

INVESTMENT PLAN

for 2019 - 2028



eso



In 2019–2028, ESO will allocate EUR 1.83 billion investments for improvement of reliability, security and smartification of the network

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1. FOREWORD FROM THE CEO

Dear All,

The sector of energy, energy distribution system and market are undergoing rapid changes. The pace of the changes is determined by the growing integrity among the system participants, innovative solutions, which have become increasingly wide-spread, and systems combining different complex technologies and sectors.

The electricity network customers also become consumers and producers who appreciate individual solutions of network reliability, smartification and quality, derivative market services and solutions which provide more opportunities or ensure greater effectiveness. The inevitable changes in the distribution system must focus on the network reliability and smartification, balanced response to stakeholder expectations, and should be effectively managed and consistent, facilitating market competition and creating best customer experiences.

The future is with the companies that are capable of adapting to the changing environment quickly. Therefore, we aim at timely planning and conducting of works which will meet the future needs of the clients, the market and the sector, will enable us to provide services of increasingly higher quality, and will open new opportunities for our existing and prospective customers.

Reliable and safe distribution of electricity and natural gas across Lithuania is our day-to-day objective. We analyse the needs of our customers and work every day in order to offer services that meet customer expectations. Decisions taken now will influence the reliability of the network and the flexibility of services in the long run; for this reason, investment planning is a lead to our vision – the reliable and smart network which provides the best customer experience.

We hereby introduce the Investment Plan of AB Energijos Skirstymo Operatorius (ESO) for 2019–2028, which summarises our major and most important priorities for the period until 2028. This document has been drafted taking into account and seeking to optimally combine the expectations of our customers and of the public, regulatory authorities, the long-term objectives and strategic directions of the LE Strategy 2030 introduced, the expectations of our shareholders and investors as well as other stakeholders for the quality and speed of services in terms of ESO operation.

We have outlined 3 key investment directions – programmes:



Network reliability



Network smartification



Customer experiences and market facilitation

We have earmarked EUR 1.83 billion for modernisation, efficiency enhancement, and flexibility of electricity and natural gas networks for the next 10 years. These investments will allow us to significantly improve the reliability of networks, create conditions for obtaining accurate real-time information on the state of the network, forecasting the state of the network, and to improve network reliability and security.

One of the main directions – implementation of the smart metering system, automated network control and employment of analysis of innovative digital technologies and data-based solutions in the control of network activities. Advanced and smart solutions combined with the capability to use them effectively help ensure network reliability, predictability and real-time management, cyber security, and pave the way to a competitive market, hence, create added value to customers.

By implementing advanced technologies today, we aim at offering decent quality services in the future: we will control the network elements remotely, identify the failures and perform troubleshooting quickly, carry out precise accounting of the consumed amount of energy, forecast network operations and improve its efficiency and security.

This document highlights our ambitions. I hope that all stakeholders will adopt an open approach focused on common result and will help us make these ambitions come true.

Mindaugas Keizeris

Chairman of the Board and CEO
of AB Energijos skirstymo operatorius




2. SUMMARY

The long-term activity planning is considered to be good business practices of the infrastructure management enterprises. The purpose of this document (hereinafter referred to as the "Investment Plan") is to set the directions and goals of ESO investments for 2019–2028, planned results of investments and expected benefits for the ESO customers and the distribution network.

The Investment Plan has been drawn up with a view to introduce ESO investment goals, directions and volumes to the widest possible range of stakeholders: the public, customers, regulatory authorities, energy sector, partners and investors.

The Investment Plan is an informative document and cannot be considered as an advice, recommendation or other kind of incentive to invest or carry out other actions. The adoption and implementation of particular decisions in achieving the objectives identified in the Investment Plan (including project scope and timing, funding technique and other aspects) will depend on specific external and internal economic, legal and other factors that may influence the adoption of such decisions and their effective implementation. All decisions will be taken only having assessed all relevant circumstances, ESO Strategy 2030, in compliance with requirements and procedures of legal acts, including, where applicable, the obligation to obtain the necessary permits or other coordination of decisions with competent authorities or stakeholders. The Investment Plan is divided into two main parts.

Part I 'Stakeholders and their expectations' identifies the most important ESO stakeholders and describes their expectations for ESO services: network reliability, safety as well as convenient services of decent quality.

Part II 'Investment programmes' provides for three investment programmes aimed at satisfying stakeholder expectations.

It is important to note that according to the Integrated Planning and Monitoring System Policy of the Group of Lietuvos Energija (hereinafter – the LE), the Investment Plan for 2019–2028 is an integral part of the LE Group planning system, inseparable from other key long-term planning documents – the strategies of the parent company – the LE and of ESO (see Annex C). The Long-term Investment Plan of ESO is a part of the long-term financial plan of ESO.

This Investment Plan presents in detail strategic investments of ESO in pursuit of the objectives set in the strategies of ESO and of the LE Group. The three-year business plan of ESO presents in detail all strategic measures of ESO aimed at the achievement of strategic objectives set in the strategies of ESO and the LE Group and in the National Energy Independence Strategy (hereinafter – the NEIS). In implementing this Investment Plan, a three-year investment plan (to be published on a quarterly basis every year) will be drawn up and clarify the investment volumes and results of the coming period. In 2019–2028, the investment of EUR 1.83 billion will be allocated for improvement of the network reliability, safety and smartification. The planned investments will be targeted towards three programmes:

P1. Network reliability. This programme is aimed at ensuring uninterrupted and decent quality energy distribution by the environmentally safe electricity and natural gas network. One of important measures of this programme is the replacement of overhead lines with underground lines giving priority to the replacement of unreliable lines in high accident-rate areas and forested territories as well as voltage quality improvement solutions, including reconstruction of unreliable natural gas steel pipelines and replacement and reconstruction of other unreliable elements of electricity and natural gas network and other innovative solutions which after completion of pilot projects would be implemented in order to improve the network reliability.

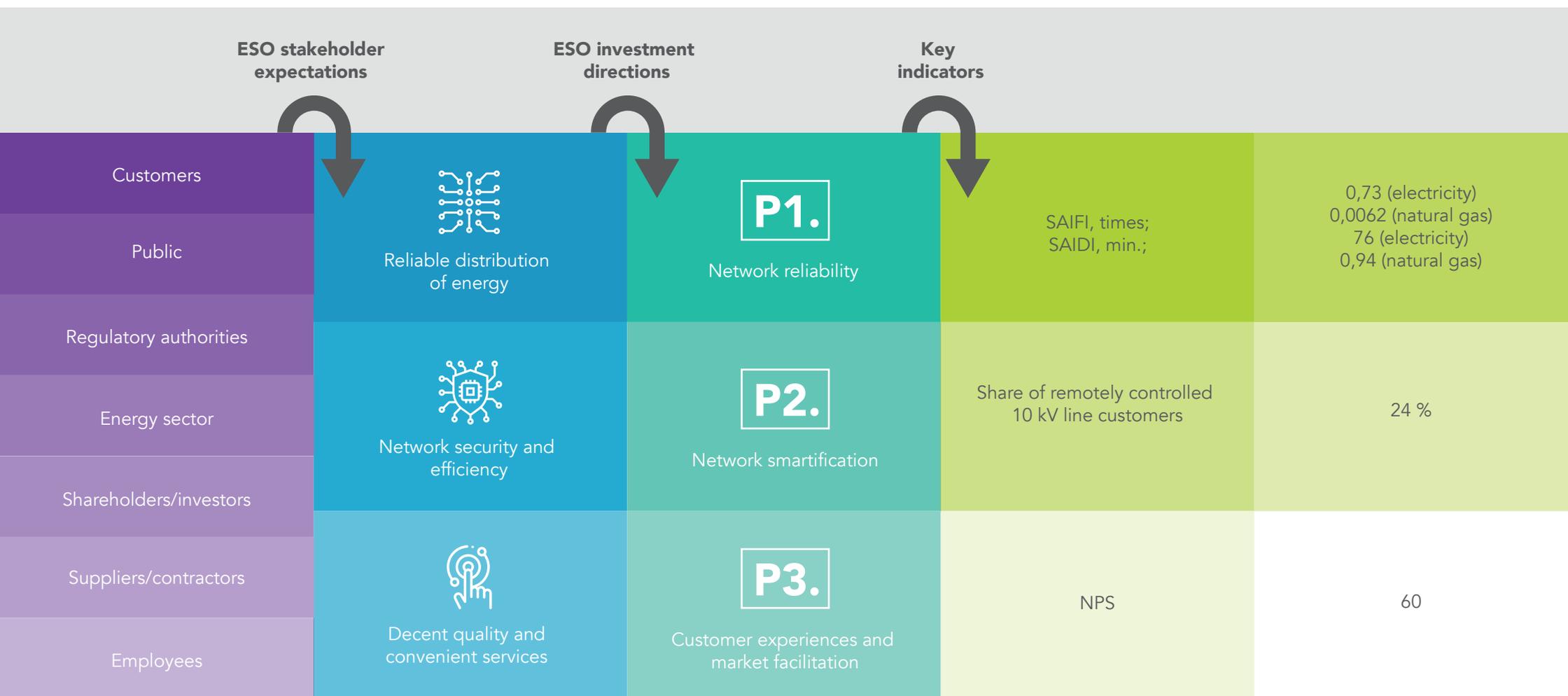
P2. Network smartification. This programme is aimed at accelerating the restoration of electricity supply in the cases of disruptions, creating preconditions for taking network management decisions on the basis of real-time information. The main measures of this programme – the implementation of equipment remotely monitored or automated and controlled by a dispatcher and the introduction of smart meters for customers. For the purpose of the network smartification pilot projects will be carried out and if they appear to be justified – solutions of a larger scale will be implemented.

