

How does Elia stay up-to-date with technological developments to make the energy transition happen?

#6_

Our electricity system is facing huge challenges. As small-scale generation and decentralisation increase, there is a greater need for digitalisation and platforms to facilitate multi-level cooperation. As well as integrating renewable energy, our grid will also have to be capable of transmitting substantial volumes of imported and exported power. Over the past 25 years we have imported an average of 6 TWh net per year, but this will be rising to 13-30 TWh by 2030, depending on the scenarios. Technology can play its part in keeping the grid secure and manageable, alongside cooperation and exchanges with our neighbours. However, it's important that we have an accurate idea of their future generating facilities so that we can assess the needs of the Belgian system as efficiently as possible.



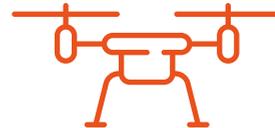
DANIELLE DEVOGELAER,
ENERGY EXPERT, FEDERAL
PLANNING BUREAU

- MEMBER OF THE FPB'S ENERGY AND TRANSPORT TEAM SINCE 2004
- ENERGY EXPERT SPECIALISING IN ELECTRICITY MODELLING



ALEXANDRE TORREELE,
ELIA STRATEGY & INNOVATION

“Changes in the energy sector are gathering pace. Driven by the energy transition, new players are emerging and new economic models are being developed. Technology facilitates and accelerates these changes. However, innovation also offers opportunities for the transmission system operators of the future. Elia tests and integrates new technologies in collaboration with all the market players. In 2017, we carried out tests involving digital technologies such as robots, machine learning and blockchain. Our aim is to determine whether these innovations can add value to our core business. This will help us to ensure that the market continues to operate efficiently in a new renewable and decentralised energy system.”





We have our eyes wide open for innovation & growth opportunities

In a rapidly changing energy landscape, innovation plays a key role in understanding, anticipating and promptly adopting the changes needed to ensure the transition towards a more reliable, affordable and efficient energy system. We continue to innovate in our industry, so the power sector can evolve and benefit us now and in the future.

Innovation is the catalyst for a swift energy transition. We are preparing for the future by keeping our eyes open for new developments in infrastructure management, system operation and the integration of our markets in a European context.

As well as continuing to integrate innovative technologies, we stay abreast of the latest developments in the energy sector. We see this as an opportunity and want to play a pioneering role. Elia has a range of initiatives that foster and reward innovative thinking, to ensure that our employees remain at the forefront of new developments.



**MENNO JANSSENS,
INNOVATION MANAGER AT ELIA**

"WE ARE COLLABORATING WITH DIFFERENT PLAYERS TO DEVELOP SOLUTIONS THAT WILL ALLOW US TO FURTHER DEVELOP THE GRID AND OPERATE THE SYSTEM IN A MORE DIGITAL, DECENTRAL AND RENEWABLE WORLD."

Our ambitions

Excelling in managing assets on the grid of tomorrow

Renewable energy integration and increased interconnection demands more of our infrastructure. The adoption of new technologies allows Elia to improve the use of our assets in many ways, providing increased capacity, lower risk or higher efficiency and reliability without increasing the impact of our infrastructure.

Developing and managing the electricity grid 2.0

Elia designs the expansion and the reinforcement of the grid according to the expected needs. Today and certainly more in the future, Elia will have to cope with the increase of renewable energy within the energy system and progressive decentralisation, whereby more production capacity is being installed in Belgian households. So, to meet future needs, Elia plans to develop and operate the power system 2.0.

Continuing to play a pioneering role in market facilitation

Elia is the market facilitator and design an efficient and transparent electricity market in Belgium to ensure a smooth transition to European market integration. Elia continuously collaborates with different stakeholders so the market can be adapted in line with the evolving needs of the power system. To keep this position, Elia is working on increasing the liquidity on the balancing market.

Open innovation through collaboration

In a world of widely distributed knowledge, Elia has decided to go for open innovation. We cannot afford to rely entirely on our own ideas and expertise to advance our technology. Buying or licensing processes or inventions from other companies, like start-ups, also makes a valuable contribution.



OBJECTIVES

We create a culture of innovation and entrepreneurship to accelerate the energy transition.

- We build an ecosystem to develop the tools and methods that will enable a more digital, decentralised and renewable energy system



What we achieved in 2017

Spatial imagery

Drones, photogrammetry, LIDAR, ground penetrating radar and more: new technologies with a spatial component are arriving at Elia, bringing both challenges and opportunities. The Spatial Imagery project aims to distribute knowledge about this technology, encouraging business departments to create opportunities that utilise it with a view to developing a structural and visionary approach.



