2018–2027

Energijos Skirstymo Operatorius AB

INVESTMENT PLAN

eso

CONTENT

FOREWORD FROM THE CEO

Dear All,

Reliable and safe distribution of electricity and natural gas throughout Lithuania is our day-to-day objective. We analyse the needs of our customers and work with great responsibility every day to provide services meeting their expectations.

Future is with the companies that are able to adapt quickly to the changing environment. Hence, we are already thoroughly planning electricity and natural gas grid renewal that would enable us to provide increasingly higher quality services and open up new opportunities for our existing and future customers.

Electricity and natural gas grids are a very long life cycle assets. Decisions taken now will have an impact on reliability of networks and flexibility of services over several forthcoming decades and therefore, investment planning is a lead to our vision – partnership in the world of smart energy technologies.

We introduce the AB Energijos Skirstymo Operatorius (hereinafter referred to as ESO) investment plan for 2018–2027 that generalises the biggest and most important of our works for the next decade. This document has been prepared taking into account expectations of our customers, society, regulatory institutions, energy sector, and our shareholders for the quality and speed of services provided by us.

We have outlined **3 most important investment directions – programs:**

- **Reliable and climate impact-resilient grid**
- **Remotely controlled grid**
- **Smart grid**

We plan to allocate EUR 2.1 billion for modernisation, efficiency enhancement, and flexibility of the electricity and natural gas grids for the next 10 years. These investments will make it possible to significantly improve the reliability of networks during storms, and will precondition obtaining accurate real-time information as well as improve networks security.

One of the directions of utmost importance is the digital network development. Implementation of advanced technologies will guarantee future provision of quality services: remote control of the network elements, fast locating and elimination of failure areas, precise estimation of energy consumption, predict grid operation, and enhance its efficiency and security.

This document highlights our aspirations. I hope it will help to better understand our objectives.

Dalia Andrulionienė

Chairwoman of the Board and CEO of
Energijos Skirstymo Operatorius AB

SUMMARY

Long-term activity planning is considered to be good business practice of infrastructure managing enterprises. The purpose of this document (hereinafter – Investment Plan) is to set the directions and goals of ESO investments for 2018–2027, and to explain the benefits of the envisaged investments to ESO customers and society.

The prepared Investment Plan aims to introduce ESO investment goals, directions, and volumes to the widest possible range of stakeholders: society, customers, regulatory institutions, energy sector and foreign investors.

The Investment Plan is a document of purely informative nature and cannot be considered as any advice, recommendation or other kind of incentive to invest or perform other actions. Decisions on specific objectives under the Investment Plan (including the scope of projects, time, method of financing and other aspects) and their implementation 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 only be taken subject to assessment of all relevant circumstances and in compliance with the requirements and procedures of the legislation, including, where applicable, the obligation to obtain the necessary permits or other coordination of decisions with the competent authorities or stakeholders.

The Investment Plan is divided into two major parts.

The first part "Stakeholders and their Expectations" identifies the most important ESO stakeholders and describes their expectations for the quality of ESO services: reliability, safety of networks, and convenient services.

The second part "Investment Programs" describes three investment programs envisaged by ESO and aimed to satisfy the stakeholders' expectations.

It is important to emphasise that, based on the policy of the Integrated Planning and Monitoring System Policy of the Lietuvos Energija (hereinafter referred to as the LE) Group, the 2018–2027 Investment Plan is an integral part of the LE Group planning system, inseparable from other key long-term planning documents - LE and ESO strategies of the parent company (see Annex D). Long-term Investment Plan of ESO is a part of the ESO long-term financial plan.

The Investment Plan presents in detail strategic ESO investments seeking to achieve the objectives set in the ESO and LE Group strategies. Whereas the three-year ESO business plan presents in detail all strategic ESO measures seeking to achieve strategic objectives set in the ESO and LE group strategies.

In 2018–2027 the investment of EUR 2.1 billion will be allocated to increase reliability, safety of the network and smart grid solutions. The planned investments will be targeted at three programs:

- **P1. Reliable and climate impact-resilient grid** aimed to ensure uninterrupted and quality energy distribution by environmentally safe electricity and natural gas grid. The main measure of this program is replacement of the overhead lines with the subterranean cables prioritising replacement of old lines, failure areas and forested areas.
- **P2. Remotely controlled grid.** The aim is to accelerate the restoration of energy supply in the event of disturbances, to create the preconditions for grid management decisions based on real-time information and to facilitate the integration of renewable energy resources (hereinafter referred to as RES). The main measure for this program is the installation of remotely monitored and managed equipment.
- **P3. Smart grid.** This program is designed to improve the quality of ESO services, create the preconditions for customers to accurately monitor energy consumption, receive accurate billing and save energy by rational consumption. The main measure of this program is the introduction of smart meters, which will allow quicker identification of customers whose power supply is interrupted.

The electric power grid is much more sensitive to weather conditions and its reliability indicators are considerably poorer as compared with the natural gas grid. Due to this reason, the major part of planned investments (88%) will be dedicated to strengthen the electricity grid. The main indicators for assessing the efficiency of investments and quality of services are provided below:

- P1: The System Average Interruption Frequency Index (SAIFI)
- P2: The System Average Interruption Duration Index (SAIDI)
- P3: Energy saving for customers (% of the total consumption).

