

01
2021

FINGRID

2 2

Why is data management important for the energy sector?

2 4

Fingrid's network vision reviews scenarios for future electricity consumption trends

0 4

THEME

The energy revolution is leading to closer collaboration

Contents



4–11

THEME

- The energy revolution is leading to closer collaboration between actors in the sector
- Open dialogue with customers is valuable

12–14

CASE

- Responsibility and efficiency are the hallmarks of Fingrid's corporate culture
- Standardising substations boosts cost-efficiency

15

COLUMN

Riku Ruokolahti

16–21

CASE

- Wind power seeks a foothold in the balancing power market
- Probability calculations help to assess power sufficiency

22–23

PRACTICAL QUESTION

24–25

FINGRID NOW

Reaching the climate objectives will require significant investments in the main grid



28–29

CASE

Work cannot proceed without a crossing statement

30–31

ENVIRONMENT

Opportunity and coercion: Getting a grip on climate change

32–33

TOPICAL

34

PROFESSIONAL

Sirpa Kulmala

35

ELECTRIC PHENOMENON

Arlo Go -camera

Now you can also find Fingrid's magazine online at fingridlehti.fi/en/

Fingrid Oyj's magazine
24. volume
1/2021

EDITORIAL STAFF

Telephone: +358 30 395 5267

Fax: +358 30 395 5196

Postal address: P.O. Box 530,
FI-00101 Helsinki

Street address: Läkkipäntie 21,
FI-00620 Helsinki

Editor-in-chief: Marjaana Kivioja,
marjaana.kivioja@fingrid.fi

Managing editor: Marjut Määttänen,
marjut.maattanen@fingrid.fi

Editorial board: Jonne Jäppinen,
Marjaana Kivioja, Niko Korhonen,
Marjut Määttänen, Risto Rynnänen,
Katariina Saarinen, Jarno Sederlund
and Tiina Seppänen

Layout and content production:
Otavamedia OMA

Publisher:

Fingrid Oyj, fingrid.fi

Change of address:

assistentit@fingrid.fi

Orders and cancellations:

www.fingrid.fi/en/order

Printed by: Newprint Oy

ISSN-L: 1455-7517

ISSN: 1455-7517 (Print)

ISSN: 2242-5977 (Online)



FINGRID



26–27

The Western Boulevard City will change the face of Helsinki's electricity network

THE FINGRID MAGAZINE

Did you like what you read? Send your comments on the magazine to the address: Fingrid Oyj, P.O. Box 530, FI-00101 Helsinki. Please write "Fingrid magazine" on the envelope. You can also send feedback via e-mail: viestinta@fingrid.fi.

PHOTO | FINGRID



Even monopolies need to provide personal service

Fingrid is a monopoly enterprise that discharges a statutory duty. The company has three internal processes for comprehensively managing these basic functions: ensuring transmission capacity, managing system security, and promoting electricity markets. These are also important for our customers, so could we provide a sufficiently customer-oriented perspective by involving customers in the development of our core processes?

In principle, customers do not pay to be included in Fingrid's internal operations, such as improving the planning, construction or maintenance of the main grid. The nature of the service should be that customers receive help for their own needs. This takes place during various interactions that constitute a series of events – service processes or value chains. Although it is important for us to discharge our statutory duties properly, we are also able to generate significant added value by investing in value chains that are visible to customers and offering expert resources for them.

When we ask customers which types of services they feel that they receive from Fingrid,

two top-level entities stand out: main grid services and electricity market services. Main grid services revolve around a network connection that enables a customer to supply energy to the grid or receive the necessary amount of high-quality electricity. The service is measured in terms of the number of megawatts, kilovolts or hertz at the connection point, as well as in the number of disturbances and outages. The core elements of electricity market services are the various marketplaces enabled by the power system, as well as the associated market rules. Customers want to trade electricity with consistent ground rules and no restrictions, also across national borders. As such, the success of the service is measured in euros – in other words, how extensively the connected power system is able to generate a financial benefit for the customers connected to it.

We aim to involve our customers in developing our services in various ways. Discussions must take place in the customer's language. This means that we need to do more than just talking about our own processes or projects using the jargon we have invented for them. We also need to engage in wider-ranging discussions, as all services ultimately rely on interaction between

people. We want our specialists to feel that they are involved in serving customers, and we want them to understand the types of services they are involved in providing, as well as what customers hope to receive from each service as a whole.

Although it is important for us to discharge our statutory duties effectively, it is at least as important to earn the trust of our customers each and every day and to help them succeed. This is particularly true right now, as our customers are investing staggering sums of money in the generation and consumption of clean electricity in the midst of an energy revolution and substantial uncertainty. Fingrid needs to have a solid overview of the big picture and a service-oriented approach, and we must advance towards a clean electricity system together, in accordance with Fingrid's vision.

Jussi Jyrinsalo
Senior Vice President,
Grid Services and Planning
Fingrid



The energy revolution is leading to closer collaboration

Finland's ambitious climate targets will lead to an enormous increase in electricity generation and consumption. This requires Fingrid to make investments and take other development measures to enable a clean electricity system. As Fingrid embarks on this work, it seeks to collaborate even more openly and closely with actors in the sector.

TEXT | OLLI MANNINEN

PHOTOS | ISTOCK, FINGRID, VATTENFALL

It is essential for different stakeholders to work more closely together as new actors and challenges begin to make their presence felt in national, Nordic and European energy markets. Solutions in the energy sector will be more closely intertwined, and it will not be sensible to go it alone.

When the objective is to address people's needs by providing reliable electricity transmission and functioning electricity markets, it is crucial to approach stakeholders in the right place at the right time and to listen to what they have to say.

"By planning and acting together, we can drive things forwards. It is important for every stakeholder to understand the direction in which the sector is heading and how decisions and solutions will affect each party's operations," says **Jussi Jyrinsalo**, Senior Vice President at Fingrid.

By way of example, Fingrid has published its vision for the long-term development needs of the main grid and the associated solutions. The vision is based on four different scenarios that describe trends in the structure of electricity generation and consumption.

"We hope that our long-term scenarios will inspire our stakeholders to engage in open

dialogue about the opportunities that the future could bring for different parties," Jussi Jyrinsalo says.

STANDING OUT THROUGH CUSTOMER ORIENTATION

Fingrid has several different external stakeholders, each with their own expectations for collaboration. In addition to main grid planning and services, Jussi Jyrinsalo is responsible for Fingrid's customer relationships. The company works with its customers in many different ways.

Customer orientation is a part of Fingrid's strategy and a way for Fingrid to differentiate itself from other transmission system operators.

"Personal or business-to-business meetings are naturally the most effective way of keeping in touch with customers. The coronavirus pandemic has forced us to switch to online interaction tools to ensure that everyone remains safe and healthy. This has had the effect of speeding up communications, especially in international relations," says Jyrinsalo.

Fingrid has arranged annual Fingrid Current events for its customers, as well as several other events related to development projects on the grid and in electricity markets. During these exceptional times, they have been held in the form of webinars, which has had the effect of making

it easier to attend events, even at short notice.

Customer committees are another important form of collaboration. There are currently three such committees: the Advisory Committee, the Market Committee and the Grid Committee.

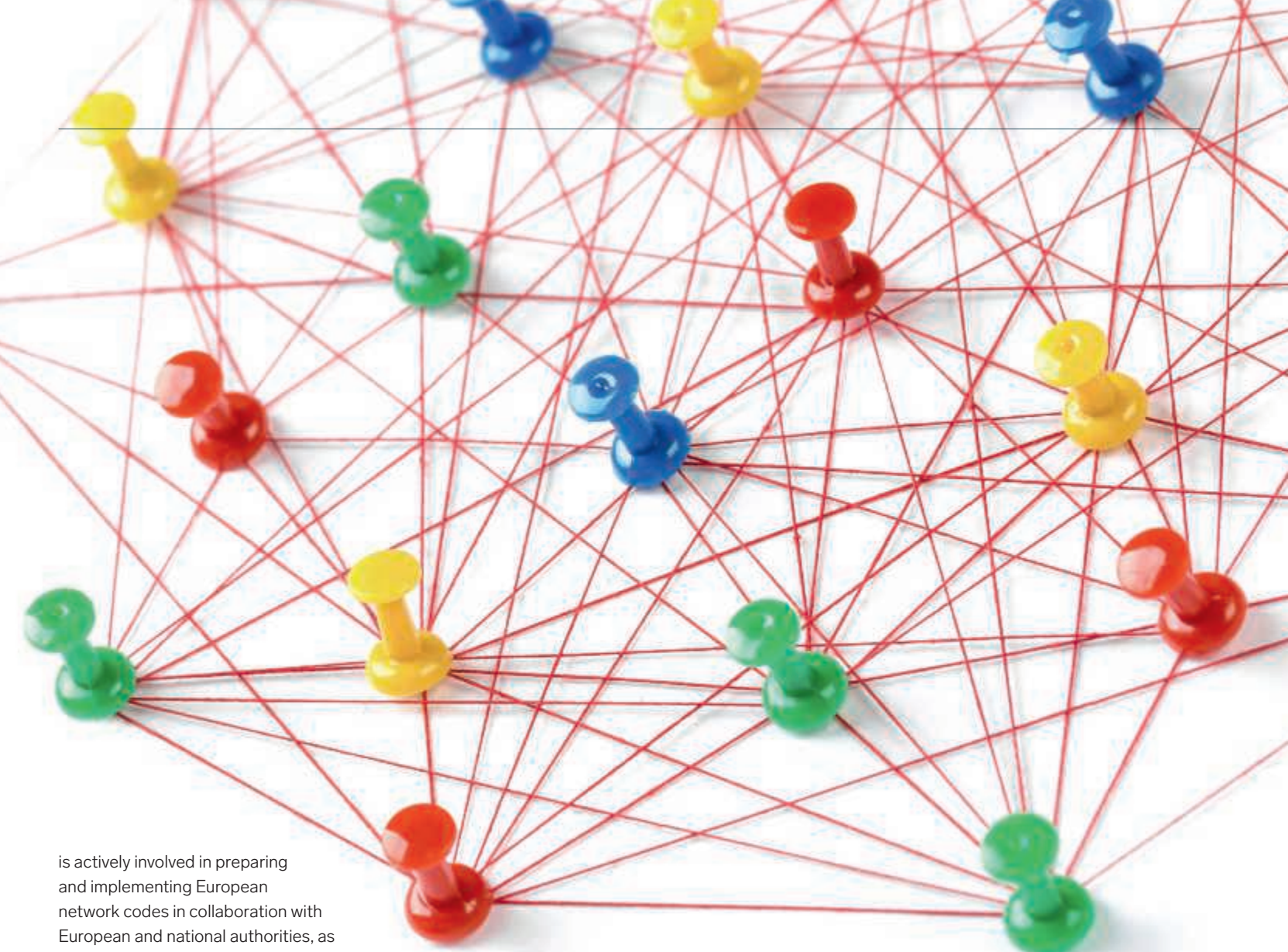
"Fingrid's committees are advisory organs that form a link between Fingrid and representatives of its various customer groups, which include electricity generators, distributors, consumers, retailers and other electricity market operators. The committees give their views on Fingrid's operations and the services it offers to customers," Jyrinsalo says.

The committees have 12 members, and they meet four times per year.

"Active collaboration with customers promotes the market-based development of the power system. Ensuring the market-based approach benefits customers and the national economy and enables the cost-effective transition to a clean electricity system," Jyrinsalo says.

BALANCING OBLIGATIONS AND CUSTOMER ORIENTATION

As a national transmission system operator, Fingrid has many other stakeholders besides its customers, and it is essential to engage in regular discussions with these stakeholders. Fingrid



is actively involved in preparing and implementing European network codes in collaboration with European and national authorities, as well as other transmission system operators.

Decisions on European network codes and regional market rules materially affect the electricity market and customers.

“In terms of communications, we have a demanding role to play, as we are tasked with the practical implementation of numerous obligations applying to customers while also operating in a customer-oriented way. We need to be able to balance our official capacity with our customer service role,” Jussi Jyrinsalo says.

