საქართველოს ნავთობისა და გაზის კორპორაცია
GEORGIAN OIL & GAS CORPORATION

TEN-YEAR DEVELOPMENT PLAN FOR GEORGIAN GAS TRANSMISSION NETWORK 2019-2028

Tbilisi

2018

The document represents a 10-year Georgian gas transmission and related infrastructure development plan. It is the continuation of 2016-year edition of "The 10-Year Development Plan for Georgian Gas Transmission Infrastructure 2017-2026" and 2017-year edition of "The 10-year Gas Network Development Plan, 2018-2027" considering the actual situation of current period.

The 10-Year Gas Network Plan will be discussed and the section covering the short-term plan will be approved by the Ministry of Economy and Sustainable Development of Georgia.

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.

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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
CNG - Compressed Natural Gas
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
LNG - Liquefied Natural Gas
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
WS - "White Stream" pipeline project

Executive summary

1. Introduction

The presented ten-year development plan for Georgian gas network:
a) endeavors to capture the transport infrastructure rehabilitatation/reconstruction projects of the period between 2019 and 2028;
b) addresses the identification of the investment projects to be implemented in 2019 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 for funding 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 the continuation of 2016-year edition of "The 10-Year Development Plan for Georgian Gas Transmission Infrastructure 2017-2026" and 2017 year edition of "The 10-year Gas Network Development Plan, 2018-2027" considering the actual situation of current period. 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 natural gas market, gas demand growth forecast and energy security risks.

3. Infrastructure development

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 parameters. The document also discusses realization prospects of strategic projects linked to provision of energy security.

4. Investment cost plan

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

- Identified projects for 2019, for which financing has been provided and those of 2020-2021 transition stage, for the financing of which only a preliminary decision has been made;
- Perspective projects for 2022-2023 and subsequent period, 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, 2016-version of The 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 should also be reflected in the updated version of the strategy. It is noteworthy that according to the Georgian Law on Energy, a project that 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 Transmission System operator and should be presented for approval to the Energy Regulatory Commission. However, at the transition stage, before the total implementation of EnC legal basis in the Georgian gas sector, the plan is prepeared by GOGC, which owns transit infrastructure and is responsible for its development. After the approval of the obligatory short-term investment plan by the Ministry of Economy and Sustainable Development of Georgia its execution will be provided.

1. Introduction

1.1. General provisions

The Gas Infrastructure Development Plan was prepared in accordance with country's national action plan elaborated within the frames of the EU Association Agreement and having regard to international commitments aimed at harmonization of energy legislation and ensuring 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 2019 with the provided financing and identifies other investment projects to be implemented within the next 2 years;

c) contains an investment timeline for the implementation of medium and long term projects.

The purpose of the 10-year Natural Gas Network Development Plan is to ensure guaranteed gas supply to consumers at present and on a medium and 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 that can be dangerous to commission and is characterized by improper technical reliability or insufficient capacity;
- potential impact of new infrastructure or those scheduled for restoration-reconstruction 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:

1. projects for 2019 with secured funding as well as the projects to be implemented in 2020-2021, for which possible funding sources are already identified;
2. medium-term infrastructure projects for 2022-2023 indicating possible sources of funding;
3. long-term – 2024-2028 and subsequent period prospective infrastructure projects and possible sources of funding to them.

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, as well as the list of urgent capital and current rehabilitation works submitted by pipeline operator company.

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 and after its presentation to the Ministry of Economy and Sustainable Development of Georgia and the approval of the obligatory short term investment program within the frames of the business plan 2019 of GOGC 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.

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 Europe.

The preliminary financial assessment of the network development plans for a short-term period (2019-2021) 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 (includes VAT)	Construction cost (includes VAT)			Total costs (for moderate 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	124
300/6,4	67	40	46	52	113	
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 financially affordable natural gas infrastructure development plan that is distributed in a specific timeline, implementation of which would ensure guaranteed gas supply to consumers in accordance with the criteria accepted in the international practice not only in ordinary

[1] Georgian gas transmission infrastructure ten-year development plan for years 2016-2025 and 2017-2026, GOGC, 2016 (see www.gogc.ge)
[2] ENTSOG and the TYNDP process, ENTSOG, 08/02/2016
[3] Unit investment cost indicators and corresponding reference values for gas infrastructure, ACER, 2015

situations but also during critical periods, 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. Georgian Natural Gas Sector

2.1. General overview of the sector

Natural gas represents one of the most widely consumed basic energy resources in Georgia. According to GeoStat, the share of natural gas in the total supply of energy resources is more than 40%. Accoridng to the gas transportation network operator, 2242 mcm of natural gas was supplied to Georgia in 2016, 869 mcm to household sector (39% of total supply) 522 mcm to power generation sector (23%) and 846 mcm to commercial sector (38%). Based on the data provided by GNERC[4] in 2017 Main Gas Transmission System of Georgia received total volume of 4 339 mcm natural gas, out of which 1 996 mcm was transported to Armenia and the loss amounted to 35 mcm, the rest of the volume was distributed among the local consumers through internal transmission system. Direct consumers in Georgia received 1 066 mcm and distribution networks 1 301 mcm in 2017, the share of household consumers amounted to 884 mcm and 358 mcm was the share of non-household consumers (loss in distribution networs totaled to 60 mcm).

Natural gas sector of the country is one of the most dynamically developing segments. According to GNERC, 1 055 600 (8,8% increase compared to 2015) 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[4]. In 2017, 5000 new consumers were connected to the network.

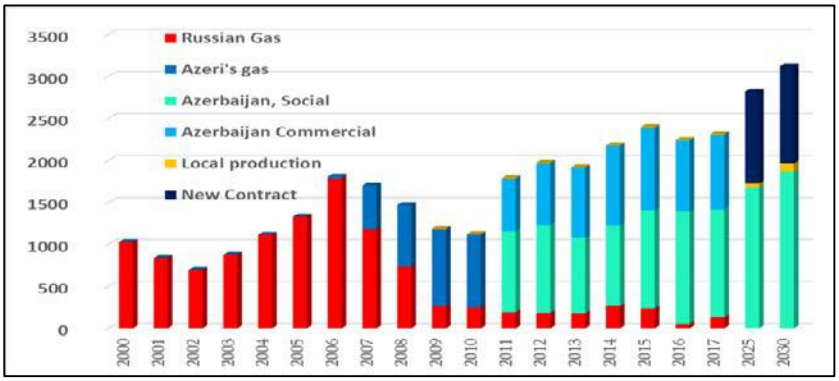
80% of the country's households are gas customers, average annual consumption per family in 2016 amounted to 773 m^3/y (4,6% increase compared to 2015), among them 1011 m^3/y in Tbilisi and 596 m^3/y in the rural regions. Average consumption of one commercial customer in 2016 totaled to 25 000 m^3/y.

The Ministry of Economy and Sustainable Development of Georgia is responsible for further gasification of the country's regions in accordance with the plan negotiated between gas distribution companies including 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. In addition, it should be taken into account that in some mountainous regions of Georgia (Upper-Svaneti, Pshav-Khevsureti, Tusheti and etc.) it is appropriate to develop decentralized systems based on the exploitation of autonomous energy sources instead of constructing costly and economically unjustified pipelines. To this end, transformed natural gas products (liquefied natural gas-LNG and compressed natural gas–CNG) or propane - butane (liquefied petroleum gas-LPG) can be used to supply the abovementioned regions along with the use of local renewable energy resources.

Georgia's demand for natural gas is mainly balanced by the import (see figure). Local gas production is small, and its share in the total consumption is less than 0.5% (about 8 mcm in 2017).

At present, key volumes of gas is supplied through foreign sources on the basis of several independent contracts (with SOCAR of Azebaijan and Shah-Deniz International Consrtium and Russian "GaspromExport").

Azerbaijan is the main gas supplier on the local market. In 2017, the total volume of natural gas exported from Azerbaijan to Georgia amounted to about 94% of the total volume of consumed gas that creates critical situation due to the lack of competition on the market. Commonly accepted international measure for assessing market competititvness - the Herfindahl-Hirschman index (HHI) for Georgian market is 5016 (if we consider SOCAR and Shah-Deniz Consortium as separate suppliers), and market concentration ratio (MCR) totals to 94% which shows oligopoly and quite higher concentration. If we consider the fact that SOCAR acts as a commercial operator in deals related to the natural gas supplied by the South Caucasus Pipeline, the HHI=8836 and MCR=94%, which shows the monopoly of dominant supplier(s) on the market.



Figue 2.1. Natural gas import [4] mcm per year[5]

Gas from Shah-Deniz field of Azerbaijan is supplied to Georgia through the South Caucasus Pipeline (SCP). Under the Host Country Agreement and Option Gas Contracts between the SCP Project participants and the Government of Georgia, Georgia has the option to buy up to 5% of the gas volume transported via SCP. The contract is valid till October 2068.

The Supplemental Gas Purchase and Sale Contract defines the volumes and prices of gas to be supplied additionally in the period up to January 2026. Under this contract, Georgia currently receives 500 mcm of supplemental gas per year. The prices under option and supplemental gas contracts are considerably lower than those on the gas market in the region. According to the forecast, the total volumes of option gas will considerably increase after the Shah-Deniz Field development, phase II is fully completed, and the transmission of supplemental gas to Turkey and Europe commences.

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

[5] „New Contract" implies the supply of natural gas specified along with the volumes to be recived by existing contracts from the source which is not currently identified in order to meet the fuul demand on the market

negotiated. The contract with current terms is valid until 2021 and the contract expires in December 2030.

Almost the whole volume of natural gas supplied from the abovementioned sources (jointly referred to as Georgian Gas) is aimed 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 Georgian industrial and commercial sectors, volumes are mainly supplied from Azerbaijan. Periodically small volume of Russian gas was imported by different commercial structures. Since 2017 a new contract envisages the possibility to receive additional 400 mcm of Russian gas in 2018 at market price, as well as guaranteed payment for the transit service of minimum 2.2 bcm natural gas to Armenia. It is also noteworthy, that until the third quarter of 2017, Georgian Gas Transportation Company, a system operator of the North-South Gas Pipeline, under the contract concluded with Russian “GazpromExport” was annually receiving in kind payment for the transit of natural gas from Russia to Armenia. From 2017, a new 2-year agreement was put into effect envisaging partially in-kind (50% in 2017) and monetary payment for the transit of natural gas during one-year transition stage.

Household customers of the so-called "social sector" are supplied with natural gas at the tariffs regulated by GNERC and 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, petroleum 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 Caucasus Pipeline (SCP). The actual load of SCP in 2014-2017 amounted to about 6 bcm per year.