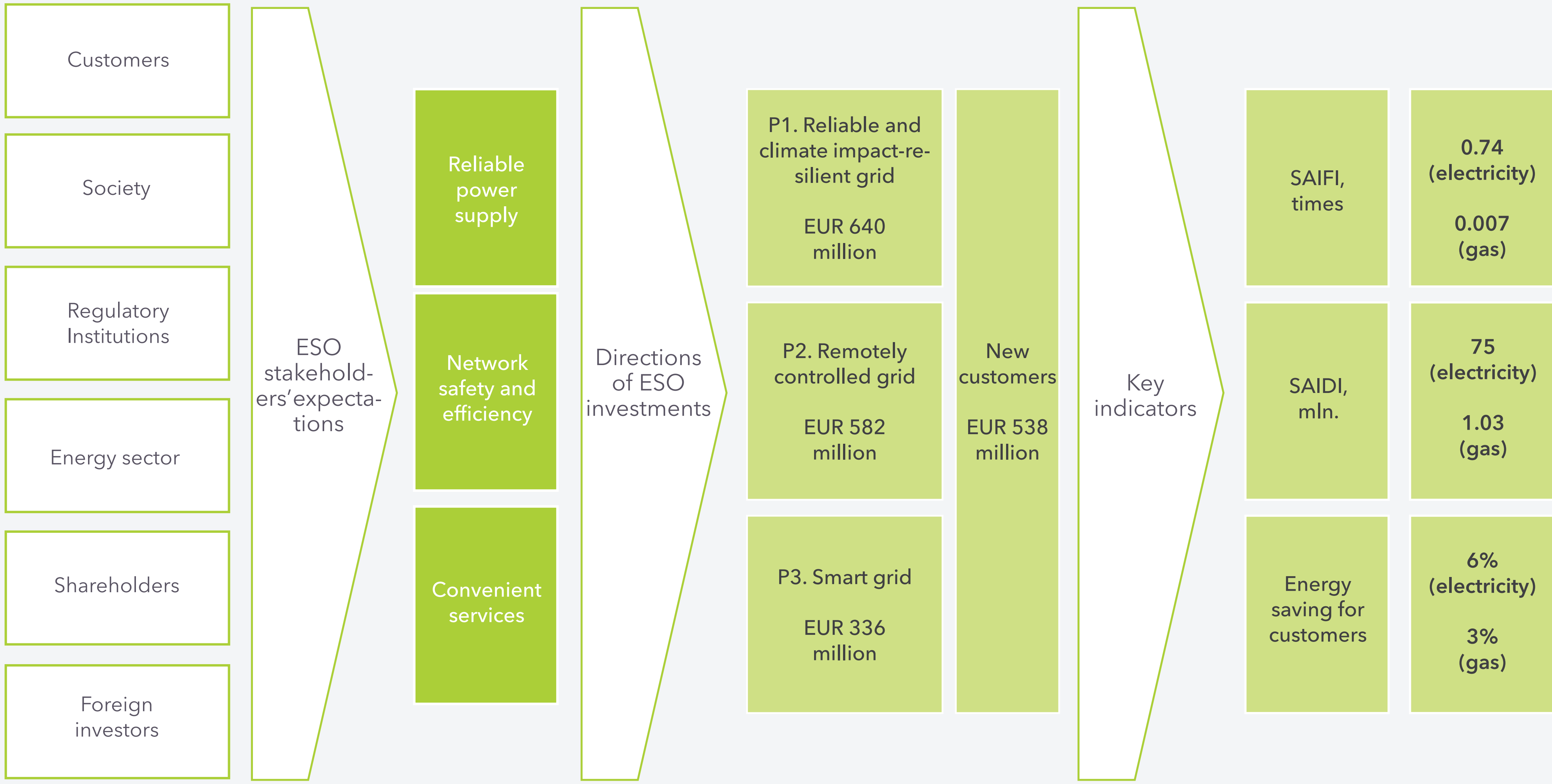


Figure 1. *Map of ESO stakeholders, their expectations and investment programs, sums for 2018–2027, indicators for 2027*

When planning the investments, ESO envisages the implementation of new elements of the grid, also the replacement of outdated elements with the new ones. The most important measures of the planned investments are provided in Figure 2. Detailed volumes of the planned investments and indicators are provided in Annex C.

P1. Reliable and climate impact-resilient grid

11 thous. km of new cable lines

63% 10 kW of subterranean lines in forests

134 km of old pipelines replaced by inserting new polyethylene pipes into old steel pipes

P2. Remotely controlled grid

38% electricity customers connected to remotely controlled devices (3,5 times more than today)

85% (10.5 thous.) of replaced old-type (insecure) 10/0.4 kV transformer stations

78% remotely controlled electricity distribution points

55% gas customers connected to remotely controlled devices (3,5 times more than today)

45 km of gas pipe cross-feeding - an alternative energy path to 38 thousand customers

97 pcs. remotely controlled gas pressure regulators (71 thous. customers)

P3. Smart grid

100% smart electricity meters for all customers

100% ismart gas meters for customers who use gas for heating

100% transformer stations with remote voltage analysers allowing to collect network voltage quality information

Figure 2. *Main aims of ESO investment programs, 2027*

3. STAKEHOLDERS AND THEIR EXPECTATIONS

ESO manages the electric and natural gas distribution networks, provides services to customers across Lithuania, and has a wide range of partners. Because of specific activities and geographical location, a great number of stakeholders (e.g. customers, the National Commission for Energy Control and Prices of the Republic of Lithuania (hereinafter – NCC), the Ministry of Energy, forest enterprises, municipalities, small investors, etc.) of different interests have influence on ESO activities. Decisions and actions made by ESO may also have a significant effect on their activities.

Resulting from this a stakeholder theory was chosen when drafting the Investment Plan. This model has been chosen for its versatility, flexibility and easily perceived structure of diverse expectations analysis justification of resulting actions that the company could take.

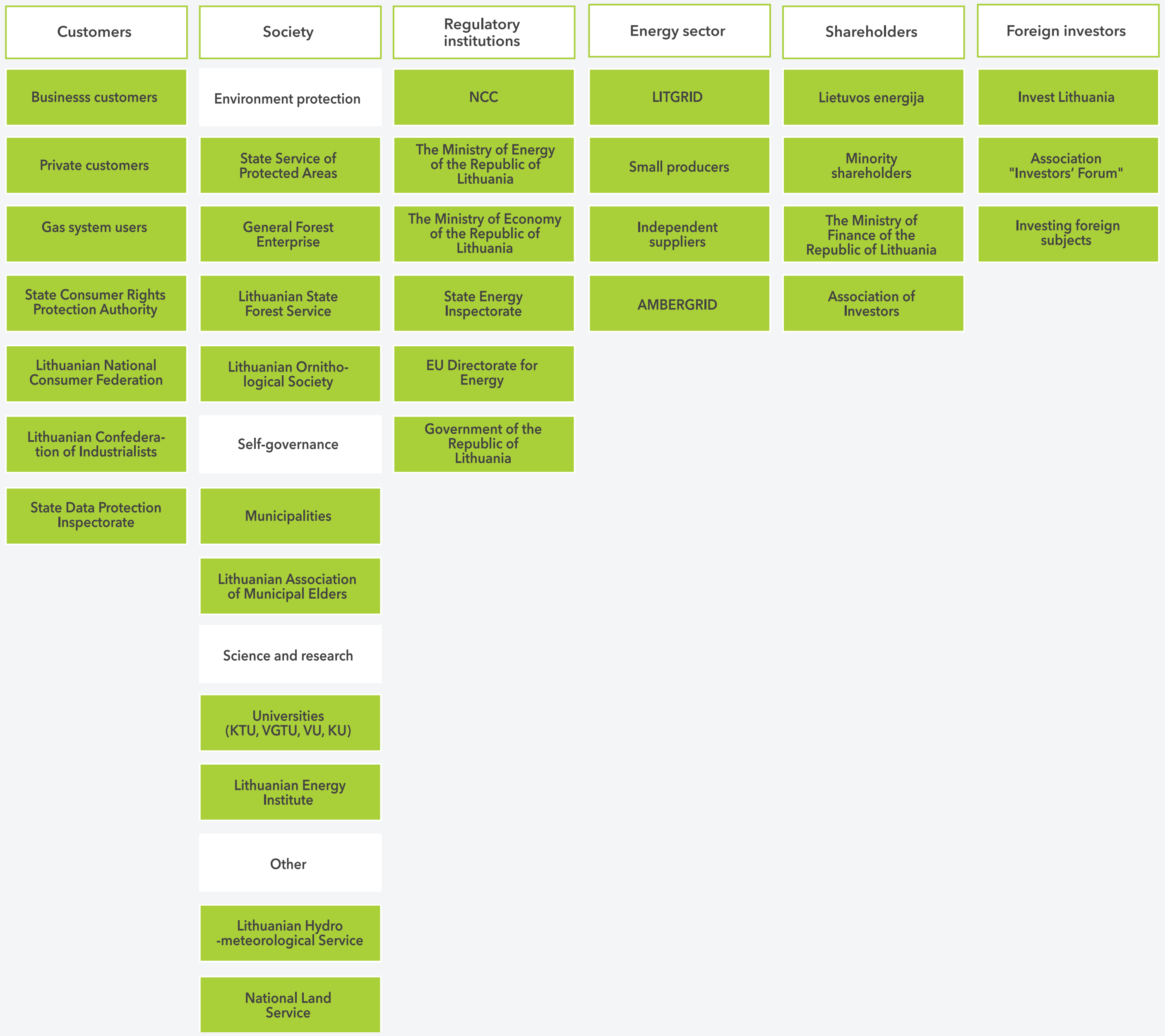


Figure 3. *Map of ESO stakeholders groups*

Stakeholders have different, sometimes conflicting expectations. The task of the company's management is to find balance between them. One of the key ideas of the stakeholder theory is that sustainable development and durable results of the company are achieved only if its stakeholders' expectations are taken into account in a balanced manner.

