


New Challenges. New Opportunities. New Horizons.

Full Report 2017/18



Expansion of renewable generation

The smooth integration of renewable generation from third parties in the network is not our only priority. We also produce green electricity and heat, and our plans call for continuous expansion in this area. Wind, water, biomass and the sun are our raw materials for the energy future.



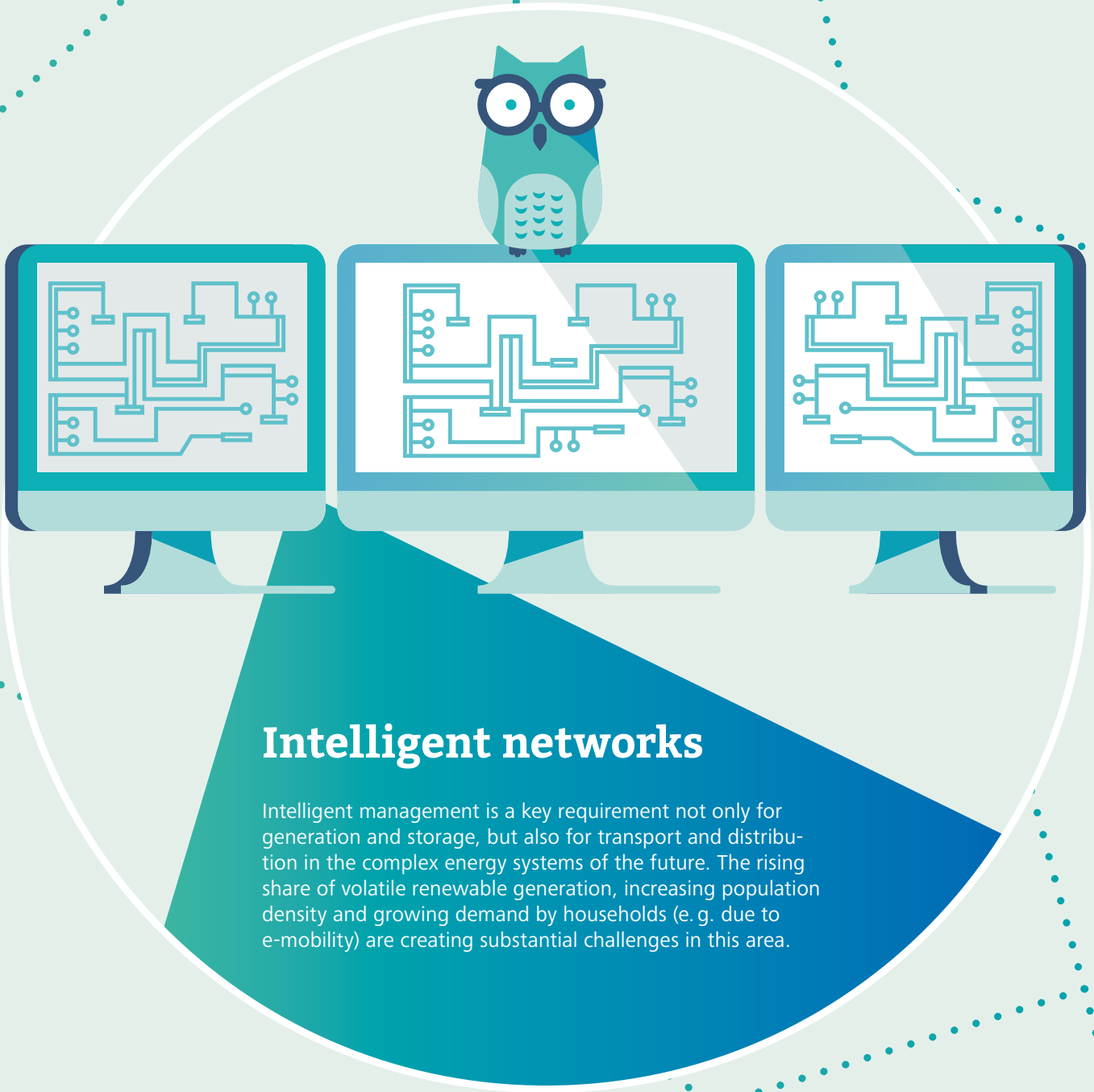
Innovative models for system optimisation

The functioning of a decentralised system with many (in part, small) producers requires a new, flexible approach to control. The role of conventional power plants is shifting from energy supplies to the supply of reserve capacity.



Supply security and network stability

Through the supply of reserve capacity and balancing energy along with the continuous development of our networks, we are supporting the expansion of renewable generation and, at the same time, making a decisive contribution to supply security.



