopted.

Emergency response

Uzbekistan is earthquake-prone, with earthquakes in the eight- to ten-point range occurring relatively frequently; it ranks 24th on the Global Facility for Disaster Reduction and Recovery's list of hotspot countries. As the country is energy self-sufficient and supply shock risks are low, the highest emergency risk is natural disaster.

Uzbekistan's state system for warning and action in emergency situations is the State Emergency Service (SES). Its main tasks are to: collect, process, exchange and issue information to protect the population and territories from emergency situations; prepare the population, officials of governing bodies, the military and the SES itself for emergency response; create reserves of financial and material resources for emergency response; respond to emergencies; implement measures for the social protection of citizens affected by emergencies; co-operate internationally to protect the population and territories from emergency situations; and provide an optimal insurance system against potential emergencies.

Chapter 2. Market design

National market structure

Electricity and heat

The Regional Electric Networks JSC was established in accordance with Presidential Decree No. PP-4249 of 27 March 2019 on the Strategy of Further Development and Reform of the Electric Power Industry of the Republic of Uzbekistan, its main functions being to manage the enterprises of the territorial electricity networks and to distribute and sell electricity to end users.

Regional Electric Networks encompasses 16 enterprises, including 14 within territorial (regional) power networks, which operate 0.4/6/10/35/110-kV power grids and oversee new construction and reconstruction as well as capital and routine repairs within their developments.

Through these 14 regional power network enterprises and 209 district and city power supply companies, electricity is transferred to 1 623 substations with voltages of 110-35 kV, then to 79 122 transformer points and through 252 600 km of power transmission lines to supply domestic and legal consumers.

Regional Electric Networks currently operates the following substations:

- 652 110-kV units with a total transformer capacity of 14 895.6 megavolts (MV) and 15 267.5 km of 110-kV lines
- 971 35-kV units with a total transformer capacity of 6 142.5 MV and 13 374.7 km of 35-kV lines
- 223 987 km of 0.4/6/10-kV lines and 79 122 transformer points.

In terms of electricity consumers, Uzbekistan registers 303 900 legal entities and 6.6 million individuals (https://www.het.uz/ru/pages/view/general_info).

Heat supply

Thermal energy is generated by the Thermal Power Plants JSC's TPPs and boilers (more than 72% of all thermal energy is generated at boiler houses). The main fuel for co-generation plants and boiler houses is natural gas. In 2019, 126 petajoules (PJ) of heat were supplied to consumers. The population at large used more than half of the

heat energy consumed, about 35% was consumed by industrial enterprises, and the remaining 14% went to public and administrative buildings.

Uzbekistan's heating networks have a total length of 4 965 km, 65% of which is in Tashkent and the surrounding region (54.5% in Tashkent alone).

Heat and hot water are supplied mainly by boilers owned by local and regional municipalities. Boilers account for 72% of heat energy production, and the rest is supplied by the Fergana, Mubarek, Tashkent, Navoi and Angren TPPs of the Thermal Power Plants JSC.

Some of Uzbekistan's boiler houses and heat supply networks are outdated and worn out, as this domain has never attracted foreign investment. As no technological modernisation has been carried out for years, the industry's expenditures on energy resources take up 85% of its revenues, and losses reach 35-40%. The excessive consumption of energy resources and consumer non-payment of bills leads to imbalances in accounts payable and accounts receivable.

The sector needs radical reformation, including renovation of existing capacity and improved management. For the qualitative organisation of heat supply, it is necessary to modernise the sector's enterprises, especially by adopting the widespread use of energy-saving and multipurpose technologies as has been done in European countries.

These innovations include a closed-loop heat supply system based on the principle of circulation and heat reuse. For example, switching to a closed system in Tashkent city would prevent the loss of 3 million Gcal of heat (worth UZS 300 billion), saving 320 mcm of natural gas (UZS 160 billion) and 85 GW of electricity (UZS 25 billion).

It is necessary to restore district heating to about 5 000 homes in 12 cities and transfer them to a closed system. Thus, in the cities of Bukhara and Chirchik such networks would have to be commissioned in 2020.

To modernise and reconstruct the heating system, USD 150 million in credit from the European Bank for Reconstruction and Development (EBRD) and USD 780 million from the Japan International Cooperation Agency are being raised to introduce new technologies into the heating supply systems of Bukhara, Fergana, Kuvasai, Urgench and Nukus. USD 55 million from the Asian Infrastructure Investment Bank will be used to modernise the Angren TPP.

Steps are being taken to create a competitive environment through the widespread introduction of market mechanisms, which requires, above all, **tariff liberalisation**.

Measures have been identified to make investment more appealing and to attract enterprises to Tashkent city's heat supply system on the basis of PPPs.

Uzbekistan also plans to introduce automated systems to record heat use in an effort to eliminate losses and reduce excessive consumption.

There are almost 6 million individual houses in 119 cities and more than 11 000 villages in Uzbekistan. The Ministry of Housing and Communal Services needs to ensure that all citizens (not only those living in apartment buildings) have access to electricity and heat, and must also develop a unified state policy in this area (<https://president.uz/ru/2905>).

Uzbekistan's **Programme for the Development of the Heat Supply System for the Period 2018-2022** was adopted to consistently implement measures to develop and modernise the heat supply system, introduce modern resource-saving technologies, and improve the quality and level of thermal energy and hot water provision.

