ESTONIAN GAS TRANSMISSION NETWORK DEVELOPMENT PLAN 2018—2027

Tallinn

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Elering is an independent electricity and gas system operator with the primary task of ensuring a high-quality energy supply to Estonian consumers. For this purpose, the company manages, operates, and develops the national and cross-border energy infrastructure. By performing its activities, Elering ensures the conditions required for the functioning of the energy market and for the development of the economy.

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Abbreviations

CEF	Connecting Europe Facility
CHP	Combined heat and power
DN	Diameter Nominal
ENTSOG	European network of transmission system operators for gas
GDS	Gas distribution station
GMS	Gas metering station
BVS	Branch valve station
CS	Compressor station
LVS	Line valve station
LNG	Liquefied natural gas
NGA	Natural Gas Act
MOP	Maximum operating pressure
PCI	Projects of common interest
RS	Receiving station
WACC	Weighted average cost of capital

1 Introduction

The ten-year development plan for the gas transmission network is drawn up by the operator of the transmission system, Elering. Other market participants also took part in the Gas Market Development Council consultations and were thus involved in the writing of the development plan. The consultations focused first on the feedback of the development plan of the previous year and the current questions and proposals were analysed during the entire process of composing the development plan. This development plan is for the period of 2018 to 2027.

Pursuant to subsection 21^2 (4) of the Natural Gas Act, the system operator submits to the Competition Authority (CA) a report on the progress made in implementing the network development plan and on eventual changes in the plan, amending the development plan with particulars in respect of the investments to be made during the following three years. The development plan must include the measures to be taken to ensure sufficient transmission capacity of the system and the security of supply in the next ten years, taking into consideration the needs of the existing and potential suppliers of natural gas and other users of the network. Compared to the previous two years, there are no significant changes to the long-term development and outlooks of the gas system, indicating that the development directions have been consistent and the investments in the gas network are long-term projects. Compared with the previous development plant, more emphasis has been placed on planned investments and the reasons behind the decisions.

The first section describes Elering's investing principles used when planning investments to the gas network. Investing principles help us better understand the structural distribution of the investments and foundations of the decision processes.

The main section of the report gives an overview of the security of gas supply and the gas market developments in Estonia and the whole region. The section describes the methodology behind evaluating the security of supply. The main influence on the gas network developments in the coming years is the plan to exit the one-supplier situation. There has been good progress compared with the previous year, and the most important project, Balticconnector, is developing quickly to guarantee cohesion with the European gas network and move towards integration with the European open gas market. The Balticconnector project is discussed in a separate chapter.

A brief summary on the issues related to the developments on the gas market can be found at the end of the report.

Additional information:

The amounts of energy highlighted in the report were calculated by using 10.5 kWh/m^3 (11.1 kWh/m^3 in the case of LNG) as the higher heating value, and the gas volumes are at standard conditions of 20 °C and 1.01325 bar.

1.1 Investing principles

Elering AS's budget for investments to the gas sector is divided into three categories according the type of funding.

1. **Investments to the regulatory asset base**
   Investments to this category are funded from the gas network tariffs.

2. **Investments with a cross-border influence that do not impact the tariffs**
   Investments to this category are funded from the following sources:
   - EU funds

3. **Investments to non-regulatory asset base**
   Investments to this category are funded from:
   - Grid connection fees. The customer who wishes to connect to the network will pay the connection fee, which is used by Elering to construct the connection and strengthen the existing network, if necessary.
   - Revenue from other activities (e.g. balancing services).

1.1.1 Profitability of investments

Investments to the regulatory asset base can be viewed from two aspects:

1) Benefits to Elering as a company
2) Benefits to society as a whole

1.1.1.1 Benefits to Elering as a company

The regulating authority (Competition Authority) has established the profitability of regulatory asset base investments with two methodologies: *Gaasi võrguteenuste hindade arvutamise ühtne metoodika* (Single Methodology for Determining the Prices of Gas Network Services) (2015) and *Juhend 2016. a kaalutud keskmise kapitali hinna arvutamiseks* (*2016 Guidelines for Determining the Weighted Average Cost of Capital*). The latter is usually updated by the Competition Authority every year. However, the 2017 guidelines have not been published yet, so the 2016 guidelines are still in force.

Investments are included in the network fees as follows:

- The calculation is based on the average annual regulatory asset base. Next year's investments to the regulatory fixed asset base are added to previous year's regulatory fixed asset base as at the end of the year, and the result is the regulatory fixed asset base as at the end of the tariff year. The average annual regulated fixed asset base is added to the regulatory working capital, which is 5% of turnover. The result is the average annual regulatory asset base.
- The average annual regulatory asset base is multiplied with regulatory WACC and this will result in earnings before interest and tax (EBIT). EBIT is one component of sales revenue, which is used for calculating precise network tariffs. WACC is taken from the Competition Authority's guidelines.

WACC guidelines are based on the generally accepted capital asset pricing model. The model analyses the components that affect the profitability of similar publicly traded companies and conclude the profitability of companies with certain risk levels.

In addition to capital costs, investments also affect the costs of the network operator. For example, investing in a compressor station results in the obligation to maintain the compressor station, which in turn increases Elering's costs. In theory, a situation where investments reduce the costs is possible (e.g. turning a gas metering station in an automatic station would decrease the labour costs of operating the station). Elering's profitability will, however, remain the same in both cases, as all changes to costs are included when calculating the sales revenue.

Conclusions on the question of the profitability of investments for Elering as a company:

- All investments to the regulatory asset base will generate Elering the profitability (WACC) determined by the regulator and is expressed in the network fees as a component of EBIT.
- Elering's profitability does not change depending on whether the investments increase or decrease the operating costs.
- All investments to the regulatory asset base are equally profitable to Elering as a company. There are no less or more profitable investments.

1.1.1.2 Benefits of the investments to society as a whole

Despite the fact that all investments to the network are equally profitable to Elering as a company, Elering acts responsibly and takes into account the interests of society as a whole when planning the investments.

Elering divides investments into the following groups from the viewpoint of society:

a) Investments to worn down networks

Elering implements the following logic when planning investments to this group:

- The security of gas supply is a vital function for society. The disruption of supply would bring about incomparably larger damages than would be the impact of investments on the transmission tariffs.
- Elering has signed open-ended agreements with customers who have a justified anticipation that the network operator must fulfil the contractual obligations. Therefore, Elering has no legal basis to one-sidedly terminate any agreements or to not fulfil contractual quality requirements for the reason that according to our calculations, providing network services is not socio-economically profitable in some areas.
- According to the Natural Gas Act, the network operator has the obligation to guarantee a due supply of gas.

Therefore, Elering does not calculate which customers are worthy to be invested in and which are not from the viewpoint of society as a whole. Society as a whole needs a vital infrastructure to work as required. Because of this, the analysis of investments to worn down network sections is based on to the volume and order of investments. The selection is further complicated by the fact that the quality of supply due to aging network equipment is probable but cannot be clearly calculated. The investment selection processes are further discussed in the next chapter. Regarding replacement investments, Elering is constantly analysing the reliability indicators of the network and uses them to determine the necessary amount to be invested.

b) Investments to develop the Estonian network

Development investments are defined as investments used to expand the gas network to areas with no existing network or increase the throughput capacity to meet the increased demand. In order to determine whether to expand the network into new areas, a socio-economic study must be commissioned.

In accordance with legal acts, the network operator is obligated to increase the throughput capacity in case of increased demand.

c) Investments to increase cross-border transmission capacity

The network operator is obligated to increase cross-border transmission capacity in accordance with directly applicable EU regulations. These investments are funded from the following three sources:

- EU funds
- Network tariffs

In order to apply for EU funds, a socio-economic analysis must always be performed. This will be submitted to the European Commission and to regulatory authorities of the involved countries. The last socio-economic analyses were conducted of both cross-border projects (Balticconnector and Enhancement of Estonia-Latvia interconnection). The results of both studies were positive and EU funds were allocated to finance the projects based on the results.

1.1.2 Investment budgeting principles

In the process of investment budgeting, different investment projects are validated and a justified selection between investment projects is done. The selection is based on the principle that in case of limited resources, objects with the greatest socio-economic benefit to society should be invested in first. The benefits may express as:

- Secure energy supply
- Better functioning energy markets
- Increased effectivity of Elering's operations
- Better customer service.

When investing to the regulatory asset base, the following inputs, analyses, and assessments are taken into account:

a) When developing the network: development plans of the networks, ENTSOG ten-year development plans, development plans related to Estonian energy policy, Elering's and its customers development plans, other studies. The investments qualify if they are used for constructing a new network element (e.g. pipeline, gas distribution station, gas metering station) due to insufficient transmission capacities or the need to guarantee the reliability according the quality requirements.
b) Internal diagnostic tests of the pipelines and examinations of the condition. Internal diagnostic tests of the pipelines are the only solution for the comprehensive assessment of the condition of underground pipelines. Diagnostic tests are used for detecting any damages or defects to the pipelines and the required repair works are performed based on the examination results and may include replacing or reinsulating sections of the pipeline or installing repair collars. The schedule of the works is divided by years until the next planned diagnostic tests (diagnostic tests are performed after every 5—6 years). The works are distributed based on the principle that larger-scale works and the elimination of defects limiting the operating pressure of the pipeline are performed within the first year, followed by works of lower importance. All defects and shortcomings preventing the pipeline from working at maximum operating pressures (MOP) with necessary strength reserves must be eliminated (necessary strength reserve means that if the pipeline can operate at pressures up to 55 bar, the defect cannot be below or equal to that line). Defects of and mechanical damages to the welds (dents in the pipe, scrapes, etc.) must be examined prior to conducting the works by using control excavations (shafts) with control measurements, non-destructive testing of the welded connections, e.g. x-ray examination.
c) Deciding upon the means of repairs. The decision on the repair method to be used (reinsulating, repairing with composite collars, replacing the pipe) is taken by the working group of specialists who will take into account the following:
   - Processing the diagnostic data with corresponding software
   - Processing the data of the pipeline in a programme (e.g., PIMS) — the age of the pipeline, the quality of the metal, the type on insulation, the impacts of the location (surface), etc.
   - Defects discovered in crossings

- Measurements performed in the pipeline (insulation, effect of the cathodic protection)
- Data received from the shafts

An economic analysis is performed based on the technical needs — the cost of performing the works is determined according to the maintenance agreement pricing.

2 The Estonian gas system

- Today, the Estonian gas system is isolated from the Western European gas system and largely depends on the gas supply from Russia.
- Once all the investments planned until 2021 have been carried out, the Estonian gas system will be connected to the rest of Europe and additional supply channels will have been established to increase security of supply.
- Estonian gas consumption has decreased by more than half compared to ten years ago, but is not expected to decrease significantly in the coming ten years.

2.1 Estonian gas transmission network

The Estonian natural gas transmission network consists of 885 km of gas pipelines, three gas metering stations (GMS), where the amount of gas entering the transmission network is metered and the quality of the gas is determined, and of 36 gas distribution stations (GDS), where the pressure of the gas exiting the transmission network is reduced, metered, and odorised and the agreed consumption regime is ensured.

Figure 1. Estonian natural gas transmission network

On the figure: Maagaasi ülekandevõrk — Natural gas transmission network; Plaanitav Balticconnector — Planned Balticconnector; Maagaasi mõõtejaam — Natural gas metering station; Maagaasi jaotusjaam — Natural gas distribution station; Plaanitav kompressorjaam — Planned compression station

2.1.1 Pipelines

The Estonian transmission network consists of several different pipelines. The pipelines differ from each other in maximum operating pressure (MOP), diameter, and age. Table 1 gives an overview of the parameters of the transmission network pipelines.

Table 1. Estonian natural gas transmission network

* according to metal loss defects

** according to a report from 30 October 2012 (external examination methods)

Pipeline	Length [km]	DN (nominal diameter) [mm]	Maximum operating pressure (MOP) [barg]	Age [years]
Vireši-Tallinn	202.4	700	49.6*	26
Vändra-Pärnu	50.2	250	54	12
Tallinn-Kohtla-Järve I	97.5	200	≤ 30	65
Tallinn-Kohtla-Järve I	149.1	500	≤ 30**	50
Kohtla-Järve-Narva	45.1	350/400	≤ 30**	58
Izborsk-Värska GMS	10.1	500	53.7*	43
Värska GMS-Tartu	75.6	500	45.9*	43
Tartu-Rakvere	133.2	500	45.2*	39
Izborsk-Inčukalns	21.3	700	49.2*	34
Pskov-Riga	21.3	700	51.4*	46
Branching pipelines	79.2			
Total	885.0			

After the five-year plan investments have been carried out, the maximum operation pressure is planned to reach 50 barg in the Izborsk-Tartu-Rakvere section and 54 barg in the Vireši-Tallinn and Izborsk-Inčukalns pipelines.

The Izborsk-Inčukalns and Pskov-Riga pipelines are parallel pipelines in Southeast Estonia and used primarily for transporting gas between Russia and Latvia but also to supply the Misso GDS located in Estonia with gas. These parallel pipeline sections are not connected to the rest of the Estonian transmission network.

2.1.2 Gas metering stations

Table 2 provides an overview of the capacities of the throughput capacities of the inlet stations of the Estonian gas transmission network at different pressure conditions.

Table 2. Throughput capacities of the inlet stations of the Estonian gas transmission network.[1]

Connection point	**Technical throughput capacity (million m³/d / GWh/d)** gas pressure at the connection point Karksi GMS: 40—42 bar Värska GMS: 40—42 bar Narva: 28—30 bar	**Throughput capacity under normal conditions (million m³/d / GWh/d)** gas pressure at the connection point Karksi GMS: 34—36 bar Värska GMS:34—36 bar Narva: 22—24 bar	**Minimum throughput capacity (million m³/d / GWh/d)** gas pressure at the connection point Karksi GMS: 24—26 bar Värska GMS: 24—26 bar Narva: 18—20 bar
Narva connection	3 / 31.5	1.2 / 12.6	0.8 / 8.4
Värska GMS	4 / 42.0	3.4 / 35.7	2.2 / 23.1
Karksi GMS	7 / 73.5	6.0 / 63.0	4.0 / 42.0
Total	**14 / 147.0**	**10.6 / 111.3**	**7.0 / 73.5**

Technical throughput capacity is the calculated throughput capacity of the pipelines at maximum pressures that the technical conditions of the pipelines allow applying at entry points.

Throughput capacity under normal conditions is the calculated throughput capacity of the pipelines at normal pressure at inlet stations.

Minimum throughput capacity is the calculated throughput capacity of the pipelines in case of exceptionally low input pressures at inlet stations.

In addition to the connection points in Narva, Värska, and Karksi, Estonia has two more connection points. The parallel pipelines in Southeast Estonia (Izborsk-Inčukalns and Pskov-Riga) are connected to Latvia at the Murati connection point and to Russia at the Luhamaa connection point.

2.2 Regional gas transmission network

The Estonian gas system is part of the regional gas system and gas market. Thus, the transmission networks of the neighbouring countries and the nearby region must be taken into consideration when developing the natural gas transmission network. As Estonia does not produce gas, all the gas consumed is currently imported from Russia, from the Inčukalns natural gas reserve in Latvia or from the Klaipeda LNG terminal in Lithuania. The Estonian transmission network also serves as a transit corridor for gas transportation between Russia and Latvia. As the level of integration of the transmission networks is high, there is a risk of affecting the gas system of the entire region in the event of a breakdown. Figure 2 provides an overview of the regional natural gas transmission network and the most significant components of the network.

