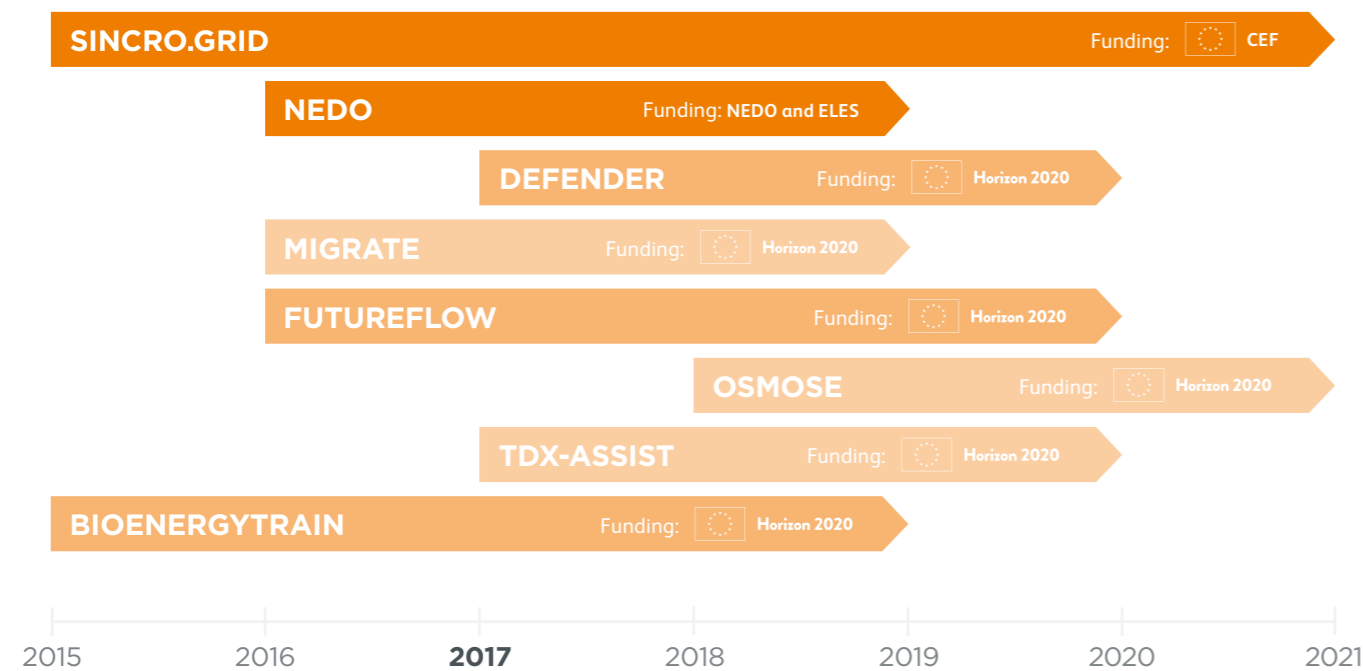


INNOVATIONS

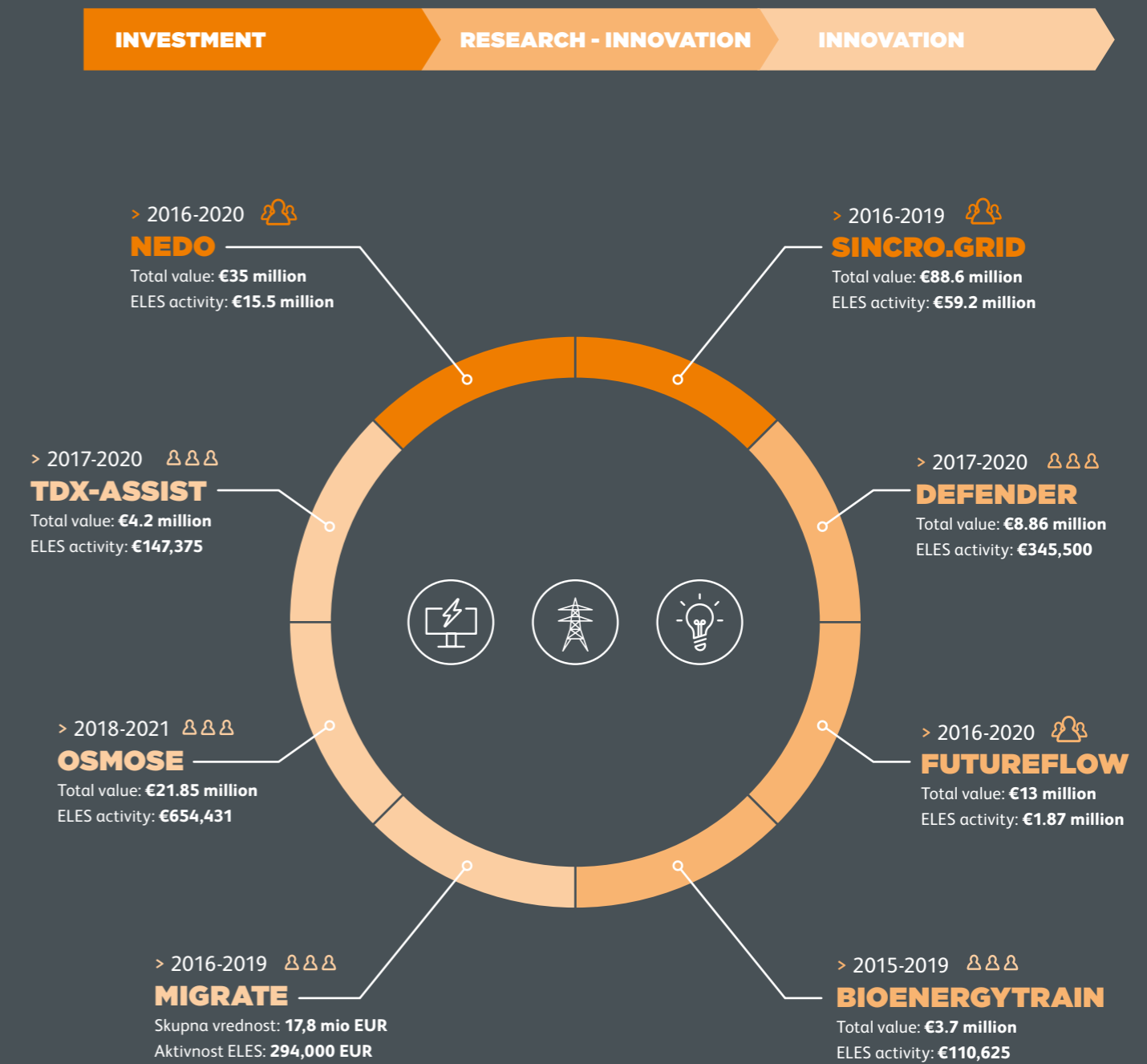
Due to major changes in the electricity ecosystem innovations are researched, developed and introduced prudently.

ELES's strategic innovations are closely integrated and provide coordinated support to all key activities performed to realise the Company mission.

The timeline of the strategic innovative European and international development projects



A map of the strategic innovative European and international development projects coordinated by ELES or involved in as a partner. The projects support the current operations of ELES while co-developing the strategic visions of our tomorrow.



STRATEGIC INNOVATIONS

Description of activities

One of the key ELES activities includes research, development and innovations. The Company demonstrates its strong commitment to them by entering in major international research and development projects, for which it successfully obtains grants from various European and national funds.

In May 2017, a **new Strategic Innovations sector was established within the scope of the Company that coordinates the implementation of strategic innovations**. That upgraded the Company's permanent stance towards innovations.

Key results in 2017

Production of studies: In 2017, **20 studies were procured that resolved the key challenges by area**. A study was made for the Transmission Network Infrastructure sector that provided a **method to update and rationalise own consumption batteries** by proposing the use of lithium-ion batteries. Another **study analysing the inhabitants' exposure to radiation** was also procured that will provide measures for its mitigation.

A **study on the introduction of a real-time control system for the technical condition of circuit-breakers** and a **study on the standardisation of electricity consumption** (in the closing stage) were made for the Asset and Project Management sector. Also pending is a **study for the assessment of non-delivered electricity**, that will provide baselines for its evaluation in case of failures in power supply to customers. The results are very important in the implementation of cost-benefit analyses, i.e. when justifying individual investments. Furthermore, a study considering and providing a solution to **set up an information system for managing vegetation on transmission line alignments** has been procured.

The System Operation sector procured **4 studies that resolve an open issue in the SUMO project** (integration of a DTRi module, inventory of processes and

determination of hardware architecture, installation plan and relocation of meters at selected transmission lines). In addition to the analysis of island operation at HPP on the Soča river, an **application for the analysis of unintentional imbalances in the system** was also made. Furthermore, 4 studies were also procured that resolve the **issue of the implementation of EU regulations in the area of operation** with stress placed on frequency stability, voltage stability, angle stability and in respect of general management requirements.

