Digital grids – smart technology for a sustainable energy future

Digital networking of generation and consumption

Heading towards climate neutrality, renewable energies and decarbonisation – the energy transition is in full swing. An illuminating insight: only through the digital integration of energy producers and consumers can renewable energies be distributed in line with supply and our grids be optimally utilised. That is why we at E.ON are driving the digitalization of our infrastructure.

Discover our vision, the challenges we are still facing and our innovations to safe, independent and sustainable energy supply.

E.ON's distribution grids are the backbone for secure, independent and sustainable energy supply.

They enable the energy transition by integrating renewable energy plants as well as electric mobility and heating solutions.

As a result, the future energy system is becoming much more complex. The number of grid participants is increasing at a fast pace. At the same time, the generation of energy is becoming more volatile and user behaviour more individually specific. Only through digitalization will it be possible to keep operating the system reliably and efficiently — for the benefit of our customers and the environment.

Thomas König, COO Networks, E.ON

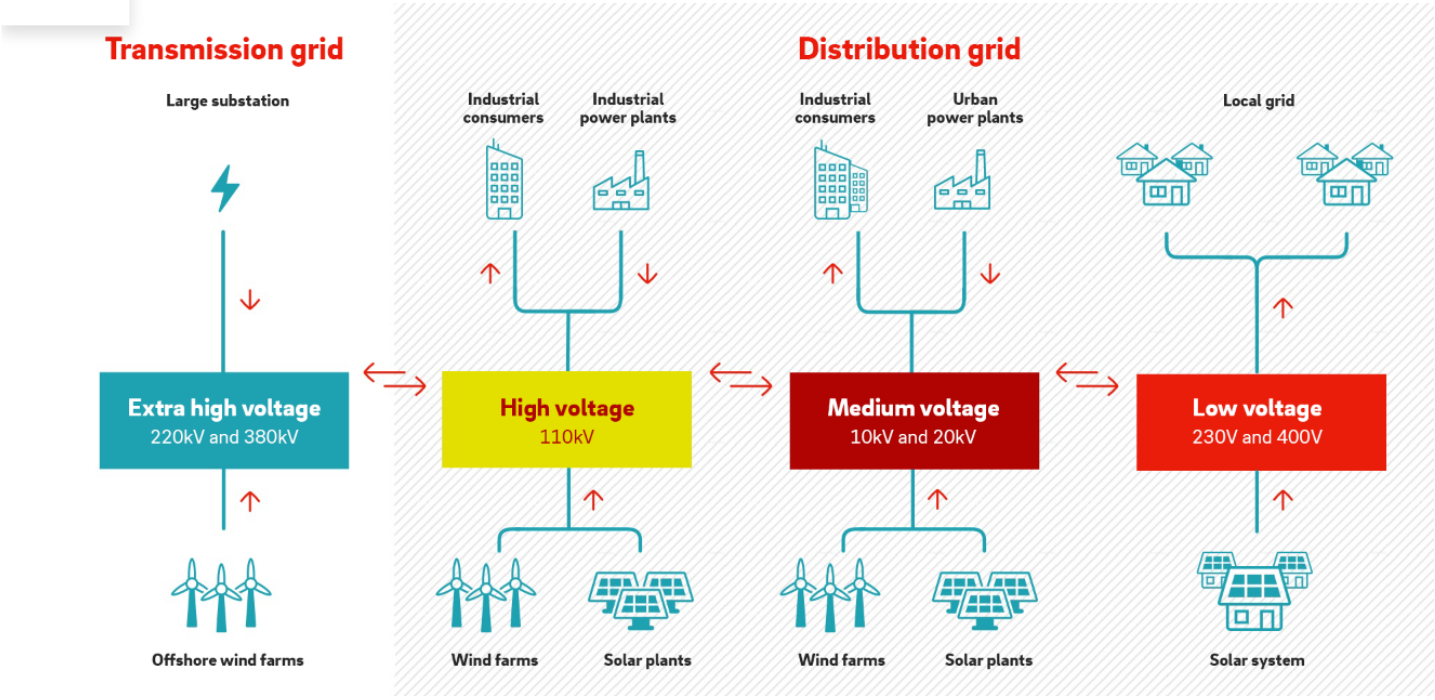
Only by using digital control and orchestrating the combination of generators, grids, and consumers can we optimally deploy sustainably generated energy, avoid unnecessary consumption, and better buffer fluctuations in consumption and generation.