North-South Gas Pipeline system (NSGP) is used to transit Russian gas to Armenia. Recent years have seen a considerable drop in the load of NSGP compared to its design capacity. In 2017 the pipeline transported approximately 2 bcm Russian gas, mostly to Armenia.

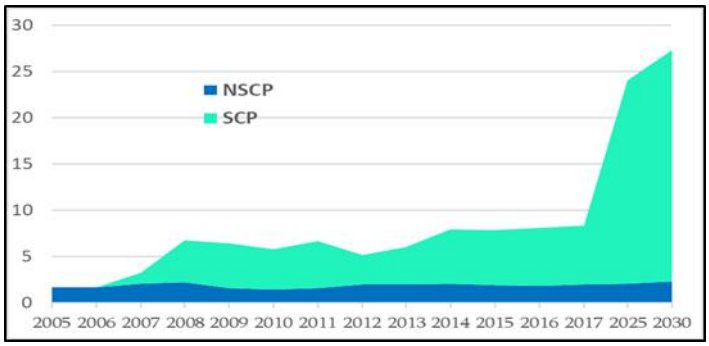


Figure 2.2. Natural gas transit, bcm per year

Georgia's internal market is supplied with gas through the East-West and North-South Main Gas Pipeline Systems consisting of Kazbegi, Kakheti, Southern, Ajara and Poti branches. The gas pipeline system is connected to Russia with the North-South Main Gas Pipeline System at Georgia-Russia border, 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 19 000 km, 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 in 2007 (at the first stage with the financial assistance[6] of foreign donors - US MCC and USAID) and actually reached the historical maximum in the last 3-5 years.

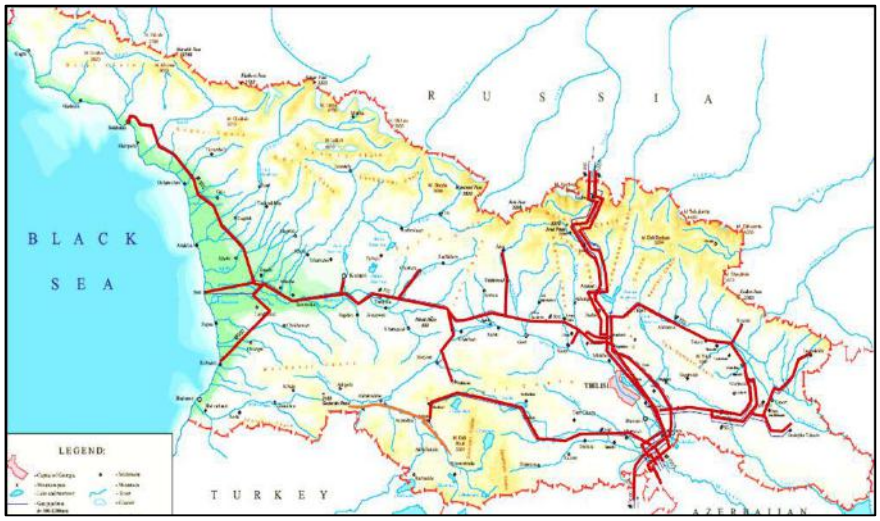


Figure 2.3. Georgian Main Gas Pipeline System

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.

[6] 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.

Internal Infrastructure Projects

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. It should be noted that, 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 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 responsibility of GOGC[7] 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 by TSO and presented to the GNERC not later 1 October 2020.

The natural gas transmission system of Georgia consists of two main parts and regional branches:

- 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 part, the gas pipelines from 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).
The table below shows design capacity and actual load data of Georgian Main Gas Pipelines (2016).

Table 2.1. Design capacity and actual load of Georgian trunk gas pipelines, bcm per year[8]

Pipeline/Direction	Design capacity	Real capacity	Actual load	Peak loading Coefficient
North-South Gas Pipeline[9]	16	8,0	≈2,05	2,3
	8-10	4,0	≈1,87	2,1

[7] See: Georgia's Law on Energy, year 2017 (draft), article 59
[8] Detailed information is provided in the source: The 10 year development plan for Georgian Gas Transmission network, 2017
[9] 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

Georgian Main Gas Pipeline System	0,25/0,45/1,5/4,0	≈3,5-3,8	≈2,3	2,2
Azeri border-Saguramo	4,0			
SCP interconnector	4,0	≈2,5	≈1,5	1,7
Center-West direction	1,5-4,0	≈1,6	≈0,8	1,9
West Georgia direction	4,0	≈1,2	≈0,62	1,7
		-	≈0,41	1,5
Bakuriani branch	0,25/0,5/1,5	-	0,04	2,1
Southern direction	1,5/0,5	≈0,1-0,5[10]	≈0,056	1,8
Kakheti direction	1,5/0,5	≈0,1-0,5	≈0,072	2,5
Kobuleti branch	1,5	≈0,3-0,5	≈0,073	2,8
Kazbegi direction	4,0	≈2	≈0,02	1,5

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 starts on the territory of Georgia at the border of Russia (about 1380 m above the sea level). It starts in the river Tergi waterway, crossing several mountainous rivers and mudflow canyons with right instable hydrology, passes over Jvari Pass (about 2430 m above the sea level) and continues to the 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 accidents. In this part of the route several tunnels and river bank protection structures are arranged to guard the pipeline from natural disasters.

DN1000 mm 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 that causes corrosion of pipelines and is often the reason for gas leakage.

The location of the parts of the pipeline in difficult areas of high mountainous regions often cause frequent technogenic accidents and require 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 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 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

[10] The document indicates conditional diametres of pipelines

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 to Gveleti and Saguramo Metering Units, 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 Main 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 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.

In 2017, construction project for Azerbaijan border-Gardabani new 700-mm section was completed. It provides uninterrupted supply of Azerbaijani (SOCAR owned) gas to the market.

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 to 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.

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 2008-2017. 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. Designing process of about 33 km section of the pipeline that will connect Akhaltsikhe to Goderdzi Pass, enabling to supply Ajara mountaneous resorts and Khulo region consumers with natural gas has already started.

East-West Gas Pipeline System Center-Sukhumi Group comprises Saguramo-Kutaisi, Kutaisi-Sukhumi, Zestaponi-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 Mtskheta-Mtianeti, Shida Kartli, Imereti, Samtskhe-Javakheti (Borjomi-Bakuriani) and Tskhinvali 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), Zestaponi (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 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.

Zestaponi- Poti Gas Pipeline (D=700 mm, L=128.7 km, P_0=55 bars) includes newly built Zestaponi-Kutaisi (23.2 km), Kutaisi-Abasha (47 km), Abasha-Senaki (29 km) and Senaki-Poti (29.6 km) sections. It is situated parallel to the existing D=500 mm Kutaisi-Sukhumi Gas Pipeline and part of it is located on 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 Zestaponi-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. Currently, the construction project of Ajara branch is being implemented and its completion is scheduled in 2019. Despite the climate conditions, the pipeline will ensure secure supply of natural gas to the region during the peak periods.

2.3 Gas consumption trends and forecast

Natural gas is one of the cheapest, simple to use and ecologically less damaging natural resources in Georgia. Its supply-consumption during the periods of the country's independence, i.e. the revival of its economy, except for 2008-2010 crisis, has been characterized by growing trends. The Business as Usual (BAU) scenario modelling results, under the USAID EC-LEDS *Clean Energy for Georgia* Project[11], 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. Gas consumption growing trends will continue within 10-15 years.

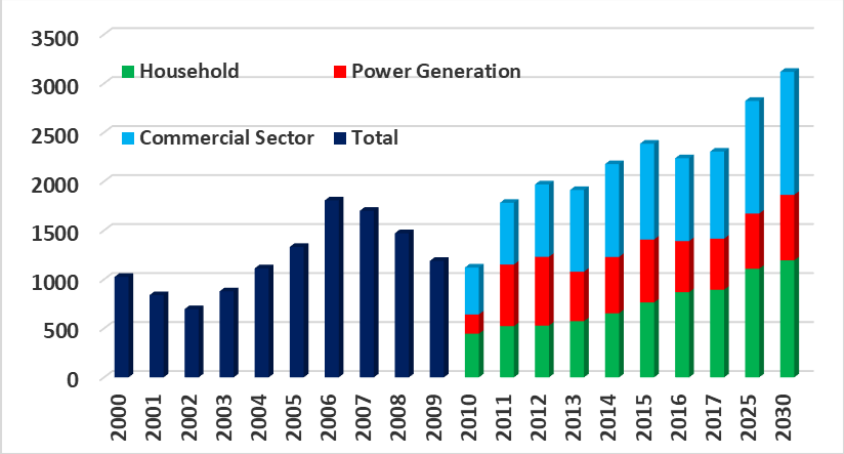


Figure 2.4 Natural gas supply, mcm per year

The Climate Change Office of the former Ministry of Energy of Georgia and 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 'Remissia'[12], the forecasts[13] adjusted by the Strategic Development and Projects and Commercial Departments of GOGC were also taken into account.

The forecasts for the demand of natural gas and transit to Armenia as well as for the transportation of corresponding volumes of natural gas through Georgian Pipelines are set forth in table 2,2.

Table 2.2. Forecast for gas transportation and transit through Georgian Main Pipeline system, Mm^3/y

	2018	2021	2024	2027	2030
Local market	2500	2680	2950	3060	3360
Transit to Armenia	1915	1980	2050	2100	2200
Total	4415	4660	5000	5160	5560

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

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

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

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. However, such issues, as seasonal consumption disparities and guaranteed gas supply to protected consumers in critical situations are still unresolved, mostly due to insufficient capacity of the gas infrastructure.

2.4. 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[14]. 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%[15] of total supply.

Significant accidents of Georgian gas pipelines (See Table 2.3) 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).