The Ministry of Housing and Communal Services, the Council of Ministers of the Republic of Karakalpakstan and regional *khokimiyats* are responsible for ensuring that heat supply enterprises provide their services in accordance with the concluded contracts, and that consumers receive uninterrupted heat energy and hot water supplies. They also ensure that payments for heat energy and hot water are made in a complete and timely manner, based on the indications of intra-apartment metering devices, normative consumption volumes and size of the heated area.

For the 2020-21 heating season, settlements for district heating services are being transferred to a payment system in which consumers pay a daily rate based on the number of square metres being heated.

The costs of developing and modernising heat supply systems are taken into account when consumer tariffs for heat supply services are formulated, and the government plans to gradually introduce mechanisms to cover service expenses by reducing production costs as well as losses in heat supply networks.

Oil and natural Gas

The Ministry of Energy is responsible for regulating the production, transmission, distribution and consumption of electric and thermal energy and coal, as well as the production, processing, transportation, distribution, sale and use of oil and gas and their

products. The Concept of Development of the Oil and Gas Industry of the Republic of Uzbekistan to 2030 has been developed.

The Uzbekneftenaz JSC is engaged in producing hydrocarbons, processing oil and gas, transporting and storing petroleum products, geological exploration, research and design work, and training personnel.

The company's main goal is to ensure that industrial hydrocarbon reserves exceed production volumes. To do this, it has begun to widely apply new methods and advanced technologies to search for oil and gas deposits. Ongoing work has confirmed the high prospects of the country's Bukhara-Khiva and Surkhandarya regions, and rich reserves were found in Ustyurt, where the large Surgil, East Berdakh and Uchsay gas fields were discovered. Alternatively, synthetic oil can be produced from shale oil using high-speed pyrolysis technology.

In accordance with the Presidential Decree of 9 July 2019 on Measures to Ensure a Stable Supply of Energy Resources to the Economy and Population, Financial Rehabilitation and Improvement of the Oil and Gas Industry Management System, Uzburneftegaz, Uzneftegazdobycha, Uznefteprodukt and Uzneftegazmash were merged with Uzbekneftegaz. Uztransgaz was withdrawn from Uzbekneftegaz, and Hududgaztaminot was established on the basis of Uztransgaz's territorial gas supply branches (<http://uza.uz/ru/documents/o-merakh-po-stabilnomu-obespecheniyu-ekonomiki-i-naseleniya--10-07-2019>).

Uztransgaz is responsible for:

- Purchasing natural gas from gas production and processing organisations, including joint ventures and foreign companies operating under production-sharing agreements, for its further transportation, including natural gas exports and imports, as a single operator.
- Selling natural gas under direct contracts to consumers connected to main gas pipelines, as well as under commission agreements with Hududgaztaminot for consumers connected to gas distribution networks.

Khududgaztaminot is responsible for:

- Operating gas distribution networks and related equipment in compliance with the regulatory requirements of the rules of safe operation.
- Purchasing, supplying, storing and selling LNG to the general population and social facilities.

Coal

Uzbekistan's current coal resource base is the Angren lignite deposit and the two smaller Shargun and Boysun coal deposits. According to British Petroleum, proven coal reserves amounted to 1.4 billion toe (Gtoe) (2 Bt) in 2017, which is comparable with data from other organisations (for example, the World Energy Council gives a figure of 1.9 Bt).

Management of the coal industry changed in July 2017: Uzbekugol JSC and Shargunkumir JSC were withdrawn from the structure of Uzbekenergo JSC and transferred to Uzbekistan Temir Yullari JSC.

Uzbekistan plans to allocate USD 690.5 million to coal mining development by 2021: USD 68.7 million from the Fund for Reconstruction and Development of the Republic of Uzbekistan; USD 378.7 million in loans from the Shanghai Cooperation Organisation; USD 87.5 million from private funds and enterprises; and USD 155.6 million from the country's commercial banks.

Approximately USD 170 million is expected to be spent on modernising Uzbekugol's enterprises. At the Angren field, USD 165 million has been designated to increase annual production to 4 Mt (2.8 million toe [Mtoe]). In late 2017, Uzbekistan Temir Yollari JSC and the China Railway Tunnel Group signed a USD 105.5-million agreement to implement the project.

After 2021, the deposit will produce 900 kt of coal per year, increasing supplies to the Angren and Novo-Angren TPPs, cement plants, and the general population. Plus, the enterprise will provide jobs for 600 people.

So far, 2 km of the tunnel to the field's main deposits has been laid, with another 1.5 km remaining. According to experts, the main array of deposits contains 33 Mt (<https://nuz.uz/politika/40330-shargunskiy-ugol-i-baysunskiy-gaz-prezident-osmatrivaet-predpriyatiya-surhandari.html>).

Projects planned in Uzbekistan's Programme for the Further Development of the Coal Industry for 2020-2024 will multiply coal production to 12.98 Mt or 9.1 Mtoe per year (<https://regulation.gov.uz/uz/document/3767>).