P3. Customer experiences and market facilitation. This programme is aimed at improving the quality of ESO services, the servicing of customers and encouraging their active participation in the market of electricity services and implementing energy efficiency solutions. One of the main measures is the data exchange platform (hereinafter – the Data Hub) creation facilitating quicker and more reliable data exchanges between market participants, thus creating preconditions for competition of market participants – offering to customers better and respectively more diversified services.

The electricity network is more sensitive to weather conditions and its reliability indicators are lower than those of the natural gas network. Due to this reason, the major part of planned investments (EUR 1.56 billion) will be dedicated for enhancement of the electricity network. The distribution of investments is maintained proportionate to electricity and natural gas network compared with previous investment plans. The key indicators of investment performance and service quality are provided below:

- P1.** System Average Interruption Frequency Index (SAIFI) per customer and System Average Interruption Duration Index (SAIDI);
- P2.** Share of remotely controlled 10 kV line customers (%);
- P3.** Customer experience of using ESO services (NPS methodology).

Figure 1. Map of ESO stakeholders, their expectations and investment programmes, indicators for 2028



¹ The electricity network covers the larger part of consumers and its disruptions lead to greater losses and affect the economy of Lithuania and the wellbeing of people.

When planning investments, ESO envisages the introduction of the new network elements and the replacement of old elements with new ones. The most important measures of planned investments are provided in Figure 2. More detailed volumes and indicators of planned investments are provided in Annex A.

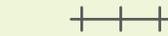
Having regard to transformations taking place in the sector of energy, emerging new technologies, integral solutions, changing consumer and market needs (e.g., producing consumers, charge stations, energy accumulation solutions, virtual consumption, modern solutions for inspection of lines and identification of defects, network reliability simulation systems, solutions created by data analytics, etc.), considering that the aforementioned market and customer needs and modern solutions emerge and are identified on the market within an increasingly shorter time limits – we expect to increase their use in the activities of ESO. For these purposes we will continue pilot – continuous projects and if they are justified – we will implement them to a wider extent. We are sure that the comprehensive value of new technological solutions for customers, market and network will grow too.

3. STAKEHOLDERS AND THEIR EXPECTATIONS

ESO manages and operates electricity and natural gas distribution networks, provides services to customers across the territory of Lithuania and has a large group of partners. Due to specifics and geographical dislocation activities of ESO are influenced by a large number of stakeholders with different interests (e.g. customers, the National Energy Regulatory Council (hereinafter – the NERC), the Ministry of Energy of the Republic of Lithuania, forest enterprises, municipalities, suppliers of the contractor organisation, public authorities, technology developers, investors, etc.) Decisions and actions of ESO can also significantly influence their activities like the actions and decisions of stakeholders influence the activities of ESO.

Due to these reasons when drafting the Investment Plan the stakeholder analysis model was chosen. This model was chosen because of its versatility, flexibility and easily understandable structure in analysing different expectations and justifying the resulting actions which could be taken by the Company.

P1. Network reliability



7,6 thousand km
new cable lines



63 % 10 kV
underground lines
in forests



164 km old naural gas
pipelines replaced by
inserting new polyethylene
pipes in old steel pipes



60 % replaced
old-type 10/0.4 kV
transformer stations



32 km of natural gas
cross-feeding – an
alternative energy path



Supply to **95%** of
customers of electrical
energy always conforming
to voltage standard

P2. Network smartification



24 % smart electricity
meters for all customers



99 % kWh of electricity
is counted through
smart meters



67 % remotely controlled
transformer substations
and distribution points

P3. Customer experiences and market facilitation



30 % share of active
consumers, %



25/35 c.d. average
duration of
electricity/natural gas connection



60 NPS

Figure 2. Main measures of ESO investment programmes for 2028

Stakeholders have different and sometimes conflicting expectations. The task of the Company is to find sustainable balance between them. One of the cornerstone ideas of the stakeholder model is that operations of the Company may be sustainable and its results – consistent and long-term only if the Company takes account of the stakeholder expectations in a balanced manner.

In ESO Investment Plan for 2019-2028 major groups of stakeholders are distinguished and the certain stakeholders identified (see Figure 3). These groups of stakeholders were also analysed when preparing ESO long term Strategy ESO 2030.

Stakeholder expectations were identified on the basis of surveys conducted by ESO (customer satisfaction survey, reputation survey), customer surveys, feedback, information about complaints, information published on websites of stakeholders or in their documents made available to the public, as well as relying on experience gained when cooperating and solving the arising issues.

Figure 3. Map of stakeholders of ESO



ESO seeks – aiming to find the optimal and rational and sustainable balance between reasonable expectations of the parties involved, for maximum alignment.

* Transmission system operators - „Litgrid“, „Amber Grid“

Although stakeholders may have different expectations regarding ESO activities and may be expecting different operating results, the majority of expectations essentially overlap and are relevant for at least two groups of stakeholders. Figure 4 presents expectations of different stakeholders, e.g. the expectations for safety of network facilities is important for all stakeholder groups. The expectation for uninterrupted energy supply is most important for ESO customers, but also for the public the wellbeing of which depends on reliable energy supply, and also for regulatory authorities that express their expectation regarding the quality of ESO services and for the sector of energy which is concerned about uninterrupted operation of the ESO network.

