საქართველოს ნავთობისა და გაზის კორპორაცია
Georgian Oil & Gas Corporation

Ten-Year Development Plan for Georgian Gas Transmission Network 2018-2027

October
2017

The document represents a 10-year Georgian gas transmission and related infrastructure development plan. It was prepared on the basis of 2016 and 2017 year editions of "10-Year Development Plan for Georgian Gas Transmission Infrastructure)", considering the actual situation of current period.

The 10-year Gas Network Development Plan was discussed with the Georgian Gas Transportation Company, presented to the Ministry of Energy of Georgia, the Georgian National Energy Regulatory Commission and other stakeholders.

Consultations regarding the information used in and information on the project implementation of the 10-year Gas Network Development Plan can be obtained from GOGC Strategic Planning and Projects Department.

Head of the Department: Teimuraz Gochitashvili, Dr. Sci, professor,
Tel: +(995 32) 2244040 (414); E-mail: t.gochitashvili@gogc.ge

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Abbreviations

AGRI - Azerbaijan-Georgia-Romania Interconnector project
BAU - Business As Usual
BS – "Blue Stream" gas pipeline project
BTC - Baku-Tbilisi-Ceyhan oil pipeline
CAC - Central Asia - Center gas pipeline
CACGP - Central Asia - China Gas Pipeline
CNG - Compressed Natural Gas
EAOTC - Euro-Asian Oil Transportation Corridor project
EnC - European Energy Community
EWGP - East-West Gas (main) Pipeline
GGTC - Georgian Gas Transportation Company
GNERC – Georgian National Energy and Water Supply Commission (Commission)
GOGC – Georgian Oil and Gas Corporation
IGAT - Iranian Gas Trunkline
ISO - Independent Transport System Operator
LNG - Liquefied Natural Gas
NS - "Nord Stream" gas pipeline project
NSGP - North-South (main) Gas Pipeline
TYNDP-Transport Network Ten-Year Development Plan
SCP - South Caucasus Pipeline (Baku-Tbilisi-Erzurum gas pipeline)
SCPX - SCP Expansion Project
SOCAR - State Oil Company of Azerbaijan Republic ("SOCAR")
TANAP - Trans-Anatolian gas pipeline
TAP - Trans Adriatic Pipeline
TAPI - Turkmenistan-Afghanistan-Pakistan-India gas pipeline project
TCP - Trans-Caspian Pipeline project
TS – "Turkish Stream" gas pipeline project
WREP – Western Route (Baku-Supsa) pipeline
WS - "White Stream" pipeline project
USAID - The US Agency for International Development

Executive summary

1. Introduction

The presented Georgian gas network ten-year development plan:
a) endeavors to capture the transport infrastructure rehabilitatation/ reconstruction projects of the period between 2018 and 2027;
b) addresses the identification of the projects to be implemented in 2018 with secured financing as well as the projects to be implemented in the next two years;
c) presents a 10-year timeline for the implementation of the investment projects and the possible sources of financing such projects.

TYND was prepared in accordance with the requirements of *Directive 2009/73/EC concerning common rules for the internal market in natural gas* and *Directive 2004/67/EC concerning measures to safeguard security of natural gas supply*. It is based on 2016 and 2017 year editions of "10-Year Development Plan for Georgian Gas Transmission Infrastructure)", considering the current actual situation on the Georgian market. The plan includes the conceptual issues of the infrastructure development. Detailed design and construction of infrastructure projects will be discussed in the later stages of development.

2. Georgian natural gas sector

To substantiate the plan, the document provides the demand-supply analysis of the Georgian market of natural gas, the gas demand growth forecast, energy security risks, and the matters relating to the integration with international energy organizations.

3. Regional market for natural gas

The document deals with the development of the regional market for natural gas, the relevant gas transmission infrastructure and analyzes the EU energy market demand and the export potential of the Caspian region. It has been determined that the prospects of developing transit projects across the territory of Georgia are mostly related to the Southern Gas Corridor and other projects for supplying gas to the European market from Azerbaijan and, possibly, Turkmenistan.

Stable gas supply without any appreciable changes from North (Russia) to South (Armenia) has been forecasted.

4. Infrastructure development plans

The document discusses development perspectives for gas transmission infrastructure across the territory of Georgia, considering the findings of the study of its condition and its hydraulic modeling results.

The document gives a brief description of the investment projects for the construction or rehabilitation/reconstruction of gas mains as a part of the transit and country-wide gas supply infrastructure and their key technical-economic parameters. The document also discusses realization prospects of strategic projects linked to provision of energy security.

5. Investment plan

The 10-year plan contains a timeline as an investment schedule for the implementation of the infrastructure projects, including:

- the identified projects for 2018, for which financing has been allocated, and those of 2019-2020, for the financing of which only a preliminary decision has been made;
- long-term projects for 2021-2022 and those subsequent to 2023, the decision on the financing of which will be made having regard to the need for their implementation and the availability of the necessary investments.

The first version, the 2016-2017 Ten-Year Georgian Gas Transmission Infrastructure Development Plan became the basis for country's energy development strategy. Changes made in the presented version of the plan would be reflected in the updated version of the strategy. It is noteworthy that according to the Georgian Law on Energy" project which is prepared according to the requirements of EU 3rd Energy Package and Energy Community Legal Framework, 4th edition, transport (transmission) network ten-year development plan should be prepared by the Gas Transit System operator and should be presented for approval to the Energy Regulatory Commission. But at the transition stage, before the total implementation of EnC legal basis in the Georgian gas sector, the plan is prepeared by the GOGC which owns transit infrastructure and is responsible for its development, considering discussions (namely the list of urgent capital and current rehabilitation works submitted by GGTC) with the operator - GGTC. The Plan was presented to the GNERC, the Ministry of Energy of Georgia as well as other stakeholders. After approval of the obligatory short term period investment plan by the Ministry of Energy of Georgia its implementation will be provided.

1. Introduction

1.1. General provisions

The Gas Infrastructure Development Plan was prepared in accordance with country's energy policy having regard to Georgia's international commitments for natural gas transit and supply as well as those under the EU Association Agreement to ensure harmonization of energy and energy security.

The presented plan:

a) identifies all infrastructure projects to be rehabilitated/reconstructed or built within the next 10-year period;

b) contains detailed information about the projects of the year 2018 with the provided financing and identification of other investment projects to be implemented within the next 2 years;

c) covers medium and long term projects of the 10-year period investment plan.

The purpose of the 10-year Natural Gas Network Development Plan is to ensure guaranteed gas supply to consumers at present and on a long-term basis, and promote the formation of internal and regional markets based on EU energy legislation through the rehabilitation/development and stable operation of the internal transmission, trans-border and transit infrastructure.

The projects included in the 10-year plan are prioritized in terms of time mainly by the following criteria:

- damaged or malfunctioning infrastructure that needs immediate recovery, or infrastructure whose commissioning is dangerous and characterized by improper technical reliability or insufficient capacity;
- The potential impact of new or restoration and reconstruction infrastructure on the country (region), economic growth and welfare of the population, the natural and social environment;
- contribution of the planned infrastructure to the country's and international energy security provision.

The presented 10-year plan contains a description of major transmission infrastructure as well as auxiliary infrastructure projects description to be implemented or initiated on the following three stages of the timeline:

The presented ten-year plan is based on the ten-year development plan[1] for the Georgian gas transmission infrastructure for years 2016-2025 and 2017-2026[1], as well as the list of urgent capital and current rehabilitation works submitted by pipeline operator company.

[1] Georgian gas transmission infrastructure ten-year development plan for years 2016-2025 and 2017-2026, GOGC, 2016 (see www.gogc.ge) [1]

1.2. Formal and methodological basis for preparing the plan

The formal basis for preparing the 10-year gas transmission network plan is Georgia's commitment to submit the 10-year network development plan subject to the requirements of *Directive 2009/73/EC concerning common rules for the internal market in natural gas* after joining the European Energy Community. It is considered to include the infrastructure projects recommended in this document into the country's energy development strategy. After its presentation to the Ministry of Energy and GNERC and approval of the obligatory short term investment program its implementation will be provided. Also it is recommended to present the plan to the European network of transmission system operators for gas (ENTSOG) secretariat for information and for identification of possible common interest projects.

It is recommended that the 10-year network development plan (TYNDP) be prepared by using *Regulation (EU) No 347/2013 on guidelines for trans-European energy infrastructure, among* them demand-supply forecast and data on the existing and planned infrastructure and etc.;

The plan provides a market demand-supply forecast for the period up to 2030. During the market modeling the country's economic and social development is discussed in the different scenarios, like methodology[2] adapted in the Europe.

The preliminary financial assessment of the network development plans for a short-term period (2018-2020) is taken based on the actual data of the gas pipeline projects built (rehabilitated) and including construction contracts on the actual expenditure values (see Table 1.1). For assessment of the medium- and long-term period planned projects indicative investment costs and actual banchmark values[3] recommended by the European Energy Regulatory Association are used.

Table 1.1. Pipeline construction and materials cost $/M (including VAT)

D(I)/t, mm/mm	Pipes and materials price	Construction cost			Total costs (for medium difficulty terrain)	Total with overhead and unforeseen expenses
		Terrain				
		Simple	Moderate	Complex		
150/5,6	44	20	23	26	66	73
200/6,4	47	26	30	34	77	85
300/6,4	67	40	46	52	113	124
500/8,7	119	64	85	106	204	225
700/10,3	185	105	181	257	366	403

The ultimate goal of TYNDP is to develop a time distributed and financially affordable natural gas infrastructure development plan, the implementation of which would ensure guaranteed gas supply to consumers according to the criteria accepted in the international practice in not only ordinary but also during critical situations, namely, those which would meet the requirements of EU regulations (Directive 2004/67/EC and Regulation (EU) 994/110 Concerning measures to safeguard security of gas supply) for infrastructure (Formula N-1) and supply standards.

[2] ENTSOG and the TYNDP process, ENTSOG, 08/02/2016

[3] Unit investment cost indicators and corresponding reference values for gas infrastructure, ACER, 2015

2. Georgian natural gas sector

2.1. General overview of the sector

Due to the shortage of local resources to satisfy the country's growing energy demand, it becomes necessary to provide the guaranteed supply of imported fuel, including natural gas. This is associated with significant challenges, due to the unstable political situation in the region, the critical dependence of the country's energy sector on climate and the high probability of natural disasters, insufficient capacity of outdated and low technical reliability of inherited transport infrastructure.

Enhancement of reliability of the gas transmission infrastructure by using interconnectors with the neighboring systems and connectors between internal systems as well as reserve lines, and their effective rehabilitation/reconstruction and launching of new capacities serve as one of the effective instruments for mitigating possible challenges and improving energy security.

Natural gas is one of the cheapest, easy-to-use and ecologically safest mineral resources in Georgia. Since the economic revival in the post-soviet period (with the exception of the crisis period of 2008-2010), there has been a growing trend in the supply and consumption of natural gas (see Figure 2.1).

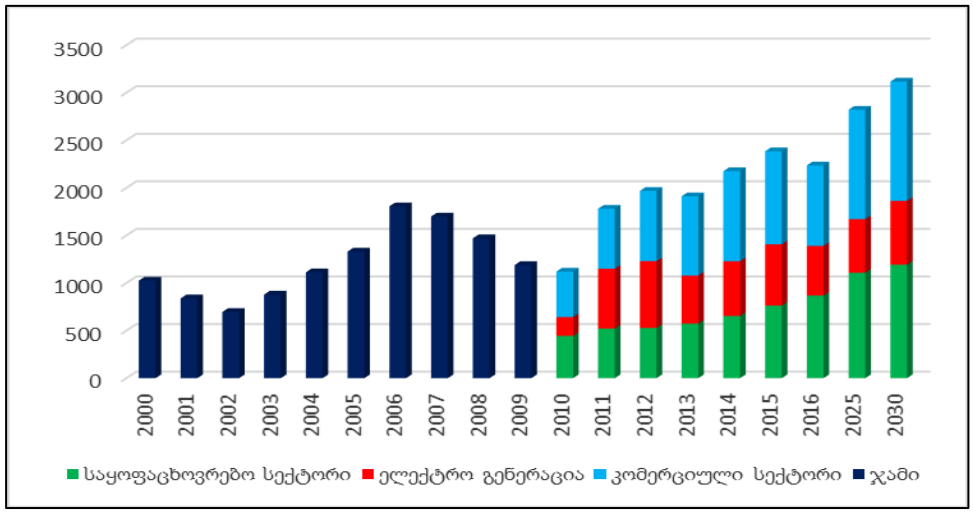


Figure 2.1. Gas consumption, mcm per year

The share of natural gas in the total energy balance accounts for approximately 40% (according to Geostat). Natural gas is the most widely consumed energy resource in Georgia. According to GGTC, approximately 2 242 mcm (with losses) of natural gas was supplied to Georgia in 2016, among them 869 mcm to household sector (39% of total delivered), 522 mcm (23%) to thermal power generation and 846 mcm (38%) to the commercial sector.

According to GNERC[4], GGTC received 4 127 mcm of natural gas in 2016, out of which 1 876 mcm was transported to Armenia and 2 236 mcm (from which 24 million was loss) was distributed through the Georgian internal system. In 2016, 991 mcm of natural gas was delivered to direct customers, 1 245 mcm to gas distribution companies, including 789 mcm to household customers and 344 mcm to non-household customers (loss in the distribution network was 112 mcm).

Natural gas sector of the country is one of the most dynamically developing segments. According to the estimations of the Ministry of Energy, 1 055 600 (8,8% increase since 2015 year) customers secured access to the natural gas network in 2016, including 1 021 621 households (80 548 new customers), 5 operating power generating facilities and approximately 33 975 thousand commercial users. Figure shows the level of gasification of the country's regions by 2016[4].

The total number of users connected to the gas distribution network significantly lags behind the number of users connected to the power supply network, among them 34,6% in the household sector. According to the information provided by GNERC, 80% of the country's households are gas customers, with an average annual consumption of one family in 2016 773 m^3/y (4,6% increase since 2015), among them 1011 m^3/y in Tbilisi and 596 m^3/y in the rural regions. Consumption of one commercial customer in 2016 was about 25 000 m^3/y.

Gasification of the country's regions also continues according to the plan negotiated between gas distribution companies and the Ministry of Energy of Georgia, among them based on SOCAR's investment obligation in the household sector. In 2013-2017, gas became available to more than 200 thousand customers across Georgia. Additional 40-60 thousand potential customers will have access to natural gas in the next 3-5 years.

Georgia's demand for natural gas is mainly balanced by imported gas (see Figure). Local gas production is small, and its share of the total consumption is less than 0.5% (about 6 mcm in 2016).

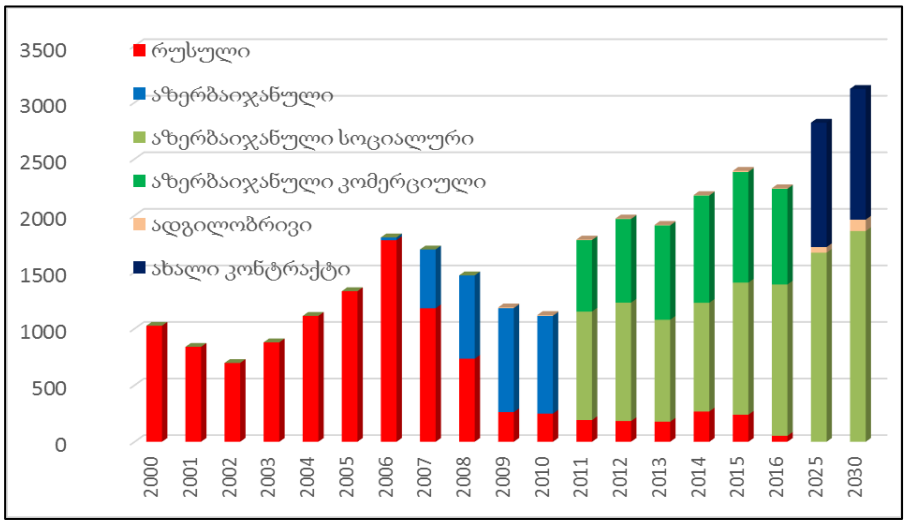


Figure 2.2 Natural gas import[5] mcm per year

At present, natural gas supply is carried out through 3 foreign sources on the basis of 4 independent contracts[6]. The main gas supplier of the local market is Azerbaijan. In 2016,

[4] GNERC, 2016-year report, 2017

[5] "New contact" means delivery of gas from currently unspecified source in order to provide total provision of required gas, except guaranteed gas to be delivered through existing contract (existing contracts are: with SOCAR and Shakh Deniz international consortium. Also considering that from 2022 Turkey will renew contract with Shakh Deniz 1st Phase for gas delivery also with gas from 2nd Phase.

[6]Source:http://old.bpi.ge/?option=com_content&view=article&id=9533:2012-11-11-17-37-08&catid=920:2011-11-06-16-35-52&fontstyle=f=smaller)

the total volume of natural gas exported from Azerbaijan to Georgia was about 93% of the total consumed gas.

Gas from Shah-Deniz field of Azerbaijan is transmitted to Georgia through the South Caucasus Pipeline (SCP). Under the Host Country Agreement and Gas Option Contracts between the SCP Project participants and the Government of Georgia, Georgia has the option to buy up to 5% of the gas volume transited via SCP. The contract is valid till 2067. The additional gas purchase and sale contract defines the volumes and prices of gas to be supplied additionally in the period up to 2026. Under this contract, Georgia currently receives 500 mcm of additional gas per year. The prices under the option and supplemental gas contracts are considerably lower than those at the gas market in the region. According to a forecast, the total volumes of option gas will considerably increase after the Shah-Deniz Field development, phase II is completed, and the transmission of additional gas to Turkey and Europe starts.

To fully meet the demand of household and power generation consumers, natural gas is supplied to Georgia under the Memorandum for Supply of Natural Gas between the Government of Georgia and Azerbaijani company (SOCAR). Under the relevant gas purchase and sale contract with SOCAR, the terms for supply of gas to the Georgian market have been negotiated, the contract expires in 2030.

Almost the whole volume of natural gas supplied from the above sources (jointly referred to as Georgian Gas) is directed at meeting the demand of household and power generation consumers who form the so-called “social consumers” of the market.

Besides, natural gas is supplied at market prices to meet the demand of the Georgian industrial and commercial sectors mainly from Azerbaijan. Periodically small volume of Russian gas has been imported by different commercial structures. Since 2017 a new contract considers possibility[7] to receive additional Russian gas.

Household customers of the so-called "social sector" are supplied with natural gas at the regulated tariffs. TPPs are supplied at prices based on the memorandum and the relevant contract between the state and “SOCAR”. For other customer’s retail and wholesale prices are deregulated and gas is supplied through publicly offered prices and conditions.

2.2 Transit and transmission infrastructure

The transit corridor located in the territory of Georgia is one of the most attractive routes to deliver hydrocarbons of the Azerbaijan and Central Asia to international markets. This corridor is used to transmit oil, oil products and gas through pipelines, railway and Georgian seaports.

Gas mains ensure the transit of natural gas towards Turkey and Armenia. The gas from Shah-Deniz Field of Azerbaijan is delivered by means of Baku-Tbilisi-Erzurum South

[7] Operator of North-South Gas pipeline (NSGP) - Georgian Gas Transportation Company (GGTC) was annually receiving gas for transit of gas to Armenia based on the contract signed with the Russian “GazProm”. From 2017 a new agreement was enacted, which considers 1year transition period during which the service payment (about 50%) will be done through receiving gas, the remaining part of the payment will be done through receiving cash payment. From 2018 transit payment will wholly be done through cash payment. A new contract msut be signed until 2019 which will consider real transit conditions and regional market prices.

Caucasus Pipeline (SCP). The actual load of SCP in 2014-2016 amounted to about 6 bcm per year.

North-South Gas Pipeline system (NSGP) is used to transit Russian gas towards Armenia. Recent years have seen a considerable drop in the load of NSGP to about 2 bcm per year, with the pipeline being used to transit gas mostly for Armenia.

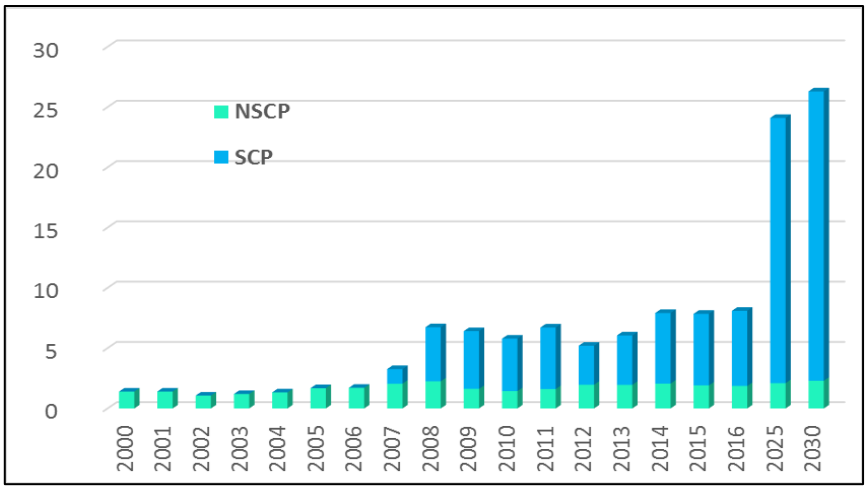


Figure 2.3. Natural gas transit, bcm per year

Georgia's internal market is supplied by gas through the system of main gas pipelines consisting of Northern (Kazbegi), Kakheti, Southern and Ajara branches. The gas pipeline system is connected to North-South Gas Pipeline, South Caucasus Pipeline, pipeline entering from Azerbaijan at the Georgian-Azeri border and pipeline connecting to Armenia near the Georgian-Armenian border. The integrated gas supply system also includes gas distribution pipelines with total length of 18 757 km (2015 y), gas distribution stations, metering units, and currently inactive two compressor stations.

The total length of the gas pipelines owned by Georgia (GOGC) is about 2000 km. Their construction started in 1959 and had high intensity in 1970s and 1980s. In the initial period of the country's independence, having the former Soviet Union's centralized economy degradation in the background, the pace of infrastructure construction fell sharply. Main pipeline construction and rehabilitation work resumed and actually reached the historical maximum in the last 3-5 years, including at the first stage financial assistance[8] of foreign donors (US MCC and USAID).

The aim of the current pipeline construction-rehabilitation and development works is basically to increase system's transmission capacity, operational flexibility and reliability by using new, high conductivity sections and interconnectors. The current stage domestic infrastructure projects are funded mainly from GOGC own sources.

Operation of the natural gas transmission system is carried out by Georgian Gas Transportation Company LLC (GGTC), a state-owned company that is a natural gas transmission licensee. At the same time, the gas mains and related equipment and structures are the property of JSC Georgian Oil and Gas Corporation. Under the lease contract between GGTC and GOGC, the system of gas mains is operated and maintained by

[8] Its noteworthy that 22 rehabilitation works were conducted on North-South Caucasus Gas Pipeline sections in the same period which are not presented on the figure.