Participation in European and international projects: When carrying out international projects, ELES cooperates closely with electricity transmission system operators and other organisations, which has an important impact on the development of transmission activity and operation of the electricity system. The Company seeks to attract other Slovenian stakeholders to participate in major international research & development consortia, thus contributing to a general orientation towards research and development and improved social welfare.

The projects implemented will enable:

- better utilisation of the existing infrastructure,
- connection of a large share of renewable energy sources to the network,
- inclusion of battery storage plants and prosumers in the most demanding system services rendered by transmission system operators.

All those activities will enhance the security of power supply and contribute to reduced greenhouse gas emissions.

Relations between European international projects and the challenges posed by the Company's core activities are shown in the introduction to Chapter 2.1 (Company activities and value creation).

In 2017, ELES obtained a grant of €874,326 within the scope of Horizon 2020 for the implementation the Defender, TDX-ASSIST and OSMOSE projects.

SINCRO.GRID project

SINCRO.GRID

 **Co-financed by the European Union**
Connecting Europe Facility

SINCRO.GRID, which includes ELES, DSOs (from Slovenia), HOPS and HEP ODS (from Croatia), is a European project of common interest (PCI) relating to smart grids that was selected for co-funding by the European Commission. The project covers a system approach to deal with current issues in the electricity system resulting from support for the inclusion of RES, attainment of EU energy and environmental targets, reduced electricity consumption after the crisis, reduced conventional electricity sources to support the electricity system, system services and close connection of neighbouring control blocks.

The SINCRO.GRID smart grid project offers innovative system integration of mature technologies that will yield benefits to both Slovenian and Croatian electricity systems as well as to those in the region. Compensation installations will be set up along with an advance system for identifying operational limits, an electricity storage system, integration of distributed renewable energy sources and a virtual control centre with pertaining ITC infrastructure.

The entire project is valued at €88.6 million. The project was successful at a call for CEF funds, since the Commission published on 17 February 2017 that it was entitled to a grant of €40.5 million, which accounts for 51 % of eligible costs incurred by ELES and HOPS. The project also achieved the best score among 22 applications that arrived at CEF and relates to gas, electricity and smart grids. The value of the ELES investment amounts to €59.2 million, while HOPS will invest €27.1 million in the project.

In 2017, activities were conducted to draw up environmental protection requirements, a concept for cooperation with the public and a public presentation of the project in Divača, Okroglo, Dol pri Ljubljani and Maribor municipalities.

NEDO project

HITACHI
Inspire the Next






PREMAKNI
PORABO
MOVE CONSUMPTION

The representatives of the Slovenian Government, ELES, Japanese New Energy and Industrial Technology Development Organisation (NEDO) and Hitachi signed official agreements in November 2016 on the start of cooperation within the scope of a Slovenian and Japanese partnership (NEDO project). In addition to ELES, the Slovenian part of the project involves a large number of stakeholders and may, therefore, be rightly called a national project, making it one of a kind project in Europe. Related projects across Europe are focused on a narrow area or community, while our project in fact involves the introduction of a smart grid at state level using integrated and centrally controlled solutions in a cloud. The project is worth €35 million. The Japanese NEDO Agency will contribute some €20 million, while ELES will contribute some €15 million.

In 2017, stage 1 of the project shifted from planning to implementation. At the Slovenj Gradec and Breg transmission system substations, most equipment was installed (3 regulating transformers, 30 circuit-breakers and 100 meters) that will be used to render advanced functionalities. The development of advanced functionalities reached the stage of laboratory testing by the end of the year.

In October, a promotional campaign started in the wider area of Ptuj that is aimed at obtaining at least 10 % of customers in that area to participate in the "Premakni porabo" (Move Consumption) project, within the scope of which the customers' response to signals to reduce offtake by network operators will be checked. By the end of the year, 830 customers (13 % of all customers in the area) will be included in the project. In November, an opening ceremony took place for the first installed regulating transformer by a Slovenian manufacturer in Turiška vas near Slovenj Gradec.

FutureFlow project



FutureFlow



The FutureFlow project, coordinated by ELES, examines and demonstrates how to include prosumers in secondary frequency control and how to render it at international level as required by Grid Codes. The project is valued at €13 million, while ELES activities are valued at €1.87 million.