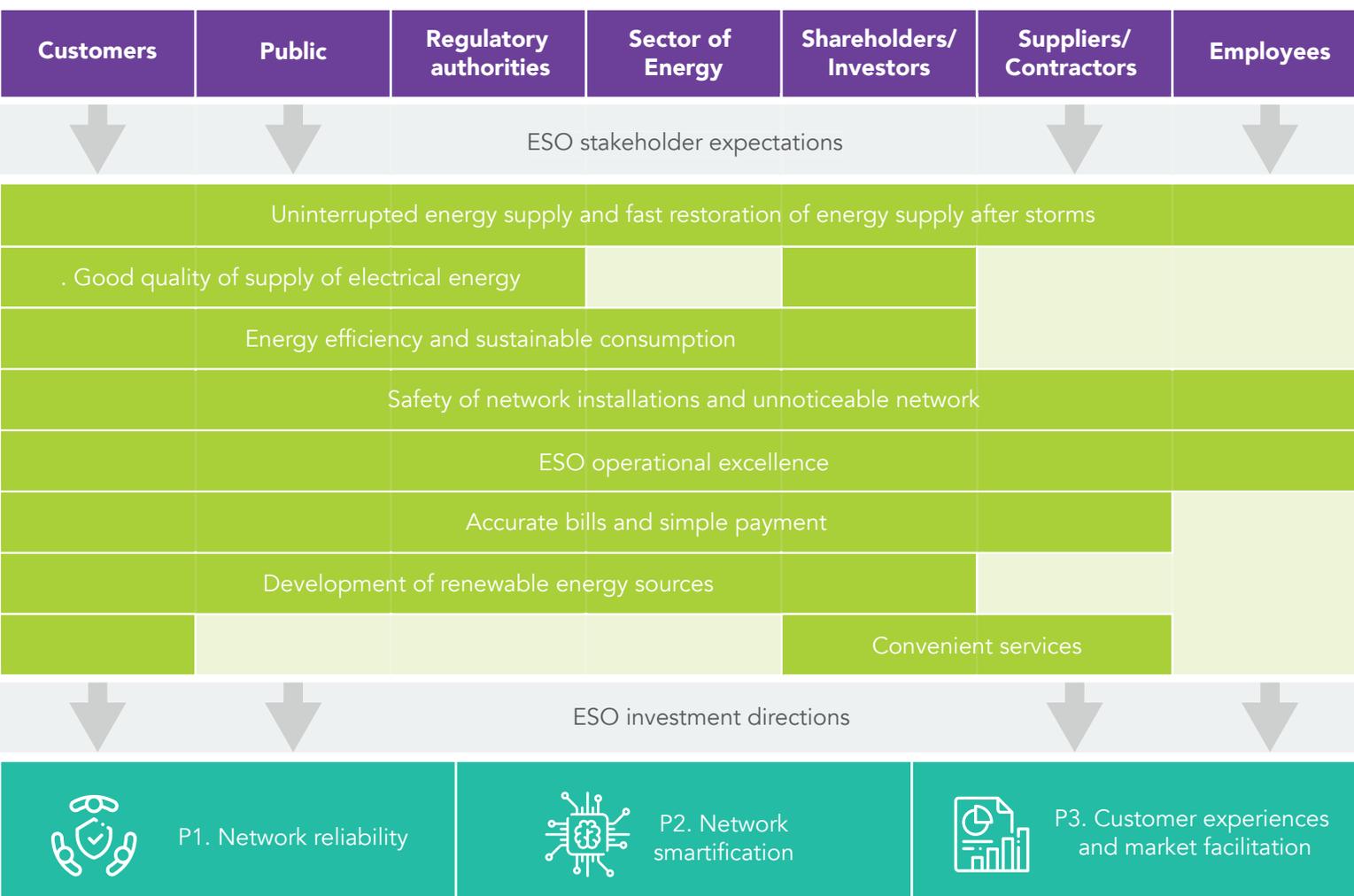


Figure 4. Relationship between expectations of ESO stakeholders and ESO investment programmes



4. INVESTMENT PROGRAMMES

This part describes investments programmes of ESO. Each programme is described according to the following typical structure:



1. Goal



2. Current situation



3. Priorities and measures



4. Benefits and indicators

These programmes were prepared taking account of stakeholder expectations (see Figure 4). Each programme focuses on one or more expectations. For example, the stakeholder expectation for uninterrupted energy supply is ensured through two programmes: P1. Network reliability and P2. Network smartification.

Each programme has the purpose or several purposes arising from the stakeholder needs. Programmes cover different measures implemented by ESO and explain how they help satisfy the needs, e.g. P2. Network smartification covers such measures as installation of remotely controlled and/or monitored equipment, etc.



P1. Network reliability

Goal

To ensure uninterrupted energy distribution of decent quality via the environmentally safe electricity and natural gas network.

Current situation

The main reason for electricity supply disruptions is electricity supply lines damaged by impact of natural forces and other reasons. 70% of electricity lines in ESO network are overhead lines which are much more vulnerable than underground cable lines. The latter electricity disruptions do not meet stakeholder expectations.

According to information of the Lithuanian Hydro-meteorological Service², during the period of 1981-2016, there were 190 natural phenomena in Lithuania, or 6-7 storms, strong winds and hail cases per year, on average. Hydro-meteorologists predict that climate change in Lithuania will increase the number of cases of strong winds, heavy rainfalls and storms to which the existing electricity network of ESO is highly vulnerable: falling trees, snow and icing cut wires off, and falling branches cause short-circuits. It should also be mentioned that underground cable lines, albeit more resilient to weather conditions, require more time for troubleshooting and are often damaged during earth excavation works in particular in the territories of high urbanisation.

Network reliability is also significantly affected by old equipment which no longer meets modern standards and gets broken more frequently, its spare parts are no longer produced, and it is inefficient and insufficiently safe for environment.

Priorities and measures

The following network reliability and security improvement measures are planned:

- **Replacement of overhead lines with underground lines**

Restoration of energy supply after a strong storm might take several days, a week and longer. In addressing this problem in the Western Europe, overhead lines are replaced with underground lines. The underground network is considerably more resistant to climate phenomena and requires less maintenance. With economic justification, underground power cables will be installed by connecting new electricity consumers to the electricity distribution network.

- **Insertions in old steel natural gas pipelines**

With a view to ensuring network safety and reliability, new natural gas pipelines made of polyethylene will be inserted in old worn steel natural gas pipelines. Overhead natural gas pipelines will be replaced by underground pipelines.

- **Alternative solutions securing natural gas and electricity supply:**

- **Cross-feeding of natural gas network.**

This measure ensures network reliability when several or more branch pipelines are connected into one ring. In the case of breakdowns or repairs of natural gas pipelines this will help ensure an alternative natural gas supply path for customers.

- **Installation of the permanent Liquefied Natural Gas (hereinafter-LNG) station in Druskininkai.**

This project is aimed at ensuring the reliable and alternative source of supply of natural gas for consumers in Druskininkai Municipality and at the same time creates preconditions for using acquired competences for future gasification of new territories as one of the possible solutions also considering the installation of the LNG station.

² 'Climatological analysis of dangerous meteorological phenomena in Lithuania' conducted in 2017 by the Lithuanian Hydro-meteorological Service under the Ministry of Environment of the Republic of Lithuania on order of ESO.

● Replacement of unreliable and frequently breaking-down equipment

With a view to ensuring network reliability and safety natural gas and electricity network installations that are depreciated, frequently get broken or are most likely to get broken and no longer meet modern standards will be replaced by modern installations:

 In electricity networks	<p>Replacement of old type 10/0.4 kV transformer stations,</p> <p>Replacement of cable lines or separate inserts.</p>
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 In natural gas network	<p>Replacement of natural gas pipeline closing devices,</p> <p>Replacement of natural gas pressure regulators (hereinafter – GPR).</p>
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● Implementation of voltage quality improvement solutions

Given that the numbers of customers are increasing and the demand for quality of supplied electrical energy is increasing, in individual cases technical parameters of existing lines to a certain extent do not ensure the decent quality of supply of electrical energy. To this end, the electricity network reconstructions are planned and in 2019-2020 the pilot project is implemented concerning the use of accumulation systems for network voltage control and reduction of network reconstruction costs; in addition, from 2019, installation of equipment regulating voltage was started as an alternative for more expensive network reconstructions. Additionally, it is planned to conduct the study in 2019-2020 for investigation of the distribution network quality parameters. Conclusions of this study will be used as a basis for installation of voltage quality recorders in the distribution network which will be intended for analysis and later – adoption of technological solutions regarding voltage directions and interruptions and improvement of other network quality parameters.

● Automated and integrated network operation activity planning and control tools/systems.

○ **Development and application of algorithms of automated predictive network maintenance solutions.** With a view to partially avoiding or reducing the scope and duration of regular routine checks of the electricity distribution network and performing technical maintenance operations and targeted planning of investments solely for those units of assets which are likely or expected to get broken, the aim is to develop solutions which would indicate the respective risks and allow reliably predicting potential failures and avoiding or effectively controlling them.

○ **Implementation of real-time monitoring and forecasting solutions for network load creating preconditions for network optimisation.** Rapidly growing quantity of distributed generation, electromobility and their charging equipment in the network, the distribution system is facing great challenges of ensuring in the most cost-efficient and optimal manner the management of network load and the quality of supplied energy. To that end, the intention is to replace the regular network development planning method by the innovative planning method using advanced load management and forecasting information systems. Network planning algorithms to be introduced will allow ensuring sustainable network development and possibilities for most efficient integration of renewable energy sources.

○ **Introduction of the advanced technological asset management system.** At present, different natural gas and electricity network maintenance systems used by ESO are ineffective and the possibilities of their further connection and development are limited. Thus, it is planned to implement a single technological asset management information system intended for storage of representative data on distribution networks and this will facilitate active asset management and changeover to automated management of network maintenance works.

○ **Upgrading of the geographical information system (GIS).** Currently, ESO uses separate electricity and natural gas network GIS systems the possibilities and installation of a new functionality of which are limited. The aim is to implement a single GIS system that will allow ESO engineers to more efficiently perform equipment monitoring, plan required investments and network maintenance operations, plan faster connections of new customers and manage electricity losses more efficiently.

Benefits and indicators

The main benefit of the programme is the increased reliability of the network and its resistance to climatic phenomena. Upgrading of network equipment reduces its environmental impact: underground lines, especially in forested areas, have lesser impact on animal and bird habitats, and the reducing of the underground protection zones reduces the areas compared to overhead lines from 2-15 to 2 meters minimises the need for pruning of plantations. Underground lines contrary to overhead lines are un-noticeable and do not impair landscape value. The new equipment operates more efficiently, produces lower losses and is relatively easier to maintain.

