

დანართი 16.

INTRODUCTORY GUIDE into Georgian Oil and Gas Industry

(საქართველოს ნავთობისა და გაზის სექტორის საწყისი გზამკვლევი)

Oil and Gas Bearing Prospects of Georgia

In terms of geological structure, the territory of Georgia may be divided into 3 large tectonic units which extend sub-latitudinally. Mountainous structures of the Greater and the Lesser Caucasus of overthrust-folding and folded-block type are located to the north and to the south. A rather large depressed line is located among them. It expands westwards and enters the Black Sea basin.

Mountainous systems are mostly built with Jurassic-Cretaceous sediments, however, fragments of fold-metamorphic basement of mostly Late Proterozoic-Paleozoic age are denudated on the surface of separate, particularly elevated sections in the forms of ridges.

The depressed line in the western and eastern parts is expressed by inter-mountain troughs of Rioni and Mtkvari rivers filled with Molasse sediments of Oligocene-Anthropogenic age. At the central section they are separated from each other by elevation of pre-Molasse basement of Dzirula-Imereti which is mostly built with Jurassic-Cretaceous sediments on the surface and a fold-metamorphic basement of pre-Jurassic age is denudated on the surface in the form of Dzirula ridge.

Geological structure of Georgia, in respect to the upper part of the sedimented cover disseminate in the region and the sections of the fold-metamorphic basement which are denudated on the surface is studied quite well. Their structure is adequately described by various field geological-geophysical surveys, and in the depressed line – by results of drilling works as well. The deep structure of the most territory is studied much less and provides a ground for a different interpretation.

16 commercial fields are discovered on the territory of Georgia where existence of certain volume of reserves is confirmed and their production occurs more or less regularly. 5 new fields have been discovered in which existence of commercial reserves are not finally confirmed yet due to various reasons (Fig. 5.1. Discovered fields).

3 commercial oil fields are located in the Western Georgia, within the territory of Rioni trough: two fields – Supsa (# 1 on Fig. 5.1) and Shromisubani (# 2) are discovered in the southern part of the trough, within Guria depression and one field – Eastern Chaladidi (#4) - is discovered in the axial part of the trough. Also, 1 oil and 1 gas field are discovered but their reserves have not been estimated yet. Goraberozhouli gas field (#3) is located in the southern part of the trough, on the eastern periphery of Guria depression. Okumi oil field (#5) is located on the northern part of the trough, at the section of its junction with Gagra-Java elevation.

13 commercial fields are discovered in the eastern Georgia: 5 fields - Norio (#6), Satskhenisi (#7), Teleti (#8), Samgori South Dome (#9), Samgori-Patardzeuli-Ninotsminda (#10) are located on the adjacent territory of Tbilisi, mostly within Tbilisi-Sagarejo elevation. Out of the remaining 8 fields, Mtsarekhevi (#15), Baida (#16), Taribani (#17), Mirzaani (#18), Patara Shiraki (#19) and Nazarlebi (#20) are located on the main territory of South Kakhети depression and 2 fields - West Rustavi (#13) and Rustavi (#14) - are located at its western end, in the line of junction with Tbilisi-Sagarejo elevation. 3 new fields are discovered but their commerciality has not been evaluated yet. Norio-Martkopi (#11) and Manavi (#12) fields are discovered within Tbilisi-Sagarejo elevation, and Vedzebi-Ildokani (#21) field is located in the mountainous Kakhети, on Gombori range dividing South Kakhети and Alazani depressions.

The fields of the east Georgia are united into two groups. One group is located on the territory adjacent to Tbilisi and the second group is located within of Outer Kakhети trough.

Strata having a wide stratigraphic range are productive on fields. Upper Jurassic sediments are productive on Okumi field. Cretaceous strata on East Chaladidi, Manavi and Vedzebi fields are oil-containing. The main gas-oil deposit on Samgori-Patardzeuli-Ninotsminda field is located in Middle Eocene rocks (industrial hydrocarbon inflow is received from other strategic horizons too). Middle Eocene sediments represent the main productive layers on Teleti, Samgori South Dome, West Rustavi and Rustavi fields too.

Two gas deposits are discovered in Lower Eocene sediments and small oil deposits are discovered in Upper Eocene, Oligocene and Sarmat sediments.

Upper Eocene sediments are also productive on Teleti field. Gas condensate deposit is discovered on Rustavi field and oil condensate deposit is discovered on other fields. On the remaining fields, main oil deposits are located in molasse strata at the level of Lower Miocene (Satskhenisi, Goraberezhouli), Middle Eocene (Norio), Upper Miocene (Supsa, Taribani, Baida), Lower Pliocene (Shromisubani, Mirzaani, Patara Shiraki, Nazarlebi, Taribani) and Upper Pliocene (Mtsarekhevi). Small-size gas deposits are also discovered in separate Pliocene layers on Mtsarekhevi field.

Multiple oil and gas shows of various nature in the form of natural, superficial effusions as well as in the process of drilling are observed in the country. They are also associated with sedimentary strata having a wide stratigraphic range, from Lower Jurassic to Upper Pliocene.