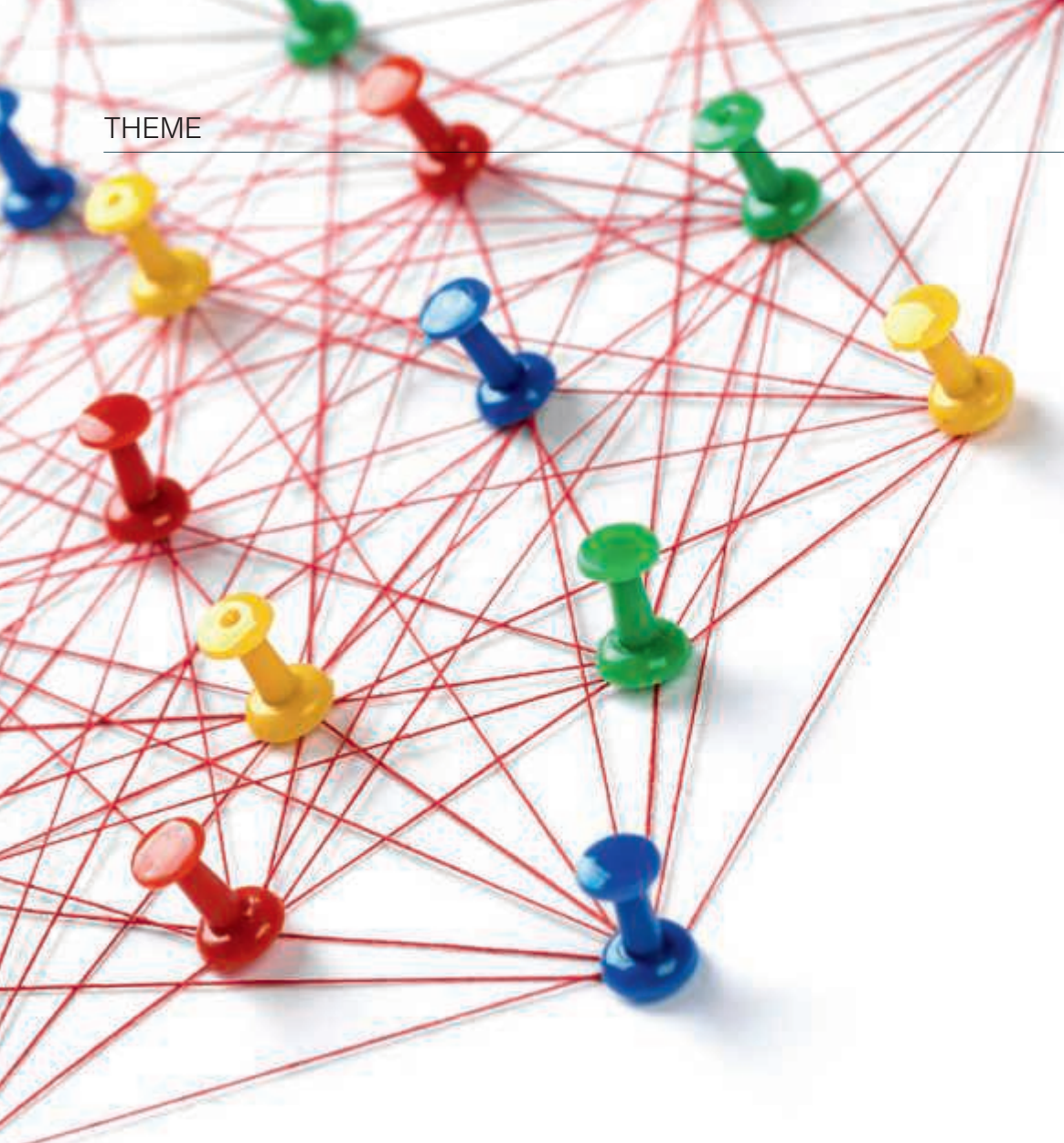
Fingrid’s stakeholders

- Political decision-makers
- Key authorities, associations, other transmission system operators
- Customers, personnel, service providers
- Owners, banks, financiers, credit rating agencies
- General public, media, landowners, institutes of higher education



“Active collaboration with customers promotes the market-based development of the power system.”

Jussi Jyrinsalo, Senior Vice President, Fingrid



Cooperation with Finnish political influencers and authorities is essential, as the goal is to develop a power system that enables Finland's climate-neutrality target to be achieved and a market-based balance to be maintained.

"Financiers, credit rating agencies and owners expect us to plan the company's finances, investments, risk management and financing over the long term. Our decision-making and operations must be based on correct and up-to-date information with the aim of ensuring efficient, productive and business activities," Jyrinsalo says.

CONTRACTORS AND SERVICE PROVIDERS – A CONTINUATION OF FINGRID IN THE FIELD

In addition to Fingrid's own personnel, hundreds of representatives of contractors and service providers are Fingrid's eyes and ears in the field.

"They provide us with valuable feedback on our activities and how they affect groups such as landowners. Contractors and service providers expect fair and timely remuneration, a safe

working environment and the chance to foresee future needs as part of our collaboration," Jussi Jyrinsalo says.

Collaboration with universities and research institutions is also a key aspect of Fingrid's stakeholder collaboration. Every year, Fingrid has approximately 50 R&D projects in progress as it seeks new innovations to enable the energy revolution. In the coming years, Fingrid's R&D activities will focus on advanced management of power system, diverse flexibility solutions, and digitalising the electricity network in order to enhance the efficiency of operation and maintenance.

CLEAR GOALS AND DIVISION OF DUTIES CLARIFY THE MESSAGE

As Fingrid has a large number of stakeholders and many forms of collaboration, there is a danger of expertise and communications becoming stuck in silos. What does Fingrid do to ensure that everyone is heading in the same direction and sharing the same message?

"It is vital for the personnel to clearly internalise our objectives and strategy to work together towards a clean electricity system. It is also important for everyone to understand their own duties as a part of the organisation. We need to be able to speak the same language as our stakeholders. Landowners value a practical approach, while politicians appreciate the bigger picture," says Jussi Jyrinsalo.

Stakeholder surveys have shown that Fingrid's communications are functional and have been improving.

"Perhaps the biggest area for improvement is in outlining, as we are working on so many different fronts with so many details," Jyrinsalo says •

Open dialogue with customers is valuable

Transmission system operators do not know everything. Nordic transmission system operators have been in the habit of preparing their proposals together before asking customers and other stakeholders for their comments.

When we do things like this, it is difficult to take into account the developments suggested by stakeholders, and the original proposal often comes into force without any changes," says **Juha Hiekkala**, Fingrid's Market Solutions Manager.

Transmission system operators often choose to see things through the prism of power system operations.

"The customers and other stakeholders who have commented on our ready-made proposals have not been happy with this procedure, and they have been sceptical about the end result," he says.

The energy revolution and the transition towards a climate-neutral power system will require major changes to take place in the power system, making it more difficult to implement changes. No single party has a chance of making changes alone.

"The energy revolution will eliminate a large proportion of the generation capacity that can be used for balancing power, and this will be replaced by wind power or other forms of generation that are difficult to balance. In the future, we will need innovative solutions to bring generation and consumption into balance. An increasingly diverse group of parties will be involved in balancing the power system. These solutions will require wide-ranging cooperation and new ideas," says Juha Hiekkala.

ATTITUDES ARE CHANGING FOR THE BETTER

Transmission system operators have begun to change their attitudes. They aim to proactively involve customers and other stakeholders in their projects. By taking a more diverse approach to planning, different stakeholders have a better chance of influencing the end result.

Fingrid has been strongly involved in changing the attitudes of transmission system

operators, and Juha Hiekkala says that one example of this is the development work on the Nordic balance management project.

"The customer perspective is now given deeper consideration, and customers' views are taken seriously. This has not traditionally been among the strong points of Nordic cooperation. Now we are heading in the right direction," he says.

"However, a cautious approach continues to prevail on Nordic projects, and the parties shy away from proactivity, which hinders the process of opening things up to stakeholders," Juha Hiekkala continues.

Although customers have a positive impression of Fingrid's customer collaboration as a transmission system operator, the feedback for Nordic cooperation has been critical. In this regard, Nordic projects are also challenging for Fingrid, as the cultural differences between the countries and the methods of working with customers need to be blended together.

ACTIVE CUSTOMER BASE DRIVES REFORM

According to Juha Hiekkala, a good example of the inclusion of customer perspectives in electricity market development is the reform of the maintenance process for cross-border connections.

"Active customers questioned the established practices and brainstormed alternatives," he says.

Maintenance management for cross-border connections was previously conducted on weekdays during office hours.

"Efforts were made to time any necessary outages so they coincided with times of statistically low transmission," Juha Hiekkala says.

In the run-up to the mid-2010s, the demand for transmission on cross-border connections began increasing, and customers became interested in the availability of cross-border connections.

"It was a constant theme in the Market Committee," he says.

Fingrid took note of customer feedback and began enhancing the maintenance management process from a broader perspective by reviewing proposed ideas and developing new ones.

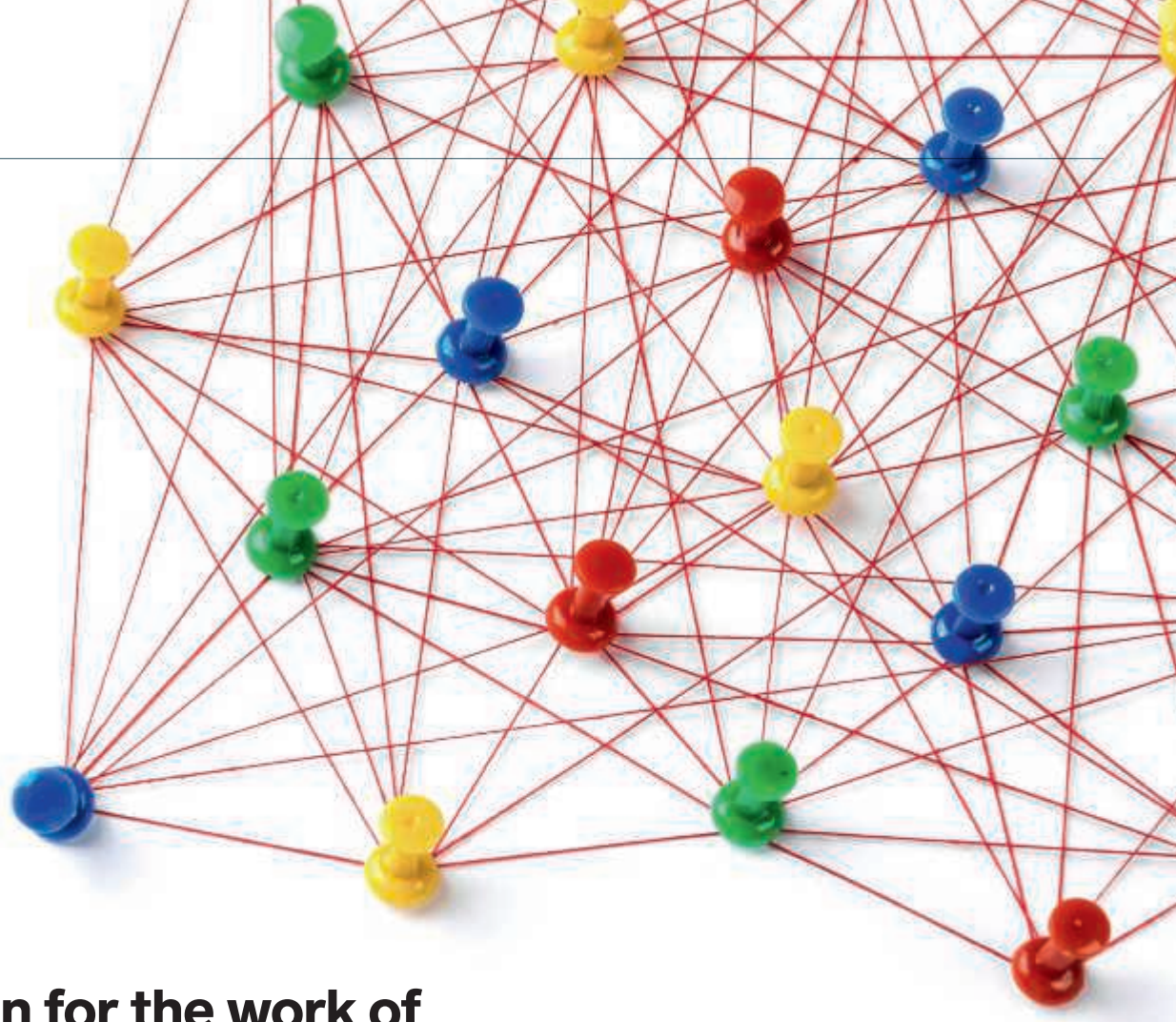
"The availability of cross-border connections is now world-class. Outages are scheduled on the basis of a market simulation, and we strive to avoid outages during office hours. At the same time, we have created the capacity to react to unforeseen faults," says Juha Hiekkala.

"Without our active customers, we would not be in this position. Customers should be consulted because they often have valuable practical information and good suggestions," Juha Hiekkala says. •



"Thanks to our customers, the maintenance management schedule for cross-border connections was changed."