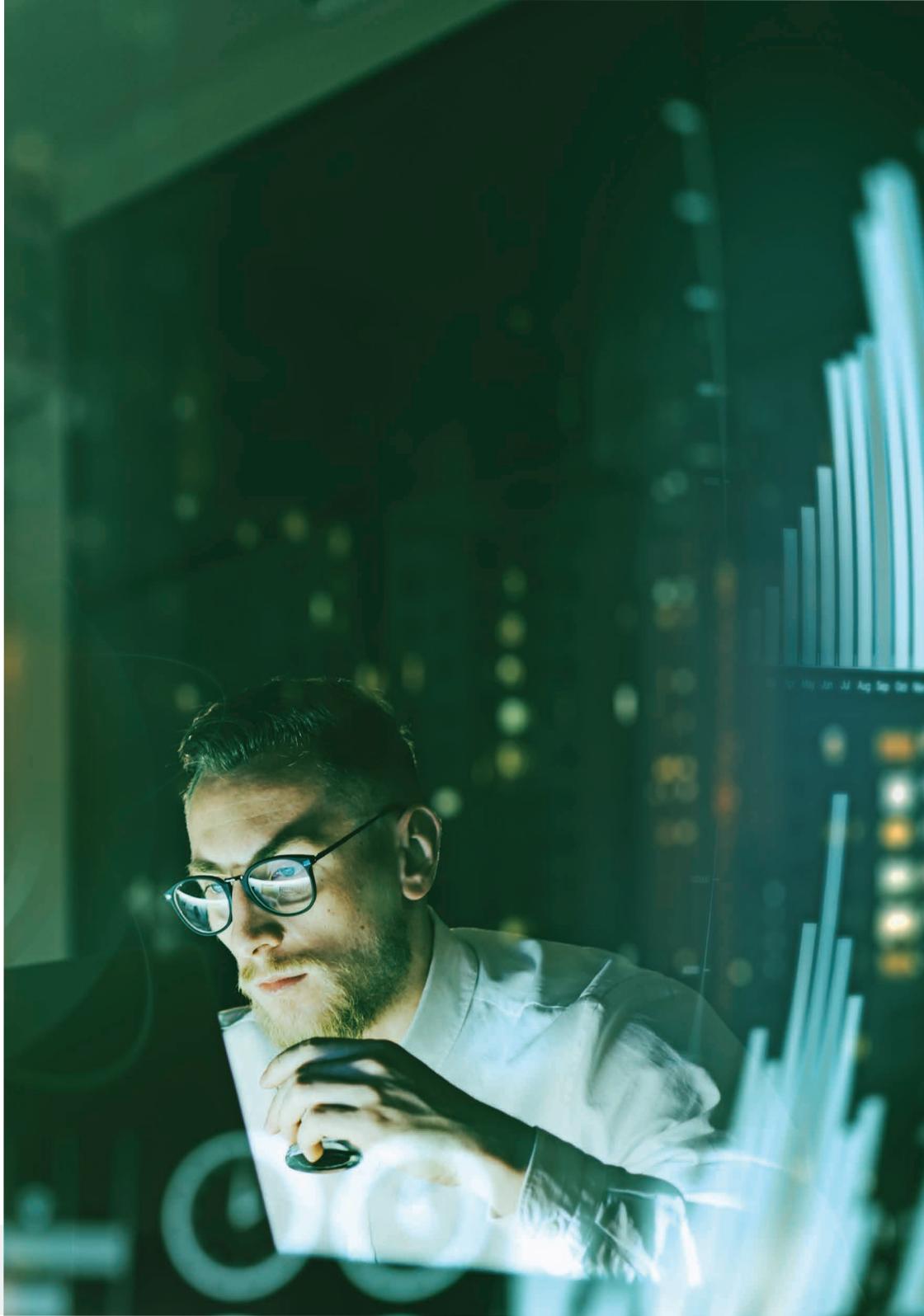
The benefit indicator of this programme is the reduced number of average supply interruptions for one customer per year – SAIFI and shorter average duration of supply interruption for one customer per year – SAIDI. On the natural gas side, reliability indicators (SAIFI and SAIDI) are high enough and it is planned to retain them through reasonable investments.

Indicators	2020*	2028	2030*
Electricity System Average Interruption Frequency Index (SAIFI) **	1,09	0,73	0,66
Natural gas System Average Interruption Frequency Index with Force majeure (SAIFI)	0,0062	0,0062	0,0062
Natural gas System Average Interruption Duration Index (SAIDI), min.**	100	76	70
Natural gas System Average Interruption Duration Index with Force majeure (SAIDI), min.	0,94	0,94	0,94

Table 1. Network reliability investment direction indicators

* Targets set in the NEIS (unplanned outages) are provided: starting point – 2017 (SAIDI 138 min; EE SAIFI 1.32 times).

** When calculating the indicators, the accidents in the distribution network during which in 48 hours more than 100 000 customers suffered from outages or more than 1 000 failures and disruptions occurred in the transmission network were eliminated.





P2. Network smartification

Goal

To accelerate restoration of energy supply in the cases of disruptions, create preconditions for taking network management solutions on the basis of real-time data, as well as energy saving and other economic-social benefits of installation of smart meters for clients.

The network is controlled in a smart manner when it is equipped with automation elements allowing:

 <p>Remote real-time monitoring of status of network elements and localising the points of failures</p>	 <p>Remote switching on/off of a device, changing its parameters or modes</p>	 <p>Programming individual elements for automated switching and responding to other extraordinary situations</p>
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Current situation

ESO receives information about network condition by conducting physical network inspections and measurements. Often defects are identified when failures occur and supply of energy is interrupted. The bigger part of the network is examined by ESO staff or contractors once in 3-6 years; but the assessment of condition of underground facilities is more difficult. Remote monitoring of the network condition is carried out only in respect of a relatively small part of the network. Although since the beginning of 2019, all dispatcher stations of ESO have been merged into dispatcher centres it should be concluded, however, that a relatively small part of the network is remotely controlled directly from the central dispatcher station. Due to insufficient automation and remote control level, lack of information of the appropriate quality about the network condition it is impossible to operatively get information about occurring failures and restore energy supply without going to the location.

Priorities and measures

In developing the network smartification, ESO envisages implementing different natural gas and electricity network automation solutions. The particular parameters of appropriate equipment are described in Technological Standards for the Development of Electricity and natural Gas Networks (see Annex C) of ESO defining the network modernisation and development principles, used technologies and equipment. The main measures envisaged for improvement of the network smartification are provided below.

● Installation of remote dispatcher-controlled equipment

Installation of remote control equipment (876 units) is envisaged in reconstructed and new 10/0.4 kV transformer stations, transformer substations and 10 kV distribution points. 10 kV overhead lines will be provided with switches for remote switching on/off or energy supply in the case of failure thus reducing the number of customers affected by the failure. We aim to increase the number of remote control customers 10 kV lines from 6 % up to 24 %.

● Installation of network operation monitoring equipment

Short-circuit indicators transmitting signals to the dispatcher control system that are being installed facilitate faster localisation of the points of failures.

Digital relay protection installed in transformer substations will provide ESO dispatchers with real-time access to network parameters (voltages, currents, frequency) and enable them precisely localize the point of failure in the electricity network.

● Installation of remote dispatcher-controlled equipment for natural gas network

Installation of such equipment allows responding to changes in the network without going to the location, to adapt flexibly to the customer needs and to minimise the network maintenance costs. It is planned to implement:

Natural Gas Pressure Devices for monitoring and regulation of remotely controlled pressure in response to changes in consumption of customers (due to seasonality or load of production equipment).

Cathodic protection devices: aimed at remote localisation of damages to the protective layer of the natural gas pipeline and avoidance of natural gas leakages.

- **Installation and development of the distribution management system (hereinafter – DMS)**

At present, dispatcher control is centralised and concentrated in two cities – Vilnius and Kaunas; however, dispatchers use several information system at the same time. It is planned to expand DMS functionally through implementation of the following measures:

- **Installation of DMS outage management system.** With the help of the system dispatchers will carry out real-time monitoring and control of natural gas and electricity network in one system. This way, it will be much easier to localise the point of failure and restore the energy supply quicker.
- **Active system management.** In other stages of DMS development it is planned to implement DMS solutions that will allow ensuring active system (including distributed generation, accumulation systems) management. In addition, it is planned to install automatic power and voltage control equipment for newly connected producers of renewable energy sources (hereinafter – RES).
- **Installation of the self-healing network (operating without dispatcher involvement during breakdowns) equipment.** It is planned to expand installation of switching devices that would independently, without the dispatcher's intervention, detect the section of damaged network and disconnect (isolate) it. In addition, it is planned to install automatic power and voltage control equipment for the newly connected RES producers.

- **Installation of smart meters**

ESO is planning the installation of smart electricity meters for customers consuming electricity who use about 90% of the distributed amount of electricity. Smart meters will be installed in stages, starting with consumers who consume largest amounts of electricity (until 2023) and later – for all other consumers. Benefits of smart meters include:

- **More effective network management** – minimisation of theft risks, more accurate network investments, optimised costs of maintenance of meters and registration of their readings and other current costs of ESO;

- **Possibility for consumers to save energy and reduce its consumption** – the pilot project carried out by ESO and cross-border experience of other countries have shown that after installation of smart meters a significant reduction in energy consumption is observed – customers closely following their consumption themselves started reducing it. During the pilot project carried out by ESO, electrical energy consumption by customers reduced by up to 6% on average.
- **Facilitation of competition** – smart meters will be provided with technical functionalities to record energy individually according to the plan selected by the customer; therefore, independent suppliers will have better possibilities to compete for customers in terms of services, their quality, prices or other individual solutions.