MICHEL UWAERTS,
INNOVATION EXPERT
AT ELIA

“THE GROWTH TOWARDS A DIGITISED, MORE ACCURATE AND AI-SUPPORTED VIEW OF OUR GRID INFRASTRUCTURE IS EXPECTED TO GREATLY BENEFIT THE VALUE TRIANGLE: SAFETY, QUALITY AND EFFICIENCY.”

Two types of spatial imagery technology are investigated:

– **Photogrammetry** = the art of obtaining reliable information about physical objects and the environment by recording, measuring and interpreting photographic images and patterns. This allows engineering teams to design high-quality 3D models quicker and more accurately. With photogrammetry, a series of photos can be used as a basis for creating a 3D model. This requires far less work than a manual 3D drawing.

– **LIDAR** (Light Detection and Ranging technology) = extensively used for atmospheric research and meteorology. It is also being tested as a way of better managing vegetation under high-voltage corridors as it can model infrastructure and line sag more accurately. With LIDAR, a point cloud reflected by light can reveal what is happening on the ground. In practice, we can use LIDAR to put together a point cloud for all infrastructures and the environment surrounding them. Once processing the data, the sag of high-voltage lines can be accurately modelled under various circumstances, thus improving efficiency and quality.



INNOVATIVE INSULATING ARMS FOR STEVIN

In 2017, two new technologies were commissioned in connection with the Stevin project.

Insulating arms were fitted to compact pylons to replace an existing 150 kV line. Transforming pylons in this way made it possible to increase the voltage level to 380 kV without having to increase the height of the new pylons. High-temperature low-sag (HTLS) conductors - which reduce the effects of sag when the temperature on the line is high - now make it possible to increase power on the new 380 kV lines.





3D printing at Elia

Starting with logistics and spare parts management, Elia is exploring the use of 3D printing throughout the company. The aim is to find cost-effective ways to deliver qualitative spare parts as and when they are needed. The first case has been successfully implemented in the field, representing a long-term cost saving.

Previously circuit breaker caps deteriorated prematurely due to the UV sensitivity of the material. For almost the same cost, Elia used 3D printing to develop a more qualitative spare part, which requires less maintenance, saving both time and money.



GARPUR

Historically in Europe, power system reliability management has been predominantly relying on the 'N-1' criterion - whereby the system should be able to withstand an unexpected failure or outage of a system component (power plant, transmission line or transformers) at all times.

Today, the increasing uncertainty of generation due to intermittent energy sources, and the growing complexity of the pan-European power system, increase the need for new reliability criteria with a better balance between reliability and costs.

The European project GARPUR aims to develop new probabilistic criteria and relevant indicators for assessing reliability at various stages (grid development, asset management and grid operation) and evaluate their practical use (compared to the current 'N-1' criterion).

To that end, GARPUR is examining every facet of the approach applied between the grid development stage (which is decided upon several years in advance) and real-time operation, and devising European recommendations to enable a gradual switch to a probabilistic approach.

Distributed flexibility

Having explored the industrial and residential sector, Elia wants to facilitate the medium sized consumers (tertiary sector) to unlock their flexibility. In order to get an initial idea about the needs and potential of the tertiary sector, Elia has conducted a demo on one of its own buildings that enabled it to assess the controllability of three devices: a chiller, an air handling unit and a humidifier.

The test showed that the chiller and the humidifier were able to deliver flexibility in an aggregated way, in other words their activation and hold-on times fulfilled provision requirements. Elia also paid attention to the lessons learnt during the test. The main one being that controllability of the load is not guaranteed. Devices sometimes cannot be curtailed as they are following a given operation schedule and are bound to strong interdependencies with other devices.



**GIANNOPOULOS GEORGIOS,
SYSTEM SERVICES PRODUCT MANAGER
AT ELIA**

"ACCESSING DECENTRALISED FLEXIBILITY IS A COMPLEX TASK THAT NEEDS TO BE TRANSLATED INTO SIMPLE, AUTOMATED ACTIONS THAT CONSUMERS CAN UNDERSTAND AND TAKE ON BOARD."

Advanced machine learning to support dispatching

The integration of renewable energy is making the grid more and more complex; as a result, it is becoming vital to be able to predict grid imbalances within a very short time frame.

This project sets out to develop a model to detect the correlation between the various parameters influencing grid imbalance and predict any imbalance within a period of 15 minutes to an hour.

Elia hopes to first test and then demonstrate the usefulness of artificial intelligence in heightening the control centre engineers' awareness of the situations they face and in supporting their decision-making.