Nuclear

Uzbekistan's uranium resources occur in sandstone-type and black shale deposits. All significant sandstone roll-front-type uranium deposits are in the Central Kyzylkum area,

in a 125-km-wide belt roughly 400 km long extending from Uchkuduk in the northwest to Nurabad in the southeast. Only sandstone-type deposits have been exploited so far. In 2014, the State Committee for Geology and Mineral Resources (Goskomgeo) evaluated that Uzbekistan has 185 800 tonnes of elemental uranium (tU) in situ: 138 800 tU of the sandstone type and 47 000 tU of the black shale type. As of 1 January 2017, Uzbekistan's total identified uranium resources at a cost of <USD 130 per kilogramme of uranium (/kgU) amounted to about 140 000 tU. Predicted resources are evaluated at about 25 000 tU.

Uranium-containing raw materials have been mined at approximately 20 sites in Central Kyzylkum in the Navoi region near the cities of Uchkuduk, Zarafshan, Zafarabad and Nurabad since 2000. Most production comes from six or seven mines and approximately ten sandstone-type deposits, developed by the underground mining method (at depths of 120-600 m) and in-situ leaching.

Mining and the processing of uranium ores and other types of raw materials is carried out by the state-owned company Navoi Mining and Metallurgy Combinat (MMC) (abnormal concentrations of molybdenum, vanadium, zinc, phosphorus, arsenic, antimony, copper, silver and gold reaching industrial values have been discovered in uranium-producing areas). Uranium-containing raw materials from the mines are fed into the processing plant, where they are processed by thermal, chemical and physical methods to obtain uranium salts, then higher uranium oxides (uranium dioxide, trioxide, etc.) (<https://oecd-nea.org/ndd/pubs/2018/7413-uranium-2018.pdf>).

Construction of a 2 400-MW NPP began in 2019, with commissioning planned for 2028.

Renewable energy and Energy efficiency

The Ministry of Energy is entrusted with implementing a unified state RES policy. In May 2019, the Law on the Use of Renewable Energy Sources and the Law on Public-Private Partnerships were adopted, creating a regulatory framework to accelerate the implementation of renewable energy projects.

The Resolution of the Cabinet of Ministers No. 610 of 22 July 2019 approved the Regulation for Connecting Businesses that Produce Electricity, Including from Renewable Energy Sources, to the Unified Electric Power System. The regulation defines the main technical aspects of integrating renewable energy facilities into Uzbekistan's single electricity system.

Presidential Decree No. PP-3981 of 23 October 2018 on Measures to Accelerate Development and Ensure the Financial Stability of the Electric Power Industry provides for the attraction of private direct investments in enterprises producing electricity, including through PPPs.

In addition, Presidential Decree No. PP-4422 of 22 August 2019 on Accelerated Measures to Improve the Energy Efficiency of Economic and Social Sectors, Implement Energy Saving Technologies and Develop Renewable Energy Sources calls for electricity produced from RESs, including hydropower, to expand to at least 25% of total electricity generation by 2030.

Almost 10 GW of new renewable energy facilities are therefore slated for construction, including 5 GW of solar (excluding individual household installations), 3 GW of wind and 1.9 GW of HPPs. These new facilities as well as the modernisation of existing HPPs will ensure renewable energy production of more than 37 billion kWh (compared with 5.9 billion kWh in 2018), as well as conditional annual savings more than 8.1 bcm of natural gas.

RES stimulation

Uzbekistan's Law on the Use of Renewable Energy Sources details a number of benefits and preferences to stimulate renewable energy use. Renewable energy producers and manufacturers of renewable energy generating units are granted the right to create local networks (electric, thermal and/or gas) and to conclude contracts with legal entities and individuals to sell electric and thermal energy and biogas produced from RESs, supplied through a local network.

To further promote renewable energy use, Presidential Decision No. PP-4422 of 22 August 2019 provides for the state budget to finance the following as of 1 January 2020, within the limits of annually approved parameters:

- compensation to individuals for 30% of the cost of acquiring solar photovoltaic (PV) installations, solar water heaters and energy-efficient gas-fired devices, up to UZS 3 million for solar PV; UZS 1.5 million for solar water heaters; and UZS 200 000 for gas burners
- compensation to individuals and legal entities to cover the interest expenses on commercial bank loans for the purchase of renewable energy generating units, energy-efficient gas burners and boilers, and other energy-efficient equipment.

Investment projects

Through a competitive selection process, the IFC chose Masdar Energy of the United Arab Emirates to implement a pilot 100-MW solar power plant investment project in the Navoi region, based on a PPP arrangement with a tariff of USD 0.027/kWh. Construction work was scheduled to begin in the first quarter of 2020, with commissioning planned for the first quarter of 2021.

Meanwhile, on 18 October 2019, the Government of the Republic of Uzbekistan and the IFC signed an agreement to attract consulting services and increase the capacity of the Scaling Solar project to 1 000 MW of solar TPPs.

In wind energy, agreements have been concluded with Juru Energy (United Kingdom) and Synergy Consulting (India) to provide consulting services and conduct relevant technical studies (financed by donor funding) as part of the auction for construction of a 100-MW wind farm in the Republic of Karakalpakstan. These agreements are based on a 14 January 2019 memorandum of understanding between the EBRD, the State Investment Committee and JSC Uzbekenergo.