Smart meters for natural gas consumers would be installed if after performing cost analysis the result is positive. Final decisions have not been adopted yet, but the scenario under consideration is related to the installation of smart meters for those customers who use natural gas for heating.

In addition to smart meters, the installation of smart metering system for control of meters and reliable collection, storage and analysis of data is envisaged.



● Micro-isles and micro-networks

As the amount of energy redistributed through distribution networks keeps growing it is necessary to assess possible capacities and reliability improvement alternatives. A traditional method is to improve network capacities by developing transformer substations and related infrastructure (lines and other installations); one of alternatives for all this is micro-isles and micro-networks capable of operating in a micro-isle mode for a certain time interval. To that end, in 2019-2020, a pilot project of micro-isles is being implemented. On the basis of its conclusions the conception of development of micro-isles will be created to address the problems of network development and reliability. It is assessed that a micro-network operating or capable of operating in a micro-isle mode allows ensuring higher level of reliability and also helps control load and voltage parameters in particular in those parts of the network where many renewable energy sources are integrated in the network.

Benefits and indicators

To accelerate restoration of energy supply in the cases of disruptions, create preconditions for taking network management solutions on the basis of real-time data, as well as energy saving and other economic-social benefits of installation of smart meters for clients.

The network is controlled in a smart manner when it is equipped with automation elements allowing:

Indicators	2020	2028	2030
Share of remotely controlled customers connected from 10 kV lines, %	8	24	25
Automated distribution points (DPP), %	53	67	70

Table 2. Key indicators of network smartification investment direction

P3. Customer experiences and market facilitation

Goal

To make use of the state-of-the-art technologies, digitise and process innovations so that each customer's contact with ESO leads to pleasant experience for the customer.

Current situation

The present system of electrical energy is traditional with prevailing standard situation when centrally generated energy is supplied to the final customer via transmission and distribution networks. However, over the coming decade, this situation will essentially change or is already changing as customers change their habits: growth of share of electromobility, installation of heat pumps and increase of electrification of households and businesses. Residents and business enterprises will be more motivated to participate in the market of electricity services not only as electricity consumers, but also as providers of system services. The significance of energy efficiency in the vocabulary of each resident and business will also grow. ESO will have to involve new and innovative methods for servicing of customers, e.g., remote channels, Chat Bots (automated or manual e-correspondence platform), interactive maps, and provide customers with possibilities of get instant services – acceptable and effective.

Network digitization by installing smart meters and creating the Data Hub will create new opportunities for the provision of new services of ESO, while also opening data to the public and thus encouraging the establishment of new businesses and/or start-ups. ESO will become an inseparable part of the Lithuanian energy innovation ecosystem.

Priorities and measures (projects)

With growing demands of customers for convenient services and access to information, together with the improvement of the distribution infrastructure it is necessary to allocate investments for management of ESO customer experiences and improvement of provided services. The following measures are envisaged for the implementation of this aim:

● Connection of new customers (consumers)

This measure is aimed at ensuring smooth, fast, convenient and effective connection of new natural gas and electricity customers and of Lithuania's competitiveness in international rating systems (e.g., 'Doing Business'). The main changes focused on the development and improvement of customer experience are:



'One click story' (OCS) – development of the principle/functions of ordering the service and instantly providing the customer with a final price and agreement (e.g., there is no need to file an application) – process automation/transfer to electronic environment seeking this way to save the customer's time and enable the customer to receive the service instantly. The process automation will shorten durations of procedures of filing an application, payment of a contribution and approval of an agreement. Within the scope of this change it is intended to extend the sample of customers who can use these functions.



Creation of the platform securing services (the system consists of the ordering of services, billing and product catalogue). This system will have to ensure smoother control of processes and contractors, timely and accurate provision of information to customers.



Faster connection of new customers. It is envisaged to perform an advance expansion of Free Economic Zones contributing to the objective of the State to attract foreign direct investments.

● Client service

In clarifying the business model between ESO, independent suppliers and customers (e.g., separation of public supply activity in end-2018, elimination of the provision of commercial services in the second quarter of 2019, etc.), the processes aimed at simplifying the customer's path to access and use services of decent quality are being prepared.

The servicing of customers is directed via remote channels in order to increase efficiency and simplify the customer's steps on all customer servicing matters.

The customer servicing process solutions (Chat Bot, Artificial Intelligence) are implemented for innovative customer servicing creating good experience and value, easily accessible and automated to the maximum extent. Automation will contribute to higher efficiency of processes and minimising the number of human errors.

In ESO value chain (E2E – end-to-end process review) the customer servicing standard is being updated focusing on management of customer experiences.

● Development of services

Digitisation, development of new technologies and market liberalisation will create new opportunities for the development of innovative services:

- Better utilisation of the infrastructure through synergies with other infrastructure developers, e.g., internet providers or street lighting networks.
- Data analytics enabling customers to benefit from innovative services and contribute to the improvement of energy efficiency at the national level.
- Solutions that will ensure higher quality parameters of electricity.

● Market facilitation

With growing consumption of individuals and business additional incentives for customers to change their consumption habits will emerge. Innovative, flexible services will enable consumers to adjust their consumption and production to the situation of the market or of the infrastructure networks and receive return and reduce their energy bill. The share of producing consumers will also grow significantly, solutions of energy saving, accumulation or provision of other services will emerge for the market enabling its participants to become active providers and consumers of such services.

Data Hub

development is divided into two stages – until 2020 and until 2023 according to the NEIS.

Until 2020

changes implemented in this stage cover the following retail market processes or their parts: access to historic data, supplier's change process, single contract and bill model. This is the first step that will enable the market to become more active and, in the first instance, simplify data exchanges among market participants.

Until 2023

the full implementation of the Data Hub is planned on the basis of functionality coordinated with market participants and authorities concerned. This Hub will serve as the basis for developing new and flexible market-based energy services enabling different groups of market participants to become active providers and consumers of services.



● Upgrading of information systems

With a view to optimising the quantity of information systems needed by ESO, their operation and maintenance and development costs, and ensure data integrity the upgrading of the existing systems is envisaged. It is planned to implement new generation information systems adapted to the sector of energy sector and meeting safety requirements: financial management and accounting system, personnel management and accounting system, document management system.

Benefits and indicators

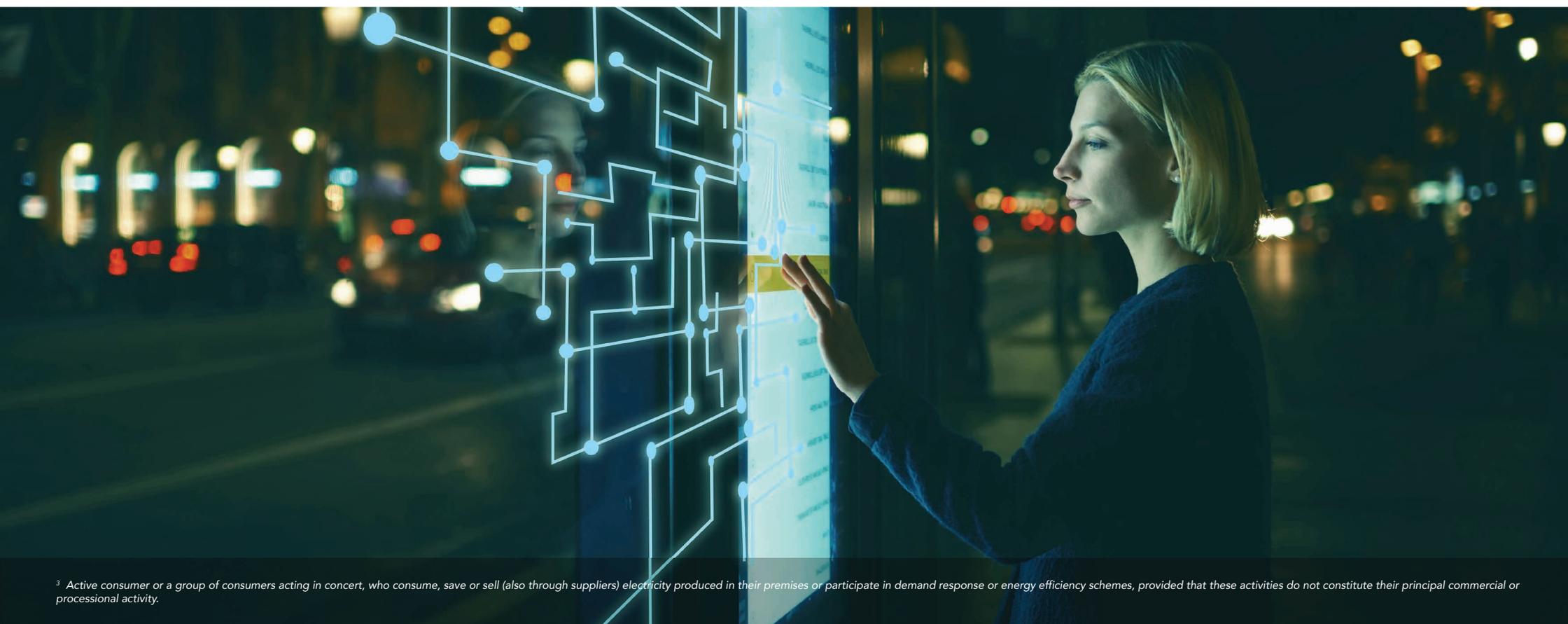
Main benefits of the programme are the effective, professional and innovative servicing of customers ('one-stop-shop' principle).