On the basis of collected information regarding oil and gas bearing prospects of the country, several principal conclusions may be made:

- Almost entire intermountain depressed line of the country and its offshore extension within the Black Sea have oil and gas bearing prospects. Only the basement high on

Dzirula-Imereti uplift and its adjacent periphery are an exception where the basement is located under a very thin sedimented cover;

- Mountainous regions of the Greater and the Lesser Caucasus ranges located within the territory of Georgia must be considered as territories of unestablished prospects and/or unpromising territories. First of all, those territories of these regions are unpromising on whose surface basement high is denudated or are covered with sediments of small thickness;
- High-mountain, inaccessible sections on which it is complicated or impossible to conduct the necessary oil and gas exploration works to the full extent also are unpromising. In addition, the most part of the southern slope of the Greater Caucasus range is also unpromising because intensely folded-fractured sediments and Jurassic sediments being at the stage of highly catagenic transformation are widely denudated on the surface here and are characterized by unfavorable conditions of formation of traditional oil and gas fields;
- At the current level of study on the territory of Georgia, major part of the Lesser Caucasus range is primarily considered as the territory of unestablished prospects, which in a number of cases is preconditioned by comparatively complex terrain conditions (Adjara-Trialeti high-mountain sections) or rather thick young lava sheets widespread on the surface (Javakheti Plateau) which significantly restricts certain types of exploration works to be conducted and/or their efficiency.

Location of explored structures by tectonic zones is shown on Fig. 5.2. Fields and prospective structures with estimated resources.

In the part of the existing 16 fields, reserves and conventional reserves of oil, gas dissolved in oil and free gas have been evaluated by January 1, 2023. 68 prospective exploration structures have been additionally allocated and prospective resources of oil, gas dissolved in oil and free gas have been evaluated in their major part. Total results of evaluation are provided in Table 5.1. Prospective resources of oil, dissolved gas and free gas (detailed information about license blocks and reserves and resources of fields is proved in the Annex).

Currently, 16 fields are processed in Georgia and their distribution by oil and gas exploration and production license blocks is shown on Fig. 5.3. Fields and License Blocks.

The list of companies participating in the operation of fields as of the year 2023 is provided in Table 5.2. Companies operating on fields.

Analysis of oil production data in Georgia from 1930 to present shows that the production rate significantly increased from the year 1975, reaching its peak (averagely 3,3, mln. tons) in 1981-1983. After that, production dropped sharply first of all due to depletion of deposits and from the beginning of 1990s - due to the disruption of economic mechanisms managed

from the center related to dissolution of the Soviet Union (see Fig. 5.4. Oil and gas production in Georgia, 1930-2023).

In the second half of 1990s, after adoption of progressive legislation governing oil and gas sector in the independent Georgia, favorable preconditions were created to attract new investors to the oil fields and introduce new technologies in existing fields, which was reflected in the increase of oil production for that period. However, this process lasted only several years. It turned out that contractor companies, except some rare cases, were mostly focused on development of the existing field reserves (some of which have been in operation since 1930s and are actually in the phase of depletion) and did not pay enough attention to conducting expensive and high-risk exploration works related to discovery of new fields.

Exploration works for the purpose of discovery of new fields have been comparatively activated in recent years. Considerable increase of investments in oil exploration and production works is envisaged by plans. In particular, it is planned to facilitate activation of geological-exploration works on oil and gas bearing territories of the country, as well as increase in total annual projected production. The main focus of the activities is made on intensive performance of field seismic exploration and exploration drillings, including for the purpose of discovery of new fields in the Black Sea offshore zones. Innovative technologies of oil production on the existing fields are also widely introduced, which has already been expressed by certain increase of production in recent years.

Approx. 28,17 Mt of oil have been produced in Georgia from commencement of production to the year 2023.

Analysis of historic data of natural gas (free and associated) production shows that peak production (approx. 332 Mm³ in 1983) was recorded in parallel with intensive oil production period, however later the decreasing trend of oil production resulted in significant decline of associated gas production. Total gas production data stably range within 13-18 M m³. in the recent period. In total, approx. 3,37 Bcm of gas have been produced in Georgia from commencement of production to the year 2023.

According to the evaluation made by experts based on reasonable assumptions, even in case of partial confirmation of pessimistic forecast resource data of prospective fields, the local oil and gas production data will significantly increase in the nearest future.

Oil refining, import and transit

Oil primary treatment facility has been operating since 1978 and is intended for collection, preparation for sales and storage of oil produced from local oil-fields. The enterprise is located in the vicinity of oil-fields near Tbilisi. Design capacity of the enterprise ensures treatment of up to 4 Mt crude oil per year.

According to the design, the complex of structures and installed facilities envisages receipt of crude oil produced from wells at the facility by underground pipelines. The received products will first of all undergo a two-step separation cycle, for the purpose of separation of associated gas from oil. It is possible to deliver received gas to consumers through compressor plants and DN500 mm, 33 km long pipeline (maximum delivery to Gardabani TPPs reached 1,0 M m³/day in 1980-83).

At the next stage, after passing through the respective technological facilities (heat transmitters, de-emulsifiers, de-hydrators etc.) oil is delivered to 5000 m³ tanks where so-called bottom water is separated which is delivered to 2000 m³ collector tanks through the sewage system and thereafter it pumped into the utilization well by water discharge pumps and pipelines.

Oil brought to the marketable condition as a result of various processes of the primary treatment technological cycle is delivered to 10000 m³ tanks. The tanks are connected to the pumping station, which according to the design, is envisaged for pumping oil through DN 530 mm, 400 km long Samgori-Batumi pipeline (currently, part of Baku-Supsa pipeline). Design capacity of Samgori-Batumi main oil pipeline is intended for transportation of 5,0 Mt of oil per year. Today, oil primary treatment facility is operating with a simplified scheme (it is planned to reconstruct and modernize the enterprise for the purpose of vacation of unused territories and replacement of malfunctioned or unused equipment by modern technologies).

Batumi refinery operating in the Soviet period played an important role in providing thermal power plants and industrial enterprises of the country with fuel. The refinery stopped functioning in 1990s and is entirely out of service currently. The main reasons for the enterprise closure were: obsolete technologies which were tailored to production of heavy petroleum products mainly, sharp reduction of local oil production, growing prices on imported crude oil, as well as reduction of demand on the produced low quality, heavy petroleum products on local and regional markets.