Table 2.3. Natural gas loss during infrastructre failures

Location of the failure	Type of the failure	Result of the failure
Meneso 224,5 km - North. South Gas Pipeline 1200 mm	rupture caused by landslide	5,8 mcm gas emission, supply and transit interruption
Meneso, 132,0 km – North-South. Main Gas Pipeline 700 mm	rupture caused by landslide	4,5 mcm gas emission, supply and transit interruption
Lemshveniera, 61 km- Kazakh-Saguramo, 1000 mm	fire caused by leakage	2,8 mcm gas emission, interruption of supply and transit
Mtskheta, 122,0 km- North-South. Main Gas Pipeline 1000 mm	rupture caused by landslide	4,7 mcm gas emission, supply and transit interruption
Goristsikhe, 78 km- Vladikavkaz-Tbilisi, 700 mm	rupture caused by landslide	3,5 mcm gas emission, supply and transit interruption
Kesalo, 55 km – Kazakh-Saguramo, 1000 mm	Pipeline corrosion	3,6 mcm gas emission, supply and transit interruption

[14] Teimuraz Gochitashvili. Energy of Georgia. Priorities of Gas sector Development, energy efficiency centre, Georgia, Tbilisi, 2012

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

Georgia-Russia Border - North-South. Cauc. Main Gas Pipeline, 1200 mm; 55,5 km – Vladikavkaz-Tbilisi, 700 mm	simultaneous rupture of two pieplines caused by explosion	Full imterruption of transit ans supply from Russia for 2 weeks
Naniani, 233 km- North-South. Cauc. Main gas Pipeline ,1200 mm	rupture caused by landslide	2,4 mcm gas emission, supply and transit interruption
Stepantsminda 66 km- Vladikavkaz-Tbilisi, 700 mm	damage caused by avalanche	damage of about 350 m section of the main gas pipeline until its restoration
Drvdoraki, 143,1 km - North-South. Cauc. Main gas Pipeline, 1200 mm; 55,5 km- Vladikavkaz-Tbilisi, 700 mm	Rupture caused by mudflow	0,5 mcm gas emission, transit interruption for 5 days

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 the supplier's offshore fields or the necessary maintenance works and tests on pipelines or metering units. The practice shows that during the failure at one of the key supplier's offshore fields during the peak consumption period in winter (January–February), supply was fully interrupted for 15 days and nights and for the next 16 days only 40% of the scheduled supply was provided. As a result, during the period of peak load in winter, within the conditions of in-the-field failure, 80% of the scheduled volume was not supplied, which amounted to the 10% of scheduled annual supply of natural gas from the supply source.

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 in winter and summer periods: in winter months the country consumes 2,5-3,5 times more natural gas than in summer.

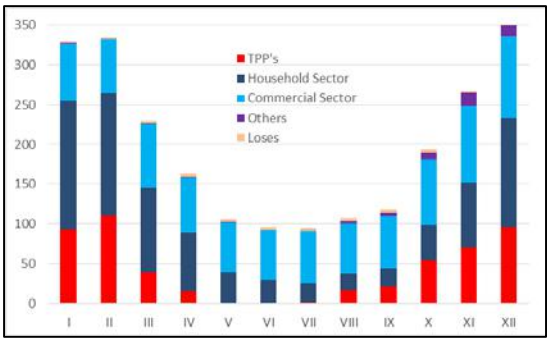


Figure 2.5. Gas Consumption disparity according to seasons, 2017

It is notable, that disparity trend in gas consumption according to seasons has remained practically the same during several years of observation.

Imbalance between the day and night consumption during peak load and minimum consumption in summer period is more significant and it seriously complicates designing the pipelines with rational parameters and effective management of gas flow.
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 hydropower 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, 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.
As the analysis show, in ordinal conditions, it is secured to meet the country's demand for gas through existing supply sources and to receive the sufficient volumes of gas. In addition, during the peak load and/or in case of unscheduled interruption (or significant decrease) a sharp deficit in natural gas is to be created[16] and provision of household with fuel is at risk. Within the conditions of winter peak consumption, in case of unscheduled interruption from any key sources, for example from the first or the third, as well as from the fouth supplier (see figure 2.6), gas deficit cannot be compensated with the country's own resources, which creates the risk of critical situation[16]. Therefore, taking costly and urgent measures prove to be necessary in order to avoid serious complications with regard to supplying the consumers with fuel and electricity. As a rule, during January-February and December peak consumption periods, when the demand specified by long-term contracts is impossible to meet, gas is purchased at current basic commercial price, which is significantly higher than the price envisaged for the household sector and power generation (social sector). During the crisis, Georgia fails to meet the obligations envisaged by the transit contract.

Therefore, it is important to fill the deficit in critical situations, for example by constructing underground gas storage, in order to create strategic reserves or to get help on the basis and within the framework of the European legislation principles[17] of solidarity through the transit pipelines or from reverse interconnectors connecting with neighboring countries, such as Turkey or Armenia.

[16] Feasibility study for Samgori South Dome, Task 10: Final report and recommendation for next step, GEOSTOCK Entreprose, April, 2016
[17] see: mutual support clause for emergency situation, refering to possibility having access to the transit flows on predefined and negotiated terms

The construction of the underground gas storage facility represents one of the most significant strategic projects for the country, which will resolve the issues related to the receipt of scheduled and increasing volumes of natural gas, their distribution according to the seasons and rational consumption. It is important to note that Georgia is one of the countries in the region that has no underground gas storage.

Feasibility study for the strategically important underground gas storage to be built on the Samgori South Dome Middle Eocene Field has been completed[18].

The analysis based on the Regulation of the European Energy Community (EU Regulation #994/2010 concerning measures to safeguard security of gas supply) shows that in order to supply household sector and power generation facilities with secured gas supply in possible critical situations, it is necessary to have about 100 mcm strategic reservs of natural gas[19]. Considering the abovementioned, nominal technological parametres for the underground gas storage have been specified (see table).

Table 2.4. Main design parametres of the underground gas storage

1	Total volume of natural gas	400-500 mcm
2	Active gas volume	210-280 mcm
3	Buffer gas volume	190-290 mcm
4	Injection Ratio	1,7-2,5 mcm per day
5	Withdrawal Ratio • Average rato (during normal winter period) • Ratio during the period of strategic operational regime (30 critical days) • Ratio during times of system stress (7 days) • Ratio during times of system stress (1 day)	≥2-6 mcm per day 2,5 mcm per day 3,5 mcm per day 5 mcm per day 6 mcm per day

Conceptual design envisages the construction of high pressure pipeline connecting surface facility (compression station) with trunk pipelines of the country.

[18] Samgori South Dome Underground Gas Storage, Feasibility Study Report, GEOSTOCK, 2016
[19] see: Regulation EU No 994/2010 – Concerning measures to safeguard security of gas supply

3. Infrastructure Development

3.1. Status of the completed and current infrastructure projects

To meet increasing demand for energy resources, it is importatant to ensure secure supply of imported fuel, including natural gas, which is related to significant challenges due to unstable political situation in the region, critical dependence of the country's energy sector on climate conditions, high risk of natural disasters, insufficient throughput capacity and poor technical reliability of some sections of outdated transportation infrastructure. Apart from that, in spite of positive dymaics in the decrease of natural gas losses in the gas transportation process, especially in gas distribution, actual losses are still high (mainly in the distribution networks).

In 2017, total volume of losses in Georgian gas distribution system amounted to 4.6% of supplied gas, in the trunk pipeline network about 0,8%. The main reason for losses was the technical malfunctioning of the network and failure of metering system. Therefore, in order to reduce actual losses, network rehabilitation/development is crucial along with equipping the system with modern regulatory, control and metering devices.

Rehabilitation-modernization works of the key sections and branches of the main gas pipeline system is aimed at promoting secure exploitation and operational flexibility of Georgian trunk pipeline system that will enable uninterrupted and effective distribution of increased projected volumes of natural gas across the territory of whole Georgia. For short and medium-term periods, the rehabilitation of critical sections of East West Main Gas pipeline is considered to be of high priority. In the long-term perspective among some of the high priority projects are the construction of the underground gas storage facility aimed at reserving strategic volumes of energy resources, as well as the construction of interconnectors of different branches and directions of the gas pipelines, in particular, reservation of the sections that are located in mountaneous regions difficult to access in adverse weather conditions, therefore in case of failure, commencement of their urgent rehabilitation is very difficult. The most critical of these sections are considered to be the Pass section of the East-West Main Gas Pipeline, Akhaldaba-Bakuriani section of Bakuriani brunch and existing branch of Ajara.

Rehabilitation-development of Georgian Main Gas Piepline System, as well as implementation of its branches and interconnector construction projects will lay foundation for the replacement of Georgian dead-end gas supply system with highly secure ring type system, which in critical situations will redirect gas flows in order to provide the consumers with safe and secure supply of gas which will significantly increase the scope of functioning of the entire transportation system and its technological reliability.

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

Table 3.1. Status of Current 2018 projects of Transport Pipelines and Infrastructure

Work name	Current status (October 2018) and planned works
Kobuleti branch (D-500 mm, L-18,3 km)	Construction works on the first 45 km lengh section is coming to an end. Tendering procedures to purchase the accessories are underway and their delivery will be finilized in 2019. Construction works are scheduled to be performed mainly in 2019.
Kakheti branch, Sagarejo-Gurjaani 500 mm section, local rehabilitation works	Rehabilitation sections defined through testing have almost been completed. Currremtly final testing of the pipeline is underway in order to commission it in 2019.
Natakhtari-Lekhura, total length 31,4 km (Natakhtari-Tsilkani- -Ksani – 18,2 km, Ksani-Lekhura -13,2 km) D-700 mm, L-31,4 km	The pipes and materials necessary for the project have been purchased and delivered. Construction works on Ksani-Lekhura section are underway (completion deadlineis 2019). The works on the rest of the sections will be performed mainly in 2019. Simultaneously dismantling and sorting of parallel, unfunctioning and inactive pipes are in progress.
Lekhura-Sveneti 20,6 km section construction works (D-700 mm, L-20,6 km)	Construction materials (pipes and accessories) have been purchased and delivered. Design works have been finalized. Construction will start and it will be completed in 2020.
Adigeni-Goderdzi (pass) section (D-300 mm, L-33 km)	Design works and procurement procedures of materials are underway. Main construction works will be performed in 2019.
Aragvi aerial crossing in Saguramo (D-700 mm, L-2,8 km)	The design procedure of the aerial crossing has been completed. Land allocation procedures for the right of way are in progress. Construction works are planned to be performed in 2019.
Khashuri (Chorchana)-Zestaponi section (D-700 mm, L-70 km)	Currently designing of initial 35 km section of the piepline is underway The subsequent sections will be designed in 2019. Tender procedures to purchase the materials for the initial section are scheduled to begin in 2018-2019 and the construction will presumably start in 2020.
GPRMS project	The 2019 plan envisages the rehabilitation of Rustavi GPRMS. Tender for the implementation of the project has been announced. The works are envisaged to complete in 2019.
Local rehabilitation works	Local rehabilitation works are underway according to existing plan.

As the analysis shows, significant part of the Azerbaijani border-Gardabani, Telavi-Akhmeta, Sagarejo-Gurjaani main gas pipelines, Kuro aerial crossing, Ptsa-Chorchana (Modified Ptsa-Vaka) pipelines as well as local restoration works have been completed. The most important part of the projects, including: Kobuleti branch, Natakhtari-Lekhura, Lekhura-Sveneti, Adigeni-Goderdzi Pass, Rustavi GPRMS, extension and completion should be taken into account in 2019 and the next year's work plan.

