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Georgia Energy Profile

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Overview

Country overview

Located in the South Caucasus region at the crossroads of Western Asia and Eastern Europe, Georgia is bounded on the west by the Black Sea, on the north by the Russian Federation (hereafter “Russia”), on the south by Türkiye and Armenia, and on the southeast by Azerbaijan. Being on the shortest route between Europe and Asia, Georgia’s transport system is a key link in the historic Silk Road trade network. Tbilisi is Georgia’s capital and largest city, and the country covers a territory of 69 700 square kilometres (km²) with a population of 3.7 million. It is a unitary semi-presidential republic, with the government elected through a system of representative democracy.

Georgia’s overall economic policy has been focused on creating a liberalised economic environment through minimal state interference, deregulation, privatisation, reduced and simplified licensing and taxation, and free trade. It has therefore been pursuing westward-oriented political, economic and foreign policies, and signed an association agreement (including assent to the Deep and Comprehensive Free Trade Area) with the European Union in June 2014. The European Parliament ratified the Association Agreement in December 2014, and in October 2016 the Georgian Ministry of Energy signed an Accession Protocol to the Energy Community Treaty, ratified by the parliament in April 2017. The country has been a signatory to the Energy Charter Treaty since 1995 and a member of the World Trade Organization since 2000. The reforms that followed have included adoption of the Law on Energy and Water Supply and the Law on Support of the Renewable Energy Sources in December 2019. Laws on Energy Efficiency and Energy Performance of Buildings were adopted on 21 May 2020.

Average annual economic growth of 3.6% between 2017 and 2021 was achieved through structural reforms that stimulated capital inflows and investment, but it was seriously hampered by the Covid-19 crisis. Reforms improved the business environment, strengthened public finances, upgraded infrastructure facilities and liberalised trade. Growth was also supported by increased foreign direct investment (FDI) and was driven by capital accumulation and the sound use of excess capacity rather than by net job creation, with productivity gains concentrated mainly in the

non-tradeable sectors. Gross domestic product (GDP) per capita (in current prices) increased from USD 920 in 2003 to USD 5 015 in 2021.¹

Georgia has developed a stable and reliable energy sector that has been largely unbundled since the mid-1990s; its primary domestic energy sources are hydropower and fuelwood. The government is focused on securing private investment to construct new hydropower stations, increase thermal generation efficiency and diversify fossil fuel supply sources and routes, but further efforts are required to improve efficiency in domestic energy use and to capitalise on the country's ample renewable energy potential.

Key energy data

TES: 4.94 Mtoe (natural gas 47.1%; oil and oil products 26.6%; hydro 14.4%; coal 4.3%; bioenergy 4.6%; other renewables 0.5%), +58.3% since 2010.

TES per capita: 1.33 toe/cap (world average: 1.80 toe/cap)

TES per unit of GDP: 99 toe/2015 USD million PPP (world average: 113 toe/USD million PPP)

Energy production: 1.04 Mtoe (hydro 68.0%; bioenergy 21.8%; coal 3.9%; oil 3.0%; other renewables 2.5%; natural gas 0.7%), -20.5% since 2010.

Supply²

- Georgia's energy production covers about one-fifth of its energy demand (21.1% in 2020).
- Most of Georgia's domestic energy production (1.043 Mtoe in 2020) comes from hydro (0.709 Mtoe) and bioenergy (0.227 Mtoe).
- Fossil fuel production exists but is very limited (40.3 ktoe of lignite, 31.8 ktoe of crude oil and 7.7 ktoe of natural gas in 2020).

Imports

- Georgia depends on imports for all its natural gas (2.7 bcm in 2020) and most of its oil products (1.33 Mt in 2020).
- Oil is imported mainly in the form of refined oil products (42.1% diesel and 40.4% gasoline).

¹ Preliminary figures for 2021.

² https://www.geostat.ge/media/28552/Sagartvelos-Energetikuli-Balansi_2018_GEO.pdf.

Demand

- Georgia's final energy consumption was 4.49 Mtoe in 2020.
- From 2000 to 2020, both final energy demand and electricity consumption per capita more than doubled, and are very close to global averages.
- The final energy mix is relatively diverse compared with other countries in the region. In 2020, natural gas was the first fuel in the mix (38.5%), followed by oil products (29.3%) and electricity (22.0%). The remainder is covered by renewables (5.5%) and coal (4.7%).
- About 80% of Georgia's electricity generation comes from hydro resources (80.5% in 2021), with the remainder produced from natural gas and from a 20.7-megawatt (MW) wind power plant (83.4 GWh in 2020).
- The residential sector has the largest share of final energy consumption (1.41 Mtoe in 2020), followed closely by transport (1.34 Mtoe in 2020). Although the transport sector has historically claimed the highest share, Covid-19 lockdowns reversed this trend.

Renewables

The share of renewables in Georgia's electricity mix is among the highest in the world (81.1% in 2021).

Energy production and self-sufficiency

Georgia's energy-policy aim is to raise the country's energy security, guaranteeing an uninterrupted supply of various energy products of acceptable quantity, quality and price to support national interests.

As a net oil and gas importer, Georgia relies heavily on imports of natural gas, oil products and hard coal to meet most of its energy needs. In fact, net imports in total energy supply (TES) rose from 47% in 2002 to 81.4% in 2020 to meet rising energy demand. After the energy crisis of 2006, the country began reducing imports from Russia and increasing those from Azerbaijan, with 84.1% of natural gas and 17.9% of oil consumption now imported from Azerbaijan. Gas imports are highest during the winter months when there is a greater need for heating and less hydropower capacity is available for electricity generation.

Interconnected with Russia, Azerbaijan, Armenia and Türkiye, Georgia exports its seasonal excesses of electricity from hydropower, but it has registered negative net electricity exports since 2012 (except in 2016). Since 2016, Azerbaijan has been

transiting its electricity to Türkiye via Georgia. Transits from neighbouring countries peaked in 2021 at 1.18 TWh, of which nearly 61% was transited from Azerbaijan to Türkiye.

Because of Georgia's substantial rise in domestic energy demand and the seasonality of hydropower generation, the government is exploring all avenues to diversify oil and natural gas supply sources at the same time as aggressively promoting further hydropower development. It is also co-operating closely with neighbouring economies to develop projects for transiting energy through its territory to secure additional natural gas supply sources.

Crucial to its energy security, Georgia is trying to develop its own gas storage to hold strategic volumes of gas stocks and to regulate seasonal imbalances in supply and consumption. An underground option with an active gas volume capacity of 210-280 mcm has been studied extensively, but the final decision is still pending.

Fuelwood, the main fuel source for space heating in rural areas, accounts for 21.6% of energy produced from domestic sources. Most wood for fuel is harvested unsustainably and used inefficiently, which has led to forest depletion and related environmental problems. While extending gas access to rural areas has significantly reduced fuelwood consumption, it is still more than double the level of sustainable use. To remedy this situation, the state is introducing new forest management practices and supporting the production and use of upgraded modern biofuels made from waste biomass.

Energy sector governance

Executive

As the body tasked with governing the energy sector, the **Ministry of Economy and Sustainable Development (MoESD)** is responsible for state policy in the energy sector as well as policies related to sustainable development of the country's economy.³ It leads energy sector reforms to implement the relevant EU directives and regulations in compliance with Energy Community membership. It took over the responsibilities of the former Ministry of Energy in 2017 and can adopt secondary legislation related to the energy sector (through ministerial orders).

To ensure sustainable resource development and protection of the environment, the **Ministry of Environment Protection and Agriculture (MEPA)** develops national

³ In November 2017 the MoESD absorbed the Ministry of Energy, with its functions transferred accordingly.

policies and strategies on environmental and natural resource protection and engages in forest and waste management, in addition to other activities.

The **Georgian Energy Development Fund** is a state-owned joint-stock company (JSC) created in 2010 and reporting to the MoESD. Its mission is to develop Georgia's renewable energy potential by identifying promising renewable energy projects and supporting their development through pre-feasibility studies and preliminary environmental impact assessments, and by finding investors.

The **Public-Private Partnership Agency** was created following adoption of the Law on Public-Private Partnerships in May 2018. The agency's mandate is to lead the development and implementation of public-private co-operation projects.

Georgian State Electrosystem (GSE) is an electricity transmission system operator. The company owns and operates 3 550 km of transmission lines and 93 substations spread throughout the country. The National Dispatch Centre manages the transmission network, and three regional networks (East, West and Kakheti) provide technical maintenance. GSE also manages the cross-border transmission lines interconnecting Georgia with Russia, Türkiye, Armenia and Azerbaijan.

Georgia's **Electricity Market Operator (ESCO)** exclusively oversees electricity balancing and guaranteed capacity trading, manages seasonal electricity imports/exports and inspects the wholesale metering nodes.

Georgian Oil and Gas Corporation (GOGC) owns the main gas pipeline system and ensures the unimpeded operation of transboundary oil and gas transportation systems on Georgia's territory. It also develops and operates gas-fired power plants.

Georgian Energy Exchange (GENEX) is a JSC established in 2019 by GSE and ESCO to function as a market operator. GENEX's main tasks include operating the day-ahead market, the intraday market and the bilateral contracts market. It also manages the financial clearing system for the day-ahead and intraday markets.

Legislative

The Constitution lays out the legislative process for introducing primary legislation in the energy sector. Legislative initiative is the prerogative of the government, ministries (initiating laws through the government), parliamentary committees, groups or individual members of parliament, and citizens when an initiative has at least 30 000 supporters. By default, laws are adopted in three hearings by the parliament and enter into force 15 days after publication.

Regulations and secondary legislation are also initiated and passed by the Georgian National Energy and Water Supply Regulatory Commission (GNERC) and the MoESD (through ministerial orders). GNERC does not have the right to initiate primary legislation and its regulations cannot come into force until at least 21 days after initiation, but the time frame for ministerial orders is not regulated.