Indicators

2019 - 2028

Share of active consumers ³ , %	30 %
Electricity connection average duration, c.d.	25
Natural gas connection average duration, c.d.	35
NPS	60

Table 3. Customer experiences and market facilitation investment direction indicators



³ Active consumer or a group of consumers acting in concert, who consume, save or sell (also through suppliers) electricity produced in their premises or participate in demand response or energy efficiency schemes, provided that these activities do not constitute their principal commercial or professional activity.

5. FINANCIAL ASSESSMENT

This part presents the general financial assessment of the ESO Investment Plan for 2019–2028 and defines main assumptions about the need for investments.⁴

On the basis of 2018 asset valuation report (electrical power segment) of ESO the replacement value of fixed assets of ESO totals EUR 4 511 million. Considering the duration of the average useful life of fixed assets (electrical powery segment) of the Company - 40 years⁵ – the average annual value of depreciated assets would be approximately EUR 113 million.

Considering the above provided assumptions regarding (i) the replacement value, (ii) the period of depreciation, and (iii) the average value of the annually depreciated assets, ESO would have to ensure the investment level of at least EUR 113 million each year (EUR 1,128 million during the next decade) which would be allocated for electricity network reconstructions in order to maintain a stable level of physical depreciation of the electricity network, i.e. maintain the electrical power network in the condition of the current technical level.

It is important to draw attention to the fact that continuous efforts of ESO to make its operations more effective help the Company find the solutions which enable the Company to retain the relatively stable asset depreciation level by investing a slightly smaller amount of funds, e.g. implementation of asset management, geographical and other systems, implementation of smart metering systems, etc.

⁴ Investment plan is an information type document and cannot be treated as any advice, recommendation or any other encouragement to invest or carry out other actions.

⁵ The average depreciation rate of network elements applied in the regulatory accounting.

For this reason, we are of view that the amount to be allocated to investments in restoration of the electrical power network could be by about 10% smaller than the arithmetically simulated amount and would total to about EUR 101 million per year (EUR 1, 015 million in the next 10 years).

One of the factors to help retain the existing depreciation rate of the electrical power network with smaller investments is the mass installation of smart metering devices. These smart devices will help identify the optimal required infrastructure of the network given the profiles of energy consumption by electricity users, will allow the Company to make use of the existing infrastructure in a more efficient manner when planning reconstruction works and will help evaluate the potential loading of new clients more accurately as well as identify the need of network reconstruction in relation to new users. Taking into consideration the experience of other countries, we estimate that the installation of smart metering devices will allow us to potentially reduce the investments in the network reconstruction and renovation by 3.5%.

In 2017-2018, a significant part of investments was funded by the Company with borrowed capital funds; however, as regards the period of 2019-2028, the possibilities of ESO to implement bigger investments are potentially limited by the following main factors:

- **Amount of capital costs**

The Company's cash flow for the financing of investments consists of: (i) depreciation of regulated assets and (ii) investment return which are included in the distribution service tariff. The present regulatory mechanism helps the Company ensure the level of income which enables the Company to invest approximately EUR 793 million into reconstruction of power networks in 2019-2028. Whereas the need for investments according to the replacement value of assets would amount to about EUR 1,128 million and considering the increase in efficiency of ESO's activities, the floor of the necessary investments could be about EUR 1,015 million (less by up to 10%) in the 2019-2028 period;

- **Lack of funding for new consumers**

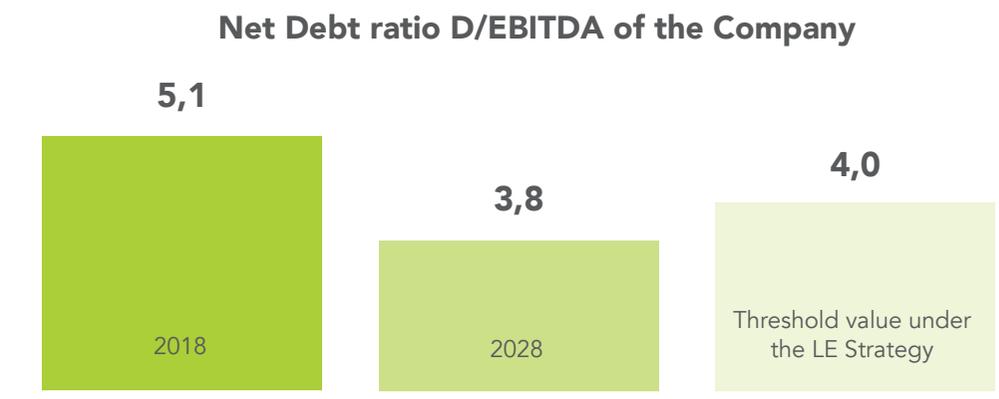
The provisions of the Law on Electricity and the Law on Natural Gas of the Republic of Lithuania oblige ESO to connect new electricity and natural gas consumers, but does not guarantee ESO sufficient funding for investments focused on connection of new consumers, because only 20% of connection costs incurred by ESO are funded by the

new consumers. The remaining amount of investments required by ESO for funding during the implementation period is regained by the Company only over the useful period of assets created when connecting new consumers, i.e. in 40 years on average, in equal parts. It should be noted that in 2017-2018, investments into connection of new consumers in electricity and natural gas segments totalled EUR 202 million, while the share paid by new consumers totalled to only about EUR 25 million. This means that investments of about EUR 177 million were financed with the Company's own funds and borrowed funds which significantly increased the debt level of the Company;

- **Financing of investments with borrowed funds**

The Company has a limited possibility to finance investments planned for the period of 10 years from borrowed funds, because in end-2018 the ratio of the Company's net financial debt to EBITDA⁶ was 5.1. According to the LE Strategy, the long-term value of this ratio should not exceed 4. Such debt level corresponds to the strategic goals of foreign companies involved in similar activities (most companies aim at not exceeding this level) as the main controlling shareholder of the Company, namely, the Ministry of Finance, expressed its expectation for 2018 in its letter "On the State's Expectations in Relation to Operation of Lietuvos Energija Group". When modelling its investment plan, the Company is going to reduce the value of this indicator to the value acceptable to the shareholders, namely, 3,8 in the period of ten years (2019-2028) (see Figure 5).