3.2. 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 previous years) and future transit volumes through the GOGC owned pipelines are considered. Results of analysis are given in Table 2.2.

For selection of local gas supply 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 2.2) 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 pressure reduction and metering stations located at the gas receiving point (Area 72), taking into consideration the planned reconstruction project;

b) For the gas volume deliverd from Azerbaijani border, a newly constructed Azerbaijan border-Gardabani-Navtlughi-Saguramo pipeline with design capacity of 16 mcm per day (4 bcm per year) is considered to be used, however it cannot be loaded fully because of limited pressure from Azerbaijan 22-24 bar which practically does not exceed 7-8 mcm per day. If under the "new contract", additional gas is delivered from Azerbaijan, 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 and its provision will be possible only after taking additional 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%.

Factual statistic and forecast result data analysis[20] show 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 to their designed technical conditions. Besides, reconstruction of 11,5 km branch of the pipeline connecting to Armenia is also recommended.
- Azerbaijan border -Saguramo new 700-mm pipeline's maximum capacity provided that the pipeline distribution of loading percentages during peak load remains

[20] The ten year development plan for Georgian gas transmission network, 2018-2027, GOGC, Tbilisi, 2017

unchanged, gas 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) (Detailed hydraulic calculations of the pipeline are presented in the paper: "The ten year development plan for Georgian gas transmission network, 2018-2027, GOGC, Tbilisi, 2017)).

- 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. 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.
- Hydraulic calculations show that in order to ensure the forecast peak capacity in 2030, gas pressure supplied from Azerbaijan should be 33.8 bar, 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.
- 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.
- Peak throughput in other directions (South, Kakheti, North, etc.) can be provided by the existing and planned pipelines without changing the conditional diameter. These pipelines are planned to perform restoration works, if necessary.

3.3. Short-term development program

The investment infrastructure projects to be developed on a priority basis in the short-term period include: the rehabilitation and construction of critical sections of the main pipeline. Realization of these projects gives opportunity to significantly increase technological reliability of the united Georgian gas supply system operation. Besides, the updated system creates the possibility of providing 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 works are distributed as follows:

- Natakhtari-Lekhura 31.4 km section;
- Lekhura-Sveneti 20.6 km length section;
- Aerial crossing on riv. Aragvi;
- Khashuri- Zestaponi approx. 70 km length section

Figures 3.1-3.3 indicate the schematic Figures of the East-West Main Gas Pipeline Azerbaijan border-Saguramo, Saguramo-Khashuri and Khashuri - Poti sections as of the fourth quarter of 2018 and with reference to the rehabilitation points provided by the plan.

Complete modification of East-West Main Gas Pipeline 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.

Preliminary works on technical design of the construction of 700 mm Aragvi crossing and Khashuri-Zestaponi ≈70 km length section and preparation of tender documentation for materials procurement and the constructor company selection process have already started. Construction works are planned to be performed in 2019-2020.

The plan nominally envisages rehabilitation works for 53.4-57.4 km-points section of the Kazakhi-Saguramo 1000 mm pipeline[21]. 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[22].

Construction of 500 mm 45 km section of Kobuleti branch began in 2017. Completion of the project, including the 18 km section, is planned in 2019.

Based on the results of the survey of Zestaponi 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 Zestaponi branch of Saguramo-Kutaisi trunk pipeline has been decided. 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.

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

The project of 12 km length, 762 mm nominal diameter pipeline connecting the SCP to the Georgian Main Gas Pipeline System supplying high-pressure gas to Gardabani TPP's envisages the receipt of natural gas with the pressure of 38-42 bar from pressure regulating-measuring node for area 72 of SCP pipeline, for the purpose of TTPS, that will reduce the losses related to the operatin of compression station serving the TPP's gas turbine.

The 2019 plan envisages completion of the restoration works of Rustavi GPRMS with the estimated cost of 10,3 mln GEL.

In addition, small scale, local projects are permanently being implemented, they 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

[21] Decision on fnding the project shall be made in 2019 with Russian „Cazprom" after agreement on the updated transit contract terms and commercial conditions

[22] Detailed information is given in the Work "the 10-year gas transmission network development plan, 2018-2027, GOGC, Tbilisi, 2017

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 of pipelines and increases the reliability of system functionality at all;
- 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 3.2 provides a list of infrastructure investment projects scheduled to be implemented between 2019-2021 with their short technical characterization. Preliminary (optional) investment plans for 2020 and 2021 are given only for information.

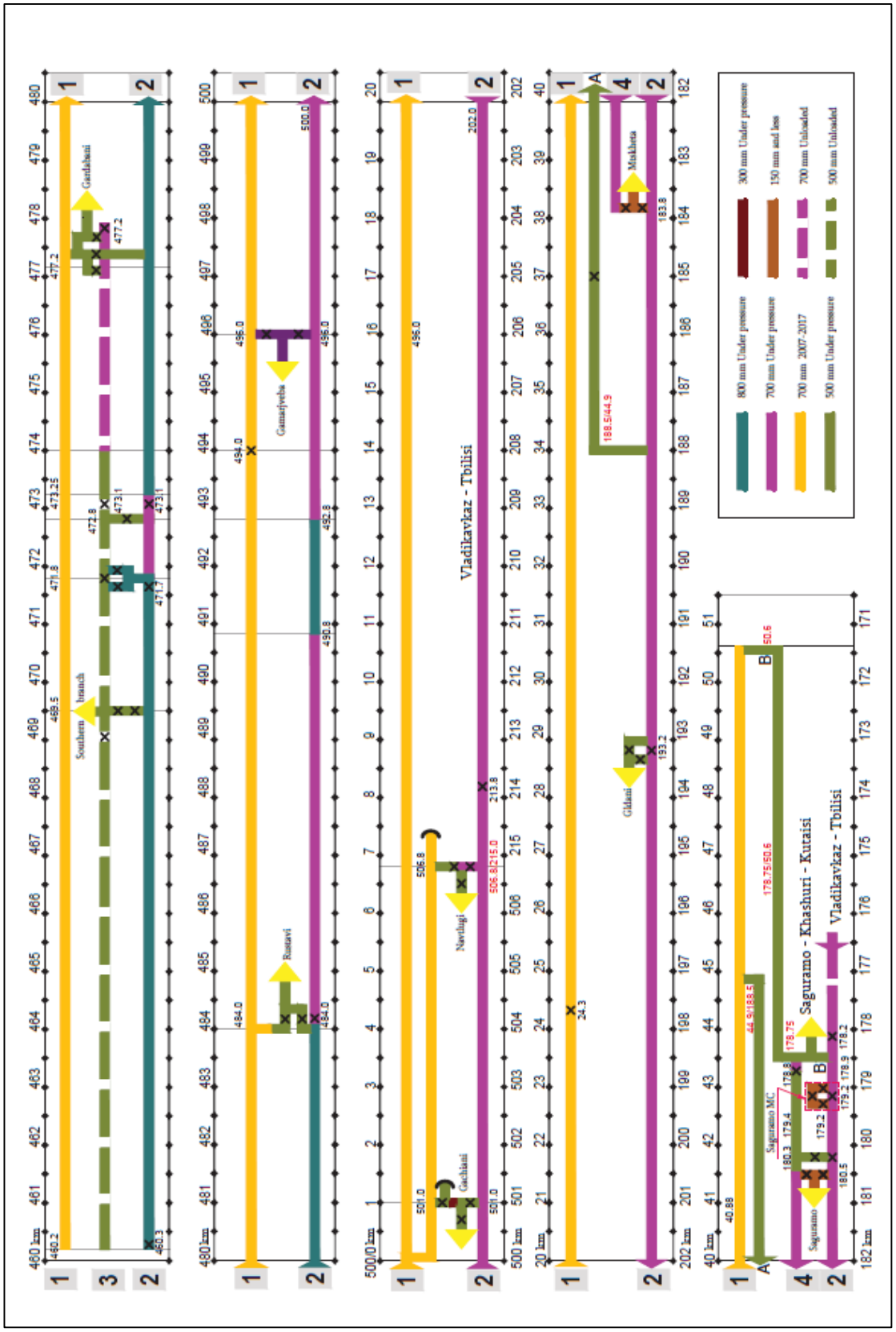


Figure 3.1 Azerbaijani Border- Saguramo section of the East-West Main Gas Pipeline