The parliamentary **Committee on Sectoral Economy and Economic Policy** oversees energy sector developments through regular or topical hearings with the participation of the MoESD and other stakeholders. The parliamentary **Environmental Committee** is concerned with the environmental impact of energy projects as well as forestry reform, which may influence the use of biomass as a fuel.

Judiciary

GNERC resolves disputes among regulated market participants or between consumers and service providers in the energy sector. Cases are resolved in open hearings, but if parties disagree with the GNERC decision they are authorised to take their case to the general courts.

Among the cases that have been taken to the Constitutional Court, one initiated in 2002 questioned the new tariff adjustment and amendments to the Electricity and Natural Gas Law and the ministerial order related to communal metering.

Regulation

GNERC, Georgia's independent energy and water supply regulator, was established in 1997 and its responsibilities include: regulating the activities of importers and exporters and of the market operator/supplier (ESCO); monitoring the electricity market and approving market rules; licensing electricity generation, transmission, dispatch and distribution; licensing natural gas transportation and distribution; regulating electricity generation, transmission, distribution and end-user tariffs and import prices; resolving disputes; developing metering, billing and collection services; and approving grid codes. GNERC also sets caps on wholesale prices for existing plants based on their costs, except for small and medium-sized hydropower plants (HPPs) developed since 2008. GNERC also does not regulate power purchase agreement prices for new HPPs under development.

The **State Agency for Oil and Gas** was established in 1999 as an independent regulatory body under the Oil and Gas Law, to oversee and regulate oil and gas exploration and production activities. Since 2013, the State Agency for Oil and Gas has been a legal entity under public law within the Ministry of Energy (currently the

MoESD) and is responsible for regulating oil and gas operations, oil refining, gas processing, and/or transportation activities in Georgia according to Oil and Gas Law Amendment No. 467 of 25 March 2013.

Regulatory framework

The new Law on Energy and Water Supply, approved by Georgia's parliament in 2019, was developed in co-operation with the Energy Community to transpose the requirements of key electricity and gas directives into Georgian legislation. The law creates the legal framework to develop a more independent, competitive and liquid market by unbundling and granting certification to transmission and distribution system operators.

In 2019-2020, the Parliament approved the Law on Energy Efficiency, the Law on Energy Efficiency of Buildings, the Law on the Promotion of Production and Use of Energy from Renewable Sources, and the Energy Labelling Law. However, a system of secondary legislation needs to be developed for effective implementation of these laws. This process is ongoing.

According to the Energy Efficiency Law, state policy on energy efficiency aims to create a legal framework for energy efficiency, define a national energy efficiency target and eliminate barriers hindering energy efficiency development. On 23 December 2019, the government of Georgia approved the National Energy Efficiency Action Plan 2019-2020 for implementation of the energy efficiency policy by Decree N2680. Since the beginning of 2021, the MoESD has been working on an integrated National Energy and Climate Plan (NECP) for 2030 covering the five priority areas of a possible energy union:

- energy security
- the internal energy market
- energy efficiency
- decarbonisation and renewable energy sources
- research, innovation and competitiveness.

The draft NECP must be approved by parliament as part of the country's National Energy Policy and submitted to Energy Community Secretariat in the summer of 2023.

Previously, in December 2019 Georgia's government adopted a National Renewable Energy Action Plan (NREAP), but its activities covered 2019-2021 only. While the

NREAP dictated that support schemes for small-scale heating and cooling from renewable energy sources should not yet be implemented but instead be reflected in bylaws, measures for developing renewable energy are now included in the NECP to be approved in the spring of 2023.

The Law on Energy and Water Supply provides the legal basis for power-related secondary legislation, the main pieces of which are the Electricity Market Model Concept and the Electricity Market Rules. By Decree No. 246 of 16 April 2020, the government of Georgia adopted the Electricity Market Model Concept, which introduces general organisational principles for the wholesale electricity trade market:

- Competitive, transparent and free trade on electricity markets.
- Avoidance of conflicts of interest and discrimination.
- Sale of electricity on the wholesale market by means of a competitive market, particularly through bilateral agreements and/or on organised electricity markets, including day-ahead intraday and balancing markets.
- Trade of electricity on organised markets only, by public energy enterprises and service providers using the facilitation mechanism/scheme envisaged under the Law on Facilitation of Production and Use of Renewable Energy.
- Determination of hourly generation and consumption schedules, means of electricity generation/consumption, and loading capacity by the responsible persons (self-dispatching).
- Hourly trade on organised markets and, accordingly, liability of market participants for hourly imbalances.
- Purchase of electricity only on day-ahead and intraday markets to reimburse losses.
- Allocation of cross-border capacities in accordance with transparent and fair rules.

In 2019, the first Energy Exchange was established in Georgia. The Energy Exchange is a neutral, unbiased and transparent organisation that, upon obtaining appropriate licences, will act as an operator of organised electricity markets. The Exchange will ensure the introduction and operation of day-ahead and daily markets through the software services of Nord Pool Consulting. It will apply the Electricity Supply and Consumption Rules and the Electricity (Capacity) Market Rules (2006; amended in 2010 and since), which outline the electricity and natural gas tariff methodology and conditions for retail and power supply markets. In 2013, the government approved Resolution No. 214 on the Approval of Rules for Expression of Interest in Conducting Technical and Economic Feasibility Studies for the Construction, Ownership and Operation of Power Plants in Georgia.

The Law on Oil and Natural Gas (1999) created a unified legal framework for state regulation, supervision, control and development of oil and gas resources and oil refining, gas processing and transportation, and for pursuing a unified national policy in these fields. It also made the Oil and Gas Agency responsible for regulating the subsector.

Key policies

The main directions of the draft National Energy Policy (NEP) are:

- **Diversification** of external energy supply sources.
- Increased energy sector **resilience** throughout the country.
- Greater **renewable energy resource** use, to become a regional leader in clean energy production and trade.
- Development of **fossil energy resources** for greater energy security.
- Increased energy supply and consumption efficiency.
- **International energy co-operation**, including regional energy trade development.
- Co-operation through an energy union and with the ENTSO-E Continental Europe Synchronous Area.
- Energy **market reform** and establishment of a competitive market.
- Reduced environmental impact.
- Climate change mitigation and adaptation.
- Better service quality and protection of customer interests.
- Elimination of energy poverty and help for vulnerable consumers.
- Research, innovation and technological development.

The National Integrated Energy and Climate Plan, which forms the appendix of the NEP, formulates the concrete state policies and measures of these directions in detail.

Meanwhile, GSE prepared its [Ten-Year Network Development Plan of Georgia for 2021-2031](#) and the MoESD approved it on 17 February 2021 by Order No. 1-1/42, and the GOGC Board of Directors has approved the [Ten-Year Development Plan for Georgian Gas Transmission Infrastructure 2021-2030](#).

As a participant of COP21 and a signatory to the Paris Agreement, Georgia submitted an Intended Nationally Determined Contribution ([INDC](#)) to the United Nations Framework Convention on Climate Change (UNFCCC). Then, in 2021 the Ministry of Environmental Protection and Agriculture, with technical assistance from GIZ,

developed and submitted a more ambitious [Nationally Determined Contribution \(NDC\) with its Climate Action Plan 2021-2030](#).

Launched in 2019 and funded through the European Union's EU4Climate programme, Georgia's Low Emission Development Strategy (LEDS) aims to develop a gender-sensitive emissions-reduction strategy by mid-century to help Georgia fulfil its Paris Agreement commitments. The LEDS is also meant to be used as a foundation for environmentally sound long-term planning in several sectors: energy; buildings; industry; transport; agriculture; land use, land-use change and forestry (LULUCF); and waste. The draft was submitted in 2022.

Energy statistics

Official energy statistics are the responsibility of the National Statistics Office of Georgia (Geostat). Seven staff members dedicate part of their time to compiling energy statistics in addition to industry and construction statistics.

Energy data are collected annually through a set of questionnaires sent to all sectors of the economy (services are surveyed every five years). Since 2015, enterprises have been obligated by law to reply to surveys and may do so through online forms, but in-person interviews are conducted for households. Geostat aims to increase the use of administrative data for source data or for data-checking.

The main energy publication is the Energy Balance of Georgia. It contains annual supply and demand data for all fuels, in physical and energy units broken down by sector, as well as information on power plant capacities. The underlying data can be downloaded from the Geostat website in Excel format.

Official annual data are shared with the United Nations Statistics Division (UNSD) and the International Energy Agency (IEA) through five joint IEA/Eurostat/UN Economic Commission for Europe (UNECE) questionnaires. Monthly oil and gas data are also collected and transmitted to the UNSD for publication through the Joint Organisations Data Initiative (JODI). In 2016, when Georgia became an Energy Community member, additional indicators for energy statistics were required in accordance with European Parliament and Council regulations. To fulfil these reporting obligations, Geostat submits annual energy questionnaire responses to the IEA and Eurostat (for coal, electricity, renewables, oil and gas).⁴ Since 2018, Geostat has also been publishing monthly oil and gas data as well as electricity and gas prices.

⁴ <https://www.iea.org/statistics/resources/questionnaires/>.

Geostat has an active institutional co-operation policy and holds regular meetings with its main data providers and users, such as the Ministry of Energy (now the MoESD), the GOGC and GNERC. It also leads an informal national energy statistics consulting group that serves as a platform for dialogue and information-sharing among national data providers and users. Geostat's official energy statistics are openly accessible in the public domain.⁵

Since 2014, Geostat has been responsible for compiling the official Energy Balance of Georgia and published the first one in that year (2013 data). To achieve this, it was necessary to introduce new data collection to obtain information on the final consumption of energy resources, and at the same time Geostat adopted international standards and a methodology for collecting and compiling energy data (solid biomass data are considered representative).⁶ Energy consumption data do not include end-use data from Abkhazia and South Ossetia, however.

