# ESTONIAN GAS TRANSMISSION NETWORK DEVELOPMENT PLAN 2017–2026

Tallinn 2017

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 a 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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# 1 Introduction

This document presents the ten-year development plan of the gas transmission network. The development plan is drawn up by the operator of the transmission system for the period from 2017 to 2026.

Pursuant to subsection $21^2$ (4) of the Natural Gas Act (NGA), 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. Pursuant to the amendments of the NGA, which entered into force on 10 April 2014, the system operator shall present the development plan of the gas transmission network to the CA for information purposes, not to obtain the approval of the authority. The development plan shall include the measures for ensuring 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. The volume and content of this development plan are quite similar to those of last year's development plan, which somewhat reflects the fact that the selected development directions have been consistent and the investments in the gas network are long-term projects. Compared to the previous development plan, this development plan specifies the most significant specifications and changes. In the course of drawing up the report, market participants have been asked to provide their input through the Gas Market Development Council. The aim of the report is to provide an overview of the security of gas supply and the developments of the gas market in Estonia. The direction to exit the isolated situation of one supplier has been highlighted as the main influencing factor in the development of the gas network and steps are already being taken towards integration with the open European gas market. This development plan is concerned with the issues of the gas market as well as the infrastructure of the gas transmission network. The first section describes the current situation of the gas network and provides an overview of the main developments and the main large-scale projects of the next ten years. The middle part of the report assesses the security of gas supply today and in the next ten years. The final part discusses the next important steps related to the development of the gas network and the future challenges in detail. The report does not merely view issues which are closely related to Estonia, but also the situation in the region and Estonia in the context of integration with the European gas market.

The amounts of energy highlighted in the report were calculated by using 10.5 kWh/m3 (11.1 kWh/m3 in the case of LNG) as the gross calorific value and the gas volumes are at standard conditions, i.e. an absolute pressure of 101.325 kPa and temperature of 293.15 K (T=20°C).

## 1.1 The European Union energy policy

The European Union energy policy is based on two factors: first, a large share of fossil energy sources (approx. 60% of the raw material for liquid fuels and approx. 30% of the natural gas) are bought from outside of the European Union, and second, the use thereof causes climate change. This also causes risks which are, on the one hand, related to the security of supply of fuels, increasing prices, and the global competition for fossil fuels, and, on the other hand, to the climate change caused by man-made greenhouse gases.

The European Union energy policy has been based on the common goal to ensure constant availability of energy products and services in the market to all consumers at an affordable price while helping to achieve the wider social and climate goals of the European Union.

The principles of the European Union energy policy are agreed in the Lisbon Treaty[1], which defines the following priorities:

- functioning of the internal energy market;
- security of energy supply;
- efficient energy consumption, saving energy, and promotion of the use of renewable energy sources;
- integration of energy markets and connection of energy networks.

Heads of state agreed on development of the energy union as a part of the strategic European Union action plan at the Council assembly of June 2014. In February 2015, the European Commission published a voluminous package of documents entitled 'Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy'. Development of the energy union is one of the most important priorities of the European Commission headed by Jean-Claude Juncker. The aims of the union are to decrease the dependence of the European Union on imported fuel and gas, to strengthen the functioning of the internal energy market, to increase the percentage of renewable energy and energy efficiency, and to ensure the leading role of the European Union in the fight against global warning.

The energy union has five measures which are dedicated to energy security, energy efficiency, and competitiveness:

- energy security, solidarity, and reliability (diversification of deliveries, cooperation to ensure security of supply, larger role of Europe in the global energy market);
- a fully integrated European energy market (connecting the markets through connections between energy systems, implementation and updating of internal energy market measures, regional cooperation, possibility to check one's consumption and freely select the energy seller);
- energy efficiency to help decrease demand (energy efficiency in housing and the transport sector);
- decreasing $CO_2$ emission from the economy (achieving the goal of decreasing greenhouse gas emissions by 40%, agreeing on global climate policy, a functioning emission trading scheme, market-based promotion of renewable energy);
- scientific researches, innovation, and competitiveness.

In the spirit of the energy union package, Elering has been supporting assimilation of the existing state-based energy markets through development of the cross-border infrastructure and software network, emission trading, and harmonisation of the codes of the market since the separation of the

[1] The Treaty was signed at the European Council in Lisbon on 13 December 2007 and entered into force upon finalising the ratification process by all Member States on 1 December 2009.

ownership of the main electricity network in 2010. The aim is to ensure equal treatment of various fuels and technologies, including harmonisation of the energy policies of the Member States. Implementation of harmonised European network codes would serve the interests of the unified internal energy market.

Gas holds an important position in the European energy supply. Over 20% of the European energy consumption comes from natural gas (see Figure 1). In 2014, roughly 70% of the natural gas consumed in Europe was imported.

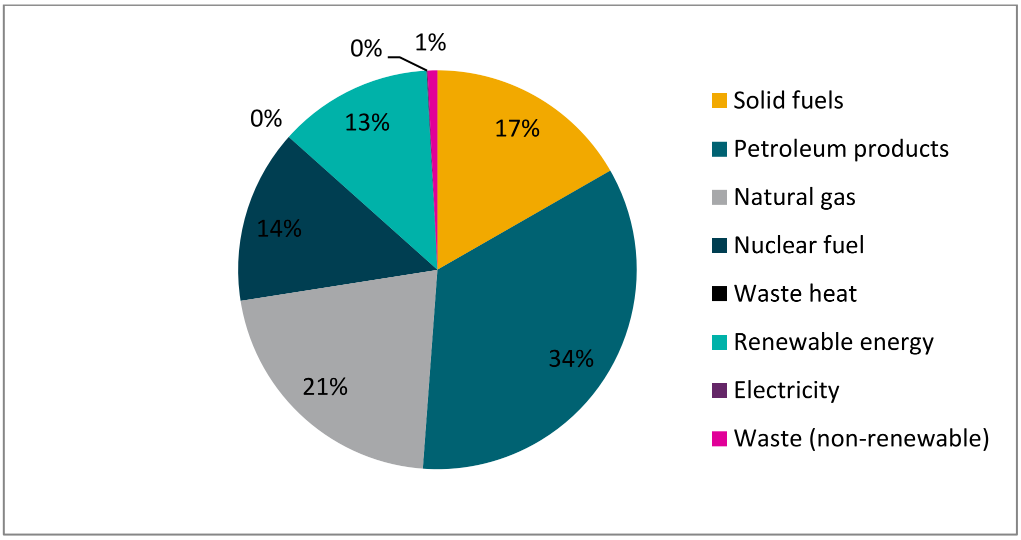



Figure 1. Percentages of European energy sources, 2014

Figure 2 shows the percentages of imports from different countries in 2014. The largest sources of import for Europe are Norway and Russia. The number of gas sources for Europe is diverse, especially thanks to the potential of the LNG terminals to deliver gas from the global LNG market.

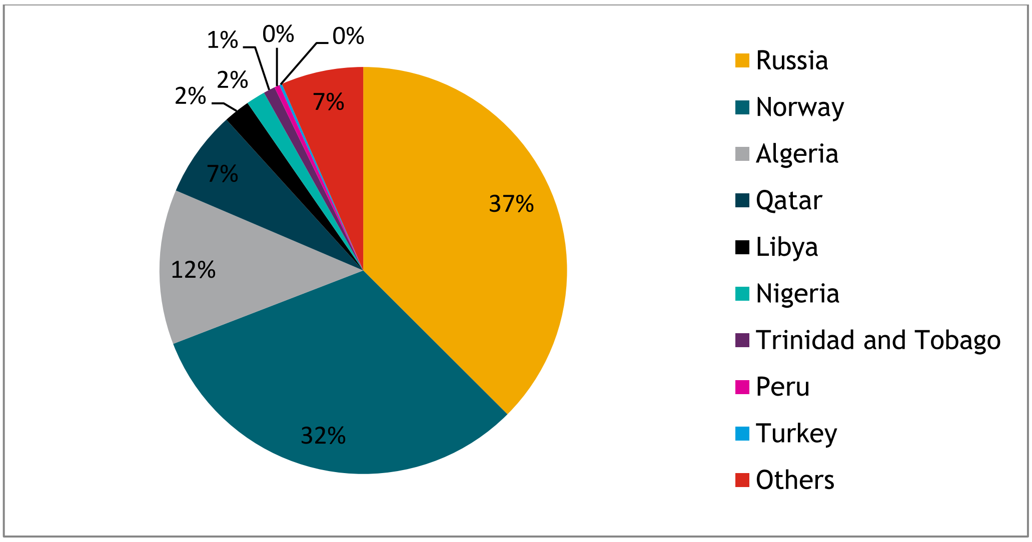



Figure 2. Percentages of natural gas imports into Europe, 2014

### 1.1.1 Energy packages I – III

At the end of the 1990s, the European Union began to pay closer attention to energy policies and set the following developmental goals:

- free competition;
- transparency;
- access to the energy infrastructure;
- security of supply.

In order to harmonise and liberalise the unified European energy market, three consecutive legislative packages were adopted in the period from 1996 to 2009. The three energy packages addressed access to the market, market transparency, consumer protection, transmission capacities, and sufficiency of supply sources. Thanks to changes in energy packages, new suppliers can enter the European market and consumers can freely select the seller suitable for them.

Initially, the electricity and gas market of the European Union was fractured and monopolised. The prices were high and there was a lack of investments. The Member States decided to open the electricity and gas markets, to eliminate the barriers to competition, and to lay the foundation for a unified energy market. The first set of legislative acts for the internal energy market, the First Energy Package, was adopted. Directive No. 98/30/EC established the first common codes for the European Union internal gas market.

It was clear that establishing the internal electricity and gas market had to occur gradually for the industrial sector to be able to adjust to the new conditions. As the First Energy package failed to meet the expectations, discussions began for adoption of the Second Energy Package. The new codes were adopted in 2003. Directive No. 2003/55/EC established more stringent codes for supplying of gas and differentiating gas networks, founding of domestic energy regulation bodies was made compulsory, and third parties were granted equal access to transmission and distribution networks. Consumers (industrial consumers in 2004 and domestic consumers in 2007) were given the possibility to freely select their gas suppliers.

Regulation No. 1775/2005 established the regulations which concerned the access of third parties to gas networks, the principles of capacity distribution, the principles of management with an overload, and the rules of transparency of the market.

The Second Energy Package also failed to fulfil the hoped goal: due to the shortcomings of the regulations, it was not possible to achieve a fully open electricity or gas market. Thus, in 2009, the Third Energy Package was adopted. It entered into force in September 2009. Directive No. 2009/73/EC established the common codes for transmission, distribution, supply, and storage of gas and for access to the market.

The Third Energy Package consists of regulations No. 715/2009, 714/2009, and 713/2009. The first one concerns access to gas networks in cross-border trade, which also prescribed the establishment of detailed network codes in various areas. The second regulates the same issues in the electricity market. The third developed the institutional framework further – Agency for Cooperation of Energy Regulation, ACER, was founded with Regulation No. 713/2009.

### 1.1.2 Common European market model (GTM)

In 2011, the agency for the cooperation of the energy market regulators, ACER, defined its framework, the so-called Gas Target Model (GTM), which lays down the vision and developmental directions to achieve a functioning gas market. The model defines a vision of the future gas market of Europe, which is characterised by competitiveness, liquidity, integration of the markets, optimum use of infrastructure, and free movement of gas between different areas. The keys to achieving this are thought to be, on the one hand, implementation of European network codes in all EU Member States, and, on the other hand, the specific steps defined in the GTM towards achieving a liquid and dynamic gas market.

Upon updating the GTM in 2015, ACER also highlighted some specific keywords which play an important part in the developments of the gas market:

Higher uncertainty in gas production as well as consumption — in connection of increased use of the cheaper shale gas in the United States, the European companies using gas have found themselves under a price pressure. Additionally, the cheapening of coal is pushing gas aside as a fuel for electricity generation (this is also supported by the low prices of $CO_2$ emission quotas). Gas generation in Europe is also following a declining trend and the trend is not expected to turn in the next few years in spite of the addition of alternative sources.

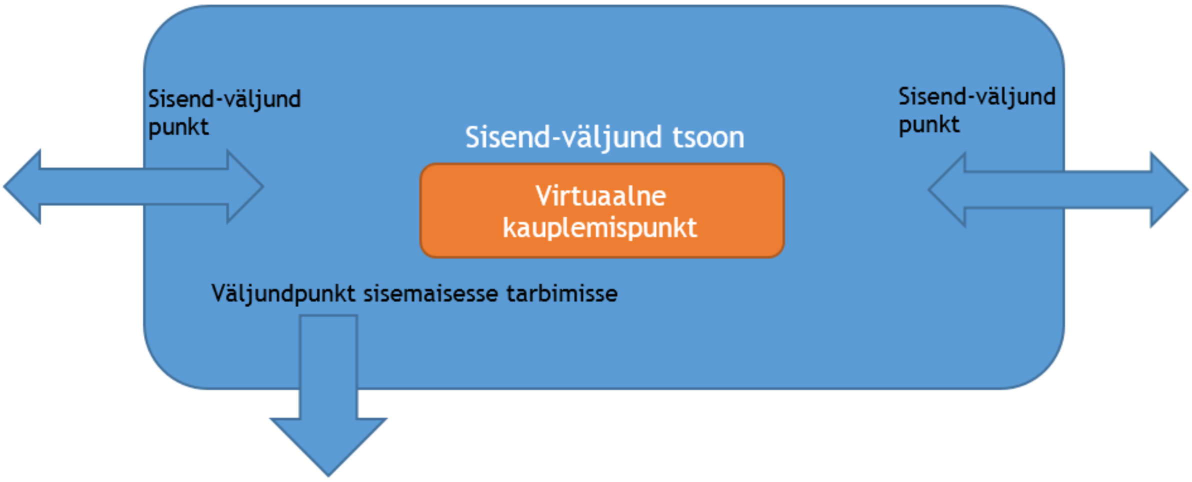
Ensuring security of supply through competition — as many European countries are too dependent on just a few gas suppliers, security of supply is most efficiently ensured by market-specific measures (primarily the measures for market-based pricing of the imbalance), which motivate market participants to contribute to the security of supply, according to the GTM. Separation of storage of gas from the main networks is also prescribed.

Functioning of the wholesale market, assimilation of the markets — ACER has defined the key characteristics of markets, which include compliance with the expectations of market participants (enabling sufficient alleviation of risks) and efficient functioning (offering sufficient competition, flexibility, and security of supply). Both key characteristics are complemented by several indicators which a well-functioning wholesale market should be compliant with.

Renewable energy goals and new areas of application for gas — the GTM proposes cooperation between operators of electricity and gas systems due to using of gas for electricity generation (in order to achieve the required adjustment capability in the case of electricity generated from renewable sources). ACER foresees wider use of gas in the transport sector and for the use of LNG and CNG and in the development of '*power to gas*' technologies thanks to establishing local solutions.

Just a few European countries meet the description provided in the GTM at this point and many countries need to make changes to achieve these goals.

The GTM is based on liquid entry-exit zones which offer sufficient competition and are equipped with sufficient external connections. The entry-exit zones may consist of several countries and, in the case of smaller countries, zones consisting of several countries are required to ensure sufficient competition and liquidity. The principle of entry-exit zones is the possibility of free intra-zone trading of gas, irrespective of which entry point the gas originates from. The entire amount of gas which has entered the zone can be traded on equal grounds, there are no route- or origin-based tariffs or quality requirements. Transmission network tariffs are paid upon entering the zone (at the entry-exit points) and upon exiting the zone (at the entry-exit points or exit points to domestic consumption) and the tariffs are not dependent on the origin of the gas or the earlier movement trajectory of the gas within or outside of the zone. Inside the entry-exit zones, there is usually a virtual trading point where gas is traded. Trading may be organised based on mutual contracts or through a gas exchange. Figure 3 illustrates the structure of an entry-exit zone.




On the figure: Sisend-väljund punkt – Entry-exit point; Sisend-väljund tsoon – Entry-exit zone; Virtuaalne kauplemispunkt – Virtual trading point; Väljundpunkt sisemaisesse tarbimisse – Exit point to domestic consumption

Figure 3. Scheme of an entry-exit zone

### 1.1.3 Unified energy market through network codes

The aim of the Third Energy Package is to create a functioning internal energy market in Europe. An internal energy market which is open to competition provides European consumers an opportunity to choose from different suppliers who provide electric energy and gas at market-based prices. On the other hand, more companies can now enter the energy market, i.e. entry is easier for smaller companies as well and those investing in renewable energy have a chance.

There are still several obstacles blocking the formation of a functioning, pan-European internal gas market. The capacity of the connections between the Member States in insufficient, there are no transmission capacities between some Member States, and the gas market is not yet unified. Even in the cases where the connections between the Member States have been established, the market codes have not yet been sufficiently harmonised, making transaction costs unreasonably high in some regions. Market barriers are created, primarily to small companies. The energy regulators of the Member States are not always taking advantage of all their rights and opportunities to establish the existing codes. Thus, in most Member States, the energy markets are still highly concentrated and there are very few new, independent suppliers.