According to the data of the State Agency for Oil and Gas, two small-capacity refineries are operating in the country currently: "Globus" LLC and "ZD Oil Company" LLC, with design capacity of 80 thousand tons and 130 thousand tons of oil per year, respectively.

At this stage, "Globus" LLC does not refine crude oil for various reasons, while "ZD Oil Company" LLC refines crude oil, including oil produced from local oil fields and produces naphtha, petrol, diesel and mazut.

As a local oil production equals to about 30-40 thousand tons per year, which allows for producing only 1,5-2% of demand of the country's petroleum products, Georgia remains dependent mainly on imported petroleum products.

In 2022, Georgia imported about 1,5 mln. tons of petroleum products. Russia, Romania and Bulgaria were key suppliers of diesel fuel and gasoline, while Turkmenistan supplied aviation fuel (see Table 5.3. Import of petroleum products in Georgia, 1000 tons).

In 2021, supply of fuel to Georgia was rather diversified, which ensured sustainable operation of a competitive market (see Fig. 5.6. Supply of petroleum products in 2021 by countries, %).

Due to the unprovoked war in Ukraine by Russia and imposition of marginal prices on Russian oil and petroleum products by G7 states, the price of petroleum products imported from Russia was significantly reduced and its share on the local market sharply increased compared to the respective period of 2021, which, despite the positive economic effect, may contain a considerable risk for reliable operation of the market.

According to the data of 2023, five large companies - Wissol Petroleum, San Petroleum, Rompetrol Georgia, SOCAR and Lukoil – dominate at the Georgian market of petroleum products, and their cumulative share in the total turnover equals to 75%. These foreign companies also own a large part of petrol stations on the territory controlled by the central government of Georgia.

Oil pipeline and marine terminals located in South Caucasus and in particular, on the territory of Georgia play an important role for supply of oil and petroleum products from the Caspian region to the international market.

Analysis shows that the trend of reduction of transit volumes is observed from 2018, which is mainly related to reduction of oil production from the offshore fields of Azerbaijan. The most considerable reduction of transit was observed in 2021-2022, which was preconditioned first by reduction of demand on oil at the global market due to COVID pandemics and later, by problems related to complication of insurance of maritime shipping due to Russo-Ukrainian war.

Gradual increase of the volume of oil and petroleum products transited to the territory of Georgia was observed from the 4th quarter, 2022, which is related to imposition of embargo on Russian oil from December 2022 and on Russian petroleum products from February 2023. Kazakhstan is implied to be the main source of increase of oil and petroleum product transit volumes. It plans to considerably diversify export routes of its own products and considers the Transcaspian route and the route passing through South Caucasus as priority directions. Transit of Kazakh oil and petroleum products through this route have been gradually increasing after launch of the Russo-Ukrainian war (by information of "KazTransOil", the volume of oil, petroleum products and liquefied petroleum gas transported via Batumi terminal in 2022 increased roughly by 75 % compared to 2021 data).

Generally, transit of Kazakh energy resources via Georgia was increasing in 2023 too, however, complexity and expensiveness of logistics of transportation of oil and petroleum products from Kazakhstan to the Black Sea ports remain a significant challenge. In order to be exported via Georgia, Kazakh oil or petroleum products is loaded into tankers or tanks located on ferries in the Caspian Sea port of Aktau and is delivered to port(s) in Azerbaijan, for further transportation to the Black Sea ports by Azerbaijan-Georgia railway, which makes transportation operations considerably more complicated and expensive (see Table 5.4. Tariff of transportation of Kazakh oil via territory of Georgia, \$/ton). An alternative route of export of up to 5 MT of Kazakh oil by Baku-Supsa pipeline and Supsa marine terminal is offered (currently, use of Baku-Tbilisi-Ceyhan oil pipeline operating with about 50% load is limited for export of large volumes of Kazakh oil due to a significantly different quality of Azerbaijani oil). However, Baku-Supsa pipeline does not actually operate currently due to complications of commercial navigation in the Black Sea water area in connection with Russo-Ukrainian war.

Increase of transit flows via South Caucasus route, in particular, via Georgia, may become a source of considerable additional income, but readiness of infrastructure located on the territory of the country may be necessary for it, which first of all, requires increase of limited capacity of railway and marine terminals (see Table 5.5. Capacity of the Georgian Black Sea ports) and ensuring reduction of tariffs using modern technologies.

The government of Georgia, by co-participation of private investors, but maintaining the controlling interest, plans to construct a deep-sea port of Anaklia on the eastern coast of the Black Sea, which will be able to receive large container ships, and at the later stage of development – high-tonnage "Aframax" and "Suezmax" type oil tankers.

Implementation of Anaklia deep-sea port project has essential importance for Georgia and the entire South Caucasus-Caspian region both from economic and strategic point of view, especially considering the reality created as a result of Russo-Ukrainian war – strategic location of Anaklia and technical parameters allow it to be formed as a transportation node alternative to the Russian port of Novorossiysk in the Black Sea.

In case of maximum load of infrastructure located in South Caucasus, in particular, on the territory of Georgia and implementation of projects of modernization and construction of railway lines and ports, critical dependence of the Caspian region's oil exporter countries on Russia will be reduced and ambitious plans of Kazakhstan to increase oil export via an alternative, non-Russian route by 15 million tons may become a reality.

Natural gas sector

Natural gas is the most commonly used primary energy resource in Georgia. According to the GEOSTAT data, share of natural gas in the total supply of energy resources equaled to 39% in 2021.