Furthermore, Geostat conducted a household survey in 2017 to collect information on end uses of energy (e.g. for space heating and cooking), establishing a basis for the government to formulate energy efficiency indicators.⁷ The survey is to be conducted every five years, and with IEA support Geostat has also begun compiling datasets for the industry and residential sectors. The next household energy consumption survey was conducted in the summer of 2022 and the results will be published before the end of the year.

The MoESD is among the main users of Geostat's energy data. The energy module of the national greenhouse gas (GHG) inventory, prepared by the Ministry of Environmental Protection and Agriculture, is based mostly on the official energy balance. Although available energy data could be used to improve energy planning, including through long-term energy modelling, this potential is currently being realised to only a limited extent.

Geostat's medium-term strategy therefore also includes the compilation of energy efficiency data.⁸

⁵ <https://www.geostat.ge/en>.

⁶ <https://unstats.un.org/unsd/energystats/methodology/ires/>.

⁷ <https://webstore.iea.org/energy-efficiency-indicators-essentials-for-policy-making>.

⁸ <https://www.geostat.ge/en/modules/categories/630/strategy-for-the-development-of-statistics>.

Energy security

Energy system adequacy

Resource endowment

Hydro resources are one of Georgia's most important natural riches. Approximately 300 rivers are significant for energy production, with total annual potential capacity of 15 000 MW and production potential of 50 TWh. According to GNERC, however, only 22.5% (3 380.2 MW) are used for hydropower.

Georgia's wind energy potential is estimated at 4 TWh (1 500 MW). The average wind speed fluctuates from 2.5 metres per second (m/s) to 9 m/s. The most favourable places for wind farms are being identified over the entire country.

Meanwhile, solar energy potential is high, with annual solar days ranging from 250 to 280 and amounting to 1 900-2 200 hours. Solar irradiance in Georgia varies between 1 250 kWh/m² and 1 800 kWh/m² annually, and total solar energy potential is estimated at 108 MW. Household solar water heating systems have been installed in rural areas, where solar energy warms water to 40-50°C.

Georgia's geothermal water stock is estimated at 200-250 mcm annually. Temperatures range from 30°C to 110°C, and the total debit is 160 000 m³ per day. More than the 80% of geothermal deposits are in western Georgia and the Zugdidi-Tsaishi geothermal field, as well as in Abkhazia. The relatively low temperature of Georgia's geothermal waters does not, however, allow for electricity generation.

[Economically viable reserves](#) of crude oil were estimated at 5 Mt in 2012 with resources of 50 Mt, and natural gas reserves at 8 bcm with 102 bcm of resources. Hard coal reserves were 201 Mt in the same year, with 700 Mt of brown coal resources, and in 2022, 16 bcm of natural gas deposits were discovered near Tbilisi. The government and the private sector continue exploration work, expecting more deposits to be found.

System reliability

Reliability in both the natural gas and electricity systems is improving. According to the MoESD, there have been no major outages in recent years, owing to rehabilitation and refurbishment of gas and electricity networks. Outages and losses are reported to GNERC as part of licensing obligations and are measured by the standard System

Average Interruption Duration Index (SAIDI) and the System Average Interruption Frequency Index (SAIFI).

In 2021, due to planned and unplanned outages the SAIDI indicator totalled 429.87 minutes, and the SAIFI amounted to 5.98 for Telasi JSC. For Energo-Pro (EP) Georgia JSC, the SAIDI indicator reached 1992.48 minutes, while the SAIFI was 24.13.

Electricity transmission network losses are around 2% and outages are rare. The collection rate is nearly 100% and estimated commercial losses are minimal. Technical losses in the gas sector are around 0.5% in the transmission network, and loss detection is performed during regular field visits and using the Global System for Mobile Communications (GSM). Equipment for loss detection includes some advanced leak detection technologies and leakage metering equipment.

Emergency response

The Law on the State of Emergency (2005) defines and regulates emergency response, but Georgia has no declared strategy for emergency stockholding or fuel switching mechanisms for energy supply disruptions.

The government estimates that Georgia's minimum strategic reserve for gas should be 120 mcm and is considering various storage options. Gas from the country's proposed underground storage facility would be used to compensate for recurring winter deficits, which are expected to reach 200 mcm by 2030.

Emergency oil product reserves are also being considered, to be built up by obligating oil product supply companies to hold stocks of oil products in addition to their normal operating requirements. Possible arrangements and compensation schemes are under discussion.

Fuel switching

Despite the general trend towards hydropower development, Georgia has no formal strategy for switching away from fossil fuels. In fact, a new gas-fired thermal power plant has been constructed and another 272 MW of capacity is under way to replace old, inefficient thermal units and increase the efficiency of gas-based generation.

According to the draft National Energy Policy, the government is planning to improve Georgia's energy security by 2030 by:

- Diversifying external energy supply sources, including gas supply alternatives (i.e. LPG, LNG and CNG swapping options).

- Reducing import dependency through energy efficiency and renewable energy development.
- Developing infrastructure, improving system safety and reliability, and installing SCADA and WAMS systems.
- Integrating renewable energy into the grid using new clean-energy technologies, including green hydrogen production, storage systems and microgrids.
- Exploring the country's own fossil fuel reserves.
- Creating gas storage and emergency reserves of oil products.
- Developing its own oil refining capacity.
- Replacing outdated thermal units with combined-cycle gas plants.
- Improving security (cyber, kinetic, etc.).

Natural gas

Infrastructure

Georgia has gas pipeline connections with Armenia, Azerbaijan, Russia and Türkiye, and oil connections with Azerbaijan and Türkiye as well as a Black Sea oil terminal in Supsa. It imports natural gas from Azerbaijan and Russia, and transits gas from Russia to Armenia and from Azerbaijan to Türkiye and further to Europe. Georgia's oil product imports come from Azerbaijan, Russia and Turkmenistan, and it transits crude oil from Azerbaijan and Kazakhstan to Türkiye.

The Karadaghi-Tbilisi gas interconnection is the main pipeline for Georgia to import gas from the Azeri gas field, from the State Oil Company of Azerbaijan Republic (SOCAR). It has a diameter of 700 mm, and the Georgian section is 46 km long.

More gas imports reach Georgia from Azerbaijan by way of the South Caucasus Pipeline (SCP), which transports gas from the Shah Deniz field parallel to the route of the Baku-Tbilisi-Ceyhan (BTC) crude oil pipeline from Azerbaijan through Georgia to Türkiye. The SCP is 692 km long (442 km in Azerbaijan and 250 km in Georgia), 1 067 mm in diameter and has a capacity of 8 bcm.

With the 2019 completion of the second phase of Shah Deniz gas field developments, SCP Expansion (SCPX), and construction of the Trans-Anatolian Natural Gas Pipeline (TANAP) and the Trans-Adriatic Pipeline (TAP), additional gas is now flowing to Türkiye and thence to European countries for a total volume of 16 bcm. To increase system transmission capacity to 24 bcm, a parallel gas pipeline and additional compressor plants (61 MW each) were constructed in Georgia as part of the SCPX and commissioned in 2018.

Underground gas storage is crucial to Georgia's energy security, to provide seasonal supply-demand balancing as well as compensate for possible supply interruptions. A 2016 feasibility study by the French company Geostock concluded that it is technically feasible to build an underground gas storage facility in the depleted Samgori Southern Arch oilfield and defined conditions for its commercial viability. However, funds allocated for the project have since been diverted into Georgia's Covid-19 emergency fund, so the project's future is uncertain.

The North-South Gas Pipeline (NSGP) system is used to supply Georgia with Russian gas and transit it to Armenia. Georgia's section of the NSGP (diameter 1 200 mm; length ≈133 km; operating pressure 55 bars) was built in 1988-1994, traversing eight separate tunnels totalling 4.6 km in length. Currently, the pipeline is still used mainly to transit gas from Russia to Armenia, but significantly less than in previous years. In 2019, the pipeline transported 1.94 bcm of natural gas to Armenia and 0.17 bcm to Georgia.

Georgia's internal market receives gas through the East-West and North-South Main Gas Pipeline systems, consisting of the Kazbegi, Kakheti, Southern, Ajara and Poti branches. Georgia's gas pipeline system is connected to Russia's by the North-South Main Gas Pipeline System at the Georgia-Russia border, by the South Caucasus Pipeline entering from Azerbaijan at the Georgian-Azeri border and by the pipeline connection with Armenia near the Georgian-Armenian border. The integrated gas supply system also includes 19 000 km of gas distribution pipelines, gas distribution stations, metering units, and two currently inactive compressor stations.

Gas market structure

In the gas sector, the GOGC administers the state's share of gas obtained under production sharing agreements (PSAs) and manages its preparation, storage, transportation and sale. The GOGC ensures the long-term sustainable development of the wholesale natural gas market to safeguard energy security, and it constructs, commissions, rehabilitates and replaces gas pipelines on Georgian territory.

Three companies extracted associated gas in 2021: Ninotsminda Oil Company, a subsidiary of Blake Oil and Gas (XIE licence block); Block Energy (XIF, XIC, XIC, XIB, IX); and NVP Georgia (VIII B). In addition, American-owned Frontera Resources produces minor amounts of gas and has announced the discovery of huge gas reserves, although no progress or confirmation have yet followed.

In 2022, the State Agency of Oil and Gas (SAOG) announced that a 16-bcm natural gas field had been discovered near Tbilisi. Block Energy limited liability company (LLC), the area's current licence-holder with shares traded on the London Stock Exchange, owns

the right to extract resources from the two blocks. The licence requires horizontal drilling, with Block Energy expected to start working on the project late this year or early in 2023.