"As a system operator it has become much harder to understand system imbalance scenarios. The impact of variable generation, such as wind power and solar energy, is just one consideration, but there are also others, like increased activity on intraday markets, flexible generation units and so on. This means that system operators have to process and interpret huge quantities of data very quickly. Technologies and models built by data scientists will help to crunch down all this information and enable us to make correct decisions." Matthias Masschelin, Head of Energy Scheduling & Balancing at Elia



ADRIEN GILLÈS, INNOVATION PROJECT LEADER AT ELIA

"BLOCKCHAIN TECHNOLOGY HAS THE POTENTIAL TO PROFOUNDLY ALTER HOW THE ENERGY SECTOR OPERATES. BY ENABLING CITIZENS TO MAKE ELECTRICITY TRANSACTIONS DIRECTLY BETWEEN EACH OTHER, BLOCKCHAIN COULD SERVE AS A VECTOR IN THE ENERGY TRANSITION."

Blockchain

With an increasingly distributed enerBlockchain is a technology that can be used to for the decentralised validation and storage of transactions between parties. The financial sector was the first to take an interest in this technology, but recent developments have expanded its scope and made it attractive to other industries. Organisations and start-ups around the world are now considering blockchain technology to be a potential solution for a decentralised energy system.

Blockchain should reduce transaction costs, enable the active involvement of a larger number of participants and, consequently, accelerate the transition to a cleaner, more reliable and more affordable energy system. To assess the impact of blockchain technology on its sectors, Elia joined the Energy Web Foundation (EWF), an organisation that focuses on developing blockchain technology in the energy sector. Harnessing the EWF ecosystem, Elia aims to demonstrate the potential of blockchain by testing use cases based on actual internal processes.



GRASP

In collaboration with the Université Libre de Bruxelles (ULB), Elia is working on the development of new methods to plan and operate the Belgian power system within the PhD project GRASP.

GRASP seeks to develop a grid reliability assessment model for the operational planning stage. This model would factor in the scope for forecasting errors regarding wind and solar power generation.

Moreover, GRASP is rooted in existing practices and suggests new procedures with a view to issuing recommendations based on a prototype that can be tested directly using real-life situations in Belgium.



Enervalis

In September 2017, Elia acquired a stake in Enervalis, a start-up that develops energy management software. By partnering with Enervalis, Elia aims to innovate and strengthen its expertise in order to better contribute to the development of the future electricity system in which digitalisation and decentralisation will play an increasingly important role.

“The goal of our company is to deliver sustainable energy solutions that allow electricity producers, distributors and consumers to optimise energy supply, storage and demand flexibility. I am convinced that our cooperation with Elia will bring these to a new scale and this will benefit the community.” Stefan Lodeweyckx, founder and CEO of Enervalis.