The ESO Investment Plan for 2018–2027 distinguished 6 principal stakeholders' groups listing the latter (see Figure 3). While identifying key stakeholders their interests were categorised into groups, e.g. electricity private customers, electricity business customers and natural gas system customers are assigned to a client group.

These groups of stakeholders were also analysed when preparing the ESO long-term strategy for 2016-2020. In comparison to that document, a new group Energy sector was included and the Employees and Suppliers groups excluded. Their expectations were not considered the basis of long-term investments, they are analysed while planning the detailed investments implementation actions and performing risk assessment.

Stakeholders' expectations were identified based on studies ordered by ESO (customer satisfaction study, reputation study), customer surveys, feedback, complaints, public information on stakeholders' websites and in their published public documents, as well as based on experience gained from cooperation and solving rising issues.

Although stakeholders may have different expectations for ESO activities and expect different activity results, the majority of expectations essentially overlap and are important for at least two groups of stakeholders. Figure 4 demonstrates expectations of different stakeholders, e.g. expectations of safety of the grid installations are important to all groups of stakeholders. Expectation of uninterrupted energy supply is central to ESO customers; nevertheless, it is also important to the public groups, whose well-being depends on reliable energy supply, also to regulatory institutions having expectations of the quality of ESO services and to the energy sector that is interested in uninterrupted operation of the ESO network.

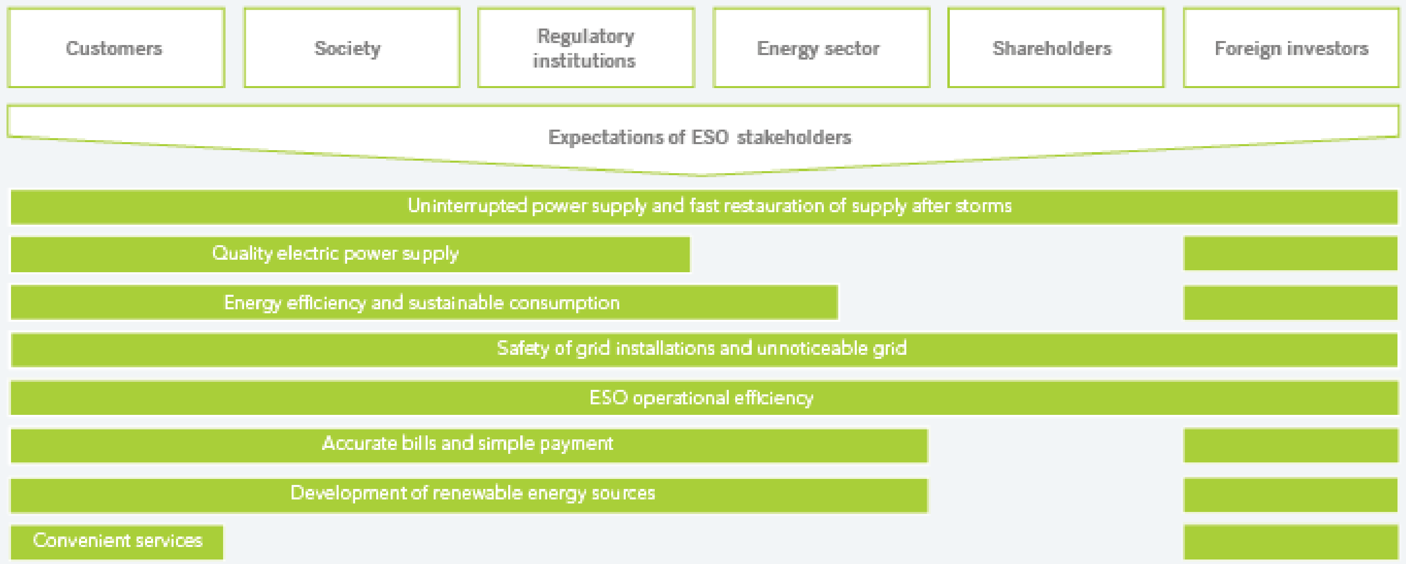


Figure 4. *Map of ESO stakeholders expectations*

4. INVESTMENT PROGRAMS

This part describes ESO Investments Programs. Each program description has a typical structure:

1. Aim,
2. Current situation,
3. Measures,
4. Benefits and indicators,
5. Financial assessment.

These programs were prepared according to the stakeholders' expectations (see Figure 5). Each program satisfies one or more expectations. For example, the stakeholders' expectations of uninterrupted power supply are ensured by two programs: *P1. Reliable and climate impact-resilient grid and P2. Smart grid solutions.*

Each program has a clear aim arising from the stakeholders' needs. The programs cover different measures implemented by ESO and explain how they help to satisfy the needs, e.g. P2. Smart grid solutions cover such measures as installation of short-circuit indicators, cross-feeding of gas pipelines, etc.

P1. Reliable and Climate Impact-Resilient Grid

Aim. Ensuring uninterrupted and quality energy distribution by environmentally safe electric and natural gas grid.

Current situation. The main reason of power outages is that even 72% of power lines in the ESO grid are overhead lines. Such technology no longer meets modern standards because of low reliability.

According to information from the Lithuanian Hydro meteorological Service , in the last 30 years there were 190 natural phenomena in Lithuania, or an average of 6-7 storms, strong winds, and hail cases per year. Hydro-meteorologists predict that climate change in Lithuania will lead to very strong winds, heavy rainfalls and storms, for which the existing ESO electric power grid is highly vulnerable: trees, snow and icing cut wires off, while falling branches cause short-circuits.

Network reliability is greatly affected by old equipment incompliant with modern standards which is susceptible to more frequent failures and spare parts for it are no longer produced, it is inefficient and not safe to environment. Figure 6 illustrates challenges for reliability and safety of the ESO distribution network.

Measures. The following network reliability and security improvement measures are planned:

• **Converting overhead lines to subterranean power lines.** It might take up to a week or more to restore electricity supply after a big storm. In Western Europe this issue is solved converting overhead lines to subterranean. The subterranean network is much more resilient to climate changes and requires less maintenance: 4 times less failures are registered in ESO subterranean lines than in overhead (measuring the number of faults per one line kilometer). It is planned to replace 11 thousand km of depreciated 0.4 kV, 10 kV and 35 kV lines by subterranean power lines in 2018–2027 and to increase the share of the ESO subterranean grid to 41% (see Annex C). 63% of 10 kV overhead lines (3.226 thous. km) in forested areas will be converted to subterranean. Only subterranean power lines will be installed to connect new electricity consumers to the electricity distribution network.