ctoria Ossadnik, COO Digital, E.ON

Our vision — a digital backbone for the energy transition

Digital grids as the path to a sustainable, secure, and efficient energy supply

photovoltaic systems and wind turbines — and, on the other hand, new consumer applications such as electric vehicles, heat pumps and storage systems. Digitalization ables us to monitor and predict electricity generation and consumption, to better ilise our grid and to help keep the highly interconnected system in balance (e.g., by oviding flexibility options). Last but not least, intelligent distribution grids, the so-lled smart grids, offer customers new possibilities for managing energy and thus for ing actively involved in shaping the energy transition.



What are distribution grids?

For more information on distribution networks and their function, please see

Wir bewegen die Energiewende (German only)

Weg des Stroms (German only)

Tasks and advantages of the digital grid

- **Making energy transition affordable:** With digital resources and automation, the utilisation of the grids can be optimised, and the grid expansion can be made as economically efficient possible.

eeping control: Energy generation and consumption can be orchestrated more efficiently an increasingly complex energy system.

nowing consumption: Digitalization creates transparency about energy consumption and pports a more efficient use of energy.

- **Sustainable heating:** Smart grids support the switch to a sustainable heat supply, e.g. with heat pumps.

- **Clever charging of EVs:** The smart grid enables sustainable mobility by intelligently controlling the charging of electric cars. This provides more customers with the opportunity to be mobile in a sustainable way.
- **Be a Change Maker:** Everyone can participate in the energy transition and thus contribute to climate protection. In the digital grid, electricity generated by one's own PV system is used, for example, to charge an electric vehicle or to power a heat pump, especially when the sun is shining.
- **Increasing resilience:** The digitalization of energy infrastructure increases resilience to extreme weather events. Digital tools and the corresponding sensory and switching technology create the prerequisite for quickly restoring the energy supply after such events.

Challenges – structural change in the energy system

Our energy system is undergoing a fundamental structural change

In the past, most energy was produced in largescale fossil-fuelled power plants. These power plants were connected to the transmission grids and could flexibly control their generation. The generated energy was distributed to private households and industrial customers via the distribution grids.

With the energy transition and the development of renewable energies, the system is now changing. By now, weather increasingly determines the electricity supply in the form of sun and wind. Due to their lower output, the new generators are no longer connected to the transmission grids, but to the distribution grids. This has a major impact because it makes the energy system more complex. However, the use of digital technologies now allows us to monitor decentralized energy sources and consumers in real time and to transport green energy to where it is needed.

The structural change is already in full swing today. Millions of renewable energy plants have already been installed, of which more than 95 percent have been connected to the distribution grids. By 2030, up to 22 gigawatts (GW) of generation from solar energy and 10 GW of onshore wind power are to be built annually throughout Germany — thus more than a doubling the currently installed capacity. Presumably, more than half of this will be transmitted through the E.ON distribution grids. And by 2035, all electricity generation is expected to be nearly greenhouse gas neutral.

Energy grids as a link between sectors

In addition to generation, more and more electrical devices such as electric vehicles and heat pumps are being integrated into the grid. By distributing green electricity and coupling the electricity, transport and heat sectors, the electricity distribution grid also enables the transition of transport and heating. This, of course, adds to the complexity. During peak times, many electric vehicles are connected to the grid simultaneously, putting a strain on the grid by charging at the same time. Digitalization helps to avoid shortages in these situations, as charging processes can be controlled intelligently, so that every car can be charged without problems.

Meanwhile, heat supply is also changing. As the accelerating use of heat pumps could potentially also lead to a strain on the electricity grid, we use digital technologies to better manage the grid and meet customers' needs.

Our innovations: pioneering initiatives for the digitalization of the distribution grids

As the leading distribution grid operator in Northern and Central Europe, we are driving the digitalization of electricity grids forward

and ensure security of supply, we are increasing transparency and controllability. We use sensors as well as intelligent metering and control technology to enable the control of ntralised generation and consumption in real time. To achieve this, we are building the red communication network and are accelerating the introduction of smart assets into our in Europe. We can then make optimal use of this grid data via a uniform digital platform. re digitalizing core business processes and offering new digital products while always ring to the highest cyber security standards.