Regulation No. 715/2009 was established to ensure that the goals set in the Third Energy Package are fulfilled and to facilitate the creation of a well-functioning and transparent wholesale market which would be characterised by a high-level security of natural gas supply. The aim of the regulation is to establish cross-border fair and non-discriminative codes for trading natural gas and thereby increase competition in the internal energy market, taking into consideration the specific peculiarities of domestic and regional markets. This includes establishing harmonised principles regarding cross-border transmission charges and market-based distribution of the existing transmission capacities. The above-mentioned goals will be implemented through establishing harmonised Network Codes and implementing the codes in all Member States.

Developing the Network Codes begins from drawing up the ‘annual list of priorities’ by the European Commission which discusses the topics that should be included in the Network Codes. The ACER will then draw up the so-called framework guidelines which will establish the principles for drawing up specific Network Codes. The Network Codes will be developed further under the leadership of the European Network of Transmission System Operators for Gas (ENTSOG). Development of the Network Codes has reached the stage in which the first have already been approved by the European

Parliament. It can be said that pan-European Network Codes determine the directly applicable framework, but the more specific and detailed lines will be drawn separately by each Member State. More Network Codes may be added in the future.

Congestion Management Procedures – 2012/490/EU

Congestion Management Procedures are an amendment to Annex 1 of Regulation No. 715/2009 with the aim to decrease congestion in the gas transmission systems. Completion of the formation of the internal energy market is hindered by frequent overloading with contracts, meaning that users of the network cannot access gas transmission systems even though the capacity is physically available. The procedure establishes the rules, according to which companies must use the transmission system capacities reserved for them or risk losing unused capacities. The unused capacities are released back into the market and distributed by using market-based measures. The update in Annex 1 of Regulation No. 715/2009 was established on 24 August 2012.

Network Codes on Capacity Allocation Mechanisms (CAM) – 984/2013/EU

The Network Codes on Capacity Allocation Mechanisms establish the obligation of transmission system operators to use a harmonised auctioning system for the distribution of gas system capacities (or, alternatively, implicit auctioning of capacities with energy). The same capacity products are sold simultaneously at the auctions based on the same pan-European codes. The Network Codes establish standardised capacity allocation mechanisms of gas transmission systems. A standardised capacity allocation mechanism includes auctioning for relevant connection points in the EU and providing and distributing cross-border standard capacity products. The Network Codes establish the cooperation between operators of the transmission systems of adjacent areas to facilitate selling capacity, taking trading rules as well as the technical rules with respect to capacity into consideration. The Network Codes cover both the existing capacities as well as the additional transmission capacities to be created as a result of investments. The Network Codes were adopted on 14 October 2013 and entered into force on 1 November 2015.

Network Codes on Gas Balancing of Transmission Networks – 312/2014/EU

The Network Codes on Gas Balancing of Transmission Networks establish the rules for maintaining the balance of the gas system and the related responsibilities of the system administrator and network users. It is important for the extensive integration of the markets that the codes on balancing would promote trading of gas in the extent of all balance areas and help to develop the liquidity of the market. Therefore, these Network Codes establish harmonised pan-European Union balancing codes with the aim to provide security that users of the network are able to manage their positions in different balance areas in an economically efficient and non-discriminative manner. The Network Codes were adopted on 26 March 2014 and entered into force on 1 October 2015.

Network Codes on Interoperability and Data Exchange – 703/2015/EU

The Network Codes for Interoperability and Data Exchange harmonise complex, technical procedures for operating the network which are used in the gas systems of the European Union Member States. The Regulation concerns inter-system connection contracts, measurement units, quality of the gas, odorising, and information exchange. The Regulation establishes the rules and procedures which enable to use a suitable level of harmonisation for efficient trading of gas and gas transport in all gas transmission systems of the European Union. The Network Codes were adopted on 30 April 2015 and entered into force on 1 May 2016.

Network Codes on Harmonised Transmission Tariff Structures

The aim of the Network Codes on Harmonised Transmission Tariff Structures is to define the unified rules and parameters for establishing transmission tariffs. The Network Codes facilitate integration of the market, increases security of supply, supports competition and cross-border trade, ensures non-discriminative and cost-based transmission tariffs, and prevents cross-subsidising between network users. The Network Codes establish the methodology for calculating the tariffs of the entry-exit system points and disclosing and consulting the data used for calculation thereof. The Network Codes are being developed, the expected time of adopting the Codes is April 2017.

Annexes to the Codes regarding Incremental Capacity

The Annexes to the Codes regarding Incremental Capacity are amendments to the two above-mentioned Network Codes – Network Codes for Capacity Allocation Mechanisms and for harmonised Transmission Tariff Structures. The annexes regarding incremental capacity complement the Network Codes for Capacity Allocation Mechanisms with provisions on how to distribute the additional or new capacities arising from investments. The Network Codes for Tariffs are complemented with provisions on how to calculate the tariffs in the case of additional and new transmission capacities. The annexes to both Network Codes are being developed.

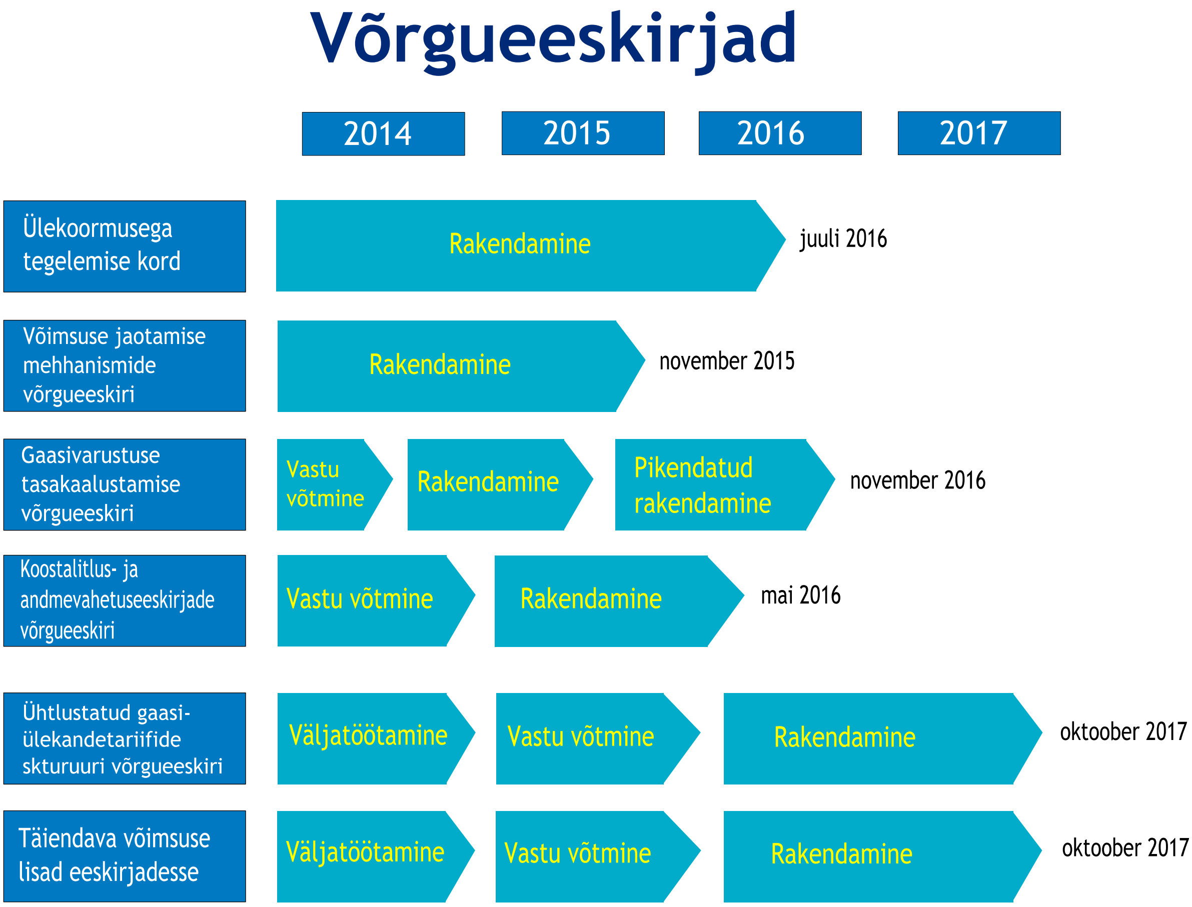



Figure 4. Gas market Network Codes and the schedule of implementation thereof

On the figure: Võrgueeskirjad – Network Codes; Ülekoormusega tegelemise kord – Congestion Management Procedures; Rakendamine – Implementation; Juuli – July; Võimsuse jaotamise mehhanismide võrgueeskiri – Network Codes on Capacity Allocation Mechanisms (CAM); Gaasivarustuse tasakaalustamise võrgueeskiri – Network Codes on Gas Balancing of Transmission Networks; Vastu võtmine – Adoption; Pikendatud rakendamine – Extended implementation; Koostalitus- ja andmevahetuseeskirjade võrgueeskiri – Network Codes on Interoperability and Data Exchange; Mai – May; Ühtlustatud gaasiülekandetariifide struktuuri võrgueeskiri – Network Codes on Harmonised Transmission Tariff Structures; Väljatöötamine – Development; Oktoober – October; Täiendava võimsuse lisad eeskirjadesse – Annexes to the Codes regarding Incremental Capacity

### 1.1.4 The European Union energy infrastructure package

The geopolitical situation that has taken shape in the last few years has pointed out the structural shortcomings of the European Union energy system and provided a strong political incentive to strengthen and construct the energy infrastructure as soon as possible. Based on Regulation No. 617/2010, the European Commission will draw up a so-called list of Projects of Common Interest (PCI), and the European Union is planning to allocate grants in pre-determined amounts to the objects in the list in the calls for proposals. Investments in common interest projects are granted to projects which involve at least two countries and the resources are made available in the form of bonds, aid, and loan securities. Additional sector-specific criteria must ensure that the projects considerably strengthen the security of supply, enable integration of the market, facilitate competition, ensure flexibility of the system, and enable to transmit the generated renewable energy to consumption centres and storage points.

Furthermore, in 2011, the European Committee proposed to establish an energy infrastructure modernisation package which would, among other things, help to achieve the climate and energy goals of the European Union. The amount of money to be allocated to the energy sector from the Connecting Europe Facility (CEF) in the period from 2014–2020 amounts to 5.85 billion euros. The resources of the Infrastructure Fund are allocated for combating climate change, achieving a more competitive social market economy, strengthening connections between different regions, and increasing pan-European economic, social, and territorial unity. This is the first occasion in which the European Union intends to co-fund construction of large-scale energy infrastructure objects from its regular budget. However, the funding package is somewhat smaller than initially agreed in 2011. As a result of the cuts, the criteria for applying for co-funding have been made more stringent, which has led to competition between projects of different purposes.

## 1.2 Estonian energy policy

Development of the Estonian gas management as part of the unified European energy market is a precondition for the formation of an efficient regional gas market with many suppliers, sufficient market capacity and infrastructure, and transparent market rules by 2020. The important landmarks related to this include the planned opening of the Latvian gas market in 2017, the physical connection of the Finnish and Baltic markets via Balticconnector and the completion of Enhancement of Estonia-Latvia Interconnection by 2020, and completion of GIPL, the connection between Lithuania and Poland, in 2021. Up until recently, Estonia has only depended on Russian gas which was and still remains a high risk for the energy security of Estonia in the light of the events in Ukraine. In addition to establishing and strengthening the connections in the direction of Finland and Latvia, the construction of GIPL, the connection between Lithuania and Poland, and the construction of liquid natural gas (LNG) terminals in the region, which would grant access to the European and global gas supplies, would also serve Estonian interests.

Based on the state’s experience so far to support the development of the electricity system and market through an independent, state-owned electricity system operator, several deficiencies can be observed in the Estonian gas market, such as the low level of liberation and transparency of the market, which can and should be solved through the state-owned natural gas system operator. As the state is not interested in improving the competitive position of one gas supplier or producer or another, the state-owned and state-controlled gas system operator is primarily independent in working towards competitiveness of energy prices through development of the gas market and is capable of making sure that wider availability of gas as fuel is achieved.

The Third Energy Package of the European Union establishes opening the natural gas market and establishing of a functioning internal market. This means, among other things, equal treatment of market participants and consumers and, separation of the transmission system operator from the company which is generating or consuming natural gas in order to achieve this. The amendments to the Natural Gas Act made in 2012 placed the system operator under the obligation to bring its activities in compliance with the requirements, based on which the system administrator is a network undertaking that owns the transmission network, owns or manages the metering systems on the state border, and holds an activity licence for provision of the gas transmission service, as of 1 January 2015 at the latest. As of the end of 2015, Elering as the gas system operator is the full owner of the core network.

Development of the Estonian and regional gas market is supported by the Energy Union Communication, published by the European Commission on 25 February 2015, and the related documents. Jean-Claude Juncker, President of the Commission, has called the development of the Energy Union as one of the significant priorities of the Commission, which aims to decrease the dependence of the EU on imported fuels and gas, strengthen the functioning of the internal energy market, increase the percentage of renewable energy and energy efficiency, and ensure the leading role of the EU in the combat against global warming.

Pursuant to the European Union Regulation, it is the duty of ENTSOG (European Network of Transmission System Operators for Gas) to develop the Network Codes of the gas market with an aim to increase integration of the markets by using unified frameworks. Directly applicable capacity allocation, balance management, interoperability and data exchange, and security of supply network codes have been developed. Unified network codes for transmission tariffs are being developed.

The ACER (Agency for the Cooperation of Energy Regulators) has suggested models for the functioning of the gas market to be applied in the internal energy market towards which Europe should be moving – the so-called Gas Target Model (GTM). Taking into consideration increasing competitiveness and using the network efficiently, the GTM tightly binds the development of wholesale markets to the creation of non-discriminative and fair principles for using the gas infrastructure for market participants. In a longer perspective, a unified regional gas market entry-exit model and a unified platform of trading capacities must be achieved. In order to create competition and a liquid wholesale market, it must be possible to trade gas, irrespective of the location thereof in the gas network. Based on this purpose, it would be useful to work towards a unified entry-exit region of the biggest possible dimensions. The size of the three Baltic states together is estimated to be the minimum size for one region, however, a unified region with Finland and Poland would be useful.

On 8 June 2015, the European Commission and the Baltic Sea countries signed a memorandum of mutual understanding which agreed on updating the framework of the BEMIP (Baltic Energy Market Interconnection Plan), including the priorities of the regional gas market and security of gas supply. The first meetings of the Baltic gas market coordination group have taken place in 2015 with Estonian, Latvian, Lithuanian, and Finnish system operators, regulators, and ministries participating. The aim of the group is to achieve a regional gas market development plan and to monitor fulfilling the market development measures. Within Estonia, regular meetings of the Gas Market Development Council with the participation of the interested market participants, the Ministry of Economic Affairs and Communications, and the Competition Authority have been assembled and conducted. Amendments to the Natural Gas Act have been prepared.

Pursuant to the action plan of the Government of the Republic, the aim is rapid development of the regional Baltic gas infrastructure (via connections between Finland and the Baltic states, incl. the Balticconnector), connection thereof to the unified European Union gas market, acquiring the core gas network by a company in which the state holds a controlling share, and establishing natural gas security reserves as well as construction of liquid natural gas terminals. The aim is also to diversify the Estonian energy portfolio, including the percentage of biofuels and local fuels in the transport sector.

Actual opening of the gas market and development of the regional market would serve the following purposes:

- ensuring of energy security;
- increasing of security of supply by elimination of the risk of an exclusive supplier;
- potential for an increase in gas consumption;
- more efficient use of the gas infrastructure;
- competition of fuels in energy generation (electricity, heat);

- equal opportunities for market participants for access to the gas infrastructure;
- transparent and uniform rules for cross-border trading;
- transparent market-based prices for consumers and suppliers;
- opportunity for consumers to choose the supplier;
- new business opportunities for participants in the energy market;
- natural gas as the cleanest fossil fuel will help to achieve the goals of climate policy.

# 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.
- In realisation of the investments plan up to 2021, the Estonian gas system is connected to the rest of Europe and additional supply channels have been established to increase the security of supply.
- Estonian gas consumption has decreased by more than a half compared to the consumption ten years ago, but is not expected to decrease significantly in the upcoming decade.

## 2.1 Estonian gas transmission network

The Estonian natural gas transmission network consists of 885 km of gas pipelines, 3 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, odorised, and the agreed consumption regime is ensured.


Figure 5. 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 one another by the maximum operating pressure (MOP), diameter, and transmission network pipelines.

Table 1 provides an overview of the parameters of the transmission network pipelines.

Table 1. Pipelines of the Estonian natural gas transmission network
* based on metal loss defects
** based on the report of 30 October 2012 (external assessment methods)

| Pipelines | Length [km] | DN (nominal diameter) [mm] | Maximum operating pressure (MOP) [bar] | Age [years] |
|---|---|---|---|---|
| Vireši - Tallinn | 202.4 | 700 | 49.6* | 25 |
| Vändra - Pärnu | 50.2 | 250 | 54 | 11 |
| Tallinn - Kohtla-Järve I | 97.5 | 200 | ≤ 30 | 64 |
| Tallinn - Kohtla-Järve II | 149.1 | 500 | ≤ 30** | 49 |
| Kohtla-Järve - Narva | 45.1 | 350/400 | ≤ 30** | 57 |
| Tartu - Rakvere | 133.2 | 500 | 42.5* | 38 |
| Irboska - Värska GMS | 10.1 | 500 | 50.8* | 42 |
| Värska GMS - Tartu | 75.6 | 500 | 44.6* | 42 |
| Irboska - Inčukalns | 21.3 | 700 | 49.2* | 33 |
| Pskov - Riga | 21.3 | 700 | 51.4* | 45 |
| Branch pipelines | 79.2 | | | |
| Total | 885.0 | | | |

Upon realisation of the five-year investment plan, it is planned to achieve the maximum operating pressure of 50 bar in the Irboska-Tartu-Rakvere section and of 54 bar in the Vireši-Tallinn, Pskov-Riga, and Irboska-Inčukalns pipelines.