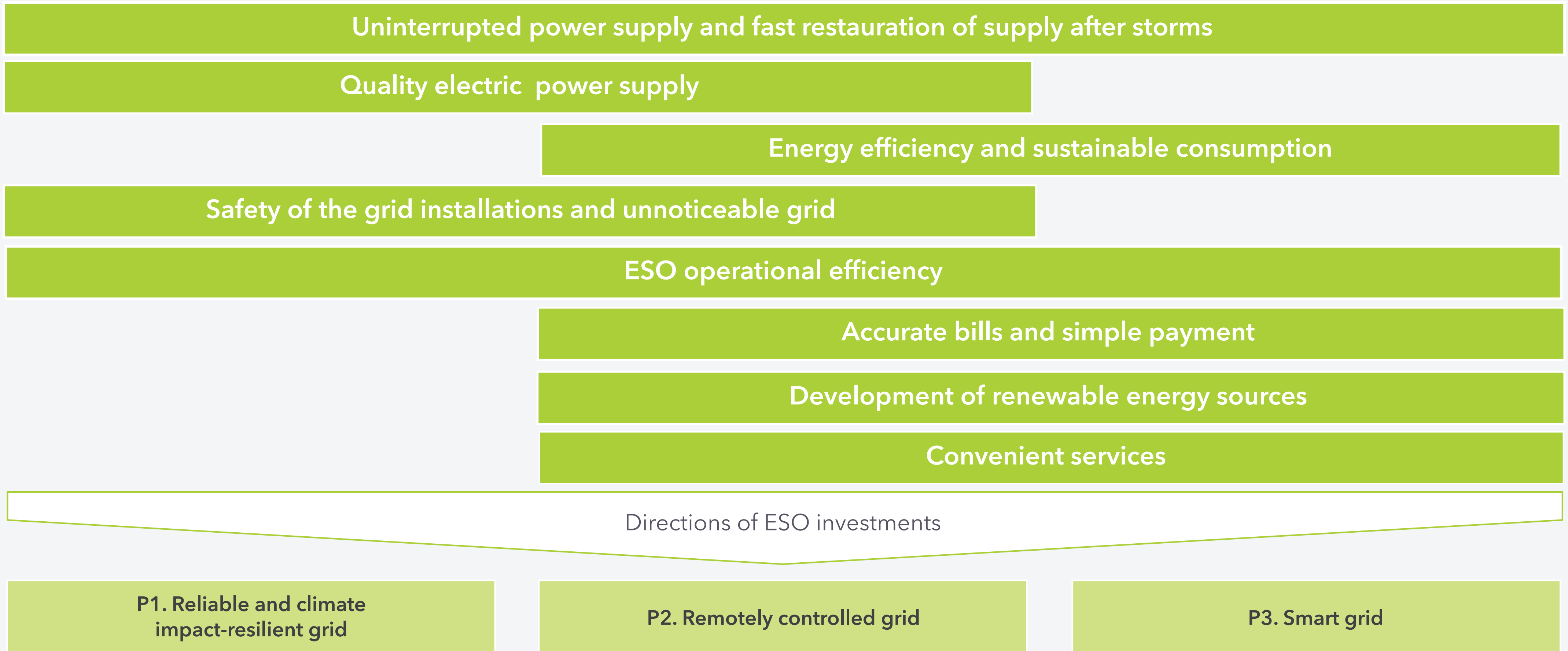
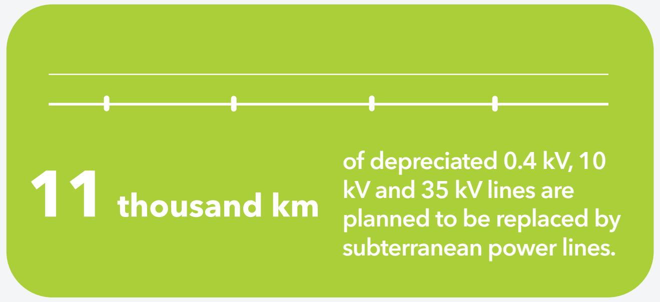
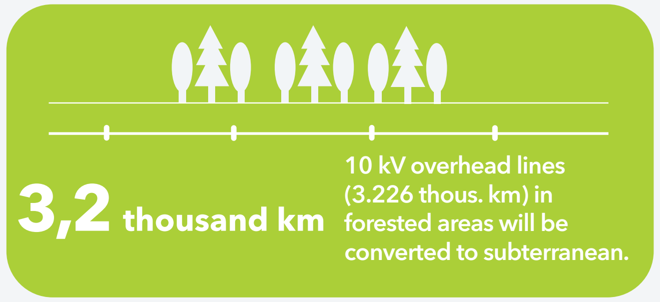


Figure 5. *Link between the stakeholders' expectations and ESO investment programs*





[1] *Under the order by ESO the Lithuanian Hydro meteorological Service under the Ministry of Environment of the Republic of Lithuania carried out the "Climatological Analysis of Harmful Meteorological Events in Lithuania"*

In 2017 as a result of breakdowns in the electric power grid, more than **2.1 million** customers were cut-off

74% of 10 kV lines through forests are overhead lines; this makes the grid vulnerable during storms

69% of overhead lines are in use 30 years and longer (beyond the service life-time)

40% of 110-35 kV transformers and distributing points are in use for 40 and more years (beyond the service life-time)

45% of 10-0.4 kV transformers and distributing points are in use for 40 and more years (beyond the service life-time)

60 transformer sub-stations (15%) do not have equipment for earth leakage compensation

15% of closing devices are outdated technologically (e.g. installed deep under the ground, their maintenance is expensive)

1 % of gas pipelines are in use for 55 years and more (beyond the service life-time)

13% of gas pressure regulation devices are in use for 18 years and more (beyond the service life-time)

Figure 6. *Current situation of the ESO distribution network*

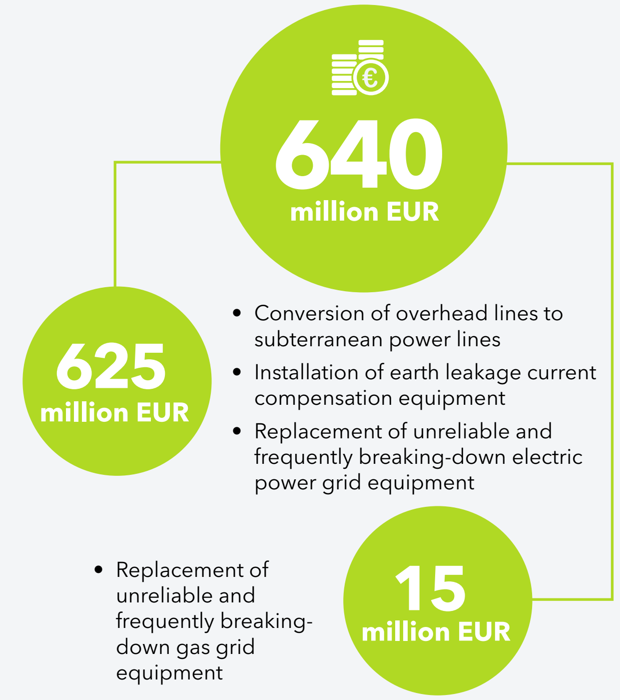


Figure 7. *P1 Directions and volumes of invetsment, 2018 – 2027*

• Installation of earth leakage current compensation equipment. Modern earth leakage current compensation equipment i.e. choke coils with automatic current control are installed. This measure ensures safer grid management.

• Replacement of unreliable and frequently breaking-down equipment. Depreciated, frequently breaking down equipment of natural gas and electric power grid no longer meeting modern standards and affected by corrosion will be replaced with modern equipment so as to ensure grid reliability and safety. It is planned to replace 134 km of the gas pipelines (1% of the network) by 2027. Re-laying of gas pipelines or their sections, insertion of pipes, replacement of above-ground pipelines with subterranean ones will be done (see Annex C).

Benefits and indicators. The main benefit of the program is increased grid reliability. Renovation of the grid equipment reduces its environmental impact: subterranean lines, especially in forested areas, have less impact on animal and bird habitats, and reducing the protection zones of subterranean lines from 2-15 to 2 meters reduces the need for pruning plantations. Subterranean lines contrary to overhead lines are unnoticeable and do not decrease the landscape value. The new equipment operates more silently and efficiently, generates less loss and is easier to maintain.