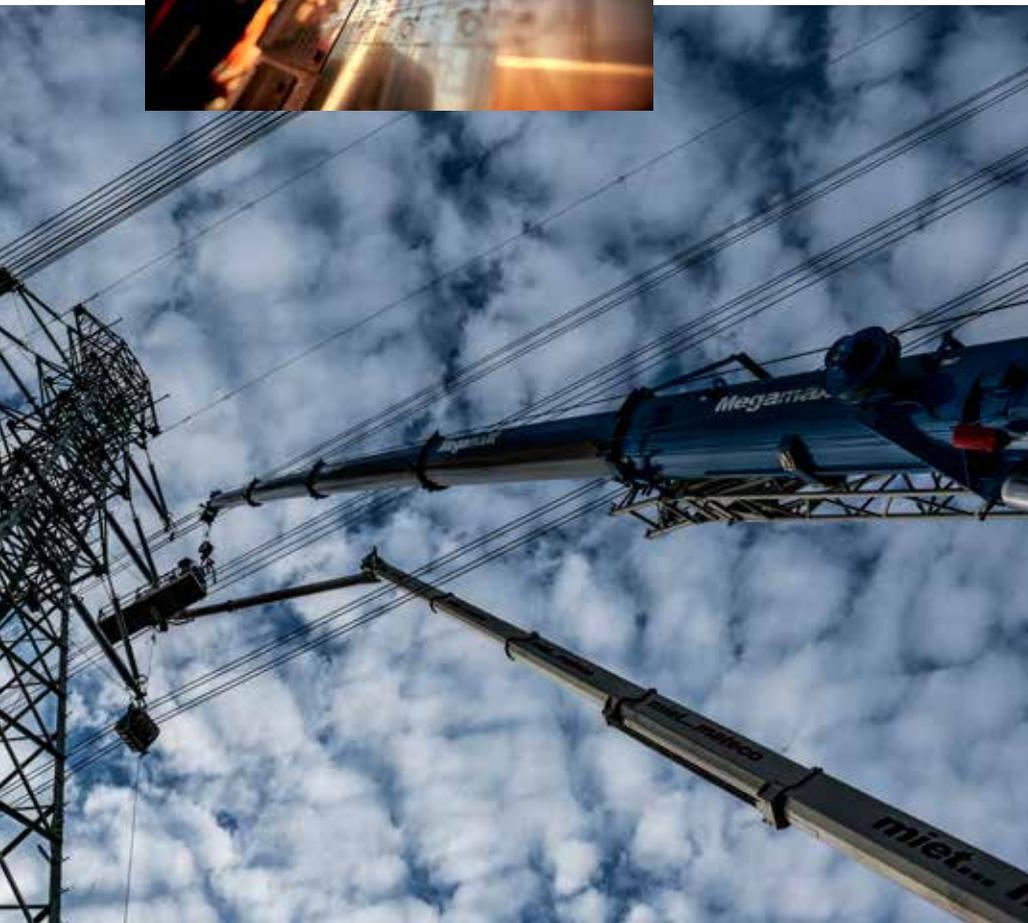
HACK BELGIUM: INNOVATING FOR BELGIUM

Fifteen Elia employees took part in Hack Belgium on 4, 5 and 6 May. The event brought together experts from various sectors, entrepreneurs and other enthusiastic and talented individuals to develop innovative ideas that will benefit Belgian society. By participating in events such as Hack Belgium,

Elia demonstrates its commitment to taking innovative and socially responsible action on behalf of the energy transition and Belgium's future. This also allows Elia's employees to cultivate the entrepreneurial and innovative mindset that is so important to the company's future. Elia will be taking part in the next Hack Belgium between 26 and 28 April 2018.

“With the development of new technologies like Internet of Things and Electric Vehicles, interaction with different sectors like IT, Telecom and Automotive becomes increasingly important. The Hack was the perfect occasion to meet innovators from these industries and develop a new perspective on innovation projects for Elia.”

Manoël Rekingier, Innovation Project Manager at Elia





Local inertia

With the increasing penetration of renewable energy sources at the expense of conventional sources and the growth in storage solutions connected to the grid, the total inertia available on the network is decreasing. While this reduction does not pose a risk to the European continental grid, it does raise the issue of inertia distribution. If an imbalance in this distribution occurs (as has already happened on the UK network), grid protection systems can be triggered, causing local power cuts.

This project investigates the phenomena related to the distribution of inertial response that may significantly impact future power system operation. The research investigation will develop

modelling tools, techniques and expertise with specific regard to the effect of distribution of inertia in the power grid, as well as considering related factors such as grid topology, RES penetration, and overall system security.

This project was granted financial support by the 2017 Energy Transition Fund. It aims to finance measures to encourage and support research and development in innovative energy projects, as well as to maintain or develop any system ensuring security of supply and the balance of the network. This fund is financed by a fee payable by Engie Electrabel, amounting to 20 million euros per year, in exchange for the extension of the reactors of Doel 1 and 2.



ELIA'S FIRST OPEN INNOVATION CONTEST

In October 2016, Elia organised the Open Innovation Challenge in order to identify start-ups that are proposing tools to enhance public acceptance of infrastructure projects. The contest was won on 16 February 2017 by Gilytics, a Zurich-based start-up. Gilytics provides an interactive platform using 3D visualisation and augmented reality to improve public participation in the planning phases of new projects.

"The tool of Gilytics allows us to define various constraints (soil, habitat, protected nature area, technical limitations, etc.) and allocate them a specific weight. It then identifies the optimum route. In the proof of concept, the results converged with the route that Elia had proposed, which validated the work done by our experts."

Johan Maricq, Innovation Project Leader at Elia.





WHAT IS HAPPENING AT 50HERTZ?

Pilot project with a new type of insulating gas

A new type of 110 kV, gas-insulated switchgear is being built at the Charlottenburg high-voltage substation. Instead of sulphur hexafluoride (SF₆), a mix of insulating gases with less environmental impact will be tested. The gas mixture, known as g³, has the same technical characteristics as SF₆ but a global warming potential that is 99% lower.

CompactLine

In late 2017, 50Hertz began building a pilot of a new type of line with shorter, narrower pylons and therefore a reduced environmental impact.

The test line runs for two kilometres and will include five pylons. It is connected to the Jessen North substation. The design of CompactLine should enable a 220 kV line to be replaced with a 380 kV line, without altering the route. 50Hertz plans to start testing the pilot project from summer 2018.

Innovation Day @ 50Hertz

The company held its 5th Innovation Day on 13 November. 50Hertz employees were briefed on 19 ongoing research and development projects, and exchanged ideas about technical developments and process innovations.



99%

THE GAS MIXTURE, KNOWN AS G³, HAS THE SAME TECHNICAL CHARACTERISTICS AS SF₆ BUT A GLOBAL WARMING POTENTIAL THAT IS 99% LOWER.