Intelligent networks

Intelligent management is a key requirement not only for generation and storage, but also for transport and distribution in the complex energy systems of the future. The rising share of volatile renewable generation, increasing population density and growing demand by households (e.g. due to e-mobility) are creating substantial challenges in this area.



Smart products for tomorrow's customers

We see ourselves as a partner for renewables who actively addresses the changes in the behaviour of customers and the usage habits of prosumers. This belief is transforming us more and more from a pure supplier into an energy manager.



New approaches for electricity storage

Low-cost, efficient solutions for the storage of electricity as a means of offsetting the volatility of generation from renewables represent a key requirement for the transformation of our energy system. An added challenge is created by seasonal energy balancing over the long term.



Full-coverage connectivity and digitalisation

Continuing digitalisation is the essential basis for all types of intelligent controls – for generation and storage as well as networks and customer equipment.

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The transformation of the energy system towards renewable generation adds to complexity but, at the same time, also opens the door for exciting new solutions and business models. As an innovative energy and environmental services provider, EVN is playing an active role in this process and making a decisive contribution to the creation of a future-oriented, sustainable system. A continuous flow of new ideas and offers are the proof.

Supply security and network stability

Valuable contributions to the development of renewables

Supply of reserve capacity
Electricity from renewable sources is not always available when it is needed. To make sure the lights also go on when the wind is not blowing and the sun does not shine, the right stand-by reserves are needed. Our thermal power plants play an important role in this process and are proving to be a valuable bridge technology for the system conversion towards renewables.

Protection of network stability
The volatility of generation and demand also has an influence on the short-term stability of the network. To make sure the network remains stable and electricity can be transported trouble-free, so-called "balancing energy" from conventional power plants is needed to make sure generation exactly matches demand at all times. We have made an important contribution in this area over the years through the supply of our thermal power plants for network stabilisation.

Investment focus: network infrastructure
In order to guarantee complete supply security – also in view of the growing number of decentralised feed-in points and the continuous

Reliable reserve capacity and efficient networks are what make the advancement of wind power and solar electricity possible.

increase in the share of electricity from renewable sources – we have been making massive investments in our network infrastructure for many years. In the 2017/18 financial year alone we invested approximately EUR 150m in our electricity and natural gas network in Lower Austria.

Expansion with a vision
The expansion of our networks consciously reflects a view towards the future, and we are already adjusting to meet the expected shifts in demand. The key issues here, for example, are the trend towards e-mobility and the greater use of heat pumps. To make sure our networks can continue to meet these growing requirements over the long term, our projects to install new transmission lines include an increase in line cross-sections and transformer density already today, in order to prevent additional expenditures for later expansion. And, at the same time, we are gradually re-fitting existing cable sections.

Expansion of renewable generation

More and more green electricity and heat from EVN

Wind power
We started to generate environmentally friendly wind power in Lower Austria during 2000 and have been steadily increasing the number of wind parks since that time. And the expansion of wind power also represents an important focal point for our future investments: we currently have a wind generation capacity of 318 MW and expect to reach a level of roughly 370 MW by the end of 2019/20. The medium-term goal is 500 MW, which we want to meet alone through the realisation of projects that have, for the most part, already been approved. Assuming the framework conditions are appropriate, we do, however, see even greater potential – in line with #mission 2030, the Austrian government's climate and energy strategy. Our wind park operations are optimised with innovative real-time software which has already created new opportunities for operations and maintenance and will support even better coordination between wind flows, electricity demand and market price levels in the future.

Biomass
Our operations with the utilisation of biomass began in 1993, and we are now the largest biomass natural heat supplier in Austria. We currently provide nearly 57,000 households and businesses with heat from this renewable, regionally available energy source. In addition to 74 biomass-fired district heating plants that are used exclusively for heat generation, we produce environmentally friendly electricity in three combined heat and power plants. Our vision for the future – in addition to the continuous expansion of our networks – is to also supply our customers with biomass-generated cooling.

Photovoltaics
The accelerated expansion of photovoltaics is one of the flagship projects described in #mission2030. Here we are making a contribution in many different ways: we are developing the infrastructure required for our network and, with local storage batteries and innovative load management technologies, creating the essential conditions for further expansion. However, we also

provide direct support for the installation of photovoltaic equipment on private houses, businesses and public buildings, for example as part of the "1,000 roofs programme" together with the province of Lower Austria.