According to GNERC data, 5 690 M m³ of gas in total were delivered to the natural gas system of Georgia in 2022, out of which 3 091 M m³ were distributed to local consumers by an internal system (including losses), and the remaining volume was transited to Armenia (losses in the transportation system equaled to about 1,14 %). In addition, 19 771,7 M m³ of Azerbaijan's Shah Deniz gas were delivered to Turkey and the EU countries through the SCP and SCPX via territory of Georgia in 2022.

Delivery of gas in the local system was carried out from several points (see Table 5.6. Delivery of gas in the gas supply system of Georgia, M m³):

- Throughput of 1200 m gas pipeline of the North-South Main Gas Pipeline system incoming from Russia equals to 20 M m³/day at the section from the border to Saguramo (21,6 M m³/day actual maximum capacity of pipeline has been fixed). By 1000 m pipeline whose actual maximum throughput at Saguramo-Armenian border section of the system equals to 12 M m³/day, Russian gas is delivered to Armenia;
- A point is installed in the vicinity of transborder measurement point on 1000 m gas pipeline transiting the Russian gas for reverse supply of 3 M m³/day the gas belonging to Armenia to the internal gas pipeline system of Georgia;
- Throughput of Kazakh-Saguramo gas pipeline coming from Azerbaijan equals to about 10 mln. m³/day (10,7 M m³/day actual maximum capacity of pipeline has been fixed), during the system load in winter season. Through this pipeline, gas is supplied to Georgia on the basis of a long-term contract signed with SOCAR;
- Currently, total throughput of SCP and SCPX equals to about 65 M m³/day. It is technically feasible to receive up to 5,5 M m³/day through the off-take point connecting SCP to the main gas pipeline system of Georgia and the 12 km interconnector.
- The volume of gas received from the point of connection to the network of local producers depends on their daily production.

In 2022, total demand of Georgia equaled to about 3057 M m³ of gas (see Fig. 5.10. Gas demand dynamics, M m³/year). As the analysis shows, consumption of gas is characterized by a growing trend, which is connected with general economic growth and improvement of living conditions of the population (periods after the war in 2008 and the global financial crisis, as well as recession related to COVID pandemics are exceptions).

Demand on gas by sectors in 2022 was distributed as follows: household consumers – approx. 1336 M m³ (43,7 %), commercial sector - 1014 M m³ (33,2 %) and power generation - 707 M m³ (23,1 % see Fig. 5.11. Gas consumption by sectors, M m³/year).

Comparatively sharp increase of gas consumption in 2022 (around annual 19% instead of the average 5% in 2007-2021) is caused by a high load of thermal power plants, while gas consumption of power generation facilities increased by about 43% compared to the

previous year (see Fig. 5.12. Electricity generation by gas-fired TPPs). This is related to the energy deficit in Turkey and Europe and high prices on electricity caused by the Russo-Ukrainian war, which created favorable preconditions for its export from Georgia.

Power generation sector of Georgia includes five gas-fired thermal power plants:

- Tbilisres 3rd and 4th steam turbine blocks with a total installed capacity of 272 MW (130 and 142 MW, respectively). Tbilisres blocks have been in operation since 1963;
- The 9th steam turbine block owned by "Mtkvari Energy" LLC with installed capacity of 300 MW. The block was put into operation in 1991;
- Gas turbine owned by "Gpower" LLC with design capacity of 110 MW. Gas turbine was put into operation in 2006;
- Gardabani gas-fired combined cycle thermal power plant (Gardabani TPP" LLC – subsidiary of GOGC) with total installed capacity of 230 MW (2x75 MW gas turbine and 80 MW steam turbine) which was put into operation in 2015;
- Gardabani combined cycle thermal power plant 2 (Gardabani TPP-2" LLC – subsidiary of GOGC) with total installed capacity of 255 MW (2x84 MW gas turbine and 87 MW steam turbine) which was put into operation in 2020. Implementation of a new, gas-fired combined cycle, approx. 400 MW TPP project is underway.

According to data of the Georgian State Electrosystem, the actual total maximum capacity of thermal power generation facilities is about 1050 MW.

Demand of Georgia on natural gas is mainly balanced by import (see the Fig. 5.13 Natural gas import by countries, M m³/year). Production of local gas is low and its share in the total supply is less than 0,5% (≈14 M m³ in 2022).

Presently, main volumes of gas are delivered from foreign sources on the basis of several independent contracts – with "SOCAR" and International Shah Deniz Consortium (Azerbaijan) and the Russian "Gazprom Export" and "Gazprom Schweiz".

Azerbaijan is the key supplier of gas to the local market. In 2022, total volume of natural gas exported to Georgia from Azerbaijan equaled to about 83% of gas consumed in the country. Gas from Azerbaijan's Shah Deniz field is delivered to Georgia through the South Caucasus Pipeline (SCP). In accordance with the Host Government Agreement and the Option Gas Purchase and Sale Agreement signed between the SCP project participants and the Government of Georgia, Georgia has a right to purchase up to 5% of the transited volume of gas. The contract term is October, 2068..

In 2022, approx. 638 M m³ of Shah Deniz field gas were delivered under the Option Gas Purchase and Sale Agreement. Total volumes of Option Gas gradually increase after finalization of phase 2 of Shah Deniz field development and increase of volumes of Gas to

Turkey and European markets. According to the forecast, volume of option gas will increase up to 1,5 Bcm after the year 2027.

Supplemental Gas Purchase and Sale Agreement establishes volumes (up to 500 M m³ per year) and prices of supplemental natural gas to be delivered in the period until January 2026. In 2022 509 M m³ of Shah Deniz field gas were delivered to Georgia under the Supplemental Gas Purchase and Sale Agreement.