In addition, the Ministry of Energy, the Ministry of Investment and Foreign Trade and the Asian Development Bank have signed a memorandum on providing consulting services for the implementation of up to 1 GW of solar power plant investment projects during 2019-25.

The Ministry of Energy is currently taking measures to announce and conduct competitive bidding in 2020 for the construction of solar TPPs with a total capacity of up to 600 MW in the Jazakh, Samarkand and Surkhandarya regions, based on PPP agreements.

Energy efficiency

According to the World Bank, Uzbekistan's economy is one of the most energy-intensive in the world. For example, the energy intensity of the country's GDP is 35% higher than in neighbouring Kazakhstan and three times that of Germany. The industry sector, which often uses outdated technologies in its production processes, accounts for 40% of all energy consumed in the country.

The Uzbek government aims to reduce the energy intensity of the economy by about 50% by 2030. To this end, state programmes have been initiated to modernise key energy-intensive sectors.

Upgrading obsolete equipment and production processes is critical to make enterprises more competitive. Greater energy efficiency not only reduces equipment maintenance and operations costs, it increases productivity, cuts energy consumption (which further reduces expenses) and mitigates climate change.

In recent years, Uzbekistan has raised its standing in the World Economic Forum's Energy Architecture Functionality Index by six positions. Formerly 84th out of 125 countries for energy efficiency, it now ranks 78th.

Regulatory framework

Tariffs

The Interdepartmental Tariff Commission (ITC) under the Cabinet of Ministers was established in 2018 to determine tariffs in Uzbekistan. The ITC's composition is approved by the Cabinet of Ministers, and it reviews and approves regulated tariffs (surcharges) on the following goods and services:

- electric and thermal energy produced by generating organisations
- electricity distribution and sales by distribution companies
- natural gas, crude oil and gas condensate production by JSC Uzbekneftegas and the Shurtan Gas Chemical Complex JSC
- LNG produced by extractive and/or processing companies and sold to organisations responsible for supplying households and social facilities.

The working body of the Commission is the Ministry of Finance, which provides organisational arrangements for the Commission's work.

Retail prices for gasoline and diesel fuel are determined on a market basis.

The government is working on switching to setting electricity tariffs based on reasonable expenses for its production, transmission, distribution and sales, taking into account the reimbursement of capital costs and maintaining 10-20% profitability. Starting in 2020, energy tariffs approved in the established manner will be set for at least a three-year period, and the purchase of electricity by a single purchaser will be carried out at tariffs determined by the ITC.

State support for low-income segments of the population will be provided by applying the basic rate of electricity and natural gas consumption, determined directly for

low-income groups, and by providing compensation for rising energy prices and tariffs for financially vulnerable consumers (<https://regulation.gov.uz/ru/document/2879>).

Electricity, natural gas and hot water tariffs increase regularly. The most recent tariff increase was on 15 August 2019, which raised the price of one cubic metre of natural gas for consumers with meters to UZS 380 (USD 0.04) – an 18.7% rise from the previous price of UZS 320 (USD 1 = UZS 8 839). In the absence of a meter, one cubic metre of gas for cooking and water heating costs UZS 660 (up 19.3% from UZS 553), and for heating the cost is UZS 380 (an 18.7% rise from UZS 320).

The cost of 1 kWh of electricity for household consumers is UZS 295 or USD 0.03 (an 18% rise from UZS 250 before the increase), and for other categories of consumers the tariff is UZS 450 (an increase of 36% from UZS 330) (<https://www.gazeta.uz/ru/2019/07/30/tariffs/>).

Regional markets and interconnections

Uzbekistan's energy system works closely with those of Kyrgyzstan, Kazakhstan, Russia and other Commonwealth of Independent States (CIS) countries through 220-kV and 500-kV lines. The small Lochin station in the Fergana valley is connected to Kyrgyzstan's power system by a 500-kV line. Seven 220-kV and two 110-kV interstate networks operate in the valley regions. In addition, 220-kV and 500-kV lines from the Tashkent TPP connect the power systems of Kazakhstan and Uzbekistan, ensuring their mutually co-ordinated operation.

The energy systems of Kyrgyzstan and Kazakhstan are interconnected in the same way. As a result, the energy ring linking Uzbekistan, Kyrgyzstan and Kazakhstan ensures optimal energy regimes.

In 2019, Tajikistan exported electricity to Uzbekistan through Surkhandarya Province and imported it to Khujand Province in Tajikistan through Syrdarya Province, indicating that the countries are connected to a single-network electricity system. Uzbekistan currently has 220-kV and 500-kV lines, and Tajikistan is implementing projects to use emergency automatics and relay protection.

Uzbekistan is developing international energy co-operation based on mutually beneficial economic relations. It particularly helps neighbouring Afghanistan by exporting electricity to it and plans to build a 500-kV line in the Surkhandarya region to increase its exports. In addition, Uzbekenergo plans to establish co-operation with Tajikistan's energy system.

Co-operation with Turkmenistan's energy system is also in view, which will allow Uzbekistan to use its energy system to transit Turkmen electricity to other regions.

The Central Asian countries signed a joint declaration on regional co-operation in energy reforms and the creation of a single electricity market as part of the Second Central Asian Conference on Energy Reforms held in Istanbul (<https://www.podrobno.uz/cat/economic/strany-tsentralnoy-azii-podpisa/>).