Hydropower
Hydropower formed the core of our business activities when EVN was founded in 1922 and has always been an important backbone of our electricity generation. Since further expansion in our supply area is hardly possible, we are concentrating on the maintenance and continuous modernisation of our existing plants so they can continue to make an important contribution to regional supply security.

Intelligent networks

Innovative solutions for transport and distribution

New intelligent technologies for the distribution network
Power line networks were once responsible primarily for transporting electricity from A to B, but their function today involves the complex management and coordination of numerous generation plants, (battery) storage and – more and more often, also self-producing – consumers.

Complex management and networking between a growing number of producers and consumers

That places high demands on controls as well as on the network itself because parallel actions by the wide range of producers, storage facilities and customers have a substantial impact on the quality of voltage in the low voltage network. At the same time, the expansion of digitalisation and the use of increasingly

sensitive equipment require high, stable network quality. The answer is the introduction of innovative new network technologies (e.g. linear voltage regulators, tap-change low voltage transformers or intelligent network stations) to control and monitor the local electricity networks.

Pilot tests in the interest of supply security
In order to gain experience with future models, requirements and solution approaches early on, we continuously carry out pilot projects in real-time operations. A recent test at Seitenstetten in Austria's Mostviertel, for example, involved the evaluation of network stabilisation under the increased use of e-mobility. The challenge was to remain within the voltage limits for a local network while, at the same time, charging numerous e-autos – a scenario that is becoming more and more realistic. Two further pilot projects in Maria Enzersdorf-Südstadt and Lichtenegg are currently dealing with the local interaction of renewable generation, storage, sector coupling (power-to-heat) and the variable demand for electricity.

New approaches for maintenance and operations
Conventional network operations have also changed significantly in recent years. New technologies have made many tasks easier and, in addition, created a wide variety of new opportunities. Examples are the use of augmented reality glasses for troubleshooting and repairs in remote control technology or the use of drones in power line construction. Predictive maintenance, whereby we mean digitally supported proactive maintenance, also plays an increasingly important role in this area, as it does in the maintenance of our generation plants.

Smart products for tomorrow's customers

Attractive offerings for demanding prosumers

joulie
In 2018 we launched an innovative new photovoltaic offering for private households which expands our product line to include more intelligent, digitally supported individual energy solutions. joulie contains a number of building blocks for decentralised energy supplies – from the analysis of requirements and advising in the form of a web-based configurator to the installation of photovoltaic equipment and individual energy management and monitoring. As a digital assistant, it optimises the use of the customer's generated electricity by including equipment with high electricity consumption (e.g. heat pumps and warm water boilers, but also storage batteries). joulie also supports the sale of surplus electricity volumes through integration in our network. And the customer always has full control over his system via smartphone, tablet or PC.

the needs of our customers in this area and, at the same time, are working to optimise the entire system of demand, generation, market prices and transport and storage capacities. The EU's plans to introduce smart meters will create additional efficient opportunities here.

Active support for e-mobility
Through the construction of a full-coverage network of e-charging stations in Lower Austria – we now operate roughly 1,200 charging points – we made an early and important contribution to the spread of e-mobility. Our electricity fuelling card gives customers access not only to EVN's e-charging stations, but also to 2,800 other charging points across Austria. We are continuing to support the development of e-mobility by further expanding the charging structure in the public and, increasingly also, in the private sector and with a variety of other initiatives. Included here, for example, are charging-related services and the development of new control

technologies to optimise household electricity consumption together with the charging of e-vehicles.

Stronger distribution of heat pumps
The increased utilisation of heat pumps for energy generation is another focus of our efforts. The use of electricity from renewable production to operate heat pumps creates a two-fold benefit for the environment. And with integration in intelligent solutions like joulie, this equipment can also make an important contribution to optimising the entire energy system.

Innovative models for system optimisation

Intelligent controls for a complex decentralised system

Flexible real-time management
Activities that could previously be planned in advance must now be constantly flexible with real-time management and control. This is a direct result of the strong growth in volatile renewable generation and the increase in the share of production capacity that is no longer available simply "at the touch of a button". Our answer here is EZISSE ("Echtzeit-Informations- und Steuerungssystem für die Energie-wirtschaft"), a completely new digital platform which we developed for the management and optimisation of the energy system. This highly innovative model integrates our own power plants as well as all decentralised generation units – from industrial aggregates to wind parks and private photovoltaic equipment. It also covers all available electricity storage facilities, including household storage batteries and e-vehicles. In this way, generation can be matched with current demand and the available generation sources can be optimised. EZISSE closes the circle of our

innovative joulie product which was launched in 2018: it can communicate directly with high-consumption equipment or storage batteries via joulie.