The prices defined by Option and Supplemental Gas Purchase and Sale Agreements are lower than natural gas prices in the region.

The State Oil Company of the Republic of Azerbaijan –SOCAR – within the framework of the Memorandum signed with the Government of Georgia – ensures delivery of gas for the purpose of fully meeting the demand of household and thermal generation consumers. Terms and conditions of delivery of gas to the Georgian market are agreed in the respective gas purchase and sale contract(s) signed with SOCAR. The contract expires in 2030.

Practically entire volume of natural gas supplied from Azerbaijani sources (jointly referred to as "Georgian Gas") is intended for meeting the demand of populace and thermal generation facilities, which constitute so-called "social consumers" of the market. In addition, SOCAR delivers gas at market prices to meet the demand of the Georgian industry and the commercial sector.

Import of gas from Russia was restricted to the maximum extent possible after the invasion of Russia to Georgia and the military conflict in 2008. However, after launch of the Russo-Ukrainian war, tendency of increase of the share of the Russian gas in the total balance is observed, which is mainly related to the limited capacity of Azerbaijan to meet Georgia's considerably increased demand on natural gas, on the one hand and commitments undertaken by Azerbaijan in respect to the EU to increase transit volumes to the west to the maximum extent possible (including, by freeing the South Caucasus Pipeline capacity by forwarding Shah Deniz gas owned by Georgia to SOCAR-owned infrastructure, which, on its part, cannot meet the demand of our country during the winter peak consumption period), on the other hand. As a result, share of the Russian gas in the total balance increased from 6% to 17% in 2022, compared to the pre-pandemic period. According to the actual data of quarter I, 2023, share of the Russian gas in the total import increased up to 30%.

Natural gas is delivered to household consumers from the so-called "social sector" at tariffs regulated by GNERC, while TPPs receive gas at preferential tariffs established by the Memorandum and respective contracts signed between the Government and SOCAR. For other consumers, retail and wholesale prices are deregulated and gas is delivered to them at publicly offered prices, terms and conditions.

The transit corridor located on the territory of Georgia represents one of the most attractive routes of supply of hydrocarbons from Azerbaijan and the Central Asian countries to

international markets. Oil, petroleum products and gas are transported via this corridor through pipelines, railway and sea ports.

Main gas pipelines provide transit of natural gas to Turkey, Europe and Armenia. An alternative source of transit of oil and petroleum products is the Railway of Georgia which connects Azerbaijan's oil terminals in the Caspian Sea (Baku, Sangachal, Diubend) to the Black Sea oil terminals of Georgia (Supsa, Batumi, Kulevi and Poti).

Gas from Azerbaijan's Shah Deniz field is delivered through the SCP (Baku-Tbilisi-Erzurum pipeline). Volume of gas actually transited by the SCP equaled to about 19,6 Bcm in 2022. It is planned to considerably increase the transit of Azerbaijani gas up to 25-30 Bcm per year by the years 2025-2027.

Russian gas is transited to Armenia via the North-South Main Gas Pipeline system. Load of the pipeline is considerably lower than its actual throughput (approx. 2,7 Bcm of Russian gas were transited to Armenia in 2022 – see Fig. 5.14. Natural gas transit, Bcm/year).

Domestic market of Georgia is served by the East-West and North-South Main Gas Pipeline systems with Kakheti, Southern, Adjara and Poti main branches and Kazbegi and Zugdidi-Anaklia direction pipelines. The unified gas supply system also includes distribution pipelines, gas distribution stations, gas metering units and currently non-functioning compression stations.

Total length of main gas pipelines owned by Georgia equals to approx. 2000 km (See Fig. 5.15. Main gas pipelines of Georgia).

Natural gas transportation system in Georgia is operated by "Georgian Gas Transportation Company" LLC, which is a state-owned company and natural gas transportation licensee. Main gas pipelines and related structures and facilities are owned by "Georgian Natural Gas Transmission System Owner" – subsidiary of JSC "Georgian Oil and Gas Corporation".

Main gas pipelines of various directions gather at Saguramo point and imported natural gas is distributed throughout the country. Therefore, the East-West Main Gas Pipeline is conditionally divided into two parts: south-east border of Georgia – center and center – Sukhumi (with branches in the direction of Adjara and Poti).

20 gas distribution companies operate in Georgia. Among them, "Tbilisi Energy" LLC, "SOCAR Georgia Gas" LLC and JSC "Sakorggas" are the dominant companies which distributed up to 90% of the total demanded gas in 2022.

Total number of retail consumers (household and non-household) equaled to 1,488,014 (including 1 426 978 households, 61 036 non-household consumers) in 2022. It is envisaged to additionally invest 265 M GEL by distribution companies in 2023-2027, which will be used for connection of new consumers, as well as modernization and increase of operational reliability of the existing network.

Consumption of natural gas by household consumers differs by cities and villages, as well as regions. Average annual natural gas consumption per a household consumer in small cities and settlements is considerably lower than the index of urban settlements, as in regions where it is available, firewood is still widely used for heating. According to GNERC data, averagely 1317 cubic meters of gas are consumed by one household consumer in Tbilisi during a year. For regional cities this volume equals to 1096 cubic meters, for rural settlements - 856 cubic meters.

Demand forecast

Gas is one of the cheapest, easily consumable and ecologically least damaging fossil fuels in Georgia. As mentioned above its consumption has been characterized by a growing trend from commencement of revival of economy in the period of the country's independence, the years 2008-2010 and critical periods caused by COVID pandemics.

According to the data of January-September, 2023, total actually gas supply exceeded 2,11 Bcm. Considering the forecast data, actual annual demand on gas will be equal to approx. 3,2 Bcm in 2023.