GGTC and the construction of new gas pipelines and the major overhaul of the network are carried out by GOGC. According to the current situation, it is the obligation of GOGC9 to prepare the transportation system development plan, which contradicts to the Energy Community Legal requirement, obligating the transportation system operator to prepare the plan. According to the new draft Law on Energy, the natural gas transportation network development plan should be prepared and presented to the GNERC not later 1 October[10] 2020 year. Thus it is recommended for GOGC to prepare the document during the transition period, until year 2020, considering GGTC's active participation in its preparation. The natural gas transmission system of Georgia consists of two main parts:

- The North-South Gas Pipeline system that supplies gas from north (Russian-Georgian border) to South (Georgian-Armenian border);
- The East-West Gas Pipeline with several terminals is used to supply gas from East (Georgian-Azeri border) to West (towards Poti Industrial Region, the Autonomous Republics of Abkhazia and Ajara).

At Saguramo Unit the gas pipelines of different directions come together – where the imported natural gas is redistributed across the whole territory of Georgia. Accordingly, the East-West Gas Pipeline can conditionally be divided into two parts: Azerbaijan Border – Center and Center – Sukhumi (with branches towards Ajara and Poti).

Table 2.1. Throughput capacity of the Georgian trunk gas pipelines, bcm per year

Pipeline/Direction	Design capacity	Real capacity	Actual load	Peak[11] consumption mcm/d	Virtual load capacity[12]	Peak [13] loading Coefficient
North-South Gas Pipeline[14]	16	8,0	≈2,05	≈13,25	4,8	2,3
	10	4,0	≈1,87	≈10,5	3,8	2,1
Georgian Main Gas Pipeline System	0,25/0,45/1,5 /4,0	≈3,5-3,8	≈2,3	≈13,8	≈5,0	2,2
Azeri border-Saguramo	4,0	≈2,5[15]	≈1,5	≈7,1	≈2,6	1,7
SCP interconnector	4,0	≈1,6[15]	≈0,8	≈4,2	≈1,5	1,9
Center-West direction	1,5-4,0	≈1,2	≈0,62	≈2,83	≈1,03	1,7
West Georgia direction	4,0	-	≈0,41	≈1,66	≈0,61	1,5
Bakuriani branch	0,25/0,5/1,5	-	0,04	≈0,23	≈0,084	2,1
Southern direction	1,5/0,5	≈0,1-0,5[16]	≈0,056	≈0,26	≈0,10	1,8
Kakheti direction	1,5/0,5	≈0,1-0,5	≈0,072	≈0,50	≈0,18	2,5
Kobuleti Branch	1,5	≈0,3-0,5	≈0,073	≈0,56	≈0,205	2,8
Northern direction	4,0	≈2	≈0,02	≈0,07	≈0,03	1,5

[9] See: Georgia's Law on Energy, year 2017 (draft), article 59

[10] See: Georgia's Law on Energy, year 2017 (draft), article 180

[11] actual day/night peak load mcm per day for year 2016 is shown

[12] virtual annual (365 day) load bcm per year, based on the actual day-night load for year 2016 is shown

[13] Peak load coefficient is virtual annual peak load relative to actual load

[14] 1200 mm section data are shown in the upper line and 1000 mm section data are shown in the lower line, considering project of compressor plants functioning

[15] Azerbaijan border-Saguramo and SCP connecting section loading capacities limited with technical potential or contract obligations

[16] Loading capacity is changing depending on the diameter of different pipelines

North-South Gas Pipeline System

The system comprises of the North Caucasus-South Caucasus and Vladikavkaz-Tbilisi paralel and Kazakh-Saguramo gas pipelines. The system can receive gas from Chmi (Russian Federation) metering station by means of the North Caucasus-South Caucasus pipeline (D=1200mm).

North-South Gas Pipeline system crosses the Russo-Georgian border (about 1380 m above the sea level), starts in the river Tergi channel crossing several mountainous rivers and mudflow canyons with right instable hydrology, passes over Jvari Pass (about 2430 m above the sea level) and passes Southeast along the channels of Aragvi and Mtkvari rivers down to Georgia-Azerbain border. A part of the pipelines traverses a high mountainous region of the rough terrain that becomes a reason for frequent man-caused accidents. In this part of the route several tunnels and river bank protection structures are arranged to guard the pipeline from natural disasters. Pipeline sections along the river Mtkvari channel are placed partly in the wetlands and soils with intensive agricultural operations, causing very high corrosion activities of the ground. Pipeline are functioning without any anticorrosion protection during the last 20-25 years.

The pipeline crosses high mountainous, difficult areas which causes frequent technogenic accidents and requires especially expensive service. Only during the last 10 years almost 60 M$ was spent on the rehabilitation works of the system.

The Georgian section (D=1200[17] mm, L≈133 km, P_0=55 bars) of the **North-South Caucasus Gas Pipeline** was built in 1988-1994. At different places, the pipeline goes through 8 tunnels of 4.6 km in total length. Currently, the pipeline is used mainly to transit gas from Russia to Armenia. The pipeline will traverse the territory of Georgia by passing Gveleti Metering Unit.

The Georgian section (D=1000 mm, L=90 km, P_0=55 bars) of **Kazakhi-Saguramo Gas Pipeline** was built in 1980. It is an extension to North Caucasus-South Caucasus Gas Pipeline from Saguramo to the Georgian-Azeri and Georgian-Armenian border. The territory of Georgia accommodates its ≈90-km section and an 11.5-km Branch bound to Armenia. The gas pipeline is used to transit Russian gas to Armenia. Tsiteli Khidi and Khrami Metering units are connected to this pipeline in order to measure volumes of gas transported to the West and Armenian directions accordingly. In Saguramo, the pipeline joins Vladikavkaz-Tbilisi Pipeline, through which the Russian gas is received. Kazakhi-Saguramo pipeline at the 66.0 km point is linked to Karadaghi-Tbilisi pipeline's 484 km point (near Rustavi).

The construction of the Georgian section (D=720/529 mm, L=166 km, P_0=55 bars) of **Vladikavkaz-Tbilisi Gas Pipeline** was completed in 1966, with some of its sections being rehabilitated/upgraded from time to time. Four sections of the route with a combined length of about 1.3 km are situated in tunnels. The pipeline is composed mainly of 700 mm pipes. The gas pipeline connects to the North Caucasus-South Caucasus Gas Pipeline parallel sections by eleven 500 mm diameter connection lines, and is considered to perform auxiliary function for 1200 mm transit pipeline. The gas pipeline is connected

[17] Conditional diameter of the pipeline is indicated in the document

to Gveleti and Saguramo Metering Units, (at 186,7 km point), it also includes Kvesheti compressor station, which is inactive at the moment. Kvesheti compressor station is arranged with 800-mm pipe loop. Section of pipeline that is deployed in densely populated area of Tbilisi, from Gldani to Navtlugi is working on a relatively safe pressure (12 bar) thus it is planned to transfer it to the distribution system operator company.

At 155.7 km point of the pipeline, Kakheti Branch feeder -Zhinvali-Telavi-Rustavi 300 mm 50,7 km length section's point of entry is arranged.

East-West Gas Pipeline System

Azerbaijan Border-Center Group of the East-West Gas Pipeline System includes: Karadaghi-Tbilisi, Azerbaijani border-Gardabani, Gardabani-Navtlugi, Navtlugi (Gamarjveba)-Saguramo Gas Pipelines, the pipeline connecting Area 72 of South Caucasus Pipeline nearby Rustavi, Kakheti Branch and Southern Branch.

The Georgian section (D=500/800[18] mm, L=46 km, P_0=55 bar) of **Karadaghi-Tbilisi Gas Pipeline** consists of two parallel lines. Its construction started in 1959. South Georgia Gas Pipeline branch is connected to Karadaghi-Tbilisi Gas Pipeline that supplies gas to Kvemo Kartli and Samtskhe-Javakheti. Currently 500 mm pipeline's 17 km length section up to Gardabani and 800 mm pipeline's 24 km length section up to Rustavi are in operation, which continue with 700 mm section up to Vladikavkaz-Tbilisi pipeline connection.

Construction project for Azerbaijan border-Gardabani new 700-mm section is completed, it provides uninterrupted supply of Azerbaijani (SOCAR owned) gas to the market. The new pipeline is designed to replace critical sections of Karadaghi-Tbilisi 500 mm diameter pipeline.

Gardabani-Navtlugi (D=700 mm; L=30.2 km, P_0=55 bar) **and Navtlugi-Saguramo** (D=700 mm; L=50.6 km, P_0=55 bar) sections were built in 2007-2010. Their combined length is 80.8 km. These pipelines transmit SOCAR's gas in the territory of Georgia (SOCAR's gas is transmitted to Azerbaijan-Georgian border by means of the Azerbaijani section of Kazakhi-Saguramo Gas Pipeline). Kazakhi-Saguramo 500 mm pipeline sections were replaced by Gardabani-Saguramo pipeline. Also, Navtlugi (Gamarjveba)-Saguramo pipeline is in parallel to Vladikavkaz-Tbilisi pipeline section and is deployed in densely populated areas of Tbilisi which significantly enhanced the operational reliability of the gas pipelines and increased transmission capacity.

Gardabani-Navtlugi Pipeline is connected to Vladikavkaz-Tbilisi Pipeline by Gachiani and Navtlugi GRS, and the latter's 188-kilometer benchmark is connected to Navtlugi-Saguramo section at 41 kilometer point with 500 mm connector.

The Area 72-Rustavi section (D=700 (762) mm, L=12.5 km, P_0=55 bar) **connecting to South Caucasus Pipeline** was built in 2006 to supply gas for the Georgian market provided under option and supplemental gas sale-purchase contracts to the Georgian gas pipeline system.

[18] In some areas, 800 mm gas pipeline has 700-mm inclusions

The works to build **Kakheti-branch (Rustavi-Telavi-Zhinvali) Gas Pipeline** (D=200/300/500 mm, L=212.9 km, P_0=25/55 bar) were performed mainly in 1970-1987. It is connected to Gardabani-Navtlugi Gas Pipeline (at KP 486 km of Karadaghi-Tbilisi Gas Pipeline) by means of a D=300 mm, L=25 km Rustavi-Sagarejo section built in 2014 to ensure gas supply to the region by restoring a circular system (second supply point is entry to Vladikavkaz-Tbilisi Gas Pipeline at KP 155.7 km with a D=300 mm, L=50.7 km section).

Telavi-Akhmeta pipeline reconstruction – higher capacity 300 mm pipeline was completed in 2017. Rehabilitation works of Sagarejo-Gurjaani section critical points and removal of small diameter inserts in the pipeline were also completed.

The gas pipeline has several internal regional branches, the most important of which are as follows: Sagarejo Branch (with a point of entry at KP 25 km), Kiziki Branch (with a point of entry at KP 69.3 km), Kabala Branch (with a point of entry at KP 88.1 km), Kvareli Branch (with a point of entry at KP 107.8 km), Gulgula-Napareuli Branch (with a point of entry at KP 137.8 km), and Tianeti Branch (with a point of entry at KP 189.6 km). In turn, Kiziki Branch splits into two – Dedoplistskaro and Lagodekhi – branches about at the 8 km off the point of entry.

Southern (Tsiteli Khidi-Akhalkalaki) **Pipeline** (D=300/500 mm, L=195.6 km, P_0=12/25/55 bar) is connected to Karadaghi-Tbilisi Gas Pipeline(s) at KP 469.5 km. The gas pipeline and its branches were built in the 1980s and in years 2008-2015. The pipeline supplies natural gas to household and commercial consumers in Marneuli, Bolnisi, Dmanisi, Tsalka, Aspindza, Akhalkalaki, Ninotsminda, Akhaltsikhe and Adigeni municipalities.

At KP 182 km, the pipeline is joined by Aspindza-Akhaltsikhe-Ude-Adigeni Branch that comprises Kotela-Aspindza (L=23 km, D=300 mm), Aspindza-Akhaltsikhe (L=27.5 km, D=300 mm) and Akhaltsikhe-Ude (L=22.5 km, D=150/200 mm) sections.

Center-Sukhumi Group of the East-West Gas Pipeline System comprises Saguramo-Kutaisi, Kutaisi-Sukhumi, Zestafoni-Senaki-Poti (parallel to Kutaisi-Sukhumi) Gas Pipelines and their branches (including Tskhinvali, Bakuriani, Ajara and Sukhumi Branches).

Saguramo-Kutaisi Gas Pipeline (D=500/700/800 mm, L=212.5 km, P_0=55 bar) starts from Saguramo Gas Metering Station. The pipeline is intended to supply gas to Shida Kartli, Imereti and Samtskhe-Javakheti (Borjomi-Bakuriani) Regions. Its construction started in 1967 and lasted till 1975. In different sections the gas pipeline changes internal diameter within the range of 700/800/500 mm. In some areas, it is represented with parallel sections. At KP 85 km of the gas pipeline, there is a connection for one of the most important branches (Gomi-Khashuri-Bakuriani) to supply gas to consumers in Borjomi-Bakuriani resort and recreation zone. The gas pipeline also has Akhalgori (KP 20.8 km), Kaspi (KP 28.2 km), Gori (KP 64.4 km), Tskhinvali-Java (KP 80.2 km), Sachkhere (KP 131,5 km), Chiatura (KP 147.3 km), Zestafoni (KP 167.6 km) and Kutaisi (KP 203.7 and 212.5 km) Branches.

Gomi-Khashuri-Bakuriani Branch (D=300/500 mm L=52.8 km, P_0=55 bar) starts from Vaka Metering Station at KP 98 km of Saguramo-Kutaisi Gas Pipeline. The gas pipeline

was built in 1972-1975. The design diameter of the gas pipeline is 500 mm but it also includes D=300 and D=200 mm segments. Gomi-Khashuri-Bakuriani pipeline supplies gas to consumers in Khashuri and Borjomi municipalities, including Bakuriani. L=5.5 km and D-200mm Akhaldaba Branch is connected to the pipeline at KP 28.2 km.

500 mm pipeline sections were replaced by new Gori-Kareli-Khashuri D-700 mm pipeline sections, constructed in the 2013-2015 years which are deployed in parallel to the existing "Saguramo-Kutaisi" trunk pipeline's 57.4-90.6 km point. This significantly increased the transmission capacity and enhanced the operational reliability of the pipeline.

Kutaisi-Sukhumi Gas Pipeline (D=500/700 mm, L=212 km, P_0=55 bar) is an extension to Saguramo-Kutaisi Gas Pipeline. Its construction was completed in 1986. It is intended to supply gas to West Georgian regions. From KP 51 of the gas pipeline, there starts a D=500 mm Kobuleti Branch to supply gas to Guria and Ajara Regions.

Zestafoni-Senaki Gas Pipeline with Poti Branch (D=700 mm, L=128.7 km, P_0=55 bars) includes newly built Zestafoni-Kutaisi (23.2 km), Kutaisi-Abasha (47 km), Abasha-Senaki (29 km) and Senaki-Poti (29.6 km) sections. It is situated either parallel to the existing D=500 mm Kutaisi-Sukhumi Gas Pipeline or in the left side of the riv. Rioni channel. Old and newly constructed pipelines are connected to each other by means of several connectors in Kutaisi, Abasha and Senaki. To the newly built Zestafoni-Senaki-Poti Gas Pipeline are also connected the existing Kobuleti Branch (at KP 15.5 km of Abasha-Senaki section).

The gas pipeline construction projects that consisted of several phases were performed in 2010-2014, with the grant allocated by USAID to Georgian Oil and Gas Corporation to enhance the energy security of the country.

2.3 Natural gas losses

Total losses of the Georgian gas distribution system amounted to approximately 112 mcm (about 5% of delivered gas) and - approximately 24 mcm (about 1% of transported gas) in gas main networks in 2016. Technical failure of the distribution network and inefficient metering control were the main causes for the high losses. Therefore, the rehabilitation and development of the network and the installation of advanced regulation, control and metering systems play one of the defining roles in reduction of actual losses.

In addition to the network losses, they are also caused by natural disasters or other causes of pipeline accidents, followed by significant amount of gas (methane) emissions in the atmosphere (see. Table).

Table 2.2. Natural Gas Losses due to the Infrastructure accidents

Accident place	Accident character	The result of the accident
Meneso, 224,5 km, North-South Trunk pipeline 1200 mm	Landslide rupture	5,8 mcm gas emission, termination of supply and transit
Meneso, 132,0 km, North-South Trunk pipeline, 700 mm	Landslide rupture	4,5 mcm gas emission, termination of supply and transit
Lemshveniera, 61 km, Kazakhi-Saguramo, 1000 mm	Fire caused by leakage	2,8 mcm gas emission, termination of supply and transit
Mtskheta, 122,0 km, North-South Caucasia Trunk pipeline, 1000 mm	Landslide rupture	4,7 mcm gas emission, termination of supply and transit
Goristsikhe, 78 km, Vladikavkaz-Tbilisi, 700 mm	Landslide rupture	3,5 mcm gas emission, termination of supply
Kesalo, 55 km, Kazakhi-Saguramo, 1000 mm	Pipeline corrosion	3,6 mcm gas emission, termination of supply and transit
Georgia-Russia border-North-South Caucasia trunk pipeline, 1200 mm; 55,5 km, Vladikavkaz-Tbilisi, 700 mm	Blast caused simul-taneous rupture of pipeline's 2 lines	Total termination of supply and transit from Russia during 2 days
Naniani, 233, North-South Trunk pipeline 1200 mm	Landslide rupture	2,4 mcm gas emission, termination of transit
Devdoraki, 143,1 km, North-South Caucasia Trunk pipeline 1200 mm; 55,5 km, Vladikavkaz-Tbilisi, 700 mm	Flood caused by the rupture	0,5 mcm gas emission, termination of supply and transit during 5 days

2.4 Gas consumption trends and growth forecast

The Business as Usual (BAU) scenario modelling results, under the USAID EC-LEDS *Clean Energy for Georgia* Project[19], prepared under the supervision and with the involvement of the Ministry of Energy of Georgia, have been used as the fundamental basis for making a gas consumption forecast. The Ministry of Energy of Georgia and the Climate Change Office of the Ministry of Environment and Natural Resources of Georgia were directly involved in the development and improvement of the model. Besides, the results of the Report: Low Emission Development Strategy – Energy Sector prepared under the project by Sustainable Development Center 'Remission'[20], the forecasts[21] made by the Strategic Development and Projects and Commercial Departments of GOGC considering the year 2016 data were also taken into account.

[19] Enhancing Capacity for Low Emission Development Strategies (EC-LEDS) Clean Energy Program, Updated MARKAL-Georgia BAU Scenario Report, USAID, Winrock International Georgia, April, 2016

[20] Report: Low Emission development Strategy – Energy Sector, Sustainable Development Center 'Remission', July, 2016

[21] See details: Georgian gas transmission infrastructure ten-year development plan 2016-2025, GOGC, year 2016

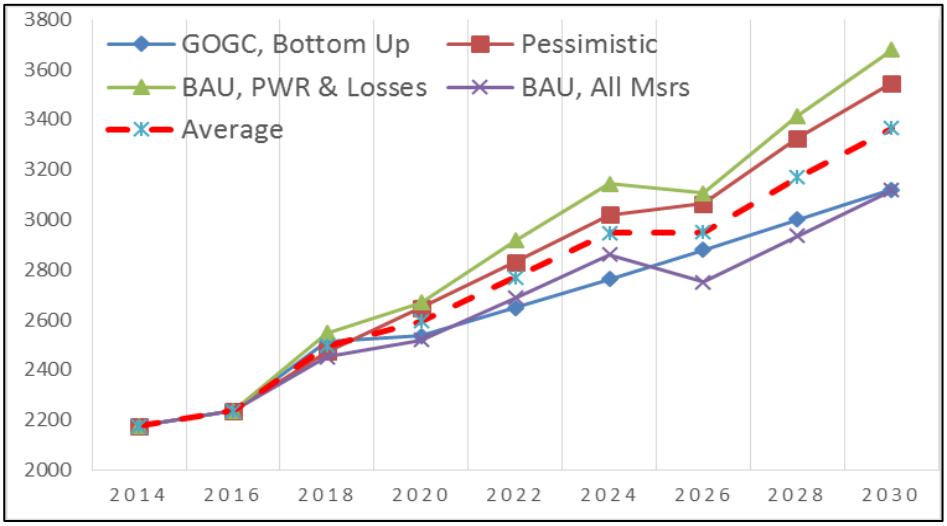


Figure 2.4 Natural gas consumption forecast, mcm per year

Table contains gas consumption reporting and forecasts indicators for the period until year 2030. The forecast is prepared by taking into the consideration the above-mentioned analysis and the results of GOGC initiated adjustments (scenario: GOGC, Bottom Up).

Table 2.3. Estimated gas consumption indicators, mcm per year

	2018	2022	2026	2030
Possible limits	2450-2550	2650-2920	2750-3100	3120-3680
Average	2500	2770	2950	3360

The forecast of gas supply to be provided under long-term contracts confirms that the estimated total volume of gas supply can meet the demand of the social sector only provided that new, highly efficient power plants will replace the existing ones and new, seasonally controlled hydropower plants are put into operation so as to appreciably reduce demand for gas for electricity generation needs (besides, under the agreement reached with SOCAR at the beginning of 2016, the social sector consumption deficit, if necessary, will be filled by supplying about 400-500 mcm of gas), however, such issues as seasonal consumption disparities and guaranteed gas supply to protected consumers in critical situations are still unresolved, mostly due to the Azerbaijan's insufficient capacity of the gas infrastructure.

2.5. Energy security

Analysis of the results of assessment of potential risks and hazards affecting the operational security of the Georgian natural gas sector shows that the creation of the most critical situation in the natural gas sector may be related to the network failure or lack of strategic fuel reserves that results in the practical inability of the system to ensure effective operation in the periods of peak consumption or incidental interruption of supply. In turn, a critical increase in peak consumption is related to a sharp change in climate conditions, while interruptions in supply may be caused by accidents prompted by natural disasters, acts of political sabotage, or technological failure, which arise from specific features of the Georgian landscape and climate, political instability in the region,

low technical reliability and insufficient capacity of trunk pipelines and related equipment.

In recent years, Georgia has seen a few cases of unscheduled interruption in gas supply, as a result of which the supply of gas to the country from different sources failed from 1 to 3 weeks or dropped by at least 30%[22] of total supply.