Within the scope of the FutureFlow project, the partnership consortium successfully underwent the first periodic project review by representatives of the European Commission. In that period, stress was placed on the design of the future secondary control market, development of a platform for the pooling of customers and renewable sources, a platform for regional settlement and re-dispatch, and on progress in the engagement of end consumers in the project.

At the end of the year, the consortium arrived at one of the key results to the benefit of system operators. It involves a projection of a common secondary control market (aFRR) between 4 countries – Slovenia, Austria, Hungary and Romania. In December, partners also completed the preparation of 7 expert documents.

OSMOSE project



Within the scope of a call from Horizon 2020, the European Commission selected the international research demonstration project OSMOSE in 2017, a part of which is also ELES as one of 33 consortium partners. ELES will lead one of four demonstrations within the scope of the project that will develop new

cross-border cooperation mechanisms between Slovenia and Italy in electricity balancing markets. The Company will participate in the project with the Slovenian HSE and Italian system operator TERNA, producer ENEL, French operator RTE and a series of other respectable partners. Cross-border cooperation will focus on system storage plants, which is one of priority topics supported by the European Commission in its research programmes. Regionally, the mentioned project holds a huge long-term potential. New mechanisms for cross-border cooperation will increase the efficiency and applicability of classic and modern system storage plants and reduce costs for users in the long run.

The 4-year budget for demonstration led by ELES amounts to €3.6 million, €458,101 of which will be received by ELES. The project will last until 31 December 2021.

Defender project



Within the scope of the Defender project, which is aimed to developing a comprehensive approach to the prevention of threats, response to attacks and protection of future energy infrastructure in Europe, a series of activities were carried out in 2017. Initially, ELES identified and analysed physical, cyber and human threats, participated in the preparation of a project meeting that was held on 17 and 19 July in Ljubljana and in the organisation of workshops to the topic of mitigating threats to the transmission network. That was followed by the preparation of scenarios for pilot tests that have been developed, amended and supplemented by ELES between September and December 2017. Possible locations for the execution of pilot tests were viewed, existing data sources/bases were identified for the purposes of pilot tests and coordinated for execution with other partners. Existing commercial tools for security control of critical infrastructure were assessed. Within the scope of the consortium, draft scenarios for the

execution of testing were presented to members of the working lot and all partners. The scenarios were later expanded with an accurate description of locations and tools to carry out pilot tests.

The total value of the project is €8.86 million, while ELES will receive €241,850 for its activities.

Migrate project



ELES participates in that international project as a project partner in a 24-member consortium. The project is focused on the search for innovative solutions or answers to questions related with new concepts for operation, protection and provision of quality electricity under changed conditions of supply to the pan-European transmission system. The project is valued at €17.8 million, while ELES activities are valued at €294,000.

Many activities in working lot 5 managed by ELES were carried out in 2017. Two reports were prepared on the current work and outcomes.

TDX-ASSIST project



In 2017, the Company started implementing the TDX-ASSIST project, a 3-year international project funded within the scope of Horizon 2020. The main goal of the project is to design and develop new, modern and safe ITC tools and technologies providing the exchange of information and data among stakeholders within the electricity sector (TSO, DSO, electricity market participants).

ELES, which is a project partner in a 12-member international consortium, will receive €147,375 of the total project value of €4.2 million for project implementation.

BioEnergyTrain project



Within the scope of the BioEnergyTrain project, two new study programmes were developed in 2017, i.e. BioRefinery Engineering (BRE) and BioResource Value Chain Management (BVCM). While BRE programmes is already implemented at the Graz University of Technology, the BVCM programme will come to life in October 2018 at the University of Twente in the Netherlands. The study programmes will try to bridge the gap between the necessary and existing human resources in the renewable energy source (RES) industry. BVCM is hence focused on the supply chain of RES technologies in individual regional contexts and on the optimisation of the use of sources within the scope of bio-economy, while BRE has is clearly focused on engineering that will enable graduates to develop advanced bio-refinery systems within the scope of bio-economy.

Within the scope of the project, ELES is active primarily in the development of a forum of all interested stakeholders, for whom three events were organised in 2017 where stress was placed on the presentation of the new study programmes and on the preparation of a list of potential content providers at Slovenian faculties and enrolment in online studies that will be provided by the project.

The project connecting 15 partners from 6 countries is valued at €3.7 million, while ELES activities are valued at €110,625.