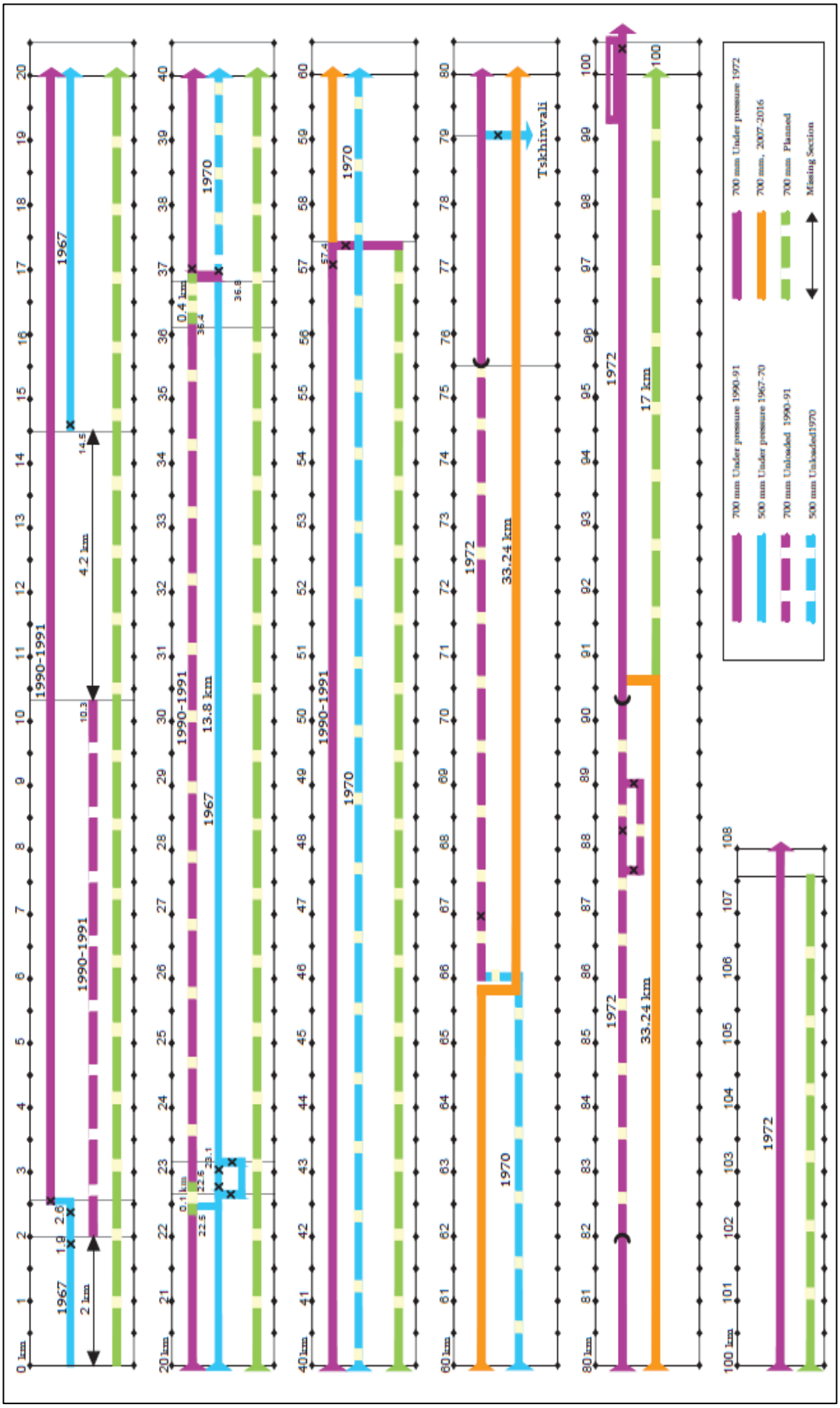


Figure 3.2. East-West Main Gas Pipeline Saguramo-Khashuri section

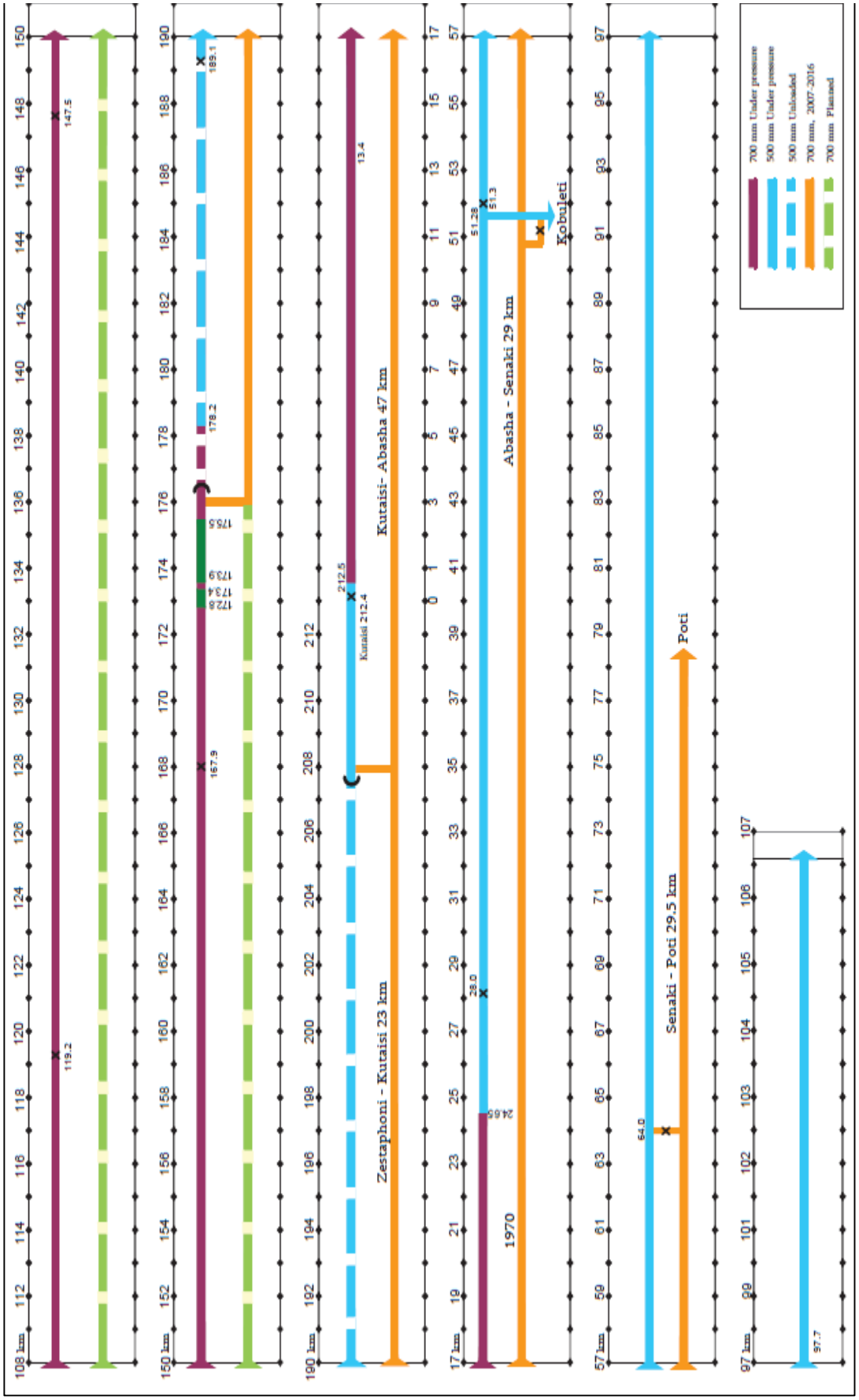


Figure 3.3. Khashuri (Chorcha)-Poti section of the East-West main gas pipeline

Table 3.2. 2019-2021 investment projects plan

Name of project	Length km	DN, mm	Project cost, GEL 1000	Remark
Short-term plan				
Year 2019				
Kobuleti Branch	18,3	500	7 000	Construction works on the first 45 km lengh section are to be completed in 2018. Construction works for the rest of the 18,3 km section are envisaged to start in 2019.
Natakhtari-Lekhura section (Natakhtari-Tsilkani-Ksani18,2km, Ksani-Lekhura -13,2 km) (D-700 mm L-31,4 km)	31,4	700	7 800	Construction of Ksani-Lekhura section has commenced and is expected to be completed in 2019. Estimated total cost of the project is GEL 10 048 000 including the costs of works performed in 2018. Approx. 7,8 GEL/m construction works are scheduled to be performed in 2019.
Aragvi aerial crossing in Saguramo	2,9	700	2 900	The cost of the project is determined by the assumption value of the 1 km long passage. Main part of the works planned in 2019 equals to 1 million USD.
Adigeni-Goderdze section	33	300	11 700	Estimated cost is specified according to the data of Table 1.1
GRS project			10 300	The 2019 plan envisages the realization of the Rustavi GRS rehabilitation project.
Local rehabilitation works			5 000	It includes the costs for local diagnostics and rehabilitation, design works, obtaining permits, concluding servitude agreements and other works
Total expenses			**44 700**	**M$16,55**
2020 year				
Khashuri-Zestaponi section (Stage I)	23,3 (70)	700	37 040	The cost of pipes and necessary materials required is 185$*2.7=500GEL/m Estimated cost of construction is taken into consideration of complexity 257*2.7≈693 GEL/m. Total cost of the project (construction + materials) 91,89 GEL/m including inbound expenses. The total length is about 70 km. Design works, obtaining permits, purchase of 50%of materials and 1/3 of construction works are scheduled to be completed in 2020. Purchase of remaining materials and construction workis will take place in 2021 and 2022.
Lekhura-Sveneti section	20,6	700	6 600	Main part of cosntruction works with total cost of about 6,6 GEL/m are to be performed in 2020.
Kazakhi-Saguramo	4,0	1000	14 784	Pipeline construction cost is based on the EU Energy Regulator Cooperative Agency (ACER) indicator[23]. Final decision upon project realization needs and financial provision will be made based on updated transit contract with Russian "GazProm"in 2019.

[23] ACER, 15-Infrastructure Unit Investment Costs-Gas-20.07.2015

Pipeline Remote Monitoring and Management System (SCADA)			6 000	Implementation of SCADA systems takes into consideration local specifics. Studies in order to define the expediency of project implementation and technical feasibility started in 2018. Estimated total cost of the project is 6 GEL/m.
Local rehabilitation works			5 000	Cost of GRSs rehabilitation projects, installation of cleaning and diagnostic receiving stations, dismantling of out of order and inactive pipelines and design works.
Total expenditures of GOGC			**69 424**	**M$25, 713**
2021 year				
Khashuri-Zestaponi (Stage II)	23,3	700	37 040	At Stage II, in 2021, 1/3 of construction works will be performed and 50% of materials will be purchased. In 2022, at stage III, 1/3 of the construction works will be performed with total cost of 17,8 GEL/m.
UGS connecting pipeline and Gas metering station	10	500	9 150	Funding of construction of the connecting pipelines will be considered in the underground gas storage project expenditures.
Gardabani TPPs connecting pipeline and Gas regulation station	5	500	5 259	The cost is estimated as per Feasibility Study project.
Local rehabilitation works			5 000	Cost for Zestaponi branch, GRS rehabilitation works, installation of cleaning and diagnostic receiving stations, anti-corrosive measures, dismantling of out of order and inactive pipelines, diagnostics, design and other works.
Total expenses of GOGC			**56 449**	**M$20,907**
Total expenditures from the GOGC budget			**170 573**	**M$63, 175**

3.4. 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. 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

Vale-Vani Main Gas Pipeline

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 SCP with the main gas pipelines 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 and substantially enhance its operational reliability. Also, appropriateness of the

arrangement of the 2nd off-take of SCP is connected to the AGRI and WS projects potencial 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 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.

As the analysis shows, the 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, it is necessary to increase the initial pipeline pressure to 75 bar and construct Vale-Vani Project section with 700 mm diameter pipes,while providing a part of the users from Zestaponi till Vani with gas delivered through Saguramo-Khashuri-Zestaponi-Kutaisi-Vani section of gas pipeline.

To meet the probable joint demand of the current consumers, new industrial and thermal power plant, it is necessary to increase the initial pipeline pressure to 75 bars and construct Vale-Vani interconnector with 800 mm diameter pipes.

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.