The Irboska-Inčukalns and Pskov-Riga are parallel pipelines in Southeast Estonia that are primarily used for transporting gas between Russia and Latvia, but also supply the Misso GDS located in the territory of Estonia with gas. The above-mentioned parallel sections of pipelines 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 entry points of the Estonian gas transmission network at different pressure conditions.

Table 2. Throughput capacities of the entry points of the Estonian gas transmission network[2]

| Connection point | Technical throughput capacity (M $m^3$ per day / GWh per day) gas pressure at the connection point Karksi GMS - 40-42 bar Värska GMS - 40-42 bar | Throughput capacity under normal conditions (M $m^3$ per day / GWh per day) gas pressure at the connection point Karksi GMJ - 34-36 bar | Minimum throughput capacity (M $m^3$ per day / GWh per day) gas pressure at the connection point Karksi GMJ - 24-26 bar Värska GMJ - 24-26 bar |
|---|---|---|---|

[2] The throughput capacities provided 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 distance of the consumption point from the

| | Narva - 28-30 bar | Värska GMJ - 34-36 bar<br>Narva - 22-24 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 estimated throughput capacity of the pipelines at maximum pressures at entry points that the technical conditions of the pipelines allow to apply.

**Throughput capacity under normal conditions** is the estimated throughput capacity of the pipelines in the case of normal pressures at entry points.

**Minimum throughput capacity** is the estimated throughput capacity of the pipelines in the case of exceptionally low input pressures at entry points.

In addition to the connection points in Narva, Värska, and Karksi, Estonia has two further connection points. The parallel pipelines in Southeast Estonia (Irboska-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 in development of the natural gas transmission network. As Estonia is not producing gas itself, 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 transportation of gas between Russia and Latvia. Due to the high level of integration of the transmission networks, there is a risk of affecting the gas system of the entire region in the event of a breakdown. Figure 6 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 compression stations (Imatra, Kouvola, and Mäntsäla) in the Finnish network with the total capacity of 64 MW. Currently, the Finnish transmission network is not connected to the transmission networks of the Baltic states, but, according to plans, the transmission networks will be connected via the Balticconnector by 2020 (the Balticconnector is discussed further in paragraph 3.1).[3]

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supplying connection point, whether the gas supply passes one connection point or more, and taking into consideration the integrity of the transmission system and efficient functioning of the network.

[3] BEMIP GRIP (Gas Regional Investment Plan) 2014-2023 - http://www.entsog.eu/public/uploads/files/publications/GRIPs/2014/GRIP_002_140514_BEMIP_2014-2023_main_low.pdf

### 2.2.2 Latvia

The total length of the Latvia transmission network is approximately 1,200 km and it has three connection points with other networks. Two of these are connections with Estonia (Karksi and Murati) and one with Lithuania (Kiemenai). The Inčukalns natural gas reserve in the territory of Latvia is the only natural gas reserve in the Baltic states. Historically, the natural gas reserve is filled with gas in the summer period, when the natural gas consumption of the region is low, and in the winter, the gas in the reserve is used to supply the region. The Latvian network also includes one compression station in the territory of the Inčukalns natural gas reserve, which is mainly used for entry of gas into the reserve.[3]

### 2.2.3 Lithuania

The total length of the Lithuanian transmission network is approximately 1,200 km. Lithuania has a connection point with Belarus (Kotlovka), through which gas is mainly supplied, a two-way connection with Latvia (Kiemenai), and a connection point with Kaliningrad (Sakiai), which is only used to transit gas to Kaliningrad. There are two compression stations operating in the network with the total capacity of 42.2 MW. In 2014, the Klaipeda LNG terminal was launched to offer an alternative source of gas for the region.[3]

### 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 Swinoujscie 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 connection to the transmission networks of the Baltic states at this point, but, according to plans, the connection will be created via the Gas Interconnection Lithuania–Poland (GIPL) in 2021[4].[3]

[4] Press release of AB Amber Grid – https://www.ambergrid.lt/en/news/pressrelease/ab-amber-grid-new-tenders-for-the-procurement-of-gas-pipeline-construction-works-and-steel-pipes-will-be-launched

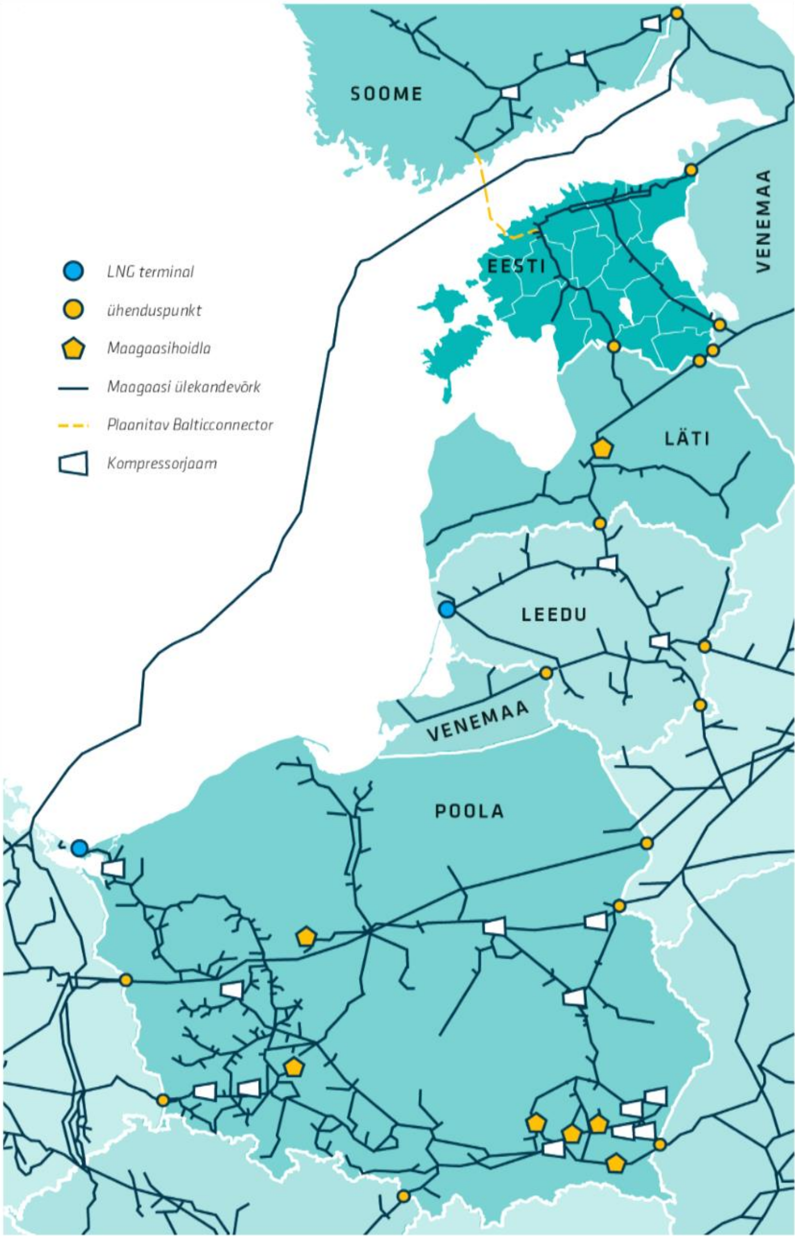



Figure 6. Regional gas transmission network

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 last few years, natural gas consumption has generally been demonstrating a declining trend, but there was a 9.5% increase compared to the year before in 2016. This was primarily caused by the cold weather in January, when the daily consumption exceeded 40 GWh for an entire week. In spite of the increased consumption in 2016, natural gas consumption has decreased by almost a half compared to the levels ten years ago (Figure 7).

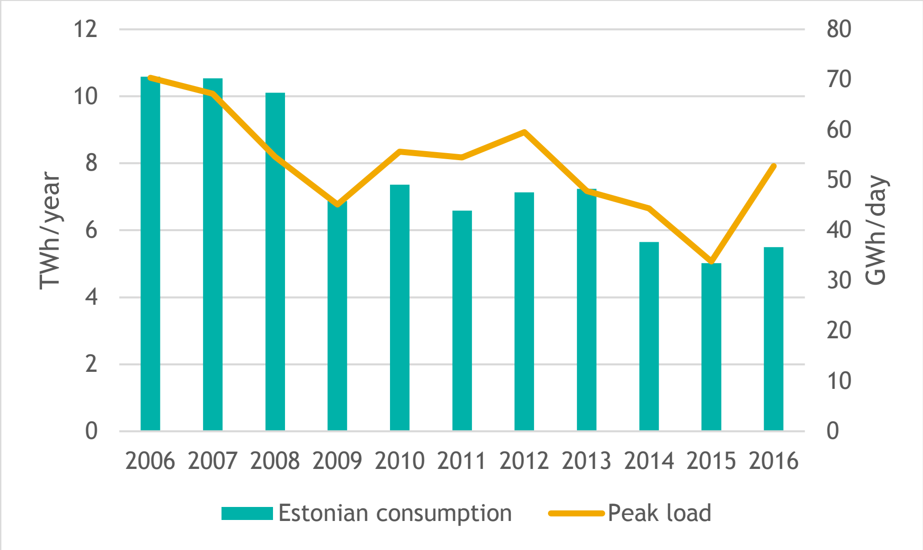



Figure 7. Estonian annual natural gas consumption (TWh per year) and the peak load (GWh per day), 2006–2016

Similar trends of natural gas consumption can be observed in the entire region (Figure 8).

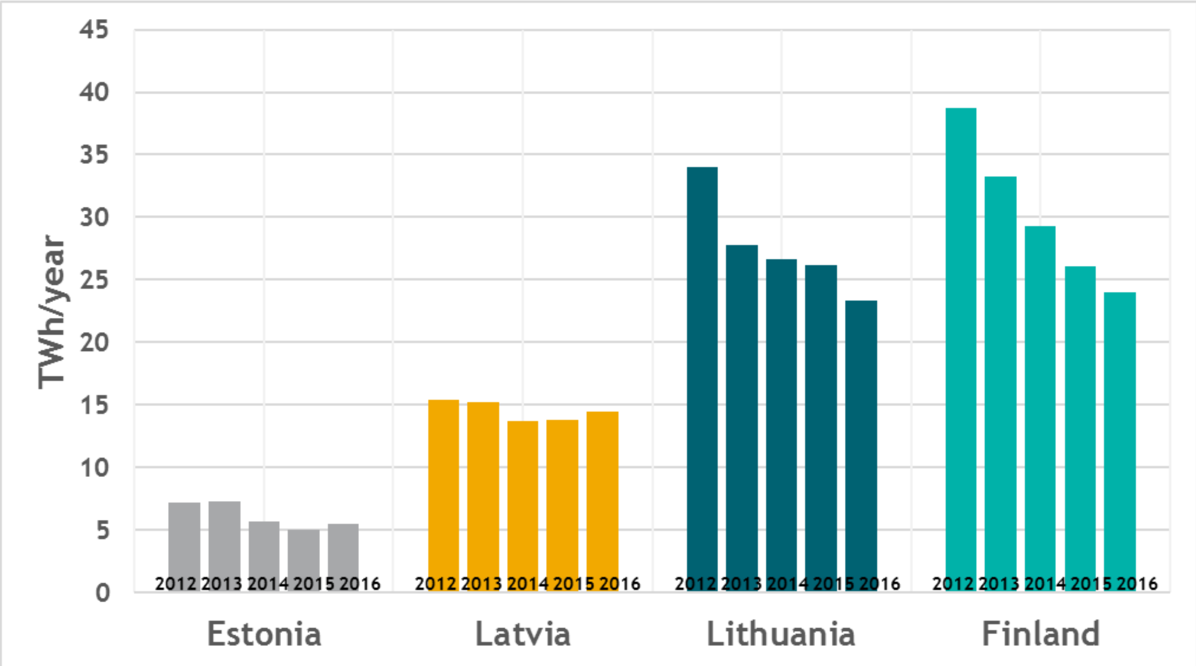



Figure 8. Natural gas consumption in the Baltic region, 2012–2016

Natural gas consumption is following the declining trend due to changes in the consumption structure (several industrial consumers and electricity and heat producers have foregone using gas as fuel, 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 9).

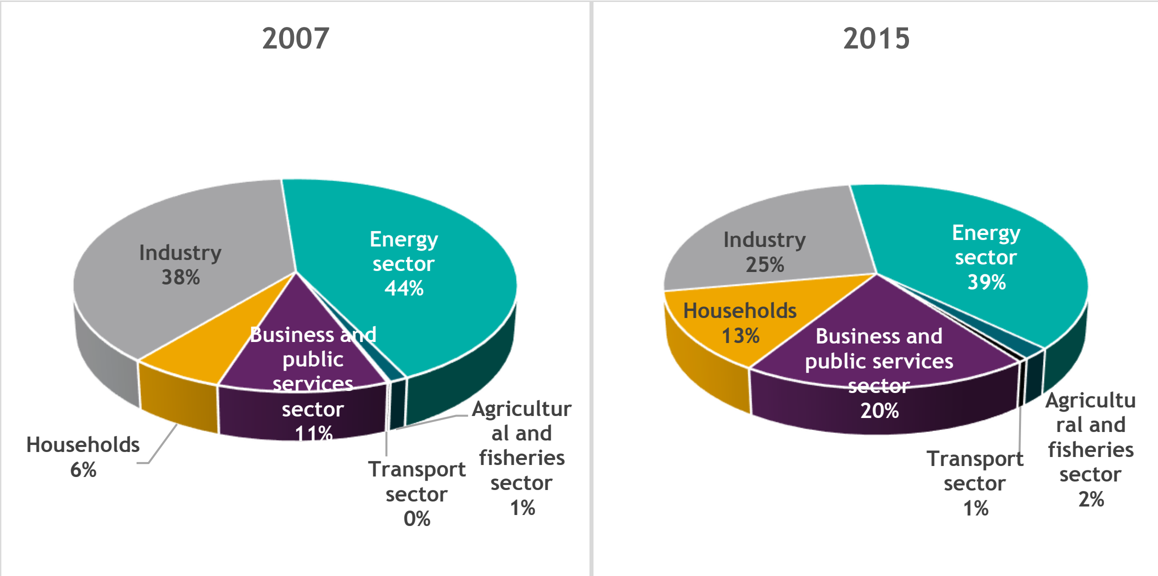



Figure 9. Distribution of gas consumption by sectors (2007 and 2015)

## 2.4 Estimated natural gas consumption until 2026

Estimations of gas consumption have an important role in planning the development of the gas network. Elering is using the results of the gas consumption estimations drawn up by the Tallinn University of Technology in 2016[5] and the company's internal analyses to estimate gas consumption. The methodology used for drawing up the basic estimations of gas consumption includes distribution of gas consumption by different types of exploitation and estimation of the trends of these types of exploitation based on statistical methods and the best knowledge.

The potential consumption of network gas (e.g., the gas transmitted over the transmission network) in the next decade depends on a number of factors (e.g., energy policy, economic growth, energy efficiency of the housing stock, etc.). The consolidated estimations of the consumption of network gas in the next ten years are provided in Figure 10 which was drawn up based on the consumption of network gas by different consumption groups.