Significant accidents of Georgian gas pipelines (See Table 2.2) are related to natural disasters or damage caused by the corrosion of old pipelines. Also, it is recorded that Georgia has seen a few unscheduled interruptions in gas supply due to political sabotage or even for technological impairment (or necessity to avoid it). As a result of the failure in the supply of the Russian gas caused by the explosion of two parallel pipelines, for two weeks in the most critical time of the winter in 2006, the country faced major social problems and an economic disaster, as Russia was the only gas exporter at the time. It was only two weeks after the accident that the gas supply from Russia could be fully restored. Consequently, gas supply to the main part of consumers was limited in the time of the crisis. The consumption in the month dropped about 3 times compared to the average consumption statistics for January and 5.7 times compared to peak consumption. In parallel, gas transit to Armenia was fully interrupted.

From time to time there have been interruptions in gas supply due to technological failures occurring in Azerbaijan offshore fields or the necessary maintenance works and tests on pipelines or metering units.

In the ordinary situation, the Georgian transmission infrastructure can handle enough volumes of gas from sources of supply to fully meet the demand. However, as the analysis shows, if there is any unscheduled interruption in supply in times of peak consumption a sharp gas deficit arises, posing a risk to gas supply to consumers. In the peak winter demand conditions, the country alone is unable to manage any substantial gas deficit that may arise in the event of an unscheduled interruption in gas supply from Russia or Azerbaijan that may prompt to a critical situation[23] in the country. Therefore, it becomes necessary to implement special, rather costly and urgent measures in order to avoid any serious complications in providing gas and power supply to consumers. In this period, Georgia is no longer able to discharge its obligations under the transit contract, either.

The analysis based on the regulation requirements provided by the Energy Community legislation shows that the strategic reserves of about 100 mcm gas must be stocked up to provide[24] guaranteed gas supply to the household customers and TPPs across the country in times of critical situations.

Significant difficulties exist due to impossibility of rational management of gas flows and the seasonal balancing, in terms of comparable stability of gas consumption with inequality and imports. Gas consumption in Georgia is characterized by sharp imbalance

[22] Energy Community Legislation, large scale supply termination is considered to be decrease of more than 20% supply from 3rd country.

[23] Feasibility study for Samgori South Dome, Task 10: Final report and recommendation for next step, GEOSTOCK Enterpose, April, 2016

[24] See: Regulation EU # 994/2010 – Concerning measures to safeguard security of gas supply

in winter and summer periods: in winter months the country consumes 3,5-5 times more natural gas than in summer.

Consumption disparity is predetermined by the necessity to involve a part of thermal power plants in the generation of electricity predominantly in the winter season when low water flow sharply reduces hydroelectric generation and the household sector switches to an intensive heating mode. At present, the problem has been addressed under the memorandum and the relevant contract with SOCAR, Azerbaijani company, but as the local consumption is expected to grow significantly in the future, it will be much more difficult to balance the demand and supply disparity for winter and summer seasons. For instance, after the supplemental gas supply from SCP is discontinued in 2027, the country will have to regularly obtain the additional gas supply to meet the demand of the social sector in the winter season. Accordingly, it is desirable to take care of possible emergency situations to get help on the basis and within the framework of the European legislation principles of solidarity[25], through the transit pipelines or from reverse interconnectors connecting with neighboring countries.

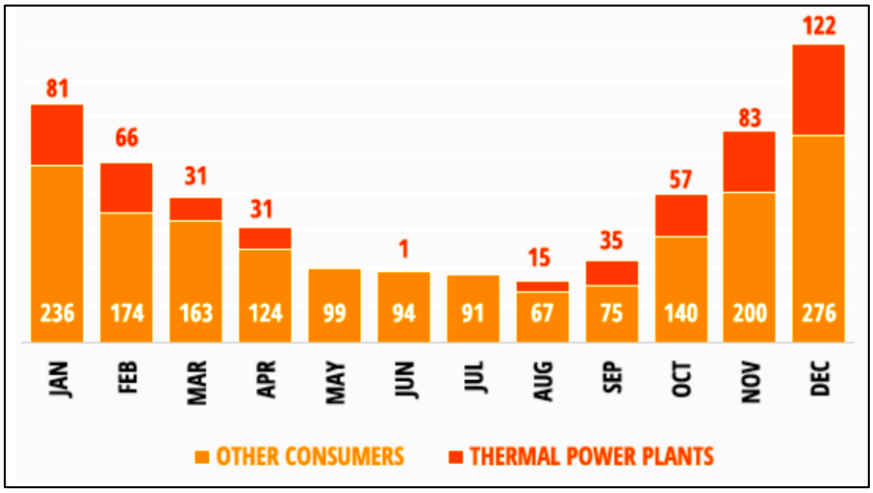


Figure 2.5 Gas consumption by seasons, 2016[26]

Rehabiltation-modernisation of main pipelines and branches aims to enhance the operational flexibility and reliability of Georgia's internal gas pipeline system, to ensure smooth and effective redistribution of increased forecasted gas volumes across the whole territory of the country. The following falls within the category of priority projects to be implemented in the short- and medium-term periods: the rehabilitation of the critical sections of East-West Gas Pipeline, and in the longer term – construction of UGS in order to store strategic reserves of energy resources and the construction of interconnectors to link different directions and branches of Georgian gas mains, inter alia, the reservation of the critical infrastructure sections, which are situated in mountainous regions hardly accessible in poor weather conditions and which are hard to respond to in emergency situations. From this point of view, the pass section of the East-West pipelines and Akhaldaba-Bakuriani section of Bakuriani Branch considered to be most critical.

[25] See: Mutual support clause for emergency situation, referring to the possibility of having access to the transit flows on predefined and negotiated terms

[26] Source: GNERC, 2016-year report, 2017

Energy security significant improvement is also possible with increase in capacity of connectors with neighboring countries (for example using compressor station on the pipeline incoming from Azerbaijan).

The implementation of the projects for the rehabilitation/development of the Georgian gas pipeline network as well as its branches and connectors (interconnectors) will lay a foundation to the modification of the bottleneck architecture of the Georgian gas supply system to a highly reliable circular type gas supply system that allows for the redistribution of gas flows in critical situations to ensure a guaranteed supply to any consumer and significantly increase the operational flexibility and reliability of the integrated Georgian gas supply system.

2.6 Integration into the international energy markets

The Country's long-term vision for the development of the natural gas sector considers introduction of the Energy Community's core principles for organizing the internal market in Georgia that in the long-term will help to create a favorable environment for competitive trade in natural gas and safeguard the interests of the vulnerable segment of consumers.

Liberalized markets are effective means of attracting investments needed for infrastructure projects and meeting a growing demand for gas consumption. The development of a clearly defined market structure and regulatory system and ensuring a non-discriminatory access to transmission and distribution networks would facilitate a successful development of the Georgian gas sector and its integration with regional systems which is one of the critical conditions for enhancing the national energy security.

Accordingly, in parallel to realization of the new infrastructure projects, Georgian natural gas sector requires refining of the legislative framework and its fundamental improvement. The introduction of effective instruments for improving the legislative framework and monitoring the market, to avoid any direct interference with regulation activity on the part of the state, would help to achieve the ultimate goal of liberalization – full opening of the market where any gas consumer can freely choose a supplier and the supplier can have unlimited access to transmission and distribution networks.

In order to develop the natural gas sector in general and successfully implement the planned infrastructure projects in particular, it is necessary to complete the harmonization of international standards and codes for design and operation and ensure their application in practice.

Subject to the requirements for trade in energy under the EU Association Agreement, Georgia has undertaken liability to approximate its legislation to the EU legislation stage by stage within defined terms. Implementation of directives mandatory for Georgia, including those linked to the infrastructure development should be made within the provisions of the binding European directives within the terms agreed with the Energy Community.

3. Regional natural gas market

3.1. Regional gas infrastructure

The regional energy market conditionally comprises the countries of South Caucasus, the Black Sea Basin and Central Asia. The region boasts major gas extraction countries among them Azerbaijan and other countries of the Caspian basin.

The ample gas reserves of the Caspian region may serve as a solid foundation for enhancing the security of the international energy market. However, an isolated location of the gas production countries and lack of direct connections to export seaports or major energy consumption hubs as well as a limited transmission capacity and low efficiency of the existing transmission infrastructure create serious obstacles to an effective realization of the potential of the fields.

The Caspian energy resources are especially interesting for Europe, some of the countries of which are critically dependent on energy products exported from the dominant supplier Russia. In order to enhance the security of the European energy market, diversify supply sources and routes, the European Union has initiated the 4th, Southern Gas Corridor Concept for the development of independent, supply routes traversing South Caucasus and Turkey or the Black Sea to supply resources from the region to Europe.

Georgia can significantly contribute to the development of the Southern Gas Corridor Concept – the country's geographical location, the available transport infrastructure and its development prospects, multi-year experience in the construction and management of large transit projects and successful partnership, the planned full liberalization of the market, the easiness of doing business, transparency and relatively low corruption recognized by international organizations, and the country's clear aspiration to integrate into the Western political and economic structures provide suitable conditions for attracting large investments and developing diversified routes across the territory of the country to supply resources to the international energy market from new sources.

The Government of Georgia represented by the state-owned Georgian Oil and Gas Corporation (GOGC) is an indirect owner of the main gas transmission infrastructure. Accordingly, GOGC owns North-South Gas Pipeline system that is dedicated to transit the Russian gas to Armenia, represents the state's authorized representative in regards to SCP functioning, development and commercial relations issues, as well as pursues the policy of facilitating the implementation of new transmission infrastructure projects.

The oil and gas pipeline systems already existing, under construction or to be constructed in the territory of Georgia are directly connected to the sea terminals on the Black Sea Coast and via Turkey – to South-East Europe countries and are considered to be the integral parts of the planned oil and gas pipeline projects (TAP, TANAP, WS, EAOTC) as well as AGRI project for liquefied (or compressed) natural gas. Besides, large-scale projects for rehabilitation and development of the Georgian pipeline systems and related infrastructure with own funds and with the funding of international donors have been successfully implemented.

Given below is brief information on the import potential and gas networks of the Georgia's bordering countries, which are directly connected to the pipelines passing through the territory of Georgia.

3.2. Bordering countries of Georgia

The South corridor between Georgia and Turkey (or via the Black Sea) is considered to be the most likely export destination for **Azerbaijan's** hydrocarbon resources. This route excludes the need of competitors - Russia, Iran, Central Asian countries and enables Azerbaijan to conduct export under favorable conditions.

The confirmed gas reserves in Azerbaijan amount to 1.1 trillion cubic meters[27]. According to the estimates of Azeri experts, the gas reserves in the territory of the country exceed 2.6 trillion cubic meters[28].

In 2016, Azerbaijan produced 17.5 bcm of gas natural gas (excluding in oil field back injected volumes), out of which 10.4 bcm for domestic consumption, for export: in Georgia – up to about 2.1 bcm, Turkey – up to 6.2 bcm, Iran – up to 0,2-0,3 bcm.

From 2018, after completion of the Shah Deniz second phase, exports of additional volumes of gas will start to Turkey and then to Europe with a total volume of 16 bcm after completion of SCP Expansion (SCPX) and TANAP and TAP pipeline projects.

Projects to explore new fields and develop reserves are continuing. The development of Phase 3 of Shah-Deniz Field is planned. For this purpose BP plans to conduct additional seismic and prospect drilling to ascertain the field reserves, increase them from 2025[29]. By then, the total marketable gas output in Azerbaijan will have increased to 40 bcm[30]. In addition, there is an additional 15 bcm of gas production and export[31] capacity in years 2030-2035, after development of operating deposits and development of new fields. In particular, it is planned to receive 5 bcm of gas from "Apsheron" field (estimated reserves of 350 bcm of gas and 45 mln tons of condensate) in 2021-2022, 5-7 bcm from the promising "Umid-Babek" field (200 and 400 bcm of gas and 40 mln tons of condensate and 80, respectively) from years 2026-2027, 4-5 bcm of gas per year since 2027-2028 from the Azeri-Guneshli-Chiragh field's horisons (although as recently anaunced by SOCAR, gas production from ACG might start already in 2019)[32]. However, the guaranteed gas sale contracts and availability[33] of technological equipment necessary to obtain gas from deep water offshore field remains an important prerequisite for realization of the fields development plans.

[27] BP Statistical review of world energy, June, 2016

[28] http://www.trend.az/capital/energy/2034296.html, June, 2012

[29] http://www.rigzone.comnews/oil gas/a/132070/Azerbaijan planning third stage of Shah Deniz project after 2025

[30] http://www.trend.az/capital/energy/2192409.html. Азербайджан намерен резко увеличить добычу газа (Azerbaijan intent on sharply increasing gas production)

[31] http://www.trend.az/business/energy/2685760.html

[32] https://news.day.az/economy/933721.html, September, 2017

[33] Gulmira Rzaewa (Oxford Institute for Energy Studies), Presentation on the Natural Resources Forum, London, June 2016

Azerbaijan-Georgian-Romania Interconnector (AGRI) project is also seen as one of the possible versions to supply Azerbaijani gas to Europe. The route is intended to build a liquefied natural gas export terminal (LNG plant) at the Black Sea Coast of Georgia, from which LNG will be transported to a terminal in Romania where receiving, regasification and distribution systems will be built. A feasibility study for AGRI has been conducted to find the commercial feasibility of the project, in the presence of certain incentives, and the technical feasibility after the 2nd phase of Shah-Deniz Field and development of other fields.

Also, Azerbaijan, together with Georgia and Turkey, is turning into an important node of transit routes for supply of hydrocarbon resources to international energy markets. First of all, this applies to Turkmen gas resources, which can be pumped from the East Coast of the Caspian Sea to Baku by means of an offshore pipeline system. However, its realization is complicated by uncertainties relating to the status of the Caspian Sea and, consequently, demarcation of the bottom.

The Azerbajani gas pipelines from the Russian border (Shirvanovka) and Iranian border (Astara) to Kazi Magomed, from Kazi Magomed to the Georgian border, along with Alti Agachi-Aksus connector and 5 compressor plants (in Shirvanovka, Syazan, Kazi Magomed, Agdash and Kazakh), were built mainly in 1982-1986. After the intense rehabilitation-reconstruction and expansion of the gas pipelines are completed, it will be possible to supply gas through the trunk systems for Kazi Magomed-Mozdok (to Russia), Kazakh-Saguramo 1000mm (to Georgia). Also 700/800 mm and 500 mm diameter Karadakh-Tbilisi pipelines currently unloaded on Azerbaijan side cross Georgia-Azerbaijan border.

Russian proven gas reserves are estimated at 32.3 tcm. The gas production in Russia reached 579,4 bcm in 2016. The country is one of the main exporters of energy resources to EU countries. In 2016, the country supplied 166.1 bcm gas to Europe and 24.7bcm gas to the former Soviet republics[34]. Besides, Russia also supplied 14 bcm liquefied gas (mainly to countries in Asia and Pacific Basin).

1200 mm and 700 mm high pressure pipelines cross Russia-Georgia border with designed pressure 55 Bar and capacity 16 bcm per year (actual load during last 15 years is no more than 4.5-5 bcm per year and in 2016 it was 2 bcm).

Dependence of EU countries on the import of Russian gas is unequal: the „old'' members get about 20% of the total gas consumption while the indicator for the remaining members – some countries of Central and Eastern Europe and some former Soviet republics – ranges from 75 to 100%. Russia tries to maintain the position of the dominant energy resources supplier at the market and thus has constructed (or plans to construct) politically motivated transit systems (NS-2, TS), in order to block alternative gas transportation routes, among them routes passing Georgian territory.

Turkey, enjoys the proximity to the Caspian and Middle East fields rich in hydrocarbon resources, on the one hand, and opprotunities of direct connection to the energy-deficit

[34] Among them 1.87 bcm of gas is delivered to Armenia through territory of Georgia and about 56 mcm to Georgia

European market on the other hand, which forms the basis for becoming one of the central transit units of efficient supply of the country's additional fuel and energy resources.

In 2016, approximately 37.4 bcm (6.3 bcm through Georgia) of gas was imported in Turkey through pipelines and 7.7[35] bcm through LNG terminals.

Efforts are being made for implementation of the following components of the new EU Southern Gas Corridor via the territory of Turkey: Trans-Anatolian Pipeline (TANAP) and Trans-Adriatic Pipeline (TAP). Their purpose is to deliver Azerbaijani gas to Turkey and Europe through Georgia.

Armenia's gas pipeline system (D=273-1200 mm) is about 2000 km in length. The system comprises about 70 gas distribution stations. In 2016, Armenia imported about 2 bcm gas from Russia and 0.4 bcm gas from Iran.

The Georgian pipeline system 11.5 km length section connected to the Armenian system is linked to Kazakhi-Saguramo 1000 mm pipeline and starts from Tsiteli Khidi gas metering unit. The section requires reconstruction because it is located in the area of the active military action between Armenia and Azerbaijan, this fact makes it practically impossible to operate it in normal conditions (see details below).

Armenia is linked to Iran with a D=700 mm gas pipeline. The length of the pipeline from Tabriz to the Iranian-Armenian border is 100 km. The annual transmission capacity of the gas pipeline is 1.1 bcm (with capabilities to increase to 2.3 bcm) though its actual load is only 300-500 mcm, as Iranian gas is relatively costlier. Technically, Armenia can annually import up to 700 mcm additional gas from Iran.

According to the current contract, the gas imported by Armenia from Iran is supplied to the thermal power plant that transmits a part of the electricity it generates back to Iran. The pipeline is not designed to supply gas to other countries. However, if it is connected by a D=500 or 700 mm pipeline to the Armenian gas pipeline system in the central part of the country, theoretically gas can be supplied from Iran to Georgia, too.

Under the current circumstances, due to difficulties in supplying gas to even the northern regions of Iran and the high cost of gas, on the one hand, and having regard to the possibility for buying cheaper gas from Gazprom, on the other hand, in the nearest future Armenia will be focused on importing gas from Russia by means of the North-South Caucasus Gas Pipeline via the territory of Georgia.

[35] Oil and Gas Pipelines and Projects of Turkey, Presentation by BOTAS

4. Infrastructure development plans

4.1. Design parameters for infrastructure planning

The table provides the status of current pipelines and infrastructure projects as of September 2017.

Table 4.1. Status of current projects of transport pipelines and infrastructure

Work name	Planned works	Current status (10 September 2017 year)
Azerbaijan border-Gardabani D-700 mm, L-18 km	Project implementation started in 2016. The deadline for completion of the project is 2017	Project is completed.
Kobuleti branch D-500 mm, L-45 km	Pipes and accessories needed for the project are provided in 2016. In 2017-2018, construction works are planned.	Construction works began on the first 45 km lengh section.
Kakheti branch, Telavi-Akhmeta D-300 mm, L-27 km section	Construction works began in 2016. The deadline for completion of the project is 2017	Project is completed.
Kakheti branch, Sagarejo-Gurjaani 500 mm section, local rehabilitation D-500 mm, L-15 km section's	Testing shows need for rehabilitation of approximately 15 km of total length sections, including 10 km long tube replacement. The project is scheduled to be completed in 2017.	Up to 50% of the planned works are completed.
Kuro aerial crossing D-1200 mm, L-0,27 km	The project is scheduled to be completed in 2017.	Project is completed.
Natakhtari-Lekhura total length 31,4 km (Natakhtari-Tsilkani-7,8 km, Tsilkani-Ksani - 10,4 km, Ksani-Lekhura -13,2 km) D-700 mm, L-31,4 km	The pipes and materials needed for the project were purchased in 2016. 2017 year plan envisages execution of part of the construction works only. It can be carried out simultaneously with the 8 km long and uninterrupted 13km pipes dismantling and sorting according to the suitability of the subsequent use.	Purchased and supplied part of the construction materials (pipes and faux parts) for this stage and the remaining part of the contract is signed on state procurement. Estimated time of commencement of construction works IV Quarter of 2017 year. Estimated Term of Completion 2018
Construction of 20.6 km section of Lekhura-Sveneti D-700 mm, L-20,6 km	In 2017 it is planned to purchase the necessary materials for the project, and construction works will be completed in 2018.	Building materials (pipes and accessories) have already been procured and provided. At this stage the design of the project is going on, which will be possible after the completion of construction works, presumably in early 2018.
6.5 km of Ptsa-Vaka and 10-km section of Vaka-Chorchana (D-700 mm, L-16,5 km)	The pipes needed for the Ptsa-Vaka project are acquired and the relevant accessories are affordable and are supplied in 2016. The state procurement agreement has already been concluded for supply of materials for the construction of the remaining 10 km section, which is scheduled for the end of September.	For the optimization of works, the original project configuration was modified, which provided for the construction of the 6.5 km section of the PACA-VAKA in 2017. A 10-km stretch of Vakha-Chorchana was planned to be integrated into a 17 km total length project, which has already been prepared for the project documentation. Construction project is scheduled to be completed in 2017. The project will be completed in 2018.

GRS project	The 2017 plan envisages the rehabilitation of Rustavi GRS. Estimated value of works is 12.1 mln GEL, which will be specified in the preparation and procurement process.	Relevant companies are chosen and government procurement contract are signed with them for procurement expenditure record documentation required for the project implementation.
Local rehabilitation works	Includes local rehabilitation works	Local rehabilitation works are underway according ro existing plan.

As the analysis shows, significant part of the Azerbaijani border-Gardabani, Telavi-Akhmeta, Sagarejo-Gurjaani main pipelines, Kuro aerial crossing and local restoration works were completed in 2017. The most important part of the projects, including: Kobuleti branch, Natakhtari-Lekhura, Lekhura-Sveneti, Ptsa-Chorchana (Modified Ptsa-Vaka) pipelines, Rustavi GRS, extension and completion should be taken into account in 2018 and the next year's work plan.

4.2. Projections of design parameters

One of the basic grounds for the preparation of TYNDP is the demand-supply forecast. For the purpose of determining the planned capacity of the infrastructure development plan, consumption forecasts in Georgia (adjusted to the data of the 2016 correction) and future transit volumes through the GOGC owned pipelines are considered. Results of analysis are given in Table 4.2.

Table 4.2. Natural gas transportation and transit forecast for Georgia, Mm^3/y

	2016	2018	2021	2024	2027	2030
Domestic consumption	2260	2500	2680	2950	3060	3360
Transit to Armenia	1870	1915	1980	2050	2100	2200
Total	4130	4415	4660	5000	5160	5560

For selection of domestic gas supply the system's actual demand trend is used for separate directions and the main branches of the pipeline considering the peak consumption. Also, in effort to calculate design parameters for 2030 year (peak), the relative increase of the average weighted gas volume for the domestic market (table 4.2) and the actual, region-based coefficient of peak consumption (table 2.1) according to projections is considered.