Chapter 3. Sustainable development

Renewable energy

As global GDP and population growth have aggravated environmental problems and raised awareness of energy resource limitations, many countries have made the transition to sustainable development their main goal.

Intergovernmental Panel on Climate Change (IPCC) research shows that raising the CO₂ price to USD 50 per tonne of carbon dioxide (/tCO₂) emitted into the atmosphere and expanding the use of RESs would help reduce CO₂ emissions 38% by 2030, and 70% by 2050.

Although the energy intensity of Uzbekistan's GDP has been declining in recent years, this indicator remains much higher than that of developed countries. Average global energy intensity of GDP is currently 240 kilogrammes of oil equivalent (kgoe)/USD 1 000. However, the energy intensity of Uzbekistan's GDP is almost four times higher than the European Union's and twice the world average. As a result, Uzbekistan is one of a group of countries with rather high levels of CO₂ emissions per unit of GDP.

Renewable energy potential

In 2018, Uzbekistan ratified the Paris Agreement and adopted a national commitment to reduce GHG emissions per unit of GDP by 10% of the 2010 level by 2030. According to the Strategy on the Transition of the Republic of Uzbekistan to the "Green" Economy for the Period 2019-2030, Uzbekistan aims to increase the share of RESs in total electricity generation to more than 25% by 2030. It also plans to double its energy efficiency indicator, reduce the carbon intensity of GDP, and provide the entire population and all economic sectors with access to modern, inexpensive and reliable energy.

Uzbekistan's considerable RES potential could spur significant development of a green, environmentally friendly economy. The country's total RES potential is 117 984 Mtoe, while its technical potential is 179.3 Mtoe.

The bulk of this potential lies in solar energy (total potential of 51 Gtoe and technical potential of 177 Mtoe). In fact, solar energy's technical potential is almost four times the country's primary energy consumption. Its favourable climate and geographical location would allow Uzbekistan to use solar energy for a wide range of industrial purposes. Wind energy potential totals 2.2 Mtoe, with 19% technical development possible.

Although total geothermal energy potential (67 Gtoe) exceeds that of solar, the underdevelopment of simple and cost-effective technologies to exploit this type of energy limits technical development to only 0.3 Mtoe.

Table 9 Uzbekistan’s RES potential

Renewable energy source	Gross potential	Technical potential
Hydropower	9.2 Mtoe	2 Mtoe
Wind power	2.2 Mtoe	0.4 Mtoe
Solar power	50 973 Mtoe	177 Mtoe
Geothermal energy	67 000 Mtoe	0.3 Mtoe
Total alternative energy sources	117 984 Mtoe	179.3 Mtoe

Uzbekistan’s total renewable energy capacity was 1 844 MW in 2018, which covered about 3% of total energy consumption. On average, 10-12% of the country’s total electricity is generated from RES.

Renewable energy goals

While Uzbekistan’s annual electricity production amounted to 54.2 billion kWh in 1991, it had dropped to 45.4 billion kWh by 1996 because the power units at its largest power plants had become obsolete. Electricity production rose steadily between 1996 and 2018, however, as a result of modernisation and commissioning of new power units.

Uzbekistan’s total electricity generation capacity is 14.1 GW, with TPPs accounting for 85.8%. With GDP and population growth, the country’s electricity demand is bound to increase. Production is therefore forecast to rise to 84.9 billion kWh by 2025 – 40% above the 2018 level. Electricity generation capacity is expected to expand 2.5 times to double annual production by 2030.

Today, many countries’ renewable energy goals include reducing GHG emissions, increasing the share of renewable energy in final energy consumption, and meeting growing demand for energy. Uzbekistan is also developing objectives to promote renewable energy and increase its share in the overall energy balance. It particularly

aims to increase the share of renewable energy in total electricity production from 10-12% in 2018 to 20% by 2025, including raising the HPP portion from 10-12% to 15.8%, solar energy from 1.95% to 2.3% and wind energy from 1.36% to 1.6%.

Factors inhibiting renewable energy development

As in other developing countries, a number of factors continue to hinder renewable energy development in Uzbekistan.

- First, the high cost of producing renewable energy and its limited generating capacity compared with traditional energy sources, as well as the low cost of traditional energy sources compared with other countries. The cost of producing electricity from RESs is still high in developing countries, and Uzbekistan leads the group of countries supplying their populations with inexpensive electricity: the average cost of 1 kWh of electricity in Uzbekistan in 2018 was USD 0.024, while in Kazakhstan it was USD 0.035; in Turkmenistan USD 0.07; in Russia USD 0.048; and in China USD 0.13. In comparison, the cost in developed countries was: USD 0.338 in Germany; USD 0.186 in the United Kingdom; USD 0.333 in Denmark; and USD 0.318 in Belgium.
- Second, there are no specific financial support mechanisms (tariffs and taxes) that stimulate RES use. The legal framework for economic mechanisms promoting RES use is inadequate.
- Third, progressive techniques and technologies based on modern control systems are not sufficiently developed. One of the main reasons for the low rate of RES development is the technical imperfection of these types of energy production technologies. Plus, short-term energy system profitability is low.
- Fourth, as in many other developing countries, public awareness of modern forms of energy – especially renewable energy – is lacking.
- Fifth, innovative renewable energy technologies are being developed too rapidly for Uzbekistan to keep up. For example, solar panels made of semiconductor silicon were quickly replaced by photoelectric panels made of amorphous silicon, and then by flexible solar cells. Because there is no local renewable energy technology manufacturing in Uzbekistan, purchase, installation and maintenance costs remain high. Rapid development of the industry requires that outdated technologies be quickly replaced with new ones.
- Sixth, nuclear power influences the scale of renewable energy use and hampers development of the energy sector. Studies show that producing clean energy from RESs is 20 times more expensive than from NPPs. It is estimated that world reserves of coal will last 270 years, oil 50 years and gas 70 years, whereas uranium reserves used in NPPs total 5 718 400 tonnes – enough for 2 500 years. In 12 countries the share of NPPs in electricity production is high, exceeding 30% (75% in France; 54% in the Slovak Republic; 51% in Belgium; and 46% in Ukraine).