Natural gas transmission, distribution and retail services are fully unbundled in Georgia. GOGC subsidiary Georgian Gas Transportation Corporation (GGTC) is the gas transmission system operator, and the numerous gas distribution system operators are all private companies. SOCAR Gas is the largest distribution system operator with its two subsidiary companies (24.94% and 36.05% of the retail market), and it distributes gas to Georgia's regions. Tbilisi Energy is the largest distribution system operator in Tbilisi, with a 24.87% share of the retail market.⁹ Many private companies are involved in gas retail. GGTC operates the main gas pipeline system, except the Georgian section of the SCP, which is operated by SOCAR.

GNERC determines the licensing rules and conditions for natural gas transportation and distribution, and it also regulates the tariffs for natural gas transportation, distribution, pass-through, supply and consumption.

Cross-border interconnections

Georgia has gas pipeline connections with Armenia, Azerbaijan, Russia and Türkiye. It imports natural gas from Azerbaijan and Russia and transits gas to Türkiye and Armenia. The 1 200-mm and 700-mm North-South Gas Pipelines transport 2-2.4 bcm of natural gas from Russia to Armenia annually. The 692-km SCP, now operated by a SOCAR subsidiary, currently transports about 16 bcm of natural gas from the Shah Deniz gas field and connects to the Turkish gas system at Erzurum; the SCPX will raise natural gas transport to 24 bcm.

Cross-border agreements with suppliers in neighbouring countries are bilateral, but Georgia is also focused on developments in gas transit from the Caspian Sea to European markets, as this would diversify its imports and provide transit revenue.

Oil and oil products

As Georgia does not have a developed oil refining industry, it mainly imports oil products from the world market.

Oil products made up 26.6% of Georgia's TES in 2020, with imports coming from various countries but mostly Azerbaijan, Russia, Turkmenistan, Romania and Bulgaria.

⁹ GNERC (2020), Annual Report.

Transport infrastructure

Oil transport pipelines serve mainly for transit purposes – for exporting Azeri and Kazakh oil to the world markets. The oil pipelines passing through Georgia are directly connected to terminals on the Black Sea coast and, through Türkiye, to Mediterranean terminals and Southeast European countries.

The BTC pipeline transports crude oil from Azerbaijan via Georgia to Türkiye's Mediterranean port of Ceyhan, and from there the oil is shipped by tanker to world markets. The BTC pipeline is 1 768 km long, with 443 km in Azerbaijan, 249 km in Georgia and 1 076 km in Türkiye, and has been in operation since May 2005.

Operational since 1999, the Baku-Supsa Pipeline transports crude oil from offshore oilfields in the Caspian Sea (belonging to Azerbaijan) to Supsa, Georgia, on the Black Sea, where it continues to European markets via tankers. Of the pipeline's 829 km, 375 km are in Georgia, and it has a capacity of 145 000 barrels per day. Recent agreements between Kazakhstan, Azerbaijan and Georgia will ensure the transport of increased volumes of Kazakh oil through these pipelines.

Oil market structure

The State Agency of Oil and Gas is a legal entity of the Ministry of Energy. Under the Oil and Gas Law, it regulates oil and gas operations, refineries and transportation.

The state-owned Partnership Fund owns the GOGC and has transferred 100% of GOGC shares to the Ministry of Energy (now the MoESD) for oversight as well as management rights. The GOGC administers the state's share of oil produced under PSAs and manages its processing, storage, transportation and sale. It is responsible for: commissioning, rehabilitating and replacing oil pipelines on Georgian territory; designing and constructing new pipelines; building, sustaining and operating necessary infrastructure; implementing projects for transporting Caspian oil and resources obtained from other regions via trunk pipelines within Georgia; and participating in and implementing national and international projects to explore, transport and supply energy resources to ensure Georgia's energy security. The GOGC also funded the construction and commissioning of two 230-MW combined-cycle gas turbine (CCGT) plants in 2015 and 2019, and a 20.7-MW wind farm in 2016.

The Association of Oil Product Importers and Distributors was established in March 2004. Its main objective is to assist in creating flexible, simple and clear customs and tax codes for oil production, import and distribution. It is involved in aligning oil market legalisation with the Georgian constitution and other legislation, and co-operates with legislative and executive powers to prepare draft legislation. It also monitors available oil

market information and conducts its own research. Oil product import, storage and transportation are carried out by private businesses.

Hydrocarbon exploration and production

Investor companies, selected through international tenders, sign PSAs with the state and carry out exploration and production work through Georgian subsidiary operation companies that perform the activities.

To date, 24 PSAs have been concluded between the government of Georgia and investor companies and, apart from the GOGC, seven oil companies are operating under these contracts: the Norio Operating Company, the Block Operating Company, the Kura Basin Operating Company, NVP Georgia, West Gulf Petroleum Engineering, Georgia Coalition Energy Limited and OMV Petrom.¹⁰

Only one company, Saknakhshiri LLC, extracts coal in Georgia. In 2019, after several coalmining accidents, the Georgian Industrial Group sold the company for a symbolic price to the Steel International Trading LLC. According to its managers, the company plans to increase annual production to 400 000 tonnes/yr.

Electricity

Electricity generation

In 2021, HPPs provided 80.5% of Georgia's electricity, with natural gas-fired facilities generating 18.8% and wind power accounting for about 0.7%. The 1 300-MW Enguri hydro facility is the backbone of the country's electricity generation system. Small and medium-sized hydro facilities totalling 2 080.2 MW (as of 2021) also provide domestic power, either on a regular basis or seasonally.¹¹ Because Georgia's main long-term policy objective is to satisfy the country's overall demand for electricity with domestic hydro resources, in addition to tendering new large HPPs the Ministry of Energy has sought foreign investment to develop new small and medium-sized HPPs.

The Georgian government plans to facilitate further development of smaller renewable energy technologies, especially micro hydropower plants and solar power systems. Under the Electricity Supply and Consumption Rules, GNERC has ensured micro power plants free access to the network and established fixed tariffs for electricity produced by these plants (Resolution No. 20, Amendment to Electricity Supply and

¹⁰ <https://www.gogc.ge/en/page/activities-fields/oil/7>.

¹¹ GNERC (2021), Annual Report.

Consumption Rules). Important steps were also taken in 2015 when GNERC developed a legal framework for net metering.

In 2022, feasibility studies were in progress for 100 HPPs (1 014 MW of total capacity), and 56 HPPs (1 914 MW) were at the licensing and construction stage.

In 2016, Georgia's first wind power plant, Qartli Wind Farm, with installed capacity of 20.7 MW and annual generation of 88 GWh, was commissioned in the Shida Kartli region of the Gori and Kareli municipalities. Qartli Wind Farm LLC, developed by the Georgian Energy Development Fund and the GOGC, was privatised in 2019 when Georgia Capital acquired it for USD 14.4 million.

Georgia also has five operational thermal power plants (TPPs): Mtkvari Energy (300 MW); two units at Tbilisres (270 MW); G-Power gas turbine station (110 MW); and the Gardabani 1 and 2 combined-cycle plants (230 MW and 255 MW).

Transmission and distribution

Georgian State Electrosystem JSC (GSE) is Georgia's largest transmission grid owner. GSE owns and operates 4 357 km of transmission lines and 93 substations all over the country. GSE neither generates electricity nor supplies it directly to consumers. It only provides electricity transmission from hydro, thermal and wind power plants and imports to power distribution companies (Telasi JSC and Energo-Pro Georgia JSC) and direct customers (large companies). The distribution companies in turn deliver the electricity to final customers, and direct customers consume it for their own purposes.

Unbundling of the distribution system operators took place in spring 2021, with Telasi JSC and Energo-Pro Georgia JSC defined as the electricity distribution system operators.¹² Based on Government of Georgia Resolution N236 of 25 May 2021, starting 1 July 2021 the Tbilisi Electricity Supply Company JSC was obligated to provide public supply services in the area of the Telasi JSC, and EP Georgia Supply was required to offer public supply services in the area of Energo-Pro Georgia LLC. The two companies have been appointed as universal service suppliers, electricity public service providers and suppliers of last resort in their respective territories.

On 4 January 2021, GSE and United Energy System (UES) Sakrusenergo JSC signed an agreement transferring the right of perpetual use (perpetual lease) of power transmission lines owned by UES Sakrusenergo JSC to GSE JSC. In addition, GSE and its subsidiary Energo Trans LLC merged in January 2021. Following these structural changes, GNERC certified GSE as a transmission system operator and issued it a new transmission licence that came into force 1 July 2021.

¹² GNERC Decisions N19/1 of 28 April 2021 and N20/2 of 13 May 2021.

Two companies carry out electricity distribution and supply activities. Telasi JSC, which serves Tbilisi, supplied approximately 2.81 billion kWh to its consumers in 2021. As of 2021, the company had 656 490 customers (37.6% residential and 62.4% non-residential), and customer services and network maintenance and operations are carried out from ten business centres situated in all administrative districts of the city. The total length of power grids in the capital is 6 390 km, including 2 422.3 km of overhead transmission lines and 3 967.76 km of underground cable. There are also 36 step-down substations of 35/6(10) kV and 110 kV, and 2 191 transformer substations of 6(10)/0.4 kV.¹³

Energo-Pro Georgia JSC is the largest private owner of distribution assets. It accounts for approximately 4.76 billion kWh of power consumption annually (as of 2021), and its service area extends over 58 846 km² (84% of Georgia's land base) with total customers exceeding 1.2 million. It owns a 35-kV to 110-kV high-voltage electricity grid, high-voltage 110-kV and 35-kV substations, and 6(10)/0.4-kV transformers.

In 2021, EP Georgia unbundled its assets and registered two separate companies. EP Generation JSC owns 15 small and medium-sized HPPs with total capacity of 469.25 MW and one gas turbine power plant with a capacity of 110 MW.¹⁴ EP Georgia Supply is a subsidiary company providing electricity supply services for up to 1.2 million customers.