A different approach is used to determine the transborder pipeline calculation parameters. Namely:

a) Maximum loading capacity of the interconnector connecting to SCP is taken from the gas receiving point (Area 72) at the GPRSM, taking into consideration the planned reconstruction project;

b) For gas coming from Azerbaijani border it is considered that the newly constructed Azerbaijan border-Gardabani-Navtlughi-Saguramo pipeline with design loading capacity of 16 mcm per day (4 bcm per year) cannot be loaded fully because of limited pressure from Azerbaijan 22-24 Bar and practically is up to 7 mcm per day. If additional gas is delivered from Azerbaijan through the "new contract", in that case additional 1.25 bcm of gas should be supplied from the border to Saguramo direction

in 2030 and peak daily load will increase to 16.3 mcm which will be possible only after implementation of special measures.

c) Actual capacity of the North-South pipeline is limited by the pressure in the Georgian pipelines (maximum operational pressure does not exceed 34 bar). In the case of the rehabilitation and construction works of 1200 mm Gveleti-Saguramo and 1000 mm Saguramo-Tsiteli Khidi sections design parameters of the pipeline will be enabled and current loading capacity of the system will increase by 60-70%.

Table 4.2. Gas transportation peak volumes forecast according country's regions and trunk pipelines mainl branches, mcm/d

Pipeline/Direction	Actual load[36] bcm/y	Forecasted load bcm/y	Peak load consump., Mcm/d	Virtual[37] load bcm/y
North-South Gas Pipeline[39]	8,0 4,0	≈2,2 (3,45)[38] ≈2,2	≈13,9 (21,7) ≈12,7	≈5,1 (7,9) ≈4,6
Georgian Main Gas Pipeline System Azeri border-Saguramo SCP interconnector Center-West Direction West Georgia Direction	≈3,5 ≈2,5 ≈1,9[39] ≈1,2 -	≈3,36 ≈2,25 (3,50) ≈1,10 ≈0,93 ≈0,62	≈20,2 ≈10,5 (16,3) ≈5,2 ≈4,27 ≈2,53	≈7,4 ≈3,83(5,95) ≈1,9 ≈1,56 ≈0,93
Bakuriani Branch	-	≈0,06	≈0,35	≈0,126
Southern Direction	≈0,1-0,5	≈0,084	≈0,42	≈0,151
Kakheti Direction	≈0,1-0,5	≈0,107	≈0,71	≈0,26
Kobuleti Branch	≈0,3-0,5	≈0,110	≈0,84	≈0,308
Northern Direction	≈2	≈0,030	≈0,12	≈0,045

Table data analysis shows that in order to meet the 2030's forecast consumption:

- The capacity of the 1200 mm section of the North-South Caucasus gas pipeline is enough for long-term forecasting loading capacity, including if Georgia gets additional gas with "New Contract" from Russia;
- The transmission capacity of Kazakhi-Saguramo 1000 mm section of North-South Transit System is insufficient for transit of projected gas volumes to Armenia due to the pressure limitation in the pipeline considering its unsatisfactory condition. For guaranteed delivery of the required transit volumes for Armenia, the Saguramo point of transit system should receive gas at about 30 bar pressure and 40-bar pressure on the Russian-Georgian border. This requires rehabilitation of hardly corroded sections of the pipelines including 53,4-57.4 kp sections in order to get closer[40] to their designed technical conditions.
- Azerbaijan border -Saguramo new 700-mm pipeline's maximum capacity provided that the pipeline distribution of loading percentages during peak load remains

[36] Pipelines actual loading capacity of 2nd Quarter, 2017, bcm per year
[37] Year 2030 forecasted virtual annual (365 day) loading capacity, bcm, based on day/night peak load
[38] Considering forecasted parameters of additional gas received through "New contract"
[39] Pressure regulating and metering unit's design loading capacity after reconstruction works
[40] Beside this, it is recommended to reconstruct 11,5 km length branch that connects pipeline with Armenia

unchanged, gas of volumes and pressure required for the west and north directions is transported to Saguramo and the current 500-mm sections is sustained at Saguramo-Khashuri section, equals to about 7 mcm per day (2.5 bcm per year) (see Table D1).

- When using the existing pipelines in Saguramo-Western Georgia during the year 2030 forecast peak load, the required pressure at Saguramo point is at least 27.8 bar (See table D2). This is based on the forecasted indicators from Saguramo to Western direction, including Adjara, provided that in the industrial zone of Poti it will be possible that the minimum pressure required for industrial enterprises will be retained at 12 bar (alternative calculations provide the minimum provision pressure required for the initial point of the Adjara branch, suggesting that at the beginning of the mountainous Adjara branch in Salibauri, minimum 12 bar pressure will be maintained - see table D3, which also requires about 28 bar pressure in Saguramo).
- Hydraulic calculations show that in order to ensure the forecast peak capacity in 2030, gas pressure supplied from Azerbaijan should be 33.8 bar (see table D4), while Azerbaijan supplies gas with a maximum 22-24 bar pressure. The shortage of the loading capacity becomes more critical, with a "new contract" of additional gas from Azerbaijan. In this case, required pressure will increase at the start of the pipeline up to 40,8 Bar (Table D5).
- In case Saguramo-West pipeline will be totally modified with 700 mm conditional diameter pipes, the required pressure will be reduced in Saguramo to 22 bar and to 29,2 bar or 37,1 bar at the border of Azerbaijan (see Tables D6, D7 and D8 accordingly).
- Peak throughput in other directions (South, Kakheti, North, etc.) can be provided by the existing and planned pipelines in 2017 without changing the conditional diameter. These pipelines are planned to perform restoration works, if necessary.

4.3. Short-term infrastructure development program

The investment infrastructure projects to be developed on a priority basis in the short- and partly medium-term include: the rehabilitation and construction of the main pipeline critical sections (among them mainly certain sections of the East-West direction from Saguramo to Zestafoni). Realization of these projects gives opportunity to significantly increase technological reliability of the united Georgian gas supply system operation. Besides, the updated system gives opportunity to provide uninterrupted supply of demanded gas during peak loading periods in the future until year 2030.

According to the priorities, East-West Gas Pipeline rehabilitation and development work is distributed as follows:

- Ptsa-Vaka-Chorchana 17 km length (project will start in 2017) –2018;
- Natakhtari-Lekhura 31.4 km section (project will start in 2017) – year 2018;
- Lekhura-Sveneti 20.6 km length section – years 2018-2019;
- Aerial crossing on riv. Aragvi – years 2018-2019;
- Chorchana-Zestafoni about 70 km length section – years 2018-2020;

Figures 4.1-4.3 indicate the schematic Figures of the East-West Main Gas Pipeline Azerbaijan border-Saguramo, Saguramo-Khashuri (Chorchana) and Khashuri (Chorchana) - Poti sections as of July 2017 and with reference to the rehabilitation points provided by the plan.

East-West Main Gas Pipeline complete modification with 700 mm diameter pipes will ensure supply of gas in the western and central regions of the country, commercial sector and industry, including the prospects of the developing industrial zones and development of the Black Sea Recreational Zone.

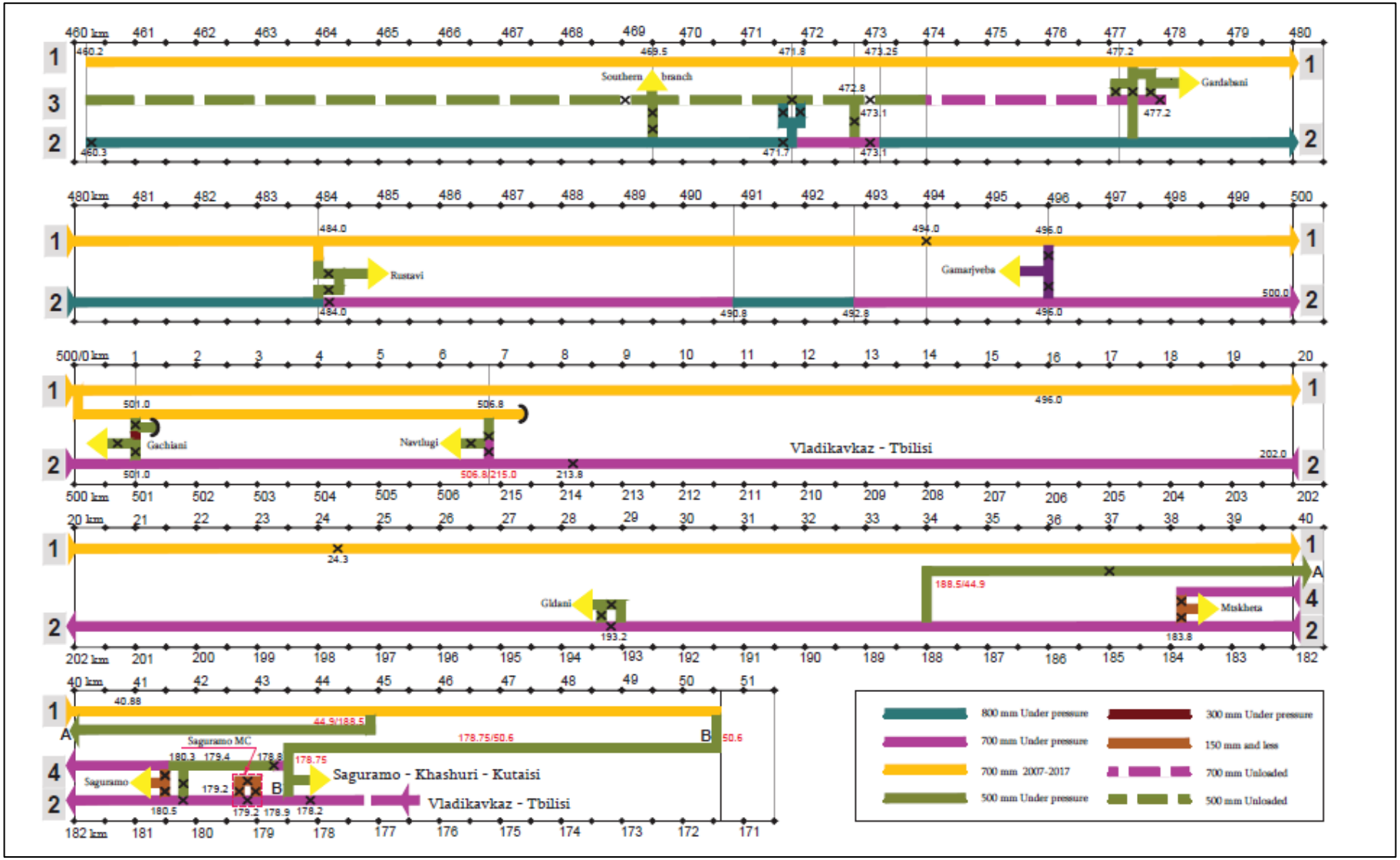


Figure 4.1. Azerbaijani Border- Saguramo section of the East-West Main Gas Pipeline

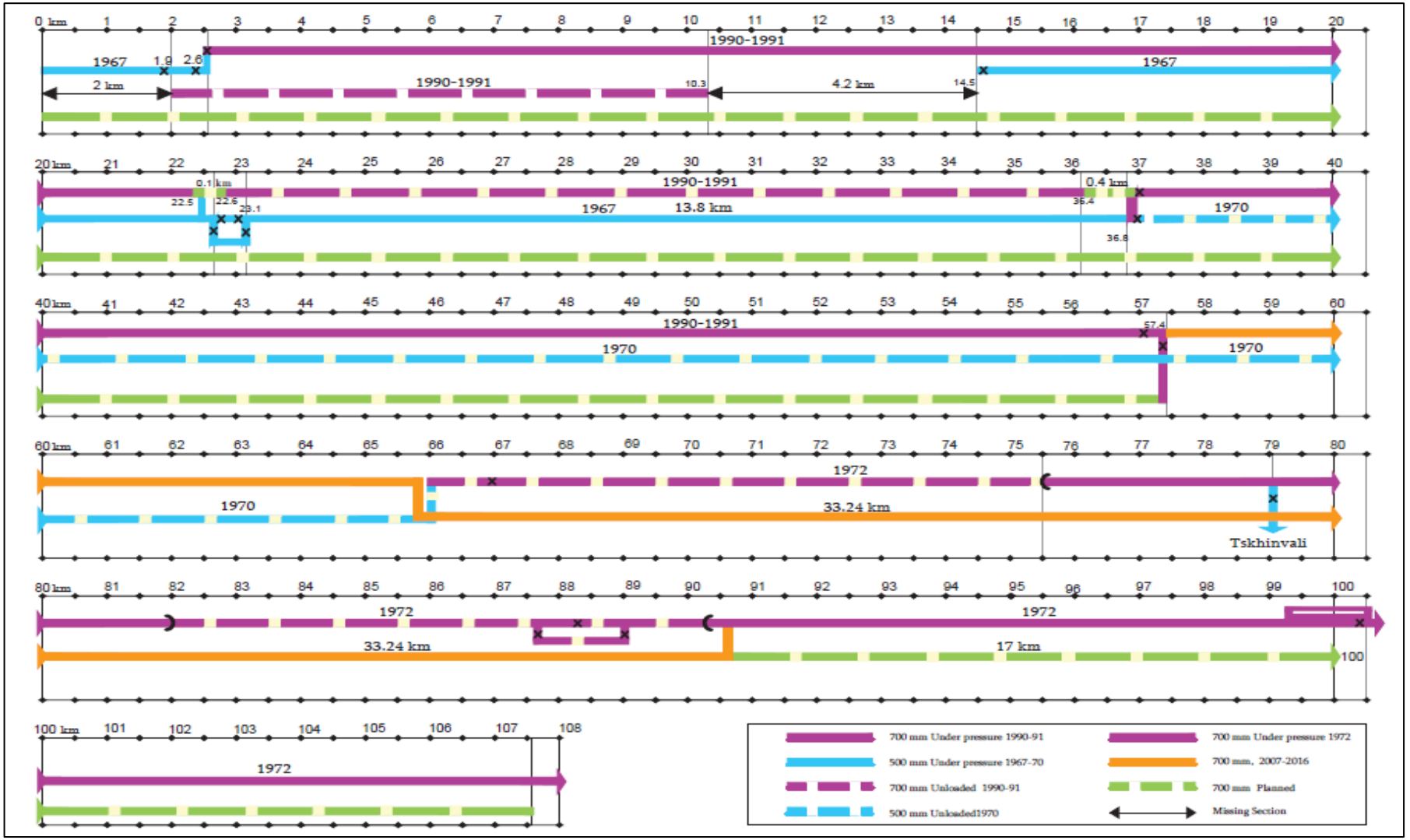


Figure 4.2. East-West Main Gas Pipeline Saguramo-Khashuri section

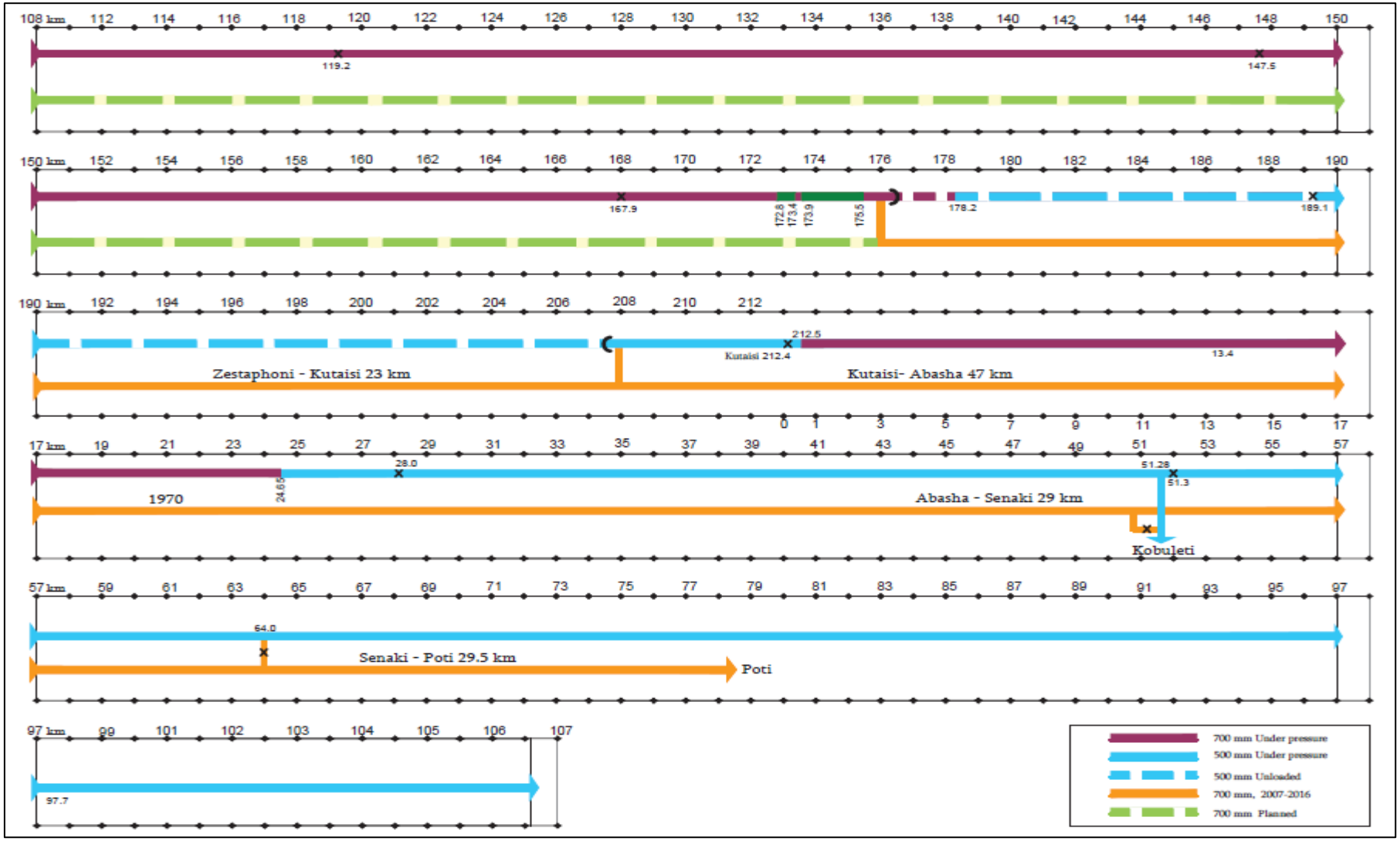


Figure 4.3. Khashuri -Poti section of the East-West main gas pipeline

Construction of Kobuleti branch 500 mm pipeline section began in 2017. Completion of the project is planned in 2018 year.

Preliminary works have begun on technical projects of construction of 700 mm Aragvi crossing and Khashuri-Zestafoni ≈70 km length section and preparation of tender documentation for materials procurement and the constructor company selection process. Construction works are planned in 2018-2020.

By 2019 Plan, Kazakhi-Saguramo 1000 mm pipeline 53.4-57.4 km-points section rehabilitation works are conditionally planned. This section of the pipeline and the surrounding areas have been under regular observation for the last few years. According to the information of the gas transportation company, from 2001 to present 45 damaged points have been found, including 3 damaged points on 3 km length section between 54-57 km.

In the year 2016, research was conducted within INOGATE[41] program , using ASME B31G standard methodology for the integrity assessment of pipeline. 6 leaking holes were detected in the tested area. Based on the results of the study conducted by GOGC in 2016, 22 critical corrosion points, with diameter 3 to 20 mm, were found on the gas pipeline section. The remaining part up to the border is relatively less damaged, however there are signs of the unsatisfactory condition of the pipeline coatings and catholic security metering points are out of the order. According to the overall estimation, the 4 km long pipeline, the most damaged section is subject to the total renewal (see Figure), and the remaining part is subject to partial rehabilitation.

Figure 4.4. Critical section of 53,4-57,4 km-points

The 2018 plan envisages restoration of the approximately 6.5 km corrosive section of the Tsiteli Khidi-Tsalka-Akhalkalaki 300mm pipeline (near Tabatskuri). This section of the

[41] Support to GOGC in integrity assessment of unpiggable pipelines (in the framework of CWP-08-GE), Report, 2016

pipeline was constructed in the framework of the project of the Burnasheti - Alastani (140.5 - 175,2 km points) project in 1990. The study of the technical condition of the pipeline was conducted in 2013, based on which it was recommended to identify the pipeline repair points requiring replacement of the pipes and the proper repair works.

List of "Major overhaul works to be studied and planned" presented by the GGTC in the letter #1/06-1-1586 dated 24 July 2017 included recommendation on feasibility of restoration of the mentioned pipeline section (change of corrosive pipes). In order to study the problem, the Pipeline Technical Monitoring Group of GOGC conducted special research in June 2017. 44 segments of the damaged pipeline section were studied from 164.16 to 170,72 km points on 6547 m section (see Figure). In addition to the pits, there were 5 active leaks, 5 stripes and 10 pre-repaired spaces. Many of the local corrosion zones with a critical damage of the pipe wall were found[42].

Figure 4.5. Rehabilitation section adjacent to Tabatskuri Lake

Based on the study, the necessity of rehabilitation of the section was confirmed. It is planned to conduct rehabilitation of the section in 2018.

Based on the results of the survey of Zestafoni 4.5 km length and 200 mm diameter branch conducted by the GOGC's Pipeline Monitoring Group also based on the request of GGTC, rehabilitation of Zestafoni branch of Saguramo-Kutaisi trunk pipeline has been decided (see Figure). It is estimated that significant portion of the pipeline is located directly on the surface of the land or covered with semi-ground, pipes isolation is completely damaged. During the observation period there were small leakage points in a few places.

[42] Detailed information is presented in the GOGC "Pipeline monitoring group"-s report, June 2017

Estimated cost of the project is about 950 thousand GEL. Its funding will be implemented at the expense of funding for local works.

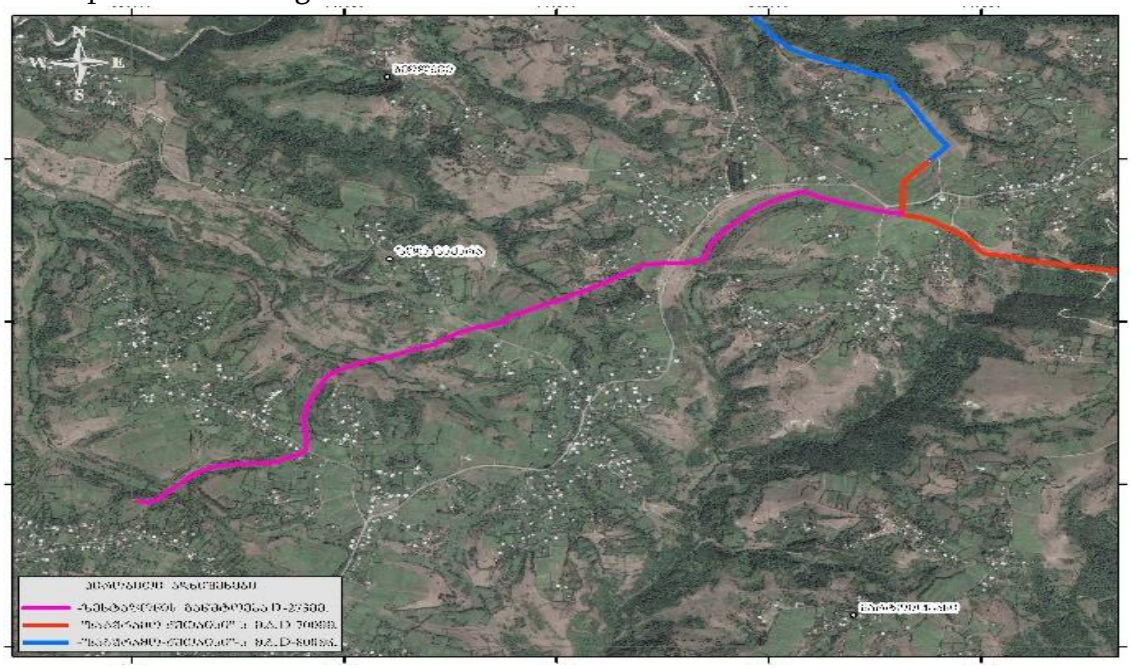


Figure 4.6. Zestafoni branch

Study is underway for the project of 12 km length, 762 mm conditional diameter pipeline connecting the SCP to the Georgian Main Gas Pipeline System for Gardabani TPP's high-pressure gas supply. According to the preliminary discussions with the operator, in 2017-2018, the project design will be prepared for the pressure regulating-measuring node for area 72 of SCP pipeline, modification of connecting pipeline and required changes in TPP's systems, procedural issues will be initiated with the SCP System Operator and presumably the necessary construction works will be initiated in 2019.