Stimulating renewable energy development

An important tool for promoting renewable energy is the green certification system, which clarifies and approves information on the composition and types of fuels used in a country, and provides transparency on the origin of electricity. These certificates are also used for product labelling.

Green certificates are used to encourage RES use, as they are the basis upon which the government provides subsidies, benefits and other types of financial assistance to producers, consumers and suppliers of renewable energy.

Another important economic mechanism for promoting renewable energy is the green tariff, which has been introduced in more than 65 countries around the world to encourage investment in renewable energy technologies.

To counterbalance the elements hindering development of the renewable energy sector in Uzbekistan, the government should introduce a variety of economic incentive mechanisms, including a green certification system, green tariffs, bonus tariffs (feed-in tariffs), grants and subsidies, and tax benefits.

The wide availability of RESs that do not have a negative impact on the environment, and that can reduce emissions of CO₂ and other harmful substances as well as mitigate climate change, will inevitably raise interest in the use of renewable energy in Uzbekistan in the near future (<https://review.uz/ru/post/vozobnovlyaemaya-energiya-dlya-ustoychivogo-razvitiya>).

Wind

Experts estimate gross wind energy potential to be 2.2 Mtoe, but this does not take wind potential in local regions (e.g. Bekabad, Ustyurt) into account. The development of wind power in Uzbekistan is very promising for agriculture in remote areas. Additional opportunities for irrigation and enlarged access to a reliable energy supply would considerably improve the quality of life for farmers and residents of remote rural settlements.

Based on the results of recent investigations, a map of the country's wind energy potential has been drawn up: mesoscale modelling shows that Uzbekistan has more

significant wind energy resources than previously recognised. The regions with the highest wind potential are a mountainous region northeast of Tashkent, mountain ranges south and east of Samarkand, and a mountain range between the Djizak and Samarkand regions. The Navoi region and the Republic of Karakalpakstan also have high wind-energy potential (www.vsemirnyjbank.org/ru/news).

Geothermal

Geothermal resources are available in almost all regions, as long-term research has revealed eight large hydrothermal resource pools. The gross potential of geothermal water is estimated at 244 200 tonnes of coal equivalent (tce), but the technical potential has not been determined. The greatest geothermal water potential is in the Fergana Valley (Namangan region: 42 600 tce) and the Bukhara region (81 200 tce). The average temperature of Uzbekistan's geothermal waters is 45.5°C, and the highest thermal potentials for groundwater have been recorded in the Bukhara (56°C) and Syrdarya (50°C) regions. The best opportunities for developing geothermal energy are in the Fergana Valley, but subsoil heat is available for use in a number of other areas.

In the future it will be possible to exploit this heat resource in almost all parts of the country, because in all regions the temperature of rock material at depths of 4 000 m to 6 000 m is in the range of 70°C to 300°C. Despite the quality research that has been done on geothermal reservoirs, thermal water use is still at an early stage. The development of thermal springs is being undertaken through the national energy programme, but to date there is no generating capacity in the country.

Biomass

Uzbekistan has the potential to use cotton stems, residues from other crop production sectors, industrial and domestic waste, and livestock and reed waste as energy resources for producing heat and electricity (through direct combustion or gasification).

From one hectare of cotton-sown land, it is possible to remove 2-4 tonnes of cotton stalks. The dried stems of cotton plants have traditionally been used in rural areas as fuel, and their calorific value is akin to that of logging residues. These stems may be processed to be used in briquette form, or they may be thermochemically decomposed to produce biogas. The annual gross energy potential of cotton plant stalks is estimated to be 2.3 Mtoe, and the technical potential (using thermochemical biomass conversion technology) is 0.3 Mtoe.

Reeds, another vegetative resource, grow spontaneously along the banks of canals and water bodies in volumes of 10 Mt to 12 Mt per year.

The resources of logging, however, are insignificant, since only a small part of Uzbekistan (3.2% of the total land area) is forested: the largest area is occupied by saxaul, juniper and barilla plant. All the country's forests are in the group I classification, and commercial felling in them and some types of non-commercial felling are not permitted.

As a result of the vast amount of land devoted to farming, more than 9 million head of cattle and 15 million sheep and goats generate more than 100 mcm of organic waste per year.