2.2.1 Finland

The total length of the Finnish transmission network is approximately 1,300 km and it is equipped with one connection point with Russia (Imatra), through which gas is supplied. There are three compressor stations (Imatra, Kouvola, and Mäntsäla) in the Finnish network with a total capacity of 64 MW. Currently, the Finnish transmission network is not connected to the transmission networks

[1] Throughput capacities given in Table 2 are of indicative nature. The actual throughput capacity of each connection point depends on the consumption in the system at any given moment, the pressure at the inlet stations, the distance of the consumption point from the supplying connection point, whether the gas supply passes one or more connection point and takes into consideration the integrity of the transmission system and efficient functioning of the network.

of the Baltic states; however, the transmission networks are planned to be connected via the Balticconnector by 2020 (Balticconnector is discussed further in chapter 3.1).[2]

2.2.2 Latvia

The total length of the Latvian transmission network is approximately 1,200 km and it has three connections points to other networks. Two of these connections are with Estonia (Karksi and Murati) and one with Lithuania (Kiemenai). The Inčukalns natural gas reserve, the only natural gas reserve in the Baltic states, is situated in Latvia. Historically, the natural gas reserve has been filled with gas in the summer period, when the natural gas consumption in the region is low, and in the winter, the gas in the reserve has been used to supply the region. The Latvian network also includes one compressor station in the territory of the Inčukalns natural gas reserve, which is mainly used for transmitting gas into the reserve.[2]

2.2.3 Lithuania

The total length of the Lithuanian transmission network is approximately 2,100 km. Lithuania has a connection point with Belarus (Kotlovka), through which gas is mainly supplied, a bidirectional connection with Latvia (Kiemenai) and a connection point with Kaliningrad (Šakiai), which is only used to transit gas to Kaliningrad. There are two compressor stations with a total capacity of 42.2 MW operating in the network. In 2014, the Klaipeda LNG terminal was launched to offer an alternative source of gas for the region.[2]

2.2.4 Poland

The total length of the Polish transmission network is approximately 11,000 km; it has six connection points with the networks of other countries and there are six natural gas reserves in the transmission network. In 2016, the Świnoujście LNG terminal and an 85 km section of aboveground pipelines were built to connect the LNG terminal to the Polish transmission network. The LNG terminal is capable of supplying 55,000 GWh of gas per year to the transmission network. The Polish transmission network is connected to the European gas network. There is no direct connection to the transmission networks of the Baltic states at this point but connection is planned to be created via the Gas Interconnection Lithuania-Poland (GIPL) in 2021[3].[2]

[2] BEMIP GRIP (Gas Regional Investment Plan) 2017
https://www.entsog.eu/public/uploads/files/publications/GRIPs/2017/entsog_BEMIP_GRIP_2017_Main_web_s.pdf
[3] AB Amber Grid press release – https://www.ambergrid.lt/en/news/pressrelease/introduction-of-amendments-to-agreements-on-the-eu-financial-assistance-to-the-gas-interconnection-poland-lithuania-gipl-project

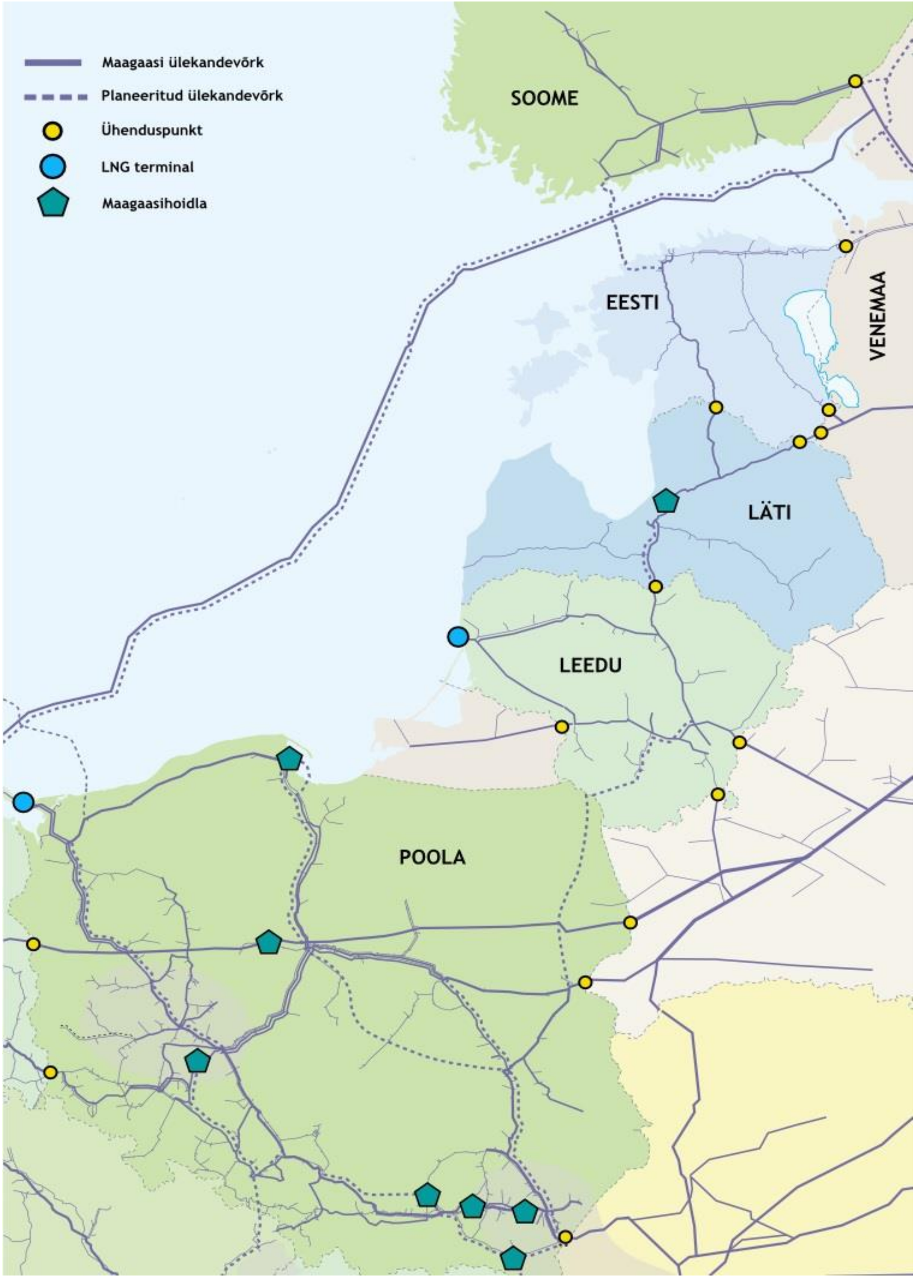


Figure 2. Regional gas transmission network (Source: ENTSOG)

On the figure: ühenduspunkt — connection point; maagaasihoidla — natural gas reserve; maagaasi ülekandevõrk — natural gas transmission network; plaanitav Balticconnector — planned Balticconnector; kompressorjaam — compression station; Soome — Finland; Venemaa — Russia; Eesti — Estonia; Läti — Latvia; Leedu — Lithuania; Poola — Poland

2.3 Natural gas consumption

In the past few years, natural gas consumption has generally shown a declining trend. The consumption increased in 2016 compared to 2015 due to relatively colder winter. In 2017, it showed a 5.1 % decline compared with the previous year. During the past 10 years, natural gas consumption has decreased by about a half (Figure 3).

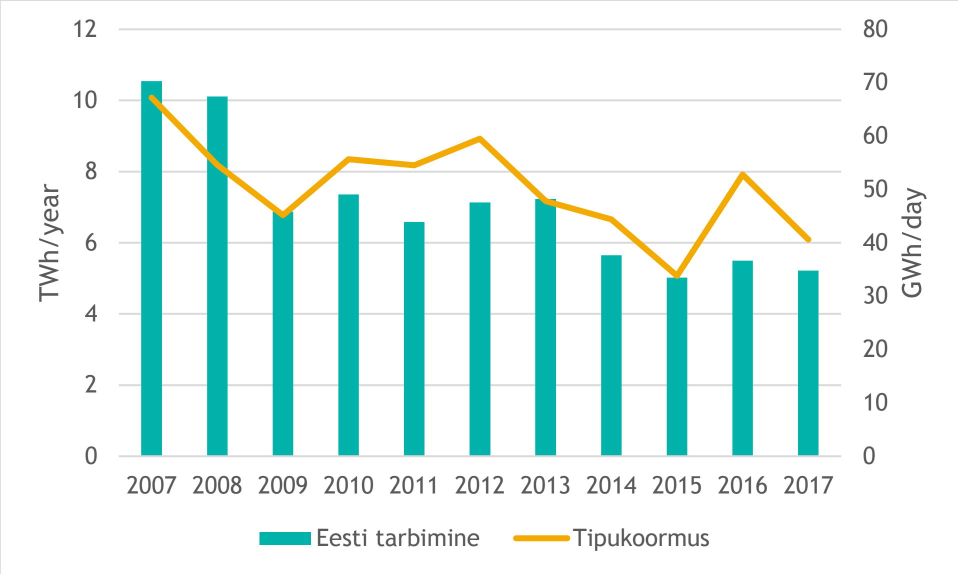
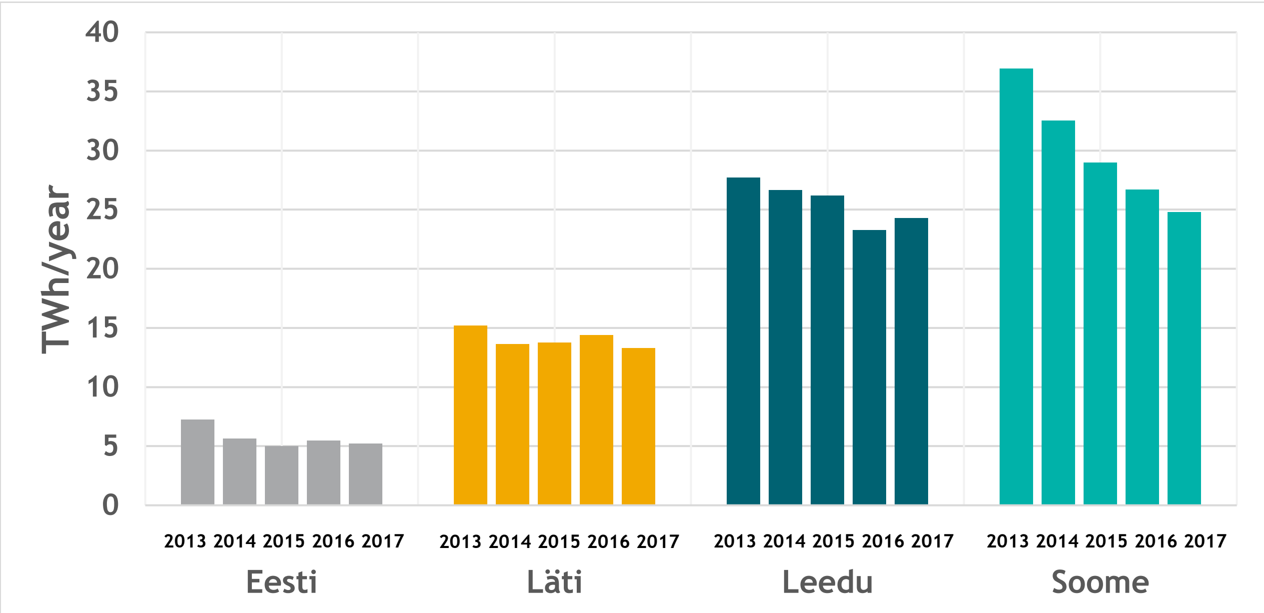


Figure 3. Estonian annual natural gas consumption (TWh/year) and the peak load (GWh/day), 2007–2017. (Source: Elering AS)

On the figure: Eesti tarbimine - consumption in Estonia; tipukoormus - peak load

Similar trends in natural gas consumption can be seen in the whole region (On the **figure: Eesti - Estonia; Läti - Latvia; Leedu - Lithuania; Soome - Finland**

Figure 4).



On the figure: Eesti - Estonia; Läti - Latvia; Leedu - Lithuania; Soome - Finland

Figure 4. Natural gas consumption in the Baltic region, 2013–2017. (Source: Elering AS, JSC Conexus Baltic Grid, AB Amber Grid, Gasum Oy)

Natural gas consumption is showing a declining trend due to changes in the consumption structure (several industrial consumers and electricity and heat producers have given up using gas as fuel and the demand has also decreased due to more efficient energy consumption), the general poor reputation of gas (as a political fuel) as well as lacking infrastructure (distance from the consumer) (Figure 5).

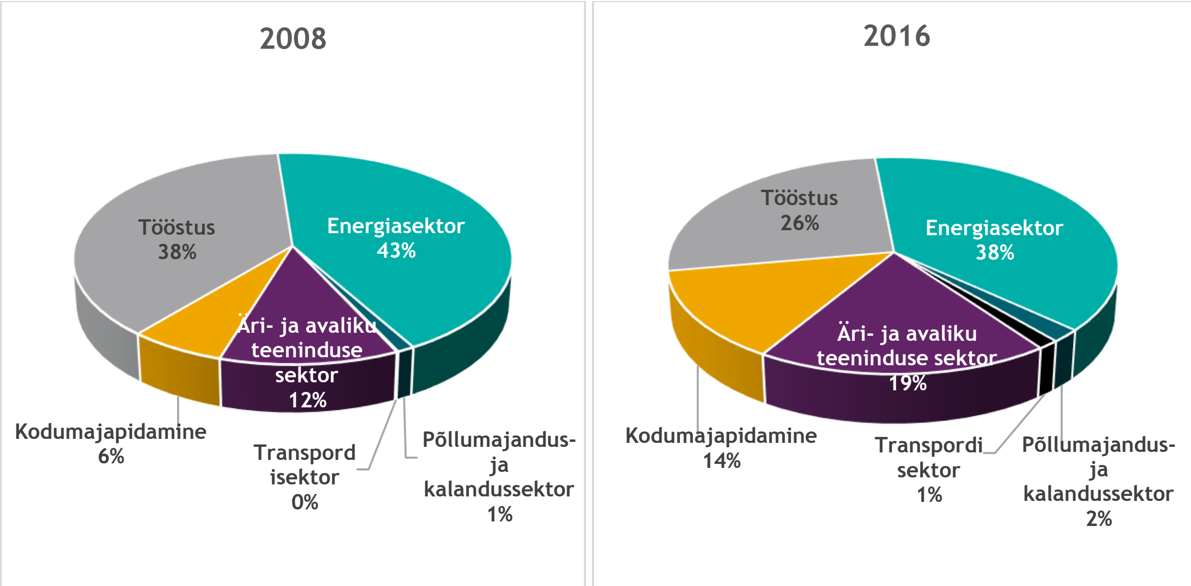


Figure 5. Distribution of gas consumption by sectors (2008 and 2016). (Source: Statistics Estonia)

On the figure: tööstus - industry; energiasektor - energy sector; põllumajandus- ja kalandussektor - agriculture and fishing sector; transpordisektor - transport sector; äri- ja avaliku teeninduse sector - business and public services sector; kodumajapidamine - households

2.4 Natural gas consumption forecast until 2027

Gas consumption forecasts have an important role in planning the development of the gas network. Elering uses the results of the gas consumption forecasts done by the Tallinn University of Technology in 2016[4] and the company's internal analyses to prognose gas consumption. The methodology used in calculating the base forecast of gas consumption includes dividing gas consumption by usage types and estimating trends in the usage types based on statistical methods and the best knowledge.

The potential consumption of network gas (i.e., the gas transmitted over the transmission network) in the next ten years depends on a number of factors (e.g., energy policy, economic growth, energy efficiency of the housing stock). The consolidated base forecast of network gas consumption in the next ten years is provided in Figure 6, which includes consumption of network gas by different consumption groups.

[4] https://elering.ee/sites/default/files/attachments/Gaasitarbimise-pikaajaline-prognoos_toimetised-4_2016_-20.3.2017.pdf

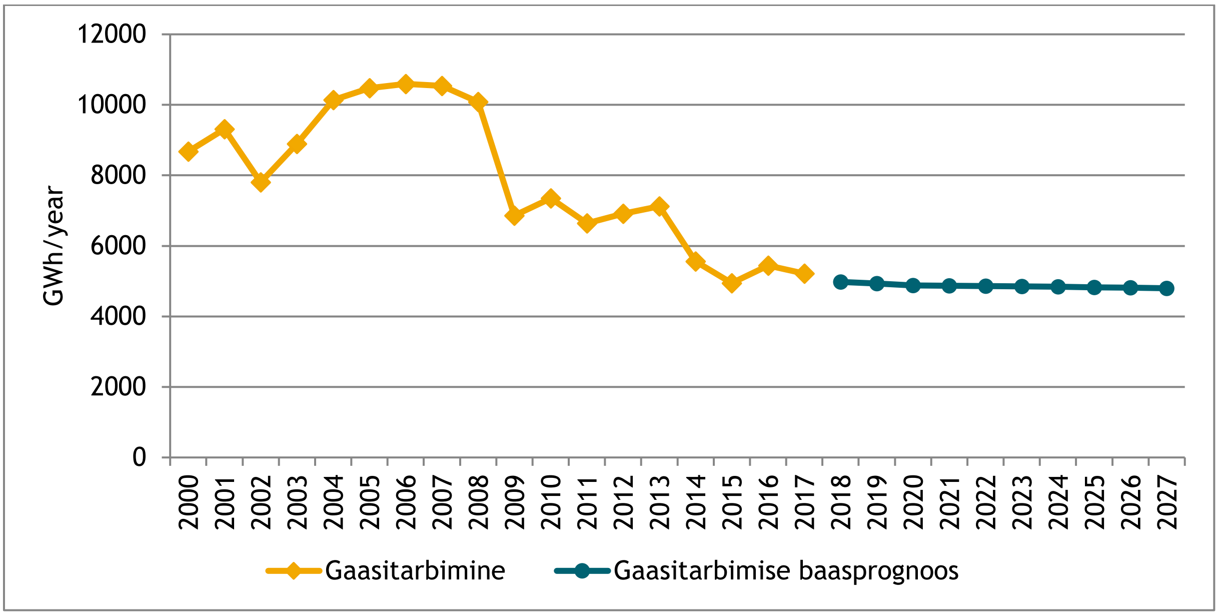


Figure 6. Annual gas consumption statistics and forecast for the next decade.