Figure 4.7. The pipeline connecting the SCP's Gardabani TPP's

The 2018 plan envisages completion of the restoration works of Rustavi GPRMS with the estimated cost of 12.1 mln GEL.

The Annex provides a list of local restoration works based on the demand and analysis of the indicated critical facilities conditions presented in the letter of the Operator Company # 1/06-1-1586 dated 24 July 2017. Generally, small-scale local restoration projects consider realization of additional works that ensures smooth operation of the system for any customer's uninterrupted gas supply. These works are considered through using annually additionally allocated 5 mln GEL during 2018-2020. In addition, the technical and financial provision of the part of local rehabilitation works are considered at the expense of the operator company. Local, small-scale projects are selected based on the data of the Georgian Gas Transportation Company and the Corporation's Pipeline Monitoring Group.

Small scale, local projects include:

- Replacement of damaged, mainly corrosive sections of the existing gas pipelines of insufficient conductivity, with relatively small diameters and length;
- Rehabilitation works of valves (different types of sizes) and elements of gas distribution stations that enable the system to improve the operational efficiency and fast localization of emergency sections, ensure optimization of system performance regimes and minimize gas losses;
- Planning and realization of trunk pipeline cleaning measures (if necessary) that allows to significantly increase the capacity of individual sections, protect the gas distribution station equipment and valves from corrosion and erosive depreciation;
- Recovery and development of electrochemical protection system that allows minimization of the corrosion loss of pipelines and increases the reliability of system functionality at all;
- Dismantling of the unserviceable pipeline sections in order to prevent their harmful impact on the pipelines operating in parallel and which are equipped with electrochemical protection system;
- River bank protection works, which envisage strengthening of crossing of rivers and other natural barriers by trunk gas pipelines in order to exclude adverse catastrophic impacts on the pipeline's reliability.

Table 4.4 provides a list of short-term and medium-term infrastructure investment projects with their short technical characterization. Preliminary (optional) investment plans for 2019 and 2020 are given only for information.

Table 4.4. 2018-2020 investment projects plan

Name of project	Length, km	DN, mm	Project cost, GEL 1000	Remark
Short-term plan				
Year 2018				
Kobuleti Branch	60,3 (45+15,3)	500	6 206 (15 971-9 765)	The pipes and accessories needed for the project were purchased. The construction works of the 45 km section began with a contract value of 11,919 mln GEL in 2017. The project completion is planned in 2018. Total project cost of the project, including the remaining 15.3 km long section, the pipes and accessories needed for the project are acquired in 2016. The construction works of the 45 km section began with a contract value of 11,919 mln GEL in 2017. The project completion is planned in 2018. The estimated cost of the project is 16-16,5 mln GEL, including the remaining 15,3 km length. In 2017, construction of works worth about 9,765 mln GEL is estimated to be 16 mln GEL. In 2017, the construction of the works is estimated at GEL 9,765 mln
Natakhtari-Lekhura total length 31,4 km (Natakhtari-Tsilkani-7,8 km, Tsilkani-Ksani 10,4 km, Ksani-Lekhura 13,2 km)	31,4	700	7 292 10 048-2 746)	The required pipes and materials are purchased. The estimated cost of construction works is 128$*/meter (according to the cost estimate of Ptsa-Chorchana), which is approximately 320GEL/m. According to the plan, the project will start in 2017, and the main part of the construction works will be completed in 2018. In 2017, the construction of 2,746 mln construction works is included in parallel to the 8 km long and suspended 13 km pipes and the sorting according to the suitability. The cost is calculated by the cost of local works
Lekhura-Sveneti 20.6 km section	20,6	700	1 600	In 2017, it is envisaged to purchase pipes and materials for the entire project, and in the 2018-2019 construction works (approximately 5 km 2018), approximately 6,6 mln GEL. Estimated cost of construction is 128 * 2.5≈3,320 GEL/m.
Ptsa-Chorchana 17 km section	17	700	2 720	The pipes and accessories needed for the project are acquired. The cost estimate cost of construction works is 128*2,5,3,320L/m. 50% of construc-tion works will be implemented in 2017 according to the business plan
Chorchana - Zestafoni (Chorchana-Boslevi-Zestafoni)	70	700	16 205	The cost of the pipes and materials required is 185$*2.5=463GEL/m. Estimated cost of construction is taken into consideration of complexity 257*2.5-1.543 GEL/m. Total cost of the project (construction + materials) 1106 GEL/m (≈442$/m) inbound expenses. The total length is about 70 km, the total value of approximately 78 mln GEL (≈31M $). In 2018, the project is planned to take part in the works and the purchase of 50% of materials. Purchase of remaining materials and construction workis will take place in 2019 and 2020 years respectively.
Air crossing on Aragvi in Saguramo	2,6	700	1 300	The cost of the project is determined by the assumption value of the 1 km long passage. 1 million dollars is equal to 2018 to complete a part of works
Tsiteli Khidi-Tsalka Akhalkalaki 164,2-170,7 kmp section	6,5	300	2 011	Costs of pipes, material for construction cost is 310 GEL/m (124$/m)
GRS project			12 100	The 2018 plan envisages the realization of the Rustavi GRS rehabilitation project. Estimated value of works is 12.1 mln GEL, which will be specified in the preparation and procurement of the worker

Local rehabilitation works			5 000	It includes the diagnostics of local rehabilitation, designation, receipts, servicing and other works
Total expenses			**54 434**	**$21 774**
Year 2019				
Chorchana-Zestafoni (Chorchana-Boslevi-Zestafoni)	17	700	26 922	On 2nd stage construction works will be completed on the beginning section and materials will be purchased for 35 km lengh section
Pipeline connecting SCP with Gardabani TPP's and pressure regulation unit	5	500	4869	The cost is derived from the project's preliminary feasibility study
Lekhura-Sveneti	20,6	700	4 992	In 2019, it is envisaged to carry out major construction works (15,6 km). Estimated cost of construction is 128$/m.
Kazakhi-Saguramo	4,0	1000	14 784	Pipeline construction cost is based on the EU Energy Regulator Cooperative Agency (ACER) indicator. Final decision upon project realization needs and financial provision will be made based on updated transit contract with Russian "GazProm"
Air crossing on Aragvi in Saguramo	2,6	700	5 200	In 2019, completion 80% of works are planned
Local rehabilitation works			5 000	Cost of GRS rehabilitation projects, installation of cleaning and diagnostic receiving stations, dismantling out of order pipelines, diagnostics and design works
Total expenses			**61 767**	**$24 707**
Year 2020				
Chorchana-Zestafoni	53	700	34 417	3rd stage of construction works on section of about 53 km lengh will commence in 2020 year. Project considers construction of pig launcher in Boslevi
UGS connecting pipeline and Gas metering station	10 (2x5)	500	17 544	Funding of construction of the connecting pipelines will be considered in the underground gas storage project expenditures
Pipeline Remote Monitoring and Management System (SCADA)			6 000	Considering the SCADA system implementation, taking into consideration the local specifications. The study works will begin in 2017 to deter-mine the expediency and technical implementation of the project implementation
Local rehabilitation works			5 000	Installation of rehabilitation projects for the GRS, cleaning and diagnostic receiving stations, anti-corrosive measures, dismantling of out of order and inactive pipelines, diagnostics, design and other works on Zestafoni branch
Total expenses			**62 417**	**$24 967**
Total expenses are 2018-2020 years			**178 618**	**$71 447**
Total expenditures from the GOGC budget			**141 966**	**$56 786**

4.4 Medium and long-term projects

The medium-and long-term infrastructure development plan mainly involves construction projects for several interconnectors, including Vale-Vani and Tabatskuri-Bakuriani pipeline and the 2nd gas receiving point, after their realization Western and Southern Georgia, as well as Borjomi-Bakuriani recreational zone current gas supply deadlock system architecture will be changed by significantly higher level of security of

gas supply to the circular one. This allows to redirect gas flows in critical situations from any suppliers to any large customers and distribution companies.

4.4.1 Vale-Vani Interconnector

One of the possible scenarios for meeting the total gas demand of all the potential consumers, including long-term high-tech projects in West Georgia, envisages setting up the 2nd off-take near SCP Area 80 in Vale, building Vale-Vani Interconnector of about 70 km in length to link the main gas pipelines with Kutaisi-Abasha section. The 2nd off-take to SCP will be set up near Akhaltsikhe before the pipeline crosses the Georgian-Turkish border in about 2023-2025. The project implementation allows adding a virtually new gas supply source to the country's gas supply system. The subsequent development of the new source would guarantee a circular gas supply system instead of the current bottleneck system and substantially enhance its operational reliability. Also, appropriateness of the arrangement of the 2nd off-take near SCP is connected to the AGRI and WS projects implementation and West Georgia's industrial enterprises and resort-recreational zones development.

The project implementation would also facilitate a rational redistribution of gas flows through Georgian gas mains when gas flows via the territory of Georgia and gas volumes purchased under the transit-related contracts increase sharply following the completion of the 2nd phase of Shah-Deniz field development. According to the existing forecast, gas volumes will start to grow from 2019 to gradually reach 1.6 bcm/y. Receiving such volume of gas through the area 72 off-take into the internal gas mains located in the adjacent area, which are also used to import SOCAR's gas from Azerbaijan, seems irrational and may result in serious technical problems in supplying gas to consumers in the central and western regions of the country.

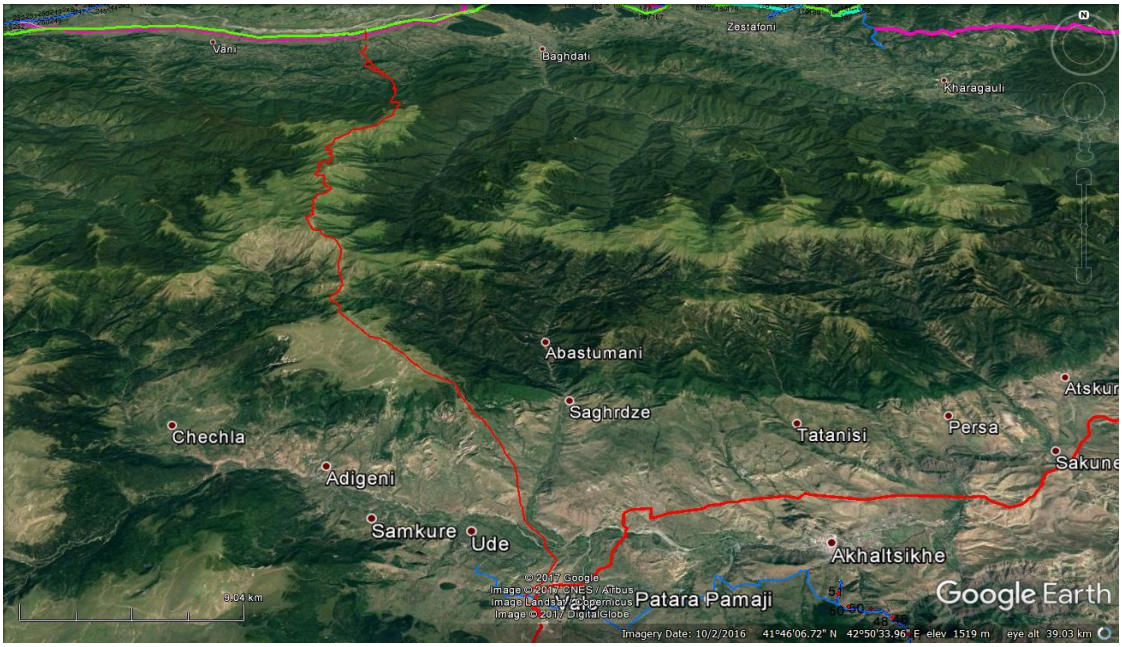


Figure 4.8. Vale-Vani Interconnector

Considering indicative parameters of the gas forecast consumption (see Table 4.8), the regional peak consumption of Western Georgia by 2030 - 2,53 mcm per day – is taken.

In addition to this, the possible increase in gas demand in case of different scenarios of economic development of the region has been taken into account, which is not included in the table and additionally envisages:

- Construction of the new chemical plant intended mostly for import of output;
- Construction of a gas combined-cycle thermal power plant to generate base electricity reserves for hydropower plants planned in the region;
- Construction of a liquefied (or compressed) natural gas export terminal in Poti;
- Simultaneous construction/operation of the above facilities in the event of an intensive economic development of the region.

Projected gas consumption of the chemical plant is estimated at about 500 mcm per year and that of the combination thermal power plant (or cement plant), in the case of operation in a base mode (for about 10 months per year) – up to 200 mcm per year.

Table 4.5. Peak consumption forecast by sectors for West Georgian regions, MMc/d

Demand scenario	Current customers	Chemical plant	TPP	Export terminal	Total peak demand
Scenario I	2,5	0	0	0	2,5
Scenario II	2,5	1,4	0	0	3,9
Scenario III	2,5	0	0,7	0	3,2
Scenario IV	2,5	1,4	0,7	0	4,6
Scenario V	2,5	0	0	22,9	25,4
Scenario VI	2,5	1,4	0,7	22,9	27,5

The operating parameters and estimated construction costs of the gas pipeline of various capacity were determined. The following limiting preconditions were taken into account:

- ✓ The maximum annual transmission capacity under the South Caucasus Pipeline Contract is 30 bcm[43], part of which, namely 22.6 bcm, is the gas produced from Shah-Deniz Field on the 1st and 2nd stages of development to be transited towards Turkish and European markets. Accordingly, maximum 7.4 bcm gas can be received at the territory of Georgia from SCP;
- ✓ The complexity of the pipeline route and climate conditions in the region make it especially difficult to build and operate big-diameter pipelines. Therefore, priority is given to 500 or 700 mm pipelines, with the use of high operating pressure, that can be guaranteed with the pressure at the off-take from South Caucasus Pipeline or by means of an interim compressor(s) to be installed on the Kutaisi-Abasha section of the pipeline.

[43]To guarantee 30 bcm/y transmission capacity, about 87.22 M$ is required in additional expenses to build a Dn56", L=57 parallel pipeline on the initial section of SCP at Sangachali terminal (see AGRI Feasibility Study, Penspen, 2013).

Table 4.6. Design parameters and construction costs

Pipeline/ CS	P_1, bar	P_2, bar	L, km	D, mm	$Q_{d,max}$, Mcm/d	$Q_{y,max}$, Bcm/y	C_Σ, M$	Pipeline scenario
Vale-Vani	55	25	72	500	7,2	2,6	51,14	scenario I
Vani-Poti	25	12	90	700	7,0	2,5	0	
Vale-Vani	75	32	72	500	10,0	3,6	51,14	scenario II
Vani-Poti	32	12	90	700	9,4	3,4	0	
Vale-Vani	75	23	72	500	10,5	3,8	51,14	scenario III
Vani-Poti	34	12	90	700	10,1	3,7	0	
KS 1 (Vani)	23	34			10,1	3,7	10,0	
Vale-Vani	55	40	72	700	13,4	4,9	66,54	scenario IV
Vani-Poti	40	12	90	700	12,1	4,4	0	
Vale-Vani	75	55	72	700	18,0	6,6	66,54	scenario V
Vani-Poti	55	12	90	700	17,0	6,2	0	
Vale-Vani	75	40	72	700	22,4	8,2	66,54	scenario VI
Vani-Poti	55	12	90	700	17,0	6,2	0	
KS 1 (Vani)	40	55			17,0	6,2	17,5	
Vale-Vani	75	38	72	700	23,0	8,4	66,54	scenario VII
Vani-Abasha	55	38	30	700	21,8	8,0	0	
Abasha-Poti	55	12	60	700	20,8	7,6		
KS 1 (Vani)	38	55					17,5	
KS 2 (Abasha)	38	55					17,5	
Vale-Vani	75	50	72	800	28,0	10,2	76,05	scenario VIII
Vani-Kopitnari	50	38	15	700	25,2	9,2	0	
Kopitnari - Abasha	55	38	25	700	24,0	9,0	0	
Abasha-Poti	55	12	50	700	23,0	8,3	0	
KS 1 (Kopitnari)	38	55					17,5	
KS 2 (Abasha)	38	55					17,5	

Note: In order to evaluate financing for infrastructural projects in the longer term, Infrastructure Unit Investment Costs, ACER, 2015, recommended by the European Energy Community have been used.

As the analysis shows, in case of the pipeline first set scenario (D_n=500 mm, P_1=55 Bar, $C_\Sigma \approx$51M$) the first 4 consumption scenarios will fully meet the demand. This indicates that construction of 500 mm diameter Vale-Vani pipeline with design pressure of 55 Bar would be sufficient to meet the probable growing demand of the current household and commercial consumers as well as the demand of a chemical plant and a TPP with the installed capacity of 150-MW if built in the region.

To meet the probable demand of the current consumers and the LNG terminal up to 8 bcm/y capacity (demand scenario V), it is necessary to increase the initial pipeline

pressure to 75 bar and constructVale-Vani Project section with 700 mm diameter pipes,while providing a part of the users from Zestafoni till Vani with gas delivered through Saguramo-Khashuri-Zestaponi-Kutaisi-Vani section of gas pipeline (VII scenario of pipeline set: Dn=700 mm, P_1=75 bar, 2 interim CS with $C_\Sigma \approx$101M $).

To meet the probable joint demand of the current consumers, the LNG terminal up to 8 bcm/y capacity and TPP production (demand scenario VI), it is necessary to increase the initial pipeline pressure to 75 bars and construct Vale-Vani interconnector with 800 mm diameter pipes. (VIII scenario of pipeline set: Dn=800 mm, P_1=75 bar, 2 interim compressor station $C_\Sigma \approx$111M $).

In general, Vale-Vani-Senaki-Poti gas pipeline connection to Kobuleti and Sukhumi Branches is a part of a prospective, multi-stage plan for the rehabilitation/development of the western direction of the Georgian gas pipeline system, which is intended to provide guaranteed gas supply to the household and commercial sectors of the region, the planned free industrial zones and the Black Sea Coast recreation zone.

4.4.2 Rustavi-Poti Gas Pipeline

In case of need of 8 bcm or more transit capacity [44], which may be predetermined in case of supply of large volumes of export gas from Turkmenistan or Iran, a new pipeline is necessary to be built on the territory of Georgia (and Azerbaijan).

Technical parameters and estimated investment cost of such pipeline are defined.[45] The pipeline starts from the Azerbaijan-Georgian border, passes along the parallel EWGP route and ends on the Black Sea Coast. The length of the pipeline on the territory of Georgia is about 370 km, the diameter - 36" (the internal diameter - 888.8 mm, the wall thickness - 12.7 mm) or 42" (the internal diameter - 1034.2 mm, the wall thickness - 15.88 mm), to be precisely defined in the detail design process. The design pressure of the pipeline is 95 bars and the operating pressure – 90 bars. The maximum height from the sea level - 1120 m. As the results of hydraulic modelling show, for D=36" pipeline, with 2 interim compressors of about 23 MW in combined capacity, the system can supply at least 8.5-10 bcm. The transmission capacity of D=42" pipeline of the same configuration would reach about 14.5-15 bcm (combined capacity of compressor stations to be about 33-35 MW). The investment cost for Rustavi-Poti D=36" pipeline is estimated at about 570 M€ (≈630 M$) and for D=42" pipeline - at about 635[46] M€ (≈700 M$). With 15% incidental costs, the investment costs would increase to 635 and 700M€, respectively[47].

4.4.3 Tabatskuri-Bakuriani Connector

The main purpose of Tabatskuri-Bakuriani connector linking the southern branch of the gas mains to the western and central regions of the country is to provide guaranteed gas

[44] Presumably after year 2027 (see: Chapter 3, Regional market)

[45] Feasibility study for AGRI project, Task 3 – Technical solutions report, Penspen Ltd, 2013

[46] Capital cost for each compressor installed capacity is 2,1 M€/MW

supply to Borjomi-Bakuriani urbanized tourist-recreation zone by means of a circular gas supply system. Besides, the project implementation makes it possible to supply gas to the central (or southern) regions of Georgia in a critical emergency using the temporary emergency scheme via Southern branch gas Supply system of Tsiteli Khidi-Tsalka-Akhaltsikhe pipeline 160 km-point (or 2nd SCP off-take) to the gas mains of the central regions of the country, or vice versa. The design pressure of the pipeline is 55 bars, diameter - 300 mm, length - about 18 km.

The new Bakuriani-Tabatskuri gas pipeline together with the existing Akhaltsikhe-Vale (Arali) Connector makes it possible to considerably improve gas supply to Borjomi-Bakuriani recreation zone and also create conditions for looping the entire gas supply system. The construction works are planned to be performed in 2020-2021.