Figure 5. ESO net debt ratio (D/EBITDA), 2019-2028



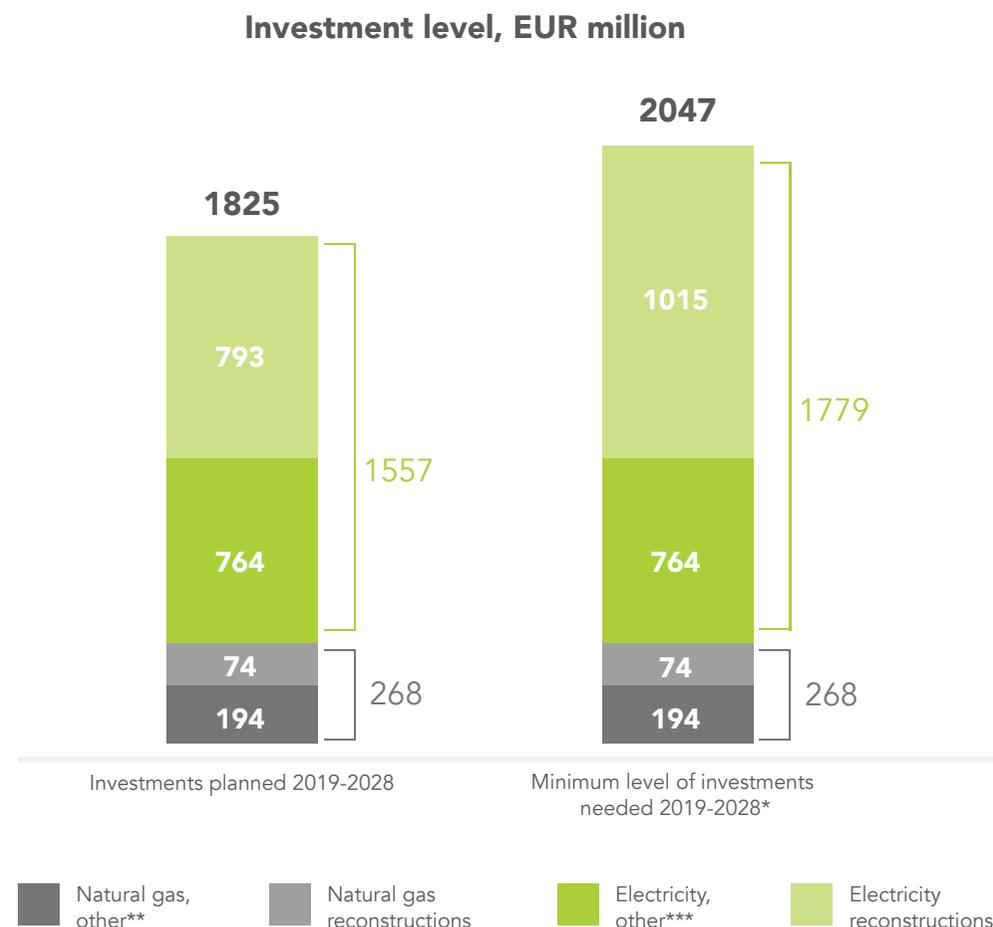
⁶ The ratio of net financial debt (D) and earnings before interest, tax, depreciation and amortisation (EBITDA) shows the Company's ability to repay debts. The value of this ratio indicates how many years the Company has to work in order to achieve EBITDA equal to the Company's debts.

Considering the financing of investments guaranteed by (i) capital costs (regulatory mechanism) and the Company's income flow in (ii) the Company's obligation to connect new consumers by funding up to 80% of connection costs and (iii) the need to achieve sustainable D/EBITDA debt ratio, the Company has planned the following amount of investments in the 2019-2028 period (see Figure 6).

The 2020 investment level is simulated within the scope of the necessary investment in the network (investments of the given period should correspond to the planned investment level of 2019), **whereas from the year 2021, the average investment level should grow, however, the maximum amount of the simulated cash flow according to the existing regulation is EUR 222 million smaller than the minimum required investment flow, which could ensure the retention of the current state of network depreciation** (the difference results in the part of reconstructions of electrical power network). The actual investments foreseen in the investment plan will depend on the decisions adopted by the regulatory authorities which provide assumptions for the funding of the aforementioned investments, i.e. (i) necessary regulatory changes to ensure a proportionate and well-balanced funding of the connection of new consumers; (ii) as of 2021 a new regulatory period is to start during which a new regulatory mechanism is to be established which, in principle, will have to define a new actual level of investments in network upgrade. In case of favourable decisions of the regulatory authorities, the volume of investments could be potentially revised.

The Investment Plan was prepared taking account of the following main aspects upon change of which potential investment possibilities and amounts would also change. The below named aspects are provided for calculation purposes and should be treated as calculation assumptions and restrictions; however, it should be emphasised that the number of new consumers of the 2019 period at the time of preparation of this document exceeded the number of the relevant period of 2018 – if such trend continues and no corrections are made with regard to the regulatory environment which determined the funding of investments in the connection of new consumers from the distribution tariff, investments in network restoration and upgrade could reduce in the long run. It should be noted further that the Company cannot control/take decisions on tariffs or on proportions of tariff components. Furthermore, in individual periods the change in the distribution service tariff may be above or below the inflation rate of that year, but it is expected that it over 10 years on average it will be close to the inflation rate.

Figure 6. ESO capital investments planned and the capital investments needed for 2019-2028, EUR million



*Level of investments required for maintaining stable physical depreciation level of electricity network

** Investments into new consumers on natural gas side, smart meters, other natural gas network-related investments – ITN, other equipment, etc.

*** Investments into new consumers on electricity side, smart meters, other electricity network-related investments – ITN, other equipment, etc.

The main aspects taking into account when planning investments for the 2019-2028 period:

Electrical energy and natural gas distribution tariff change is close to inflation level and amounts to 5% a year on average;

Qualitative indicators were established considering stakeholder expectations for service quality and good practices of Western Europe;

Investments in connection of new customers were assessed on the basis of the statistical information of the previous year.

During the period of implementation of the Investment Plan, the Company provided for actions the successful implementation of which would facilitate the increase of investment level into electricity network reconstructions:

○ **Level of capital costs in regulated income:**

The Company considers that it is expedient to take an active part in the review of the regulatory mechanism planned with NERC from 2021 by making proposals regarding incorporation of a reasonable and justified depreciation rate in the prices of regulated services that would ensure sustainable restoration of network depreciation over the long-term period;

○ **Connection of new consumers:**

The Company considers that it is expedient to further seek reasonable and justified change in the structure of financing of new consumer investments though more objective allocation of investment financing proportions between the Company and new consumers linking them to benefits generated by investments. Presently, the Company analyses the potential alternatives for new consumer investment funding and hopes to provide the regulatory authorities with the proposals regarding targeted changes in the regulatory environment in the foreseeable future.

○ **EUF support:**

We consider that it is expedient, where practicable, to continue seeking that part of investments is financed from the European Union (EU) funds. It is planned that part of investments could be financed with the EU funds

covering up to 50 % of the value of separate projects. Such investment funding source would enable to implement more investments which are necessary for the network upgrade with a lower impact on the tariff of electricity distribution prices and to improve the indicators of financial debt and cash flows of the Company.

In providing all amendments to the regulatory environment and recalculations of prices the Company will take account of the cyclical nature of the economy (will consider electricity and natural gas quantities planned to be distributed) and will seek to minimise the impact of investments on electricity and natural gas tariffs.

6. ANNEXES

A. Quantities of Replaced Equipment and Indicators

Equipment type	Programme	2019	Total up to 2028
Electricity network⁷			
Underground electricity lines, km	P1	453	7597
Length of 10 kV underground lines in forests, km	P1	92	2480
Share of 10 kV underground lines in forests, %	P1	36%	63%
Share of 0.4; 10 and 35 kV underground lines, %	P1	31%	39%
Reconstructed transformed substations, ps.	P1	12	96
Reconstructed distribution points, ps.	P2	6	113
Reconstructed old type prefabricated transformer stations, ps.	P1	214	6968
Switching equipment, ps.	P2	5	876
Share of remotely controlled customers connected from 10 kV lines, %	P2	6%	24%
Installation of smart electricity meters, thousands of ps.	P2	0	1605
Share of smart electricity meters, %	P2	0%	100%
Voltage analysers, ps.	P1	0	400
Electrical energy meeting the voltage standard supplied to the part of customers, %	P1	93%	95%
Natural gas network⁸			
Reconstruction of natural gas distribution pipelines, km	P1	30	164
Sensors of natural gas pressure parameters, ps.	P2	12	118
Cathodic equipment, ps.	P2	0	432
Share of remotely monitored and controlled anti-corrosion equipment, %	P2	0	86%
Cross-feeding, km	P1	1	32
Installation of smart natural gas meters, thousands of ps. ⁹	P3	0	122

⁷Total length of electricity distribution networks – 125 077 km (126 600 km – according to the data of 31 December 2018, including used and subscriber network).

⁸Total length of natural gas distribution networks – 8 914 km (8 954 km - according to the data of 31 December 2018, including used and subscriber network).

⁹Final decisions on installation of smart natural gas meters have not been adopted.