For our customers' benefit: digital technologies offer a wide range of opportunities

The opportunities offered by digitalization and artificial intelligence (AI) are multifaceted and run through our entire value chain: from optimal grid planning to the efficient operation of energy infrastructures to new digital solutions. For example, we are developing a new process and technology platform to achieve the greatest possible automation and standardization from grid connection to meter reading and billing. This will enable us to process customer enquiries faster and more efficiently. In the future, this can be done 100 per cent online.

Other possibilities for the use of AI include intelligent local network stations, drones with AI-based software for route maintenance, intelligent charging management for electric cars and AI-operated chatbots for efficient digital customer interaction.

- Smartmeter
- Digitalization

Data from our grids is the basis for the successful energy transition

Digitalization gives the distribution grid a dual function: not only does electricity flow in the smart grid, but data is also exchanged. Information about grid utilisation, available grid capacity and generation, for example, is the basis for an optimally utilised grid and thus a more efficient energy system.

Intelligent metering systems, such as smart meters, are also an essential part of the digital grid infrastructure. The information provided by sensory and switching technology as well as communication technology is what makes the real-time control of decentralised generators and consumers possible in the first place. Smart meters can deliver the necessary data and are part of the navigation system of the energy transition. With their help, we can, among other

climate protection. In addition, flexible tariffs become possible, lowering costs even further if electricity is preferably consumed at moments when a lot of it is available in the grid.

ON, we are not only standardising the core processes of our grid operators, but also the iated IT systems, such as for grid expansion and maintenance for all our regional grid anies. Uniform data and processes serve as our basis for predictive maintenance, oved customer interactions as well as digital innovations. Data generated in the grid is also undation for the development of individual and innovative solutions with which mers can actively participate in the sustainable energy world of tomorrow.

What are smart meters?

Learn more (German only)

Our projects for the digitalization of distribution grids

grid infrastructure

Prerequisite for digitalizing

Heart of digital distribution grids

technology

Intelligent grid operating equipment

Smartification of grid infrastructure

As a prerequisite for digitalizing the grid, we create a virtual replica — a so-called digital twin. This virtual image contains the topology of the operating equipment used, such as local network stations and transformers. In addition, the status of the grid is visible through the data and can be intelligently controlled. For this purpose, we build state-of-the-art, intelligent equipment that transmits relevant information and receives control commands.

To drive digitalization forward, we have set ambitious goals. Only through digitalization can we achieve the monitorability and controllability of our grids needed in the future for safe and efficient operation as well as for the rapidly increasing integration of renewable energies and decentralised units such as heat pumps and e-mobility. In medium voltage, our goal is to achieve 100 percent monitorability and 20 percent controllability by 2026. Digital local network stations are the key to this. Mathematical models enable us to achieve complete monitorability over our medium-voltage level with the recording of just 30 percent of the grid points. In low voltage, we want to make 30 percent of the grid monitorable by 2026. But to achieve this, we will need the data from the smart meters.

And yet the installation of smart devices alone is by no means enough. It is crucial that the transmitted information and the data on the operating devices are available in a secure, standardised, and readable form. Only then can we use them to develop new solutions for the energy system. To this end, we have set up a uniform digital platform for our energy networks.

Better customer service
Digital solutions for our customers

E.ON Lab
Digital local network stations at work

Better customer service through digitalization

We develop digital solutions that make it easier for our customers to be connected to the electricity grid (e.g connection of a single-family home to consume energy or the connection of a photovoltaic system to feed energy into the grid). The days of paper applications and long waiting times are a thing of the past. We already offer digital application via grid connection portals such as SNAP. The advantage: customers immediately receive information about the connection point when they submit their requests. This functionality, which is already available in some grid areas, will soon be available throughout the E.ON Group via the central digital platform.

Digitalization and standardisation are also entering our business processes. Group-wide projects to standardise our billing and asset data systems as well as the underlying processes are leading to considerable efficiency benefits and form the basis for the use of intelligent solutions at all E.ON grid companies in Europe.

However, digitalization does not end at the Group's borders: we also involve our contractors in the automation of ordering, processing and invoicing procedures.

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