Rustavi-Poti Gas Pipeline

In case of need of 8 bcm or more transit capacity[24], which may be predetermined in case of supply of large volumes of export gas from Turkmenistan, 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.[25] 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" or 42" , the design pressure of the pipeline is

[24] Presumably after year 2027 (see: Chapter 3, Regional market)
[25] Feasibility study for AGRI project, Task 3 – Technical solutions report, Penspen Ltd, 2013

95 bars and the operating pressure – 90 bars. 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).

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 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.

Trans-border pipelines and infrastructure

Georgia is connected with the trans-border pipelines to natural gas 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 0,25 km along the border and crossing the boundary line from the Armenian-Azerbaijan border The fire points of the opposing sides are arranged on strategic highes of 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.

Based on the aforesaid, it is expedient to construct a new segment of Armenia-Georgia Interconnector to connect Georgia to Kogbi (Armenia) gas station located in the area of the border conflict zone

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. 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 and river-bank protection works[26] in Tergi river valley, restoration of pig launcher stations (in Devdoraki and Saguramo), and electrochemical protection systems and etc.

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 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.

Current maximum pressure of gas provided from Azerbaijan through SOCAR owned pipelines is limited at the border, this makes impossible to increase daily volume during the peak consumption. It is necessary to discuss several alternative technical decisions of Azerbaijan border-Saguramo section capacity increase[27] in order to provide delivery of contractual and forecasted volumes in the future with requested parameters (including the arrangement of compression stations, change of current gas transportation scheme and the use of DN 1000 mm pipeline for Azerbaijani gas and etc.).

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 (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 were 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.

Pressure regulation and metering stations

[26] 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)

[27] 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

Based on the results of a preliminary study[28], several most important GPRMSs in a critical condition (see table) have been selected for priority rehabilitation.

Rustavi GPRMS rehabilitation project[29] has already started, which is expected to be completed in 2019[30]. 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 GPRMS-s will be financed from the so-called "local "projects budget.

Table 3.3 Gas Distribution Stations

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
Zestaponi	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

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 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.

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

Connecting pipelines for Underground gas storage

Conceptual design of the gas storage considers construction of pipeline connecting surface pipelines to Georgian main gas pipelines of approximately 5 km length and internal diameter of 500 mm.

[28] Report of the Joint Commission of GOGC Technical Department and GGTC for Examination of Gas Main GDPs, 2014 (see the Annex)
[29] Tender is undergoing to identify the performer of design works
[30] Tender is undergoing to identify the performer of design works

4. Investment Costs

4.1. Investment costs – summary

Table 4.1 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.

4.2. Main results and recommendations

1. The formal basis of the 10-year plan is the National Action Plan prepared within the frames the EU Association Agreement and the commitment to elaborate the 10–year infrastructure development plan subject to the requirements of *Directive 2009/73/EC concerning common rules for the internal market in natural gas*, undertaken as a result joining the European Energy Community as well as the energy sector development plan envisaged by the energy strategy 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,

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 2019 and the projects identified for the transitional period of 2020-2021, 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;

The main part of infrastructural projects presented in the 10-year network development plan for Georgia is included in the energy development strategy of Georgia. In addition, it is recommended to present the plan to the European Energy Community secretariat for information and for identification of possible common interest projects.

Table 4.1. Investment costs of 10-year plan

Name of work	Length, km	DN, mm	Project cost 1000 Gel	Source
Short-term plan				
2019 year				
Kobuleti Branch	18,3	500	7 000	GOGC budget
Aragvi Aerial Crossing (Saguramo)	2,9	700	2 900	GOGC budget
Natakhtari - Lekhura (Natakhtari-Tsilkani-Ksani-Lekhura)	31,4	700	7 800	GOGC budget
Adigeni-Goderdzi	33	300	11 700	GOGC budget
GPRMS project			10 300	GOGC budget
Local rehabilitation works			5 000	GOGC budget

Total expenses from GOGC budget for 2019 year			**44 700**	**$16 555 556**
2020 year (Medium-term plan)				
Lekhura-Sveneti	20,6	700	6 600	GOGC budget
Khashuri-Zestaponi (Stage I)	23,3 (70)	700	37 040	GOGC budget
Kazakhi-Saguramo (53,4-57,4 section)	4,0	1000	14 784	To be verified
Pipeline monitoring system (SCADA)			6 000	GOGC budget
Local rehabilitation works			5 000	GOGC budget
Total expenses from GOGC budget for 2019 year			**69 424**	**$25 712 669**
2021 year				
Khashuri-Zestaponi (Stage II)	23,3 (70)	700	37 040	GOGC budget
SCP-Gardabani TPPs and pressure regulation unit	5,0	500	5 259	Gardabani TPPs
UGS connecting pipeline	5	500	9 150	GOGC budget
Local rehabilitation works			5 000	GOGC budget
Total expenses from GOGC budget for 2020 year			**56 449**	**$20 906 909**
Total expenses From GOGC budget for 2019-2021 years			**170 573**	**$63 175 134**
Medium-term plan (continuation)				
2022-2023 years				
Tabatskuri-Bakuriani	18	300	6 016	GOGC budget
Khashuri-Zestaponi (Stage III)	23,3 (70)	700	17 800	GOGC budget
Armenia-Georgia interconnector ***	6,7(5,1+1,6)	1000	20 550	GOGC budget
Local rehabilitation works			10 000	GOGC budget
Total expenses from GOGC budget for 2022-2023 years			**54 366**	**$20 135 459**
Long-term plan				
After 2023 year				
Vale-Vani ****	70			
Capacity 2 bcm/y	70		138 070	Project sponsor
Capacity 8 bcm/y	70		274 158	Project sponsor
Rustavi-Poti,**** 8,5-10 bcm/y	370	900	1 701 000	Project sponsor
Total expenses **(possible maximum) 2023-2028 years**			**1 701 000**	**$630 000 000**
Total expenses in 2019-2027 years from GOGC budget			**224 939**	**$83 310 593**
Total expenses in 2019-2027			**1 925 939**	**$ 713 310 593**

*The financing of these pipeline projects is envisaged from the interested third party - Beneficiary budget or on the bases of the agreement concluded with the party

**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

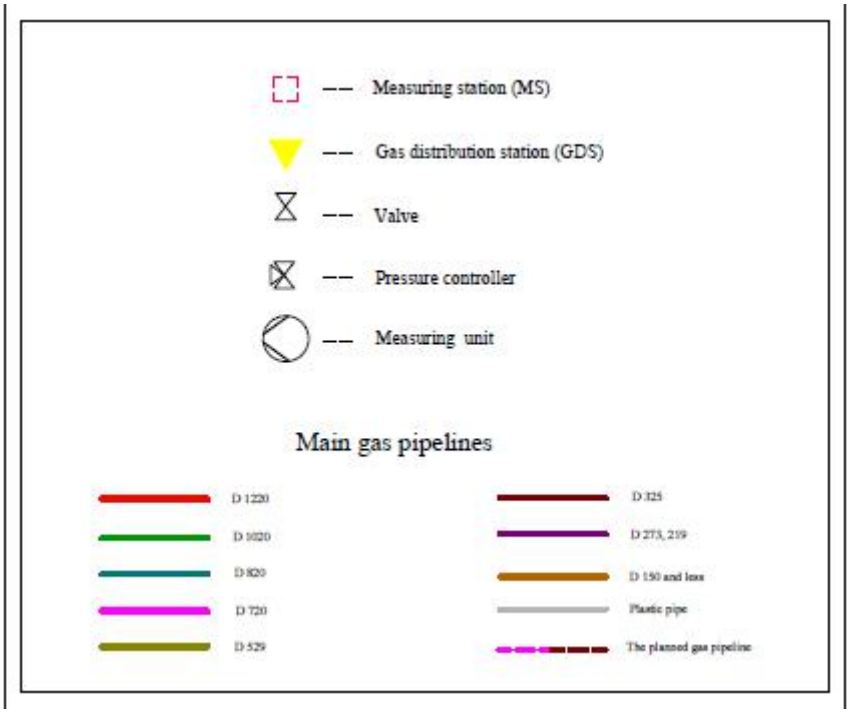
**** The financing for the construction of Vale-Vani (Poti) or Rustavi-Poti pipelines is provided as part of the new offshore pipeline, LNG and CNG project implementation and therefore is not included in the total expenses for the 10-year network development plan