Smart energy solutions for the flexible, per second balancing of production and demand

Virtual power plants
Digitalisation is also bringing new achievements in the area of presumably "static" analogue technology like power plants: so-called "virtual power plants" now expand and complement the previous picture. This term is used to describe a large number of smaller plants which are managed, optimised and marketed as a single unit. With joulie and

various other offerings, we are creating the basis for these types of smart energy solutions.

Predictive maintenance
The perfect optimisation of the entire system requires the greatest possible availability of all equipment. We are also relying on innovative new solutions in this area, including the digitally supported, proactive maintenance of our generation equipment. That should help us avoid unplanned operational interruptions as far as possible. Exactly with this goal in mind, we are currently implementing a package of measures to prevent wind turbines from freezing.

New approaches for electricity storage

Equalising the volatility of wind and sun

Short-term household storage
Storage batteries in private homes are already capable of accumulating smaller volumes of electricity from photovoltaic equipment. That helps to balance the timing differences between generation and consumption – for example, higher production at midday and consumption peaks in the morning and evening hours. And the customer benefits in two ways: his own coverage ratio is increased and his electricity costs are reduced. At the same time, this eases the strain on the electricity network. Heat pumps are an ideal addition to these batteries – the self-generated electricity can also be used for heating, warm water production or cooling the house.

Large storage battery
Our activities also include a concentrated focus on the large-scale storage of electricity. There are currently no marketable technologies – aside from pump storage – to support these types of facilities, but they are indispensable for a sustainable

system conversion. In a joint research project with partners, we installed a large lithium-ion storage battery with a performance of 2.5 MW and a capacity of 2.2 MWh – which represents the demand by roughly 600 households – at our Prottes wind park. Various trials and test series have given us valuable insight into the operational capability of these storage facilities to stabilise the networks and equalise the local network voltage fluctuations caused, for example, by photovoltaic generation peaks or higher household demand at certain times of the day.

Sector coupling: power-to-heat, power-to-gas
Large volumes of electricity can also be stored using other forms of energy. One important example is the hot water storage facility at our Theiss power plant, which uses surplus electricity as heating equipment for the city of Krems. In addition to this power-to-heat equipment, we are working together with

partners on "power-to-gas" research projects – meaning the conversion of electricity into renewable gas and the use of the natural gas network for seasonal storage. Electrolysis converts the surplus electricity production into, for example, hydrogen. This is added to the natural gas and can be used as needed to operate gas turbines which, in turn, generate electricity. Our subsidiary RAG is also working on a project for "underground sun storage", which involves the accumulation of solar electricity in the form of renewable methane.

Pump storage power plant in Ottenstein
One still very important form of electricity storage is the operation of pump storage power plants like EVN's facility in Ottenstein. It uses surplus electricity to pump water into a reservoir, which is then available for electricity generation at a later time.

Full-coverage connectivity and digitalisation

Basis for the optimisation of the entire system

A wide variety of new opportunities
Digitalisation has made many things possible which were unimaginable only a few years ago and has fundamentally changed our lives. What is more, no stone has been left unturned in the area of energy supplies. The shift is taking place from pure supplies to energy management. Intelligent networks and meters, the data-based optimisation of individual consumption, new product and service offerings, innovative tariff models, optimised real-time network management and much more would be unthinkable without digitalisation and full-coverage connectivity. A growing number of customers are now able to optimise their own consumption, production and storage. And we too benefit from the wide-ranging possibilities created by the digital world in the management of this significantly more complex and fragmented energy system. Through the continuing expansion of the glass fibre infrastructure operated

by our subsidiary kabelplus and the installation of high-performance data lines for real-time transmission as part of our own network expansion, we are creating the necessary infrastructure – for our customers as well as for ourselves.

Innovative approaches for the transformation from pure supplies to intelligent energy management

Supply security and cybersecurity as the top priorities
In addition to numerous benefits, today's increasing interconnectedness is also making systems more complex – and thereby puts them at greater risk for disruption and attacks. Cybersecurity is therefore at the top of our agenda. Our primary

objective is to protect the availability of all systems so we can meet our commitment to supply security at all times. The quality of our products and services – and our customers' comfort – is an integral part of these activities. It goes without saying that we handle our customer data with the greatest of care. In this sense, data protection and cybersecurity are elementary components of every EVN project. All types of networking are carried out very carefully and with the diligent handling of all risks. Particularly sensitive applications are subject to even stricter security precautions and are consciously separated from other systems.