B. Map of investment programmes for 2019-2028

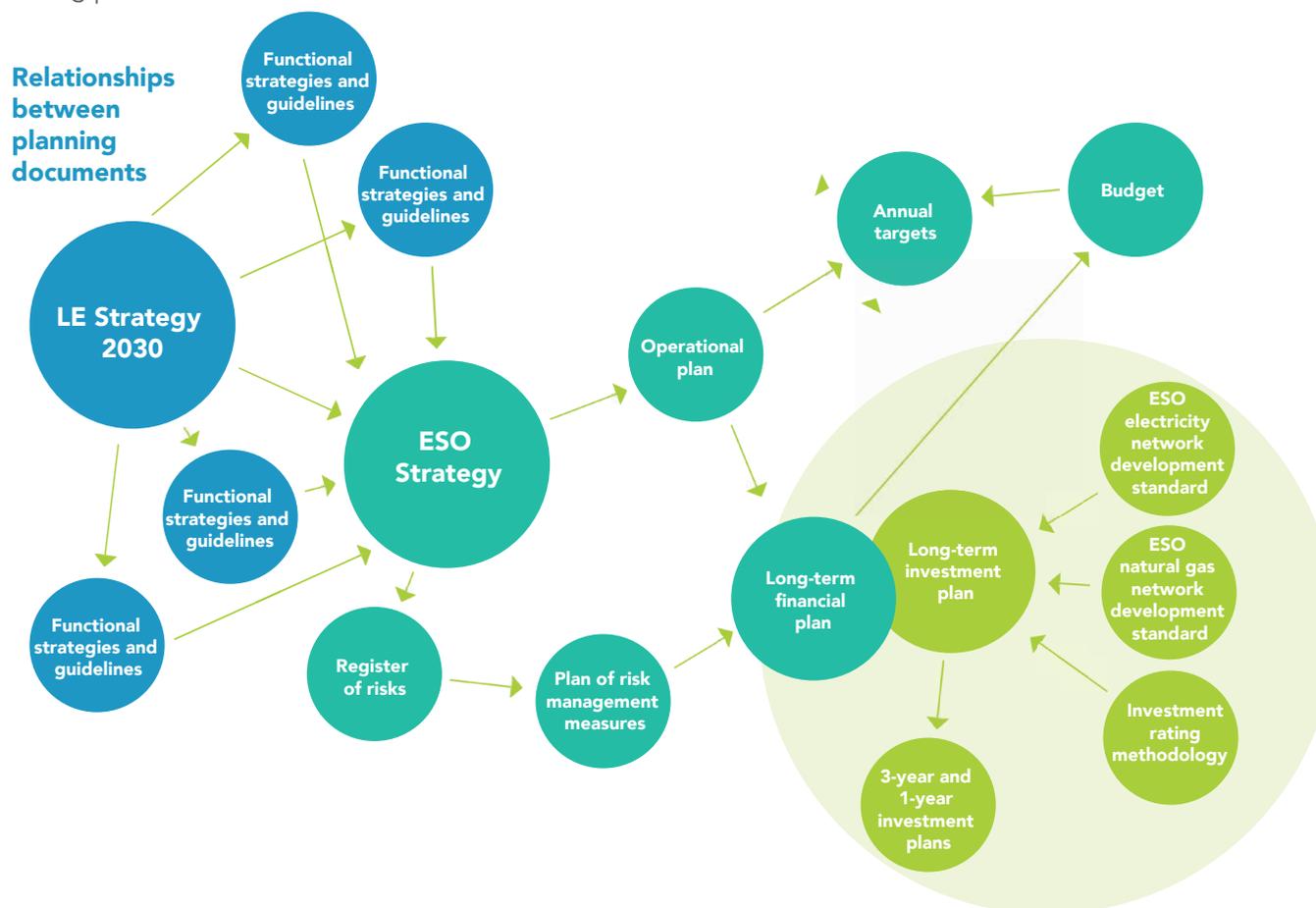
INVESTMENT PROGRAMME	STRATEGIC PRIORITIES AND MAJOR PROJECTS	
<p>P1. Network reliability</p>	<ol style="list-style-type: none"> 1. Replacement of overhead lines 2. Replacement of unreliable and frequently breaking down equipment 3. Solutions securing alternative supply of natural gas 4. Inserting in old steel natural gas pipelines 5. Implementation of voltage quality improvement solutions 6. Automated and integrated network operation activity planning and management tools/systems 7. Pilot projects in all stages and spheres after justification of which larger-scale solutions are planned 	<ul style="list-style-type: none"> ● Asset management system ● Automated predictive maintenance solutions ● Geographical information system ● LNG station ● Pilot projects for installing voltage quality analyzers, power storage devices, automatic power and voltage regulators
<p>P2. Network smartification</p>	<ol style="list-style-type: none"> 1. Installation of remotely dispatcher-controlled and network operation monitoring equipment 2. Installation of smart meters 3. Distribution management system (DMS) installation and development 4. Installation of remotely dispatcher-controlled equipment for electricity and natural gas network 5. Micro-isles and micro-networks 	<ul style="list-style-type: none"> ● Installation of outage management system ● Project of installation of smart meters ● Development of self-healing networks ● Active system management ● GPRE telemetry. Telemetry of cathodic safety devices
<p>P3. Customer experiences and market facilitation</p>	<ol style="list-style-type: none"> 1. Connection of new electricity and natural gas customers 2. Customer servicing and preparation of processes to improve customer experience 3. Market facilitation enabling its participants to become active providers and consumers of services 4. Development of services; development of innovative services 	<ul style="list-style-type: none"> ● Data Hub ● New self-service portal of ESO ● Platform for ensuring of services ● Development of 'One click story' principle/functions ● Early development of LEZ

C. Scheme of relationships between the Investment Plan and other documents

The scheme below shows how the Investment Plan is integrated into the long-term planning process of ESO and the LE group. The ESO Strategy 2030 is developed based on the LE Strategy 2030. The Investment Plan has been prepared in order to ensure the implementation of the objectives provided for in the ESO Strategy and to plan the required investments seeking maximum possible results taking account of the existing limitations.

The investment plan serves as a basis for the accurate planning when annually updating the ESO operational plan and preparing the budget, and when annually updating more detailed 3-year and 1-year investment plans each quarter.

Investments were planned taking into account other planning documents of the LE Group (e.g. digitisation guidelines) as well as the ESO natural gas and electricity development strategies that describe the principles of modernisation and development of the network, and the technology and equipment used were taken into account in the investments planning process.



D. Impact of Investments on the distribution tariff

This annex illustrates the impact of the Investment Plan for 2019–2028 on electrical power and natural gas distribution tariffs in the considered period. The impact was measured as the difference between the amount of investments specified in the investment plan approved in 2018 for the period of 2018 – 2027 and the level of investments provided for in the investment plan for 2019–2028.

Taking account of the new investment level for 2019–2028, the average reduction of the electricity distribution tariff due to different distribution of investments in different years compared with the investment plan for 2018-2027 would annually decrease by 0.05 ct/kWh or 1,7 % on average in the period from 2019 to 2028.

The natural gas distribution tariff would annually increase by 0.16 EUR/MWh or 2.7% on average in the 2019-2028 period. This increase is due to the growth trend of new customer observed in 2017-2019, with correspondingly planned higher investments in connection of new customers in 2019-2028.

The calculation assessed only the impact of investments on the distribution tariff. When calculating the whole electricity and natural gas distribution tariff other components were also taken into account: the increase in energy consumption volume, technological losses, adjustments of income level, performance, etc. The Company simulates that the growth of the average distribution tariff considering all components during the average period of 10 years would be close to the annual inflation level, however, in individual periods the change amount to 5 per cent on annual basis in the distribution service tariff may be higher or lower than the inflation level of the year.

Figure 1. Change in electricity distribution tariff in 2012–2028 (compared with the Investment Plan for 2018-2027), %

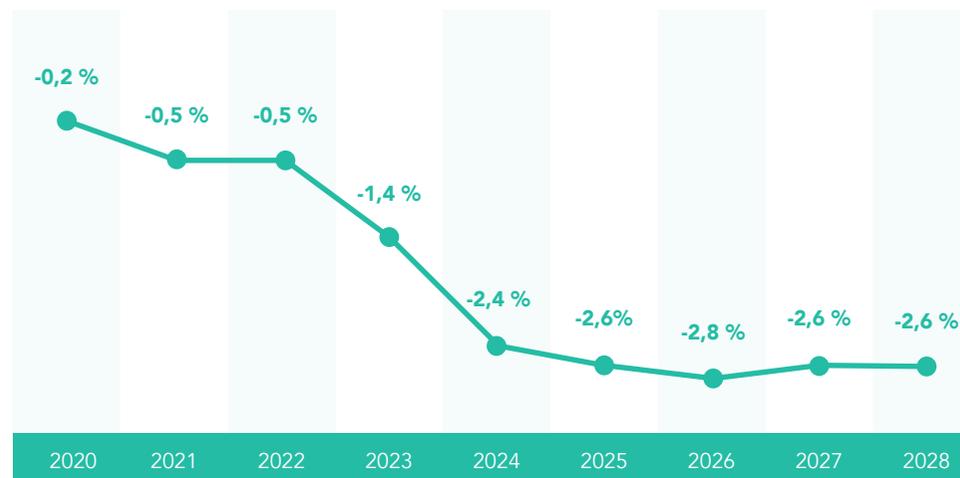


Figure 2. Change in natural gas distribution tariff in 2010–2028, % (compared with the Investment Plan for 2018-2027)*.



* The influence on the gas distribution tariff is increasing due to the growth trend of new customers observed in 2017-2019 with correspondingly planned higher investments in connection of new customers in 2019-2028.