On the figure: gaasitarbimine - gas consumption; gaasitarbimise baasprognoos - gas consumption base forecast

The gas consumption trend in Estonia is clearly declining. The consumption has decreased in heat generation, electricity generation, and in the industrial sector for heating as well as for raw material use. A growing trend in natural gas consumption is expected in the transport sector. This is related to the European Union's goal to cover 10% of the energy consumption of the transport sector with renewable energy, in which Estonia is expected to play a major role by using biomethane. By far, the largest share of natural gas is used for heat generation in Estonia. Since 2008, a declining trend can be seen in the gas consumption for heat generation. The main reasons of the decline are the implementation of energy-saving measures in the district heating regions and the transition to using local fuels (wood chips and peat). The following projects have decreased the gas consumption (transfer to using local fuels) the most:

- At the end of 2008, a wood chip fuelled power plant in Tallinn (annual heat production of up to 480 GWh/year) and the Tartu CHP (combined heat and power plant) (planned heat generation of ~ 300 GWh/year) were completed.
- On 28 January 2011, the Pärnu CHP was launched (planned heat production of 220 GWh/year).
- In the summer of 2013, Iru CHP waste combustion block was launched (estimated annual heat generation of up to 430 GWh/year).
- In 2013, construction works on the Rakvere CHP were completed (estimated heat generation of 25 GWh/year).
- In 2014, construction works on the 4 MW solid biofuel boiler in Põlva were completed (heat generation of approximately 25 GWh/year).
- In 2017, Väo-2 combined power and heat plant, which gives heat to Tallinn's heat network (planned heat production of about 400 GWh/year), started working at full capacity.

Based on observation of changes in consumption of natural gas for heat generation in the period 2008—2014, a declining trend can be detected; however, there were fluctuations departing from the trend in 2010 and 2012. This may be explained by the fact that those years were significantly colder compared to others.

The forecast is based on the presumption that in addition to the Väo 2 combined heat and power plant, which started generating heat for Tallinn's heat network at full capacity in 2017, an average of 5 MW of heat generation capacities per year will be replaced with local fuels each year until 2020 (indicative annual output of 30 GWh, an approximately 32 GWh decrease in natural gas consumption). Thereafter, 2 MW per year will be replaced (indicative annual output of 12 GWh, a 13 GWh decrease in natural gas consumption).

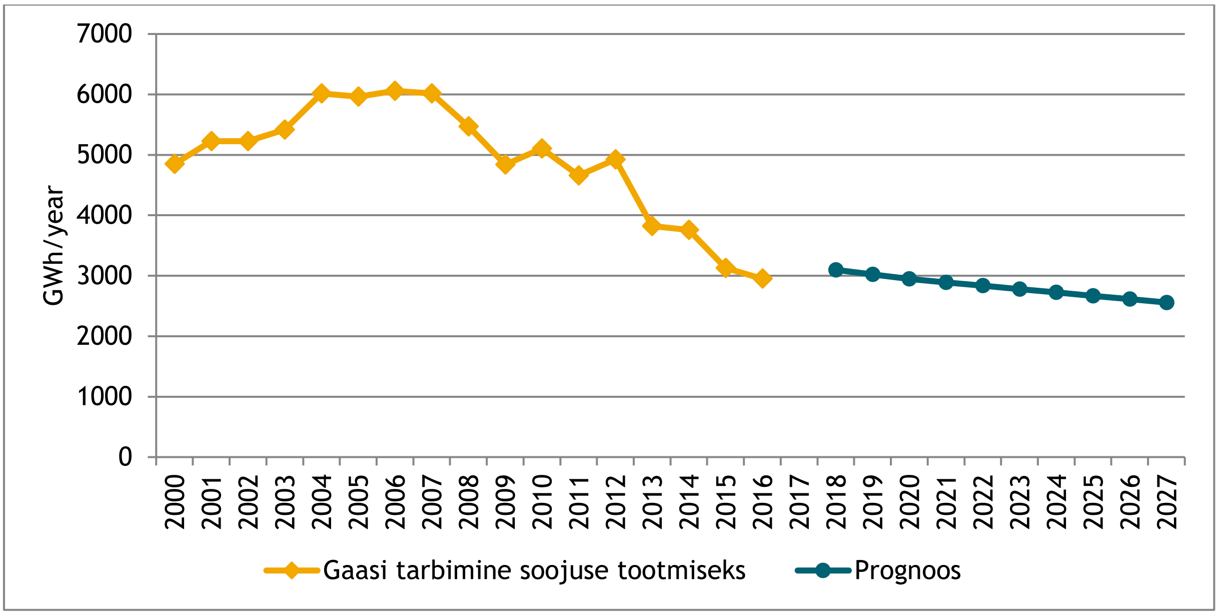


Figure 7. Statistics of gas consumption for heat generation and ten-year forecast[5]

On the figure: gaasi tarbimine soojuse tootmiseks - gas consumption for heat production; prognoos - forecast

The peak consumption of gas plays and important role in the development of the gas network and ensuring the security of supply. The peak consumption statistics and forecasts for the next decade are provided in Figure 8. While the annual gas consumption largely depends on the average annual temperature, the peak consumption significantly depends on extremely cold weather. Thus, the peak consumption forecasts are also provided based on two weather scenarios – the cold scenario corresponds to extreme winter temperatures of –25 °C and the regular scenario to cold winter temperatures of –20 °C.

[5] As the time of publication of the development plan, there are no sector-specific statistics available for 2017.

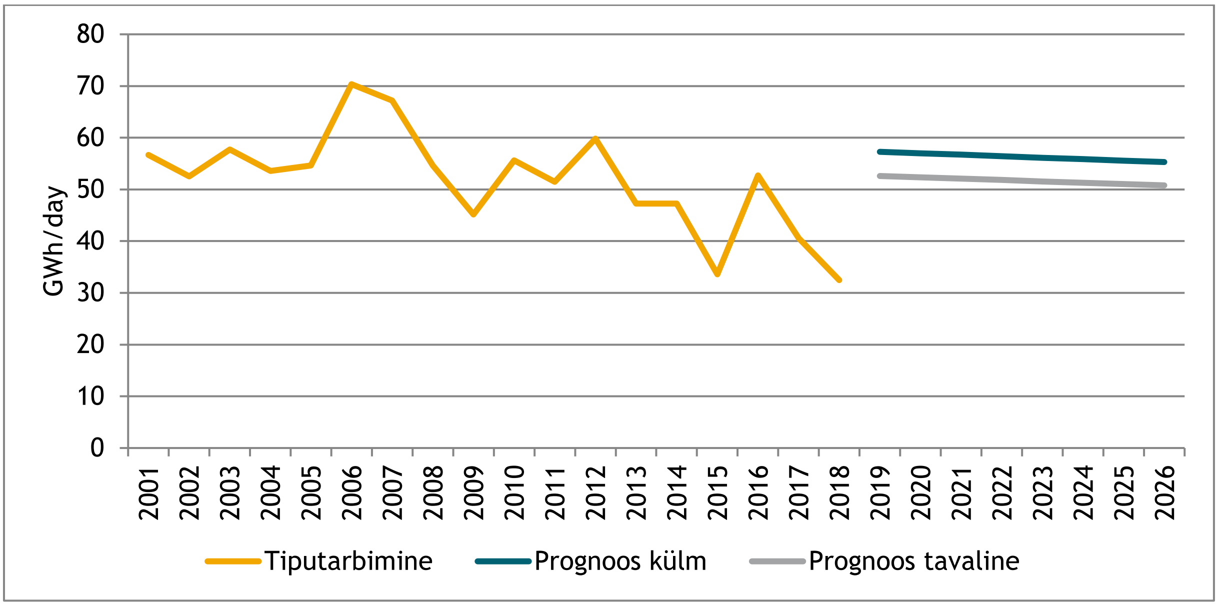


Figure 8. Natural gas peak consumption statistics and forecasts for the next ten years[6]

On the figure: tiputarbimine - peak consumption; prognoos külm - cold forecast; prognoos tavaline - regular forecast

The peak scenario forecast in regular weather conditions also shows a declining trend; however, the estimated decline is slower. The decline primarily arises from transitioning to other fuels in the heat generation sector. On the other hand, the peak consumption decline trend is estimated to be more conservative, as there is always a risk of one or two combined heat and power plants being excluded from the heating network during colder weather for various reasons (due to a failure of the station or a failure of the heat pipelines connected to the station). In such cases, the capacity must be covered by gas boilers. Such a risk is primarily expected to occur in the network areas of Tallinn, Tartu, and Pärnu. Due to the above, the decrease in the peak gas consumption provided in the forecast is twice as slow as the estimated decrease in the annual gas consumption.

Gas consumption scenarios

The gas consumption forecast research conducted in 2016 by the Tallinn University of Technology observed optimistic and pessimistic gas consumption developments in addition to the base scenario and used them to compile optimistic and pessimistic scenarios (Figure 9).

[6] For 2018, the level provided in the graph is the peak consumption as at the end of January 2018.

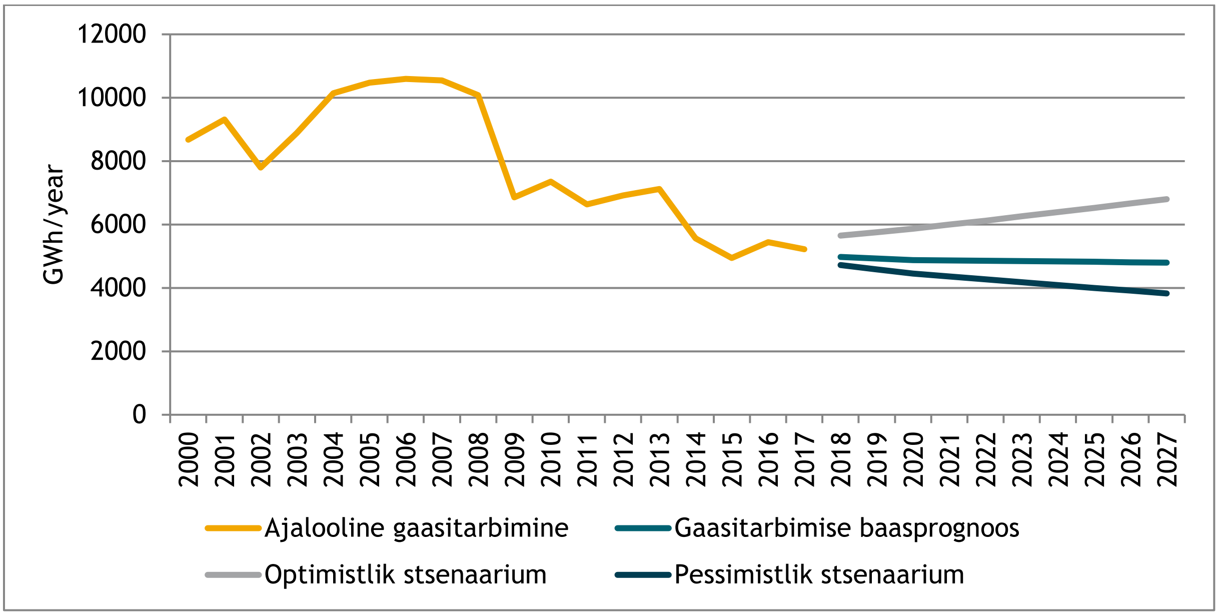


Figure 9 Gas consumption forecasts for the next decade for various scenarios

On the figure: ajalooline gaasitarbimine - historical gas consumption; optimistlik stsenaarium - optimistic scenario; gaasitarbimise baasprognoos - gas consumption base forecast; pessimistlik stsenaarium - pessimistic scenario

The scenarios viewed the sensitivity of gas consumption to various influencing factors and produced the respective consumption forecasts. The scenarios are based on changes in the preconditions of the influencing factors compared with the base forecast. The so-called optimistic scenario and pessimistic scenario are covered. In the case of the optimistic scenario, the combined effects of potential positive factors (economic and political) on gas consumption were taken into consideration. This means that compared with the base forecast, the estimated effects of potential factors promoting the consumption are realistically positive. In the case of the pessimistic scenario or the so-called reversed scenario of the optimistic one, the potential combined negative effects of various (economic and political) factors on gas consumption are taken into consideration.

In order to compose the base forecast, the entire consumption is divided into groups according to usage areas/consumers:

- Network gas used in the energy sector:
  - electricity generation
  - energy sector own use
  - heat generation
- Local consumption of the network gas
- Industrial consumption and consumption as raw material
- Transport sector consumption
- Agriculture and fishing sector consumption

Consumption of network gas in the energy industry has the highest impact. Gas consumption for electricity and heat generation has been showing a steady decline, which is likely to continue. Depending on the scenario, network gas consumption in the energy sector will reach 2,387—3,390 GWh by 2027 (in 2016, the consumption was 3,486 GWh, i.e. 64% of the entire network gas consumption).

The consumption of natural gas can only be expected to increase in electricity generation, provided that distributed energy generation solutions and combined heat and electricity generation solutions based on renewable energy — solar panels, solar heating, more extensive use of wind turbines — will begin to develop significantly in Estonia. In such a case, natural gas would provide a good alternative as a replacement fuel and for covering the potential peak loads (peak and/or balancing stations).

Local consumption of network gas (consisting of the consumption of households and in the business and public services sector) will either remain at the current level or continue to grow moderately. Depending on the scenarios, local consumption of network gas will amount to 987—1,347 GWh by 2027 (in 2016, the consumption was 1,229 GWh, i.e. 23% of the entire consumption of network gas).

In the future, the increase in gas consumption will be influenced by new consumers; on the other hand, older residential buildings being renovated will start lowering heat consumption. It must be taken into consideration that there are more stringent (less heat-consuming) requirements set for new buildings as well as buildings going under extensive reconstruction works (from 2019 and 2021). It is also known that gas suppliers are constantly searching for opportunities to increase the sales volumes of gas and are working on increasing the density of gas consumption in areas where the required communications have been created.

The end consumption of network gas in the industrial sector is strongly dependent on the operations of AS Nitrofert. Nitrofert used natural gas as raw material in the production of mineral fertilisers but stopped their production in 2014. Excluding the impact of Nitrofert, the statistical amounts of consumption remain relatively unchanged. Depending on the scenario, the consumption of network gas in the industrial sector will reach 249—826 GWh by 2027 (in 2016, the consumption was 651 GWh, i.e. 12% of the entire consumption of network gas).

The consumption of network gas in the remaining groups (the transport sector, agriculture and fishing sector, and consumption for raw material) was 74 GWh in 2016, i.e. less than 1% of the entire consumption of network gas. Depending on the scenario, the consumption of network gas in the aforementioned groups will amount to 205—1238 GWh by 2027, with the main estimated growth arising from consumption of network gas in the transport sector.

Network gas consumption in the Estonian transport section is very modest. Since 2009, Eesti Gaas has managed to almost double the sales of compressed gas each year. In the future, network gas consumption in the transport sector may be considerably influenced by the production of biomethane and state support for the use biomethane.

It has been optimistically presumed that by 2020, the production of biomethane into the gas transmission network will form up to 3% of the consumption of diesel and petrol fuel in 2015. Thus, by 2020, biomethane production will amount to approximately 300 GWh (for comparison, the value provided for 2020 in the ENMAK 2030+ low intervention scenario is 352 GWh per year) and will reach 1,192 GW by 2027. It has been presumed that all produced biomethane will be transmitted to the consumers through the transmission network and the transport sector will be the main consumer.

In a pessimistic scenario, it is presumed that the annual growth of network gas consumption in the transport sector is half of the figure provided in the base forecast and six times lower compared with the optimistic scenario, forming 184 GWh by 2027.

3 Developments of the gas network until 2027

- One of the priorities for the next ten years is the Balticconnector project with the enhancement of Estonia-Latvia interconnection, which will connect the gas systems of Finland and the Baltic States. Another important project in the region is the construction of the gas interconnection Lithuania-Poland (GIPL), which will connect the gas systems of the Baltic states, which have been so far isolated from the rest of Europe.
- After the regional projects have been completed, the Estonian gas system will change from a dead-end system to an important transit corridor.
- Due to large potential biomethane resources in Estonia, potential grid connections of biomethane producers to the gas network can be foreseen in the next ten years.
- Before submitting a grid connection application, all market participants are welcome visit Elering to conduct a preliminary connection analysis, after which the technical terms will be drawn up in cooperation between Elering and the connector.

3.1 2017 Investments and activities overview

Figure. 10 illustrates investments to the gas sector in 2017. A more detailed overview of 2017 investments and activities by area can be found below the figure.