According to the GSE's Ten-Year Network Development Plan (TYNDP), Georgia's cross-border infrastructure in 2031 will include:

- with Russia: 500-kV, 220-kV and 110-kV lines; 1 600 MW of capacity
- with Azerbaijan: 500-kV and 330-kV lines; 1 400 MW of capacity
- with Armenia: 220-kV and 400-kV lines; 700 MW of capacity
- with Türkiye: 400-kV, 220-kV, and 154-kV lines; 1 400 MW of capacity.

The Black Sea Transmission Network (BSTN) Project, commissioned in 2013 and connecting Georgia and Türkiye via the Black Sea, includes a 700-MW back-to-back direct current (DC) interconnection, 500-kV transmission lines to Vardzia and Zekari, a 400-kV interconnection line to Meskheti and the 500-kV/400-kV/220-kV substation at Akhaltsikhe.

Cross-border electricity trade, electricity demand growth and anticipated seasonal energy exports require transmission infrastructure investments and further development of the network. In its capacity as transmission system operator, GSE has elaborated a Ten-Year Transmission Grid Development Plan to 2031 to meet emerging demand,

¹³ <http://www.telasi.ge/ge/about/activities>.

¹⁴ <http://www.energo-pro.ge/en/company/>.

incorporate new generation capacity and achieve even higher reliability standards. The GSE intends to complete numerous projects during 2021-2031:

- the Batumi-Akhaltzikhe Project
- the Jvari-Khorga Project
- the Ksani-Stepantsminda-Mozdok Project
- Marneuli-Ayrum Project components
- the Jvari-Tskhaltubo-Akhaltzikhe Project
- the North Ring-Tskaltubo Project
- the Guria Project
- rehabilitation of the 220-kV Kolkhida-1 overhead line (OHL)
- the Akhaltzikhe-Tortum Project
- the Batumi-Muratli 1 Project
- the Namakhvani-Tskaltubo Project
- rehabilitation of the 500-kV Imereti 1 Project OHL
- a substation renovation project
- reinforcement of the Kakheti infrastructure project
- the Security of Supply of Tbilisi Region Project
- rehabilitation of the 220-kV backbone Zestaponi-Ksani Project
- construction of the second circuit of the 330-kV Gardabani-Agstafa Project OHL
- the Georgia-Russia-Azerbaijan power system connection project (feasibility study)
- the Georgia-Romania Black Sea Submarine Cable Project (feasibility study).

Cross-border projects to increase power exchange and capitalise on energy trade opportunities with neighbouring countries include:

- the 400-kV Akhaltzikhe-Tortum OHL and the 350-MW high-voltage direct current (HVDC) back-to-back link at Akhaltzikhe substation (SS)
- the 500-kV Ksani-Stepantsminda-Mozdok OHL and the 500-kV/110-kV Stepantsminda SS
- the 500-kV Marneuli-Ayrum OHL, and the 500-kV switchyard with linkage to the 220-kV switchyard at Marneuli SS
- the 154-kV Batumi-Muratli OHL and the 350-MW HVDC back-to-back link at Batumi SS.

Cross-border interconnections

Georgia's electricity system is interconnected with those of Russia, Azerbaijan, Armenia and Türkiye. ESCO has the authority to trade electricity with neighbouring countries to balance the needs of the Georgian market, and regional trade is arranged through bilateral agreements and memorandums of understanding (MoUs). The transmission system operator ensures operations with each neighbouring country and signs relevant agreements on technical issues.

In January 2012, Georgia and Türkiye signed an agreement on cross-border electricity trade using the Akhaltsikhe-Borcka interconnection. The agreement sets out competitive market trading rules and identifies the terms for managing electricity imports and exports on the line.

In 2015, the Khorga substation was completed under the Regional Power Transmission Enhancement Project funded by the Asian Development Bank, and the electricity transit corridor began operating from Russia to Armenia (daily average 30 MW) and from Azerbaijan to Türkiye (daily average 80 MW). Energy transfer between Georgia and Türkiye continues through the 700-MW HVDC converter station and the related 500-kV and 400-kV lines.

In 2009, the Azerbaijan-Georgia-Türkiye (AGT) Power Bridge project was established by the transmission system operators of the three countries (AzerEnergy, GSE and TEIAS). The energy bridge became operational in 2015, and 813 million kWh of electricity were transited from Azerbaijan to Türkiye already in 2016. The table below lists existing and planned electricity interconnection lines.

Power exchange capabilities with neighbouring power systems

Country	Cross-border line	Nominal voltage (kV)	Exchange	TTC summer, (MW)	TTC winter, (MW)	Mode
Russia	Kavkasioni AC-3x300	500	Export	570	650	S
			Import	570	650	S
	Stepantsminda (Ksani-Stepantsminda- Mozdok) AC-3x300, 2023	500	Export	1000	1000	S
			Import	1000	1000	S
	Salkhino AC-400	220	Export	50	50	I
			Import	150	150	I
Azerbaijan	Mukhranis Veli AC-3x300	500	Export	630	710	S
			Import	630	710	S
	Gardabani AC-480	330	Export	630	710	S
			Import	630	710	S
Armenia	Alaverdi AC-300	220	Export	150 / 100	150 / 100	S / I
			Import	150 / 100	150 / 100	S / I
	Marneuli (Marneuli-Ayrum) AC 3x330, 2025	400	Export	700	700	B
			Import	700	700	B
Türkiye	Meskheta AC-3x500	400	Export			
	Tao (Akhaltzikhe-Tortum) AC-3x500, 2022		Import	1 050	1 050	B
	Batumi-Muratli, 2025	154	Export	350	350	B
			Import	350	350	B
	Adjara AC-400	220	Export	150 / 150	150 / 150	I / R
			Import	150 / 150	150 / 150	I / R

Notes: S = synchronous mode. I = isolated mode. B = operation with back-to-back station. R = in reserve. Both the Tao and Meskheta 400-kV OHLs can each transfer up to 1 500 MW, but their total transfer capacity is limited by the Akhaltzikhe HVDC back-to-back units, which will have a capacity of 1 050 MW after 2025.

Source: GSE (2021), [Ten-Year Electricity Network Development Plan of Georgia 2021-2031](#).

Market structure

Georgia's electricity sector is partially deregulated and unbundled into generation, transmission and distribution companies. Most generation and distribution assets are fully privatised.

The wholesale electricity market operates predominantly under bilateral contracts, while the state-owned electricity market operator (ESCO) purchases and resells unsold power

through bilateral contracts. ESCO is responsible for balancing and settlement according to market rules, and it exports surplus power. About 75.9% of all electricity generated is sold through bilateral contracts and the rest through ESCO. The Georgian Energy Exchange was to be launched on 1 September 2022 to introduce day-ahead and intraday markets as well as markets for bilateral contracts, significantly modifying the current electricity trade structure. However, its opening has been repeatedly postponed because of the incompleteness of market operation procedures.

Georgia's one transmission system operator, GSE, operates the entire transmission grid, including the 500-kV lines and interconnectors leased from Sakrusenergo through a 50/50 joint venture between the Georgian government and Russia's Inter RAO UES.

Meanwhile, Georgia's two distribution system operators are:

- Energo-Pro Georgia JSC – owned by Energo-Pro (Czech company)
- Telasi JSC – owned 75% by Silk Road Holdings BV (and ultimately Russia's Inter RAO) and 25% by Best Energy Group LLC.

Electricity generators are regulated, partially regulated, or deregulated. The state-owned Enguri and Vardnili HPPs are regulated generators with GNERC tariffs. Most other HPPs have tariff caps, while small HPPs (15 MW or less) and HPPs built since August 2008 are fully deregulated and can sell their electricity at competitive prices to ESCO or any other market participant.

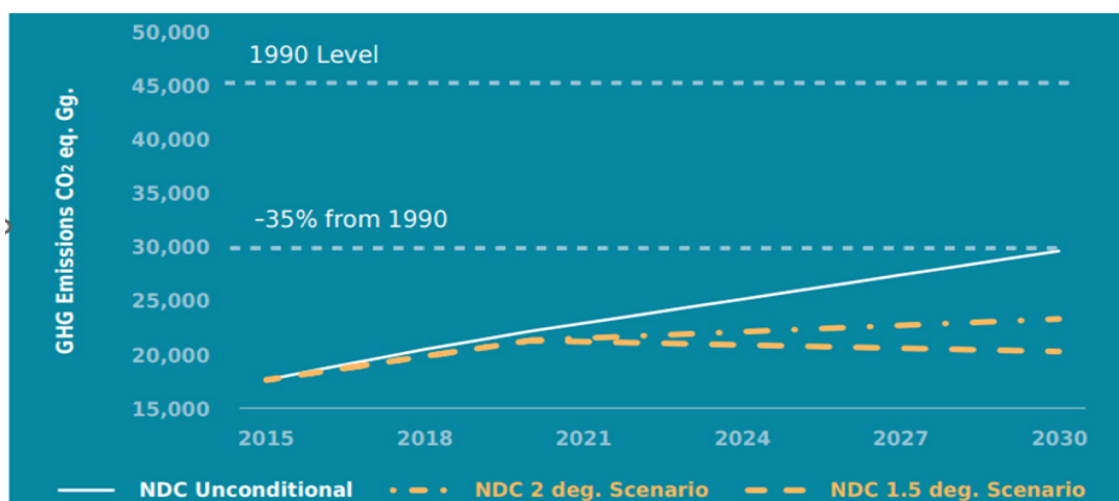
Energy system transformation

Energy and climate change

In 1994 Georgia acceded to the UN Framework Convention on Climate Change (UNFCCC), and on 21 February 2017, the government of Georgia approved the Paris Agreement. The country also revised its national climate goals and objectives in its updated Nationally Determined Contributions (NDC) document,¹⁵ adopted in April 2021. Although Georgia faces national security threats from Russian occupation, economic and political crises, and the Covid-19 pandemic, it has set more ambitious targets¹⁶ than in its previous NDC. It remains fully committed to the Convention's objectives and acknowledges the urgent necessity for climate change mitigation and adaptation. To support the country's sustainable development, Georgia's updated NDC aims to:

- Unconditionally reduce national GHG emissions to 35% below the 1990 level by 2030.
- Conditional on international support, reduce GHG emissions to 50% below the 1990 level by 2030 if the world commits to limit average global temperature increase to 2°C.
- Reduce GHG emissions to 57% below the 1990 level by 2030 if the world commits to limit average global temperature increase to 1.5°C.