[5] http://gaas.elering.ee/kasulikku/gaasituru-arendamine/

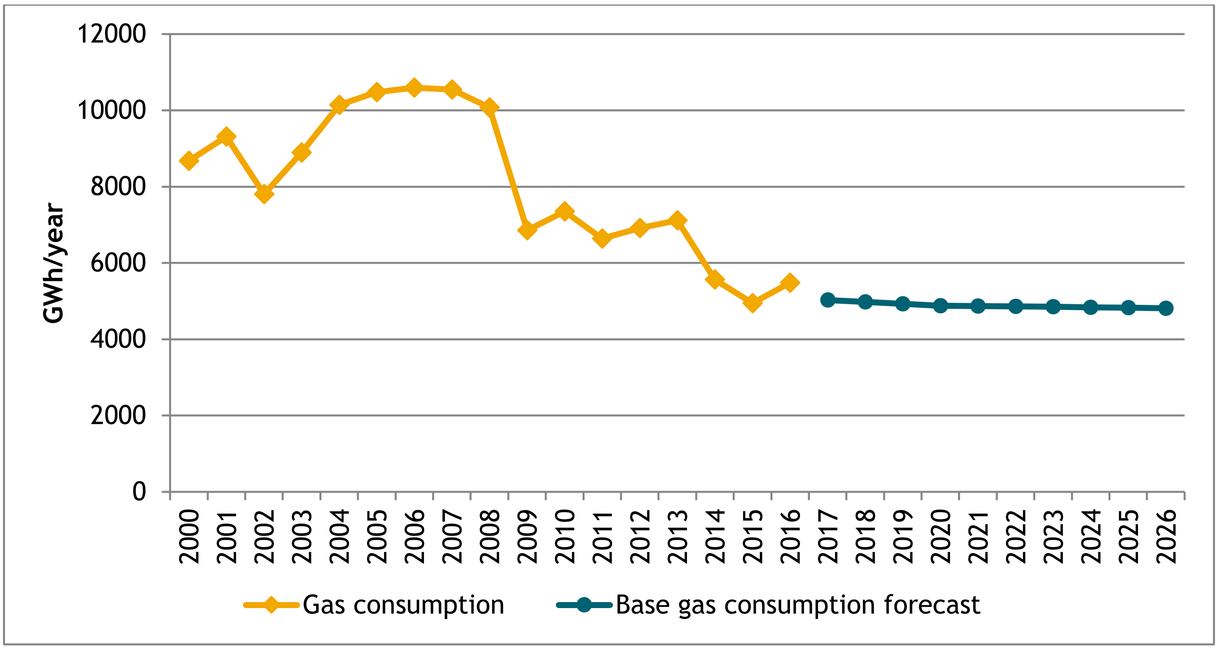



Figure 10. Annual gas consumption statistics and estimations for the next decade

The gas consumption trend in Estonia is clearly declining. The consumption is decreased in heat generation, electricity generation, in the industrial sector for heating as well as raw material. A growth trend is expected in the natural gas consumption in the transport sector. This is connected to the goal of the European Union to cover 10% of the energy consumption of the transport sector with renewable energy, in which Estonia is expected to play a big role in using biomethane. By far the largest share of natural gas is used for heat generation in Estonia. Since 2008, a declining trend can be observed in the gas consumption for heat generation. The main reasons for 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 are among the ones which have most decreased the gas consumption (transfer to using local fuels):

- In the end of 2008, construction works of the wood chip fuelled Tallinn power plant (annual heat production of up to 480 GWh) and the Tartu CHP (combined heat and power plant) (planned heat generation of ~300 GWh per year) were completed.
- On 28 January 2011, the Pärnu CHP was launched (planned heat production of 220 GWh per year).
- In the summer of 2013, the waste combustion block of the Iru CHP was launched (estimated annual heat generation of up to 430 GWh per year).
- In 2013, construction works of the Rakvere CHP were completed (estimated heat generation of 25 GWh per year).
- In 2014, construction works of the 4 MW solid biofuel boiler in Põlva were completed (heat generation of approximately 25 GWh per year).

Based on observations of the changes in consumption of natural gas for heat generation in the period from 2008–2014, a declining trend can be detected, but there were also 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 estimate is based on the presumption that in addition to the Väo 2 combined heat and power plant, which will start to generate heat for the heat network of Tallinn at full capacity in 2017 (expected estimated heat generation of 400 GWh, decrease in natural gas consumption of approximately 435 GWh, see Figure 7 for decline in the consumption 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).

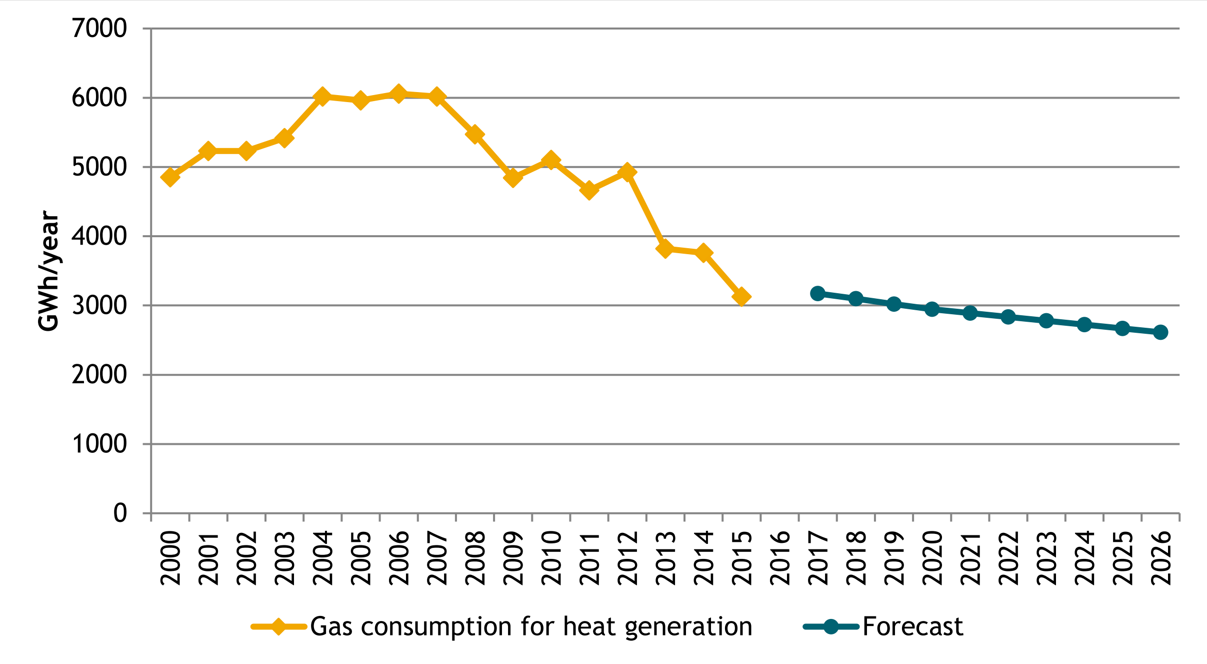



Figure 11. Statistics of gas consumption for heat generation and forecast for the next decade[6]

Development of the gas network and ensuring of security of supply play an important role in the peak consumption of gas. The peak consumption statistics and estimations for the next decade are provided in Figure 12. 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 the extreme temperature of -25°C and the regular scenario to the cold winter temperature of -20°C.

[6] As at the moment of publication of the development plan, there are no sector-specific statistics available for 2016.

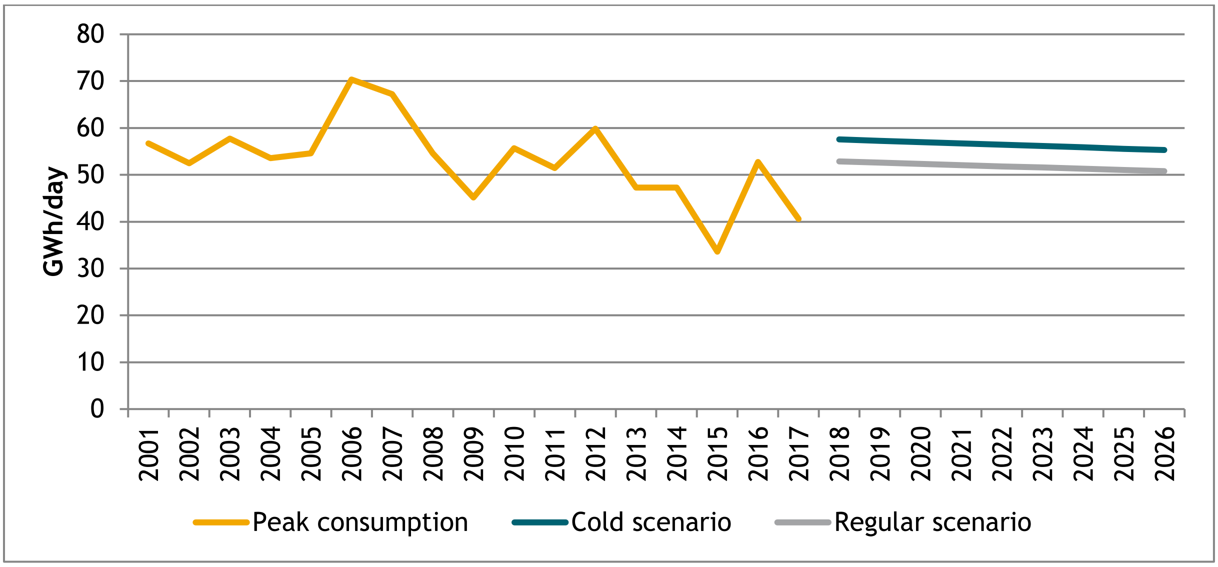



Figure 12 Natural gas peak consumption statistics and estimates for the next decade[7]

The peak scenario estimation in regular weather conditions also shows a declining trend, but 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 risk is primarily expected to arise in the network areas of Tallinn, Tartu, and Pärnu. Due to the above, the decrease in the peak gas consumption provided in the estimates is twice as slow as the estimated decrease in the annual gas consumption.

Gas consumption scenarios

The gas consumption estimation research conducted by the Tallinn University of Technology in 2016 also observed optimistic and pessimistic gas consumption developments in addition to the base scenario and drew up optimistic and pessimistic scenarios on the basis thereof (Figure 13).

[7] For 2017, the level provided in the graph is the peak consumption as at the end of February 2017.

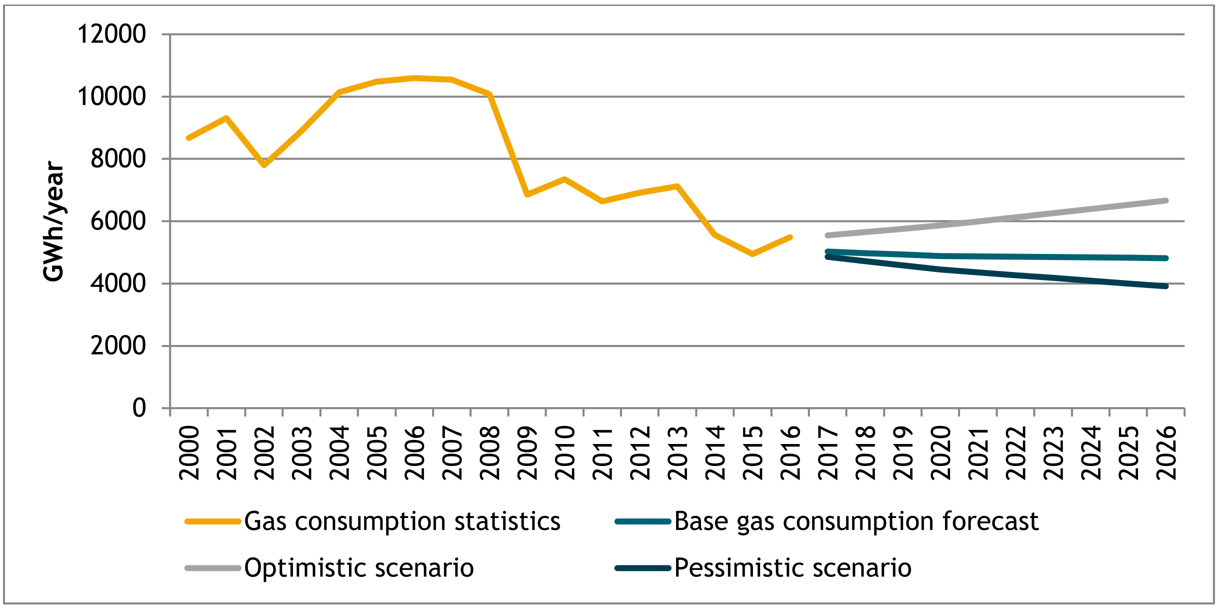



Figure 13. Estimated gas consumption in the next decade in the case of various scenarios

On the figure: GWh/aastas – GWh/year; Gaasitarbimise statistika – Gas consumption statistics; Gaasitarbimise baasprognoos – Base gas consumption estimation; Optimistik stsenaarium – Optimistic scenario; Pessimistlik stsenaarium – Pessimistic scenario

The scenarios viewed the sensitivity of gas consumption to various influencing factors and drew up the respective consumption estimations. The scenarios are based on changes in the preconditions of the influencing factors compared to the base estimation. 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 to the base estimation, 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 draw up the base estimation, the entire consumption is divided into groups by areas of application/consumers:

- use of network gas in the energy sector:
  - electricity generation;
  - own consumption of the energy sector;
  - heat generation;
- local consumption of the network gas;
- industrial consumption and consumption as raw material;
- consumption in the transport sector;
- consumption in the agricultural and fisheries sector.

Consumption of network gas in the energy sector is the group of the highest impact. The consumption for the purposes of electricity and heat generation has been showing a constant decline which is likely to continue. Depending on the scenario, consumption of the network gas in the energy sector will reach the level of 2,565–3,460 GWh by 2025 (in 2014, the consumption was 4,085 GWh, i.e. 73% 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 case, natural gas would provide a good alternative to use as 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 on 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 985–1,290 GWh by 2025 (the consumption in 2014 was 977 GWh, i.e. 17–18% of the entire consumption of network gas).

In the future, the increase in gas consumption will be influenced by the addition of new consumers; on the other hand, renovation of residential buildings constructed in the earlier periods will be bringing down the heat consumption thereof. It must be taken into consideration that there are more stringent (less heat-consuming) requirements set for new buildings as well as the buildings going under extensive reconstruction works (as of 2019 and 2021). Also, it is 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 the 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 was using natural gas as raw material in the production of mineral fertilisers, but the production stopped 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 275–715 GWh by 2025 (in 2014, the consumption was 462 GWh, i.e. 8–9% of the entire consumption of network gas).

The consumption of network gas in the remaining groups (the transport sector, agricultural and fisheries sector, and consumption for raw material) was 41 GWh in 2014, i.e. less than 1% of the entire consumption of network gas. Depending on the scenario, the amount of consumption of network gas in the above-mentioned groups forms 170–1030 GWh by 2025, with the main estimated growth arising from consumption of network gas in the transport sector.

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

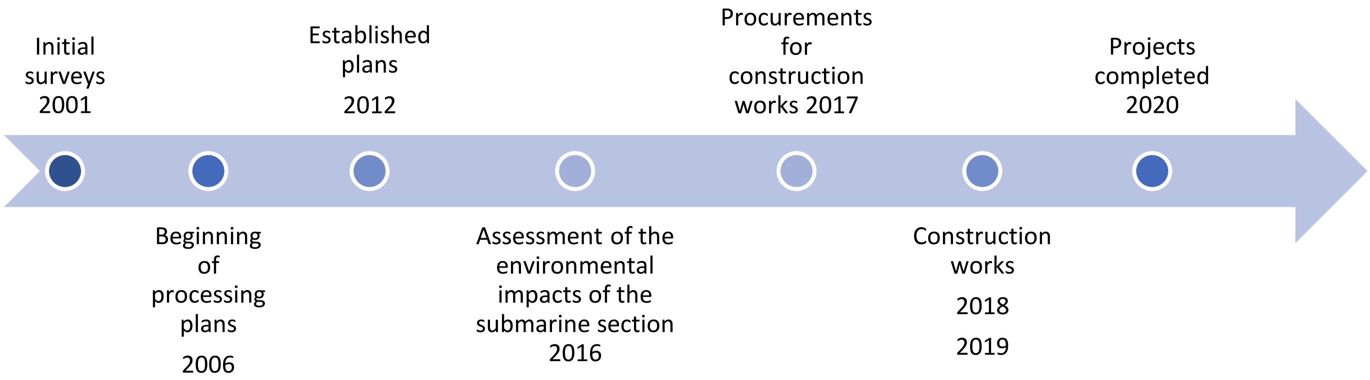
It has been optimistically presumed that by 2020, generation of biomethane into the gas transmission network will form up to 3% of the consumption of diesel fuel and motor gasoline in 2015. Thus, by 2020, biomethane generation will amount to approximately 300 GWh (for comparison, the value provided for 2020 in the ENMAK 2030+ low intervention scenario is 352 GWh per year). It has been presumed that the entire amount of the biomethane is transmitted to the consumers through the transmission network and the transport sector will be the main consumer thereof. As there was no biomethane generation in Estonia for 2015, the additional annual production capacity from biomethane should amount to 75 GWh, on average, in order to reach 300 GWh by 2020 (provided that the first biomethane station will commence biomethane generation in the beginning of 2017). It has been presumed that the annual increase in biomethane generation after 2020 will remain the same and amount to 930 GWh by 2025.

In the pessimistic scenario, it is presumed that the annual growth in the use of network gas in the transport sector is half of the figure provided in the base estimation and six times lower compared to the optimistic scenario, forming 150 GWh.

# 3 Developments of the gas network until 2026

- One of the priorities for the next decade is the Balticconnector project with Enhancement of Estonia-Latvia Interconnection, which will connect the gas systems of Finland and the Baltic States. Another important project of 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 isolated so far, to the rest of Europe.
- After the realisation of the regional projects, the Estonian gas system will turn from a dead-end system to an important transit corridor.
- In connection with the large potential biomethane resources in Estonia, potential subscriptions of biomethane producers to the gas network can be foreseen in the next decade.
- Prior to submission of applications for subscription, all market participants should visit Elering to conduct a preliminary survey for subscription, in the course of which the technical terms of reference will be drawn up in cooperation between Elering and the subscriber.

## 3.1 Balticconnector and Enhancement of Estonia-Latvia Interconnection




The ‘Balticconnector’ project to connect the gas transmission networks of Estonia and Finland, along with ‘Enhancement of Estonia-Latvia Interconnection’, the project to strengthen the gas transmission capacities of Estonia and Latvia, is an undisputed priority among investments in the Estonian gas transmission network. The projects are technically interconnected and only form a complete cluster enabling to achieve 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 towards completion of the project pursuant to the communication of the Prime Ministers of Estonia and Finland on 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 project Enhancement of Estonia-Latvia Interconnection is developed by Elering AS. The completion date of the project pursuant to the grant agreement entered into with the European Commission is in 2019.