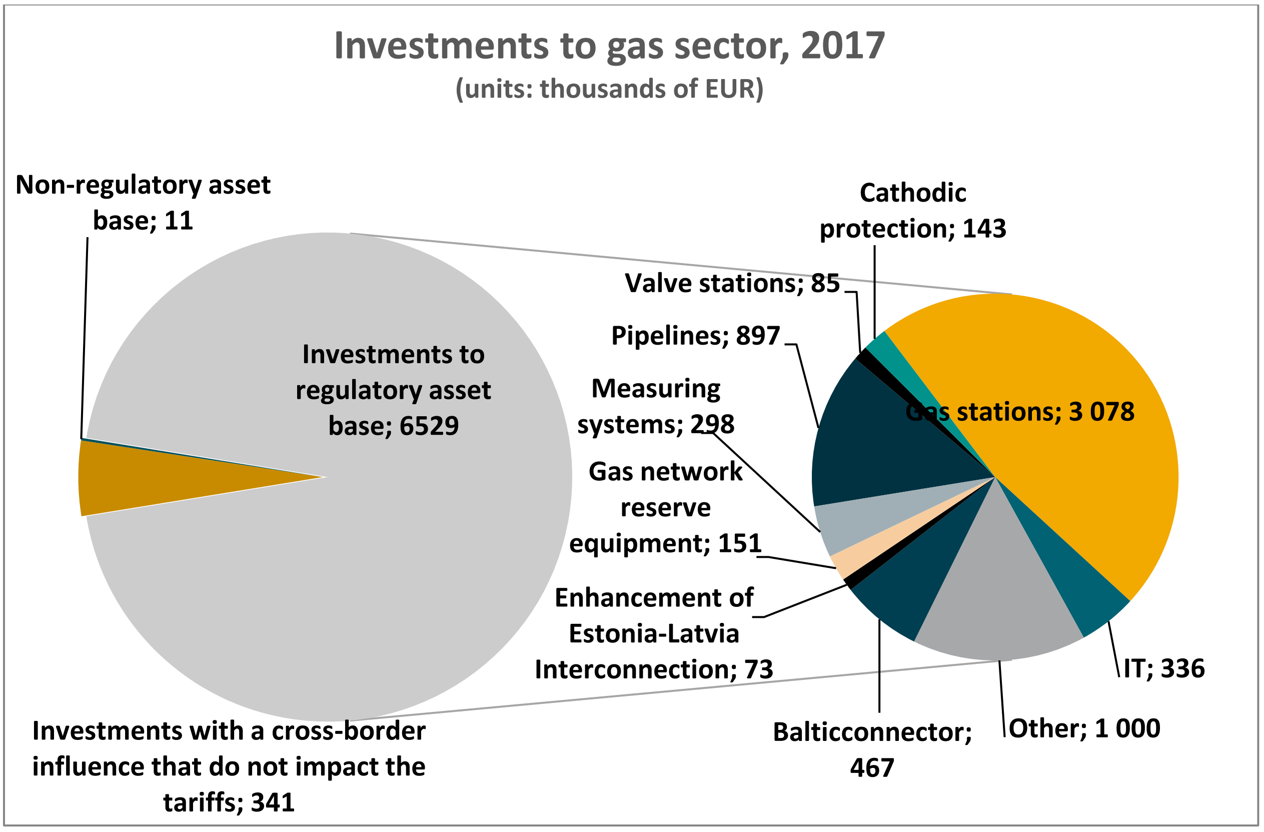


Figure. 10 Investments to gas sector in 2017. Units: thousands of euros

Examinations of the pipes after diagnostic tests and shaft examinations in the following sections:

- Karksi GMS–Õisu LVS
- Viljandi LVS–Puiatu 1 LVS
- Navesti LVS–Kalmaru LVS
- Rapla LVS–Kohila LVS
- Kalmaru LVS–Lokuta LVS
- Lokuta LVS–Rapla LVS

Replacing pipeline sections in the following sections:

- Russian border on Piusa river–Värska GMS
- Värska LVS-Veriora LVS
- Saadjärve LVS-Palamuse LVS
- Palamuse LVS-Jõgeva LVS
- Rakke LVS-Väike-Maarja LVS
- M. Härma LVS-Vedu LVS
- Ühendussõlme LVS-Loo LVS
- Vedu LVS-Saadjärve LVS
- Tallinn-Jõhvi
- Pandivere LVS-Lihulõpe LVS

Installing/repairing load-bearing and protection structures in the following sections:

- Tartu-Räpina-Värska — pipe in contact with the casing
- Lepna — pipe in contact with the casing
- Ilmandu — pipe in contact with the casing

Repairing corrosion defects with repair collars in the following sections:

- M. Härma LVS-Vedu LVS
- Väike-Maarja LVS-Pandivere LVS

Reinsulating in the following sections:

- Karksi GMS–Õisu LVS

Valve assembly works:

- Loobu LVS renovation
- Karla BVS — new fence
- Salla LVS — building a new plug pipeline
- Lihulõpe RS, SLS — building a fence and restoring the isolation
- Kunda BVS — building a new plug pipeline

Cathodic protection works:

- New anode grounding for the Kunda river cathodic station
- New anode grounding and cable for the Lagedi cathodic station
- New anode cable for the Lokuta cathodic station
- Installing alternating current filters in the Kalmaru cathodic station
- Installing alternating current filters in the Pärnu cathodic station
- Replacing Eidapere cathodic station cathode transformers with remotely controlled devices
- Replacing Võidula cathodic station cathode transformers with remotely controlled devices
- Replacing Härgla cathodic station cathode transformers with remotely controlled devices

- Replacing Valtu cathodic station cathode transformers with remotely controlled devices
- Replacing Lokuta cathodic station cathode transformers with remotely controlled devices

Gas stations:

- Renovating the Värska gas metering station
- Loo GDS — replacing four fast engaging valves and valves at the end of the line
- Replacing Kunda GDS boilers and the gas heating control system
- Reconstructing the Järvakandi GDS main distribution centre
- Replacing the Kunda GDS backup electric generator
- Tartu GDS odoriser
- Installing the Sillamäe GDS boilers and the gas heating control system
- Ensuring the electric installation of Loo GDS meets the required standards
- Construction the Ahja BVS/LVS and its remote control
- Replacing the Sillamäe GDS backup electric generator
- Replacing Rakvere GDS boilers and gas heating control system

Replacing the metering systems in the following GDSs.

- Rakke GDS, Aseri GDS, Jõgeva GDS, Järvakandi GDS, Karla GDS, Kiviõli GDS, Kohila GDS, M. Härma GDS, Misso GDS, Narva GDS, Nitrofert GDS, Palamuse GDS, Rapla GDS, Saadjärve GDS, Saku GDS, Sindi GDS, Tartu GDS, Viru GDS, Vändra GDS, Ahja GDS, Kohtla-Järve GDS, Vedu GDS

Investments to IT:

- Investments to hardware
- Gas system consumption forecast application
- MS Dynamics NAV development
- IHS Information system development
- Remote control of data communications systems
- Developing the information system of biogas certificates of origin

Balticconnector project:

- Conducting different studies
- Activities related to Kiili-Paldiski pipeline section
- Activities related to Paldiski compressor station (CS) and GMS

Enhancement of Estonia-Latvia Interconnection

- Activities related to Puiatu compressor station (CS)
- Activities related to Karksi GMS
- Activities related to border LVS (Lilli)

3.2 2018—2022 investments overview

The below figure shows planned investments to gas transmission network for 2018—2022. It can be seen from the figure that the majority of investments for 2018—2020 are composed of the Balticconnector project (discussed further in chapter 3.3) and Enhancement of Estonia-Latvia interconnection project (discussed further in chapter 3.3), which will be completed by 2020. The aforementioned large-scale projects will increase the regional security of supply and create a positive environment for the development of the gas market. In addition to large-scale projects, regular investments have been budgeted for to renew the gas network to increase its reliability and ensure the consumers security of supply (internal diagnostics of the pipes, replacing sections of the pipeline, isolating the pipelines, valve stations, gas stations, etc.). Investments made to increase the reliability of the gas network are further discussed in chapter 3.4.

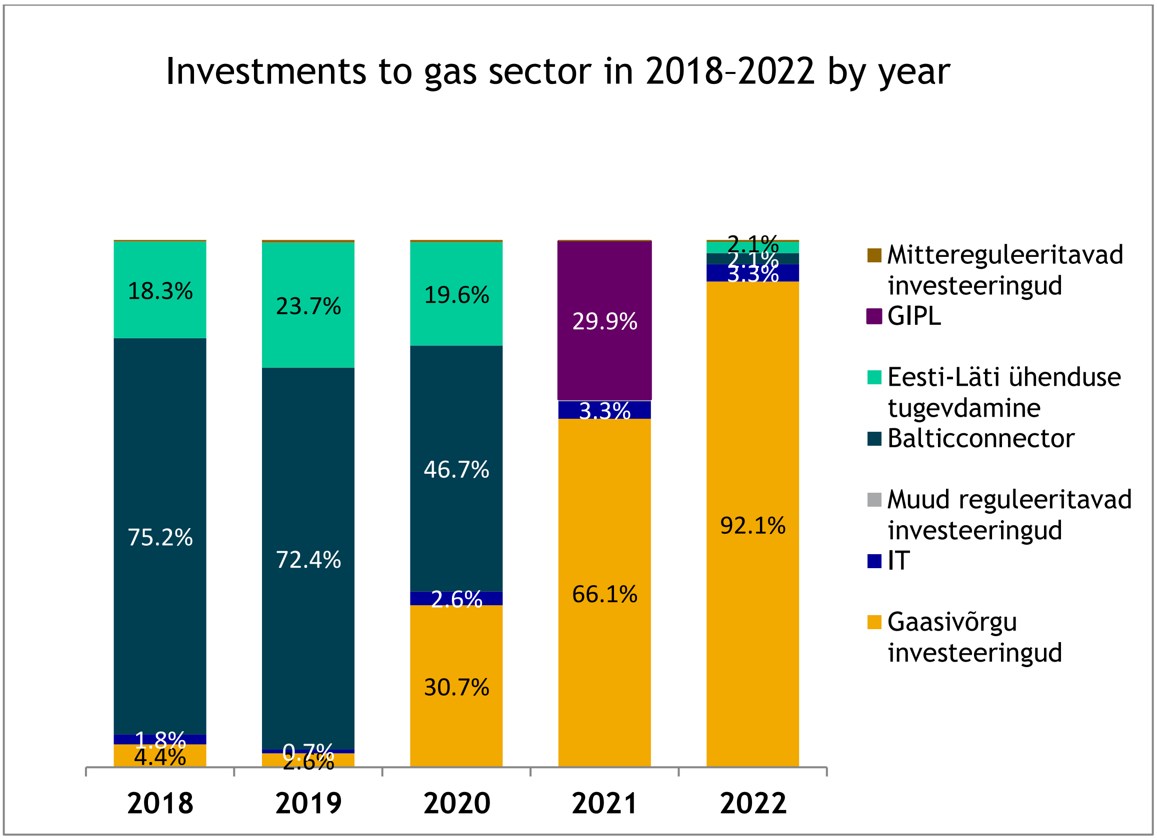
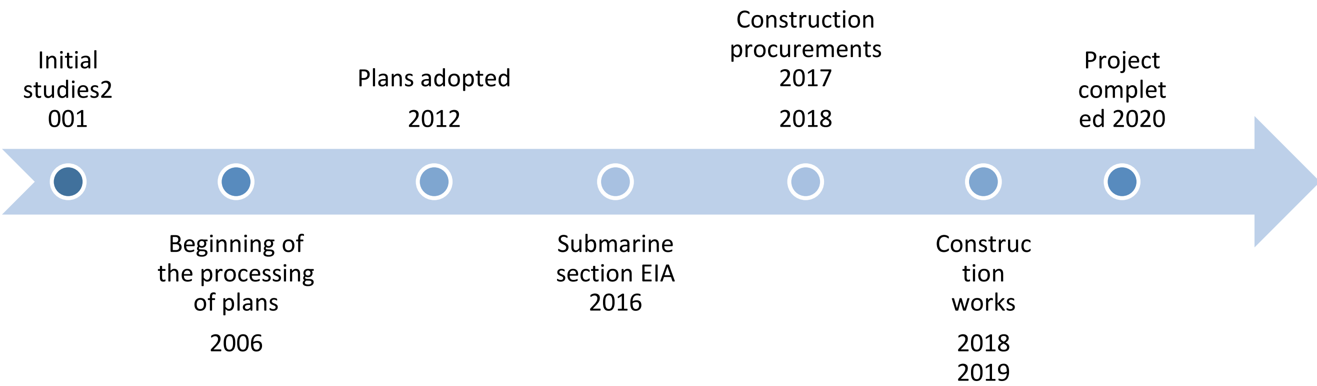


Figure 11. Investments to gas sector in 2018–2022 by year

On the figure: mittereguleeritavad investeeringud - investments to non-regulatory asset base; GIPL - GIPL; Eesti-Läti ühenduse tugevdamine - enhancement of Estonia-Latvia interconnection; IT - IT; gaasivõrgu investeeringud - investments to the gas network

3.3 Balticconnector and enhancement of Estonia-Latvia interconnection



The Balticconnector project, which will connect the gas transmission networks of Estonia and Finland, and the Enhancement of Estonia-Latvia Interconnection project, which will strengthen the gas transmission capacities of Estonia and Latvia, are undisputed priorities among investments in the Estonian gas transmission network. The projects are technically interconnected and only form a complete cluster enabling achieving the desired transmission capacities and integration of the markets if they are co-implemented.

The Balticconnector project is being jointly developed by Elering AS, the Estonian transmission network operator, and Baltic Connector Oy, a Finnish state-owned company. Both developers of the project are aiming to complete the project in accordance with the public statement by the Prime Ministers of Estonia and Finland of 24 November 2014 and the grant agreement entered into with the European Commission on 21 October 2016, which foresees completion of the construction of the Balticconnector by 2020.

The Enhancement of Estonia-Latvia Interconnection project is developed by Elering AS. In accordance with the grant agreement entered into with the European Commission, the project completion date is in 2019.

Both projects in the project cluster have been declared projects of Europe-wide importance and are included in the Projects of Common Interest list (PCI list) — the Balticconnector is project number 8.1.1 and Enhancement of Estonia-Latvia Interconnection is project number 8.2.2 in the PCI list.

The aim of the Balticconnector and Enhancement of Estonia-Latvia Interconnection project cluster is to connect the transmission networks of the Baltic states and Finland and thereby create the preconditions for establishing a unified gas market of the Baltic countries and Finland. After investments have been made, the regional security of supply will improve and a positive environment will be created for the development of the regional gas market. After the completion of the Gas Interconnection of Poland–Lithuania (GIPL), the Baltic states and Finland will be integrated into the unified European gas transmission network. The higher regional market volume will create the preconditions for additional delivery chains in the form of a regional LNG terminal, which will also ensure the Russian influence on gas supply will decrease. The Balticconnector and Enhancement of Estonia–Latvia Interconnection will also provide Finland access to the Inčulkans gas reserve and enable optimising investments to reconstruct Estonian and Finnish transmission networks.

In the spring of 2015, The European Committee and developers of the Balticconnector Project entered into a grant agreement for funding the studies required for the construction works from the Connecting Europe Fund (CEF) in the extent of 5.4 million euros. The purpose of the studies is to prepare the design works and permits to begin the works.

In October 2016, the European Committee and developers of the Balticconnector project, Elering AS and Baltic Connector Oy, entered into a grant agreement to cover the capital costs of the project in the extent of 187.5 million euros or 75% from the Connecting Europe Fund (CEF).

In December 2016, the European Commission and Elering AS, the developer of the Enhancement of Estonia-Latvia Interconnection project, entered into a funding contract to cover the capital costs of the project in the extent of 18.6 million euros or 50% from the Connecting Europe Fund (CEF).

All Balticconnector project cluster construction procurements were started in Estonia and Finland in 2017.

3.3.1 Technical parameters

Balticconnector project consists of:

- Inkoo–Paldiski 77 km submarine pipelines in the Gulf of Finland, DN500, 80 barg
- Siuntio–Inkoo 20 km land pipelines in Finland, DN500, 80 barg
- Kiili–Paldiski 55 km land pipelines in Estonia, DN700, 54 barg
- Kiili gas pressure regulation station
- Inkoo natural gas metering station + compressor station (Finland)

- Paldiski natural gas metering station + compressor station

Enhancement of Estonia-Latvia Interconnection project consists of:

- Karksi (bidirectional) natural gas metering station
- Lilli line valve station
- Puiatu compressor station

Submarine pipelines
The submarine pipelines of the Balticconnector consist of a bidirectional submarine gas transmission pipeline from Inkoo to Paldiski with a length of approximately 77 km, approximately 40 km of which is in the Estonian economic area. The planned transmission capacity of the pipeline is 81.2 GWh/day. The nominal diameter of the submarine pipeline is DN500 (wall thickness 15.9 mm) and the maximum designed operating pressure is 80 barg. To ensure the required anchoring to the bottom of the sea, the pipelines are covered with a 60 mm layer of concrete. Based on the conducted risk analyses, the transmission pipelines are additionally covered with stones on the sea floor in the coastal areas.

The environmental impact assessment of the submarine pipelines has been approved, the project has been drafted, and the procurement process was started in 2017 for all agreements. Permits for the special use of water to construct a pipeline have been issued in Finland and Estonia.

Land pipelines

1. Kiili–Paldiski

The Kiili–Paldiski transmission pipelines are part of the Balticconnector project. The transmission pipelines run through the parishes of Kiili, Saku, Saue, and Keila and through the towns of Keila and Paldiski. The route of the pipeline was selected when processing the comprehensive and thematic plans. The proceedings of strategic environmental assessment (SEA) of the route of the pipeline have been conducted.

- The length of the pipeline is approximately 55 km
- The nominal diameter of the pipeline is DN700
- The maximum designed operating pressure of the pipeline is 54 barg.
- The planned line valve station near Keila and the Kiili pressure reduction station are integral parts of the land pipeline section.

2. Inkoo-Siuntio

The Inkoo–Siuntio transmission pipelines, located in Finland, are part of the Balticconnector project. The route of the pipeline was determined in the course of preparing the detailed plan for the Finngulf LNG terminal. The proceedings of the SEA of the route of the pipeline have been conducted.

- The length of the pipeline is about 20 km.
- The nominal diameter of the pipeline is DN500.
- The maximum designed operating pressure of the pipeline is 80 barg.

Compressor stations

The Paldiski and Inkoo compressor stations must ensure sufficient transmission capacity for the submarine Inkoo–Paldiski pipeline of the Balticconnector. Puiatu compressor station must ensure sufficient transmission capacity between Estonian (including Finnish) transmission network and Latvian (including Lithuanian/Polish) transmission network.