ANNEXES

Annex 1

Schematic Figures of the Georgian main gas pipeline system

Used Symbols



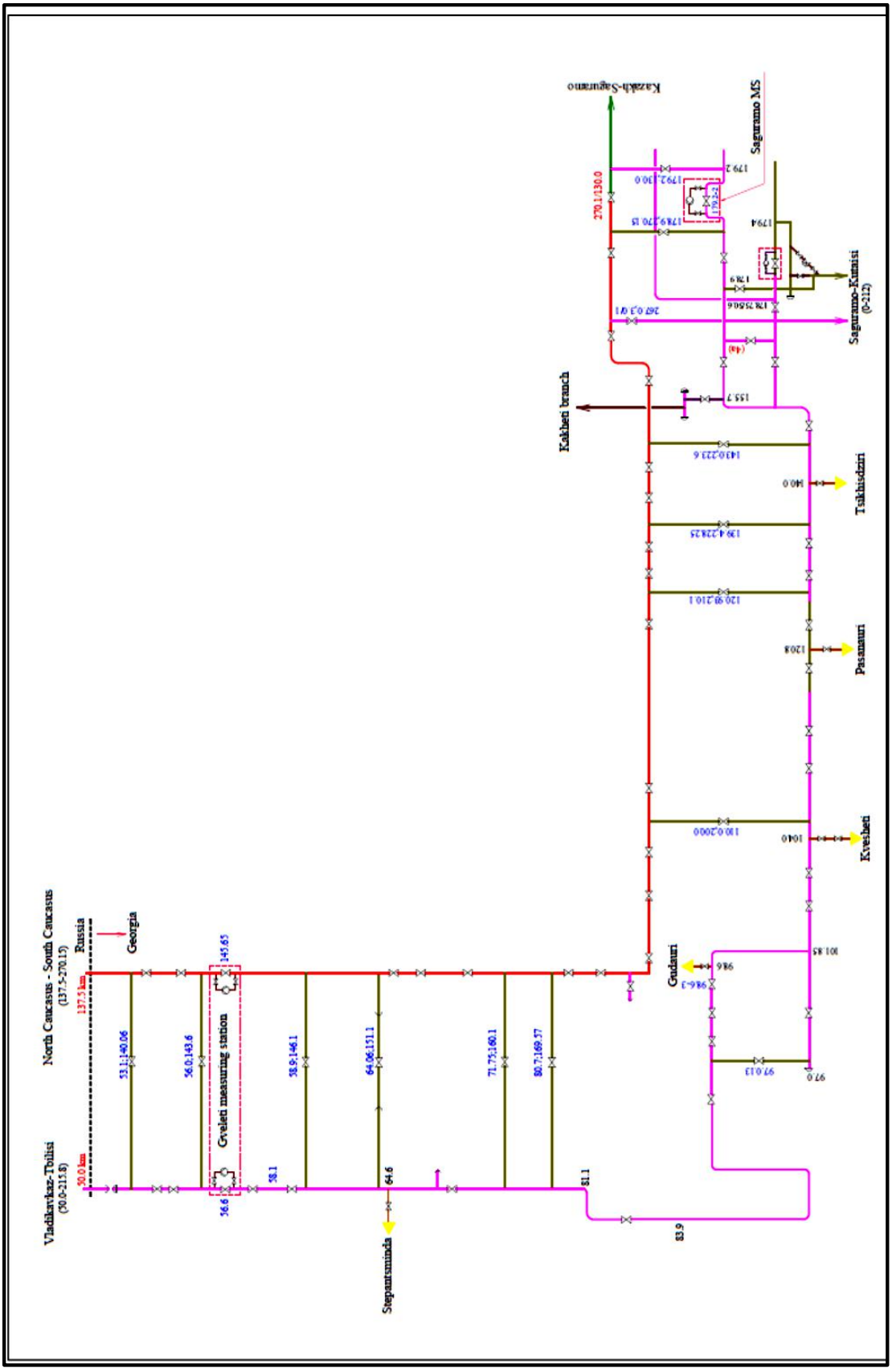


Figure A1.1. Georgian Gas Main Pipelines: Northern Border – Center (Saguramo GPRMS)

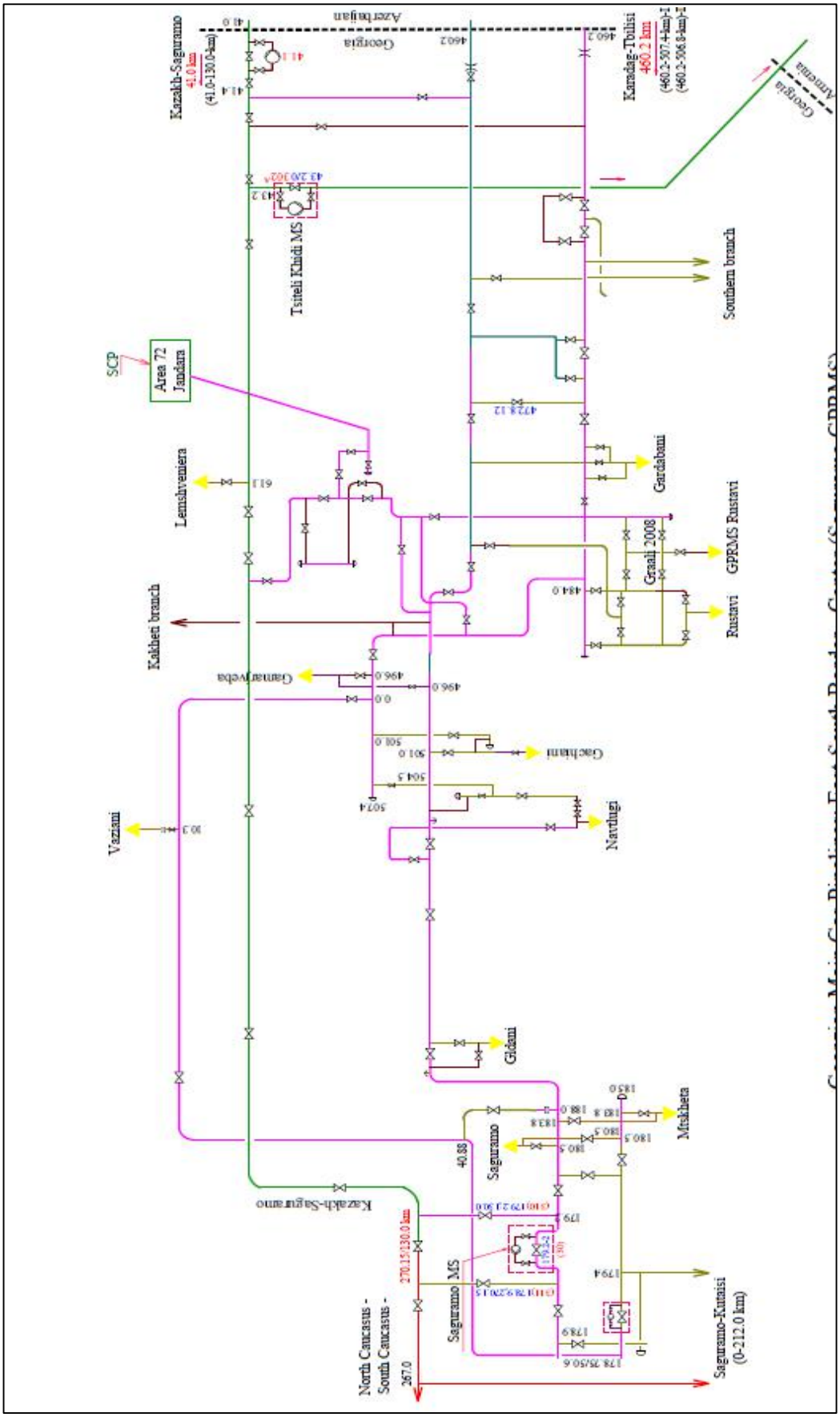


Figure A1.2. Georgian Gas Main Pipelines: South-East Border – Center (Saguramo GPRMS)