Nationally Determined Contribution targets



Source: Reproduced from Georgia, Ministry of Environmental Protection and Agriculture (2021), [Georgia's Updated Nationally Determined Contribution](#).

¹⁵ <https://www.euneighbours.eu/en/east/stay-informed/publications/georgias-updated-nationally-determined-contribution-ndc>.

¹⁶ In Georgia's previous NDC, the unconditional national GHG emissions reduction target for 2030 was about 24% below the 1990 level (unfccc.int).

According to Georgia's latest National Greenhouse Gas Inventory,¹⁷ in 2017 net emissions (including LULUCF) amounted to 12 842 kt CO₂-eq and CO₂ emissions from fuel combustion were 8.7 Mt CO₂ (+60% from 2007). The transport sector accounted for 42% of these emissions, followed by the residential sector (20%) and industry (19%). Owing to the large share of hydro in electricity generation (80%), power generation accounts for only 12% of energy-related emissions, and the remaining 6% comes from the commercial sector. Although Georgia was responsible for just roughly 0.04% of the world's GHG emissions in 2016,¹⁸ developing and implementing mitigation and adaptation measures would synergise Georgia's adaptive capacity with that of other countries and also create economic, social and environmental benefits.

In 2016, the EU-Georgia Association Agreement entered into force, emphasising collaboration in climate change mitigation, adaptation to climate change, emissions trading, integration of climate change into industrial policy, and clean technology development. The Agreement underlines the inevitability of co-operation in technology transfer based on Georgia's Low Emission Development Strategy (LEDS), its Nationally Appropriate Mitigation Actions (NAMAs) and its Technology Needs Assessment (TNA).

Several documents outline the country's national climate policy. Georgia's recently published NDC defines climate goals and overall targets to 2030, and its Climate Change Strategy and Action Plan details sector-specific targets and relevant measures. Meanwhile, the Long-Term Low Emission Development Strategy (LT LEDS) is intended as a visionary policy document with no concrete mitigation measures or action plan, and its scope extends to 2050. The National Energy and Climate Plan (NECP) outlines integrated energy and climate measures at the national level, and Georgia regularly publishes National Communications (NCs) and Biennial Update Reports (BURs) on climate change issues to meet its UNFCCC obligations (its latest [fourth] NC was published in April 2021).¹⁹

Georgia's 2030 Climate Change Strategy and Action Plan accompanies the updated NDC to identify measures to meet unconditional and conditional commitments and mitigation targets in the transport, buildings, energy generation and transmission, agriculture, industry, waste management and forestry sectors. NDCs need to be updated every five years, and countries are expected to set more ambitious goals and targets each time.

Under the Paris Agreement, all countries agreed on an enhanced transparency framework for action and support, including clarity and tracking of progress in achieving

¹⁷ [National Greenhouse Gas Inventory](#).

¹⁸ In 2016, Georgia's national GHG emissions were 18 534 kt CO₂-eq (excluding LULUCF, FNC), while global GHG emissions were 49.4 billion tonnes of CO₂-eq (<https://ourworldindata.org/ghg-emissions-by-sector>).

¹⁹ <https://unfccc.int/documents/271341>.

the NDCs. Unfortunately, Georgia has not yet developed a national adaptation plan, but its updated NDC identifies several adaptation and vulnerability assessment objectives:

- Assess the impact of climate change on the coastline, glaciers, forest lands, mountain ecosystems and ecosystem services.
- Assess the impact of climate change on the availability of groundwater and surface water resources for sustainable use in different economic sectors.
- Assess and strengthen the adaptive capacity of agricultural production to ensure food security.
- Assess the effects of climate change on human health and take measures to mitigate damage caused by extreme weather events.
- Strengthen the adaptive capacity of the most vulnerable winter and coastal resorts.

Furthermore, in 2017 Georgia began to develop national indicators and targets for Sustainable Development Goals, which are closely related to GHG emissions reductions.

Climate change policy planning happens not only nationally, but also at the municipal and city levels. Indeed, 26 Georgian cities and municipalities have joined the Covenant of Mayors initiative to reduce GHG emissions to 20% below the 1990 level by 2020 and to 40% below by 2030. Signatories are obligated to submit Sustainable Energy and Climate Action Plans (SECAPs) outlining the key actions they plan to undertake up to 2030.

Although Georgia has made some progress in developing climate change policy, challenges and barriers impede achievement of its UNFCCC and Paris Agreement commitments: qualified people to staff national and municipal public institutions responsible for climate change policies are in short supply; the state's financial resources are insufficient to implement climate change mitigation and adaptation measures; there is a dearth of climate change-related research, academic institutions and educational courses and programmes; public demand for climate protection action is lacking because public awareness is limited; and the country needs an integrated database of projects contributing to climate change mitigation or adaptation. All these obstacles have caused the level and pace of Georgia's development and implementation of climate-friendly and sustainable technologies to be low.

Energy and environmental protection

As all projects to develop renewable or fossil energy sources and establish transmission infrastructure strongly impact the environment, it is essential for Georgia to have sound procedures and proper protective mechanisms in place. In this respect, it has implemented several important reforms in recent years, and its current legislation is largely aligned with EU legislation and directives.

For instance, the country adopted an Environmental Assessment Code in 2017, with its main section implemented in 2018. Its updated legal framework for environmental impact assessments, including key requirements and procedures for environmental monitoring of the energy sector, is based on EU directives for environmental impact assessments and strategic environmental assessments:

- Directive 2011/92/EU on the Assessment of the Effects of Certain Public and Private Projects on the Environment
- Directive 2001/42/EC on the Assessment of the Effects of Certain Plans and Programmes on the Environment
- Directive 2003/4/EC on Public Access to Environmental Information
- Directive 2003/35/EC Providing for Public Participation in Respect of the Drawing Up of Certain Plans and Programmes Relating to the Environment
- Directive 2004/35/CE on Environmental Liability Regarding the Prevention and Remedying of Environmental Damage.

Georgia's Environmental Assessment Code is also based on the principles of the Convention on Environmental Impact Assessment in a Transboundary Context (the Espoo Convention) and its Protocol on Strategic Environmental Assessment and the Aarhus Convention.

This new legal framework defines how to assess the impact individual energy projects will have on the natural and social environment, and it establishes appropriate procedures, the scope of public involvement, the decision-making process and other related issues. The law delineates institutional roles and the scope of authority required for appropriate decisions/findings.

Before adopting its Environmental Assessment Code, Georgia had already transposed several EU directives into its legislation:

- Directive 1999/32/EC of 26 April 1999 Relating to a Reduction in the Sulphur Content of Certain Liquid Fuels and Amending Directive 93/12/EEC
- Directive 2010/75/EU of 24 November 2010 on Industrial Emissions
- Directive 2001/80/EC of 23 October 2001 on the Limitation of Emissions of Certain Pollutants into the Air from Large Combustion Plants
- Article 4(2) of Directive 79/409/EEC of 2 April 1979 on the Conservation of Wild Birds.

Despite this new legal framework, environmental concerns relating to HPP developments and the construction of high-voltage transmission lines in the mountains of Georgia have yet to be addressed. This is partly due to challenges in the practical implementation of procedures, specifically:

- The lax observance and slow implementation of administrative procedures.
- A lack of methodological clarity and coverage, including cost-benefit analyses, ecological minimum river flow, etc.
- Low public awareness and participation due to inadequate access to information.
- Aberrant public perceptions and awareness resulting from exposure to biased and incorrect information.
- Low availability and poor quality of geographic information systems (GISs) to acquire proper environmental information.
- Poor indoor air quality caused by inefficient combustion of wet wood fuel.

Nevertheless, significant progress has been made in the policies and legal framework for air quality improvement: automatic air monitoring systems have been upgraded; a technical inspection system for vehicles has been introduced; and normative requirements for gasoline and diesel quality have been strengthened. Georgia also introduced an obligation for continuous instrumental monitoring by industrial enterprises, including TPPs, in line with Directive 2010/75/EU of 24 November 2010 of the European Parliament and the Council. Furthermore, it has expanded the country's natural gas networks and reduced the use of firewood significantly. In fact, the share of firewood in Georgia's total energy consumption had fallen to 4.8% or 1.3 million m³ in 2019, down from 2.1 million m³ in 2015. The state is also planning measures to replace low-efficiency stoves that are harmful to public health.

To improve environmental governance, Georgia is planning to:

- Optimise the administrative process for environmental assessments.
- Perfect and consolidate geo-informational systems and databases.
- Improve air quality monitoring systems.
- Promote the use of modern, efficient wood stoves.

Energy efficiency

The MoESD and its Division of Energy Efficiency and Alternative Energy Resources are the key policy-making entities supporting the development of energy-efficient technologies in Georgia. The MoESD develops, implements and co-ordinates country-relevant sustainability actions; it also supports and co-ordinates energy efficiency in the industry, construction, transport and service sectors, and creates measures that favour a green economy.