Juha Hiekkala, Market Solutions Manager, Fingrid



VATTENFALL: Appreciation for the work of customer committees

Customers appreciate the open dialogue in Fingrid's customer committees. According to the companies involved, committee work is an effective way of sharing views about the operating environment in the energy sector and discussing questions related to the energy revolution.

At present, Fingrid has three customer committees: the Main-Grid Committee, and the Market Committee.

These advisory organs convene four times per year.

According to **Elina Kivioja**, Vattenfall's CEO and ex chair of the Advisory Committee nominated by Fingrid's Board of Directors, there was a good team spirit in the Advisory Committee, and it was possible to openly discuss themes of concern for customers.

"The quality of discussion has improved in recent times, and customers have also been proactive in posing questions for the transmission system operator to give its views on," Kivioja says.

She says that the reports provided by **Jukka Ruusunen**, Fingrid's President & CEO, about Fingrid's latest projects and development sites

contain important information about upcoming projects and help customers to plan and schedule their own future investments.

NORDIC TRANSMISSION SYSTEM OPERATORS COULD TAKE INSPIRATION

Elina Kivioja praises Fingrid for its customer-oriented approach, which is exemplified by the collaboration on the work in North Karelia to renew main grid transmission lines and build a

new substation to ensure that Vattenfall's Pamilo hydroelectric power plant can operate without disturbances.

"Fingrid asked us to give our views and took them into consideration during the planning phase. The projects have progressed as expected. Other Nordic transmission system operators could learn from Fingrid's customer-oriented approach," Kivioja says. •



"Other Nordic transmission system operators could learn from Fingrid's customer-oriented approach."

Elina Kivioja, CEO, Vattenfall



OULU ENERGY: Networking and interaction

Oulu Energy's Director of Sustainability and HR, Katja Virkkunen, has chaired Fingrid's Main Grid Committee. She values the exchange of information between the representatives of network operators, industry and production when the committee convenes four times per year.

The committee's meetings are themed around topical issues, leading to a more structured way of working, as the committee members can prepare in greater depth before each meeting.

"Discussions have been very active, and they have promoted networking between operators in the sector," **Katja Virkkunen** says.

The coronavirus pandemic has forced the committee to meet online instead of in person, but communication has remained good despite the extraordinary circumstances.

FINGRID ALSO HAS A STRONG REGIONAL PRESENCE

Katja Virkkunen describes the collaboration with Fingrid as vital, as Oulu Energy is working on several substantial investment projects for which solid collaboration with the transmission system operator is essential.

"Connecting our new bioenergy power plant to the grid is a big thing for us. Fingrid has worked with us to ensure that the power plant meets the grid system's requirements," she says.

Advance information on Fingrid's large upcoming substation investments has also helped Oulu Energy to coordinate its own future investments.

"When we work together, we can synchronise our schedules and minimise the outages suffered by customers," Virkkunen continues.

Katja Virkkunen also appreciates Fingrid's active involvement in the regional power area

committee for Northern Finland and its work in the regional risk assessment working group.

"Improving contingency planning and analysing risk assessments are key themes for a society that is increasingly reliant on electricity. It is important that we work together to consider how we can prevent or minimise the duration of disturbances and ensure rapid power restoration in the event of a problem," she says.

CONSTRUCTIVE FEEDBACK FOR THE DATAHUB PROJECT

According to Oulu Energy's Katja Virkkunen, the introduction of Datahub, Fingrid's centralised information exchange system, demands close dialogue with every operator in the sector with regard to the energy revolution and the future development of the operating environment. Virkkunen also has some constructive feedback to offer to the Datahub project.

"Datahub has undergone some challenges during its development, but things are now moving in the right direction. As the project progresses, the companies associated with the project have had the opportunity to voice their opinions, but it remains a little unclear how these matters have been taken into consideration. This may be more of a communication difficulty. Now that the system suppliers have been included in the dialogue to a greater extent, there has been faster and more favourable progress," Virkkunen says. •



"Connecting our new bioenergy power plant to the grid is a big thing for us. Fingrid has worked with us to ensure that the power plant meets the grid system's requirements."

Katja Virkkunen, Director of Sustainability and HR, Oulu Energy

Closer Nordic collaboration

Nordic RSC, the joint Regional Security Coordinator office of the Nordic transmission system operators, offers transmission system operators regional analysis in support of operational planning and implements a new method for calculating capacity based on transmission.

TEXT | OLLI MANNINEN

PHOTO | ISTOCK

The Nordic RSC, which was established in 2016, provides transmission system operators with a joint regional overview of the network's operating status. In practice, the Nordic transmission system operators deliver forecast and network modelling data to Nordic RSC, which analyses the data at its office in Copenhagen, Denmark, and provides the results as a service to support the decision-making of transmission system operators.

Nordic RSC's services include coordinated calculation of transmission capacity, system security analysis, coordination of transmission outages, consolidation of the common grid model, and short-term electricity adequacy forecasts.

"Services offering a regional overview of the network's operation will become more important in the future as energy markets are increasingly decentralised and more closely interconnected," says **Tuomas Mattila**, Specialist at Fingrid, describing the importance of Nordic RSC's services.

Shared information and agreed analysis methods can guarantee a reliable Nordic power system throughout the energy revolution, as electricity generation will vary according to the weather conditions rather than plans.

NEW METHOD FOR CALCULATING TRANSMISSION CAPACITY IN THE TESTING PHASE

The most significant Nordic RSC project is the procurement and deployment of a calculation tool related to a new method for calculating



transmission capacity. This Nordic project will incorporate the flow-based method into capacity calculation, initially for the day-ahead market and later also for the intraday market.

The project is currently in the testing phase, after which parallel operation will begin. The objective of parallel operation is to verify the functionality of the method and provide market parties with information about the results of the new method.

“The new calculation method is more accurate and up-to-date than the previous one. It can be used to distribute capacities to the market more efficiently while retaining a good standard of grid reliability,” says Fingrid’s RSC Engineer, **Tuukka Huikari**.

AIMING FOR A REGIONAL COORDINATION CENTRE IN 2022

Three specialists from each of the four Nordic transmission system operators work at the Nordic RSC office in addition to the office’s own employees and a group of external consultants.

“The forms of work include various work-

The most significant Nordic RSC project is the procurement and deployment of a calculation tool related to a new method for calculating transmission capacity.

shops, most of which have been held via remote connections during the coronavirus pandemic. This form of collaboration works well when the agenda is focused and precisely defined,” says Tuukka Huikari.

According to Nordic RSC’s manager, **Jens Møller Birkebæk**, the joint office of the Nordic transmission system operators needs to take on a new role in the future.

“According to EU guidelines, in July 2022 the office will become a Regional Coordination

Centre owned by the transmission system operators. Its sphere of operations will be greater than it is now,” Birkebæk says.

The change will also make the RSC a more independent organisation. •

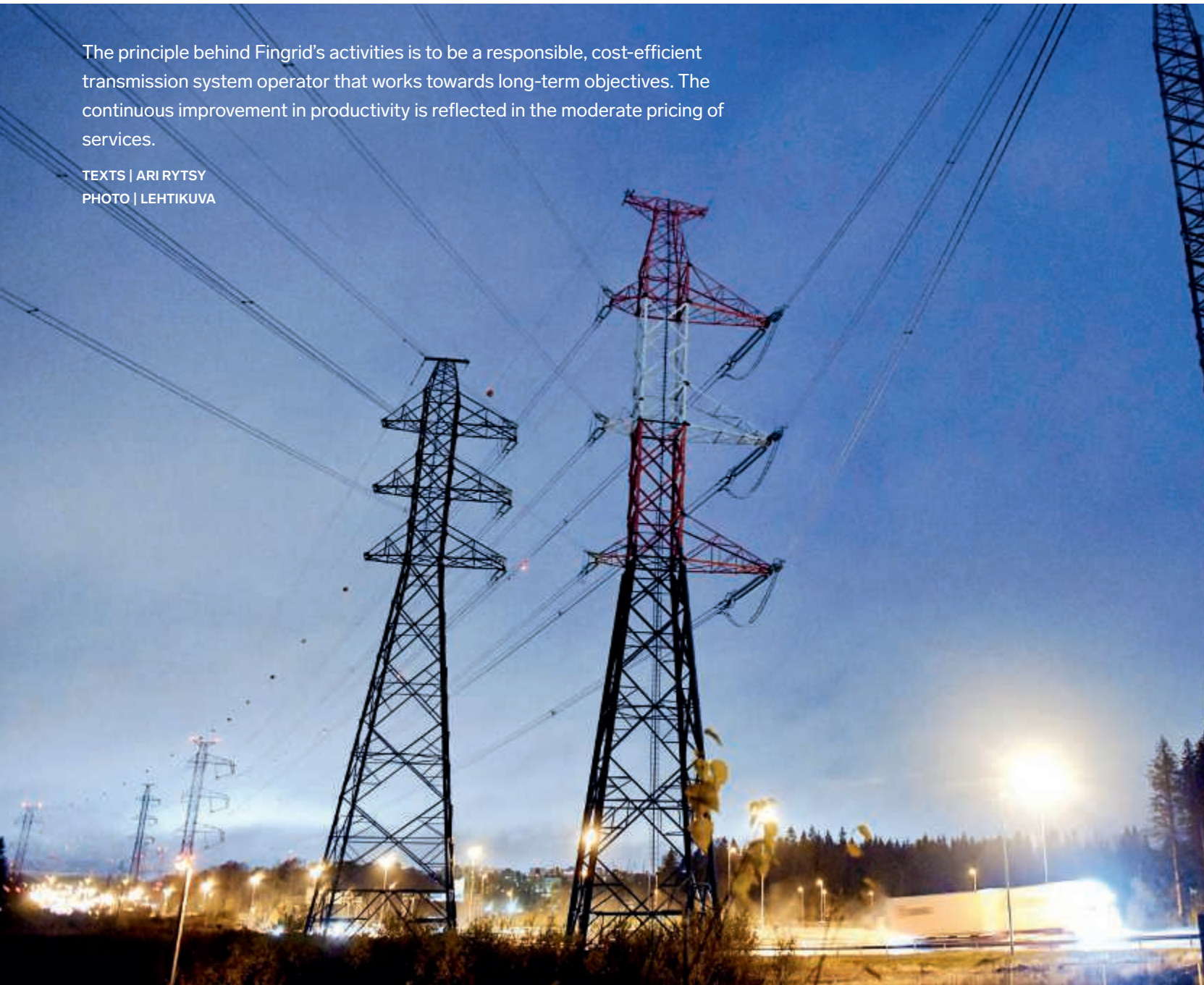
Flow based for beginners on Youtube:
www.youtube.com/user/FingridOyj



Responsibility and efficiency are the hallmarks of Fingrid's corporate culture

The principle behind Fingrid's activities is to be a responsible, cost-efficient transmission system operator that works towards long-term objectives. The continuous improvement in productivity is reflected in the moderate pricing of services.

TEXTS | ARI RYTSY
PHOTO | LEHTIKUVA





“We focus on fulfilling the duties assigned to us by the Electricity Market Act as effectively and cost-efficiently as we can.”

Jan Montell, CFO, Fingrid



Fingrid’s cost-efficiency and good risk management explain why international studies rank it among the top companies in terms of the pricing and quality of main grid operations year after year. According to a study by the European Network of Transmission System Operators for Electricity (ENTSO-E) in 2019, the transmission tariffs for electricity on Finland’s main grid are the third lowest in Europe.

Fingrid’s cost-efficiency is the outcome of an operating model whereby the company focuses on its core expertise and outsources the construction and maintenance of the power network to selected partners. Fingrid also engages in active planning work with its customers and innovates in a number of ways, such as working on projects with start-ups. This leads to better, more cost-efficient solutions in areas such as main grid investment and development work.

“Fingrid’s corporate culture emphasises its clear strategy and strict financial management. We do not aim for growth and new business activities – instead, we focus on fulfilling the duties assigned to us by the Electricity Market Act as effectively and cost-efficiently as we can. All of our investments take account of the big picture and future needs,” says **Jan Montell**, Fingrid’s CFO.

MANAGEMENT STRUCTURES UNDERPIN OPERATIONAL EFFICIENCY

Fingrid has centralised its monitoring and control of the main grid on a single site, thereby increasing efficiency and improving the management of the power network. Fingrid’s motivated and highly qualified personnel also plays a key role. The specialist organisation is managed in a matrix structure to ensure collaboration, as well as agile and efficient operations across organisational boundaries.