Thorough research is needed to accurately assess the energy potential of biomass, and it should be borne in mind that cotton stalks are traditionally used in rural areas for cooking; waste from cereal and other agricultural crops is used as fodder for livestock and for building material; and livestock and poultry waste is used locally as a fertiliser, or is naturally dried to be used as fuel.

Preliminary studies have shown that the most common direct use of biomass in Uzbekistan is in processing biomass and organic agricultural waste to produce biogas. As fertiliser can also be produced in the biogas production process, obtaining both organic fertiliser (biofertiliser) of high quality and an autonomous energy source at the same time will offset the GHG emissions and environmental damage that come from the systems for collecting organic waste, thereby creating an ecologically closed energy system. The economic effects of using biofertilisers are therefore very similar to those of using biogas, making biofertiliser the second most-important product of biogas technologies.

Furthermore, biogas complexes can be installed in remote rural settlements and on small farms that do not have access to traditional energy sources. It is not possible, however, to organise the industrial production of biogas plants or their individual components (e.g. pipe fittings, metal structures, wires and cables, basic mechanical and rubber products, and control devices) in Uzbekistan.

Waste

More than 30 mcm of solid household waste are generated annually in Uzbekistan, and the total accumulation of such wastes in polygons located in settlements is more than 100 mcm. Because a sufficiently acceptable technology for their processing is lacking,

they are stored without preliminary processing or separation into fractions and useful components. With the biological decomposition of these household wastes, numerous landfills emit methane, carbon dioxide, etc., into the environment.

Fuel switching

In 2019, the Government of Uzbekistan launched a programme for converting to natural gas-fuelled vehicles. Currently, more than 800 000 cars use compressed natural gas (CNG) and liquefied petroleum gas (LPG). The serial production of cars at Uzbekistan's GM enterprises and of ISUZU trucks installed with gas-cylinder equipment is highly developed (<https://lex.uz/docs/3377221>).

Environmental protection

Uzbekistan has adopted an Environmental Protection Concept of the Republic of Uzbekistan until 2030 and a roadmap for its implementation.

The Concept pays particular attention to environmental protection in the energy sector. It points to the unsustainable use of natural resources, including water and land, fuel and energy, and biological resources, without taking further development prospects into account.

Uzbekistan's main sources of air pollution are metallurgy, energy, construction materials, oil and gas, and mining industries, as well as motor transport.

Anthropogenic activities have led to the accumulation of billions of tonnes of industrial waste, as well as solid domestic waste, which is often placed in substandard landfills, dumps and sludge storage facilities. The most damaging industrial wastes are generated by the mining, oil and gas production, coal and chemical industries.

According to Presidential Decree No. UP - 5863 of 30 October 2019 (<https://lex.uz/docs/4574010>), a variety of measures should be implemented by 2030 to improve the quality of the natural environment:

- ensure the reduction of air pollutant emissions
- increase the share of RES use in the overall structure of generating capacities
- encourage energy efficiency in buildings, promoting the use of low-carbon technologies (heat pumps, renewable energy) and cleaner fuels in individual households
- in transport, shift to gas-cycle fuel, electric traction and other alternative fuel technologies, and improve road infrastructure

- adopt standards for all types of wheeled vehicles as well as Euro-6 motor fuels
- ensure the development and adoption of specific emissions standards for pollutants produced by electricity and heat generation
- create inventories of pollutant emissions, including by economic sector
- revise state standards for solid fuels to reflect environmental considerations
- ensure that coal mined in Uzbekistan is enriched to increase its calorific value and reduce ash content
- ensure that existing standards are harmonised with International Organization for Standardization (ISO) and International Electrotechnical Commission (IEC) requirements.

In addition, the government will forbid:

- new ecological-class motor fuel production below the Euro-4 level as of 1 January 2020
- the “temporary import” customs regime and “release for free circulation (import)” of motor fuels below the Euro-3 ecological class as of 1 January 2022, and below Euro-4 as of 1 January 2023.

Climate change

Uzbekistan has been a party to the United Nations Framework Convention on Climate Change since 1993, it signed the Kyoto Protocol in 1998 and ratified it in 1999, and it ratified the Paris Agreement in 2018.

Ongoing global warming trends pose a great risk to human health and economic development, and Uzbekistan is among the countries most vulnerable to climate change.

Ratification of the Paris Agreement imposes certain obligations on the country, such as reducing GHG emissions and attracting additional funds to modernise infrastructure and improve energy efficiency.

Uzbekistan’s greatest GHG emissions (more than 80%) originate in the energy sector, from the combustion of fossil fuels (oil, natural gas and coal) and technological methane leaks during the extraction, processing and transportation of natural gas. The share of emissions from fuel combustion has fallen from 71% to 59% in recent years, while at the same time the share of methane leaks from oil and gas complexes and coal production has risen. The increase in emissions associated with methane leaks is mainly due to higher volumes of gas processing (including transit gas).