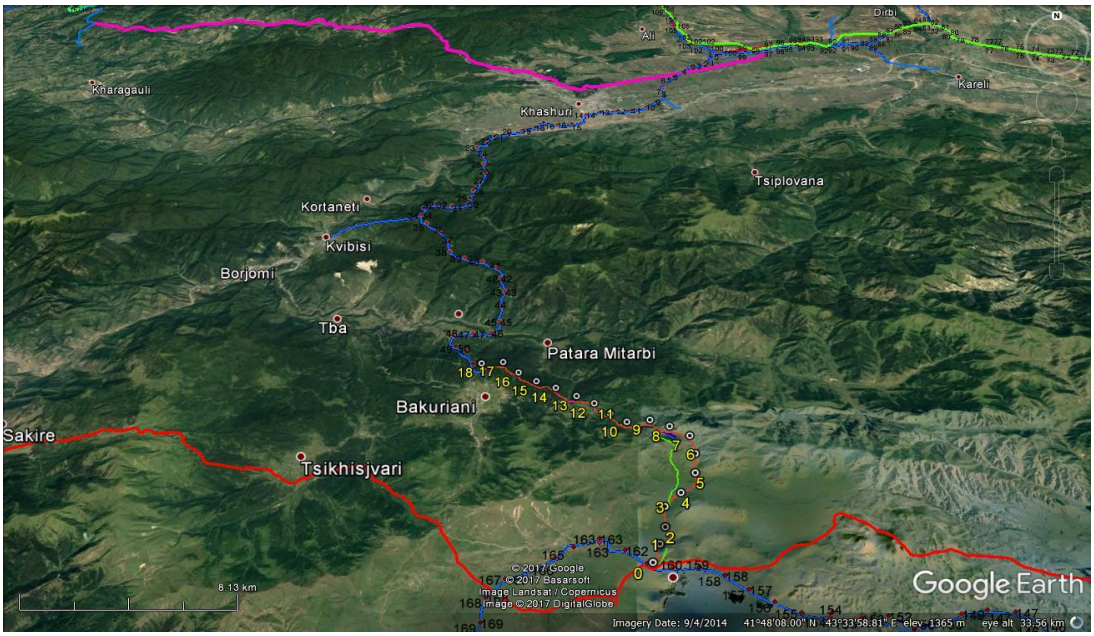


Figure 4.9. Tabatskuri-Bakuriani pipeline

4.4.4 Trans-border pipelines and infrastructure

Georgia is connected to natural gas trans-border transport infrastructure of Azerbaijan, Armenia, Turkey and Russia, reliable operation and further development and improvement of which are of great importance.

The 11.5 km length section of pipeline, connecting Georgia's main pipeline system to Armenia is connected to the 1000-mm pipeline of Kazakhi-Saguramo and starts from Tsiteli Khidi metering unit. The gas pipeline is used for transiting Russian gas to Armenia. It is located in Georgia-Azerbaijan, Georgia-Armenia and Armenia-Azerbaijan border zone, approximately 5 km along the border and crossing the boundary line of 0,25 km from the Armenian-Azerbaijan border (see Figure).

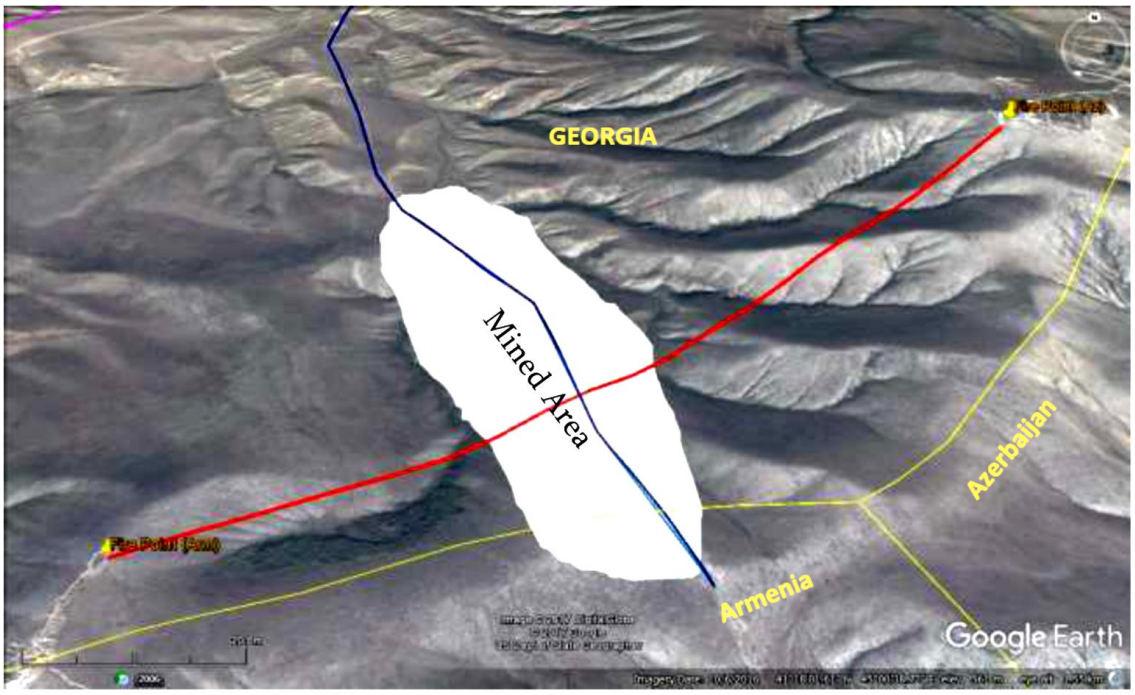


Figure 4.10. The pipeline connecting Georgia-Armenia on the border zone

According to the current information, the pipeline is located in the zone of periodically active military operations of the Armenia-Azerbaijan conflict and is mined. The fire points of the opposing sides are arranged on strategic higles, located in approximately 0.9 km radius from the pipeline. These circumstances make it actually impossible to take care of the gas pipeline, carry out the necessary preventive maintenance and general operation works.

The construction of a new segment of Armenia-Georgia Interconnector is estimated to be approximately 6,7 km length (including 5,1 km on the territory of Georgia), connecting Georgia to Kogbi (Armenia) gas station in the area of the border conflict zone of about 2 km away from the border zone pipeline (see Figure[48]). The cost of construction of the Georgian section of the pipeline is about 7,8-8,5 M$ (6,82-7,44 M€[49]).

[48] Realization of the project will be dependent upon conditions of agreement with partner country. Beside this final decision depends on terms and conditions of transit contract with "GazExport", this can lead to construction of 1000 mm pipeline with a new route connecting Georgia and Armenia.

[49] Design technical parameters of the pipeline and investment costs will be defined after conducting Feasibility study of the project.

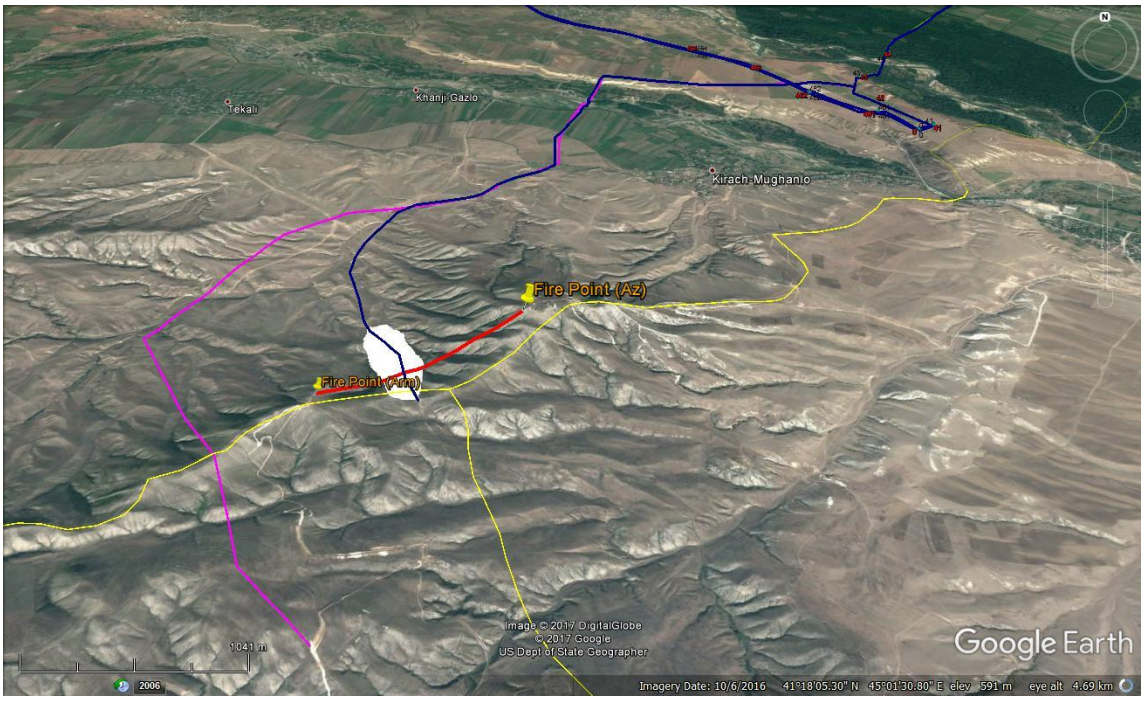


Figure 4.11. New route of Georgia-Armenia connecting pipeline

It is noteworthy that Armenia has European Energy Community observer status, in the perspective is a candidate for the membership and will benefit from the assistance provided by the partner countries of energy community, based on solidarity principle. Accordingly, a new section of trans-border interconnector project, which connects Armenia with Georgia, can be granted the status of a joint project of the PMI (Project of Mutual Interests), and supported by the European Energy Community[50].

Georgia is connected to Russia through 1200 mm diameter North-South Caucasia and 700 mm diameter Vladikavkaz-Tbilisi main pipelines, however the latter, due to Russia's unilateral decision, is locked in its territory (was not restored after the terrorist act in 2006) and currently Georgia is running operations on one North-South Caucasus transit pipeline only. As it was noted, its capacity is enough for long-term forecasting loads, even if Georgia would get additional gas under the "new contract" from Russia. Nevertheless, for the purpose of ensuring guaranteed gas transmission and high quality of services through gas pipelines it is necessary to conduct large-scale rehabilitation works, including rehabilitation of the tunnels (#1, 5, 6 and 7) and river-bank protection works[51] in Tergi river valley, restoration of pig launcher stations (in Devdoraki and Saguramo), and electrochemical protection systems and etc.

For the purpose of ensuring guaranteed delivery of forecasted gas transit volumes and high quality service through the North-South gas pipeline system, it is necessary to conduct rehabilitation works on 1000 mm Kazakhi-Saguramo pipeline as well. They include reconstruction of 11.5 km length pipeline section (see above), replacement of

[50] According to the letter of the Energy Community dated 7 July #EU4ENERGY/O/jko/94/07 identification of joint interest projects has begun. Georgia (as well as Armenia) received the offer for nomination of projects.

[51] See detailed information regarding condition of the pipeline tunnel in the report "NSCP preliminary technical study results regarding #1 tunnel on the Russian-Georgian border", GOGC, 2017. The report is stored in the corporation's archive (Shared folder (//datasrv) (X:) General Directorate – Strategic planning and projects department)

pipes on 4 km length between 53,4-57,4 km-point corroded section and rehabilitation of 12 km length pipeline between 41,1-53,4 km-points, reconstruction and river-bank reinforcement works, restoration of pig launcher stations (Saguramo and Tsiteli Khidi) and electrochemical protection systems and etc. According to the preliminary estimates, these works will require tens of millions of investment expenses. In addition, the current transit agreement with the Russian "Gas Export" is valid only until 2019, which does not allow the possibility of final investment decision, despite the urgent need for rehabilitation and reconstruction works.

As it was mentioned, the current maximum pressure of gas provided from Azerbaijan through SOCAR owned pipelines is not more than 23-24 bar at the border, this makes impossible to increase daily volume by more than 6-6,5 mcm. It is necessary to discuss several alternative technical decisions of Azerbaijan border-Saguramo section capacity increase[52] in order to provide delivery of contractual and forecasted volumes in the future with requested parameters:

1) Restoration of functioning of Kazakhi compressor station (or increase the capacity of the Agdash CS), suggesting that gas pressure on the border will increase to at least 30 bar. In case the additional gas through "new contract" will be obtained from Azerbaijan, then the pressure should be increased to peak 37,1 bar;
2) Arrangement of a compressor station at the border area, to increase the pressure to 29,2 or 37.1 bar (see Tables D7 and D8), respectively, in order to provide a peak demand for 2030. An estimated cost of 8-10 mcm per day capacity and 25 to 37 bar pressure, approximately 7-10 MW capacity compressor station is 15-20 mln $. Investment cost is established by the rough proximity of the European source data and may contain a significant margin of error;
3) Rehabilitation of current 800/700 mm Karadaghi-Tbilisi section and provision of a new 700 mm working pipeline parallel to the pipeline load. In such case, the required pressure will be 23,3 and 25 bar at the border, according to peak 10,5 and 16.3 mcm per day loads (see Tables D9, and D10), which can be ensured in case of effective coordination with the Azeri side.
4) Change of the current technological schemes of gas transportation: gas from the Tsiteli Khidi to be transported through Kazakhi-Saguramo 1000 mm pipeline and gas transit from Russia to Armenia – through newly constructed 700 mm diameter pipeline (after rehabilitation and reconstruction works, including additional interconnector(s) between 1000 and 700 mm pipelines).

In addition to selecting any options for solving the problem, it is necessary to clean the gas supplied from Azerbaijan and arrange the measuring unit corresponding to the modern, international standards at the border.

[52] In order to solve complex problem of guaranteed gas delivery to the West Georgia more effectively priority is given to arrangement of the second gas intake point in the Vale and construction of the Vale-Vani interconnector

4.5. Pig launcher/receiving stations

A significant number of the current gas pipelines built in 1970-1980s are not fitted with modern flow control and pressure release devices or pig launcher stations. Arrangement of pig launcher stations on the East-West and North-South main gas pipeline systems is planned to (see details in the: Ten-Year Development Plan for Georgian Gas Transmission Infrastructure, 2016-2025", GOGC, 2016). In particular, on the 700 mm East-West pipeline system, from Azerbaijan border till the pass 158 km-point (near Boslevi branch) it is planned to install three launching/receiving stations in Saguramo, Khashuri and Boslevi (on Azeri border, in Vani and Poti existing stations are installed during the construction of pipelines of the relevant sections).

One station needs to be rehabilitated on the 1200 mm pipeline of the North-South Caucasus Gas Pipeline system (the station was installed on a 700-mm pipeline but has never actually worked and one launching station needs to be installed in Devdoraki at the Russian border and one receiving station – in Saguramo. Besides, one launching station (in Saguramo) and one receiving station (at Tsiteli Khidi) must be installed on a 1000 mm section of the system.

4.6. Pressure regulation and metering stations

Based on the results of a preliminary study[53], several most important GPRMSs in a critical condition (see table) have been selected for priority rehabilitation.

Rustavi GPRMS rehabilitation project[54] started in 2017, which is expected to be completed in 2018[55]. Works for other GPRMSs having high priority are considered to be commenced after completion of works on Rustavi GPRMS. It is also worth mentioning that small-scale rehabilitation works for some GPRMSs will be financed from the so-called "local "projects budget.

Table 4.5 GPRMS's

GPRMS name	Commissioned in	Q_p, m³/h	P_p, Mpa
Rustavi	1959	61 000-300 000	1.2-5.4/0.3-1.2
Kaspi	1970	61 000-300 000	1.2-5.4/0.3-1.2
Gori	1970	61 000-300 000	1.2-5.4/0.3-1.2
Navtlughi	1959	61 000-300 000	1.2-5.4/0.3-1.2
Borjomi	1975	21 000-110 000	1.2-5.4/0.3-1.2
Gardabani	2007 (major overhaul)	61 000-300 000	1.2-5.4/0.3-1.2
Gldani	1963	61 000-300 000	1.2-5.4/0.3-1.2
Zestafoni	1975	12 000-70 000	1.2-5.4/0.3-1.2
Khashuri	1972	12 000-70 000	1.2-5.4/0.3-1.2
Kazbegi	1971	1 100-4 750	1.2-5.4/0.3-1.2

[53] Report of the Joint Commission of GOGC Technical Department and GGTC for Examination of Gas Main GDPs, 2014 (see the Annex)

[54] Tender is undergoing to identify the performer of design works

[55] Tender is undergoing to identify the performer of design works

4.7. Pipelines remote monitoring and management system (SCADA)

The arrangement of Remote monitoring and management systems for the gas pipeline network (SCADA) is being planned. Furthermore, it should be considered that some key segments of the current-days gas infrastructure network operate under off-spec design parameters and therefore – control and management of such infrastructure through high-tech information monitoring systems is quite problematic and at times – even impossible. Hence, before making a final investment decision upon installing SCADA system it is necessary to conduct thorough technical research and analysis.

Within the Asian Development Bank (ADB) technical assistance project grant funding, it is undertaken to conduct pre-research works (I stage) and SCADA project specification preparation (II stage[56]).

In addition, with the assistance of Honeywell company, the main pipelines valves automation project is implemented as SCADA's pilot project.

4.8 Connecting pipelines for Underground gas storage

Construction of the underground gas storage is one of the most important infrastructure projects of the country. Implementation of the project will ensure supply of planned increasing volume of natural gas, seasonal distribution and rational consumption. Consequently, a decision was made on the construction of a strategic underground gas storage in Georgia, on the base of Samgori's Southern Dome oil field.

The Feasibility Study [57] of the project has been prepared. Design technological parameters of the UGS have been established. Conceptual design of the gas storage considers construction of two parallel pipelines connecting surface pipelines to Georgian main gas pipelines of approximately 10 km length (2 x5 km) and conditional diameter of 500 mm. In addition, design of the UGS considers usage of its compressor stations and connecting pipelines to increase gas flow pressure in the main gas pipelines, if necessary, to ensure the supply of gas to the West, as well as during the crisis in the neighboring country to provide assistance for the regions surrounding customers.

[56] Support for Capacity Development, Knowledge and Networking (Subproject 1) – Capacity Development Consultants (49407-002), Inception Report, Fitchtner (ADB's Consultant), July 2017

[57] Samgori South Dome Underground Gas Storage, Feasibility Study Report, GEOSTOCK, 2016

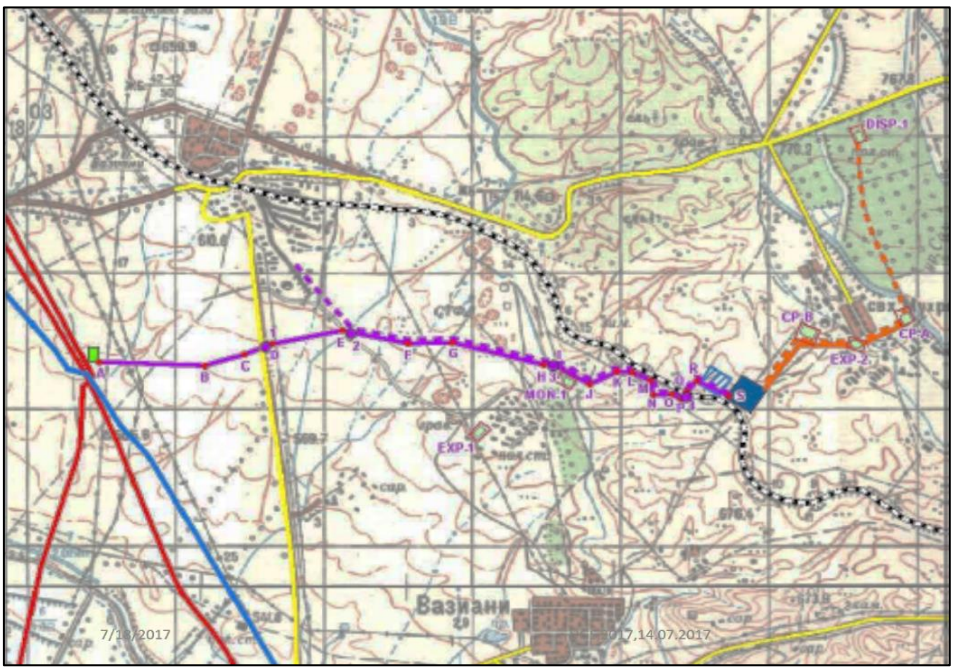


Figure 4.12. Pipeline connecting UGS with main gas pipeline system

4.9 Rehabilitation works in the temporarily occupied regions of Georgia

It is considered to conduct rehabilitation works after the conflict resolution in Georgia's temporarily occupied regions, implementation of such works would, in addition to the resulting economic benefit, facilitate[58] the resolution of serious social and political problems and reintegration of the regions into the economic system of Georgia. Besides, this rehabilitation of a L=110 km, D=500 mm Zugdidi-Sukhumi Gas Pipeline with branches to Gali (D=325 mm, L=3.4 km), Ochamchire (D=529 mm, L=1.5 km) and Sukhumi (D=529 mm, L=0.5 km) enables to provide Abkhazian gasified towns and region with the low cost and easy to use heating resource before political settlement of the conflict, in order to partially replace electricity during the planned rehabilitation of Enguri HPP.

[58] The presented plan does not include financing issues of the planned restoration works on the temporally occupied territories

5. Investment plan

5.1. Investment costs – summary

Table 5.1 provides a list of the infrastructure rehabilitation/development short-, medium- and long-term projects. The costs of the projects are provided for preliminary estimation only (with a -20+30% accuracy range for medium- and long-term projects) and should be defined more precisely on the subsequent project development stages.

Table 5.1. Investment costs for the 10-year infrastructure development plan

Name of work	Length, km	DN, mm	Project cost 1000 Gel	Source
Short-term plan				
2018 year				
Kobuleti Branch	60,3 (45+15,3)	500	6 206	GOGC budget
Aragvi Aerial Crossing in Saguramo	2,6	700	1 300	GOGC budget
Natakhtari - Lekhura	31,4	700	7 292	GOGC budget
Lekhura-Sveneti	20,6 (5)	700	1 600	GOGC budget
Ptsa-Vaka-Chorchana	17	700	2 720	GOGC budget
Chorchana-Zestafoni (purchase of materials)	70 (35)	700	16 205	GOGC budget
Tsiteli Khidi-Tsalka-Akhalkalaki (164,2-170,7 kmp)	6,5	300	2 011	GOGC budget
GPRMS project			12 100	GOGC budget
Local rehabilitation works			5 000	GOGC budget
Total expenses from GOGC budget for 2018 year			**54 434**	**$21 773 683**
2019 year				
Lekhura-Sveneti	20,6 (15,6)	700	4 992	GOGC budget
Chorchana-Zestafoni (purchase of materials for 35 km section and first section	17	700	26 922	GOGC budget
Aragvi Aerial Crossing in Saguramo	2,6	700	5 200	GOGC budget
Kazakhi-Saguramo (53,4-57,4 section)	4,0	1000	14 784	To be verified
SCP-Gardabani TPPs and pressure regulation unit	5,0	500	4 869	Gardabani CCPP*
Local rehabilitation works			5 000	GOGC budget
Total expenses from GOGC budget for 2019 year			**42 114**	**$16 845 721**
2020 year				
Chorchana-Zestafoni (last section and pig launcher station)	53	700	34 417	GOGC budget
Pipeline monitoring system (SCADA)			6 000	To be verified**
UGS connecting pipelines and gas metering Unit	9,7	50	17 544	UGS project*
Local rehabilitation works			5 000	GOGC budget
Total expenses from GOGC budget for 2020 year			**45 417**	**$18 166 990**
Total expenses From GOGC budget for 2018-2020 years			**141 966**	**$56 786 394**
Medium-term plan: 2021-2022 years				
Tabatskuri-Bakuriani	18	300	5 570	GOGC budget

Armenia-Georgia interconnector ****	6,7 (5,1+1,6)	1000	20 550	GOGC budget (76%)***
CS at Azerbaijani border			43 750	GOGC budget
Local rehabilitation works			10 000	GOGC budget
Total expenses from GOGC budget for 2021-2022 years			**79 870**	**$31 948 053**
Long-term plan after 2022 year				
Vale-Vani-Poti****				
Capacity 2 bcm/y	70		127 850	Project sponsor
Capacity 8bcm/y	70		253 850	Project sponsor
Rustavi-Poti,**** 8,5-10 bcm/y	370	900	1 575 000	Project sponsor
Total expenses **(possible maximum) 2022-2027 years**			**1 575 000**	**$656 250**
Total expenses in 2018-2027 years from GOGC budget			**193 423**	**$77 369 017**
*The financing of these pipeline projects is envisaged from the interested third party - Beneficiary TPP's or underground gas storage project budget				
**SCADA project (or its part) will be funded by grant				
*** Projects total cost is 9,77 million euro (≈27 million Gel). Main part of the pipeline - 5,1 km is on Georgian territory and accordingly Georgian party's funding is calculated proportionally				
**** The financing for the construction of Vale-Vani-Poti or Rustavi-Poti pipelines is provided as part of the new offshore pipeline, AGRI LNG project implementation and therefore is not included in the total expenses for the 10-year network development plan.				