“Fingrid’s personnel is a crucial resource. A further significant factor is data, which has grown in importance in recent years. There can be no digitalisation without data, so the data must be high in quality and available to support decision-making. For example, data enables us to develop entire processes, accelerate lead times, and offer customers and other partners new development pathways,” says Montell.

Fingrid strives to ensure stable trends in the prices of its services by planning its finances for the long term and obtaining financing from a diverse range of sources. Strong economic and financial expertise and risk management combined with strict quality requirements are fundamental aspects of a transmission system operator’s activities and its capacity to safeguard continuity.

In 2017, Fingrid became the first Finnish company to issue green bonds. Green bonds are used to finance projects that are expected to have a net positive effect on the environment over the long term. The green bond projects involve connecting renewable energy generation to Fingrid’s power network, reducing transmission losses or creating smart solutions that save energy and protect the environment.

“Responsibility is the company’s most important value. It is, therefore, natural for us to use green financing, and we aim to pave the way for positive market development in this regard while also obtaining low-cost financing,” says Montell. •

Standardising substations boosts cost-efficiency

Building a substation is traditionally a slow and expensive undertaking, but the new, lightweight connecting stations increase the security of energy supply while boosting speed and cost-efficiency. The connecting station is a lighter-weight version of a main grid substation, and the costs come to approximately half those of a normal substation.

PHOTO | MIKKO NIKKINEN



Fingrid is improving the cost-efficiency of all its substations using standardisation, which means using proven standard solutions over the long term. Building everything in the same way every time will reduce project lead times and facilitate maintenance. In turn, this will be reflected in higher-quality operations and lower costs.

A major standardisation process for secondary systems is now underway, and the intention is to set the resultant models in stone for the next four to seven years.

Kimmo Muttonen, Manager of Fingrid's Secondary Systems Unit, says that configuration and device programming are the biggest jobs.

"A lot of work has gone into system testing over the last couple of years. The coronavirus has forced us to change our plans – we originally intended to carry out testing in England, but we have had to switch to a remote connection."

Fingrid's previous standardisation projects include mat foundations for reactors, which have received type approval, providing reactor suppliers with greater leeway in terms of the external dimensions of reactors. As a result, reactor losses have fallen by 33 per cent, and noise levels have decreased by five decibels.

"The standardisation of the foundations and support legs has also enabled a quicker, easier and safer method for carrying out

maintenance tasks. In addition, we are no longer reliant on individual reactor suppliers, as the same foundations are compatible with equipment available from several different manufacturers," says **Timo Ojanen**, Technical Specialist at Fingrid.

A separate standardised adapter is available for the old foundations, enabling different reactor models to be installed on existing foundations if an old reactor fails. •

Development Director Riku Ruokolahti has 20 years of experience at T-Media. The company initially focused on measuring the employer image of organisations before expanding its field of study into the analysis of key factors surrounding trust and reputation. T-Media's Trust & Reputation product has been applied in over 40 countries. In December 2020, T-Media published The Reputation Management Handbook written by Ruokolahti.



What are reputation and trust made of?

An organisation's reputation can be measured and influenced. Assertive, proactive steps should be taken to boost the organisation's reputation. If action is taken too late, it can be difficult to appear credible.

Reputation is the most valuable intangible capital in an organisation, says **Riku Ruokolahti**, Development Director at T-Media. This is why it should be measured, analysed and managed. It is unsustainable for a company to be unaware of its most valuable asset or to manage it with the heart rather than the head.

Reputation is the sum of several parts. Development and management rely on an awareness of the structure of the organisation's reputation and its implications. Naturally, the basics must be under control: the quality of products and services must be in good order. Effective management and administration ensure performance and financial stability.

The organisation's capacity for renewal is the crucial factor in maintaining a strong reputation. This demands a proactive approach and well-managed interaction and communication – even before anything damaging has occurred.

It is essential to be open and deliver on the organisation's promises. For example, if a company has pledged to become carbon-neutral by 2035, a simple notification is not enough. It must also describe the milestones it has passed and the plans it has made for progressing towards the objective.

Companies and organisations do not operate in isolation from society. Interaction with stakeholders is important. The positive contribution of stakeholders is at the heart of the company's value generation, and its reputation is built of the conceptions and interpretations of the company and its activities which these stakeholders accumulate.

The reputation and trust that the organisation enjoy can – and should – be measured. Reputations affect people's behaviour and influence the company's ability to secure the support of stakeholders, even if the information and impression that people have is not based on facts. People are not rational. The things we think we know are already true in our minds.

People are not rational. The things we think we know are already true in our minds.

Fingrid has a unique product – the maintenance of basic infrastructure has been a success when ordinary people do not notice it. Fingrid also creates trust and builds

its reputation via stakeholder relations and international networking.

Above all, Fingrid is an early adapter in the area of reputation measurement and management. The company understood the significance of being proactive and managing its reputation at a very early stage. Fingrid systematically utilises research and analytics in order to gain clarity on which areas it needs to develop in its activities and communications. All too often, companies wrongly presume that everyone out there is aware of their achievements and good intentions, as the company has a good internal awareness of them. •



"In any case, every company has a reputation, whether it is measured or not."
- The Reputation Management Handbook

Wind power seeks a foothold in the balancing electricity market

The share of electricity generated from sources that vary according to the weather is on the rise in Finland. At the same time, it is becoming increasingly challenging to maintain the balance between electricity generation and consumption in the power system. At the moment, it is important to ensure that nobody with flexible electricity generation capacity faces any financial barriers that would prevent them from participating in balancing the system.

TEXT | SAMI ANTEROINEN

PHOTO | ISTOCK

Hanni Sonkeri, Planner at Fingrid, has studied the participation of wind power in Finland's balancing electricity market. She has recently completed her Master's thesis, which found that wind power plants have the technical capability to participate in the power system balancing, but whether it is cost-effective for them to do so is still for some part uncertain.

"For this reason, wind power still accounts only a small share of the balancing electricity market, and not many parties are involved," Hanni Sonkeri says.

THE DOWN-REGULATION MARKET STIRS INTEREST

Based on Fingrid's data, only about 2.3 per cent of Finland's total wind power capacity was involved in the down-regulation market in 2019, and the down-regulation market is currently considered more favourable for wind power than the up-regulation market.

"At present, wind power actors consider down-regulation more practical as it makes more sense in terms of risks and cost-effectiveness," Sonkeri says.

"The barriers for wind power to enter the balancing electricity market should be as low as possible, as with every type of electricity generation," she adds.

Hanni Sonkeri approached the topic by interviewing dozens of Finnish wind power actors. According to them, the wind power participation in the balancing electricity market and other electricity markets will increase in the future.

"The interviewees found the subject interesting and relevant. However, there are some challenges associated with the participation, and these must be overcome before larger share of wind power would be able to participate in the market," Hanni Sonkeri says.

BALANCING ELECTRICITY MARKET:
The balancing electricity market provides resources for balancing the production and consumption of electricity in real time. Fingrid orders either up- or down-regulation on the balancing power market according to the needs of the power system..

DOWN-REGULATION:
A decrease in electricity generation or increase in consumption.

UP-REGULATION:
An increase in electricity generation or decrease in consumption..



“The interviews revealed a desire for additional information about the opportunity for wind power to participate in the balancing electricity market, as well as in other electricity marketplaces,”

Hanni Sonkeri, Planner at Fingrid

NO MAJOR TECHNICAL BARRIERS

What is holding the wind power actors back? – The Master’s thesis states that among others the current subsidies for wind power generation, the operating methods of wind power plants and contractual arrangements between the parties affect participation possibilities of wind power in the balancing electricity market.

“The main challenges preventing wind power from entering the balancing electricity market are mostly related to the activities of the wind power actors and their general knowledge of the participation possibilities,” says Sonkeri. She adds that the way the balancing market currently works does not create any major barriers for the wind power participation.

“In addition, wind power is operated in a fairly distributed way, which makes the operation more challenging and highlights the need of interfaces and good connections between them. However, the actors have become more aware of this problem.”

CHANGE IS AROUND THE CORNER

Despite the challenges prevailing in the present state, wind power actors are willing to seek change if it can be reasonably made.

“The interviews revealed a desire among the wind power actors for additional information about the opportunity for wind power to participate in the balancing electricity market, as well as in other electricity marketplaces,” Hanni Sonkeri says.

She thinks that Fingrid should improve communication targeted towards the wind power actors on a practical level in a form such as webinars or workshops.

“The improved information exchange between the wind power actors and Fingrid would also be beneficial for the operators in the Main Grid Control Centre,” she states. She adds that also increased amount of real-time published market data for the market participants would improve the opportunities for wind power actors to participate.

“Furthermore, the development of the balancing capacity market in the down-regulation side is one possible measure that could be considered in order to ensure that the power system has sufficient balancing capacity.”

AUTOMATION PROVIDES A BOOST

Hanni Sonkeri points out that eventually, the price levels in the balancing market and in other

electricity markets will determine the profitability of wind power participation in the balancing market – and she is optimistic about that development. In addition to parties sharing their information and experiences about the wind power participation in the balancing electricity market, automation of processes is constantly levelling the playing field.

“The fact that it is already profitable for market-based wind power to participate in the balancing electricity market is a big deal.” •



More information is needed about the balancing power market

EPV Energy is one of the trailblazers in industrial-scale wind power generation in Finland: in 2019, approximately 17.4 per cent of EPV's energy was generated from wind power. EPV Windpower Ltd has wind farms in Teuva, Vaasa, Ilmajoki and Kristinestad.

TEXTS | SAMI ANTEROINEN

PHOTOS | KAISA SIREN / LEHTIKUVA, FINNISH WIND POWER ASSOCIATION

Teuva will soon have more generating capacity, as we are currently building 21 new wind power plants," says **Reima Neva**, Vice President of Energy Management at EPV Energy.

The Teuva project is a market-based wind power investment with no public subsidies. Neva says that this will be noteworthy going forward:

"The owners are now making decisions based on the market price."

According to Reima Neva, EPV Energy has been participating in the balancing power market – in practice, mainly the down-regulation market – "to some degree".

"We have different modes of energy generation, ranging from nuclear power and CHP plants to hydroelectric power, and we act as a

balance responsible party. We aim to participate in markets in every way."

Neva, who is a member of Fingrid's electricity market committee, notes that risk management plays a crucial role in energy generation. For wind power, the price of imbalance power constitutes a particularly large risk, as the output cannot be controlled in the same way as with other modes of generation.

According to Neva, wind power also indirectly carries capacity risks that could affect society as a whole. As such, operations have their own political risks – how can operators react to disruptions?

"If the market were more transparent, it would not take much to reduce the probability of high imbalance power prices. More real-time

data on prices in the balancing power market, realised volumes and offer book volumes could help to balance out the entire electricity system," Reima Neva says.

This could lead to quicker reactions in the event of shortages of various types in the balancing power market, as well as the intraday market. Fingrid has already made occasional efforts in this direction under certain circumstances, Neva points out.

"These activities could be continuous, and trading between operators could be possible until the beginning of an imbalance settlement period."

According to Reima Neva, it is critical to the onward development of the ground rules that every type of operator is treated impartially.



“The transition to a single-balance model will be a step forward for the commercial balancing of wind power generation when it becomes possible to make direct use of consumption units to compensate for imbalances.”

This will enable electricity to be consumed for heating, as well as a broader overall optimisation of energy generation and consumption.

“For this reason, it is very important for generation and consumption to be treated on equal terms from the perspective of imbalance power costs,” says EPV Energy’s Reima Neva. •



Wind power sector still has plenty to learn about how the balancing power market works

Anni Mikkonen, CEO of the Finnish Wind Power Association, says that the wind power sector still has plenty to learn about how to operate in the balancing power market.

Down-regulation is the principal market for wind power operators, and even that is not particularly significant at the moment,” **Anni Mikkonen** says.

However, the wind of change has already begun to blow: Mikkonen believes that the price of electricity will fluctuate in the 2020s so much that many operators in the wind power sector will identify new business opportunities.

“Wind power operators are keeping a close eye on electricity price trends, and they will participate more actively in the balancing power market.”

She also hopes that the debate surrounding the balancing power market will become more active.

“Hanni Sonkeri’s Master’s thesis on wind power in the balancing power market was a welcome contribution to the discussion,” she says.

“WORK LIKE THIS WILL DRIVE THE MARKET FORWARD.”

The current state of wind power may be stronger than ever. For example, Finnish Energy’s annual Energy Attitudes survey found that wind power is the most popular form of industrial-scale electricity generation, and the second-most popular of all types of electricity generation, just behind solar power.

“The proliferation of inexpensive wind power will reduce prices on the electricity market,” Anni Mikkonen says.