Analysis of gas demand forecast results in the long run (source: Projections of Natural Gas Annual and Peak Demand in Georgia Through 2050, Report, EIHP, Zagreb, November, 2023) during various scenarios of development of the country's energy shows that by the year 2050 gas consumption in Georgia may vary between 2,16 and 7,23 billion cubic meters per year.

Considering analysis of the obtained results and the target data defined by the country's energy policy and the National Energy and Climate Plan (NECP), estimated forecast parameters of long-term gas consumption have been selected by a joint decision of the Ministry of Economy and Sustainable Development of Georgia and specialized departments of GOGC. The first, so-called "optimistic" scenario envisages an active engagement of the state for achievement of mandatory goals of decarbonization of energy, which will be ensured by reduction of total consumption of energy, considerable increase of electricity share in the energy balance and active facilitation of development of renewable energy. The second, so-called "conservative" scenario implies moderate development (approximated to historical trend) of renewable energy and comparatively lower share of electricity in the total energy balance.

As the analysis shows, under conditions of forecasted gas consumption, guaranteed supply of market may face a significant risk, as the Supplemental Gas Purchase and Sale Agreement expires after 2026 and the long-term contract concluded with SOCAR expires in 2030. The above deserves particular attention considering the fact that today Azerbaijan is mainly

focused on fulfillment of obligation of delivery of doubled volumes of gas (20 Bcm/year) to the EU from the year 2027 and is less likely to express readiness to prolong contract with Georgia.

Challenges related to energy security

Achievement of planned target indicators of decarbonization and ensuring significant increase of share of renewable energy sources for meeting the demand on primary energy resources, requires significant additional investments for production, transportation and adequate arrangement of reserving infrastructure, in addition to various technical-economic measures and political will. At the same time a complicated and expensive transitional process will be carried out under conditions of deficit of available capital preconditioned by outcomes of economic recession related to COVID pandemics and the region's unpredictable political situation created as a result of Russo-Ukrainian war.

Despite the general growing trend of demand on primary energy resources, Georgia significantly lags behind averaged indicators of industrially developed regions and the world, as well as neighbor countries by level of energy consumption per capita, which is accompanied by high level of energy capacity of products produced in the country compared to the leading industrial countries. Therefore, to achieve the desirable level of wellbeing of the population, it is necessary to significantly increase consumption of energy resources, first of all, electricity, together with introduction of energy-efficient technologies.

Energy security implies continuous energy supply, ensuring security of supply at an acceptable price, protection of state and its population from any kind of deficit of energy resources or unplanned delay in supply which may occur under influence of natural, technological, political and social-economic, internal or external factors.

Unplanned delays in supply in the natural gas sector of Georgia are related to risks associated with termination of import, political, commercial reasons, technological or natural disasters, while resilience of the system is defined by the ability to restore supply with minimum losses and urgently or replace the source, route of supply or imported natural gas from reserves or with alternative resources.

In the current period, the main challenges of the energy security of Georgia are related to:

- Geopolitical factors which are mainly related to occupation of a part of the country's territory by Russia (in the energy sector, occupation is expressed by several main negative factors, including by location of critical infrastructure (main oil and gas pipelines, high voltage power transmission lines, Enguri HPP etc.) on the occupied territories and in their vicinity, high participation of Russian state and commercial

companies in the sector, etc.);

- Critically high dependence on import of energy resources and growing trend of this dependence;
- Obsolescence of energy infrastructure and incompliance with international technical standards;
- Complexity of diversification of energy resource supply sources and routes;
- Inexistence of reserves of energy resources;
- Inadequate level of cybersecurity of the existing energy assets, as well as inadequate use of software and electronic services in the process of preparation of development plans and operational management;
- Deficit of available capital during the transitional process preconditioned by the economic and geopolitical situation created in the region.

Potential negative impact of these challenges creates significant threats and risks and preconditions critical vulnerability of supply of energy resources.

Guaranteed receipt of imported resources is one of the external factors which may create significant risks and threats to ensuring wellbeing of the population, and in particularly extreme situations – to the country's territorial integrity or proper functioning of state institutions. Diversification of imported sources and routes of supply will facilitate reduction of energy security risks.

As the analysis shows, creation of a critical situation in gas sector may be related to lack of strategic reserves, which preconditions a particularly low level of the system flexibility, while the country is almost entirely dependent on imported fuel and gas plays a leading role in the energy balance, together with imported petroleum products.

Likelihood of creation of a critical situation is high due to complexity of foreseeing efficiency of long-term risk agreements concluded with foreign partners in the long run, considering that these importer countries dominate in other sectors of energy too and control a significant part of main means of distribution (according to the data of the first half of the year 2023, more than 80% of petroleum products consumed in Georgia are imported from Russia, while Azerbaijani companies control gas distribution companies serving more than half of the country's consumers).

Emergencies on infrastructure and delays in supply under influence of climatic factors are related to a high risk of creation of frequent and damaging critical situations.

Creation of a critical situation in the natural gas sector may be related to deficiency of infrastructure, lack of fuel reserves, which preconditions the system's practical inability to ensure efficient operation during peak consumption period or in case of unforeseen delays or termination of supply.

Critical increase of peak consumption is related to a drastic seasonal changeability of climatic conditions and adequate variability of gas demand in the household sector and thermal power generation by seasons. Delays in supply may be caused by emergencies related to natural disasters or technological failure, which are preconditioned by peculiarities of terrain and climate of Georgia, unstable political situation in the region and low technical reliability and insufficient throughput of main pipelines and part of related equipment.

Up to 10 cases of unscheduled termination of gas supply have been observed in Georgia during recent years and their major part was mainly related to natural disasters. As a result, supply of gas volumes delivered to the country from various sources was terminated in an emergency mode during the period of 1-3 weeks or was reduced by at least 20-30% of the total supply.