The benefit indicator of this program is a reduced average number of supply interruptions per customer per year – SAIFI. It is forecasted that after implementation of the envisaged measures this indicator will improve by 40%, furthermore, in 2030 this indicator is forecasted to improve by 50% (as compared to the situation in 2017).

The reliability indicator in the natural gas section is high and it is planned to keep it at this level making targeted investments.

Indexes	2017	2027	2030
Electricity System Average Interruption Frequency Index with Force majeure (SAIFI)	1,23	0,74	0,61
Gas System Average Interruption Frequency Index with Force majeure (SAIFI)	0,007	0,007	0,007

Table 1. *ESO System Average Interruption Frequency Indexes*

Financial assessment. It is planned to allocate EUR 640 million of investment for the program P1 Reliable and Climate Impact-resilient Grid for 2018–2027. The major part of investments will be allocated for the power grid. Planned volumes of investments are given in Table 2.

Directions of investments	million EUR
Conversion of overhead lines to subterranean power lines	
Installation of earth leakage current compensation equipment	625
Replacement of unreliable and frequently breaking-down electric power grid equipment	
Replacement of unreliable and frequently breaking-down gas grid equipment	15
Total:	640

Table 2. *P1 Directions and volumes of invetsment, 2018 – 2027*

P2. REMOTELY CONTROLLED GRID

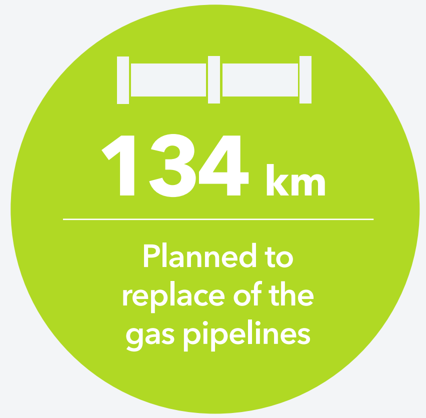
Aim. The aim of the program is to accelerate the restoration of energy supply in case of disturbances, to create preconditions for network management decisions based on real-time information and to facilitate the integration of RES.

Subject to installed automation elements, the grid has a remote control function that enables to:

• Remotely monitor the condition of grid elements in real-time and localise faults;

• Remotely turn on/off the installation, change its parameters or operation modes;

• Program individual items to auto-switch and respond to other atypical situations.



Current situation. ESO receives information on the grid condition performing asset inspections and measurements. Often defects are detected only when malfunctions and failures of power supply occur. The major part of the grid is inspected visually by ESO employees or contractors only every 3-6 years, whereas the state of subterranean equipment is even more difficult to assess. Only a relatively small section of the grid is monitored remotely and a still smaller section thereof is controlled from the central dispatch office (see Figure 7)

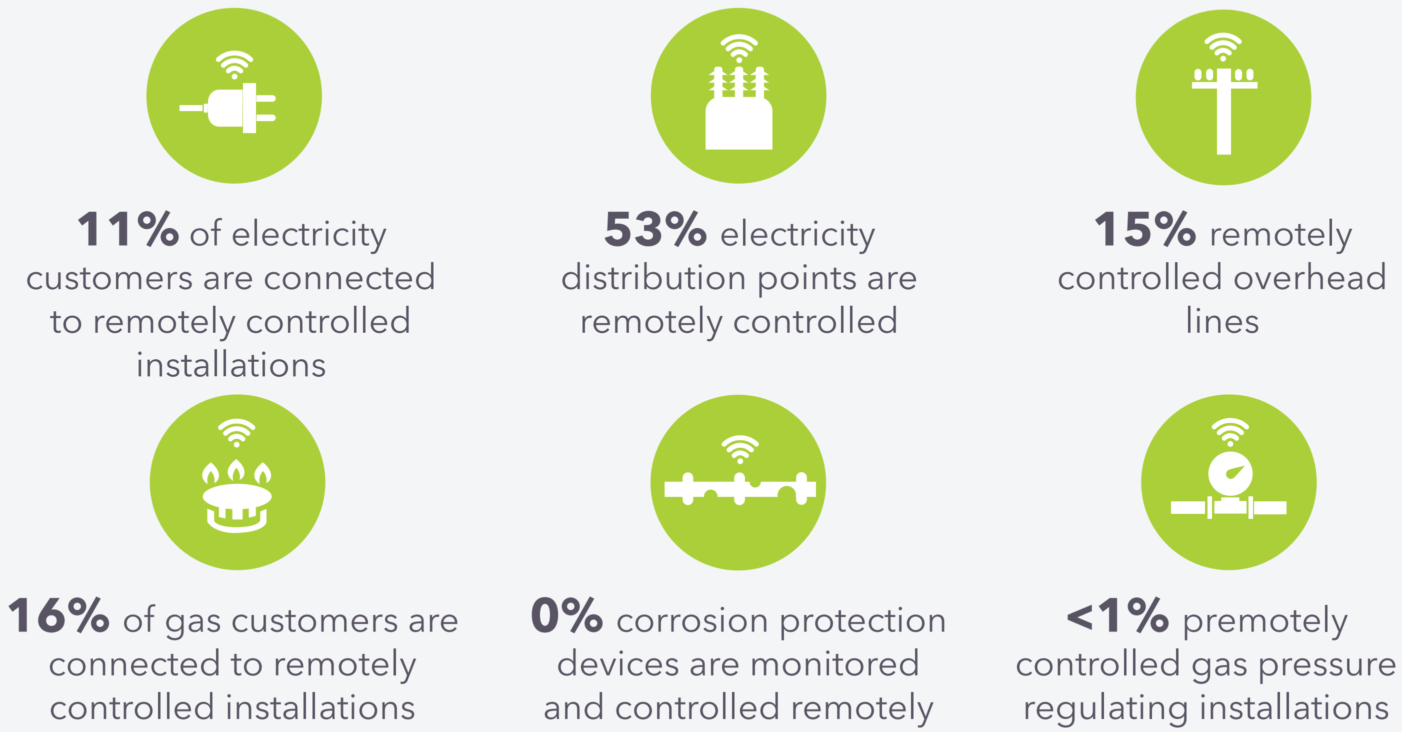


Figure 8. *Current level of the ESO grid automation*

Non-monitoring grid parameters because of the low automation level and absence of the quality information about its operation make it impossible to find out failures and restore energy supply without visits to locations.

Measures. Creating remotely controlled grid ESO has planned to implement different gas and power grid automating solutions. Specific parameters of appropriate equipment are described in the ESO strategies for Technological Development of Power and Gas Grids (see Annex D), defining the principles of grid upgrading and development, technologies and equipment used. The main measures for enhancing the remotely controlled grid qualities are presented in this paper. For the electric power grid these measures include:

• **Installation of the remote dispatcher-controlled equipment.** It is planned to install remote-control equipment in reconstructed and new 10/0.4 kV transformer stations and 10 kV distribution points.

Circuit-breakers used to turn on/off power supply in case of breakdown are planned to be installed in 10 kV overhead lines to reduce the number of customers affected by the breakdown.

• **Installation of the grid operation monitoring equipment.** Short-circuit indicators transmitting signals to the dispatcher control system are being installed, and they help to quicker detect faults.