“The large amount of new wind power capacity that will be built in the coming years will cause further price drops,” she says.

What is the future of wind power generation? – For an indication of this, we can look to a study conducted by Gasum on assignment from the Finnish Wind Power Association. The study, which was published in October 2020, found that Finland’s electricity system will have 25–30 terawatt-hours of annual wind power output in 2030.

“The outcome of the study underpins the Association’s goal of having enough wind power to cover 30 per cent of Finland’s electricity consumption by the turn of the next decade,” Anni Mikkonen says.

She is satisfied with the current pace of growth of wind power capacity through market-based investments.

“We know that many companies are currently preparing investment decisions, so the rate of growth in the coming years will be even higher than we can currently infer on the basis of the investment decisions that have been published.”

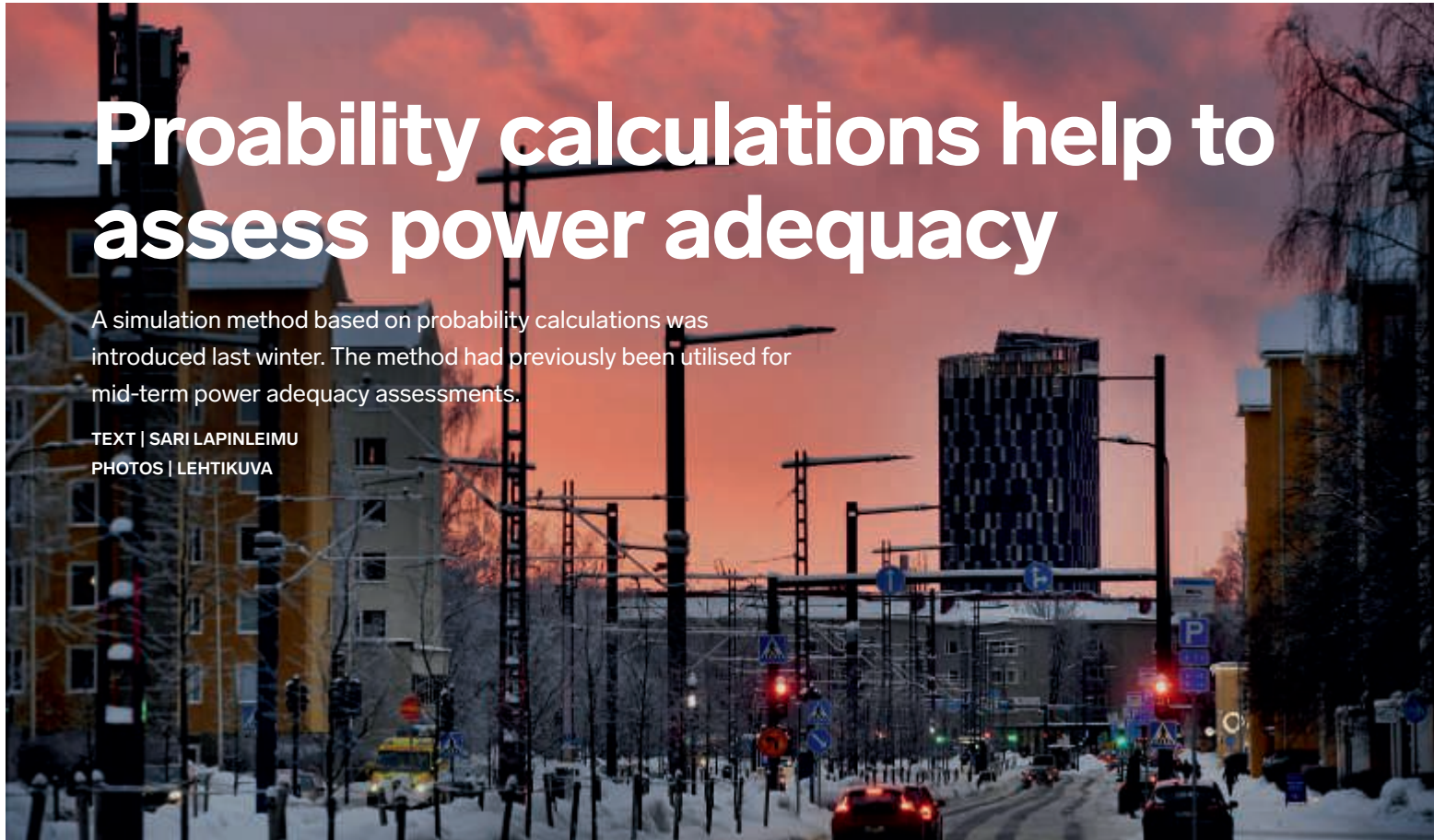
Anni Mikkonen says that technological advancements have reduced the costs of wind power generation to such a level that we will soon see “Wind Power 2.0”.

“The technology has developed dramatically over the last ten years – or even over the last five years,” she says. •

Probability calculations help to assess power adequacy

A simulation method based on probability calculations was introduced last winter. The method had previously been utilised for mid-term power adequacy assessments.

TEXT | SARI LAPINLEIMU
PHOTOS | LEHTIKUVA



Looking after the power system of Finland – and keeping generation and consumption in balance – requires lessons to be learnt from the past and forecasts to be made for the future. Historical hourly data is available for the past three decades or more, and hourly forecasts are made for the next ten years.

“Power adequacy analyses under ENTSO-E are prepared for the short- and long-term. In Finland, the analysis that attracts the most interest is the Winter Outlook, which is always

prepared for the following winter,” says **Esa Äärinen**, Specialist at Fingrid.

The methods for estimating electricity consumption and the adequacy of generation have improved at pace in recent years. Äärinen says that the main reason for developing these methods is the increase in power generated from renewable sources that are dependent on the weather, especially wind power, and the decline in regulating power generated from fossil fuels.

“For example, the Winter Outlook traditionally used addition and subtraction. The ade-

quacy of energy generation has been estimated by adding together the available capacities of generation plants and cross-border connections and then subtracting an estimate of peak consumption in the winter. Alongside this, a new method has been introduced using probability calculations and market simulations,” he says.

The transition phase is currently underway, and the traditional and new methods are being used side-by-side. In the future, the simulation model based on probability calculation will be developed more also in ERAA analyses stretching further into the future.

“In the future, long-term analyses in ERAA will be able to take into consideration the impacts of climate change on electricity generation and consumption. Furthermore, the analysis will include an economic viability assessment. In other words, it will provide an estimate if the forecasted generating capacity trends are feasible. When the new method is fully in use, we will use it to simulate the next ten years; this year, we will analyse target years 2025 and 2030,” Äärinen explains.

“The Winter Outlook helps us to prepare for the coming winter. Last year, it estimated that the greatest risk of this winter would occur in week two. It just so happened that one of this winter’s consumption peaks took place then.”

Esa Äärinen, Specialist at Fingrid

ENTSO-E (European Network of Transmission System Operators for Electricity). A collaboration organisation for European transmission system operators that began operating in 2009 with the aim of developing the EU's electricity markets and improving collaboration between transmission system operators.

Winter Outlook. A report published by ENTSO-E containing analyses and forecasts of the adequacy of electricity in the coming winter based on probability calculations. The analysis takes into consideration the fluctuations in electricity consumption and generation due to the weather, as well as failures in power plants and interconnectors.

ERAA (European Resource Adequacy Assessment). A report that ENTSO-E compiles based on information provided by transmission system operators in various countries. The ERAA's power adequacy analyses cover the coming ten years. New legislation calls for the ERAA to be used to determine the need for capacity mechanisms in the future. ERAA replaces the previous Mid-term Adequacy Forecast (MAF).

HOW IT WORKS

Historical data on the weather conditions, including wind speeds, temperatures and hours of sunshine, is analysed. These variables help to define distinctive generation and consumption profiles for different regions.

"Based on the profiles, we can estimate the conditions at different times: how much energy would be generated in these conditions using different capacities? Similarly, consumption patterns are estimated based on temperatures. In the market simulation, demand-side response is guided by the price. Furthermore, the calculations take into consideration the frequency of forced outages at power plants and interconnectors," Esa Äärynen says.

Finally, the weather and fault profiles are used to simulate the market and assess whether the amount of electricity will be sufficient in the future. This provides a highly comprehensive estimate of the future.

"In the next Winter Outlook, the prevailing circumstances are entered into the market model. Planned outages are taken into consideration, and the estimates will be as accurate as possible. Naturally, estimates reaching ten years into the future contain more assumptions about the development of the electricity system," he says. •

Turning weather forecasts into megawatts

Short-term generation and consumption forecasts are based on weather forecasts purchased from commercial operators. Fingrid refines the weather forecasts to produce electrotechnical quantities such as wind power generation and consumption volumes.

Fingrid's Specialist **Mika Laatikainen** makes forecasts to optimise the use of the network in the week ahead.

High-quality forecasts enable the Main Grid Control Centre to maintain an excellent standard of system security now and in the future.

"The forecasts estimate electricity transfers via the cross-border connections and over internal connections within Finland. This ensures that we do not breach the thresholds set for ensuring system security. The forecasts are also used to monitor the balance between generation and consumption in Finland," he says.

Short-term estimates of electricity consumption and generation are created using ready-made weather forecasts from commercial providers. Information is purchased from several sources in order to minimise the number and impact of errors.

ASSISTED BY FORECASTING SYSTEMS

Fingrid transforms the weather forecasts it receives from service providers into megawatts of electricity. Forecasting systems analyse this weather data, interpreting the significance of temperature, air pressure, wind direction and wind speed.

"When the forecasting system has finished its analysis, Fingrid verifies that the result makes sense. This is largely based on our knowledge of Finland's main grid and the ability to keep up with the pace of change in the sector. For example, we need to know when new wind farms will come

online," Mika Laatikainen says.

Forecasts are also purchased from commercial service providers to support the data created by the forecasting system. These outsourced forecasts are used to compare the results – if the differences are substantial, the average of the results is used.

INCREASE IN WIND POWER PRESENTS A CHALLENGE

The amount of wind power, which fluctuates according to the weather and is difficult to predict, has increased rapidly and become increasingly important for forecasting. This makes the work more challenging.

"We have a forecasting system based on numerical weather forecasting which is widely used in the sector. Our outsourced services leverage machine-learning models that have been in use for a few years," Laatikainen says.

"Our consumption forecast is already very accurate: the margin of error is just a couple of per cent, which equates to about 200 megawatts. This corresponds to the electricity consumption of a medium-sized town or a large paper mill. However, the models need to be constantly developed because even a small error can multiply in size as the volumes of consumption and volatile, weather-dependent generation increase," Laatikainen states.

The data produced by Fingrid is also freely shared with companies and private individuals. The data is available at data.fingrid.fi

"We strive to continuously improve the quality of our forecasts: even a minor error can become significant if it multiplies in size."

Mika Laatikainen, Specialist, Fingrid



Why is data management important for the energy sector?

Fingrid's Head of Business Development, Mikko Järvenpää, answers the questions.

TEXT | PÄIVI BRINK

PHOTO | ISTOCK

WHAT DOES DATA MANAGEMENT MEAN IN THE ENERGY SECTOR?

Data is a critically important form of capital, the foundation of digitalisation and a prerequisite for high-quality expert work. The energy revolution calls for investments to be made in data centralisation, refinement and dissemination. Cost-efficiency and time-savings can be realised by automating processes with the help of data. Electricity generation and consumption must be kept in balance, and the electricity market needs better situational awareness. It is also important in terms of asset management to invest in building a digital twin of the physical network. Ultimately, it all comes down to reliable and inexpensive electricity for our customers.

HAS THE IMPORTANCE OF DATA MANAGEMENT AND QUALITY CHANGED OVER TIME?

The energy revolution that is now underway will further increase the importance of access

to realistic, real-time data. As more and more renewable energy comes online, the quality and availability of data used for purposes such as forecasting will become more important. Smart electricity networks and sector integration require data in order to work. The electricity market can only function properly if everyone is looking at the same data. The data update cycle will be accelerated by the transition to a 15-minute imbalance settlement period, among other things.

WHO IS RESPONSIBLE FOR DATA MANAGEMENT AT FINGRID?

Every Fingrid employee produces data and uses it, so, in a way, we are all responsible for data management. The company's data capital is divided into domains, and the development of these domains is coordinated by the data management group. The owners of data areas are obliged to ensure that the data in their areas is provided as a service to our customers and

for our own use. Responsibility for key data concerning each identified company has been delegated to nominated personnel who are responsible for the quality and availability of data beyond individual systems and processes. Fingrid also has people responsible for analytics and technical data work.

WHO USES DATA?