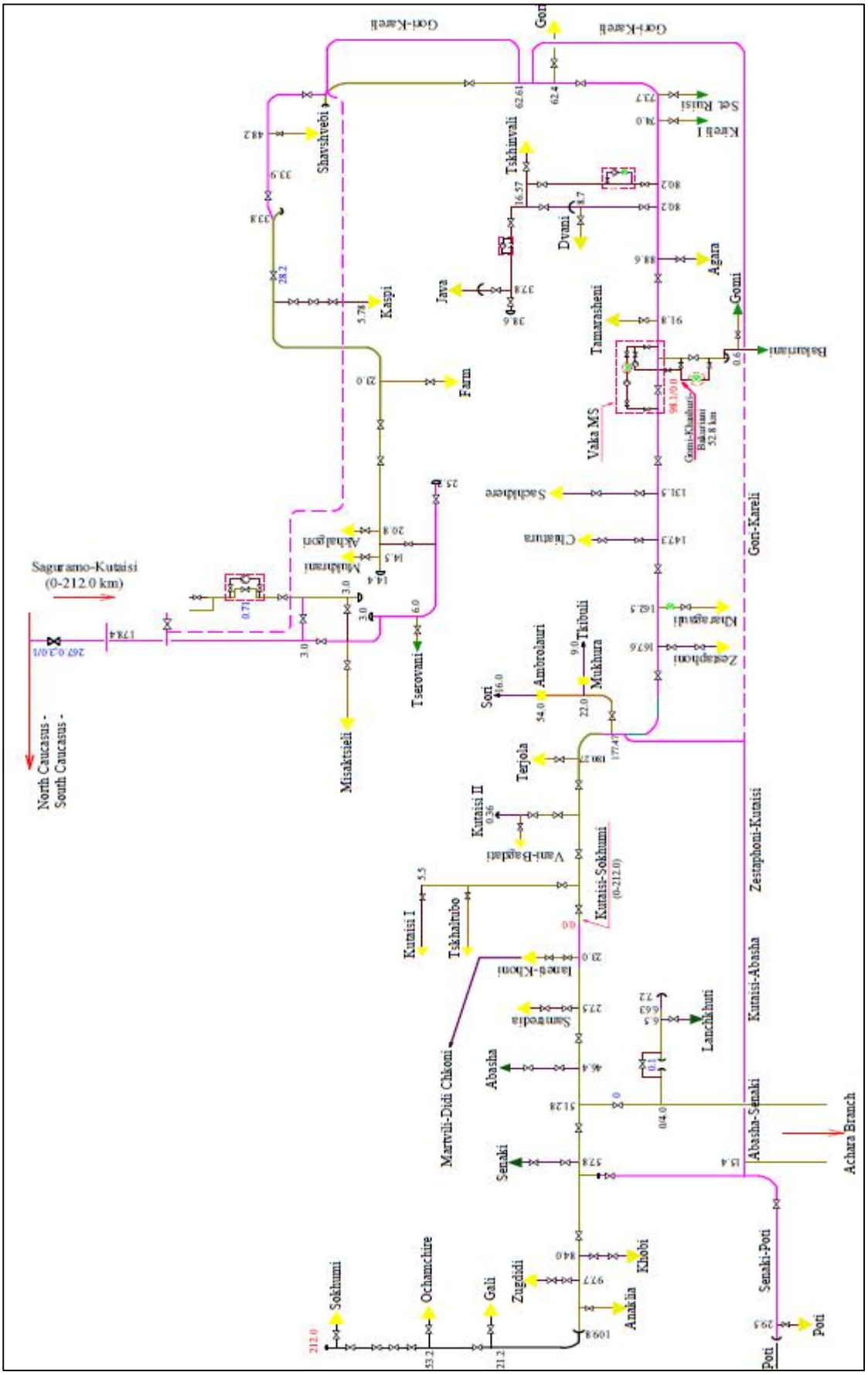


Figure A1.3. Main Gas Pipelines: Center - West Direction

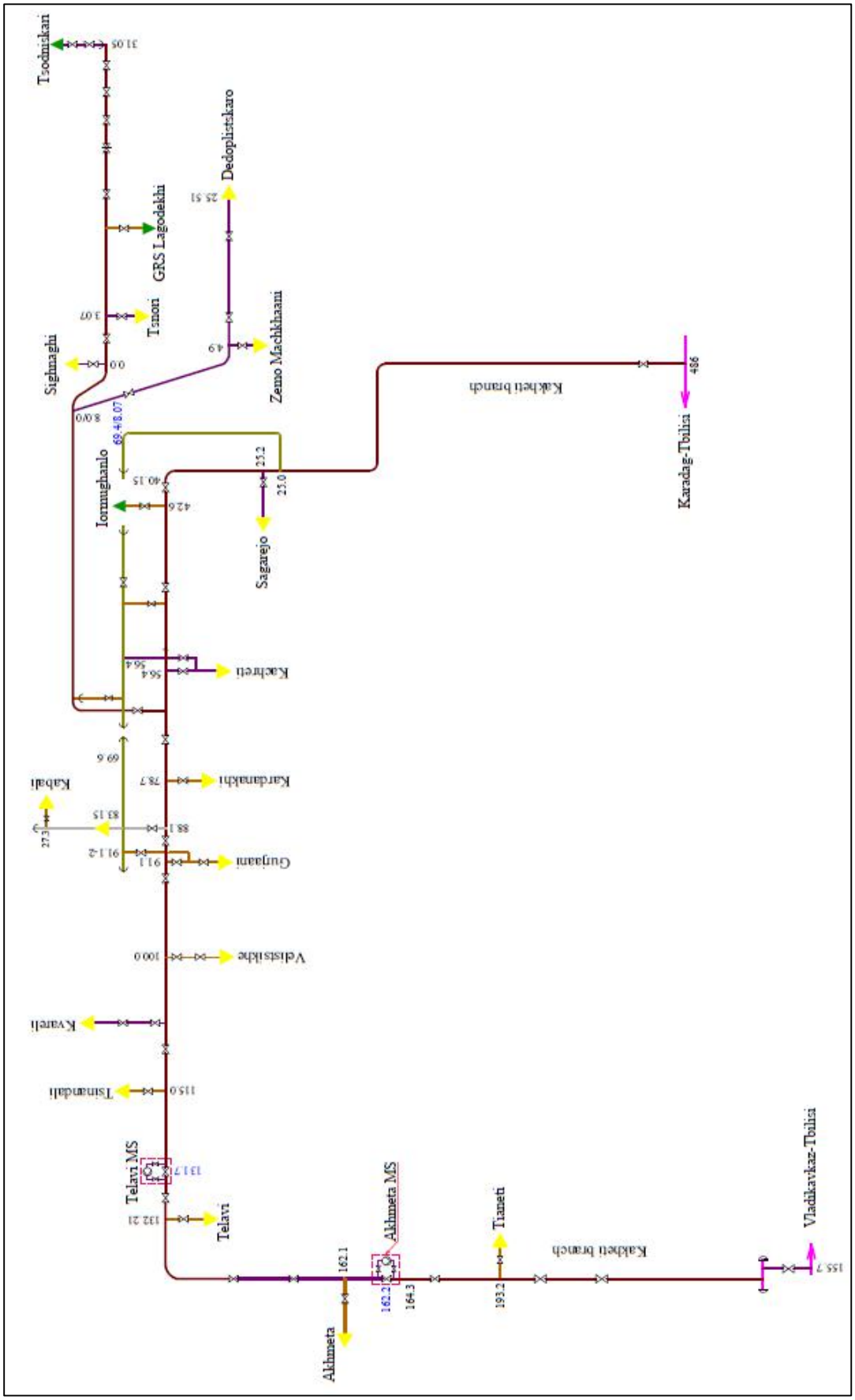


Figure A1.4. Main gas pipelines: Kakheti branch

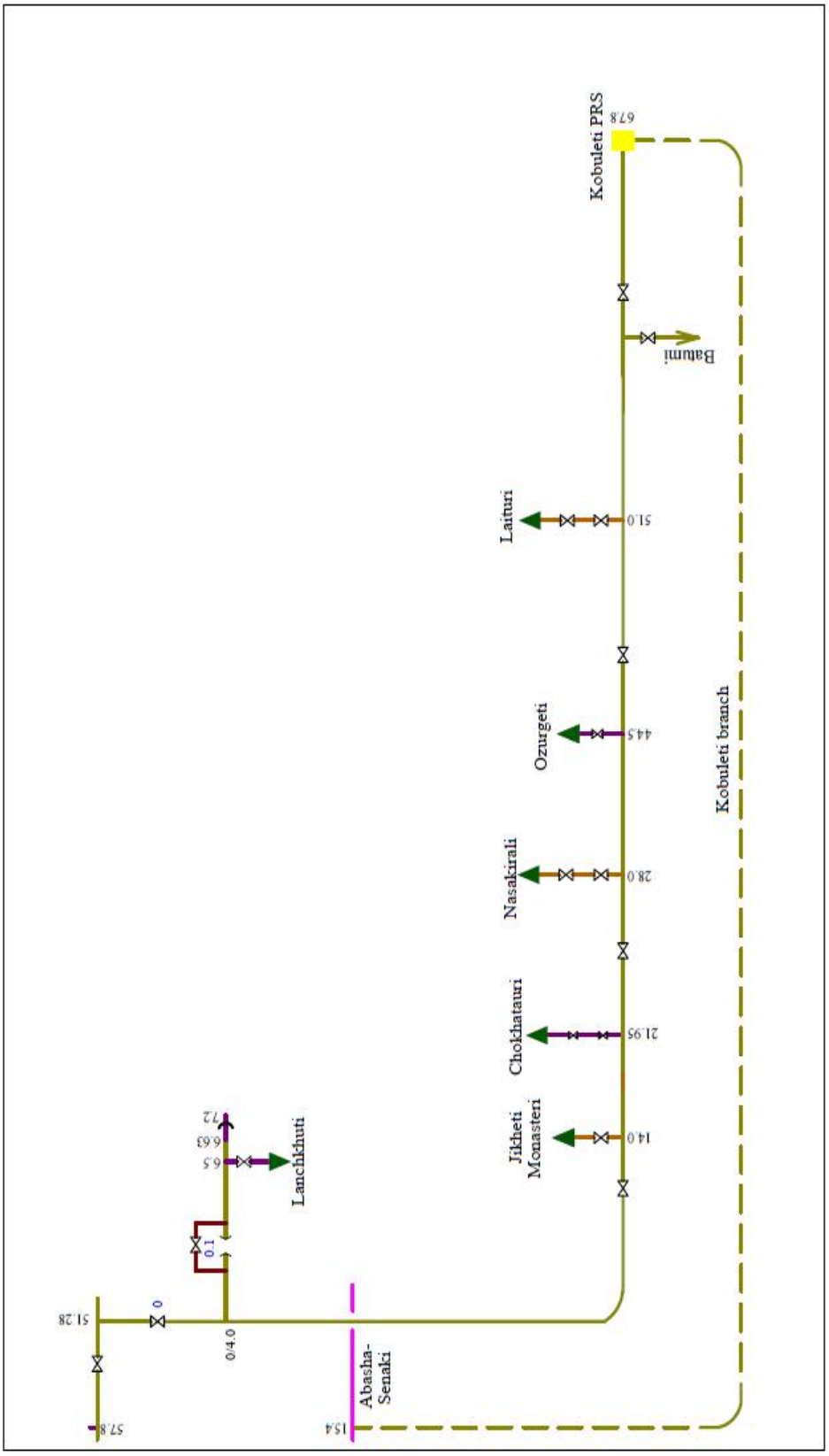


Figure A1.5. Main gas pipelines: Adjara branch

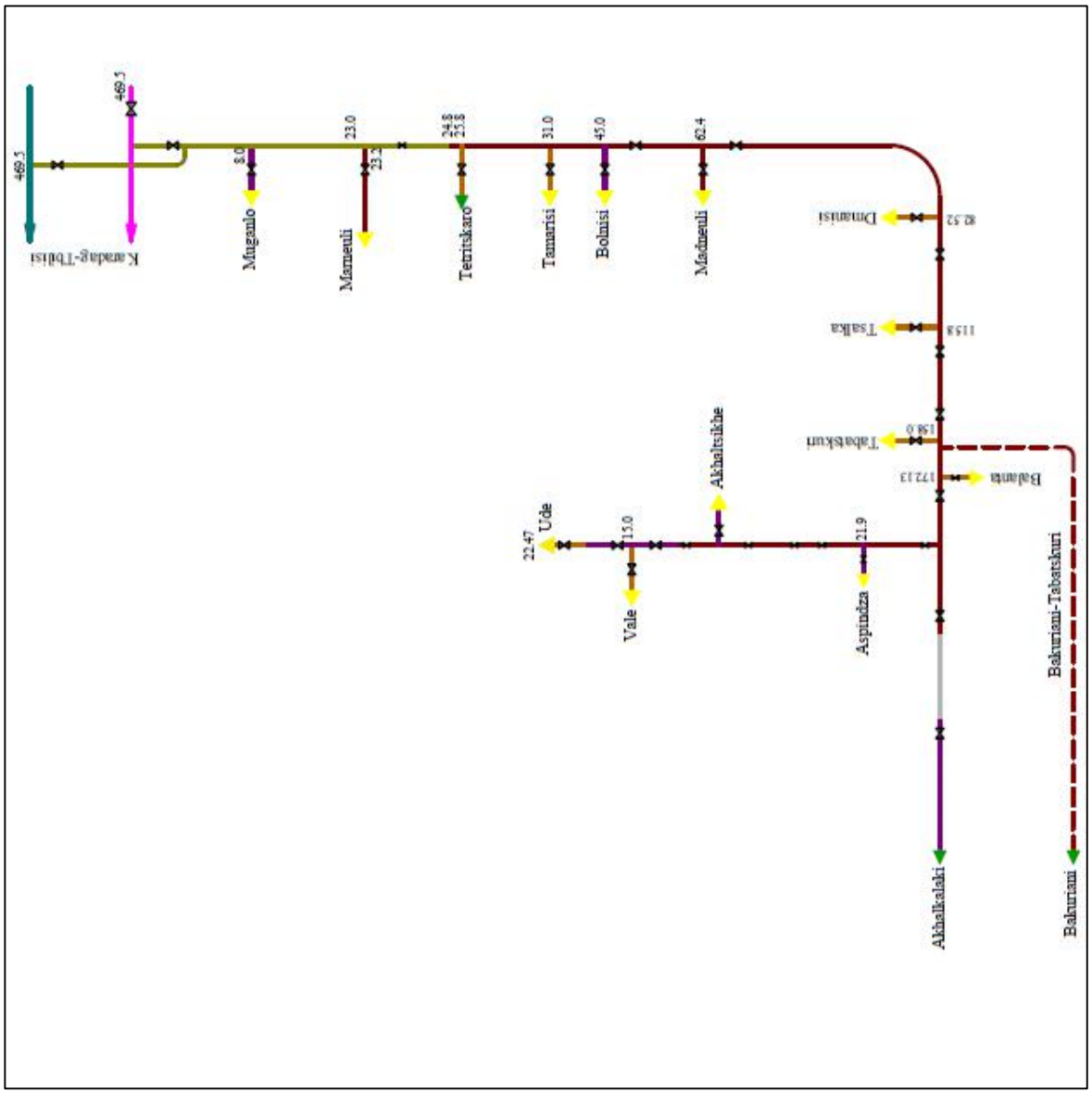


Figure A1.6. Main gas pipelines: Southern branch