Both projects of 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 in the PCI list and Enhancement of Estonia-Latvia Interconnection is project number 8.2.2 in the PCI list.

The aim of the project cluster of the Balticconnector and Enhancement of Estonia-Latvia Interconnection is to connect the transmission networks of the Baltic states and Finland and thereby create the prerequisites for establishing the unified gas market of the Baltic countries and Finland. After the realisation of the investments, 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 prerequisites for additional delivery chains in the form of a regional LNG terminal which will also ensure minimising Russian influence on gas supply. The Balticconnector and Enhancement of Estonia-Latvia Interconnection will also provide access for Finland to the Inčulkans gas reserve and enables 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 surveys required for the construction works from the Connecting Europe Fund (CEF) in the extent of 5.4 million euros. The aim of the surveys is preparation of 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 project for Enhancement of Estonia-Latvia Interconnection, 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).

### 3.1.1 The technical parameters

The Balticconnector project consists of:

- Inkoo–Paldiski 80 km submarine pipelines in the Gulf of Finland, DN500, 80 bar
- Siuntio–Inkoo 20 km aboveground pipelines in Finland, DN500, 80 bar
- Kiili–Paldiski 50 km aboveground pipelines in Estonia, DN 700, 55 bar
- Gas pressure regulation station in Kiili
- Inkoo natural gas metering station + compression station (Finland)
- Paldiski natural gas metering station + compression station

The project for Enhancement of Estonia-Latvia Interconnection consists of:

- Karksi (reversible) natural gas metering station
- Lilli pipeline intersection
- Puiatu compression 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 80 km, of which approximately 40 km is in the Estonian economic zone. The planned transmission capacity of the pipeline is 81.2 GWh per day. The reference diameter of the submarine pipeline is DN500 (wall thickness 12.7 mm) and the maximum designed operating pressure is 80 bar. To ensure the required anchoring in the bottom of the sea, the pipelines are covered with a 50 mm layer of concrete. Based on the risk analyses conducted, the transmission pipelines are further covered with stones in the sea floor in the maritime transport crossing points and in the coastal areas.

The assessment of the environmental impacts of the submarine pipelines has been approved and the preliminary project design documentation for the submarine pipelines has been drawn up. The underwater geodetic surveys and prospecting will be conducted in the winter of 2016/2017.

Aboveground 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 in the course of processing the comprehensive and thematic plans. Strategic assessment of environmental impacts has been conducted on the route of the pipeline.

- Length of the pipeline: approx. 50 km
- Reference diameter of the pipeline: DN 700
- Maximum designed operating pressure of the pipeline: 55 bar
- The planned pipeline intersection near Keila and the Kiili pressure reduction station are integral parts of the aboveground section.

2. Inkoo–Siuntio

The Inkoo–Siuntio transmission pipeline, which is located in the territory of Finland, is part of the Balticconnector project. The route of the pipeline was determined within the framework of drawing up the detailed plan for the Fingulf LNG terminal. Strategic assessment of environmental impacts has been conducted on the route of the pipeline.

- Length of the pipeline: approx. 20 km
- Reference diameter of the pipeline: DN 500
- Maximum designed operating pressure of the pipeline: 80 bar

Compression stations

The Paldiski and Inkoo compression stations must ensure sufficient transmission capacity for the submarine Inkoo–Paldiski pipeline of the Balticconnector. The Puiatu compression station must ensure a sufficient transmission capacity between the transmission networks of Estonia (incl. Finland) and Latvia (incl. Lithuania/Poland).

Paldiski compression station

- Consumed capacity for the compression station: approx. 6–10 MW
- Transmission capacity of the compression station: 81.2 GWh per day
- The zoning plan of the compression station was approved on 20 October 2014

Inkoo compression station

- Consumed capacity for the compression station: approx. 6–10 MW
- Transmission capacity of the compression station: 81.2 GWh per day

Puiatu compression station

- Consumed capacity for the compression station: approx. 6–10 MW
- Transmission capacity of the compression station: 105 GWh per day
- The zoning plan of the compression station was approved on 3 May 2016

Gas metering stations

The Balticconnector project includes gas consumption metering stations in Paldiski and Inkoo. The above-mentioned stations will be reversible and will enable to meter movement of gas flows between the gas networks of Estonia and Finland (from Estonia to Finland and vice versa).
The project for Enhancement of Estonia-Latvia Interconnection includes a gas metering station in Karksi. The station will be reversible and enable to meter movement of gas flows between the gas networks of Estonia and Latvia (from Estonia to Latvia and vice versa).

1. Paldiski GMS – throughput capacity 81.2 GWh per day
2. Inkoo GMS – throughput capacity 81.2 GWh per day
3. Karksi GMS – throughput capacity 105 GWh per day

Transmission capacity
A bidirectional submarine gas transmission pipeline between Estonia and Finland, transmission capacity 81.2 GWh per day.

Costs of the parts of the Balticconnector projects

- Inkoo–Paldiski 80 km submarine pipeline, DN500, 80 bar – approx. 150 million euros
- Siuntio–Inkoo 20 km aboveground pipeline, DN500, 80 bar - approx. 10 million euros
- Paldiski–Kiili 50 km aboveground pipeline, DN 700, 55 bar – approx. 30 million euros
- Inkoo natural gas metering station + compression station – approx. 30 million euros
- Paldiski natural gas metering station + compression station – approx. 30 million euros

Based on current estimations, the total cost of the Balticconnector project will amount to approximately 250 million euros, but a more accurate price will be determined in the course of the surveys.

Costs of the parts of the project to strengthen the connection between Estonia and Latvia

- Puiatu compression station – approx. 30 million euros
- Karksi natural gas metering station – approx. 5.8 million euros
- Lilli line valve point – approx. 0.6 million euros

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

### 3.1.2 Status of the project

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

Submarine pipelines

The preliminary draft for the submarine pipeline and assessment of the environmental impact of the pipeline in the territorial waters of Estonia have been completed. The further geodetic surveying of the sea bottom required to prepare the procurement documents of the submarine pipeline will be conducted in the winter of 2016/2017. After issuing the building permit for the Estonian territorial waters (currently being processed), applications will be submitted for a permit for special use of water and a building permit.

Kiili–Paldiski pipeline

The route of the Kiili–Paldiski pipeline has been determined in four thematic plans and two comprehensive plans. The preliminary draft required to draw up the procurement documents is in the process of being granted final approval. The procurement procedures for the procurement consultant and owner's engineer are ongoing. The procurement documents will be drawn up by the procurement consultant and owner's engineer.

Inkoo–Siuntio pipeline

The route of the Inkoo–Siuntio pipeline has been designated within the FinGulf LNG terminal. Necessary assessments of environmental impacts have been conducted on the route of the pipeline.

Paldiski compression station

The zonal plan for the Paldiski compression station has been approved. The procurement procedures for the procurement consultant and owner's engineer are ongoing. The procurement documents will be drawn up by the procurement consultant and owner's engineer. The Paldiski natural gas metering station will be constructed within the framework of the same procurement procedure as the Paldiski compression station.

Puiatu compression station

The zonal plan for the Puiatu compression station has been approved. The procurement procedures for the procurement consultant and owner's engineer are ongoing. The procurement documents will be drawn up by the procurement consultant and owner's engineer.

Inkoo compression station

The layout of the Inkoo compression station has been approved. The procurement procedure for drawing up the preliminary building design documentation is ongoing. The procurement documents will be drawn up upon completion of the preliminary building design documentation.

Karksi natural gas metering station

The procurement procedure for the reconstruction works of the Karksi natural gas metering station has been opened. The planned completion time of the reconstruction works is December 2018.

Lilli pipeline intersection

The procurement procedure for construction of the Lilli pipeline intersection has been opened. The planned completion time of the Lilli pipeline intersection valve point is December 2018.

### 3.1.3 Socio-economic impact of the Balticconnector cluster

The Balticconnector along with 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 a strengthened connection between Estonia and Latvia will add a new supply source for Finland. This means alleviating risks related to one supply source of gas, as well as those arising from failures of the gas system. For Estonia, implementation of the project does not immediately bring a new supply source, but will bring a new supply channel which will ensure the security of supply in the case of technical problems. The projects would improve the Estonian N-1 criteria from 68.7% to 183.6%[8]. In a longer perspective, the large integrated market will probably result in additional supply sources for Estonia as well, for example in the form of a regional LNG terminal. Conclusively, the potential social losses arising from interruptions in the gas supply are likely to decrease as there will be alternative supply channels.

Connecting the markets through infrastructure will be beneficial through integration of the market and increasing of competition. Firstly, the gas prices in the previously separated markets will harmonise. For example, the difference between the prices of gas in Estonia and Finland have differed by roughly five euros per MWh in the last five years, being cheaper in Finland. Connection of the markets is expected to harmonise the market prices of gas and decrease the geographic price discrimination arising from the situation of just one gas supplier. There will also be more competing gas suppliers in the wider connected and open market. The import route diversification indicator (also known as the Herfindahl-Hirschmann 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[9]. In such conditions of tighter competition, the consumers of gas will gain through lower prices and better service quality.

In addition to the above-mentioned benefits related to security of supply and integration of the market, several further benefits arising from the project can be highlighted. The large gas market being formed as a result of connection of the gas systems will enable to make investments into the infrastructure which 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 storage of gas. There is great potential for biogas and biomethane generation in the Baltic states and Finland, the role of which in the transport sector is increasing at the European level and which may become an export article. Connected gas systems will enable cross-border selling of balance services, which will lower the overall costs of the balance service. Conclusively, implementation of such projects will enable to postpone or decrease national investments into the Estonian as well as Finnish networks, which would have otherwise been important for ensuring security of supply.

Conclusively, the benefits arising from implementation of the projects are diverse and reach outside of the geographical borders of the countries of location of the projects.

The total costs of the investments in the Balticconnector project and the project for Enhancement of Estonia-Latvia Interconnection 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 dimension of the projects and their use outside of the countries of location, wider socialisation of the costs of 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, the status thereof 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 investment. This is the highest percentage of co-funding from the Connecting Europe Facility among all projects which have applied for support so far.

[8] Calculation of the N-1 criteria is explained in paragraph 'Overview of security of supply'. Calculation of the N-1 criteria in the case of the Balticconnector and Enhancement of Estonia-Latvia Interconnection:

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

[9] The HHI expresses the size of individual supply channels compared to the total amount of supply channels. The calculation formula is $HHI = \sum_i^N {s_i}^2$, in which s expresses the percentage of each supply channel of the total amount of supply channels. The maximum value of the HHI is 10,000 (one supply channel).

## 3.2 Reconstructions and renovations of the gas network

### 3.2.1 Potential developments of the Jõhvi–Narva pipeline

The ten-year investment plan for 2017–2026 includes replacement of the Jõhvi–Narva pipeline. Diagnostics cannot be performed on the Jõhvi–Narva pipeline, as the pipeline is partially made of pipes of different dimensions and polymer deposits have formed in the pipeline. Considering the time of construction of the pipeline, 1955, the pipeline requires complete replacement in the entire extent of 45.1 km. A calculation made with the SIMONE software which was created for modelling and analysing the gas networks gives DN400 as the minimum dimension of the pipe (external dimension of D=426 mm), provided that the gas consumption will remain at the same level. The average construction cost of a DN400 steel pipe per km is 400,000 euros, which means that the total cost of replacement of the pipeline would be approximately 18 million euros. The costs of construction of the diagnostics input chamber assembly in the beginning of the pipeline and the diagnostics removal assembly in the end of the pipeline will be added to the amount. The existing valve points and cathode stations must also be modified – some of the valves must be replaced and the devices must be made remotely controllable. The cost of the entire project would probably reach 19 million euros, which could be divided over 5 years.
The decision for renovation of the Jõhvi–Narva pipeline will be made after completion of the Balticconnector gas pipeline, probably in 2020.

Depending on the development of the Estonian gas market, the diameter of the replacement pipe may be larger or smaller based on the demand for transported gas. Construction of pipelines of a larger diameter would, however, require large investments into construction of the pipeline and replacement of all valve points. If constructing a gas pipeline of a larger dimension is connected to a plan of transporting significant amounts of gas from Narva to Tallinn, the need for renovation of the existing gas pipeline from Jõhvi to Tallinn should also be considered. At this point, this need is not included in the ten-year investment plan.

### 3.2.2 Other investments in / reconstructions of the transmission network

The need for investments arising from the condition of the gas network is based on the principles provided below.

Internal diagnostics of the pipelines and surveys of the condition. Internal diagnostics of the pipelines (hereinafter diagnostics) is the only solution for comprehensive assessment of the condition of underground pipelines. The diagnostics detects any damages or defects to the pipelines and the required renovation works are performed as a result of the surveys. This includes replacement of sections of the pipeline, installation of repair collars, and/or re-isolation of sections of the pipeline. The schedule of the works is planned by years up to the next diagnostics. 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 within the first year, followed by works of lower importance. All defects and shortcomings which qualify within the maximum operating pressure (MOP) for which the pipeline is designed must be eliminated. Internal diagnostics of the pipeline are planned with the interval of 5–6 years for all transmission pipelines, which matches the programmes of performing analyses. Defects of and mechanical damages to the welded connections (dents in the pipe, scrapes, etc.) must be examined prior to conducting the works – control excavations with control measuring, x-raying of welded connections.

Replacement of sections of pipelines. Replacing sections of the pipeline on the Ibroska–Tartu–Rakvere route, where the defects found in the course of the last diagnostics (2013) are yet to be eliminated, have been proposed for the investment plan for 2017–2020. In the case of other pipelines, the proposed volumes are estimated. Estimated means that the diagnostics will be performed during the validity of the investment plan and based on previous experience of conducting of diagnostics, the need for renovations can be presumed. The estimated amounts are provided based on previous experience.

Elimination of a defect qualifies as replacement of a section of the pipeline if the defect constitutes a risk for the operating pressure or a health hazard from the perspective of the metal of if more than three composite material repair collars must be installed on a pipeline. The choice of replacing a section of the pipeline or install composite collars also depends on the possibility to vacate the section of the pipeline of gas.

Load-bearing and protection structures. Reconstruction of the load-bearing and protection structures will remove the risk of damages to the pipeline at the points of crossing with roads, railways, and rivers and ensure more efficient functioning of the cathode protection and lower corrosion of the pipeline. At the above-mentioned crossings, the gas pipeline is either installed in a barrel or on supports (protection and load-bearing structures) and it is necessary to ensure electrical insulation of the gas pipeline with respect to the structures and prevent deformation of the pipeline due to sagging of the support structures.

Repairing of defects with repair collars. Repairing of defects with repair collars is important as this allows rehabilitation of local damages (corrosion, smaller dents, etc.) to the gas pipeline. Installation of a composite material collar will increase the reliability and working life of the entire pipeline section. Installation of the collars also includes inspection and isolation of the entire pipeline repaired – after that, the pipe is renewed in the system. We have been placing repair collars of the dimension of DN500–700 to the pipelines. The advantage over replacement of the section of the pipe is that the collars can be installed without an interruption in 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 collars and replacing the pipe. If a section of pipeline between valve assemblies must be switched off (freed from gas pressure) in the same year based on the schedule of conducting the works, repairing the defective section of the pipeline by replacement of the pipe is preferred.

In the investment plan, installation of welded steel repair collars has also been included as a new work operation under installation of repair collars. It is primarily planned to perform this operation to repair/strengthen the welded connections of the Vireši–Tallinn gas pipeline. The information regarding the need to perform the works was obtained by conducting internal diagnostics of the pipeline. The welded connections were also examined further by x-raying and the need for conducting the works was determined.

Re-insulation. Re-insulation of sections of the pipeline is required because the insulation of the pipelines installed in the course of construction has been damaged due to various reasons. Timely replacement of the insulation on the pipeline will significantly increase the resistance of the pipeline to failures, lower the expenditure on renovation works (installation of repair collars, replacement of sections of the pipeline) and will thereby also reduce the interruptions in the gas supply.

Reconstruction of valve assemblies. Reconstruction of the valve assemblies is required for ensuring the reliability and safety of the gas network and ensures the possibility to control the gas network. Reconstruction of the valve assemblies includes replacement of old and depreciated valves with new valves which are automatically closed in the case of failures and remotely controlled (via the Scada system). The old valves are no longer reliable and spindles or other parts may develop leaks which cannot be eliminated. The programme for reconstructing valve assemblies focusses on making the assemblies remotely controllable, which will decrease the need for using manpower on driving to the assembly sites to switch off the valves. Remotely controllable valves also enable immediate closing of the valves, which decreases the economic losses if a gas pipe bursts and large amounts of gas flow out.

Reconstruction of the cathode 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 depreciates. Timely replacement of the cable increases the service lives of the cathode transformer and the grounding field and decreases the expenditure on energy consumption. Grounding fields are parts of the cathode protection system which are sensitive to wear and tear and the investment plan prescribes replacement of the grounding fields based on the service lives thereof. 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.