Fingrid's entire organisation uses the data we produce. Our customers produce data on our shared system, and they also use it via the My Fingrid service. Our services for customers include an open data service. Our service providers also produce and use data that is shared with them. We also share information with regulatory bodies, such as the Energy Authority, on a regular basis. •

What is data management? See our video:
www.youtube.com/user/FingridOyj

Examples of successful Fingrid data management:

Asset data management

Fingrid's Unit Manager Marcus Stenstrand: The digital twin of the main grid should be treated with the same requirements as the physical network, and the data model must always be aligned with the physical network. All of Fingrid's decision-making is based on the data that we have on various systems. Even the best experts' decisions are no better than the quality of the data. IoT has generated a huge amount of data, which is used in a highly sophisticated way – a lot of calculations are performed in order to obtain significant results from it.



Network map

Fingrid's Expert Pasi Turunen: The network map is a good example of asset data management. It is an application that presents the data on Fingrid's ELVIS asset management system in visual form on a map. When information is updated on the ELVIS system, it is automatically transferred to the network map. The network map is used by Fingrid's employees, service providers working on the main grid, and our customers. We can see the information we share with others, and we can correct any errors in the data. When data is presented visually, the errors are easy to identify. Users have access to the same, reliable, up-to-date data.

kartta.fingrid.fi

My Fingrid for Partners

Fingrid's Project Manager Hannu Hätönen: My Fingrid for Partners, which is primarily intended for service providers, serves as a platform for exchanging information about progress on substation, transmission line and maintenance projects. My Fingrid for Partners is connected to Fingrid's other document management systems, and information is transferred between the systems automatically. As such, everyone who needs information has access to the same, up-to-date information, without the confusion of having different versions of the same document. We are constantly improving the functionality of this service, which began operating last year.

partners.fingrid.fi

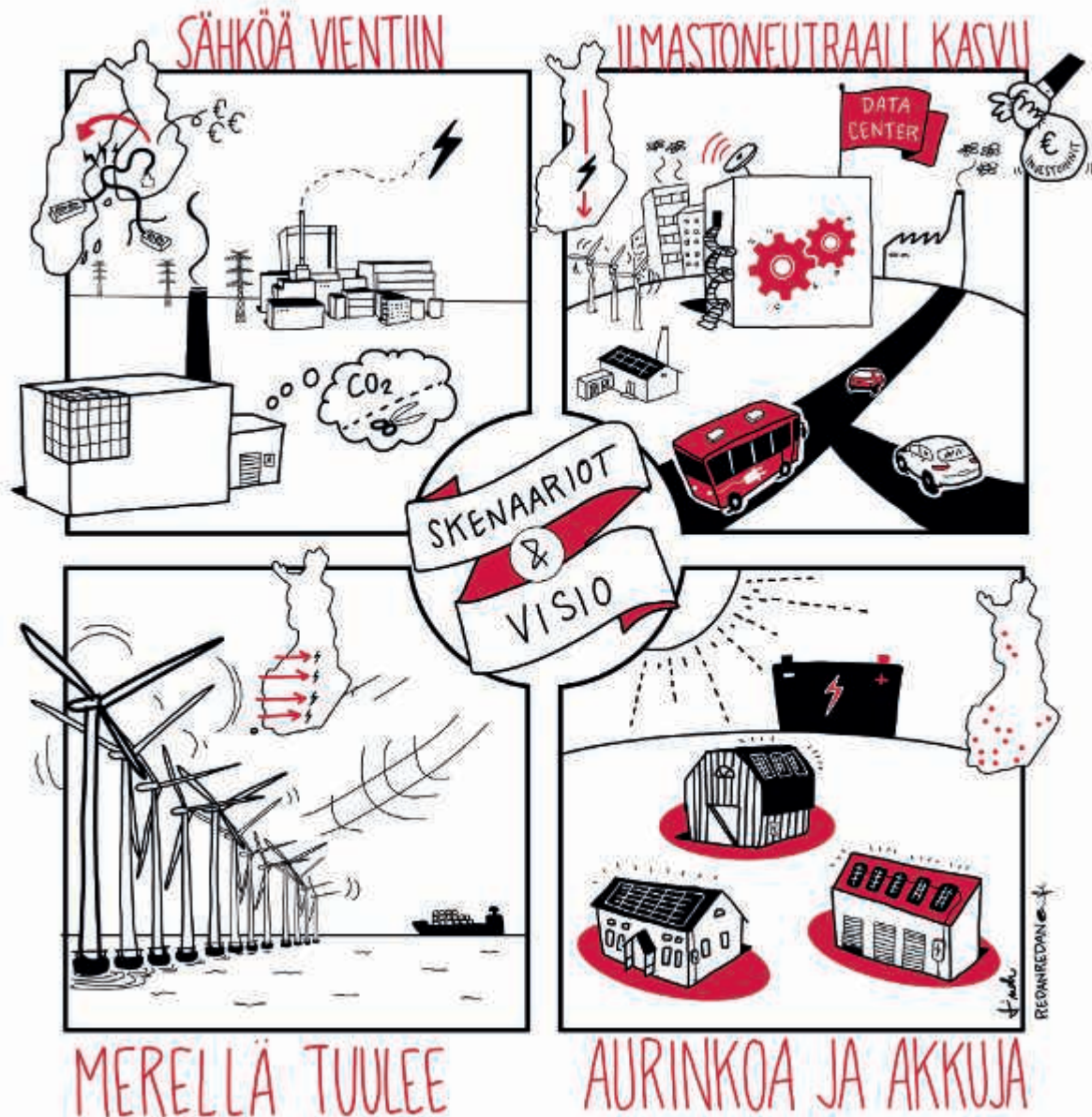


Reaching the climate objectives will require significant investments in the main grid

Fingrid's network vision analyses the need to strengthen the main grid by 2035 and 2045. The electricity transmission capacity must be boosted substantially, but in terms of the main grid, the objective of a carbon-neutral Finland by 2035 is within reach.

TEXT | PÄIVI BRINK

PICTURES | LINDA SAUKKO-RAUTA





ingrid's network vision, which was published in January, reviews scenarios for future electricity consumption trends in Finland over the next 15–25 years and considers the need for electricity transmission created by the increase in consumption.

In its network vision, Fingrid estimates that Finland's target of becoming carbon neutral by 2035 will require approximately EUR 3 billion of investment in the main grid over the next 15 years. This is in line with Fingrid's current investment programme. Investments in the main grid will enable clean domestic energy generation and allow industry, transport and heating to become electric.

ENVISAGING THE FUTURE TOGETHER FOR THE FIRST TIME

Network visions are usually prepared every three years. This was the first time that the work was done with public stakeholder collaboration.

"We started by creating four different scenarios for future electricity needs in Finland, and we asked our stakeholders for feedback on them. We received some really good, well-reasoned and insightful feedback," says **Mikko**

Network vision: Finland's target of becoming carbon neutral by 2035 will require approximately EUR 3 billion of investment in the main grid over the next 15 years.

Heikkilä, Fingrid's Manager of Strategic Grid Planning.

"We made changes to the scenarios based on the feedback – for example, we increased the growth of offshore wind power – but, above all, we received confirmation that our conceptions of the future were broadly correct. The debate on our vision will continue in the spring in forums such as the Fingrid Current event and the customer committees," Mikko Heikkilä continues.

In its vision, Fingrid considers the requirements for transmission capacity on the main grid so that as many scenarios as possible would benefit from a stronger network cost-effectively.

"The need for clean energy is likely to increase significantly by 2035 as industrial processes, among others, switch from fossil fuels to electricity. In the future, the need for electricity may grow exponentially as a consequence of

energy exports or strong growth in energy-intensive industries using clean electricity," says Fingrid's Specialist, **Eveliina Seppälä**.

"The investments in the main grid will enable electricity-intensive investments to be made in Finland, and they will be essential for Finland's competitiveness as it becomes a carbon-neutral society," Eveliina Seppälä continues.

In the future, Finland will need many times more electricity transmission capacity from the north to the south than it currently has. Finland's chances of succeeding in its climate objectives will be boosted by the implementation of new electricity transmission links to Sweden and the Baltic states. Based on the vision, Fingrid will prepare a main grid development plan for the next ten years. •

Read more about the network vision:
www.fingrid.fi/verkkovisio

Network vision work involved listening carefully to



ingrid's customers praise the new, more approach to creating a network vision for the main grid. The scenarios are considered to encapsulate future electricity transmission requirements, and the vision is perceived to correspond accurately to future needs under the various alternatives.

"This way of working on the network vision, including rounds of commenting, is highly compatible with Fingrid's policy of emphasising the role of customers. In order for us to invest, we must believe that the main grid is able to respond to our future needs and those of the electricity market. SSAB aims to eliminate carbon dioxide from all of its production by 2045, and electricity will have a major role to play in reaching this goal," says **Mikko Lepistö**, SSAB's Energy Manager.

Jouni Pylvänäinen, the CEO of Kymenlaakson Sähköverkko, thinks it is good that

customer feedback is taken on board while the vision work is still underway.

"I consider this a modern way of listening to customers. All electricity networks are in a state of transition, and we cannot be sure which way trends will turn. The network vision seems like a comprehensive package, and the four scenarios aptly encapsulate future investment needs. I believe that we will be able to trust in the reliability of the main grid going forward," Pylvänäinen says.

FOCUSING ON INVESTMENT PRIORITIES

The location of investments on the main grid is significant for customers.

"It will be interesting to see whether we get any wind power plants in Southeast Finland in the future. This would reduce the need for transmission from the north to the south. The number of solar panels in our area of influence doubles every year and, in the

future, we will need to take this form of energy generation into consideration. In the vision of the future, the role of the distribution network is up for further discussion, and Fingrid's network vision provides a solid foundation for this," Pylvänäinen says.

SSAB's electricity consumption will increase up to tenfold over the next 25 years.

"The main grid vision could contain more plans for the northernmost parts of Finland. About one-third of Finland's territory still has fairly poor electricity network coverage. The electricity market functions better with larger uniform price areas. For this reason, it is important to have enough import and export connections. The main grid is an enabler of electrification – in the future, it will need to connect significantly more electricity generators with consumers," Lepistö summarises. •



The Western Boulevard City will change the face of Helsinki's electricity network

The urban Western Boulevard City planned by the City of Helsinki will require Helen Electricity Network's high-voltage overhead lines and substation in the area to be moved. This will only be possible if Fingrid, the transmission system operator, brings forward its plans to build a 400-kilovolt live power feed to the city centre. Collaboration has resulted in a solution that enables third-party schedules to be coordinated optimally.

TEXT | OLLI MANNINEN

PHOTO | VOIMA GRAPHICS/ CITY OF HELSINKI



The Western Boulevard City - Vihdintie



Rikhard Manninen, Head of the Urban Planning Division at the City of Helsinki, praises Helen Electricity Network and Fingrid for their active cooperation to identify a solution that every party can use to advance the plan for the Western Boulevard City project.

“In terms of the Western Boulevard City plan, a large tract of land will be freed up for residential development once the transmission lines are moved, and this will enable the dense and efficient construction of the area while helping the City reach its annual residential construction targets,” Manninen says.

The City of Helsinki, Helen Electricity Network Ltd and Fingrid Oyj signed a preliminary agreement on collaboration in November 2020. The overall planning phase of the project is now underway, and each party’s technical design, costs and schedule will be fine-tuned.

“The first town plans for the area have been prepared, and the plans are progressing piece by piece. Residential construction will begin in earnest in the Western Boulevard City towards the end of the 2020s,” Manninen estimates.

ROBUST POWER SUPPLY

The increased number of inhabitants and the needs of heating and transport will increase electricity consumption in Helsinki, while the volume of electricity generated in the inner city will decrease when the Hanasaari coal-fired power plant is decommissioned in 2024.

In order to safeguard the power supply, Fingrid will build a 400-kilovolt transmission line cable to Helsinki, and the most cost-efficient route for this will be from Länsisalmi in Vantaa to the new Vanhakaupunki transformer station in Viikinmäki. The transmission line cable will be completed by the end of 2026.

“The project is challenging for Fingrid, as we are working with technology that is new to us, and we are building the main grid underground in the middle of an urban environment,” says **Jussi Jyrinsalo**, Senior Vice President of Grid Planning at Fingrid.

Markku Hyvärinen, Director Of Business Development at Helen Electricity Network, describes the Western Boulevard City plan as one of the most significant joint projects that Helen has been involved in so far.

“The project will promote Helsinki’s target of realising a carbon-neutral energy system, and it also plays a part in communicating the urbanisation megatrend,” Hyvärinen says.