Digital relay protection is planned to be installed in transformer sub-stations, and this will enable ESO dispatchers to see the grid parameters (voltages, currents, frequency) in real time, as well as to precisely detect faults in the power grid.

• **Installation of the self-healing grid (operating without the dispatcher's involvement during breakdowns) equipment.** Switching devices that would independently, without the dispatcher's intervention, detect a section of malfunctioning of the grid and would disconnect (isolate) it are planned to be installed in selected segments of the grid. Moreover, installation of automatic power and voltage regulation equipment for newly connected RES producers is foreseen.

Measures to upgrade smart natural gas network:

• **Cross-feeding of the gas pipeline.** It is planned to lay 45 km of new gas pipeline sections for cross-feeding the pipeline. This will provide an alternative way of energy supply to customers in the event of failure or repair of gas pipelines.

• **Installation of the remote dispatcher-controlled equipment.** Installation of this equipment will make it possible to react to changes in the grid without going to the location, adapt flexibly to the customers' needs, and reduce the grid maintenance costs. It is planned to install:

- o **Closing devices:** for insulating a section of the pipeline during breakdown or scheduled maintenance works.
- o **Gas pressure regulation devices**: for remote monitoring and regulating pressure in case of changes in customers' consumption patterns (due to seasonality and overload of production facilities).
- o **Cathodic protection devices:** aimed to remote location of damages in the protective layer of the gas pipeline and avoid gas leaks.

Benefits and indicators. The main benefit of this program is fast restauration of energy supply after breakdowns. Installation of such equipment enables quick locating of breakdowns and remote changing of the grid diagram to restore the supply in several minutes or seconds. Some breakdowns and voltage fluctuations could be avoided by monitoring and analysing the grid parameters, and taking preventive actions.

The benefit indicator of this program is reduced system average interruption duration per customer a year – SAIDI (see Table 3).

Indicators	2017	2027	2030
Electricity average interruption duration index with Force majeure eliminating accidents in the transmission network and disturbances in the distribution network (SAIDI), min.	126	75	63
Share of electricity blackouts eliminated within 12 hours or faster	92%	100%	100%
Share of gas breakdowns eliminated within 6 hours or faster	98%	100%	100%
Gas average interruption duration index with Force majeure (SAIDI), min.	1,16	1,03	1,03

Table 3. *ESO System Average Interruption Duration Index*

It is forecasted that implementation of the planned Investment Plan measures will improve the indicator by 40%, and by 2030 this indicator is expected to improve by 50% (as compared to the situation in 2017).

It is planned that in 2027 due to targeted investment 100% of failures in the electric network will be repaired within 12 hours and faster, and in the gas network - 100% within 6 hours.

In the gas section, the reliability indicator is high and it is planned to be kept at the same level by rational investment.

Financial assessment. During 2018–2027, it is planned to allocate EUR 582 million of investment for the Smart Grid Solutions. The major part of investments will be allocated for the power grid. The planned volumes of investments are given in Table 4.

Directions of investments	mln. EUR
Installation of the remote dispatcher-controlled equipment in the power grid	542
Installation of the power grid operation monitoring equipment	
Installation of the self-healing grid equipment	
Cross-feeding of the gas pipeline	40
Installation of the remote dispatcher-controlled equipment in the gas grid	
Total:	582

Table 4. *P2 Directions and volumes of investment, 2018–2027*

P3. SMART GRID

Aim. The speed, dissemination and application of technologies in different activities encourage the ESO to expand the level of digitisation of its processes to ensure the provision of quality services to future customers.

The grid is smart when operator and customers using receive information on the state of the network and energy consumption using information systems, which enables data-driven solutions for energy efficiency, network maintenance processes and services improvement.

The aim of the program is to improve the quality of ESO services, enable customers to receive accurate bills and save energy by rational consumption.

Current situation. At present, very few ESO customers, only 0.2-2.1% (see Figure 8) have remotely readable meters (17.6% of electricity business customers, 0.3% of private customers, 9.6% of gas business customers and only a few private customers, <0.01%). The absolute majority of customers have to declare their energy consumption every month. Customers must be aware of the exact rates and apply them correctly. This often results in arrears / debts and inaccuracies in accounts.

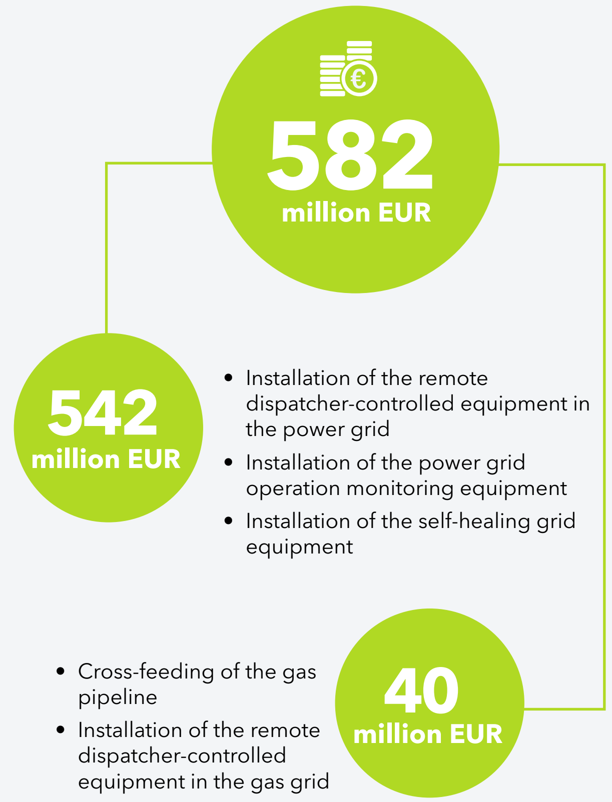


Figure 9. *Directions and volumes of investment, 2018-2027*

[1] Dujų dalies SAIDI reikšmė yra labai maža, jos reikšmė 2016 m. buvo mažesnė nei numatyta, tačiau ilgalaikė reikšmė planuojama bus ~1min. vidutiniškai klientui.

Figure 10. *ESO remotely readable meters*

Measures. With an increase in customer expectations for convenient services and information accessibility, a mere infrastructure improvement is not sufficient. Therefore, P3 investments are intended for the improvement of ESO customer infrastructure, communication, and services. The following measures are planned to this aim:

• **Installation of smart meters.** By 2023 ESO plans to replace all customer meters by remotely readable electricity meters. Customers will no longer need to declare electricity consumption; ESO will be able to send accurate invoices promptly. In case of electricity blackout ESO dispatchers will immediately be able to identify a precise list of customers who need restoration of electric power supply.

In the gas sector it is planned to remotely take the meter-readings of all customers who use gas for heating by 2023.

It is planned to create the infrastructure necessary for remote data reading and information system for reliable data storage and analysis. Exact volumes of meters to be installed and installation scenarios are currently under revision based on the cost benefit analysis, and will have to be approved by the NCECP.

• **Renewal of information systems.** Seeking to optimise the quantity of information systems (hereinafter – IS) necessary for ESO, their operation, and maintenance costs, it is planned to renew the systems and expand their functionality. Currently, the following most important projects are carried out:

o **Installation of the distribution grid management system (DMS).** Currently dispatchers use several information systems at the same time to manage the grid. The new DMS system will make it possible for the dispatchers to monitor and control the gas and eleric power grid in one system in real time. This will make it much easier to locate faults and faster restore energy supply.

o **Installation of the geographical information system (GIS).** Currently, ESO uses separate GIS systems of the electric power and gas grid that are technologically outdated, and installation of a new functionality is limited. The goal is to implement a single GIS system that will allow ESO engineers to more efficiently perform equipment monitoring, plan investment and network maintenance tasks, plan new customer connections faster and more efficiently manage electricity losses.

o **Installation of a digital asset management system.** Currently, different gas and electric power grid maintenance systems owned by ESO are outdated and the possibilities of their further combed use and development are limited. It is planned that the new asset management system used for ESO infrastruc-

ture maintenance, management, work planning, and information accumulation will be more flexible and help manage the processes more effectively.