Equipment of gas stations. The control and protection devices on the lines of the gas stations ensure quick analysis and monitoring of the work of the station, accelerate detection of failures and deficiencies, and switching off a failed line and leaving on the reserve line in case of a failure, thus the investment plan includes renewal and modernisation of the control and protection equipment. The need for replacement of the operating equipment (boiler equipment, odorising equipment, reserve electric power generators) is also included.

Reconstruction of gas distribution stations. The five-year plan or the detailed investment plan prescribes full reconstruction of five gas distribution centres in the period from 2018–2021 – Misso, Aseri, Saadjärve, Ahja, and Veriora. These are the last gas distribution stations in the transmission network which are equipped with older generation (Russian) gas equipment. Keeping these gas distribution stations operational today is complicated, as they require frequent maintenance, cannot be automated, and finding spare parts is problematic. Without reconstructing the stations, it is not possible to sustainably ensure safety or the required operating parameters at the connection points. The above-mentioned gas distribution stations are included last in the investment plans due to the fact that gas consumption through these stations is low and the payback time, if the station is reconstructed, exceeds the service life of the station. A working group has been formed to analyse the different possibilities for reconstructing the above-mentioned gas distribution stations or offers alternative opportunities for replacement of the gas distribution stations. Closing and demounting of a station of lower gas consumption, with the above-mentioned working group assessing the feasibility and impacts thereof, may serve as an alternative.

Reserve equipment. A list of reserve equipment and materials has been drawn up for unforeseeable events in the gas network which have long delivery times but are required for quick elimination of failures. Investments are planned with the purpose of obtaining the reserve equipment and materials which are not available today.

## 3.3 Potential developments of the gas network in the next ten years

### 3.3.1 Possibilities for expansion of the transmission network and distribution networks

The gas consumption survey conducted by the Tallinn University of Technology in 2016[10] analysed the potential for gas consumption in the areas with no gas network and potential expansion of the gas transmission network to areas with a consumption potential. It was presumed in the survey that the potential increase in the gas consumption would be connected to the following main factors:

- replacement of fuel oil used for heat generation in district heating and in industrial boiler plants;
- gasification of households.

In forecasting of an increase in the consumption of network gas in areas without a gas network, conditions were taken into consideration, based on which development of the gas transmission network (investments), as a rule, should not increase the price of natural gas transmission services. Taking into consideration the above, a methodological approach was used in the survey for assessment of the potential increase in the consumption of network gas in areas without a gas network, which consisted of the following main points:

[10] http://gaas.elering.ee/kasulikku/gaasituru-arendamine/

1. Determining of minimum amounts of gas consumption in the case of different investments into the gas transmission network (i.e. what is the minimum amount, in the case of which the price of the natural gas transmission service would not increase).
2. Determining the potential areas to be supplied with gas.
3. Analysis of the potential gas consumption of the potential gas consumption areas. The analysis was conducted by areas. The main factors for assessment of the potential for gas consumption are the existence of fuel oil-fuelled boilers and the potential gas consumption arising from the replacement thereof.

The survey concluded that there are no areas of sufficiently high gas consumption potential today where it would be feasible to expand the gas transmission network to. Instead, a potential growth of gas consumption is foreseen from the expansion of the distribution network to areas without a gas network and expanding of gas consumption in the areas with a gas network. The largest places with a potential for increased gas consumption include:

- The town of Paldiski. Potential 335 GWh (32.0 M $m^3$) (in the case of completion of the Balticconnector). The main expected increase in the consumption is connected to the Alexela fuel terminal, the consumption of which, taking into consideration the expansion project, may reach 210 GWh (20.0 M $m^3$).
- The town of Keila. The estimated consumption potential amounts to up to 21 GWh (2.0 M $m^3$) (in the case of completion of the Balticconnector). Half of the consumption potential is related to the potential transfer of the Entek network area from oil shale to natural gas. The second part is achievable when the boiler plant of the network area of the town of Keila will be connected to the gas network, with the oil shale used for achieving the peak load replaced with gas.
- The town of Võru. The estimated volume of gas consumption in the Pikk Street region of the town of Võru amounts to 15 GWh (1.4 M $m^3$). The area of Pikk Street is not included in the district heating network area. There is currently a LNG station construction project being developed there. In connection with construction of the LNG station, the town of Võru is planned to be equipped with a B-category (5 bar) natural gas pipeline.
- Industrial undertakings that use fuel oils for heat (including industrial steam) generation. The feasibility of such undertakings switching over to gas must be based on negotiation between the distribution network and the industrial undertakings.

### 3.3.2 Subscriptions to the transmission network

Development of the terms and conditions for subscription to the gas transmission network of Elering launched in 2016 will be completed in the first half of this year. The terms and conditions of subscription will be regulating subscriptions to the network of Elering in the areas of both production and consumption; the rules of processing subscriptions and of construction, implementation, and inspection of gas structures will be established as well as the requirements for the producers for ensuring the quality of the gas. The terms and conditions for subscription also specify the technical principles and parameters for the client's gas installations as well as the gas transmission network. In connection with establishing the terms and conditions for subscription, Elering will also update the methods for calculating the subscription fee to the gas network of Elering AS and the fee for changing the terms and conditions for consumption and production.

Last year, one subscription contract was entered into for subscription to the gas network of Elering and one application for subscription was submitted. Both subscriptions are planned in Ida-Viru County.

### 3.3.3 Implementation of remotely readable gas meters

3.6% of the gas metres in Estonia are remotely readable and are used to meter 85% of the gas consumed in Estonia – these are mainly used by large-scale consumers. In connection with the expiry of the service lives of old gas meters, new gas meters which enable remote reading will be installed for most end consumers by 2021. To make the meters remotely readable, they must be equipped with a data connection module and data connection must be established. It is not yet clear whether remote reading of small consumers would be feasible (the expenditure and resource vs the benefits from remote reading).

One cost-effective option for implementation of remote reading would be the integration of the gas meters of small consumers to the consumers' electricity consumption remote reading equipment, which are already equipped with the data connection module and data connection. This way, no separate data connection module would have to be purchased for gas meters and no new data connection would have to be established. It may be presumed that implementation of remote reading would create different socio-economic benefits: further development of the energy market, new energy services for the consumers, more efficient use of energy, development of a smart network, etc.

In order to obtain an overview of the potential benefits, challenges, and grounds for future decisions regarding implementation of remote reading at end consumers of gas, Elering will be conducting a survey titled "*Socio-economic impact analysis of remote metering of natural gas end-consumers*" in 2017. After completion of the survey, the survey will also be published by Elering. The goals of the survey include:

- Analysing the socio-economic benefits which may arise form implementation of remote reading of the gas meters at the end consumers;
- Analysing the benefits by various consumer groups;
- Overview of the consumers of gas in the case of whom it would be beneficial to implement remote reading based on the amount of gas consumed by them
- Suggesting an optimal technical solution for implementation of remote reading of gas meters (e.g., using the existing remotely readable electricity metering equipment vs installation of new data connection modules and establishing of data connection);
- Overview of needs for gas meter types of various consumer groups and a schedule for implementation of remote reading;
- Overview of the potential synergies with the data communication systems of other infrastructures.

#### 3.3.4 Biomethane

Pursuant to the EU Renewable Energy Directive 2009/28/EC, Estonia is required to reach the percentage of renewable energy in the transport sector of 10% of the amount of liquid fuels used in the sector by 2020. A total of over 9.1 TWh[11] of transport fuels are used in Estonia, approximately two thirds of which are formed by diesel fuel and the rest by 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 country is planning to develop biomethane production based on local raw material and to 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 4.4 TWh (=450 M $m^3$)[12] 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. Commencement of biomethane generation will add a local raw material-based supply source to the gas market and open a new area in the transport sector with respect to gas consumption.

Development of the area of biomethane will help to diversify the energy consumption in Estonia and improve energy security. Using renewable fuel will also enable the transport and industrial sector to decrease greenhouse gas emissions. The state has set the goal of 4% of the gas in the gas network being formed of biomethane by 2020, which would amount to approximately 20 million $m^3$ of

[11] Eurostat, 2014
[12] Report of the Development Fund – Estonian energy economy, 2015

biomethane per year. If the above-mentioned 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.

For the development of gas filling stations selling compressed natural gas and biomethane, grants can be applied for from the Environmental Investments Centre (EIC). In addition to the six existing compressed gas filling stations and two in the stage of development, there is sufficient aid still available from the EIC for the construction of approximately 20 further filling stations. National support for gas sellers for faster launch of the biomethane production and consumption, which are planned to be funded from the revenue from the sales of the $CO_2$ quota, are also about to be added in the near future. In order to provide security of investment to the biomethane producers and a long-term developmental direction for the area, the state is planning to apply an obligation to supply biomethane in the extent of 4% to gas sellers as of 2021.

Biomethane action plan

In the end of 2016, a survey focussed on the promotion of the possibilities for using biomethane in Estonia commissioned by Elering as a preparation for the national action plan was completed. The survey titled *Development of Biomethane Based Fuel Market in Estonia*[13], which was developed by the Energy Research Centre of the Netherlands in cooperation with Dutch, Swedish, and Estonian experts, consists of 12 practical and cost-efficient measures. The aim of the activities is to replace 3% (or approximately 35.8 M $Nm^3$) of the fuel used in the transport sector with biomethane by 2020. The measures highlighted in the report include all aspects of the biomethane value chain: the consumers, filling stations, vehicles, biomethane production and a cost-efficient fiscal network, which will grant a competitive fuel price for the suppliers.

The survey reveals that the largest challenge in the way of achieving the goal is the high price of fuel compared to imported natural gas. Due to the big price difference between biomethane and natural gas, it is not yet economically feasible to produce biomethane. In order to achieve the ambitious goal, however, it is first necessary to improve the economic feasibility of the generation and consumption of biomethane and then to expand and increase the market. Such an approach will decrease costs and enable to solve any issues and problems which arise, before the market matures.

Based on the survey, establishing of gas filling stations and connection of biomethane producers to the gas network needs to be supported. A system for supporting biomethane producers in order to ensure the ability of biomethane to compete with natural gas must also be launched. Additionally, in order to develop the market, all parties involved with biomethane should be assembled in a common network to facilitate information exchange and cooperation and thereby the arising and development of business opportunities. For the fuel sellers to be able to use biomethane to fulfil the renewable energy goals established for them, a system of certificates of origin of biomethane must be implemented.

It is important to draw up a national plan for the use of biomethane in transport, which would set the goals, rules, and terms and conditions for investing into the sector. It is also necessary to develop a strategy for the construction of biomethane filling stations, which would determine the optimum density and locations of the filling stations, taking into consideration the possibility of adding gas filling stations to existing filling stations. Figure 14 provides an overview of the locations of D-category pipelines, the locations of the existing filling stations and the number of stations per 25 $km^2$, as well as the traffic frequency on Estonian roads, which is an important tool in determining of optimum locations for new filling stations. Based on the survey, the goal of development of the biomethane market must also be taken into consideration in organising public procurements in order to promote using vehicles consuming compressed gas in the public sector. The criteria for public transport

[13] Development of Biomethane Based Fuel Market in Estonia, 2016 - http://elering.ee/biometaan/

procurement procedures must be developed for this purpose to enable the vehicles using methane to compete with vehicles running on other fuels.

The above-mentioned survey will be used as an important input and tool in the development of the Estonian national plan for using biomethane in the transport sector.

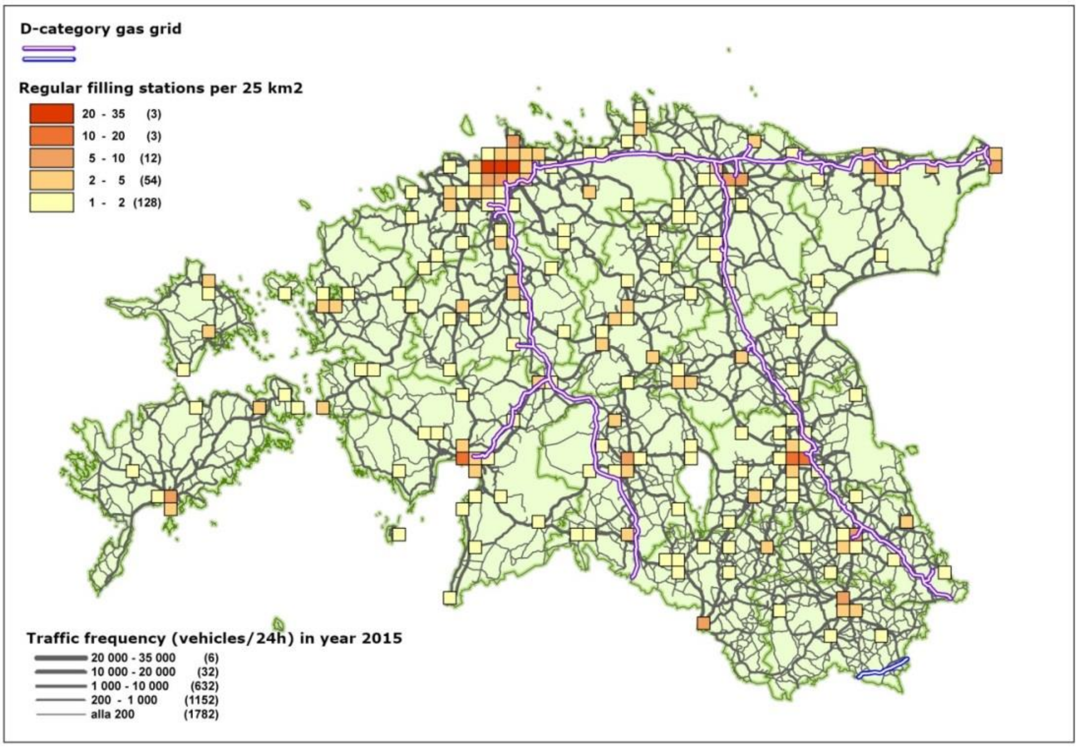



Figure 14. Network of existing filling stations, D-category gas grid, and traffic frequency

The role of Elering

The aim of Elering is to facilitate the development of the production of consumption of biomethane in Estonia in every way and Elering as the owner of the core gas network and the system operator can help to transport the produced biomethane to consumers and to account the biomethane. The goals of Elering are:

1. To create efficient conditions for subscription to the gas network and to advise producers in finding opportunities for subscription.
2. To implement biomethane quality requirements and establish the capability for measurement and monitoring the amounts and quality of the biomethane accepted to the network. In 2015, primary requirements were implemented with respect to the biomethane accepted to the network (http://gaas.elering.ee/kasulikku/vorgugaasi-kvaliteedinouded)
3. To enable filling stations to quickly subscribe to the existing and new gas lines.

   In order to develop the biomethane sector, the Minister of Economic Affairs and Infrastructure approved a development measure in the amount of 10 million euros to support the filling station infrastructure with the aim to create possibilities for using natural gas and biomethane as motor fuel with a Regulation of 24 November 2015.

4. To study the possibilities for transporting gas and accepting biomethane to the network in the case of *off-grid* generation stations.

5. To create and implement a system of certificates of origin of the gas to prove the origin to the consumers, which would also include accounting of the biomethane generated by the producers that are not connected to the grid. Furthermore, launching the respective system in Estonia would help the state to keep records of consumed transport fuels originating from renewable energy sources.
6. To ensure availability of important biomethane-related information to all market participants through the website and organisation of biomethane information days.

## 3.4 Developments in the region

### 3.4.1 Main messages of the ENTSOG TYNDP 2017

ENTSOG TYNDP 2017

The ENTSOG (European Network of Transmission System Operators for Gas) draws up biannual European Union-wide ten-year development plans – the TYNDP (*Ten-Year Network Development Plan*). The obligation to draw up the development plan arises from Regulation of the European Parliament and the Council No. 715/2009.

The purpose of the development plan is to provide an overview of the European Union-wide gas network, consumption of gas, and to identify the required investments which 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[14] published in the beginning of the year allows to conclude 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 is also concluded that the existing gas infrastructure, taking into consideration the estimated gas consumption in the future, is capable of managing the daily gas supply, even in the 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 further connections are included in the Projects of Common Interest list (PCI)[15] and will be completed in the next few years, according to plans.

### 3.4.2 Large-scale projects of the region

In addition to the Balticconnector project and the project for Enhancement of Estonia-Latvia Interconnection, several other large-scale projects are being developed or have been recently completed in the region, helping 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 with the existence of the GIPL. There are also three new LNG terminals of regional dimensions being developed in the region. Figure 15 provides an overview of the development projects in the region.