A SHOWROOM FOR CARBON-NEUTRAL HELSINKI

The Western Boulevard City covers an area almost four kilometres in length, beginning on Huopalahdentie at the southern end of Munkkiniemi and extending to Vihdintie via the Haaga roundabout. Rather than becoming a separate urban district, the Western Boulevard City will supplement the existing urban fabric of Munkkiniemi, Niemenmäki, Munkkivuori, Länsi-Haaga and Pitäjänmäki.

“The project will promote Helsinki’s target of realising a carbon-neutral energy system.”

Markku Hyvärinen, Director Of Business Development, Helen Electricity Network

In the future, the Western Boulevard City will be home to 14,000 new residents. New services will also be developed for the area. The Jokeri Light Rail line and an additional light rail line under construction will supplement the existing rail network in the area and improve transport connections.

The Western Boulevard City is part of Helsinki’s broader vision of a networked city of rail transport.

The aim is to make the Western Boulevard City a climate-aware construction area, which promotes low-emission construction, renewable energy generation and energy efficiency.

“The area could be described as a showroom for carbon-neutral Helsinki. The Western Boulevard City is intended to become a smart urban environment that makes intelligent use of new innovations to realise an energy system with the lowest possible emissions and create a functional, pleasant and ecologically sustainable urban environment,” says Manninen. •

Work cannot proceed without a crossing statement

Heidi Oja and Max Isaksson write crossing statements for Fingrid. In recent times, 400–500 statements have been written each year, and the rate is only increasing. But what is a crossing statement?

TEXTS | SAMI ANTEROINEN

PHOTO | PAULA LEHTO, ANTTI YRJONEN / LEHTIKUVA

Heidi Oja and Max Isaksson say that a crossing arises when a landowner wants to do work such as dig a ditch or clear a field beneath a transmission line.

“Crossings also occur when roads or car parks are built or from overhead lines and lighting if there are transmission lines in the area. Crossings are all activities or events that occur near transmission lines,” they say.

A crossing statement is required in order for a project planned in the area to be executed safely.

“This also helps to ensure that electricity transmission is not disrupted. The statement does not explicitly approve or reject any plans. Instead, it sets appropriate limits for the construction or event,” Max Isaksson summarises.

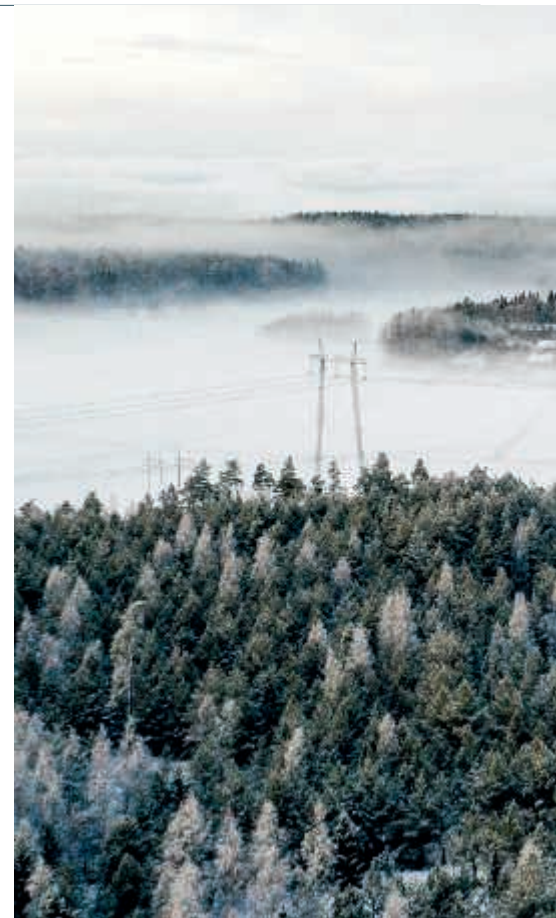
Statement requests can be sent by email, letter or on Fingrid’s map service – and people are always welcome to call, the pair say.

HIGH COMPLETION RATE

Crossing statements are always issued in writing. They come with a map showing the transmission lines and the construction site. Crossing statements provide guidelines on where and how the site can be safely built on. At present, almost all crossing sites can be implemented, as long as the plan is fine-tuned to ensure the correct safety distances.

Why are more and more statements needed? – Oja and Isaksson list a few reasons: firstly, the number of transmission lines has increased.

“The plans call for many more transmission lines to be built in the future,” Heidi Oja states.



And the more the grid is strengthened, the greater the earth fault current and earthing voltages will be. This increases the importance of coordinating crossings and transmission lines.

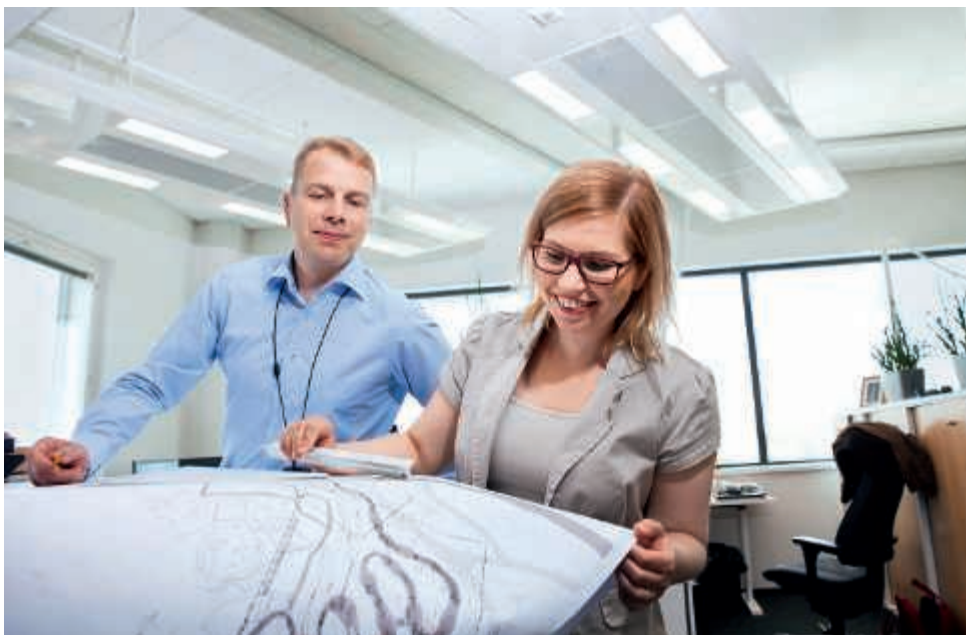
UNDERGROUND CABLES COMING SOON

Heidi Oja and Max Isaksson state that operators in the sector seeking to reduce the amount of storm damage to their networks are rapidly switching from overhead lines to underground cables, including near Fingrid’s lines.

“Nowadays, all overhead lines that cross transmission lines are being replaced by underground cables, also to facilitate the construction of our transmission lines,” Heidi Oja says.

The rate of activity in the field is further increased by the fact that a large number of cable links are built near new connection stations due to factors such as the increase in wind power generation.

According to the duo, crossing statements should be requested well in advance of the start of construction, and the statements are usually delivered on time. However, approximately once per month, a situation arises where someone sitting in a work machine phones and asks if they can start digging.





“In urgent situations like these, we strive to respond very quickly, and we have been quite successful in doing this,” Oja and Isaksson state.

In simple cases, a statement can be completed in one day, but if information needs to be collected from various parties before a statement can be prepared, the process could take several weeks.

WIDE-RANGING TEAMWORK

Heidi Oja and Max Isaksson have been preparing statements since 2007, so they have the necessary expertise to respond to extensive and complex requests. However, they do not run the whole show alone: they are currently assisted by a fixed-term planner and two part-time trainees.

“We have long had students from higher education institutions working with us, and they have been responsible for work such as mapping,” Heidi Oja says.

Fingrid’s regional organisations also provide solid support.

“Ultimately, the transmission line experts in various regions are the ones who contact customers the most,” Oja says.

“Fault current counters, line route planners and line project managers are important partners for us.” •

Streamlining the torrent of statements

‘STREAMLINING THE CROSSING statement process’ took first place in Fingrid’s internal contest among development projects – known as the Virta projects – in 2020.

Fingrid’s crossing statement function created an impact analysis tool to identify which project should be initiated first. The Virta steering group’s evaluation specifically acknowledged the help that the model provided to other parties.

Max Isaksson from the crossing statement function says that the streamlining process mainly focused on eliminating bottlenecks.

“One of these was the large amount of paper moving around the company. In this regard, we made a leap into the

digital realm in order to get rid of the unnecessary paperwork,” he says.

Another example was the effort to locate and reduce the amount of overlapping work.

“Cases like this arose when entries were made in different systems or archiving. We succeeded in cutting out a lot of unnecessary things.”

According to Max Isaksson, this thorough review of the function’s operating methods was an interesting and educational experience that will continue to bear fruit long into the future.

“We were able to deploy some of the improvements we developed immediately, while the implementation of the rest will still need to be planned.” •



Opportunity and coercion: Getting a grip on climate change

Although we have long been aware of the acceleration of climate change and its impact on biodiversity, we have only begun taking note of the economic impact in recent years.

TEXT | SARI LAPINLEIMU

PHOTO | MARKKU ULANDER / LEHTIKUVA

Did you know that pollination services are intrinsically linked to two-thirds of our food production?

“In many parts of China, apple trees are already being pollinated manually. We can only wonder how much a kilogram of Finnish apples would cost if we ended up in that position. Or the impact of the disappearance of pollinating organisms on the Finnish forest industry,” says **Riku Lumiaro**, Expert in Biodiversity and Communications.

The key method of safeguarding biodiversity is to enhance the efficiency of operations and energy consumption. Renewable energy sources and sustainably-produced raw materials also contribute to this, as well as recycling and reducing food waste.

“For example, Rudus fitted all of its heavy-duty vehicles with a mechanism that automatically prevents idling. Previously, large machines were running eight hours a day,” Lumiaro says.

“Kesko is providing financing for a project to clean up running water, and Fazer is improving

the state of the Baltic Sea. Valio’s contract farms graze their animals outdoors. And so on. Trees left in forests, marshes without draining ditches: all of these things make a big difference.”

Transport is a different matter entirely, with electricity, hydrogen, natural gas or, for example, gas from composted manure entering use.

“Carbon dioxide emissions need to be halved by 2035, and there is currently no solution for this in the heavy-duty traffic sector. There are 2.7 million cars in Finland, but only 30,000 of them are currently classified as low-emission vehicles.”



“According to the Government’s programme, Finland aims to cut the greenhouse gas emissions of domestic traffic in half by 2030.” •

A major change is required, but Lumiaro has faith in Finland’s adaptability.

“By any measure, Finland is among the top ten in the world. I am sure that we will be living good lives here a century from now: a lot has been done and continues to be done.” •



“Carbon-neutrality will require the construction of 1,200–1,300 wind power plants. The landscaping and utilisation of the land areas surrounding the power plants is of great importance.”

Riku Lumiaro, Expert in Biodiversity and Communications.

Putting transmission line rights-of-way to use

Fingrid offers landowners ideas, consulting and financial support for putting transmission line rights-of-way to use to benefit people and nature.

Although landowners may not be overjoyed at the prospect of a transmission line bisecting the landscape, it may be good for biodiversity.

“With active management, many transmission line rights-of-way can be turned into traditional habitats with a high biodiversity and scenic value,” says **Tiina Seppänen**, Expert at Fingrid.

Fingrid has worked with the Rural Women’s Advisory Organisation and Finland’s Forest Centre to produce idea cards that provide landowners with tips for putting transmission line rights-of-way to good use.

The themes of the cards include traditional habitats, saving pollinators, establishing wetlands, feeding game animals, cultivating Christmas trees, making



use of the natural products in transmission line rights-of-way, and pastoral animals that take care of the landscape.

Tangible support is also available for managing traditional habitats. The support consists of a management plan drawn up by a landscape designer for the Rural Women’s Advisory Organisation, as well as grants for parties taking care of such sites. •

Idea cards for landowners

www.fingrid.fi/ideakortit

Application for support and criteria:

www.fingrid.fi/perinnekohteet

Further information, stories and

pictures : Tiina Seppänen,

puh. 0303 95 5164,

tiina.seppanen@fingrid.fi

COMPILED MARJUT MÄÄTTÄNEN
PHOTOS | ISTOCK, FINGRID

Progress on the Nordic balancing model

The joint Nordic balancing model is making progress in Finland and all across the region. Some adjustments have been made to the timetables.

■ Before the joint Nordic capacity market for the automatic Frequency Restoration Reserve (aFRR) can go live, each transmission system operator may first deploy the new market platform in its national market. This will be possible as of September. The go-live process for the pan-Nordic market will begin at year-end at the earliest.