Paldiski compressor station

- Capacity consumed by the compressor station is 6—10 MW.
- The transmission capacity of the compressor station is 81.2 GWh/day.
- The detailed plan of the compressor station was approved on 20 October 2014.

Inkoo compressor station

- Capacity consumed by the compressor station is 6—10 MW.
- The transmission capacity of the compressor station is 81.2 GWh/day.

Puiatu compressor station

- Capacity consumed by the compressor station is 6—10 MW.
- The transmission capacity of the compressor station is 105 GWh/day.
- The detailed plan of the compressor station was approved on 3 May 2016.

Gas metering stations

The Balticconnector project includes gas consumption metering stations in Paldiski and Inkoo. The aforementioned stations will be bidirectional and make it possible to measure movement of gas flows between the gas networks of Estonia and Finland (from Estonia to Finland and vice versa).
The Enhancement of Estonia-Latvia Interconnection project includes a gas metering station in Karksi. The station will be bidirectional and make it possible to measure movement of gas flows between the gas networks of Estonia and Latvia (from Latvia to Estonia and vice versa).

1. Paldiski GMS — throughput capacity 81.2 GWh/day
2. Inkoo GMS — throughput capacity 81.2 GWh/day
3. Karksi GMS — throughput capacity 105 GWh/day

Transmission capacity
A bidirectional submarine gas transmission pipeline between Estonia and Finland with a transmission capacity of 81.2 GWh/day.

Cost of Balticconnector project components:

- Inkoo–Paldiski 77 km submarine pipeline, DN500, 80 barg — approx. 120 million euros
- Siuntio–Inkoo 20 km land pipelines, DN500, 80 barg — approx. 20 million euros
- Paldiski-Kiili 55 km land pipelines, DN 700, 54 barg — approx. 30 million euros
- Inkoo natural gas metering station + compressor station — approx. 40 million euros
- Paldiski natural gas metering station + compressor station — approx. 40 million euros

Based on the current estimations, the total cost of the Balticconnector project will amount to approximately 250 million euros; however, a more accurate price will be determined after all the studies have been conducted.

Cost of Enhancement of Estonia-Latvia interconnection project components:

- Puiatu compressor station — approx. 30 million euros
- Karksi natural gas metering station — approx. 5.8 million euros
- Lilli line valve station — approx. 0.6 million euros

The total cost of the Balticconnector cluster will amount to approximately **285** million euros.

3.3.2 Status of the project

The projects in the Balticconnector cluster are in different stages of development.

Submarine pipelines

The operational design for the submarine pipeline and the environmental impact assessment of the pipeline in the territorial waters of Estonia have been completed. The procurement process for the materials of the submarine pipeline has been successfully completed and the installation agreements are planned to be signed in Q1/2018.

Kiili-Paldiski pipeline

The route of the Kiili-Paldiski pipeline has been determined by four thematic plans and two comprehensive plans. The pipeline construction tender was announced in 2017 and is planned to be signed in Q2/2018.

Inkoo-Siuntio pipeline

The route of the Inkoo–Siuntio pipeline was selected when planning the Finngulf LNG terminal and necessary environmental impact assessments have been conducted. All construction procurements necessary to construct the pipeline have been announced.

Paldiski compressor station

Paldiski compressor station detailed plan has been approved. The compressor station construction procurement was announced in 2017 and is planned to be signed in Q2/2018.

Puiatu compressor station

Puiatu compressor station detailed plan has been approved. The compressor station construction tender was announced in 2017 and is planned to be signed in Q2/2018.

Inkoo compressor station

Inkoo compressor station plan has been approved and construction procurement announced.

Karksi natural gas metering station

Karksi natural gas metering station construction procurement has been announced. The planned completion time of Lilli line valve station is August 2019.

Lilli line valve station

Lilli line valve station construction procurement has been announced. The planned completion time for Lilli line valve station is August 2019.

3.3.3 Socio-economic impact of the Balticconnector cluster

Impact on security of supply and the gas market

The Balticconnector and the Enhancement of Estonia-Latvia Interconnection will integrate the gas markets of the Baltic states and Finland. Integration of the markets will be accompanied by several socio-economic benefits for Estonia and Finland as well as the entire region.

Investments in the infrastructure are, above all, beneficial for the security of supply. The Balticconnector and Enhancement of Estonia-Latvia interconnection will add a new supply channel to Estonia and this will increase the security of supply in case of technical problems. The projects would improve the Estonian N-1 criterion from 68.7% to 183.6%[7]. In accordance with the security of gas supply regulation (EU 994/2010), the required security of supply level should at least equal 100%. Balticconnector and Enhancement of Estonia-Latvia Interconnection will add a new source of supply to Finland. This means that the risks related to one source of gas supply, as well as the risks related to gas system failures will reduce. In the long run, the unified market would mean additional supply sources for Estonia, for example, in the form of a regional LNG terminal. In short, the potential damages to society due to gas supply interruptions will decrease, as there would be alternative supply channels.

Connecting the markets through infrastructure will be beneficial by market integration and increased competition. Firstly, the gas prices in the previously separated markets will level. For example, the gas prices have differed greatly in the past five years in Estonia and Finland, being lower in Finland. Balticconnector and regional gas market developments lay the groundwork for the price differences to decrease or disappear altogether. After the markets have been unified, the prices are expected to level and the price discrimination resulting from the situation of one gas supplier to decrease. This will lower the gas prices for the end consumer. There will also be more competing gas suppliers on the larger unified market. The import route diversification indicator (also known as the Herfindahl-Hirschman Index — HHI), which expresses the concentration of gas supply channels, is expected to drop from 4,400 to 3,600 in Estonia thanks to the projects[8]. In such conditions of tighter competition, the gas consumers will benefit from lower prices and better service quality.

In addition to the aforementioned benefits related to security of supply and integration of the market, several other benefits arising from the project can be highlighted. The large gas market formed after connecting the gas systems will make it possible to invest in the infrastructure in amounts that are not possible in a smaller market. The projects will provide both the Finnish and Estonian market participants with a chance to use the Inčuklans underground gas reserve for gas storage. There is great potential for biogas and biomethane production in the Baltic states and Finland. The role of biogas and biomethane in the transport sector is increasing all over Europe and it may become an export article. Connected gas systems will make it possible to sell balancing services across the border, which lowers the overall costs of the balancing services. Finally, implementing such projects will make it possible to postpone or decrease national investments to the Estonian as well as Finnish networks that would have otherwise been important for ensuring security of supply.

Conclusively, the benefits arising from implementing the projects are diverse and reach outside of the geographical borders of the countries where the projects are implemented.

The total costs of the investments in the Balticconnector and the Enhancement of Estonia-Latvia Interconnection projects amounts to 285 million euros. This is an extremely large-scale investment and cannot be made by merely taking into consideration the current gas consumption in Estonia and Finland and determining the transmission tariff. Due to the regional dimensions of the projects and their benefits outside of the countries of implementation, wider social distribution of the costs of

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[7] N-1 criterion formula is explained in the chapter 'Retrospective view on Security of Supply'. N-1 criterion calculated for Balticconnector and Enhancement of Estonia-Latvia Interconnection.

$$N-1[\%] = \frac{(1.2+3.4+10+7.7) \quad +0+0+0-10}{6.7} \times 100\% = 183.6\%$$

[8] HHI expresses the size of separate supply channels compared with the sum of the supply channels. Formula $HHI = \sum_i^N s_i^2$, where s denotes the supply channel proportion of the sum of supply channels in percentages. The maximum value for HHI is 10,000 (one supply channel).

the project would be reasonable. Thus, the leaders of the projects, Elering AS and Baltic Connector Oy, applied for co-funding of the projects from the Connecting Europe Facility (CEF). Due to the priority of the projects, their status in the Projects of Common Interest list of the European Union and the region-wide benefits, the leaders of the project applied for co-funding in the maximum possible extent of 75%. The European Commission agrees that the projects are of regional significance and co-funds the projects in the extent of 72% of the total costs of the investments. This is the highest percentage of co-funding from the Connecting Europe Facility among all projects that have applied for support so far.

Impact on gas transmission tariffs

Although European co-funding percentage is high, the projects will nevertheless impact the transmission tariffs. The gas network, which is operated by Elering and used as the basis for the transmission tariffs calculations, is currently worth 50 million euros. Thanks to the European Union support, Elering i.e. the Estonian gas consumer has to contribute in the construction of the Balticconnector only 50 million euros of the total amount of nearly 300 million euros. It is clear that as a result of the investment, the value of the gas network will rise and thus the transmission tariffs will increase. The cost of the Balticconnector and Enhancement of Estonia-Latvia Interconnection projects will be added to the transmission tariffs gradually as the connection is finished.

The transmission tariffs are impacted by increased operational costs due to new pipelines and other components being added to the gas network. When the projects are completed, Elering will operate additional 55 km of land pipelines, 38.5 km of submarine pipelines, two compressor stations, one new gas metering station, and one gas pressure regulation station. All new additional gas network components increase the operating costs to ensure the reliability of the gas system, allow the regional gas market to function and guarantee security of supply for the consumers.

Considering that the transmission tariffs make up a small percentage of the natural gas final price, the increase of transmission tariffs is a barely noticeable change for the end consumer. Furthermore, as the investments connect the Baltic and Finnish gas systems and create a positive environment for the regional gas market to develop, it is expected that the costs of the investments will pay off in the form of lower gas prices.

3.4 Reconstructions and renovations of the gas network

3.4.1 Potential developments of the Jõhvi-Narva Pipeline

Replacing the Jõhvi–Narva pipeline section mentioned in the 2017 gas network development plan in 2022—2026 is no longer relevant due to the following reasons:

1. The external inspections of the Jõhvi–Narva have shown that the pipeline is in a good condition. The main reason for replacement was the age of the pipeline — 63 years.

2. It is planned to conduct a socio-economical study of the Jõhvi-Narva pipeline to determine the outlooks of the pipeline and its actual necessary throughput capacity.

3. Developments regarding the renovation of the Russian gas pipelines are unclear and therefore, the possible working pressure at the border point on the Narva river.

There are diagnostic activities planned to be performed to assess the technical condition of the Tallinn–Jõhvi pipeline during 2019—2022. Diagnostic tests will be performed in two stages: Haljala-Jõhvi and Haljala–Tallinn. In order to perform diagnostic tests on the Haljala-Tallinn pipeline, it is necessary to replace a section of the pipeline in the lower section of the Loobu river and construct a receiving chamber in the Ühendussõlme valve station.

3.4.2 Other Investments in/Reconstructions of the Transmission Network

The following section describes the general principles of gas network reconstruction and renovation and gives an overview of the planned activities to increase the reliability of the gas network during 2018—2022. The following activities have been planned: replacing pipeline sections where diagnostic tests have detected defects (corrosion, cracks), renovating the motorway crossings, reinsulating pipeline sections, strengthening the welded connections with repair collars, reconstruction worn down gas stations, partial replacing of gas station equipment — odorizes, back-up electric generator systems, automatic control systems of devices, gas heating devices, and valves.

In 2017, necessary repair works were performed in accordance with an approved investment plan in the Izborsk-Tartu and Tartu-Rakvere pipelines and renovation works in the Värska GMS based on the principle that above-mentioned inlet station and pipelines of the Estonian gas network would be in working order and there was no need to perform any activities that call for the gas supply to be interrupted during 2018—2019 when the Vireši-Tallinn pipeline is being prepared to become part of the Balticconnector. Repair works performed in the Vireši-Tallinn pipeline section are described below.

3.4.2.1 Pipelines

Internal diagnostic tests of the pipelines and examinations of the condition

Internal diagnostic tests of the pipelines are the only solution for comprehensive assessment of the condition of the underground pipelines. Diagnostic tests are used to detect any damages or defects to the pipelines and the required repair works are performed based on the examination results an may include replacing or reinsulating sections of the pipeline or installing repair collars. The schedule of the works is divided by years until the next planned diagnostic tests. The works are distributed based on the principle that larger-scale works and/or elimination of the defects limiting the operating pressure of the pipeline are performed during the first year and followed by works of lower importance. All defects and shortcomings that prevent the pipeline from working at maximum operating pressures (MOP) with necessary strength reserves must be eliminated (necessary strength reserve means that if the pipeline can operate at pressures up to 54 barg, the defect cannot be below that line or equal to it). Internal diagnostic tests of the pipeline are planned with the interval of 5—7 years for all transmission pipelines, as this will ensure sufficient risk assessment and analyses (the assessment and analysis of the risks is done using the Pipeline Integrity Management System (PIMS) programme). Defects of and mechanical damages to the welds (dents in the pipe, scrapes, etc.) must be examined prior to conducting the works — control excavations (shafts) with control measurements and x-ray examination of the welds.

Pipeline diagnostic testing programme has been composed proactively for ten years (2018—2027) and includes two subsequent diagnostic tests and necessary activities between them.

Internal diagnostic tests of the pipelines and condition surveys planned for 2018—2022:

Table 3. Internal diagnostics of the pipelines and condition surveys planned for 2018–2022

Diagnostic tests	2018	2019	2020	2021	2022	2023	2024	2025	2026
Vändra-Pärnu									
Vireži-Tallinn									
Izborsk-Tartu-Rakvere									
Halajala-Jõhvi									
Haljala-Tallinn									
Pihkva-Riga I									
Pihkva-Riga II									

Replacing sections of the pipeline

The 2018—2022 investment plan includes repair works related to replacing sections of the pipeline. Some sections of the Vireši–Tallinn pipeline are to be replaced in 2018 and 2019 based on the results of the defect examinations (diagnostic tests + shafts). If the weld defect turns out to be too dangerous for installing a repair collar or if there are defects on the welded pipe, it is economically more reasonable to replace the pipe and the weld than to perform different repair works. According to diagnostic tests performed in 2012, some pipes have internal surface defects that cannot be sufficiently assessed with external measurements and would therefore require the pipe to be replaced. After the section of the pipe with internal defects has been cut out, it can be used to examine the nature of the defect and make generalisations about similar defects.

For other pipelines, the proposed volumes are estimations. This means that the diagnostic tests will be performed during the validity of the investment plan and based on previous experience from conducting diagnostic tests, the need for renovations can be presumed. The estimated amounts are based on previous experience.

Eliminating a defect qualifies as replacing a section of the pipeline if:

- The defect might impact the operating pressure or pose a health hazard due to the state of the metal.
- The pipe needs to be repaired with more than three composite material repair collars (if more than three collars are needed, the cost of the repair works exceeds the cost of replacing the pipe – however, the pipe would still be repaired with collars if gas cannot be expelled to replace the section of the pipe or it was too expensive).

Load-bearing and protection structures

Renovating the load-bearing and protection structures will eliminate the risk of damages to the pipeline at crossing points with roads, railways, and rivers and ensure more efficient functioning of the cathodic protection and lower corrosion of the pipeline. At the aforementioned crossings, the gas pipeline is installed either in a casing or on supports (protection and load-bearing structures). By performing the works, it is necessary to ensure electrical insulation of the gas pipeline with respect to the structures and prevent deformation of the pipeline due to sinking support structures.

The casing can usually be renovated only when a new pipe is installed in the casing with clamps protecting the insulation and required measuring contacts and airing pipes are installed in the casing.

Repairing defects with repair collars

Repairing defects with repair collars is important, as this allows rehabilitating the local damages (corrosion, smaller dents, etc.) of the gas pipeline. Composite material collars are installed on defects that prevent the pipeline from working at maximum operating pressures or pose a threat to the integrity of the pipe at concentrated loads. Installing composite material collars will increase the reliability and working life of the entire pipeline section. When installing the collars, it is also possible to inspect and isolate the entire repaired pipeline — after that, the pipe is updated in the system. The advantage over replacing the section of the pipe lies in the fact that the collars can be installed without interrupting the gas deliveries and practically all year round by creating the required conditions at the site. However, if more than three repair collars must be installed on one pipe, the technical and economic aspects are reviewed and a choice is made between installing the collars and replacing the pipe. If a section of a pipeline between the valve assemblies must be switched off (relieved from gas pressure) during the same year based on the schedule of conducting the works, repairing the defective section of the pipeline by replacing the pipe is preferred.

The 2018—2022 investment plan includes installing welded steel repair collars under the plan to install repair collars. This is planned to be performed mainly to strengthen the welds of the Vireši-Tallinn pipeline as well as other pipelines if it is necessary to increase safety and the conditions of the pipes connected with the welds is good.

Data regarding the need to perform the work has been gathered when performing diagnostic tests. Before deciding to perform the works, it is important to examine the weld with x-ray and the feasibility of the works from the viewpoint of safety. It is possible to perform the work without interrupting the gas supply; however, it is mandatory to lower the gas pressure — recommended pressure is no more than 20 barg.

Reinsulating

Reinsulating pipeline sections is required because the insulation installed at the factory or when the pipeline was constructed has been damaged due to various reasons — above all due to tree roots and rocks shifting in the ground — and cannot guarantee that the metal of the pipes is protected from corrosion. Timely replacement of the insulation of the pipes will significantly increase the resistance of the pipeline to failures, lower the expenditure on renovation works (installing repair collars, replacing sections of the pipeline), and will thereby reduce the interruptions in the gas supply. It is necessary to reinsulate defects that do not prevent the pipeline from working at maximum operating pressures but are close to it.

Renovating valve assemblies

Renovating the valve assemblies is required to ensure the reliability and safety of the gas network. Valves with controllable drives ensure that the gas network is switched in a timely manner and closed in case of an emergency, if necessary.