- **Installation of electric power grid management decision-making IS based on Big Data.** Upon increasing the quantity of remotely monitored and controlled equipment, ESO will collect more parameters on the grid operation. Based on collected information, a possibility appears to analyse data, make the grid maintenance processes more effective, and to extend the life-cycle of these assets. The following measures will be installed:

  o **A system of forecasting the production by small power producers** that will help forecast the production quantities and grid load.

  o **Grid maintenance staff time planning tool** linked to DMS and facilitating better scheduling works when liquidating the consequences of storm-caused breakdowns.

  o **Preventative maintenance system** that would help to identify the weak points in the grid and strengthen them preventively according to the accumulated data on the grid condition and weather conditions.

  o **Data Hub** that would enable customers, suppliers, grid operators, and other market participants to exchange data easily (consumption, contract duration, etc.) Upon the decision of the Ministry of Energy of the Republic of Lithuania to designate ESO manager of data platform additional funding will be required. The planned project budget is almost EUR 10 million. If the project is implemented by the ESO, part of the functionality will be realised in the scope of smart metering, and therefore the planned budget needed for the implementation of the data exchange platform is EUR 7.5 million.

  o **Grid demand-response system** enabling customers to provide services for grid operators and establishing possibilities for customers to receive financial incentives in cases of peak load of the grid.

The necessity and expediency of all the measures of this program will be assessed based on cost-benefit analysis.

Benefits and indicators. The main benefit of the program is a possibility for customers having precise data on their consumption to decide on more efficient energy consumption and save energy costs. Based on results of the cost-benefit analysis of smart meters, ESO customers could save up to 6% of their annual energy consumption (see Table 5).

Installation of smart meters will improve customer services quality, and a dispatcher will have a possibility to automatically receive a signal on power supply disruptions.

Financial assessment. It is planned to allocate EUR 336 million investments for the Smart Grid Program during 2018–2027. The major part of investments will be allocated for the power grid. The volumes of planned investments are given in Table 6.

Indicators	2018–2027
Electricity saving after the installation of smart meters	6%
Gas saving after the installation of smart meters	3%*

Table 5. *P3 Indicators*

* On the basis of p.23.9 of Order No. 187-1 of July 2017 ,14 "On Approval of the Description Procedure for Concluding Energy Saving Agreements" approved by the Minister of Energy of the Republic of Lithuania (when energy accounting devices are replaced by smart meters, the energy savings are considered to be 3 percent of the energy consumption of the last calendar year before installation of the new equipment).

Directions of investments	million EUR
Installation of smart electricity meters Renewal of information systems for the electricity part Installation of power grid management decision-making IS based on Big Data, etc.	287
Installation of smart gas meters Renewal of information systems for the gas sector	49
Total:	336

Table 6. *P3 directions and volumes of investment, 2018–2027*

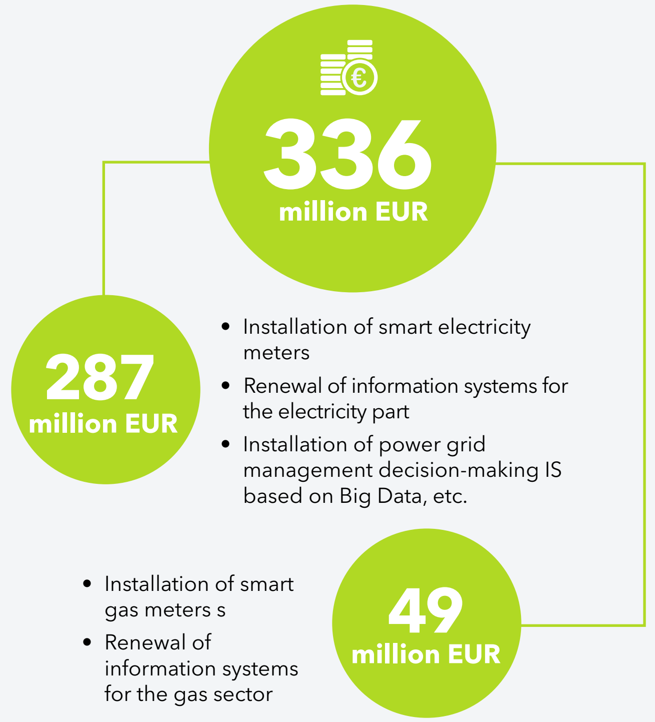


Figure 11. *P3 directions and volumes of investment, 2018–2027*

5. FINANCIAL ASSESSMENT

This part presents overall financial need for the ESO 2018–2027 Investment Plan, and defines main assessment assumptions and sources of financing (see Table 7).

Investment programs	2018-2027
Investments into the electricity grid	million EUR
P1 Reliable and climate impact-resilient grid	625
P2 Remotely controlled grid	542
P3 Smart grid	287
New customers	418
Total for the electricity grid:	**1 872**
Investments into the gas grid	million EUR
P1 Reliable and climate impact-resilient grid	15
P2 Remotely controlled grid	40
P3 Smart grid	49
New customers	120
Total for the gas grid:	**224**
Total for the electricity and gas grid:	**2 096**

Table 7. *ESO investments needs for 2018–2027, million EUR*

The major part of investments (69%) will be allocated to ensure safety, reliability, and flexibility of the electric power grid, 5% – for investments in the gas grid. The remaining part – for connecting of new consumers. The investments planned by ESO also include the investments for connecting new customers.

The following main aspects were considered drafting the Investment Plan:

• The level of investment was set for the qualitative indicators SAIDI, SAIFI and the reduction of failure time;

• Qualitative indicators were set taking into account the expectations of Stakeholders for the quality of services and the good practices of Western European countries;

• New customer connection investments were assessed based on statistical data of the previous year. These investments are approximate and will depend on the needs of customers and the situation how quickly new customers will appear.

While planning investments, ESO is looking for a rational way to reach sustainable balance between increase in tariffs and assurance of quality services. For these reasons, ESO plans:

• To cover a part of investments from the European Union (EU) funds. Part of the investment in P2 and P3 is planned from the EU funds financing up to 50% of the different projects value. The total amount of EU financing could amount to EUR 31 million. The main measures: installation of smart meters, grid automation solutions, cathodic protection devices, etc.

• As an alternative, a possibility to increase the share of borrowed capital will be analysed.

• Part of the tariff growth is compensated for by growth in energy consumption together with the GDP, i.e. with the increase in the quantity of distributed energy ESO will receive bigger income without changing the tariff.

It is estimated that the planned investments will not have a significant effect on growth in the electricity and gas distribution tariff.

[2] The investment plan is an informational document and cannot be considered as any advice, recommendation or any other incentive to invest or perform other actions.