Uzbekistan is implementing Green Economy principles, which provide for:

- The development of economic measures and levers, including the introduction of fees to reduce GHG emissions, a system of incentives for energy-saving, including through the application of financial benefits, and energy management and auditing of energy-intensive enterprises.
- Reconstruction and modernisation of the generating capacities of existing power plants with the introduction of highly efficient technologies based on steam-gas and gas turbine units.
- The complete equipping of power consumption systems with automatic control and metering devices.
- The introduction of new thermal energy generation technologies, including co-generation in central boiler houses and coal-fired steam-turbine power units operating on ultra-supercritical steam parameters, and modernisation and reconstruction of outdated boiler-house equipment.
- Implementation of the Law on the Use of Renewable Energy Sources and the Law on the Rational Use of Energy.
- The reduction of natural gas losses during natural gas production, processing, transportation and distribution through the modernisation of compressor stations, low- and medium-pressure gas distribution networks, and the gas transportation system with the introduction of a SCADA system.
- The improvement of approaches to architectural and planning solutions in the construction and reconstruction of buildings, taking energy efficiency improvements into account; the creation of an energy certification system for buildings; and the revision of existing norms and standards (and the adoption of new ones) for thermal-insulating building materials.

Technology research, development and deployment

An important condition for Uzbekistan's dynamic development is the accelerated introduction of modern, innovative technologies in the economic, social and other domains with the widespread use of scientific and technological advances.

Research and development (R&D) in Uzbekistan covers three main groups of activities: fundamental research; applied research; and technological development.

In 2018, Uzbekistan's R&D expenditures amounted to 0.1% of GDP (<https://knoema.ru/atlas>). R&D financing in Uzbekistan is much lower than in developed countries, interactions between scientific institutions and the economic sectors and the

social sphere are low, and the activities of ministries and agencies, as well as local authorities in the field of innovative development, are poorly co-ordinated.

The World Intellectual Property Organization (WIPO) Global Innovation Index (GII) for 2019 indicates innovation levels for 129 countries. While the index provides rankings for Kazakhstan (79th), Kyrgyzstan (90th) and Tajikistan (100th), Uzbekistan has not yet been included (<https://www.globalinnovationindex.org/gii-2019-report>).

In accordance with Presidential Decree No. UP-5544 of 21 September 2018, the Strategy for Innovative Development of the Republic of Uzbekistan for 2019-2021 and the roadmap for its implementation were adopted. The strategy provides for an increase in public spending on R&D, bringing this figure to 0.8% of GDP by 2021. The Global Innovation Index anticipates that Uzbekistan will join the ranks of the 50 advanced countries of the world by 2030.

The government intends to strengthen the country's scientific potential and the effectiveness of scientific R&D by creating effective mechanisms to integrate education, science and entrepreneurship for the widespread introduction of research results, experimental design and technological work (<https://lex.uz/ru/docs/3913186?ONDATE=22.09.2018%2000>).

Scientific institutions engaged in R&D work

Today Uzbekistan is an important scientific centre in Central Asia with a well-developed research base and qualified scientific personnel. Its scientific potential is founded on the Academy of Sciences of the Republic of Uzbekistan.

Results of the Academy of Sciences' applied research and innovation in the field of energy include:

- Import-substituting ceramic filter cartridges, pontoons, and membranes for fine purification of oil and gas products, introduced at the enterprises of Uzbekneftegaz JSC and Uztransgaz JSC within the national programme of localisation.
- Technology for producing aviation fuel based on local raw hydrocarbon materials for the Boeing A-1 jet, Airbus and RG gas-turbine aircraft engines.
- Development of the theory, principles and automated control systems of electricity networks and their relevant equipment, and of the problems of RES use.

Uzbekneftegaz has several divisions engaged in R&D:

- Uzbek Research and Design Institute of the Oil and Gas Industry (the UzLITIneftegas JSC) provides comprehensive scientific and design support for developing and improving hydrocarbon fields and the construction of oil and gas facilities.
- The Institute of Geology and Exploration of Oil and Gas Fields (IGIRNIGM JSC) is the largest research centre in Uzbekistan for oil and gas geology, drilling and gas condensate research. The main research goal in the field of oil and gas geology remains active assistance in discovering new oil and gas fields and increasing the country's hydrocarbon base.
- The I.M. Gubkin Branch of Russian State University of Oil and Gas (National Research University) in Tashkent specialises in formation of the national innovation system and the basis of innovative economy; the development of sustainable growth strategies and mechanisms of innovative oil and gas complex development; and the formulation of risk management strategies in oil and gas companies and others.
- Professional oil and gas industry colleges.
- Personnel training for the oil and gas industry.
- The Bukhara Vocational College of Oil and Gas.
- The Fergana Vocational College of Oil and Gas.
- The Uzbek Oil and Gas Magazine is published quarterly and is the only sectoral publication in Uzbekistan.

JSC Uzbekenergo has the following scientific departments:

- The Scientific and Technical Centre of JSC Uzbekenergo aims to raise the level of scientific and technological development and introduce modern, highly efficient technologies into the electric power industry, ensure the implementation of strategic modernisation programmes and the technical and technological re-equipment of electric power enterprises, and create modern research and laboratory facilities.
- The International Institute of Solar Energy introduces high-tech developments into the industrial use of solar energy and prepares proposals for the practical use of solar energy in various sectors of the economy and the social sphere.
- The international magazine Heliotekhnika covers all the main areas of R&D on solar energy use: the direct conversion of solar energy into electrical energy; solar installations and their application; solar energy concentrators; solar power plants; solar engineering materials science; solar heat/cold supply; storage; solar radiation; and RESs (<http://geliotekhnika.uz/ru/page/2>).

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