Long-term experience shows that damages of obsolete infrastructure caused by corrosion are another main reason for its breakdown.

Damages caused by subjective reasons are less intensely observed under conditions of construction and operation of main gas pipelines of Georgia.

Severe gas shortage may be created in case of unscheduled termination of supply from any key source (Azerbaijan or Russian Federation), under conditions of winter peak consumption. Therefore, it becomes necessary to carry out special, immediate measures for the purpose of avoidance of problems related to supply of fuel and electricity to consumers.

Delays in supply related to technological failures developed on the supplier's gas fields or necessity of performing preventive works and testing on transport pipelines and measurement points are also observed periodically.

In addition to necessity of timely elimination of outcomes of emergencies caused by various reasons, significant difficulties are created due to impossibility of rational management and seasonal balancing of gas flows by own efforts, under conditions of consumption misbalance and relatively stable supply of imported gas. Gas consumption in Georgia is characterized by strongly expressed misbalance during winter and summer periods, which is mainly preconditioned by necessity of increase of share of TPPs in electricity generation during winter period, when hydrogeneration is sharply reduced due to low water level, as well as

by transition of the household sector into intensive heating mode. The tendency of unequal gas consumption by seasons is practically unchanged based on the long-term observation. Misbalance of daily consumption of volumes supplied during peak and nominal loads is particularly considerable.

Balancing misbalance between demand and supply of winter and summer periods represents a significant problem. Urgency of the issue is also preconditioned by growth of peak consumption correlated to increase of total gas consumption, which makes the process of effective management of gas flows seriously complicated, due to lack of internal reserves and limited throughput of transborder infrastructure.

Critical infrastructure

In terms of energy security of the country, particular attention is attached to protection of critical infrastructure whose functioning may become risky for security of the country or separate region(s).

Critical energy infrastructure includes energy generation and production facilities, transport networks and other elements on which maintaining national security, the country's economic viability, and health protection of population depends. Therefore, it is necessary to take care of ensuring functioning of critical infrastructure and its protection from natural disasters, terrorist acts, cyberthreats and other possible damaging factors.

In addition to protection from damaging kinetic or virtual impact, high level resilience is required from systems containing critical infrastructure, which implies their readiness to quickly adapt to changed conditions: In particular, they should be able to resist and/or quickly restore in case of unplanned delays in operation after target attacks, accidents, naturally caused threats or incidents.

Georgia's critical infrastructure under priority protection may include:

- Responsible sections of main (transportation) oil and gas pipeline systems, significant process units and transborder measurement points (for example, pass, hardly accessible sections of the main gas pipelines, whose failure during heavy snow in winter may lead to termination of gas supply to consumers of Georgia for a long period of time);
- Responsible sections and significant process units of average and high-pressure gas distribution systems of a region or a large city (for example, sections of the pipeline connecting Tbilisi gas distribution network to the main gas pipeline system);
- Storage systems of strategic and/or operational reserve, such as gas storages, liquefied natural gas storages, oil and petroleum product storages etc.;
- Responsible sections and significant process units of oil and gas pipeline transit systems (for example, interconnector connecting the SCP Georgian section Area 72 to

the main gas pipeline system of Georgia, oil and gas pipeline pumping and compression stations etc.).

Operational and strategic reserves

During peak loads and/or in case of unplanned termination (or significant reduction) of supply, severe gas shortage is created and it becomes necessary to carry out special, expensive and instant measures for avoidance of significant complications of supply of fuel and electricity to consumers.

Particularly severe situation may be created, if unplanned termination of gas supply from key source(s) takes place for any reason. Termination of gas supply from Azerbaijan preconditions occurrence of shortage of about 50% of demand. Also, unplanned termination of gas supply from Russia may result in about 45% shortage during peak consumption periods.

In general, the tendency of increasing the share of the Russian gas in the total balance in the recent period represents a significant challenge for the energy security of Georgia. The tendency of increasing the dependence on the Russian gas reaches a particularly high level in the peak gas consumption period (share of the Russian gas in the total balance exceeded 40-45% during the peak consumption in January-February 2023). Peak consumption for the years 2022-2023 exceeded the peak consumption of the pre-pandemic period by almost 25%. In case Azerbaijani gas continues to be delivered only by SOCAR-owned pipelines (for the purpose of vacating the SCP capacity), the volume of the Russian gas in the days of peak consumption may exceed 10 Mm³, which should be considered undesirable in terms of energy security. Therefore, it is recommended to ensure filling the gas deficit from other sources or reserve volumes during unplanned termination of supply or in the winter peak consumption period to balance seasonal and operational demand.

The discussed plan envisages establishment of expediency of supply of natural gas from alternative sources to fill the possible deficit of gas supply due to the increasing demand and expiry of the existing contracts and selection of alternative means of balancing seasonal and operational misbalance of gas demand, including, by implementation of the underground gas storage, LNC or CNG storage projects or projects of mutual assistance with neighbor and the Energy Community countries etc.

Infrastructure development

For the purpose of meeting the demand of the country and separate regions with energy resources, it is necessary to rehabilitate part of morally and technically obsolete transport infrastructure due to its insufficient throughout and low technical reliability. Furthermore, despite the fact that a positive trend of reduction of natural gas losses is observed in general,

losses observed in the process of gas transportation and particularly, distribution, are yet inadmissibly low.

Works of rehabilitation and modernization of key sections and branches of main gas pipelines serve the goal of increasing the gas pipeline system's operational flexibility and reliability to ensure unhindered and effective distribution of the forecast gas demand throughout the country. .