Renovation principles:

- In valve stations where old valves are no longer reliable and spindles and other parts may start leaking in a way that cannot be stopped, the old and worn out valves are replaced with new remotely controlled valves (or valves that are ready to be remotely controlled).
- Reconstructing valves that are ready to be remotely controlled – arranging electric connections, installing actuators to valve reductors (altogether drives), and installing automatic control systems. Line valves, branch valves, and gas station protection valves will be reconstructed to be remotely controlled.

The valve renovation programme puts a lot of focus on remote control, which will reduce the need to use workers to drive on site for switching and will reduce the economic losses in the event that the pipe breaks due to the ability to quickly close the valves to limit the amount of gas exiting the pipeline.

Valves planned to be renovated or constructed:

- Luhama line valve station — the last gas line valve station at the European Union border — is planned to be completely reconstructed. The equipment has worn down and the valve assembly is located on only one DN700 pipe. The existing valve assembly needs to be completely reconstructed and a new separate valve assembly has to be constructed on a different DN700 line 10 m further away.
- Sudiste line valve station — it is planned to construct a new line valve station in the Vireši-Tallinn pipeline on the premises of the Karksi branch valve station, which will be demolished. The property is located near the Karksi-Sudiste road and has good access and presumably electric connections. The need for a line valve station is great, as according to the signal received from the gas chromatography, to prevent low quality gas entering the rest of the system, the Karksi GMS and the closest line valve must be closed. Low quality gas

must be eliminated from the system via purge plugs and therefore, the valve station must be as close to the GMS as possible but no closer than what is needed to close the valves, considering the speed the gas moves at (suitable distance 4—7 km). The closest valve to Karksi GMS is the Õisu LVS 20.8 km away. Unfortunately, Õisu LVS has old manual valves and when the need to eject gas into the atmosphere arises, the residents are problematically close (noise, air pollution).

Renovating the cathodic protection

The cable line connecting the cathode transformer and the grounding anode field in the cathode protection system is an important part of the functioning of the system. The cable works under a heavy load and wears down. Timely replacement of the cable increases the lifespan of the cathode transformer and the grounding field and decreases the expenditure on energy consumption. Grounding fields belong in the cathodic protection system, which are sensitive to wear and tear, and the investment plan prescribes replacing the grounding fields based on the time they are worn down — this means that the anode disintegrates completely in the course of use (depending on the type of anode, the lifespan in 10—15 years).

The plan also includes making the cathode stations remotely controllable, which would significantly increase the efficiency of the cathode protection through the possibility of timely reaction and reduce the need for driving to the site to adjust the system. The biggest benefit arises from the remotely controlled cathodic stations, which guarantee the right protection potential at any given time and therefore, the need for repairs due to corrosion is smaller. Readings from the remotely controlled stations can also be highly useful when assessing the integrity of the pipeline and therefore, when to perform the necessary repair works. Abrupt change in the readings may also indicate the cathodic stations cable has been damaged or the insulation has been tampered with by third parties, and this makes it possible to react in a timely manner.

3.4.2.2 Deciding upon the method of repairs

The decision as to which repair method to use (reinsulating, repairing with composite collars, replacing the pipe) is taken by the working group. The work group consists of a gas technology specialist, pipeline specialist, and a gas network operation specialist.

The decision is based upon the following:

- Processing the diagnostic data with corresponding software
- Processing the data of the pipeline in a programme (e.g., PIMS) — the age of the pipeline, the quality of the metal, the type on insulation, the impacts of the location (surface), etc.
- Defects discovered in crossings
- Measurements performed in the pipeline (insulation, effect of the cathodic protection)
- Data received from the shafts

3.4.2.3 Gas stations

Gas station equipment

The control and protection devices on the lines of the gas stations and the auxiliary devices servicing the lines must work reliably to ensure output parameters required by the network agreements, cut-off reliability, and safety but also switching off a failed line and leaving on the reserve line in case of a failure and therefore, the investment plan includes replacing the following worn down devices.

- Updating and modernising the control and protection devices of the lines
- Replacing boiler equipment (the lifespan of gas heating devices is usually 15 years)
- Replacing the control systems of the heating systems of the lines

- Replacing odourisers – worn down devices are replaced with remotely monitored devices
- Replacing back-up electric generators – diesel generators at the end of their lifespan are replaced with gas-powered generators (independent of fuel supply and refilling)
- Bringing the distribution centres of electric systems into conformity
- Modernising the telematic systems

Renovating gas stations

The investment plan includes renovating seven gas distribution stations (GDS) that have not been renovated – without renovating the GDSs, it is not possible to sustainably guarantee necessary operating parameters at the connection points.

Renovating the GDSs with wear down equipment (predominantly of Russian origin) have been scheduled in the investment plan for 2018–2022 as follows:

2018 – Aseri GDS and Ahja GDS
2019 – Veriora GMS
2020 – Veriora GMS
2021 – Misso GDS/GMS
2022 – M. Härma and Nitrofert GMS partial renovation

The renovation prices for the GDSs are based on minimal technological solution – optimal standard solutions have been prepared.

3.4.2.4 Reserve equipment

A list of reserve equipment and materials that have long delivery times but are required for quick elimination of failures has been compiled for unforeseeable events in the gas network. Important reserve equipment (valves, regulators) have been acquired by the end of 2017. Additional supply of pipes and mounting fittings will be purchased in 2018. The need for purchasing new reserves will be lower for the next years – the need will only arise once the emergency supplies have been used up, i.e. when the consequences of the emergency have been dealt with.

3.4.2.5 Control measurement devices

By the end of 2017, two new pipeline positioning devices were purchased that provide better accuracy of measurement and transmit the GPS coordinates of where the measurements are taken to the GIS programme. The budget for 2018 includes two more similar positioning devices, and after that, the gas network will be equipped with necessary operational devices. The devices will wear down with use in 6–10 years and the following purchases will be due to wear and tear.

3.5 Connections to the transmission network

The grid connection terms and conditions of Elering AS entered into force on 1 January 2017. The calculation methodology for changing connection fees, consumption fees and production conditions (hereinafter methodology) entered into force at the same time as the connection terms and conditions. Methodology has been approved by the Estonian Competition Authority. Connection terms and conditions and methodology can be seen on Elering's website https://elering.ee/ulekandevorguga-liitumine.

There were no standard terms and conditions regulating the gas connection so far. Establishing connection terms and conditions makes the connection process smoother, lays out technical requirements and proceedings, ensure everyone is treated equally during the proceedings, and makes the process transparent. Connection terms and conditions determine the connection process and the technical and procedural requirements.

Connection terms and conditions cover consumer and producer connections The latter have shown an increasing interest to connect to Elering's gas transmission network year after year. One of the main investment projects of Elering, the Balticconnector, which will be completed by 2020, will also make the gas market more active and promote new connections.

Connecting to the gas transmission network is possible for consumers with B, C, and D category gas installations (i.e., gas installations over 0.1 bar), when technically possible. Only producers with D category gas installations (all producers whose inlet stations are over 16 bar) can connect to the network. The connection terms and conditions include five technical solutions for consumers and one technical solution for producers.

The customer must pay all actual reasonable costs related to connection, including the processing fee of sending out the connection offer composed based on the connection application and signing the agreement and the operational fees of activities performed after signing the connection agreement, including opening the flow of gas.

In 2017, Elering received and signed one connection application from a consumer and received one connection application from a producer. Currently, Elering is working on two connection agreements with consumers. Both connections are planned in Ida-Viru County. One connection agreement includes constructing a new gas distribution station by 2019 and the other installing a new measurement installation in an existing gas distribution station during 2018.

3.6 Biomethane

In accordance with the EU Renewable Energy Directive 2009/28/EC, Estonia is required to reach the target of 10% share of energy from renewable sources in transport in Community energy consumption by 2020. 2016, renewable sources in transport amounted to 0.4% of Estonian share of energy, being the lowest of all EU member states.[9] A total of over 9.1 TWh of transport fuels are used in Estonia[10], approximately two thirds of this is diesel fuel and the rest gasoline. The consumption of LPG and biofuels in the transport sector has remained marginal so far. In order to increase the amount of biofuels consumed in Estonia, the state has decided to develop biomethane production based on local raw materials and start using biomethane extensively in the transport sector.

According to the Estonian Development Fund, the biomethane generation potential of Estonia is estimated to amount to 4.7 TWh (= 450 million m^3)[11] of biomethane per year, with biomass from grasslands, agricultural production waste, as well as biodegradable waste from the industrial sector, landfill gas and municipal waste from wastewater treatment plants mainly used for raw material. Biomethane production would add a new local raw material based supply source to the gas market and open a new area in the transport sector with respect to gas consumption.

Developing the biomethane sector will help to diversify the energy consumption in Estonia and improve energy security. Renewable fuel use will also enable the transport and industrial sectors to decrease greenhouse gas emissions. The state has set a goal that by 2020, 4% of the gas in the gas network will be made up from biomethane, which would amount to approximately 20 million m^3 of biomethane per year. If the aforementioned amount of biomethane would be consumed in the transport sector, the biomethane would cover at least 2% of the fuels used in the transport sector. There was no biomethane produced in Estonia in 2017; however, two biomethane plants are planned to be launched in 2018.

Biomethane regulations and support measures

[9] Eurostat, 2016
[10] Eurostat, 2015
[11] Estonian Development Fund report — Eesti energiamajandus 2015

Certifying biomethane production with a certificate of origin is regulated by the Estonian Natural Gas Act (NGA). NGA set certain requirements for certificates of origin and requires the transmission system operator to create an electronic database for the administration of certificates of origin and publish information concerning the certificates of origin that have been issued on its website.[12] The quality conditions and the list of particulars to be shown on the certificate of origin of the gas inserted into the gas system has been established by the network code governing the operation of the gas market.[13]

In order to promote the production and consumption of biomethane, the supportive regulation *Biometaanituru arendamise toetamise toetuse kasutamise tingimused ja kord* was established on 13 September 2017[14]. In accordance with the regulation, the transmission system operator shall pay support to biomethane producers for proven supply from 1 January 2018 until 30 November 2020 or until the budget funds to support the activity have been used up. The support measure is funded with the revenue from the CO_2 quota sales. The amount of support depends on the proven usage of biomethane. If biomethane is used in the transport sector, the amount of support shall be 100 euros per MWh minus the average market price of the current month. If biomethane is used through the gas system for some other purpose (excluding transport), the amount of support shall be 93 euros per MWh minus the average market price of the current month. In order to offer biomethane producers investment security and give the sector a long-term direction of development, the Minister of Economic Affairs and Infrastructure has expressed the desire to obligate the gas sellers to supply biomethane in the amount of 4%, starting from when the support measure ends in 2021.[15]

In addition to support measures directed at biomethane producers, it is possible to apply for support from the Environmental Investment Centre to develop petrol stations that sell compressed natural gas and biomethane.[16] Support is given to projects that promote biomethane supply and fuelling in a public stand-alone or chain petrol station. In the first and second rounds, 15 petrol stations all over Estonia received support in the sum of 2.67 million euros (See Figure 12).

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[12] https://www.riigiteataja.ee/en/eli/ee/524072017015/consolide/current
[13] https://www.riigiteataja.ee/akt/129072017006
[14] https://www.riigiteataja.ee/akt/115092017009
[15] https://elering.ee/sites/default/files/attachments/Biometaani%20tegevuskava%2002-12-2016.pdf
[16] https://www.kik.ee/en/supported-activity/production-biomethane-and-promoting-its-use-transportation

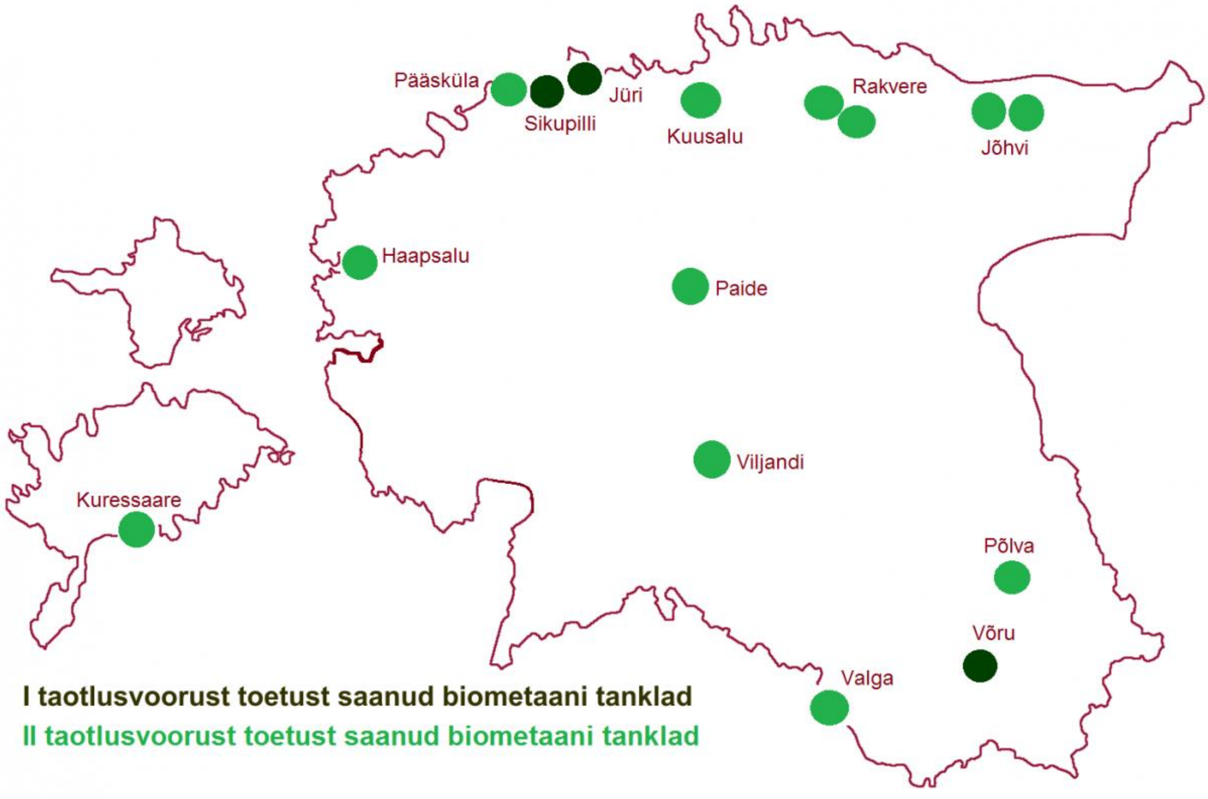

Figure 12. Petrol stations that have received support from the Environmental Investment Centre

On the figure: I taotlusvoorust toetust saanud biometaani tanklad — petrol stations that received funding in the first round of application; II taotlusvoorust toetust saanud biometaani tanklad — petrol stations that received funding in the second round of application

Elering's role

Elering AS and the Ministry of Economic Affairs and Communications signed a cooperation agreement in December 2017, in accordance with which, Elering will start managing the support payments and biomethane certificate of origin registry and will inform the market participants. The agreement is based on biomethane support regulation *Biometaanituru arendamise toetamise toetuse kasutamise tingimused ja kord* of September 2017.

Elering's goal is to promote biomethane production and consumption in Estonia every way possible. Elering as the owner of the main network and transmission system operator can help to transport the produced biomethane to the consumer and keep track of the produced biomethane. Elering's goals are to:

1. Create favourable conditions for connecting to the gas network and to advise producers in finding opportunities for connection.
2. Implement biomethane quality requirements and establish the capability to measure and monitoring the amounts and quality of the biomethane accepted to the network.
3. Enable petrol stations to quickly connect to existing and new gas lines.
4. Create and implement the certificate of origin system to prove the origin to the consumers in a way that includes keeping track of the biomethane produced by producer not connected with the network. Launching this system would help the state to keep track of consumed transport fuels of renewable sources.

5. Disburse support to biomethane producers according to deleted (consumed) certificates of origin.
6. Inform market participants and ensure biomethane related information is available to all market participants in accordance with the cooperation agreement signed by the Ministry of Economic Affairs and Communications and Elering.
7. Study the possibilities for transporting gas and accepting biomethane to the network from off-grid production stations.

3.7 Developments in the region

3.7.1 ENTSOG TYNDP 2017 main messages

ENTSOG TYNDP 2017

ENTSOG (European Network of Transmission System Operators for Gas) publishes a ten-year network development plan (TYNDP) every two years. The obligation to publish the development plan arises from Regulation No 715/2009 of the European Parliament and of the Council.

The purpose of the development plan is to provide an overview of the EU-wide gas network and gas consumption and to identify the required investments that would ensure sufficient cross-border capacities, help to establish the gas market and support its efficient functioning and ensure the security of supply of the Member States. The development plan also aims to provide an overview of the wider dynamics of the European gas market, taking into consideration the sources of gas supply, integration of the gas market, and the security of supply.

The ENTSOG TYNDP 2017[17] published at the beginning of the year concludes that the European gas infrastructure plays an important role in achieving the energy and climate goals of the European Union. By connecting the gas infrastructure to the infrastructures of electricity and heat, it is possible to decarbonise the energy system of the European Union in a cost-effective and feasible manner. The TYNDP 2017 concludes that the existing European Union-wide gas infrastructure is well connected and close to achieving its goal, which is enabling the functioning of the unified energy market. It also concludes that the existing gas infrastructure, taking into consideration the estimated gas consumption in the future, is capable of managing the daily gas supply even during very cold periods. Some European regions require new connections with one another as well as connections to access new gas sources. Most of the projects for the additional connections are included in the Projects of Common Interest list (PCI)[18] and will be completed in the next few years according to the plans.