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[14] ENTSOG TYNDP 2017 - http://www.entsog.eu/publications/tyndp#ENTSOG-TEN-YEAR-NETWORK-DEVELOPMENT-PLAN-2017
[15] Projects of Common Interest - https://ec.europa.eu/energy/en/topics/infrastructure/projects-common-interest

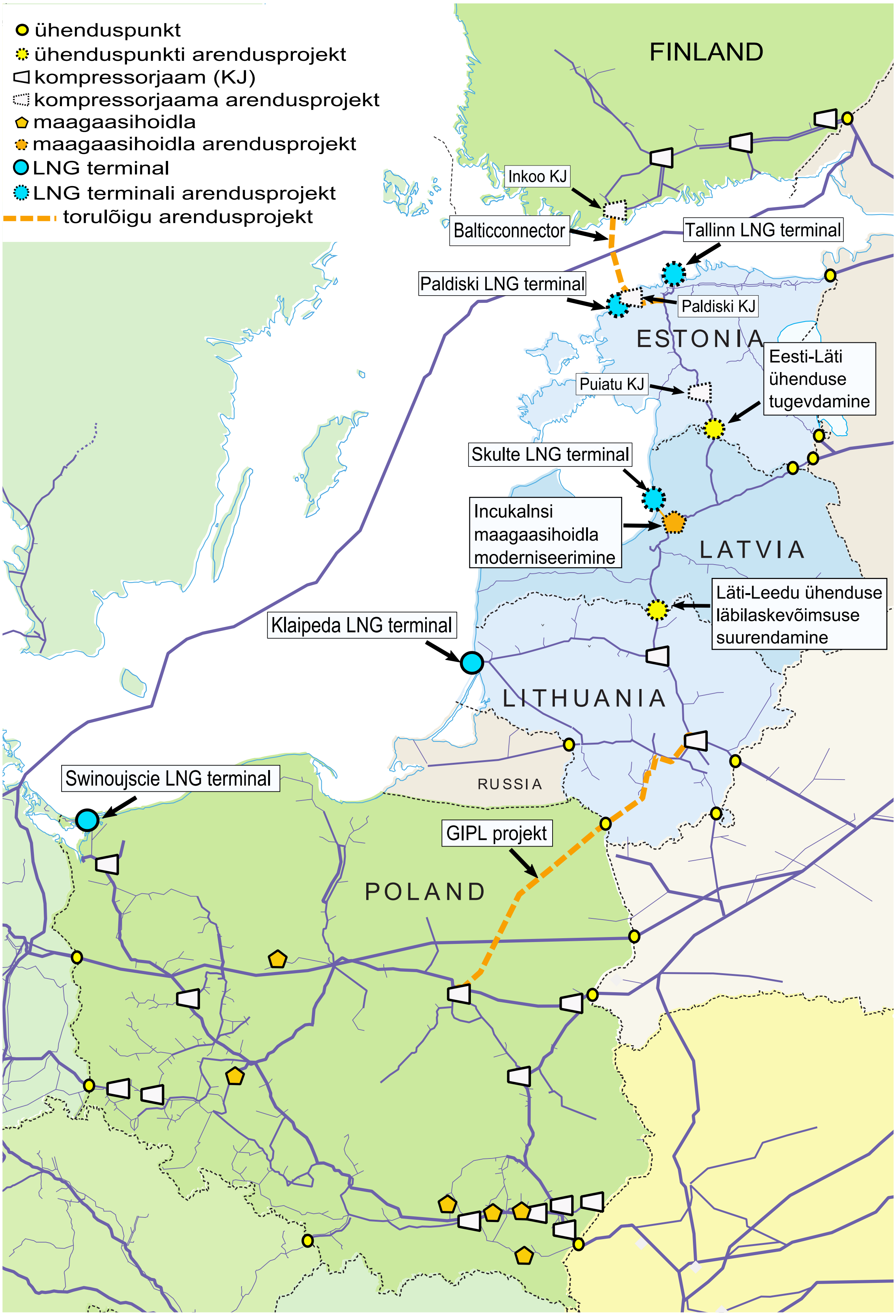


Figure 15. Completed and ongoing large-scale projects in the region

On the figure: ühenduspunkt – connection point; ühenduspunkti arendusprojekt – connection point development project; kompressorjaam (KJ) – compression station (CS); kompressorjaama arendusprojekt - compression station development project; maagaasihoidla – natural gas reserve; maagaasihoidla arendusprojekt – natural gas reserve development project; LNG terminali arendusprojekt – LNG terminal development project; torulõigu arendusprojekt – pipeline section development project; Eesti-Läti ühenduse tugevdamine – Enhancement of Estonia-Latvia Interconnection; Inčukalnsi maagaasihoidla moderniseerimine – modernisation of the Inčukalnsi natural gas reserve; Läti-Leedu ühenduse läbilaskevõimsuse suurendamine – increasing the throughput capacity of the connection between Latvia and Lithuania; GIPL projekt – GIPL project

### 3.4.3 GIPL (Gas Interconnection Poland-Lithuania)

The GIPL is the gas pipeline between Lithuania and Poland which will integrate the Baltic states and Finland (after 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 prerequisites for competition in an open gas market, increasing the number of supply sources of 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 will increase the flexibility of the gas system. The initial planned completion deadline of the GIPL was 2019, but due to changing the initial gas route in the territory of Poland, the new planned completion deadline is 2021.[4] According to the Polish project developer, only the technical parameters in the territory of Poland will change, the technical parameters of the project on the Lithuanian side will remain the same.[16]

### 3.4.4 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 it is 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 of Poland and Lithuania, as they would be able to make more extensive use of the Inčukalns natural gas reserve. The estimated completion deadline of the project is 2020 and the project includes the following[17]:

- Increasing the throughput capacity of the Kiemenai GMS in the territory of Lithuania;
- Construction of a new pipeline section from Riga to the Lithuanian border with a total length of 93 km;
- Doubling the throughput capacity of the connection between Latvia and Lithuania to 126 GWh per day.

### 3.4.5 Modernisation of the Inčukalns natural gas reserve

The Inčukalns natural gas reserve is located 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, thereby reducing the amount of investments required to be made into the transmission pipelines. Traditionally, gas is supplied to the Inčukalns reserve in summer, when gas consumption is lowest, and is used in winter, when gas consumption is higher. Historically, Estonia and Latvia have been receiving the required gas in winter from the Inčukalns natural gas reserve. Modernisation of the natural gas reserve will help to operate the common gas market of the region more efficiently and, with other infrastructure projects of the region (Balticconnector, GIPL), will help to increase the security of supply of the region. The project is divided into three stages[18]:

[16] Gaz System - http://en.gaz-system.pl/centrum-prasowe/aktualnosci/informacja/artykul/202335/
[17] Latvijas Gaze - http://www.lg.lv/?id=3377&lang=eng
[18] Latvijas Gaze - http://www.lg.lv/?id=3376&lang=eng

- In the first stage of the project (2014–2018), the general security of the natural gas reserve is improved and the current gas extraction capacity of 315 GWh per day will increase to 336 GWh per day. This will be achieved through reconstruction works and by construction of a new compression station;
- In the second stage of the project (2019–2020), the gas extraction capacity will increase to 367.5 GWh per day;
- In the third stage of the project, it is planned to increase the storage capacity of the natural gas reserve from 24.2 TWh to 29.4 TWh. The necessity of the third stage largely depends on the gas demand of the region and other projects implemented in the region.

### 3.4.6 Regional LNG terminals

The development plans of the regional gas system and gas market include the construction of an LNG terminal on the shore of the Gulf of Finland. As the Finnish Fingulf LNG terminal project was cancelled, plans of construction of a regional LNG terminal in Estonia and Latvia have arisen. An LNG terminal would provide a new supply source for the entire region and would thus increase the security of supply of the region. Through the LNG terminal, it would be possible to participate in the global LNG market and thereby increase the competition in the local gas market. The Estonian LNG terminal projects (the Paldiski LNG terminal and Tallinn LNG terminal) are included in the second European Projects of Common Interest (PCI)[19] list. The Latvian project (the Skulte LNG terminal) is not included in the second Projects of Common Interest list. All three terminals are designed to service the regional Baltic and Finnish gas market and to increase security of supply.

- The storage capacity of the Paldiski LNG terminal would amount to 180,000 m3 – 320,000 m3 of liquid natural gas (LNG) and the terminal would be able to transmit 26.3 TWh per year into the gas network;
- The storage capacity of the Tallinn LNG terminal, which would be located in Muuga, would amount to up to 320,000 m3 of liquid natural gas (LNG) and the terminal would be able to transmit 42–84 TWh per year into the gas network;
- 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. The plan prescribes construction of a gas transit line from the terminal to the nearby underground Inčukalns gas reserve, where the LNG would be stored in the form of gas. The terminal would be able to transmit 5.3 TWh per year to the gas network.[20]

### 3.4.7 Swinoujscie LNG – the Polish LNG terminal

The Swinoujscie LNG terminal is located in Poland and was launched in 2016. The Swinoujscie LNG terminal would provide an alternative LNG-based supply source for the Baltic region after the realisation of the GIPL and would increase the security of supply of the region. The project of the LNG terminal includes the following[21]:

- Capability of supplying 52,500 GWh per year into the Polish transmission network;
- 85 km of aboveground pipes for connection of the LNG terminal and the Polish transmission network.

[19] European Projects of Common Interest - https://ec.europa.eu/energy/en/topics/infrastructure/projects-common-interest
[20] Skulte LNG terminal - https://ec.europa.eu/eipp/desktop/en/projects/project-187.html
[21] Polskie LNG - http://en.polskielng.pl/lng/terminal-lng-w-polsce/

# 4 Assessment to the security of supply

- In 2016, supplying of all consumers with gas and supplies to the balance managers were ensured, including during repair works.
- Investments in the next decade will help to increase the security of supply, including criterion N-1 of the security of supply, which is not met at regular pressures today.

## 4.1 Review of the 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 2016 by months and the transmission capacities available at the border crossing points at the times of maximum gas flow.

Table 3. Maximum gas flows at border crossing points of the Estonian gas transmission network and transmission capacities in 2016

| Month | Karksi GMS | | | Värska GMS | | | Narva connection | | |
|---|---|---|---|---|---|---|---|---|---|
| | Max. gas flow per day, MWh | Transmission capacity, MWh | Use of the transmission capacity, % | Max. gas flow per day, MWh | Transmission capacity, MWh | Use of the transmission capacity, % | Max. gas flow per day, MWh | Transmission capacity, MWh | Use of the transmission capacity, % |
| January | 52,190 | 68,570 | 48.9 | 0 | 29,190 | 0 | 0 | 10,710 | 0 |
| February | 26,850 | 73,500 | 30.5 | 0 | 29,610 | 0 | 0 | 11,870 | 0 |
| March | 29,510 | 73,500 | 27.6 | 0 | 30,660 | 0 | 0 | 11,970 | 0 |
| April | 18,300 | 73,500 | 19.6 | 0 | 30,350 | 0 | 0 | 12,710 | 0 |
| May | 10,780 | 73,500 | 10.2 | 0 | 28,350 | 0 | 0 | 13,440 | 0 |
| June | 6,460 | 72,660 | 1.6 | 6,610 | 30,140 | 17.2 | 0 | 4,200 | 0 |
| July | 8,350 | 73,500 | 5.6 | 8,860 | 15,440 | 10.0 | 0 | 13,230 | 0 |
| August | 9,650 | 73,500 | 2.8 | 7,540 | 34,180 | 11.3 | 0 | 12,500 | 0 |
| Sept. | 7,800 | 73,900 | 1.9 | 8,860 | 42,200 | 12.8 | 0 | 12,900 | 0 |
| October | 18,500 | 57,120 | 4.8 | 19,670 | 30,765 | 42.6 | 0 | 14,385 | 0 |
| Nov. | 15,460 | 56,217 | 4.3 | 24,070 | 25,515 | 72.4 | 0 | 12,747 | 0 |
| Dec. | 12,600 | 57,593 | 2.6 | 27,640 | 29,295 | 66.8 | 0 | 12,999 | 0 |

The actual capacities below the technical capacities at the border crossing points were caused by the regular pressure regime at the borders in the case of gas supply depending on the demand.

The peak day with the maximum gas flow of 52,740 MWh per day (average capacity of 2,196 MW) was 8 January and the gas consumption was lowest on 6 August, when only 4,284 MWh per day was consumed. As the winter of 2016 was only colder during a short period in the beginning of the year, the peak consumption was also modest, but still formed 77% of the capacity of the Karksi GMS and 49% of the total capacity of Estonia. The Värska GMS, however, was closed. The peak capacity used by the Värska GMS on 11 December amounted to 27,556 MWh per day, forming 90% of the capacity thereof on the day.

In 2016, further supplies were imported through Lithuania, including gas originating from Gazprom in Belarus in the extent of 7.6%, with the balance managers also using the gas stored by them in the Inčukalns natural gas reserve in Latvia in the extent of 0.6% of the total amount of natural gas imported, and an additional 0.2% was purchased from the Latvian transmission system operator.

Overview of the events in the gas transmission network in 2016

In 2016, the system operator continued investing into the transmission networks and with planned maintenance-related works to improve the security of supply. Similar works were also performed in the transmission networks of the neighbouring system operators. The schedule of the works which influenced the throughput capacity of the gas transmission networks was published on the website of the system operator: [http://gaas.elering.ee/wp-content/uploads/2016/10/2016-hooldustööd-2016-10-20.pdf](http://gaas.elering.ee/wp-content/uploads/2016/10/2016-hooldustööd-2016-10-20.pdf). However, supplying Estonian consumers with gas and all supplies to the balance managers were ensured during the performance of all works. The aim of the performed works was to ensure the security of supply of the transmission network.

Scheduled works in the transmission network of the Estonian gas system

Below, there is an overview of the larger-scale scheduled works in the transmission network of the Estonian gas system performed in 2016:

- In the Tallinn-Narva transmission pipeline, the pipeline sections of both threads were replaced in the site of crossing Pikaristi Road;
- In the Irboska-Tartu-Rakvere transmission pipeline, the defective sections of the pipeline determined based on the results of the diagnostics of the interior of the pipeline were replaced in the section between Väike-Maarja PLI (pipeline intersection) – Pandivere PLI, and Põlva PLI and Roiu PLI, and renovation of the Ahja PLI; in the same time, a defective valve at the Pskov PLI in Russia was also replaced;
- In the Tallinn-Narva transmission pipeline, the renovation works of the Loobu PLI, which had been delayed due to problems with the delivery of the valves, were performed in November, during which the throughput capacity of the entry points was also partially restricted;
- In the Vireši-Tallinn transmission pipeline, insulation works were performed in the section between Rapla PLI and Saha-Loo PLI (Connection PLI);
- It was decided to postpone the scheduled diagnostics in the Tallinn-Narva transmission pipeline in spring and in the Vireši-Tallinn transmission pipeline in autumn/winter until 2017.

Failures and breakdowns in the gas transmission network in 2016

There were no significant failures or breakdowns of the transmission network to cause a disruption in supplying the consumers with gas. Thus, there were also no undelivered amounts of gas in 2016.

## 4.2 Compliance with the N-1 criteria in 2016 and forecasts for 2017

Pursuant to Regulation (EC) No. 994/2010, the criteria of the security of supply are the N-1 criteria, which show how sustainable the gas system is when the element of the highest throughput capacity of the system is out of service. The following formula is used to calculate the criteria:

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

$EP_m$ - capacity of the entry points of all systems (M $m^3$ per day)
$P_m$ - domestic production capacity (M $m^3$ per day)
$S_m$ - amount delivered by domestic gas reserves (M $m^3$ per day)
$LNG_m$ – capacity delivered from domestic liquid natural gas terminals (M $m^3$ per day)
$I_m$– throughput capacity of the network element of the highest capacity (M $m^3$ per day)
$D_{max}$ - total daily gas demand in the area on a day of exceptionally high gas demand, which occurs once in 20 years based on statistical likelihood (M $m^3$ per 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. The network element of the highest throughput capacity of the Estonian gas transmission network is the Karksi gas metering station. Thus, in 2016, the values of the variables included in the formula are as follows (under regular conditions):

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

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

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

Table 4 provides an overview of the throughput capacities of the border crossing points under different conditions and thus also in the situation of security of supply level N-1.

Table 4. Throughput capacities of the border crossing points of the Estonian gas transmission network and assessment to the N-1 criteria[22]

| Connection point | Technical throughput capacity (M m³ per day / GWh per day) gas pressure at the connection point<br>Karksi GMS – 40–42 bar<br>Värska GMS – 40–42 bar<br>Narva – 28–30 bar | Throughput capacity under normal conditions (M m³ per day / GWh per day) gas pressure at the connection point<br>Karksi GMS – 34-36 bar<br>Värska GMS – 34-36 bar<br>Narva – 22–24 bar | Minimum throughput capacity (M m³ per day / GWh per day) gas pressure at the connection point<br>Karksi GMS – 24-26 bar<br>Värska GMS – 24-26 bar<br>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 |

[22] The throughput capacities provided in Table 4 are of indicative nature. The actual throughput capacity of each connection point depends on the consumption in the system at any given moment, the distance of the consumption site from the supplying connection point, whether the gas supply passes one connection point or more, and taking into consideration the integrity of the transmission system and efficient functioning of the network.

| | | | |
|---|---|---|---|
| N-1 (%) based on the formula | 104.4 | 68.7 | 44.8 |

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

Throughput capacity under normal conditions is the calculated throughput capacity of the pipelines under normal pressures at entry points.

The minimum throughput capacity is the calculated throughput capacity in the case of exceptionally low input pressures at entry points.

The table above shows that the estimated security of supply may drastically differ depending on the conditions based on which the N-1 criteria is calculated. Based on the technical throughput capacity, the security of supply is ensured, but the gas transmission network is operating under optimum, lower operating pressures (in the 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, the main gas supply into Estonia through the Värska connection on the Russian side is supposed to be gas supplied by Gazprom and by gas from the Inčukalns underground gas reserve in Latvia in exceptional situations. The remaining market participants are importing gas based on the supply scheme through the connections of Karksi or Värska. The larger balance manager does not yet have a contract for using the connection of Narva.