According to the Ten-Year Network Development Plan (see: Ten-Year Network Development Plan (2021-2030), Strategic Planning and Projects Department, GOGC, Tbilisi, 2020), the priority projects to be implemented in the short- and medium-term periods include rehabilitation of critical sections of the East-West Main Gas Pipelines, and the long-term projects include construction of interconnectors connecting various routes and branches of the main gas pipeline of Georgia, including reserving critical infrastructural sections located in mountainous regions which are hardly accessible during adverse weather conditions and it is complicated to start their immediate rehabilitation in case of emergency.

Implementation of investment infrastructural projects to be implemented as a priority in the short-term period ensures guaranteed gas supply of the country's western and central regions, including considering the prospects of development of the free industrial zones and the Black Sea recreational zone.

The medium- and long-term infrastructure development plan mainly envisages the projects of high-pressure gas supply to Gardabani TPPs through the pipeline connecting to interconnectors, including Vale-Vani and Tabatskhuri-Bakuriani connector, as well as the South Caucasus Pipeline to the main gas pipeline system of Georgia.

Implementation of projects of restoration and development of the main gas pipeline system of Georgia, as well as its branches and interconnectors will lay a basis for replacement of the dead-end architecture of the gas supply system of Georgia with highly reliable circular gas supply, which allows for redirecting gas flows in critical situations for the purpose of guaranteed gas supply of any consumers and will significantly increase the operation area and technological reliability of the unified gas supply system.

Legislation and integration into international energy organizations

Within the framework of the Association Agreement with the EU, Georgia signed the Protocol of Accession to the European Energy Community on October 14, 2016 which was ratified by the Parliament on April 21, 2017. Since then, Georgia has been enjoying advantages of the country holding a status of the full-fledged contracting party of the Energy Community and is obliged to ensure introduction of key principles of the European energy market formation in Georgia (considering the exceptions (benefits) related to peculiarities of the internal gas market, including those related to transit projects). In

particular, in accordance with requirements related to energy trade under the Association Agreement, Georgia is gradually harmonizing the energy legislation of the country with the EU legislation.

According to the agreed plan, it was considered necessary to introduce the following European directives and regulations in the gas sector of Georgia:

- Directive 2009/73/EN concerning common rules for internal market in natural gas;
- Regulation (EC) No 715/2009 on conditions for access to the natural gas transmission networks;
- Directive 2004/67/EC concerning measures to safeguard security of natural gas supply (which is already replaced by Regulation (EU) No 994/2010 concerning measures to safeguard security of gas supply and repealing Council Directive 2004/67/EC and Regulation (EU) 2017/1938 of the European Parliament and of the Council of 25 October 2017 concerning measures to safeguard the security of gas supply and repealing Regulation (EU) No 994/2010

Therefore, the long-term policy of the country's natural gas sector development envisages creation of a favorable environment for competitive trade with natural gas and ensuring protection of consumer interests, as well as significant reduction of critical dependence on dominant suppliers.

Energy law

The Law of Georgia on Energy and Water Supply represents an adapted version of the respective laws of the EU, considering peculiarities of the energy market of Georgia.

Main objectives of the Law for natural gas sector are the following:

- to establish common rules for the organization and functioning of natural gas market of Georgia, including, its further development and management, for the purpose of integration with the Energy Community countries markets;
- to set the terms and conditions for the provision of public service obligations in natural gas sector, and to ensure the protection of interests of final customers;
- to regulate and monitor the unbundling of transmission system operators and distribution system operators, as well as to ensure their effective independence from other energy activities and related commercial interests.

Unbundling of competitive and monopolistic activities

According to law, transmission is activity of public interest which include transportation of natural gas through the transmission network, its operation, maintenance, development and other related activities required for safe, reliable and efficient functioning of the entire natural gas system of Georgia.

Transmission system operator must be established as a specialized and independent energy enterprise having a status of a legal entity created under the Georgian legislation. Independence of the operator is achieved by separation from integrated enterprise, which implies effective separation of activities related to energy infrastructure from commercial interests and is achieved by division of property and/or ensuring legal, functional, administrative, operational and decision-making independence.

The law defines that each enterprise which owns a transmission system must act as a transmission system operator and obtain a license for transmission activities. As an exception, according to the terms and conditions defined by a special paragraph of a clause of the Law related to unbundling, it is allowed to establish a so-called Independent System Operator (ISO) which does not represent a transmission system owner.

At the same time, it should be mentioned that a shareholder of a vertically integrated enterprise and the transmission system operator may not be the same state authorities (for example, Ministry), institution or another public body of Georgia. They should represent two separate public bodies, one of which exercises control on the transmission system operator and the other – on the enterprise which carries out production, supply or other competitive activities. Under the conditions of Georgia, this provision limits the possibility of control of the transmission system operator (GGTC) and the network owner enterprise carrying out competitive activities ("Transmission System Owner" affiliated with GOGC) by the same public authority.

Based on the above provisions of law and consultations with the Energy Community experts, considering the existing long-term contracts, ensuring supply security of the country and international commitments of key players of the natural gas market of Georgia, "Independent System Operator" (ISO) has been established on the basis of "Georgian Gas Transportation Company" LLC and the main gas pipeline network was transferred into ownership of a newly established company – "Georgian Natural Gas Transmission Network Owner" LLC, subsidiary of GOGC, which is independent, in terms of legal form, organization and decision-making, does not participate in activities related to transmission, distribution and storage.

The law defines the issues of security of natural gas supply similarly to requirements of the respective EU requirements, which includes measures related to security of supply, in particular, the national emergency plan prepared in advance, the terms and conditions of restriction of gas supply in case of emergency and monitoring of security of gas supply.