3.7.2 Large-scale projects in the region

In addition to the Balticconnector project and the Enhancement of Estonia-Latvia Interconnection project, several other large-scale projects are being developed or have been recently completed in the region, which helps to increase the security of supply in the region and create competition in the gas market. It is planned to strengthen the connection between Latvia and Lithuania, to connect the Baltic and Finnish gas system to the European gas system (GIPL) and to modernise the Inčukalns natural gas reserve. In 2016, a new LNG terminal was launched in Poland, which provides an additional supply source for the region once the GIPL is completed. There are also three new LNG terminals of regional dimensions being developed in the region. Figure 13 gives an overview of the development projects in the region.

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[17] ENTSOG TYNDP 2017
https://www.entsog.eu/public/uploads/files/publications/TYNDP/2017/entsog_tyndp_2017_main_170428_web_xs.pdf
[18] Projects of Common Interest https://ec.europa.eu/energy/en/topics/infrastructure/projects-common-interest

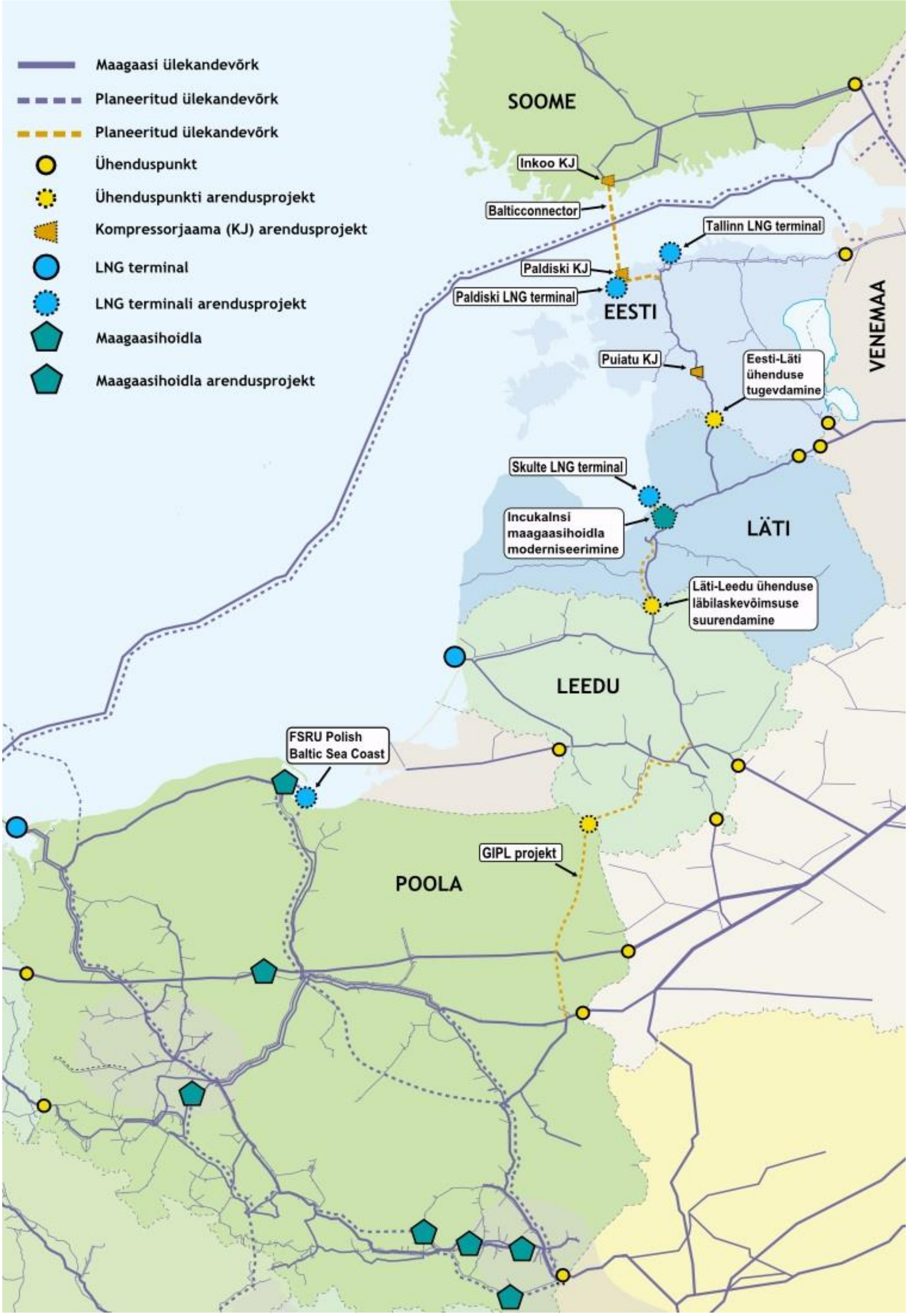

Figure 13. Large-scale projects developed in the region (source: ENTSOG)

Maagaasi ülekandevõrk – Natural gas transmission network

Planeeritud ülekandevõrk – Planned transmission network

Ühenduspunkt – Connection point

Ühenduspunkti arendusprojekt – Connection point's development project

Kompressorjaama arendusprojekt – Compressor station's development project

LNG terminal

Maagaasihoidla – Natural gas reserve

Maagaasihoidla arendusprojekt – Natural gas reserve's development project

Läti-Leedu ühenduse läbilaskevõime suurendamine – Increasing the throughput capacity of the Latvian-Lithuanian connection

Inčukalnsi maagaasihoidla moderniseerimine – Modernising the Inčukalns natural gas reserve

3.7.3 GIPL (Gas Interconnection Poland-Lithuania)

The GIPL is the gas pipeline between Lithuania and Poland, which will integrate the Baltic states and Finland (after the completion of the Balticconnector), which have remained isolated so far, with the unified European gas market. The GIPL provides an alternative supply source for the Baltic states and Finland and access to the global LNG market, which will also increase the security of supply of the Baltic and Finnish region. The GIPL will create the required conditions for competition in an open gas market, which increases the number of supply sources in the region to three (in addition to Russia and the Klaipeda LNG terminal). The GIPL will also enable the Polish market participants to use the Inčukalns natural gas reserve in Latvia, which increases the flexibility of the gas system. The initial planned completion deadline of the GIPL was 2019, but as the initial Polish gas route was changed, the new planned completion deadline is 2021.[3] According to the Polish project developer, the technical parameters will only change in Poland but remain the same in Lithuania.[19]

3.7.4 Increasing the throughput capacity of the connection between Latvia and Lithuania

The connection between Latvia and Lithuania may become the bottleneck of the open Baltic and Finnish gas market when connected to Europe. Increased throughput capacity on the border between Latvia and Lithuania would provide more flexibility to the gas system of the region. After the completion of the GIPL project, Latvia and Estonia would be able to import most of their gas from Europe. Increasing the throughput capacity would also benefit the market participants in Poland and Lithuania, as they would be able to make more extensive use of the Inčukalns natural gas reserve. According to the initial project, a new pipeline section will be built from Riga to the Lithuanian border, with a total length of 93 km, and the throughput capacity of the Kiemenai GMS in Lithuania will be increased. The estimated completion date of the project is 2020. Other solutions are being considered, for example, increasing the pressure in the existing pipeline sections or building a new pipeline section between Klaipėda and Liepāja. The project depends significantly on other projects in the region (e.g., GIPL and Balticconnector) and the gas consumption of the

[19] Gaz System http://en.gaz-system.pl/centrum-prasowe/aktualnosci/informacja/artykul/202335/

region. In order to find the optimal solution to increase Latvia–Lithuania throughput capacity, the Latvian and Lithuanian gas system operators are planning to conduct additional studies in 2018.[20]

3.7.5 Modernising the Inčukalns Natural Gas Reserve

The Inčukalns subterranean natural gas reserve is situated in Latvia and is the only natural gas reserve in the Baltic states. Natural gas reserves help to increase the flexibility of the gas system and cover seasonal consumption peaks, reducing the amount of investments required to be made in the transmission pipelines. Traditionally, the Inčukalns reserve has been filled in summer when gas consumption is lowest and used in winter when gas consumption is higher. Historically, Estonia and Latvia have received necessary gas from the Inčukalns natural gas reserve at winter times. The modernisation of the natural gas reserve will help to operate the common gas market of the region more efficiently and will help to increase the security of supply in the region with other infrastructure projects of the region (Balticconnector, GIPL). In the first stage of the project, the following is planned.

- In the first stage of the project (2014—2019), the general security of the natural gas reserve will be improved and the current gas extraction capacity of 315 GWh per day will be increased to 336 GWh/day.

Due to changes that have taken place during the past few years and the planned changes in the regional gas market, it is necessary to specify the works performed in the natural gas reserve and their volumes. In order to specify the precise manner of the works, Conexus Baltic Grid performed a corresponding study in 2017.[21]

3.7.6 Regional LNG Terminals

There is currently one LNG terminal, Klaipeda LNG terminal, operating in the Baltic states and three regional-sized LNG terminal are being developed. Two of these are located in Estonia (Paldiski LNG terminal and Tallinn LNG terminal) and one in Latvia (Skulte LNG terminal). All three terminals are designed to service and increase the security of supply of the regional Baltic and Finnish gas market. There are several small-scale LNG projects being developed in Finland that are not planned to be connected to the transmission network.[22] In addition to the existing Świnoujście LNG terminal, the new FSRU Polish Baltic Sea Coast LNG terminal is being developed in Poland. The LNG terminals will give the region a new supply source and thereby increase the region's security of supply. It is possible to participate in the global LNG market and hence increase the competition in the local gas market.

- The storage capacity of the Paldiski LNG terminal would amount to 160,000 m^3 of liquefied natural gas (LNG) and the terminal would be able to transmit 37.6 TWh per year into the gas network.[23]
- The storage capacity of the Tallinn LNG terminal, which would be located in Muuga, would amount to up to 320,000 m^3 of liquefied natural gas (LNG) and the terminal would be able to transmit 44.4 TWh/year into the gas network.[24]
- The Skulte LNG terminal differs from other projects in that the plan of the project does not foresee the construction of the infrastructure required for the storage of LNG. According to the plan, a gas transit line will be constructed from the terminal to the nearby underground

[20] Conexus Baltic Grid http://www.conexus.lv/ipgk-modernizacijas-projekti-eng/latvijas-lietuvas-starpsavienojuma-jaudas-palielinasana-latvijas-dala
[21] Conexus Baltic Grid http://www.conexus.lv/ipgk-modernizacijas-projekti-eng/incukalna-pgk-jaudas-palielinasana
[22] BEMIP GRIP 2017 https://www.entsog.eu/public/uploads/files/publications/GRIPs/2017/entsog_BEMIP_GRIP_2017_Main_web_s.pdf
[23] ENTSOG TYNDP 2017 https://www.entsog.eu/public/uploads/files/publications/TYNDP/2016/TYNDP053-161021_Projects-Details.pdf
[24] Tallinn LNG http://www.tallinnlng.com/documents/

Inčukalns gas reserve, where the LNG would be stored in a gaseous state. The terminal would be able to transmit 5.55 TWh/year to the gas network.[25]

- FSRU Polish Baltic Sea Coast — a planned floating LNG terminal in Poland, capable of transmitting 50—100 TWh/year to the gas network. The planned completion date of the project is 2020.[26]

[25] Skulte LNG terminal https://ec.europa.eu/eipp/desktop/en/projects/project-187.html

[26] ENTSOG TYNDP 2017 https://www.entsog.eu/public/uploads/files/publications/TYNDP/2016/TYNDP053-161021_Projects-Details.pdf

4 Security of supply assessment

- In 2017, all consumers and balance providers were sufficiently supplied with gas, including during repair works.
- Investments carried out during the next decade will help to increase the security of supply, including security of supply criterion N-1, which is not met at regular pressures today.

4.1 Retrospective view on security of supply

Overview of the physical gas flows and technical capacities at border crossing points

The Estonian gas transmission network has three border points through which cross-border trade can occur — Karksi, Värska, and Narva. Below, there is an overview of the maximum physical gas flows in 2017 by months and the transmission capacities available at the border crossing points at the times of maximum gas flow.

Table 4 Maximum physical gas flows at order crossing points and transmission capacities in the Estonian gas transmission network 2017

Month	Karksi GMS			Värska GMS			Narva connection		
	Max. gas flow per day MWh	Trans mission capacity MWh	Trans-mission capacity %	Max. gas flow per day MWh	Trans-mission capacity MWh	Trans-mission capacity %	Max. gas flow per day MWh	Trans-mission capacity MWh	Trans-mission capacity %
January	6,350	57,880	0.5	35,165	30,050	79.0	0	13,290	0
February	6,540	57,760	3.8	33,030	30,160	73.1	0	12,790	0
March	14,730	57,180	10.8	20,570	30,760	43.7	0	12,600	0
April	46	55,860	0.0	18,620	32,130	47.3	0	12,840	0
May	12,020	35,400	15.3	15,170	10,110	43.1	0	13,680	0
June	6,590	21,950	24.5	5,280	800	99.9	0	13,150	0
July	6,710	20,490	28.7	2,560	350	87.8	0	12,550	0
August	8,350	21,100	31.2	0	0	0.0	0	13,720	0
September	0	9,360	0.0	11,695	15,330	54.5	0	12,950	0
October	3,940	17,770	2.3	22,740	18,810	77.6	0	6,000	0
November	22,790	50,010	14.3	21,480	24,620	43.0	0	10,440	0
December	21,270	53,080	22.1	22,520	22,590	35.4	0	9,850	0

The actual capacities at the border crossing points were below the technical capacities because of the regular pressure regime due to low demand at the borders. The peak day with the maximum gas flow of **40,583 MWh** (average capacity of **1,660** MW/h) was 7 February, when it was necessary to supply additional gas from the Karksi GMS. The gas was mainly supplied through the Värska input point. The peak consumed capacity of Värska GMS was **35,165 MWh** on 5 January. On the other hand, 2017 winter was colder only at the beginning of the year and for a short period. Gas consumption was lowest on 24 June when only **4,607 MWh** was consumed.

In addition to gas imported from Gazprom, **12.21%** from 2017 total supply was made up of supply from other market participants; gas exchange transactions took place on the GET Baltic exchange, where a special product was introduced so that Estonia could in its own virtual trading points.

There were no significant failures or accidents that caused interruptions in the gas supply of the consumers. Therefore, there were no amount of gas remained undelivered in 2017. During the planned replacing of a section of the transmission pipeline in October 2017, the gas supply was guaranteed using the AS Gaasivõrgud distribution pipeline.

4.2 Compliance with the N-1 criterion in 2017 and assessments for 2018

Pursuant to Regulation (EC) No. 994/2010, the criterion of the security of supply is the N-1 criterion, which shows how sustainable the gas system is when an element with the highest throughput capacity of the system is out of service.

$$N-1[\%]=\frac{EP_m+P_m+S_m+LNG_m-I_m}{D_{max}}\times 100\%,\quad N-1\geq 100\%$$

EP_m – capacity of the entry points of all systems (million m^3/day)
P_m – domestic production capacity (million m^3/day)
S_m – amount delivered by domestic gas reserves (million m^3/day)
LNG_m – throughput capacity of domestic liquefied natural gas terminals (million m^3/day)
I_m – throughput capacity of the network element with the highest capacity (million m^3/day)
D_{max} – total daily gas demand in the calculation area on a day of exceptionally high gas demand, which occurs once in 20 years based on statistical likelihood (million m^3/day)

The Estonian gas transmission network is connected to the Russian transmission network in Narva and Värska and to the Latvian transmission network in Karksi. Karksi gas metering station has the highest throughput capacity of all Estonian gas transmission network elements. Thus, as at 2017, the values of the variables included in the formula were as follows (under regular conditions):

EP_m = 10.6 million m^3/day
P_m = 0 million m^3/day
S_m = 0 million m^3/day
LNG_m = 0 million m^3/day
I_m = 6 million m^3/say (Karksi–Tallinn)
D_{max} = 6.7 million m^3/day (2006)

Based on the above, the N-1 criteria of the Estonian gas system is:

$$N-1[\%]=\frac{(10{,}6)\ \ +0+0+0-6}{6{,}7}\times 100\%=68{,}7\%$$

Table 5 below provides an overview of the throughput capacities of the border points at in different conditions and the resulting security of supply in terms of N-1 values.

Table 5 Throughput capacities at border crossing points and N-1 criterion assessment of the Estonian gas transmission network

Connection point	**Technical throughput capacity (million m³/d / GWh/d)** gas pressure at the connection point Karksi GMS: 40—42 bar Värska GMS: 40—42 bar Narva: 28—30 bar	**Throughput capacity under normal conditions (million m³/d / GWh/d)** gas pressure at the connection point Karksi GMS: 34—36 bar Värska GMS: 34—36 bar Narva: 22—24 bar	**Minimum throughput capacity (million m³/d / GWh/d)** gas pressure at the connection point Karksi GMS: 24—26 bar Värska GMS: 24—26 bar Narva: 18—20 bar
Narva connection	3 / 31.5	1.2 / 12.6	0.8 / 8.4
Värska GMS	4 / 42.0	3.4 / 35.7	2.2 / 23.1
Karksi GMS	7 / 73.5	6.0 / 63.0	4.0 / 42.0
Total	**14 / 147.0**	**10.6 / 111.3**	**7.0 / 73.5**
N-1 (%) per formula	**104.4**	**68.7**	**44.8**

Technical throughput capacity is the calculated throughput capacity of the pipelines at maximum pressures that the technical conditions of the pipelines allow applying at entry points.