Based on the current assessment, no significant differences can be observed between 2017 and 2016, but putting the Narva connection into use will hopefully be added on the period of the maintenance works to be performed in the summer. Pursuant to the agreement of the Baltic states and the new Natural Gas Act, a transfer to accounting of the amounts of gas in energy units is planned. The highest daily peak load in the beginning of 2017 was lower than the peak consumption in the beginning of 2016 (roughly 36.7 GWh per day), but, depending on the weather conditions, there are probably more days of winter peak loads to come. Thus, under regular conditions, the security of supply has been ensured based on the N-1 criteria. Problems with meeting the N-1 criteria may only arise in rare days of peak consumption.

## 4.3 Security of supply, 2017-2026

In order to assess the security of supply in the next decade, the estimated natural gas consumption, the capacities of the connection points between countries, and the development projects of the local network must be taken into consideration. The assessment of the security of supply is based on the above-mentioned aspects and the N-1 criteria.

The estimation of the Estonian natural gas consumption discussed in paragraph 2.4 allowed to conclude that consumption of natural gas will be following a declining trend in the next 10 years. Additionally, peak consumption is not expected to increase, due to which the maximum demand for natural gas in the last 20 years will remain unchanged and at the level of 70.4 GWh per day (6.7 M m3 per day).

There are several projects planned for the next decade which will significantly increase the capacity of the connection points and thus also the security of supply. Reconstruction of the Karksi GMS with reconstruction of the Tallinn–Vireši pipeline will increase the throughput capacity of the Karksi GMS to 105 GWh per day. Construction of the submarine pipeline of the Balticconnector and the aboveground Kiili–Paldiski pipelines with provide Estonia a new connection point with Finland with the capacity of 81.2 GWh per day.

The security of supply would also be positively impacted by the reconstruction of the Jõhvi-Narva and Tallinn-Jõhvi gas pipelines, as a result of which the throughput capacity of the Narva connection point would increase significantly. Construction of an LNG terminal in Estonia would also have a large positive effect on security of supply. However, the projects of the LNG terminal and Jõhvi-Narva and Tallinn-Jõhvi gas pipelines cannot be taken into consideration with respect to security of supply, as there are currently no specific schedules or plans agreed for the above-mentioned projects.

Figure 16 provides an overview of the security of supply in the next decade.

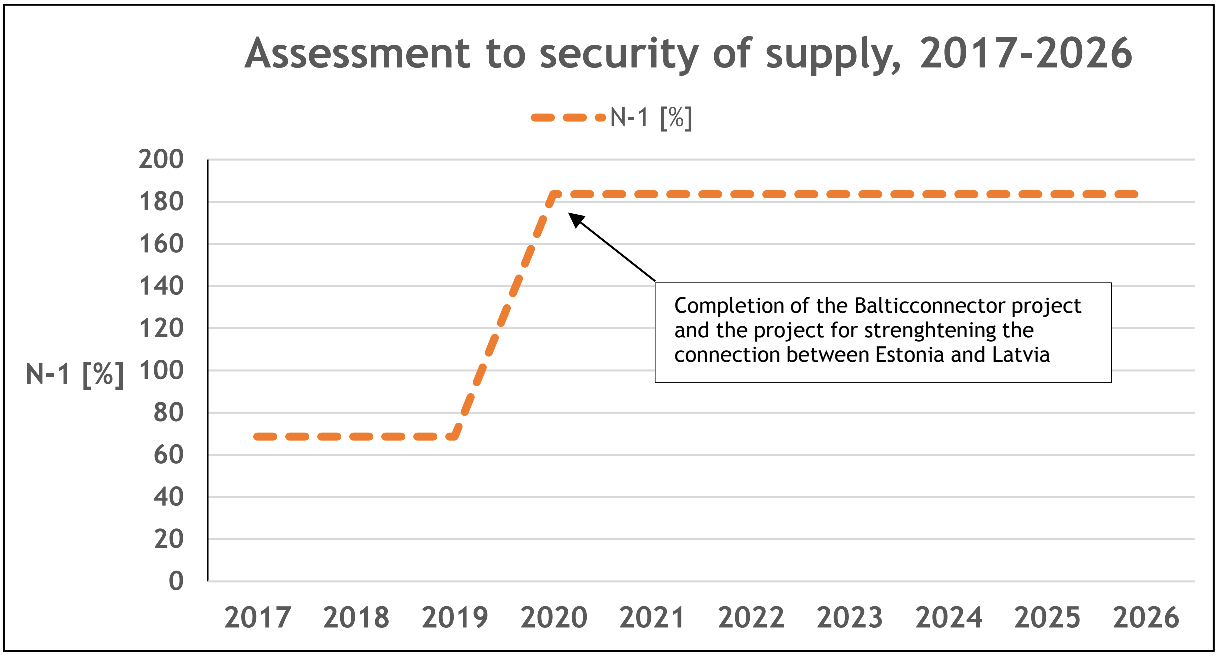


Figure 16. Assessment to security of supply, 2017–2026

Assessment to security of supply, 2017-2026

Up to 2019 (incl.), the security of supply criteria N-1 will remain under 100%, provided that the gas pressure at the connection points remains under standard conditions. Construction of the Balticconnector and the restoration project of the Karksi GMS will bring the N-1 criteria to 183.6% and ensures security of supply for Estonian gas consumers. The results allow us to presume that the Balticconnector project is of vital importance to ensure the security of supply of 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, a possibility will also arise for connecting the gas markets of the Baltic states and Finland, which will bring socio-economic gain for all of the countries.

## 4.4 Risks impacting security of supply

The risk analysis conducted by Elering detected two main risks which are significant from the perspective of ensuring functioning of the vital service (i.e. functioning of the Estonian gas system). One of the two is related to the impact of the neighbouring systems on the Estonian gas system and the other to ensuring the functioning of the domestic gas transmission network.

Decreasing cross-border gas supplies below the minimum required level

The potential events activating the risk are interruption or decrease in the amount of cross-border gas deliveries into Estonia or the Baltic states in general. This risk may also be activated by emergency situations in the Russian transmission pipelines or the Latvian transmission pipelines due to breakdowns, which is accompanied by extensive interruption in the gas supply (over 72 hours) or a sudden increase in the domestic gas demand in the cold winter period (temperatures under –20°C).

In practice, realisation of the risk means that pressures at the border crossing points of the Estonian gas transmission network (Värska GMS, Karksi GMS, and Narva PLI) drops under the minimum required level, as a result of which the pressures at important points of the Estonian transmission network may drop or will drop below the minimum pressure. Due to the 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 criteria, it may not be possible to ensure that the entire peak consumption of the Estonian gas system is ensured. In order to ensure supplying the protected consumers with gas, it may be necessary to restrict the gas consumption of other Estonian consumers.

To alleviate the risk, the system operator has entered into cooperation contracts with operators of neighbouring systems for operations in emergency situations. The reserve for protected consumers is ensured in the sufficient amount and measures have been developed for restricting gas consumption.

Interruption of the domestic gas supply in Estonia

The events which activate the potential risk are breakdowns at the gas distribution stations or gas metering stations, as well as on the pipelines of the transmission network or the physical overburdening of the transmission network due to extremely cold weather for a prolonged period of time.

The risk may realise:

- as a result of various external events, such as a fire in the nature, physical overburdening of the pipelines, a natural disaster, terrorism, vandalism, etc.;
- damage caused by various events originating from the gas network, such as damages due to corrosion of the pipelines, leaks in connections or equipment, bursting of an underground gas pipeline due to external load;
- as a result of a fire and/or explosion at gas distribution centres or gas metering stations;
- as a result of air entering the pipeline;
- in the event of disruptions in the functioning of technical control system of the gas system, SCADA, or data connection.

In order to alleviate the risk, the system operator has entered into various cooperation contracts for elimination of breakdowns and regular breakdown trainings are organised together, an action plan for operating in emergency situations has been drawn up, and measures are being implemented to ensure the functioning of significant objects in a non-standard situation.

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 has an effect on the security of electricity supply as gas is, as a rule, an important fuel for electricity generation. On the other hand, unlike our neighbours Latvia and Lithuania, the impact of an interruption in the gas supply on the functioning of the electricity system is insignificant in the case of the Estonian electricity system. The most important production plant using gas as fuel for generation of electric energy is block 2 of the Iru Power Plant (gross capacity of 110 MW), but as the annual number of working hours of the plant is minimal, the impact thereof 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 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 reserve power generators, where the power for the essential equipment is reserved from batteries or UPSs when switching the power supply. 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 does 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

Pursuant to subsection $26^1$ (2) of the Natural Gas Act (NGA), the minimum requirements for security of supply, 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 for the purposes of ensuring the gas supply for as long as possible 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.

The Competition Authority has appointed the gas system operator of Estonia to serve as the natural gas undertaking under the obligation to implement measures in order to ensure gas supply to the protected consumers of Estonia in the cases specified in Article 8, subsection 1 of the Regulation of the European Parliament and of the Council (EC) no. 994/2010, who found a contractual partner for ensuring the natural gas reserve for the protected consumers by a public procurement procedure.

Reserve for protected consumers

Activation of the natural gas reserves occurs within no more than 24 hours in the heating periods, which runs from 1 October to 30 April, and within 1 week during the remaining year, from 1 May to 30 September. An analysis has been performed to assess the volume of the reserve for protected consumers and the required amount of natural gas was estimated on the basis thereof. The amount of the reserve for protected consumers is established for each month. Part of the amount of gas for protected consumers is included in the amount of reserve gas, which is required to ensure the gas supply to the protected consumers during the period required for activation of the amounts of natural gas located outside of the Estonian gas system.

Activation of the reserve for protected consumers

Activation of the reserve for protected consumers may be caused by the following events or situations in the Estonian gas system:

- extreme temperature on seven consecutive days of peak demand, which happens once in 20 years based on statistical data;
- exceptionally high gas demand in a period of at least 30 days, which happens once in 20 years based on statistical data;
- interruptions in a single largest gas infrastructure for the period of at least 30 days in average winter weather conditions.

Notification

Pursuant to the Natural Gas Act in force, If the system operator has reliable information that an event may take place which could to a significant extent adversely affect the supply situation or that a supply disruption has already taken place, the system operator shall notify the Ministry of Economic Affairs and Communications and the Competition Authority of the event or the disruption and of the market measures implemented by the system operator. The Ministry of Economic Affairs and Communications shall analyse together with the Competition Authority the information received and the market measures implemented by the system operator. If the analysis reveals that for the purpose of ensuring security of supply it is necessary to implement measures of compulsory reduction of gas demand, the Ministry of Economic Affairs and Communications shall communicate this to the crisis committee of the Government of the Republic and then make a proposal to the Government of the Republic to allow the implementation of the measures of compulsory reduction of gas demand named in the plan of measures required to eliminate the supply disruption referred to under section 262(1) of the NGA or to alleviate the effects of such disruption. If the European Commission decides to implement measures to ensure the security of supply in the entire European Union or in a specific region of the European Union, the Ministry of Economic Affairs and Communications shall communicate this to the crisis committee of the Government of the Republic and shall then, if necessary, make a proposal to the Government of the Republic to allow the implementation of the measures of compulsory reduction of gas demand.

A draft act for amendment of the NGA has also been initiated, which will complement the act with respect to the terms and conditions of taking the gas reserve for the protected consumers into use as well as the terms and conditions of the storage and use thereof. For example, the system operator has the right to take the reserve for protected consumers into use if the analysis shows that the security of supply for protected consumers is not ensured.

Analysis of the location of the reserve for protected consumers

Pursuant to the proposal for amendment of the Natural Gas Act, the system operator, Elering, is responsible for the formation and management of the gas reserve for protected consumers. The aim of the gas reserve is to ensure the security of gas supply for protected consumers even in the case of supply failures. On a monthly basis, the gas reserve must always be kept at the level which ensures the gas supply for protected consumers in compliance with the Regulation of the European Parliament and of the Council (EC) No. 994/2010. The location of storage of the gas reserve is restricted to the European Union Member States, but the reserve must be stored in a manner which ensures availability of the reserve in the event of a supply disruption, which is why the selection of potential countries is limited to the Baltic states today.

Until March 2017, Elering was storing the gas reserve based on an option contract, which enables Elering to take the gas reserve into use if necessary, but Elering is not the owner of the gas. As of March 2017, Elering has decided to become the owner of the gas reserve, which decreases the risks related to supplying the gas reserve.

Another important issue in addition to the ownership of the gas is the location of storing the gas reserve. Today, there are, in principle, two options for storage of the reserve gas: the Inčukalns natural gas reserve in Latvia and the Klaipeda LNG terminal in Lithuania. Upon selection of the storage location, Elering primarily values availability of the gas in the event of a supply disruption, the cost of storage, and the likelihood of availability of the gas reserve. The likelihood of availability of the gas reserve expresses the risk of the gas reserve being unavailable due to technical reasons (gas pipeline breakdown). Thus, the location of the gas reserve, specifically the proximity thereof to the centre of the Estonian gas consumption, is a value which is compared against the costs of storage of the gas.

# 5 Gas market

- Regional working groups have commenced working to achieve a unified Baltic-Finnish entry-exit system by 2020.
- The most important challenge of 2017 in Estonia will be establishing a regulation to ensure the functioning of information exchange.

## 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 pricing of gas transmission services and compensation mechanisms between the system operators in the region (led by the regulators);
- Creation of a common, virtual trading hub (VTB) and regional gas exchange (led by the system operators);
- Organisation of the market (led by the system operators) – includes operative management of the system, balance management, etc.;
- Pricing of the infrastructure (LNG terminals and reserve) and socialising of the expenditure (led by the regulators).

By the end of 2017, a proposal to harmonise the bases for tariff methods will be completed in the working group of regulators as a result of the existing tariff mechanisms and an analysis of the regulations of the European Union. In 2018, the work will continue with respect to a common tariff methodology and a potential compensation mechanism between system operators, which should, to implement it according to plan, be adopted in the legislation in 2019.

Another working group of regulators examining the pricing of different infrastructure objects which provide security of supply and potential socialisation of the costs has set an aim to assess the role of various objects in the regional gas market by the end of 2018. Based on this assessment, potential principles of socialisation will then be proposed, if necessary.

The working group of system operators will carry on with a common action plan for both issues led by the system operators. The plan is to reach a common concept regarding the regional model of virtual trading hubs and a coordinated balance area in the course of 2017, develop common interoperability codes, and enter into subscription contracts based on those codes. These conceptual documents will be published for public consulting in the end of 2017. The plan for 2018 is to draw up a common network code which includes access rules to the virtual trading hub and the network and will form a basis for the planning, administration, and balance management of the system of the region. If the creation of the virtual trading hub will play an important role in the regional gas exchange as a central trading platform, then a so-called market area manager may be tasked with the implementation of the coordinated balance management of the system as a common, centralised function.

As a transfer stage, the Baltic system operators have entered into a cooperation contract to implement the implicit model for capacity allocation on the borders within the Baltic states by the middle of 2017. An implicit model for capacity allocation means that the short-term cross-border capacity is allocated in the regional gas exchange simultaneously with the gas sold. This model will be the first step in connecting the Estonian, Latvian, and Lithuanian gas markets, which will help to increase the liquidity and improve the competition in the Baltic market. The implementation of the model also calls for development of the regional gas exchange in the Baltic market.

## 5.2 Developments of the local gas market

2016 brought several changes to the organisation of the gas market in Estonia:

- Decision no. 7.1-11/16-001 of the Competition Authority of 15 January 2016 approves the standard terms and conditions of an Elering balance contract, which establish the principles of balance responsibility, incl. the schedule of balance responsibility, the rights and obligations of market participants who have entered into a balance contract with the system operator, etc. The terms and conditions of gas balance contracts entered into force as of 1 April 2016. As at the beginning of 2017, six market participants have entered into a balance contract with Elering (Alexela Energia AS, Baltic Energy Partners OÜ, Eesti Energia AS, Eesti Gaas AS, Elektrum Eesti OÜ, and Scener OÜ).
- Elering is applying the 'Methods of allocation of gas transmission capacity and congestion management and terms and conditions for access to the cross-border infrastructure' to the gas supplies provided since 1 October. According to the methodology, all market participants who are involved with cross-border gas supplies or supplying gas from the transmission system to the end consumer and/or the distribution network must enter into a contract of allocation of transmission capacity with Elering and reserve the capacity of the respective points approved by the Competition Authority in advance for each delivery. As at the beginning of 2017, five market participants have entered into such a contract with Elering. The capacity can be reserved by submitting the balance plan for the following day or by updating the balance plan in the course of the day. Furthermore, it is possible to reserve capacity for one year based on the methodology, but no tenders were received for the first round of tendering in the period from 1 October 2016 – 30 September 2017.
- As of December, the Gas Data Hub was launched (https://gaasiandmeladu.elering.ee/). This is an information exchange environment for participants in the gas market which covers the main three processes: (1) the process of exchanging suppliers and exchanging messages describing the process, (2) the process of submission of metering point data and metering data, incl. submission of estimated data; and (3) the coding process. Furthermore, the Data Hub includes the function of calculation of the metering data required for balance explanations.

The primary challenges in 2017 include establishing the regulation to ensure the functioning of information exchange (both in the form of amendments to the Natural Gas Act and establishing the Network Codes for gas) and continuing work at the regional level to achieve a unified Baltic-Finnish entry-exit system by 2020.