5.2. Main recommendations

1. The formal basis for the development of the plan is the country's commitment to submit, after joining the European Energy Community, a 10-year network development plan subject to the requirements of *Directive 2009/73/EC concerning common rules for the internal market in natural gas* as well as the energy legislation of Georgia;

2. To substantiate its feasibility, the plan provides a demand-supply analysis for the Georgian internal market of natural gas, reviews the regional market and the opportunities for the development of transit projects across the territory of Georgia, the current infrastructure and its capabilities, identifies the causes and grounds for the rehabilitation/reconstruction of the current infrastructure and initiation of new infrastructure projects and making investment decisions;

3. The presented 10-year plan contains an investment timeline for the implementation of infrastructure projects, including:

- the projects, for which financing has been allocated in 2018 and the projects identified for the transitional period of 2019-2020, for the financing of which only a preliminary decision has been made;

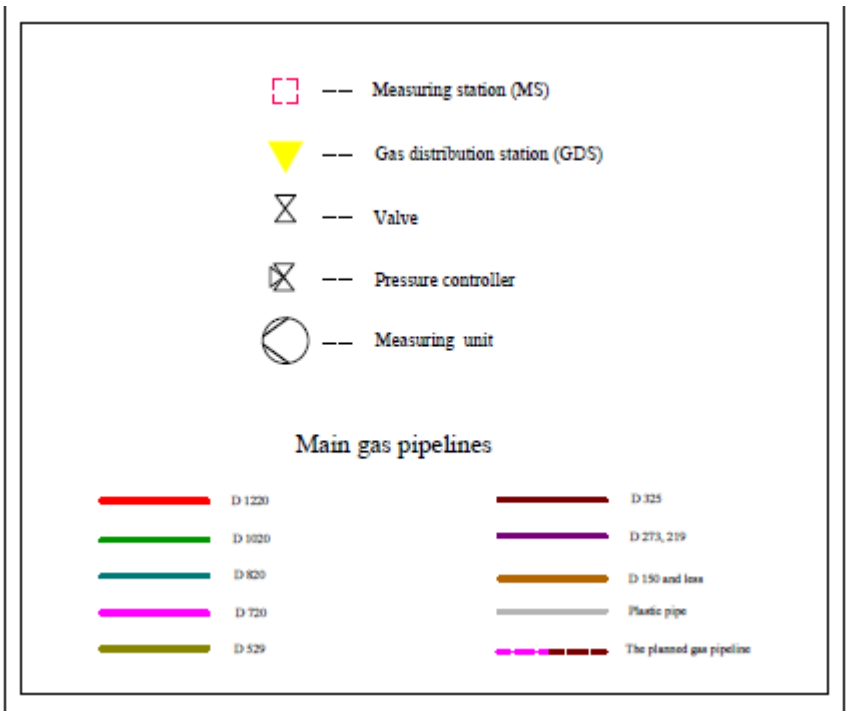
- the projects initiated for a medium- and the long-term period the decision on the financing of which will be made later, having regard to the needs and the availability of investments required for their implementation;

ANNEXES

Annex 1

Schematic Figures of the Georgian main gas pipeline system

Used Symbols



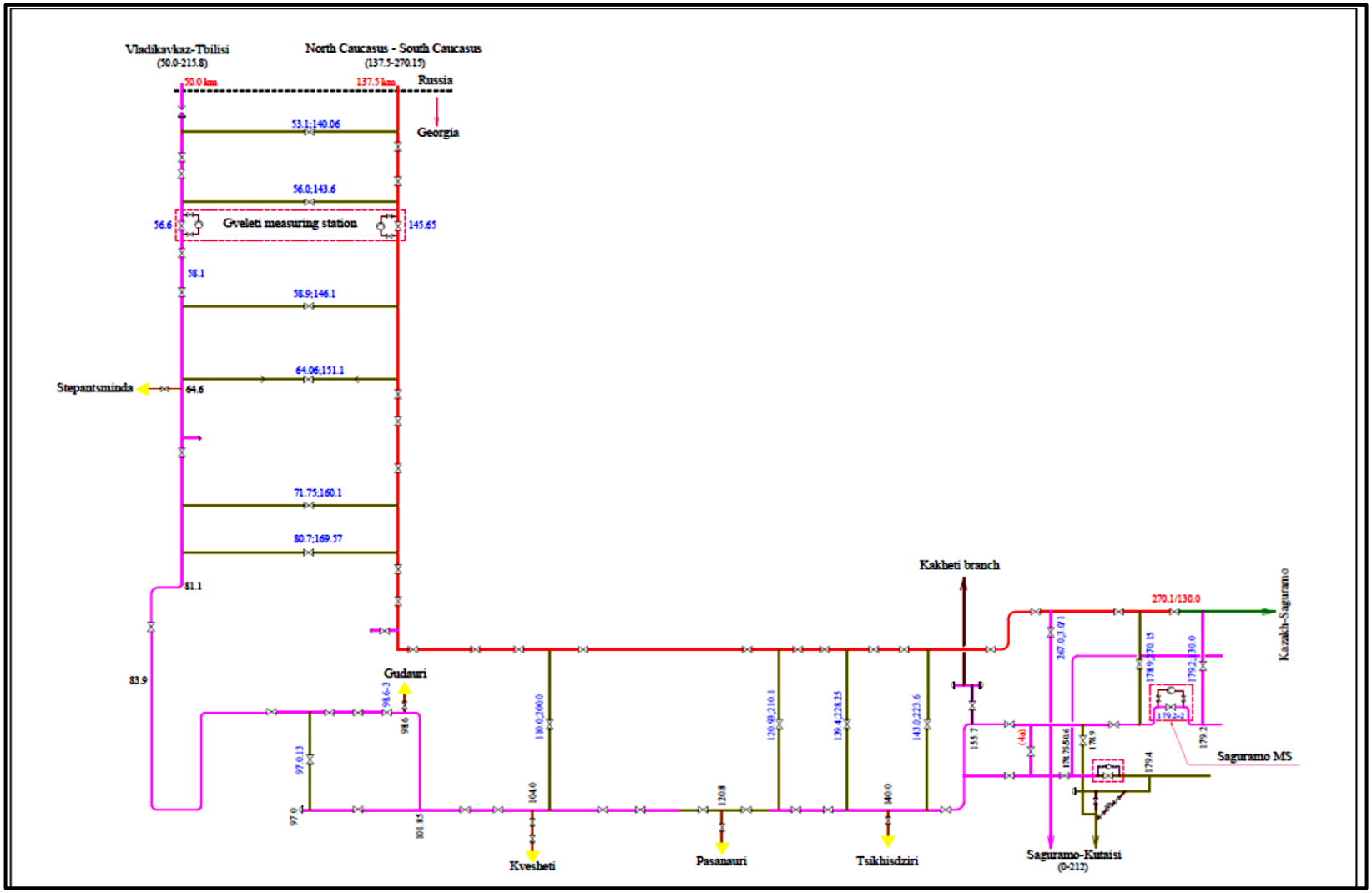


Figure A1.1. Georgian Gas Main Pipelines: Northern Border – Center (Saguramo GPRMS)

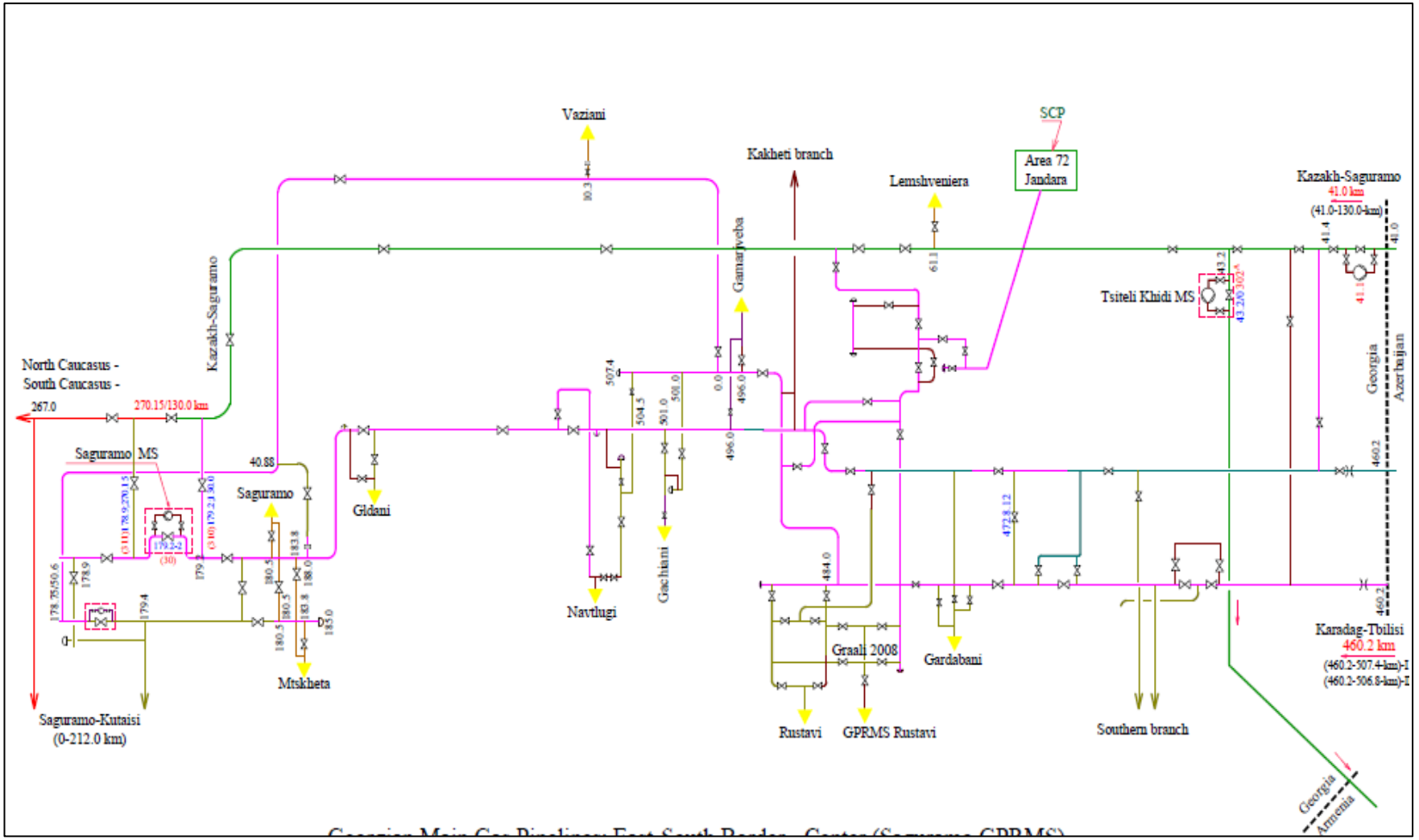


Figure A1.2. Georgian Gas Main Pipelines: South-East Border – Center (Saguramo GPRMS)