Georgia has implemented energy efficiency legislation to transpose the Energy Community acquis on energy efficiency. The Law on Energy Efficiency, prepared according to EU Energy Efficiency Directive 2012/27/EU, aims to:

- Establish a common framework to promote and implement energy efficiency within the country.
- Improve energy savings, increase energy supply security, enhance energy independence, and remove barriers to energy efficiency development.
- Establish a process to develop a national energy efficiency target through an energy efficiency action plan, which would also outline measures to meet the target.
- Provide a procedure to adopt the energy efficiency action plan.
- Institute an energy efficiency obligation scheme and/or alternative policy measures to achieve energy savings.
- Ensure co-ordination among parties to control, monitor and supervise implementation of the country's energy efficiency policy.

The Law on Energy Efficiency of Buildings was prepared according to EU Energy Performance of Buildings Directive 2010/31/EU. Several secondary acts have already been drafted but not finalised to implement this law, which will:

- Set buildings sector regulations to ensure the improved energy efficiency of existing and new buildings.
- Introduce minimum energy performance standards and the obligation to adopt a methodology for calculating the energy performance of buildings.
- Include provisions to establish energy performance certification and the inspection of heating and cooling equipment.
- Introduce sanctions for breaching the provisions of this law.

Georgia adopted a Law on Energy Labelling on 20 December 2019. It transposes Directive 2010/30/EU, and its purpose is to provide standard and additional information about the consumption of energy and other resources, as well as consumption indicators for energy-consuming products in Georgia, which will allow consumers to assess their use of energy and other resources.

The government also approved important secondary legislation: a National Methodology for Calculating the Energy Efficiency of Buildings, and Minimum Requirements for Energy Efficiency of Buildings, Parts of Buildings or Elements of Buildings.

To implement the primary legislation, a number of bylaws are being developed and adopted, including 19 legislative acts related to the Law on Energy Efficiency, 11 legislative acts on the Law on Energy Efficiency of Buildings and 10 legislative acts concerning the Law on Energy Labelling. Work is also under way on Georgia's Law on Eco-design.

The MoESD has developed a National Energy and Climate Plan (NECP) with 27 horizontal and sectoral measures in buildings, industry, transport, electricity and gas

production and supply to be implemented by 2030. After rounds of public discussions and adjustments, the finalised NECP will be approved by the parliament and submitted to the Energy Community Secretariat.

The NECP's wide-ranging measures include:

- Building certification and minimum energy efficiency standards; annual energy efficiency renovations of 1% of administrative buildings; and an energy efficiency information system for public buildings.
- Educational programmes and certification mechanisms to train specialists and support the energy service market.
- Energy-efficient procurement in the public sector.
- Awareness-raising programmes and preparation of energy managers.
- A standards and labelling system for energy-consuming equipment.
- Support for efficient lighting, including the replacement of incandescent lights.
- Implementation of energy audits and energy management systems in industry.
- A wide spectrum of energy efficiency measures in transport, including:
 - Public transport infrastructure improvement and a switch to sustainable transport systems
 - Fuel taxation to encourage lower consumption
 - Tax benefits for hybrid and electric vehicles
 - Inspection and standards for transport vehicles (EUR4/EUR5)
 - Urban planning measures, including Tbilisi's Green Transport Policy
 - Incentives for railway and other public transport use.
- In the energy sector:
 - New CCGT power plants to replace simple-cycle units
 - Transmission network improvements and transboundary co-operation
 - Loss reduction in networks through incentive-based regulation.
- The government encourages municipal activities within the framework of the Covenant of Mayors. Of the 26 cities and towns that have joined, most have already prepared energy action plans.
- Concrete energy efficiency targets for 2030 will be fixed in the final draft of the NECP.

Renewable energy

The share of renewable energy in Georgia's energy supply in 2020 was 19.5%, of which 15% was electricity produced by hydroelectric plants and 5% was biomass-based (i.e. firewood and agricultural waste used for heating). As Georgia lacks significant fossil fuel

reserves, it relies primarily on renewable energy (mainly hydropower) for energy security. As of 2021, the share of renewable energy in electricity production was 81%, provided by hydropower and one wind farm.

Hydropower

Of Georgia's 4 533 MW of installed power generation capacity, 2 381 MW are reservoir hydropower plants and 942 MW are run-of-river facilities. Small power plants (less than 15 MW of capacity) contribute 282 MW. In 2021, electricity production totalled 12 645 MWh, with reservoir plants generating 5 318.1 MWh and seasonal run-of-river plants contributing 4 022.1 MWh. Small power plants generated 841.9 MWh of clean energy.

In 2021, seven large HPPs used for seasonal regulation of electricity production generated 42% of the country's total generation:²⁰

- Engurhesi (1 300 MW) – state-owned
- Vardniliesi 1 (220 MW) – state-owned
- Khrami 1 (113 MW) – owned by Inter RAO
- Khrami 2 (110 MW) – owned by Inter RAO
- Shaorhesi (38 MW) – owned by JSC Energo-Pro Georgia
- Dzevulhesi (80 MW) – owned by JSC Energo-Pro Georgia
- Zhinvalhesi (130 MW) – owned by JSC Georgia Capital.

The technically and economically feasible potential of Georgia's hydropower resources is 2 286 projects, offering generation of 30 TWh/year at a construction cost of less than USD 0.35/kWh. Along with providing additional energy, hydropower development would allow Georgia to integrate greater volumes of solar and wind power and also regulate waterflow in periods of extreme runoff and for various needs, thereby contributing to climate change mitigation and adaptation. However, as hydropower development is complex, realising its full potential will require thorough study and proper planning.

Major challenges impeding hydropower development in Georgia include ineffective implementation of environmental impact assessments and public communication procedures (resulting in public opposition and bias against infrastructure projects); an absence of clear and transparent procedures for public-private partnerships with minimum administrative burden; and a lack of qualified strategic investors with adequate financial and technical resources.

²⁰ GNERC (2022), [Energy data](#).

Solar and wind

Reliable and comprehensive assessments of Georgia's solar and wind potential still need to be conducted, involving an accurate evaluation of resources and geospatial analysis using a GIS. Wind potential has been roughly estimated at 1 500 MW of capacity, for 4 TWh of average annual electricity generation. Concerning solar energy, annual sunshine days range from 250 to 280 (1 900 to 2 200 hours) in most regions of the country, indicating considerable solar PV and solar thermal potential.

The medium-term assessment for wind and solar power potential is based mostly on network and balancing considerations.²¹ Georgia's electricity transmission system operator (GSE) estimated that the country's power system would be able to accommodate 333 MW of wind and 130 MW of solar capacity during 2020-2022. However, adding more reservoir HPPs to the system would permit the integration of 1 332 MW of wind and 520 MW of solar.

As of April 2022, Georgia had 397 solar PV installations (each below 500 kW) for a total capacity of 20.4 MW. In addition, the Ministry of Infrastructure initiated and is financing a GEL 2-million project to install autonomous micro-PV plants in sparsely populated, hard-to-reach villages in mountainous regions.

At a larger scale, the government has signed 31 MoUs for solar power plants. Total installed capacity is 146 MW, with expected annual electricity generation amounting to 200 million kWh. It has also signed 13 MoUs for wind power plant projects, with total capacity of 740 MW and expected generation of 2.65 billion kWh. Construction of an 8-MW project has begun.

Georgia's only wind power plant (Qartli, 20.7 MW) was commissioned in 2016 and had a high (46%) capacity factor in 2021.

Geothermal

Georgia has over 250 natural and artificial geothermal sources in 44 geothermal fields, more than 80% of which are in western Georgia. Geothermal water, used mainly for simple household or agricultural (greenhouse) purposes, varies in temperature from 30°C to 110°C. The share of geothermal energy in the country's energy balance is insignificant.

The Zugdidi-Tsaishi geothermal area has nine productive and seven reinjection wells, and three observation bore-hole wells considered to be exploitable. In addition, two deposits are known to contain geothermal water, from which up to 30 000 m³ could be

²¹ NVE (2021), [Hydro Power Potential in Georgia](#).

obtained for reinjection twice a day. Poti, Georgia's main port city, could be supplied with geothermal water from the Kvaloni and Menjisi water deposits.

Biomass

Woody biomass has been one of Georgia's main sources of heating for years, especially in rural regions. However, with greater access to gas and a reduction in available forest resources, firewood consumption has decreased significantly. Bioenergy supplies in 2019 amounted to 10 279 TJ (1.3 million m³) or 4.8% of total energy consumption, mainly consisting of woody biomass. A small amount of solid modern biofuel (pellets and briquettes) is produced from forestry and agricultural waste.

The sustainable regeneration limit of Georgia's forests is estimated at 400 000-500 000 m³, meaning that fuelwood is consumed at the expense of forest degradation. Under the ongoing forestry reform, the forestry agency has begun to organise "business yards" to provide people with legal wood fuel supplies. This system is intended to replace the poorly controlled "social logging" that led to forest degradation.

To further reduce pressure on forests, it is necessary to develop alternative energy solutions to meet heating demand with sustainable bioenergy. For instance, inefficient wood stoves should be replaced with efficient ones, and advanced solid biofuels could be made from agricultural waste directly or used in the form of pellets and briquettes.²²

Waste

As Georgia does not currently use waste for power and heat generation, waste management legislation is needed to encourage the collection and use of biological waste for energy purposes. Helpfully, a new, modern landfill adhering to EU requirements is planned in the Autonomous Republic of Adjara. While there are plans to install a landfill gas capture facility to use this gas for energy, project construction has yet to begin.

Institutions, legislation and policies

As a structural unit of the MoESD's Energy Reforms and International Relations Department, the Division of Energy Efficiency and Renewable Energy Policy Promotion implements state policies to support renewable energy resource development and the deployment of energy-efficient technologies.