Throughput capacity under normal conditions is the calculated throughput capacity of the pipelines at normal pressure at inlet stations.

Minimum throughput capacity is the calculated throughput capacity of the pipelines in case of exceptionally low input pressures at inlet stations.

The table above shows that the estimated security of supply may drastically differ depending on the conditions that are used for calculating the N-1 criterion. Based on the technical throughput capacity, the security of supply is ensured but the gas transmission network is operating under optimal pressures that are on the lower side (in case of a breakdown, even minimal pressures are likely), in the case of which the peak consumption remains uncovered in the N-1 situation (the gas reserves for protected consumers are ensured, though).

Since the autumn of 2016, Gazprom will mainly supply Estonia with gas through the Värska inlet and only in exceptional cases through the Karksi inlet via the Latvian TSO. The remaining market participants are importing gas based on the supply scheme through the connections in Karksi or Värska. The largest balancing service provider does not have a contract to use the Narva connection yet and in 2019, the connection will be closed.

According to the current assessment, 2018 would not bring about any significant changes compared to 2017 but hopefully, the Narva connection will be put into service during the summer maintenance works period. When considering the N-1 criterion, security of supply is guaranteed under normal conditions and problems may arise only on sporadic days of peak consumption.

4.3 Security of supply 2018—2027

In order to assess the security of supply of the next ten years, the natural gas consumption forecast, the capacities of the connection points between the countries and the development projects of the local network must be taken into account. The security of supply assessment is based on the abovementioned aspects and the N-1 criterion. The Estonian natural gas consumption forecast, discussed in paragraph 2.4, concluded that natural gas consumption would be following a declining trend for the next ten years. Additionally, peak consumption is not expected to increase and therefore, the maximum demand for natural gas for the past 20 years will remain unchanged and at the level of 70.4 GWh per day (6.7 million m^3/day). There are several projects planned for the next ten years that will significantly increase the capacity of the connection points and thus also the security of supply. Renovation of the Karksi GMS and the Tallinn-Vireši pipeline will increase the throughput capacity of the Karksi GMS to 105 GWh/day. Construction of the submarine pipeline of the Balticconnector and the Kiili-Paldiski land pipelines will provide Estonia with a new connection point with Finland with the capacity of 81.2 GWh/day. Figure 14 provides an overview of the security of supply until 2027.

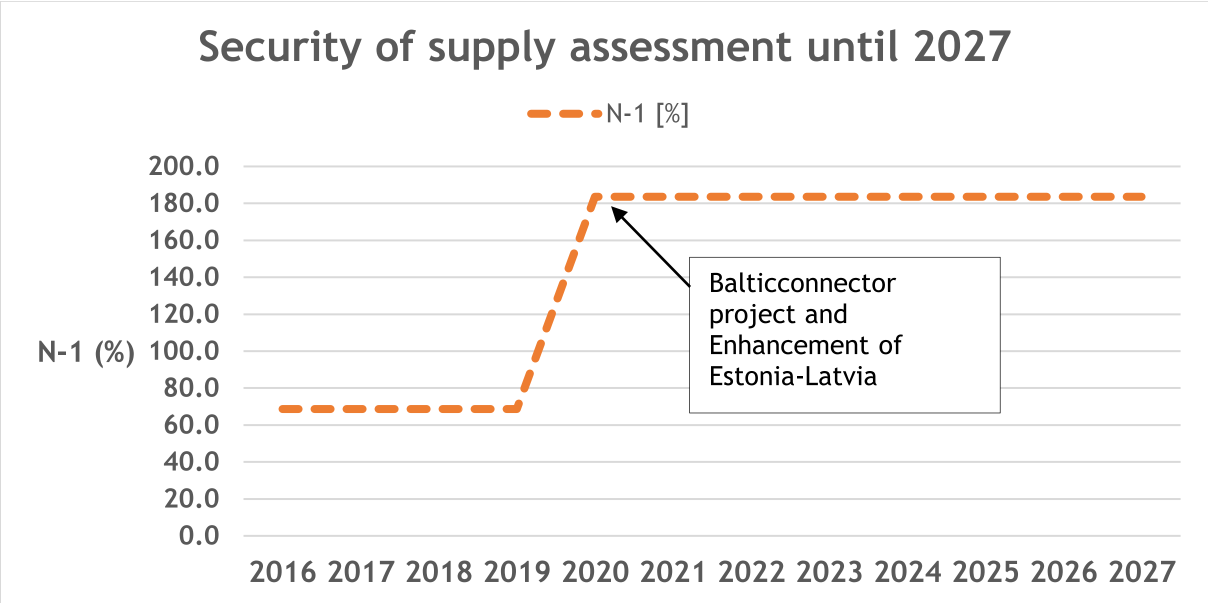

Figure 14. Security of supply assessment until 2027

Security of supply assessment, 2017-2026

Until 2019 (incl.), the security of supply criterion N-1 will remain under 100%, provided that the gas pressure at the connection points will remain under standard conditions. Constructing of the Balticconnector and renovating the Karksi GMS will bring the N-1 criterion to 183.6% and guarantee security of supply for Estonian gas consumers. The results allow us to presume that the Balticconnector project is of vital importance to ensure security of supply in Estonia. Without the Balticconnector, it may prove necessary to restrict the consumption of non-protected consumers in the event of a large-scale system breakdown. Construction of the Balticconnector will eliminate this risk. In addition to increasing the security of supply, there will also rise a possibility to connect the gas markets of the Baltic states and Finland, bringing socio-economic benefits for all of the countries.

4.4 Risks impacting security of supply

Elering AS performed an internal audit to assess security of gas supply and how the consistency of reliability managed. The transmission system operator’s risk analysis identified the risks related to the gas supply and gave the vital service reliability a risk category value. Risk maps show different risk related to gas supply, agreed upon preventive measures and alleviating after activities and the appointed persons responsible for implementing the activities. The main risks that affect the reliability of a vital service (i.e., the functioning of the Estonian gas system) have been identified and preventive measures have been developed.

Cross-border gas supplies decreasing below the minimum required level or being interrupted altogether

The potential events triggering the risks are interruptions in cross-border gas deliveries into Estonia or the Baltic states in general or decrease in the amount of deliveries. This risk may also occur due to emergency situations in the Russian transmission pipelines or the Latvian transmission pipelines due to breakdowns that are accompanied by extensive interruptions in the gas supply (over 72 hours) or a sudden increase in the domestic gas demand in the cold winter period (temperatures under $-20\ ^\circ C$).

When the risks occur, this means that pressures at the border crossing points of the Estonian gas transmission network (Värska, Karksi, and Narva) drops under the minimum required level and as a result, the pressures at important points of the Estonian transmission network may drop or will drop below the minimum pressure. Due to low pressure, the cross-border transmission capacities at the border crossing points of the Estonian gas transmission network will drop and, in the situation of the N-1 criterion, it may not be possible to ensure that the entire peak consumption of the Estonian gas system is guaranteed. In order to ensure the consumers gas supply, it may be necessary to restrict the gas consumption of other Estonian consumers and use the stocks of the protected customers.

To alleviate the risks, the transmission system operator has entered into agreements of mutual cooperation in emergency situations with neighbouring transmission system operators. The supply of protected consumers is secured in the sufficient amount and measures have been developed to restrict gas consumption and use gas reserved for protected customers. As the Estonian gas system is connected with Latvian and Russian gas systems, operative planning and management cooperation with aforementioned gas transmission system operators is important to ensure that the reliability of a vital service is guaranteed. Elering has signed necessary agreements with the transmission system operators of the aforementioned countries to ensure this.

Interruption of the domestic gas supply

Potential risks triggers may be accidents in gas metering stations, transmission network, and gas distribution stations. Furthermore, physical overload due to long and exceptionally cold weather.

The risks may occur:

- as a result of various external events, such as natural disasters, physical overload of the pipelines, terrorism, vandalism, etc.;
- damage caused by various events originating from the gas network, such as damages due to corrosion of the pipelines, leaks in the connections or equipment, bursting of an underground pipeline due to external load;
- as a result of a fire and/or explosion at gas distribution centres or gas metering stations;
- gas injected into the system does not meet the required quality standards;
- SCADA technical control system of the gas system or data communication does not function

In order to alleviate the risks, the transmission system operator has signed agreements cooperation agreements with partners and regular accident drill are being held, an emergency action plan and the Estonian gas system emergency management plan have been composed and measures have been taken into use to ensure important objects will function in exceptional situations. SCADA systems and communication solutions have been backed up.

Relationship between the security of gas supply and the security of electricity supply

Gas and electricity systems are tightly interconnected. Thus, the security of supply of one system also affects the security of supply of the other system.

Security of gas supply affects the security of electricity supply as gas is usually an important fuel for electricity generation. On the other hand, unlike our neighbours Latvia and Lithuania, any interruptions in the gas supply have an insignificant impact on the functioning of the Estonian electricity system. The production plant that uses gas as a fuel to generate the most electric energy for the market is the unit 2 of the Iru Power Plant (gross capacity of 110 MW), but as the annual number of working hours of the plant is minimal, its impact on the functioning of the electricity system is also minimal. The most important factor from this perspective is the functioning of the Kiisa emergency reserve power plants, which use gas as the main fuel. However, as the Kiisa emergency reserve power plants can also run on alternative fuels, the transmission system operator has alleviated the risks here as well.

The energy supply of gas distribution stations and gas metering stations is important for the gas transmission network to function. On the other hand, the risks arising from interruptions in the energy supply are alleviated with autonomous and local solutions from the electricity system. For example, the stations are, as a rule, equipped with autonomous, automatically activated gas or diesel-powered reserve generators and the essential equipment work on batteries or UPSs when the power supply is being switched. In remotely controlled pipeline intersections, the uninterrupted continuation of the SCADA-based data communication is ensured by electric power reserved on batteries. As a rule, interruption of the electric power will not cause interruptions in the gas supply, but it may hinder the operation of SCADA-based data communication and metering systems.

4.5 Protected consumers

Definition of a protected consumer

According to clause **26^{1} 2), Minimum requirements for security of supply subsection**, the protected customers in respect of whom the supply standard stipulated in Article 8 of Regulation (EC) No 994/2010 of the European Parliament and of the Council applies include: 1) household consumers whose consumer installation is connected to a gas distribution network and 2) undertakings who produce heat for heating dwellings and for whom it is impossible to use any fuel other than gas.

Supply of Protected Customers

In accordance with section **26^{4}** of the Natural Gas Act**, the stocks are constituted and administered by the system operator, Elering AS, in a quantity that** ensures the supply of gas to protected customers in accordance with article 8(1) of Regulation (EU) No. 994/2010 of the European Parliament and of the Council. The justified costs flowing from the administration of the stocks are borne by the users of network services through the price of those services. The keeping of the stocks is organised in a manner that ensures the availability of the stocks in the event of a supply disruption.

In order to guarantee supply of protected customers, Elering AS announced a public procurement and signed an option agreement with the winner to store, guarantee and sell reserved natural gas. The reserves of the stored natural gas are activated within 24 hours during the heating period of 1 October — 30 April and within one week during the rest of the year from 1 May — 30 September. A study was conducted to assess the supply of protected consumers and forecast the necessary amount of gas. The supply of protected consumers in determined for each month. Some of the supply of protected consumers is included in the reserve gas, which is required ensure gas supply to protected consumer during the time when the amounts guaranteed by option agreements are to be activated.

Using the supply of protected customers

The supply is used in case of interruptions of supply to ensure security of supply The transmission system operator analyses security of supply of protected consumers after any measures mentioned in subsection **26^2** (3) of the Natural Gas Act have been implemented to ensure security of supply and if necessary, activates the stored supply and notifies the Competition Authority and publishes the decision on its website on the day on which it is adopted.

5 Gas market

- Regional working groups have commenced work to achieve a unified Baltic-Finnish entry exit system by 2020.
- In 2017, the gas exchange was launched for the first time in Estonia.

5.1 Regional gas market

On 11 May 2016, it was agreed at the RGMCG (Regional Gas Market Coordination Group — a working group including ministries, regulators, and infrastructure administrators of the gas sector in the Baltic region) to establish a regional Baltic-Finnish gas market or common entry-exit system by 2020. The declaration of the agreement was signed by the ministers of the three Baltic states in charge of the gas sector on 9 December 2016.

The following working groups were formed:

- Implementing the pricing of gas transmission services and compensation mechanisms between the transmission system operators in the region (led by the regulators)
- Creating a common, virtual trading hub (VTB), and regional gas exchange (led by the transmission system operators)
- Organising the market (led by the transmission system operators) — includes operative management of the system, balancing service provision, etc.
- Pricing of the infrastructure (LNG terminals and reserve) and distributing the costs (led by the regulators).

By the end of 2017, guidelines to create a single transmission service pricing methodology for the Baltic region's common input-output zone were composed by the regulators work group. The guidelines include a two-stage approach to regional tariffs methodology. In the first, or the transitional stage, starting from 2019, the common model will include Estonia, Latvia and Lithuania and the compensation mechanism between transmission system operators; in the second stage, starting from 2020, when the Balticconnector will be completed, the model will include Finland. In 2018, the work will continue on the initiative of transmission system operators to develop a common tariff methodology and a potential compensation mechanism between system operators.

The second working group of regulators, which explores the possible social distribution of pricing and costs of different infrastructure object with potential effect on security of supply, has set the goal of assessing the role of different objects in the regional gas market by the end of 2018. Based on this assessment, potential principles of social distribution will then be proposed, if necessary.

The joint working group lead by the transmission system operators completed a common proposal concept for regional virtual trading hub and coordinated balancing area model by autumn of 2017. Concept documents were under public consultation until 23 November, after which the RGMCG approved the concepts. Feedback received from public consultations is planned to be taken into account in the following stages of the work, when we are moving towards setting specific common rules.

In 2018, it is planned to compose common network rules, which include access rules to virtual trading hubs and networks. As a separate task, it is planned to compose common balancing rules, which will form the foundation on which the planning, management, and balancing service provision of the network will be based. Regarding the common virtual trading hub, regional gas exchange as a central trading platform will play an important role; however, coordinated balancing services provision will be at least initially done in cooperation between transmission system operators on a common IT platform.

Baltic transmission system operators signed an agreement with GET Baltic to implement the implicit capacity allocation model on border areas within the Baltic states from 1 July 2017 as a transitional stage to integrate the Estonian, Latvian, and Lithuanian gas markets. Implicit capacity allocation model means that short-term cross-border capacity will be allocated on the regional gas exchange with the sold gas, increasing the liquidity and improving the competition on the Baltic market. With the implementation of the implicit capacity allocation model, GET Baltic became a regional gas exchange by opening separate trading areas in Estonia and Latvia addition to existing trading area in Lithuania.

5.2 Developments on the local gas market

2017 will be remembered for two important milestones in the development of the local gas market. Firstly, Natural Gas Act was significantly amended to improve the functioning of the open market and harmonise the rules with the rules in the European gas markets. Secondly, the gas exchanges started offering its services for the first time in Estonia and a transparent wholesale market price reference was created.

Elering considers the most important the following July amendments to the Natural Gas Act:

- the definition of balancing period was changed to correspond with the balancing day used in the rest of Europe (7 a.m. to 7 a.m.),
- balance will be measured in units of energy (kWh) instead of volumes (m^3);
- adding biomethane and certificate of origin definitions to the legal act;
- establishing gas market network code in order to better regulate data exchange;
- the network operator is obligated to equip measuring points with an annual consumption of over 750 m^3 with measuring systems that take into account the temperature of the gas and enable gathering the data remotely;
- regulating the management of supply of protected consumers in accordance with Regulation (EC) No 994/2010 of the European Parliament and of the Council.

Due to the amendments, the gas network code entered into force in August and it regulates, among other things, data exchange and Elering's obligation to transmit measurement data to the gas data warehouse completed in 2016. In addition, Elering initiated amendments to the standard terms and conditions of domestic and cross-border transmission services and they should take effect in 2018 after they has been approved by the Competition Authority.

The gas exchange was launched in Estonia July 2017 and as was explained in the previous chapter, thanks to the implicit capacity allocation model, it is possible to trade natural gas with other Baltic states independent of the location of the gas seller of buyer. The gas exchange covering all the Baltic states is managed by UAB GET Baltic, previously operating only in Lithuania, which won the competition held by the Baltic transmission system operators. The gas exchange publishes separate prices for all areas (if there were any transaction) and an average Baltic exchange price, which is a transparent price reference point for all market participants. Beginning from 3 October, the GET Baltic gas exchange offers previous day products in the Estonian bidding area, enabling the balancing service providers to additionally correct their imbalances. Due to implementing the implicit capacity model, Elering amended is methodology *Gaasi ülekandevõimsuste jaotamine ja piiriülesele taristule juurdepääs Eestis* (Gas Transmission Capacity Allocation and Access to Cross-Border infrastructure in Estonia).