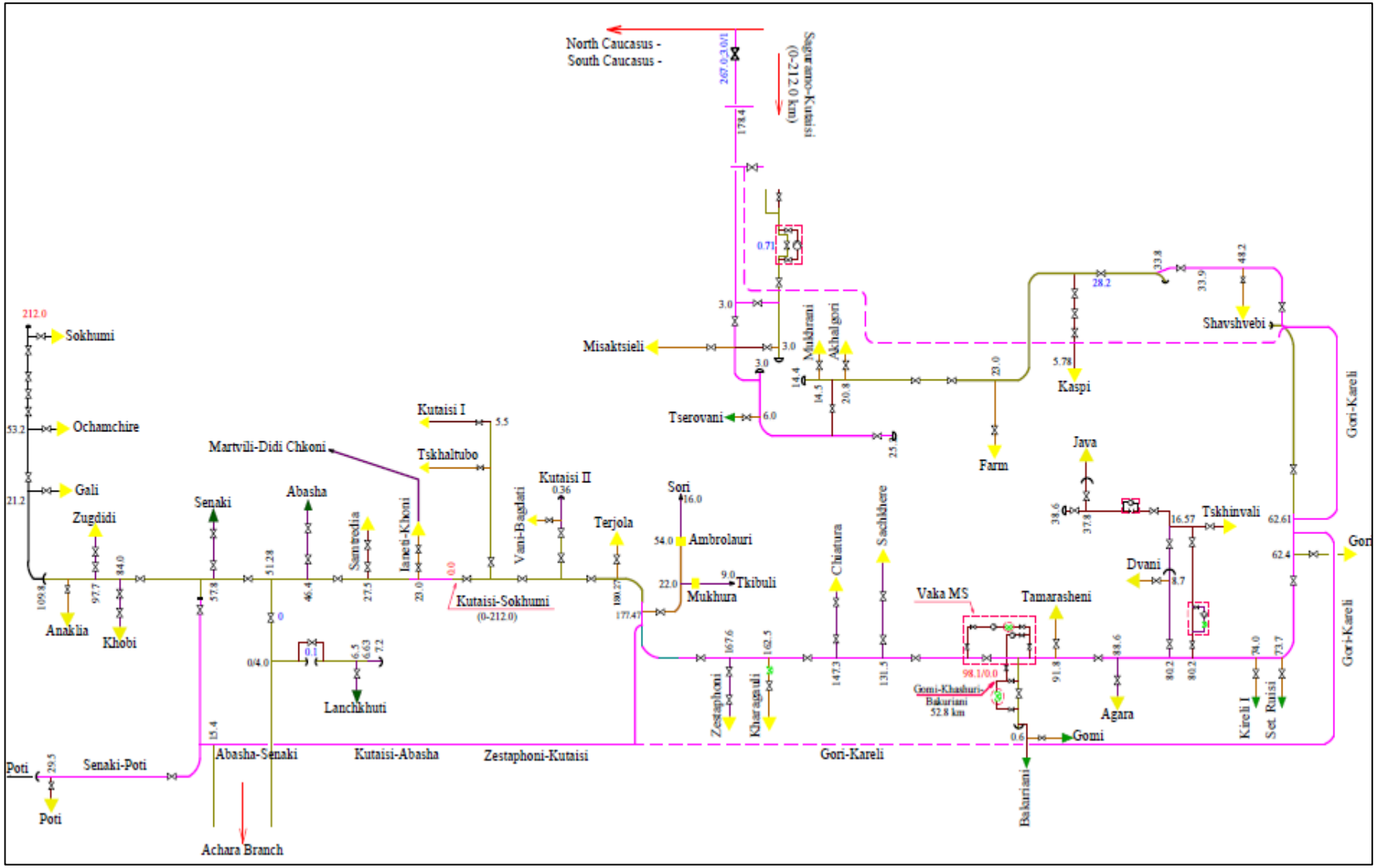


Figure A1.3. Main Gas Pipelines: Center - West Direction

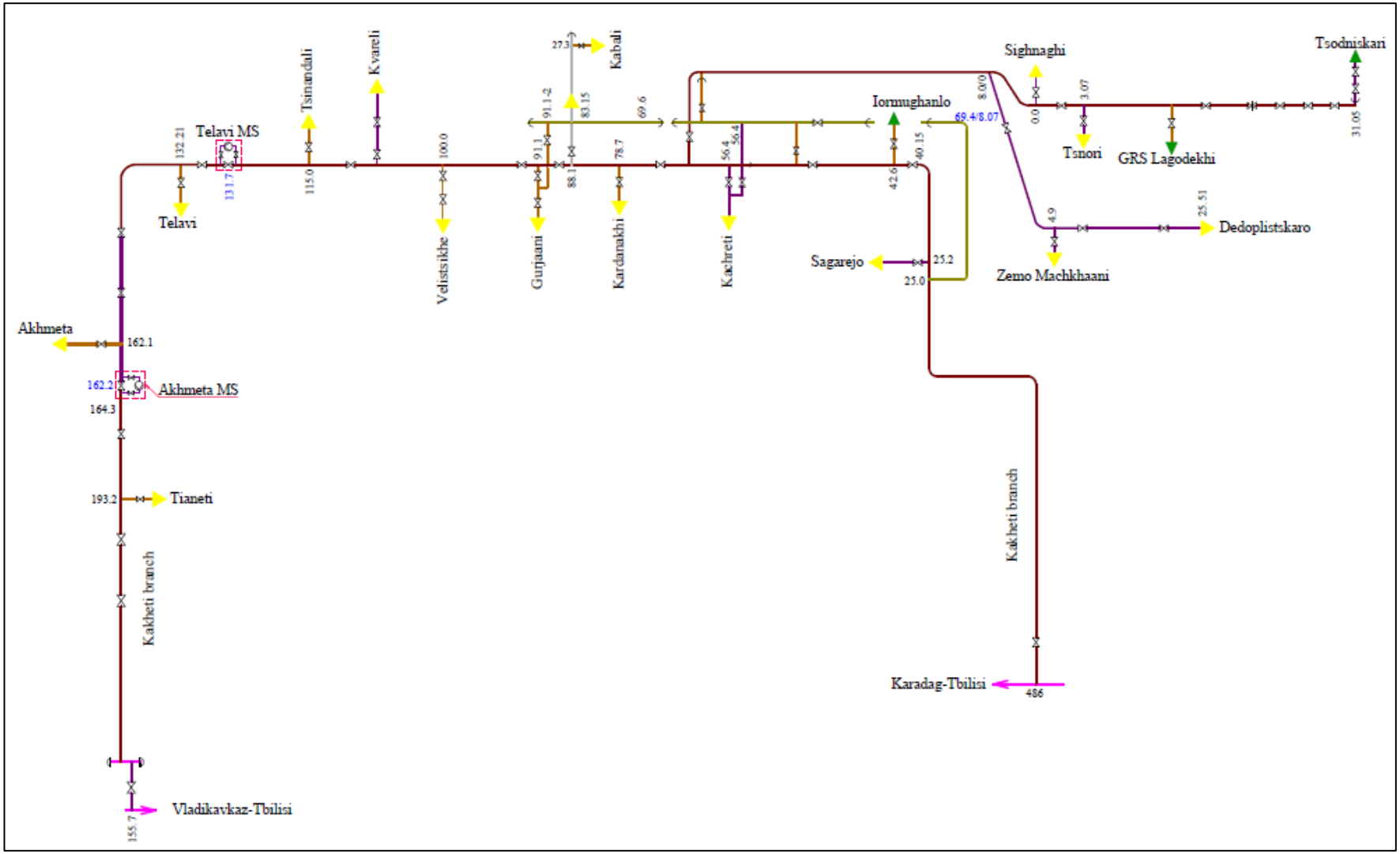


Figure A1.4. Main gas pipelines: Kakheti branch

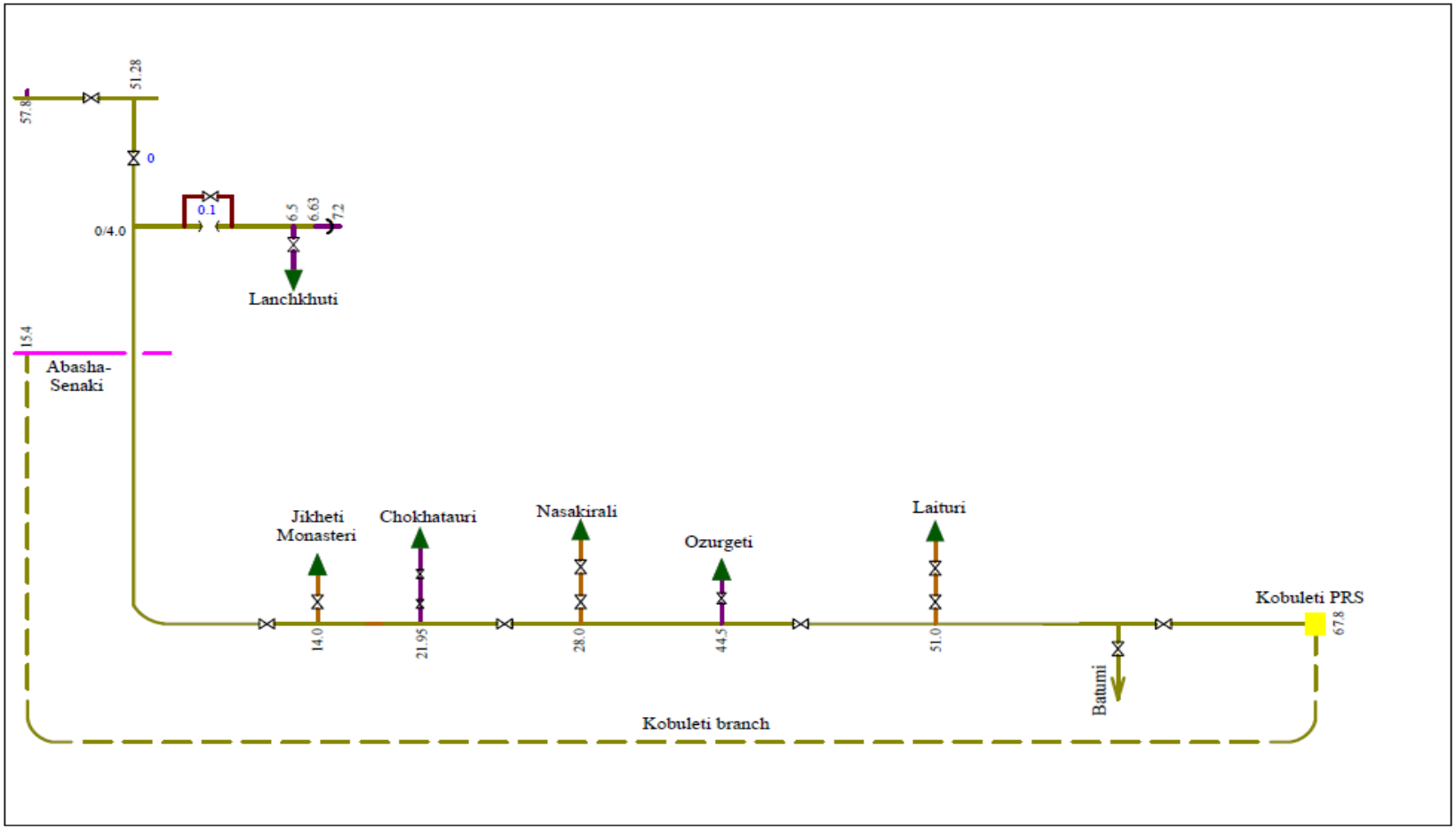


Figure A1.5. Main gas pipelines: Adjara branch

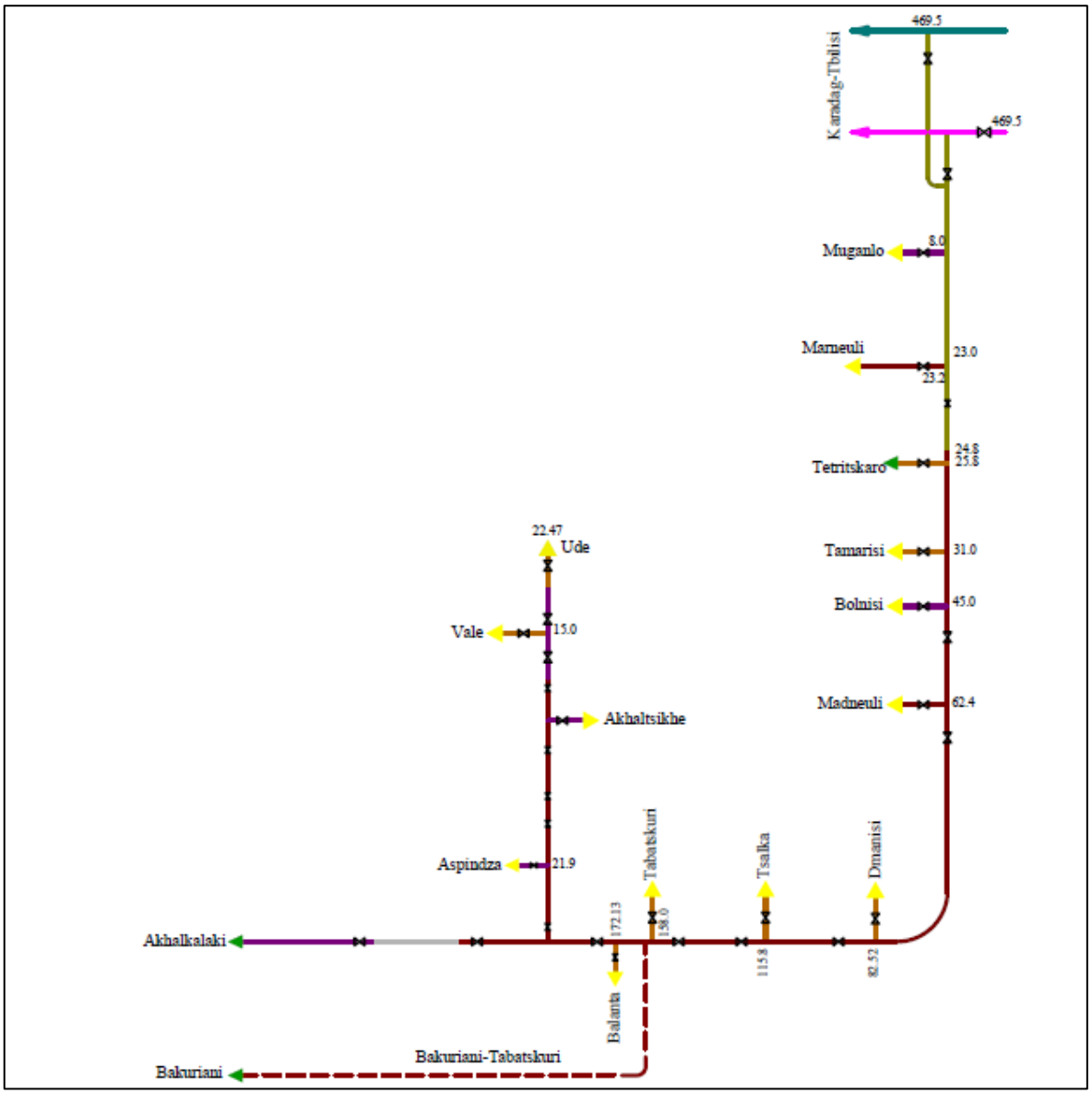


Figure A1.6. Main gas pipelines: Southern branch

Annex 2.
Hydraulic modeling of forecasted loads for Year 2030

Table A2.1. Current period maximum throughput at Azerbaijan border-Saguramo section

Section name	$P_{beg.}$, Bar	$P_{end.}$ Bar	ΣQ_{max} bcm/y	$Q_{max.}$ section bcm/y	%	$\Sigma Q_{max.}$, m³/d
border-South branch	22,3	21,1	2,5550	0,0494	2%	7 000 000
South branch-Gardabani	21,1	19,9	2,5056	0,8607	34%	
Gardabani-Rustavi	19,9	19,5	1,6450	0,2561	10%	
Rustavi-Navtlugi	19,5	18,7	1,3889	0,7905	31%	
Navtlugi Saguramo	18,7	18,3	0,5984	0,5984	23%	

Table A2.2. Hydraulic calculation of Saguramo-West direction, using pipelines existing[59] Year 2017

Section name	$P_{beg.}$, Bar	$P_{end.}$ Bar	ΣQ_{max} bcm/y	$Q_{max.}$ section bcm/y	%	$\Sigma Q_{max.}$, m³/d
Saguramo-Vaka	27,8	15,9	1,5944	0,6437	41%	4 270 000
Vaka-Zestafoni	15,9	13,7	0,9507	0,1559	10%	
Zestafoni-Abasha	13,7	12,1	0,7949	0,6234	40%	
Abasha-Poti	12,1	12,0	0,1714	0,1714	11%	

Table A2.3. Hydraulic calculation of Adjara branch considering the peak load forecast for Year 2030

Section name	$P_{beg.}$, Bar	$P_{end.}$ Bar	ΣQ_{max} bcm/y	$Q_{max.}$ section bcm/y	%	$\Sigma Q_{max.}$, m³/d
Abasha-Kobuleti	14,1	13,0	0,307	0,061	20%	840 000
Kobuleti-Salibauri	13,0	12,0	0,245	0,245	80%	

Table A2.4. Hydraulic calculation of Azerbaijan border-Saguramo section, using pipelines existing in 2017 (with no additional gas available from "new contract")

Section name	$P_{beg.}$, Bar	$P_{end.}$ Bar	ΣQ_{max} bcm/y	$Q_{max.}$ section bcm/y	%	$\Sigma Q_{max.}$, m³/d
border-South branch	33,8	32,0	3,8325	0,0740	2%	10 500 000
South branch-Gardabani	32,0	30,3	3,7585	1,2910	34%	
Gardabani-Rustavi	30,3	29,6	2,4675	0,3841	10%	
Rustavi-Navtlugi	29,6	28,5	2,0833	1,1857	31%	
Navtlugi Saguramo	28,5	27,8	0,8976	0,8976	23%	

[59] In the calculation model, the existing 500 and 700 mm sections of Saguramo-Vaka section are replaced by a virtual joint diameter pipeline of about equivalent capacity.

Table A2.5. Hydraulic calculation of Azerbaijan border-Saguramo section, using pipelines existing in 2017 (in case of additional gas from Azerbaijan through "new contract")

Section name	$P_{beg.}$, Bar	$P_{end.}$ Bar	ΣQ_{max} bcm/y	$Q_{max.}$ section bcm/y	%	$\Sigma Q_{max.}$, m³/d
border-South branch	40,8	37,0	5,9495	0,1149	2%	16 300 000
South branch-Gardabani	37,0	33,4	5,8346	2,0041	34%	
Gardabani-Rustavi	33,4	32,0	3,8304	0,5963	10%	
Rustavi-Navtlugi	32,0	29,4	3,2341	1,8406	31%	
Navtlugi Saguramo	29,4	27,8	1,3935	1,3935	23%	

Table A2.6. Hydraulic calculation of Saguramo-West direction considering planned infrastructure (using totally 700 mm pipes)

Section name	$P_{beg.}$, Bar	$P_{end.}$ Bar	ΣQ_{max} bcm/y	$Q_{max.}$ section bcm/y	%	$\Sigma Q_{max.}$, m³/d
Saguramo-Vaka	22,0	15,9	1,5944	0,6437	41%	4 270 000
Vaka-Zestafoni	15,9	13,7	0,9507	0,1559	10%	
Zestafoni-Abasha	13,7	12,1	0,7949	0,6234	40%	
Abasha-Poti	12,1	12,0	0,1714	0,1714	11%	

Table A2.7. Hydraulic calculation of Azerbaijan border-Saguramo section, using planned infrastructure (without additional gas available from "new contracts")

Section name	$P_{beg.}$, Bar	$P_{end.}$ Bar	ΣQ_{max} bcm/y	$Q_{max.}$ section bcm/y	%	$\Sigma Q_{max.}$, m³/d
border-South branch	29,2	27,0	3,8325	0,0740	2%	10 500 000
South branch-Gardabani	27,0	25,0	3,7585	1,2910	34%	
Gardabani-Rustavi	25,0	24,2	2,4675	0,3841	10%	
Rustavi-Navtlugi	24,2	22,8	2,0833	1,1857	31%	
Navtlugi Saguramo	22,8	22,0	0,8976	0,8976	23%	

Table A2.8. Hydraulic calculation of Azerbaijan border-Saguramo section, using planned infrastructure (in case of additional gas from Azerbaijan through "new contracts")

Section name	$P_{beg.}$, Bar	$P_{end.}$ Bar	ΣQ_{max} bcm/y	$Q_{max.}$ section bcm/y	%	$\Sigma Q_{max.}$, m³/d
border-South branch	37,1	32,8	5,9495	0,1149	2%	16 300 000
South branch-Gardabani	32,8	28,7	5,8346	2,0041	34%	
Gardabani-Rustavi	28,7	27,0	3,8304	0,5963	10%	
Rustavi-Navtlugi	27,0	24,0	3,2341	1,8406	31%	
Navtlugi Saguramo	24,0	22,0	1,3935	1,3935	23%	

Table A2.9. Hydraulic calculation of Azerbaijan border-Saguramo section considering planned infrastructure and maintenance[60] of existing parallel pipeline functioning (without additional gas available from "new contract")

Section name	$P_{beg.}$, Bar	$P_{end.}$ Bar	ΣQ_{max} bcm/y	$Q_{max.}$ section bcm/y	%	$\Sigma Q_{max.}$, m³/d
border-South branch	23,3	22,9	3,8325	0,0740	2%	10 500 000
South branch-Gardabani	22,9	22,5	3,7585	1,2910	34%	
Gardabani-Rustavi	22,5	22,3	2,4675	0,3841	10%	
Rustavi-Navtlugi	22,3	22,1	2,0833	1,1857	31%	
Navtlugi Saguramo	22,1	22,0	0,8976	0,8976	23%	

Table A2.10. Hydraulic calculation of Azerbaijan border-Saguramo section, the possibility of the planned infrastructure and the maintenance of the existing parallel pipeline functioning (in case of additional gas from Azerbaijan through ("new contract")

Section name	$P_{beg.}$, Bar	$P_{end.}$ Bar	ΣQ_{max} bcm/y	$Q_{max.}$ section bcm/y	%	$\Sigma Q_{max.}$, m³/d
border-South branch	25,0	24,0	5,9495	0,1149	2%	16 300 000
South branch-Gardabani	24,0	23,2	5,8346	2,0041	34%	
Gardabani-Rustavi	23,2	22,8	3,8304	0,5963	10%	
Rustavi-Navtlugi	22,8	22,3	3,2341	1,8406	31%	
Navtlugi Saguramo	22,3	22,0	1,3935	1,3935	23%	

[60] In the calculation model, the existing 800 and 700 mm parallel sections and the new 700 mm pipeline from Azerbaijan border till Saguramo are replaced by the virtual joint diameter pipeline of about equivalent capacity.

Annex 3

Results of Preliminary Study of the Technical Status of the North-South Caucasus Main Gas Pipeline in the Tunnel # 1 located on the Russian-Georgian border

(Short Summary)

The North-South Caucasus 1200 mm pipeline design is developed by Vnipitransgaz. Construction of the gas pipeline and its sections in the tunnel was conducted by Gas Industry Ministry "Somkhetgazmshen" of the former Soviet Union. Construction was completed and the pipeline was put into operation in 1994 year.

The tunnels were constructed by the Georgian "Tbilgvirabmsheni". The width of the tunnel floor is 4 m, the height in the central part is 3,2-3,5 m. The Tunnel entrance North Portal is located on the territory of the Russian Federation at km-pont 0 + 79,5. The tunnel crosses the Russian-Georgian border and ends with the south outlet portal at km-pont 13 + 52,4. The length of the gas pipeline between the portals is 1272.5 meters. The total length including of the compensators is 1511 meters.

In 2014, specialists from main pipeline Mozdok Operation Division (Russian Federation) conducted a study of the technical condition of the North-South Caucasus Main Gas Pipeline No. 1 Tunnel and the pipeline installed in it. The results of the study were sent to GGTC.

After analysis of the presented information, the following conclusions can be made:

- The actual technical condition #1 tunnel of the North-South Caucasian pipeline and the pipeline installed in it is critical and requires urgent preventive-restoration works.
- The precise definition of the type and volume of the works should be carried out after further examination of the site. At the same time, the approximate definition of rehabilitation works is already possible based on the existing information. Namely:

- Cleaning and repairing of the southern portal of the tunnel, protective walls and roofing of the compensator;
- All three side entrances of the tunnel and the wrecks originated in the tunnel should be cleaned;
- Water discharge system should be arranged, roof considered by the project of the pipeline section should be restored, the tunnel walls require arrangement of hydro-insulating cover (at least cementation) to prevent water spills to the pipes and other metal structures;
- Reinforcement of the tunnel in the area of detection of unsustainable layers (the volume of works will be specified on the basis of the tunnel clearing and conducting study on the entire length of the tunnel);

- The compensator – the pipe at the southern portal of the South should be rehabilitated, stones that prevent the efficient work of the compensator have to be dismantled;
- The anchoring installed in the tunnel should be restored. Damaged (broken) poles and rollers should be replaced because of strong corrosion;
- Functionality of the reinforcing basement of the compensator's work installed on the middle section of the tunnel should be restored;
- The pipelines entire length requires to be cleaned and covered with anticorrosion painting (or other similar material), and in places of concentration of local damage - pipes should be changed.

Main conclusions

- Further exploitation of the #1 tunnel and the North-South Caucasus pipeline installed in it, without rehabilitation, puts at high risk uninterrupted natural gas supply from Russia and transit into Armenia;
- According to the preliminary estimates conducted by GGTC, nearly similar situation is observed in the #5, 6 and 7 tunnels (portals should be restored; abundant water flow is from walls is observed. The corrosive state of pipelines and metal devices cannot be investigated, due to the danger of the gas pipeline leakage);
- It is necessary to temporary switch gas supply to the parallel, 700 mm pipeline to conduct detailed analysis of the tunnels and pipelines on the Russian territory by a complex group of specialists to identify the exact volume of rehabilitation/restoration works and their planning/realization;
- During preparing the natural gas supply contract for Year 2019 it is recommended to raise the issue of joint operations with the Russian side, maintenance and rehabilitation works on the #1 tunnel and main gas pipeline installed in it (and other tunnels mentioned above) located on the Russian-Georgian border and provide appropriate financing through considering required investment in the transit tariff.

Full report on "Preliminary study results of the technical condition of the North-South Caucasus Main Gas Pipeline situated in the #1 tunnel on the Russian-Georgian border", GOGC, 2017, is stored in electronic archives of GOGC (Shared Folder (//datasrv) (X:)- General Directorate – Strategic Planning and Projects Department).

Annex 4

Local repair works

Table A4.1
Major overhauls planned to be executed after presentation of defective acts

№	List of existing problems	Comment
1	North-South Caucasus D-1200 mm Main Gas Pipeline 169,6 km-point (Kobi) needs change of existing D-1200 mm wired tape and bypass D-300 mm bypass lines tapes (D-1200 1 piece, D-300-3 piece)	To make decision GGTC should present defective acts
2	Kazakhi-Saguramo 1020 mm Main Gas Pipeline 41,5 km-point and Karadakh-Tbilisi D-800 mm 460,7 km-point needs to be equipped with connector D-700 mm instead of the failed valve №302	To make decision GGTC should present defective acts
3	Change failed valve of Kutaisi-Sokhumi D-500 mm Main Gas Pipeline at 28,0 km point	To make decision GGTC should present defective acts
4	Change connector of failed valve №310 situated between Kazakh-Saguramo D-1020 mm Main Gas Pipeline 130,3 km-point and Vladikavkaz-Tbilisi D-700 mm Main Gas Pipeline 178,9 km-point	To make decision GGTC should present defective acts
5	Change of the failed underground 500 mm valve on Saguramo-Kutaisi D-500 mm Main Gas Pipeline 212,4 km-point	To make decision GGTC should present defective acts
6	Change existing D-1200 valve and bypass line D-300 tape (D-1200 – 1 piece, D-300 – 1 piece) on North Caucasus-South Caucasus D-1200 mm Main Gas Pipeline 160,0 km point	To make decision GGTC should present defective acts
7	Change D-700 mm failed valve with new one on Vladikavkaz-Tbilisi D-700 mm Main Gas Pipeline 154,3 km-point	To make decision GGTC should present defective acts

Table A4.2

Major overhauls to be performed by JSC "Georgian Oil and Gas Corporation"			
1	Protective wall at North Caucasus –South Caucasus D-1200 mm Main Gas Pipeline 140,5 km-point is damaged	The design will be prepared	The project is planned to be implemented by GOGC
2	From Tsiteli Khidi-Tsalka-Akhalkalaki D-300 mm Main Gas Pipeline 164,0 km-point till 170,0 km-point change of corroded section with new one	The design will be prepared	The project is planned to be implemented by GOGC
3	Discuss joint decision upon condition of aerial pipeline (uncompleted during construction)between Kotelia-Aspindza-Akhaltsikhe D-300 mm branch between 12,0-17,5 km-points	The design will be prepared	The project is planned to be implemented by GOGC
4	Study/rehabilitation of Kazakhi-Saguramo D-1020 mm Main Gas Pipeline hardly corroded section between 53,0-57,0 km-points	The design will be prepared	The works will be planned after the agreement with the Ministry of Energy
5	North Caucasus- South Caucasus D-1200 mm Main Gas Pipeline 200,8 km-point on left side from pipeline aerial crossing section of the pipeline is tied up	The design will be prepared	The project is planned to be implemented by GOGC
6	North Caucasus – South Caucasus D-1200 mm Main Gas Pipeline 194,0 km-point in the river Aragvi valley - a certain section of the pipeline is tied up	After a detailed study, the design will be developed and implemented	
7	About 60 meters of Kobuleti D-500 mm branch is tied up at 48th km-point; pipeline needs cleaning, restoration of isolation and presumably arrangement of stone gabions, filling up with land	The design will be prepared	The repair will be completed after the completion of the new branch of Kobuleti
8	From Rustavi-Telavi-Jinvali D-300 mm Main Gas Pipeline 42,6 km-point till 45,6 km-point study/replacement of 3000 meters long section which crosses residential houses	The issue is discussed, needs to be remade in the case 500 mm gas pipeline will not be switched in the main gas pipeline system	The works will be planned after studying the inactive D-500 mm pipe
9	Change Zestafoni branch (4,5 km) D-273 mm	The design will be prepared	The project is planned to be implemented by GOGC

Table A4.3

Major overhauls to be implemented after a detailed study by GOGC-GGTC

№	List of existing problems	Comment	Planned works
1	Change of 9000 meters of corroded section Karadagh-Tbilisi D-800 mm Main Gas Pipeline between 475,0-484,0 km-points	The issue should be studied jointly by GOGC and GGTC to make decision	Based on study
2	Joint study of 2000 meters section Karadagh-Tbilisi D-700 mm Main Gas Pipeline between 502,0-504,0 km-points	The issue should be studied jointly by GOGC and GGTC to make decision	Based on study
3	Change of corroded 500 meters long D-219 mm section with new one from Saguramo-Kutaisi D-700 mm Main Gas Pipeline 88,6 km-point	The issue should be studied jointly GOGC and GGTC to make decision	Based on study
4	Joint study and preparation of the respective decision on Vladikavkaz-Tbilisi D-700 mm Main Gas Pipeline №6 tunnel and pipeline going through it	Conduct study with invited specialists to identify technical condition of pipeline's tunnels and make joint decision	Based on study

Table A4.4

Current works and measures to be planned as a result of long-term monitoring			
№	List of existing problems	Comment	Planned works
1	Study of developed landslides and carry out relevant measures at Kazakhi-Saguramo D-1020 mm Main Gas Pipeline 107,6 km-point	Study of the threats, minimizing risks and continuous monitoring	Based on study and monitoring
2	Study of developed landslides and carry out relevant measures at Kazakhi-Saguramo D-1020 mm Main Gas Pipeline 108,3 km-point	Study of the threats, minimizing risks and continuous monitoring	Based on study and monitoring
3	Restoration of pipeline's necked isolation and performing rehabilitation works on 35 meters long section at North Caucasus-South Caucasus D-1220 mm Main Gas Pipeline 180,5 km-point	GOGC and GGTC should jointly discuss issue in order to make design decision	GGTC to perform appropriate measures
4	Study/replacement of 600 meters long section crossing a marsh at Rustavi-Telavi-Jinvali D-300 mm Main Gas Pipeline 105,5 km-point	Study of the threats, minimizing risks and continuous monitoring	Based on study and monitoring
5	Study and replacement of about 100 meters long corroded section of Kutaisi-Sokhumi D-500 Main Gas Pipeline between 76,0-83,0 km- points	GOGC and GGTC have jointly discussed issue	
6	It is necessary to study the area of landfill sites and if necessary, replace the pipeline between Rustavi-Telavi-Jinvali D-300 mm Main Gas Pipeline 180,0 and 183,0 km-points into another trajectory	Study of the threats, minimizing risks and continuous monitoring	Maintain the existing trajectory of the pipe and GGTC to conduct small repair works (current)
7	North Caucasus-South Caucasus D-1200 mm Main Gas Pipeline 174,0 km-point 15-20 meter on section is washed out by water	GOGC and GGTC should jointly discuss issue in order to make design decision	GGTC to perform appropriate measures (current)