In 2010, the government established the Georgian Energy Development Fund (GEDF) JSC to realise the country's energy potential by mobilising funds to develop and

²² IEA (2020), [Sustainable Bioenergy for Georgia: A Roadmap](#).

implement projects. The Fund identifies prospective renewable energy projects and promotes their development through preliminary screenings, feasibility assessments and environmental impact assessments; it then finds investors and secures their interest in the projects.

Furthermore, the Law on the Promotion of Energy Production and Use from Renewable Sources was adopted in December 2019.²³ To create an investor-friendly environment, the government offers attractive export markets, free third-party access to the grid and an efficient legal and regulatory framework for greenfield projects based on the build-own-operate principle. Liberal tax legislation, double taxation avoidance agreements with Organisation for Economic Co-operation and Development (OECD) member countries, a rapidly expandable export market, simplified procedures, and a strong commitment to renewable energy source development also create a favourable business climate for potential investors.

To further encourage renewable energy development, government of Georgia Resolution No. 403 of 2 July 2020 approved a scheme to support the production and use of energy from renewable sources. It provides for payment of a market premium to renewable energy plants (hydro, wind and solar) with an installed capacity of more than 5 MW.

Renewable energy project development in Georgia is based on the Law on Public-Private Partnerships²⁴ and Resolution No. 515 of the Government of Georgia (October 2018). As of April 2022, 43 renewable energy projects were being developed based on the Law on Public-Private Partnerships, with 4 wind power projects at the final phase of implementation.

In 2015, GNERC passed a regulation introducing net metering for small-scale power plants (i.e. installed capacity of less than 500 kW) owned by retail consumers. Customers participating in this scheme are eligible to transfer excess energy to the grid. Electricity generated in surplus of self-consumption needs can be injected into the grid and then resupplied upon request later for self-consumption; otherwise, excess electricity can be sold to distribution companies at the weighted average purchase price.

As part of Georgia's electricity market reform, a day-ahead market and a market for system services are planned. While the planned launch for September 2022 was postponed, the market design is being finalised.

²³ <https://matsne.gov.ge/ka/document/view/4737753?publication=0> (available in Georgian only).

²⁴ <https://matsne.gov.ge/document/view/4193442?publication=2>.

Meanwhile, the MoESD is finalising the National Energy Policy and the NECP, in which renewable energy sources are central for decarbonisation and energy security. The draft document fixes the binding target for renewable energy in 2030 at 27.4% of total final consumption.

According to the draft, in 2022-2030 the state plans to:

- Integrate renewable energy into buildings and offer local municipality support to install renewable energy systems in new buildings.
- Introduce renewable energy requirements for new and capital-renovated buildings in 2025, and for public buildings in 2022.
- Deploy technologies for sustainable use of biomass, ensuring at least 85% efficiency in residential and commercial buildings and at least 70% efficiency in enterprises. MoESD co-operation under the forestry reform will promote the use of only sustainably harvested firewood.
- Promote the use of modern solid biofuels (briquettes and pellets) made from forestry and agricultural residues.
- Implement EU-standard environmental labelling and energy labelling, and other technical standard systems for solar water heaters to promote the use of certified equipment and systems.
- Create a training and certification system within the national qualification framework for installers of small biomass boilers, solar PV systems, heat pumps and other renewable energy technologies.
- Initiate informational, awareness-raising and training programmes involving local and regional government bodies to inform residents about the advantages and practicalities of developing and using renewable energy.
- Co-operate internationally to develop joint projects and statistical transfer schemes. Introduce a single-window principle for local and foreign investors, and co-ordinate co-operation of the various state structures.

Technology research, development, demonstration and deployment

Georgian RDD&D in general is linked to its Socio-Economic Development Strategy to 2020, but as the country's science system has over 80 non-prioritised research directions, there are no special energy-related RDD&D provisions in the Development Strategy or in any strategic document related to science and innovation. However, recent reforms have increased support for RDD&D in general, the key institutions providing funding being the Shota Rustaveli National Science Foundation (SRNSF), which supports projects at the initial stages of development, and Georgia's Innovation and Technology Agency (GITA), which finances globally scalable start-up projects.

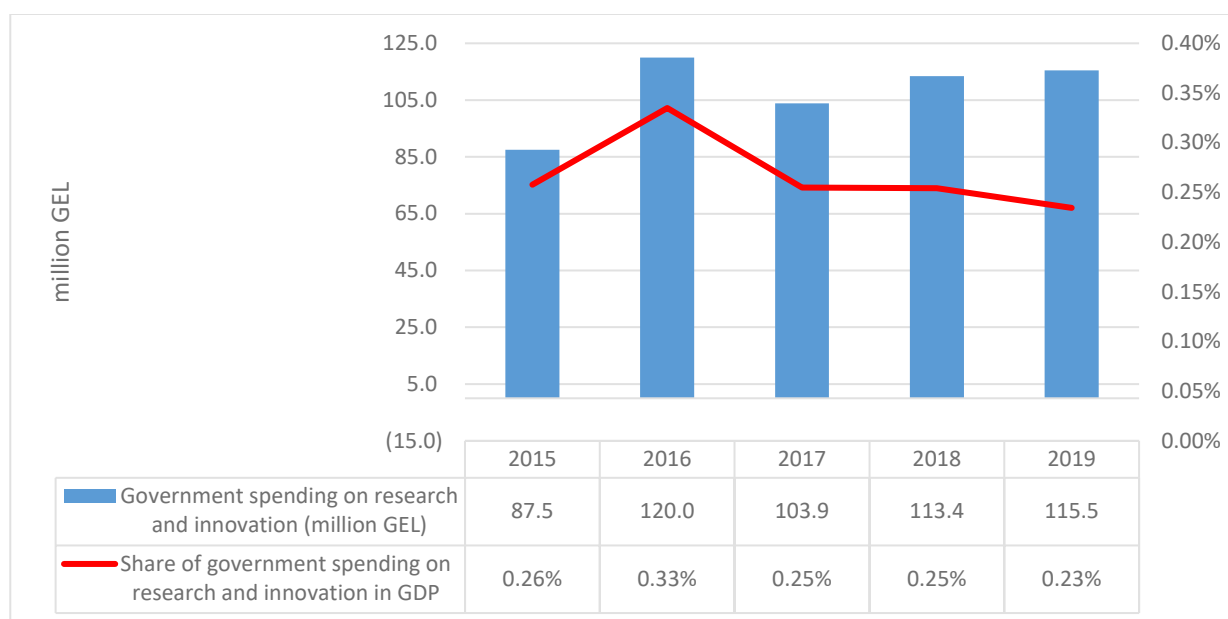
Several laws regulate management of Georgia’s science, technology and innovation system:

- The Law on Science, Technologies and Their Development (1994)
- The Law on Grants (1996)
- The Law on Higher Education (2004)
- The Law on Education Quality Improvement (2010)
- The Law on Innovations (2016).

No specific institution has been designed to support energy RDD&D, so energy-related research and innovation projects are implemented within the general RDD&D framework.

Although government spending on all RDD&D has increased significantly in recent years, its share in national GDP remains low compared with EU countries (see Figure). Georgia’s RDD&D intensity – the ratio of government RDD&D spending to GDP – was 0.23% in 2019, while the average rate for EU countries is 2.3% (2020 data). Furthermore, both the country’s financing of RDD&D and its RDD&D intensity have fallen since 2016.

Government of Georgia spending on RDD&D



Source: Based on data from Geostat and the Georgia State Treasury.

During 2017-2020, Georgia spent GEL 3.3 million on energy-related research, development and innovation through GITA and the Shota Rustaveli National Science Foundation.

Public funding for RDD&D in Georgia comes from several sources, and priority-setting and decision making on funding is decentralised. Project-based funding comes from the SRNSF, GITA and Enterprise Georgia, and funding for research institutes comes mainly from the Ministry of Science, Education, Culture and Sport (MES).

The MES allocates funding to the universities, which then decide how to redistribute the money to research units/institutes. The SRNSF also provides resources for maintaining and upgrading research facilities and infrastructure. In practice, there is no baseline funding for research in Georgia since MES allocations are mostly used to cover researchers' salaries (even though salaries in research and science are well below the country's average wage, especially for beginner researchers). It is difficult to evaluate private sector spending on energy RDD&D because reliable data and statistics are lacking. Experts estimate that funding from local industry is quite small, and while there is some international funding, it is attracted in an ad-hoc manner. The data are thus too scattered to present a complete picture of total funding for energy RDD&D. According to Geostat, in 2018 the private sector spent GEL 600 000 on RDD&D, and in 2019 it spent GEL 1 181 000.

In April 2016, Georgia's MES signed an association agreement with the EU Framework Programme for Research and Innovation, Horizon 2020 (now Horizon Europe). Becoming an Associated Country means Georgian research organisations can participate in Horizon Europe's calls for projects with the same rights as organisations from EU member states. However, due to the high level of competition and Georgia's lack of experience, shortage of qualified research institutions and other country-specific barriers, the participation rate of Georgian organisations is quite low. In the previous framework programme (Horizon 2020), Georgia's participation was ranked 12th out of 16 Associated Countries. Of the total EUR 8.7 million Georgian organisations received from participating in 85 Horizon 2020-financed projects, EUR 1 million was dedicated to energy- and climate-related projects. In addition, as a Near Neighbour Country (NNC), Georgia is also eligible to participate in the European Cooperation in Science and Technology (COST) programme.

Also in the interests of RDD&D, the SRNSF co-operates with Elsevier, which provides access to the electronic journals and data of 21 independent public research institutes and research universities, and the SRNSF pays Georgia's annual membership fees for the European Organization for Nuclear Research (CERN) and the Dubna Joint Institute for Nuclear Research. Georgia is also eligible for the North Atlantic Treaty Organization (NATO) Science for Peace and Security programme.

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