6. ANNEXES

A. Terms and abbreviations

Term	Explanation
Company, ESO	Energijos Skirstymo Operatorius AB
EU	European Union
GPRD	Gas pressure regulating device used to reduce gas pressure and maintain the set level
Investment Plan	The foreseen ESO 2018–2027 Investment Plan, the present document
IS	Information systems
kV	Kilovolts
LE	„Lietuvos energija“, UAB
Regulator, Commission, NCC	The National Commission for Energy Control and Prices
RES	Renewable energy resources
Transformer	Equipment of the power grid used to change parameters of the alternating current without changing their frequencies

B. Description of indicatorsi

Indicator	Description
Electricity SAIFI with Force majeure	The system average unscheduled electricity transmission interruption frequency index. The index shows how many times a year on average electricity transmission to one customer was interrupted as a result of unscheduled disconnections in the grid. SAIFI with Force majeure is calculated by including force majeure into the categorised events.
Electricity SAIDI with Force majeure	The system average unscheduled electricity transmission interruption duration index. The index shows how much time a year on average electricity transmission to one customer was interrupted as a result of unscheduled disconnections in the grid. SAIDI with force majeure is calculated by including force majeure into the categorised events.
Gas SAIFI with Force majeure	The system average unscheduled gas distribution interruption frequency index. The index shows how many times a year on average gas distribution to one customer was interrupted as a result of unscheduled disconnections in the NG grid. SAIFI with force majeure is calculated by including force majeure into the categorized events. .
Gas SAIDI with Force majeure	The system average unscheduled gas distribution interruption duration index. The index shows how much time a year on average gas distribution to one customer was interrupted as a result of unscheduled disconnections in the NG grid. SAIFI with force majeure is calculated by including force majeure into the categorised events.

C. Quantities of Replaced Equipment and Indicators

Equipment type	Program	2017*	Total until 2020	Total until 2027
Electricity grid				
Subterranean electric power lines, km	P1	34 546	38 315	45 760
Length of 10 kV subterranean lines in forests	P1	2 297	4 136	5 522
Share of 10 kV subterranean lines in forests, %	P1	26%	48%	63%
Share of 0,4 kV, 10 kV ir 35 kV subterranean lines, %	P1	28%	32%	41%
10/35/110 kV transformers, pcs.	P2	618	680	744
35 kV switchyards cages, pcs.	P2	902	1 069	1 328
10 kV switchyards cages, pcs.	P2	15 980	17 062	20 489
10/0,4 kV transformer stations, pcs.	P2	12 736	16 239	23 264
Switching equipment, pcs.	P2	261	839	2 205
Share of remotely controlled lines, %	P2	15%	27%	46%
Installation of smart electricity meters, thous. pcs.	P3	0	346.6	1 760
Share of smart electricity meters, %	P3	0%	19%	100%
Voltage analysers, pcs.	P3	0	147	220
Natural gas grid				
Reconstruction of natural gas distribution pipelines, km	P1	8 261	8 325	8 395
Remotely conrolled gas pressure regulation devices (GPRD), pcs.	P2	4	31	101
Cathodic equipment, pcs.	P2	500	769	1 220
Share of remotely monitored and controlled anti-corrosion equipment, %	P2	0%	24%	54%
Cross-feeding, km	P2	6	51	51
Installation of smart gas meters, thous.pcs.	P3	0	21.7	110
Share of smart gas meters for customers who use gas for heating, %	P3	0%	19%	100%

[3] Total quantity at the end of 2017, unless indicated otherwise. An annual change indicated for 2018-2027.

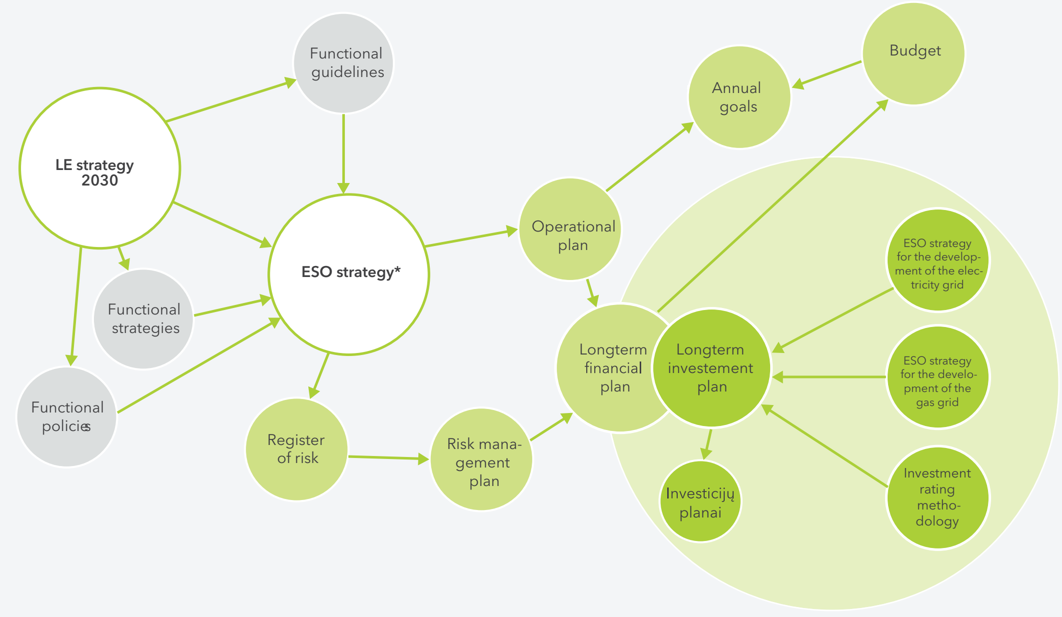
D. Diagram of Interrelations between the Investment Plan and Other Documents

The chart below shows how the Investment Plan is integrated into the ESO long-term planning process. The ESO strategy is developed based on the LE strategy. The Investment Plan is made to ensure implementation of the ESO Strategy objectives and to accurately plan the investments required.

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

The investment plan serves as a basis for accurate planning of updating the ESO operational plan on a yearly basis and for budget formation.

Interrelations between planning documents



* The ESO strategy for 2014-2020 is currently in force, but in 2018 it will be updated according to the strategy LE strategy 2030

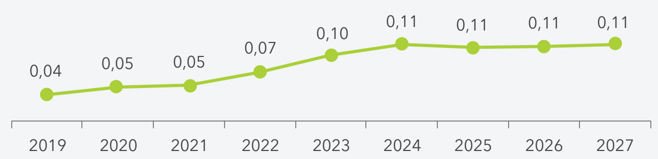
E. Impact of Investments on the Distribution Tariff

This annex illustrates the impact of the Investment Plan for 2018–2027 on electricity and gas distribution tariffs. The change is measured as the difference between the basic investment level (which equates to investments in 2016) and the level of investments provided for in the investment plan for 2018–2027.

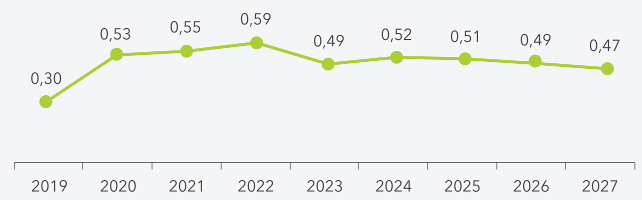
Having taken account of the investment for 2018–2027, the electricity distribution tariff may increase to 0.11 ct/kWh and the gas tariff – to 0.59 EUR/MWh (comparing both scenarios).

In calculation only the effect of the investment on the tariff was taken into account. Calculating the common electricity and gas tariff, other components were also taken into account: energy consumption growth, overflow correction, efficiency, etc.

Change in electricity distribution tariff in 2018-2027. ct/kWh



Changes in gas distribution tariff in 2018-2027, EUR/MWh

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