The closure of the aFRR capacity market has been scheduled for 8:30 am (Finnish time) on the day before the delivery. Go-live instructions for the aFRR capacity market have also been published.

The schedule for the energy market in the manual Frequency Restoration Reserve (mFRR) has been updated. The decision was made to postpone the introduction of the marketplace by six months to the final quarter of 2022. The automated mFRR energy market will remain in operation until 22 May 2023.

Go-live instructions for the mFRR energy market have also been published along with a product memorandum.

The Nordic transmission system operators remain committed to the simultaneous transition to a 15-minute imbalance

settlement period on 22 May 2023. The go-live date will be confirmed in April at the latest when the Energy Authority issues a decision on the matter.

The Energy Authority's consultation period ended on 15 February. What results can the consultation be expected to produce? What is the most important lesson from the consultation? Read more: <https://energiavirasto.fi/-/kuuleminen-sahkojarjestelman-tasehallinnan-ehdoista-tasevastaaville-ja-reservoimittajille>

We will provide information about the progress of Nordic balancing model projects and arrange webinars on topics relevant to the projects. Among the topics to be covered in the upcoming webinars will be the 15-minute imbalance settlement period, which will be discussed on 15 March and 12 April. Keep up to date on our website:

www.fingrid.fi

Further information:

www.fingrid.fi/pohjoismainen_tasehallintahanke (Finnish)

www.nordicbalancingmodel.net (English)



Development of flexible solutions continues

Fingrid is taking part in the OneNet flexible market project, which began last autumn.

OneNet is a three-year research project that is mainly funded by the European Commission's Horizon 2020 framework. It seeks to develop various flexible market solutions to address the challenges that the power system faces during the energy revolution.

■ Under the OneNet project, Fingrid is continuing to develop flexible market solutions that were first developed as part of the INTERRFACE project. In addition, we began some new studies of the larger-scale utilisation of flexible operation, among other things. Under the earlier project, Fingrid focused primarily on development requirements related to the moment of provision of electricity. OneNet continues this work, but it also takes into consideration the longer-term needs of flexible procurement. The themes of the OneNet project area related to matters such as forecasting flexibility, visualisation, information exchange, modelling, trading and settlement.

Flexible electricity markets mean trading in the flexibility of power system resources as a part of the management of the power system with regard to frequency, transmission and voltage. •

Transmission reliability rate of the main grid: 99.99995%

■ In 2020, the transmission reliability rate on the main grid reached a record-setting 99.99995 per cent. This figure describes the amount of energy transmitted by the main grid for consumption as a proportion of the amount of energy that was available for transmission. Only 37 MWh of electrical energy was not transferred for consumption as a result of disturbances on Fingrid's network. In addition, the quality of the frequency in the Nordic synchronisation area was much better last year than in the preceding years. •



A decade of investment!

This decade, Fingrid will invest a record EUR 2 billion in electricity networks and substations on Finland's main grid.

■ The sums required in main grid investments have rapidly increased to approximately EUR 2 billion. Last spring, the estimate stood at only EUR 1.4 billion. One of the main reasons for the increase in required investments is the growth in the volume of wind power, which has increased more rapidly than projected. The objective of making Finland climate-neutral by 2035 will require a significant increase in emission-free electricity generation and consumption.

Fingrid's annual investments amount to approximately EUR 200 million, a sum that covers dozens of projects all over Finland. The vast majority of the investments in the main grid – accounting for 70 per cent of the total – are in new construction, while the remainder will be spent on refurbishing the old grid. •

MOST SIGNIFICANT INVESTMENTS IN THE MAIN GRID FROM 2021 TO 2030:

Strengthening connections between the north and the south:	EUR 550m
Connecting wind power	EUR 450m
Cross-border connections	EUR 300m
Power supply to Greater Helsinki	EUR 100m
Number of new substations	30

Praise for the Guarantees of Origin service

Fingrid's Guarantees of Origin service received excellent reviews in the annual customer survey, which was conducted at the end of last year. The service authenticates the origin of renewable energy.

■ The Guarantees of Origin service has received good feedback in the customer survey for several years in a row. Previously, only the main users of the Guarantees of Origin register were asked to provide feedback, but this year, the survey was sent to all other registered users. Despite the larger sample size, the general grade on a scale from 1 to 5 was an excellent 4.4 (4.6 in 2019). All of the other key themes also received ratings of over 4: communication 4.2, register functionality 4.3, and experience of collaboration 4.5.

The Net Promoter Score (NPS) among customers using Guarantees of Origin was also excellent at 51.1. The open-ended comments included praise for the expertise and availability of customer service, swift response times and the functionality of the register. •

Deploying My Fingrid for Partners

Fingrid has built a new digital service for service providers. My Fingrid for Partners will be deployed in phases, and it will replace FGPartners by the autumn.

■ My Fingrid for Partners functions as an information exchange platform for Fingrid and its service providers working on construction projects and maintenance. It is used by Fingrid's own personnel, as well as construction contractors, maintenance providers and providers of project planning services. The service will cover all projects in the planning, implementation and warranty periods, as well as maintenance.

My Fingrid for Partners enables Fingrid and its service providers to manage projects jointly. The service stores the administrative and technical documents required for projects, thereby making it easier to keep track of the project's timetable, progress and upcoming steps.

The service is necessary because the amount of day-to-day interaction is constantly increasing, and the old channels are no longer effective enough for this purpose.

"It will facilitate the work of both parties and offer the opportunity to enhance efficiency. The importance of information security cannot be overemphasised," says **Hannu Hätönen**, Fingrid's Project Manager in charge of designing My Fingrid for Partners. The aim was to make the service so easy to use that

everyone can learn to use it without undergoing training that would consume time and resources. The objective is full self-service. Users of the new service can edit documents themselves, which makes design work easier.

A lot of photos are taken in work locations, but it is not always easy to manage them and put them to good use. Any user of My Fingrid for Partners can save photos of a project.

"Photos are automatically saved in the correct place based on the geolocation data. Photos can also be filtered by date and time. For example, tree felling is not of interest during the closing stages of the project," says **Marcus Stenstrand**, Fingrid's Unit Manager.

At present, My Fingrid for Partners hosts dozens of projects and has about 200 users. All in all, Fingrid has almost 70 substations, transmission line and maintenance projects underway. By early autumn, all of the projects will be transferred to the new service, and the number of users will increase to approximately 1,000. The old system, FGPartners, will be closed down on 30 September. •

partners.fingrid.fi

TEXT | KATI SÄRKELÄ
PHOTO | SAMULI SKANTSI



Sirpa Kulmala and the transformation of the energy sector

Sirpa Kulmala has enjoyed a grandstand view of the development of Finnish energy system.

If there is one person with a real perspective on the Finnish energy sector, it is **Sirpa Kulmala**. She has worked in the sector for more than 40 years. Her first job in the sector was in the Helsinki office of Imatran Voima. Her CV includes stints as a secretary in IVO's travel service and legal department, among others.

"I worked as Executive Assistant at Perusvoima Oy from the start of the project right up to the Chernobyl disaster in 1986. This was perhaps the most arresting event in my career. The repercussions reached into the discourse on Finland's energy policy. People demanded more information about radiation and radioactivity, as well as different forms of energy generation.

For this reason, after the nuclear power project was closed down, women working in the sector set up the Energiakanava (Energy Channel) working group under the Finnish Nuclear Society in 1990. Sirpa Kulmala served as secretary to the working group, and she was actively involved for about 20 years. Most of the members were experts from the energy sector who spoke at events and seminars arranged by Energiakanava in their spare time. Information was accumulated, and the net-

work of energy sector professionals expanded.

"I learnt an incredible amount at those meetings. I really appreciate the expertise that the professionals in the working group represented, as well as their ability to talk about different forms of energy in a way that ordinary people could understand."

"When the chairmanship of the energy sector collaboration body Energiäfoorum (now known as WEC Finland) was transferred to IVO, I worked as an administrative assistant. One particularly memorable event was the 17th congress of the WEC held in Houston in 1998. IVO was responsible for the Finnish delegation's travel arrangements. In addition to making the practical arrangements, I was able to see the opening ceremony of the congress and hear George W. Bush's opening speech.

The next change in Sirpa Kulmala's career took place in 1998 when IVO and Neste merged. After a short time working for Fortum, she moved to Fingrid in 2000.

"I was asked to work as the Executive Assistant to the former CEO, and that is where I remain to this day."

"The biggest change in my work has been the development of the tools I use. The transition from the IBM Selectric typewriter

to the computer era and electronic communication channels made everything so much easier. My work has always been multifaceted. In addition to my duties as Executive Assistant, I make preparations for meetings of the Board of Directors with the General Counsel, and I work in stakeholder coordination with Finnish and international parties. Initiative and familiarity with the sector are useful here."

"The amount of work involving European stakeholders has increased, especially with parties in the Nordic and Baltic countries. Fingrid is a highly respected partner on an international scale."

"The corporate culture at Fingrid is characterised by openness and equality – we work well together. Trust and openness are important. It is specifically openness that has enabled Fingrid to build such a strong reputation."

"As a modern monopoly, we listen to our customers. Fingrid works closely with its customers and stakeholders. Responsibility pervades everything we do, and it is even more important now that the energy sector is shifting towards forms of clean energy generation in line with the principles of sustainable development." •

Fingrid initiates discussion on topics related to its industry. In this series, we participate in the discussion by highlighting electric novelties and current phenomena. You can suggest a topic for this page via e-mail: viestinta@fingrid.fi

A real-time remote connection to the worksite

An Arlo Go camera shows a live feed from the people on Fingrid's worksites. The amount of work-related travel can be cut, decision-making is faster, and time is saved.

TEXT | KATI SÄRKELÄ

PHOTO | SITEMA OY



Fingrid has begun using Arlo Go cameras on several of its worksites. The live feed is used for a variety of worksite supervision needs, as well as worksite meetings, quality control, reception inspections and access control.

"The aim is for real-time video to become an additional tool that saves time and money in worksite supervision. The remote video solution also improves occupational safety, as experts can avoid making long car journeys to worksites. Furthermore, it has also been necessary to minimise contact between people during the coronavirus pandemic," says Senior Project Manager **Risto Ryytänen** from Fingrid.

Fingrid has partnered with Sitema Oy to develop the new tool. A trial began in October 2019 using two cameras, and by March 2020, it expanded to 17 Arlo Go cameras on various Fingrid sites.

The Arlo camera is mounted on a helmet or a drone. When the camera is on a helmet, the user's hands remain free. The device is wireless, and the connection to remote users takes place via a smartphone or web browser.

"The person with the camera can talk to remote viewers using a Bluetooth headset or the bidirectional audio connection built into the

camera," says **Juuso Männikkö**, Development Director at Sitema.

"The people connected remotely can watch a real-time video feed on a computer or mobile device. The video can be viewed on the Arlo portal or monitored and saved on Teams."

Arlo cameras have also been used for access control. Mounted cameras can also be detached if pictures of something else are needed. Thanks to the infrared feature, the camera can also provide detailed images in dark conditions.

"Inadequate network connections on some times have caused problems with image quality or prevented the camera from being used at all. In the main, the image has been clear and sufficient. The person wearing the camera should avoid moving too quickly. When the Arlo is stationary, it provides a very detailed image of the work or monitoring site," Ryytänen says.

Savings have been realised in terms of both working hours and emissions. For example, a safety walk was conducted at the Pyhäselkä substation in Muhos via a remote connection. Instead of flying eight people out from Helsinki, only the worksite organisation and the Arlo helmet cam were needed on-site.

"We have had positive experiences during the testing phase. We hope to be able to use Arlo more frequently and in more types of situations,"

says **Jarkko Kaisanlahti**, Regional Manager for Northern Finland.

"Remote connections are highly beneficial in the event of sudden disturbances or faults because several experts can assess the situation."

Fingrid and Sitema are monitoring technological developments with interest, and they take an open-minded approach to experimenting with new solutions. Augmented reality, smart glasses, 360-degree imaging, and artificial intelligence, which is developing in leaps and bounds, provide opportunities for creating new, safer and more efficient operating models. •

ARLO GO HELMET CAMERA

- Wireless, can be attached to a helmet or drone or used handheld
- Real-time remote connection to several viewers
- Bidirectional voice connection between remote viewers and the camera operator via the camera or a mobile device
- Videos and photos can be saved if necessary
- Good reliability in worksite conditions, weatherproof
- Long-lasting battery, 1–3 months on a single charge

Fingrid Current in April!



Fingrid Current webinar 20 April 2021

The event will involve an examination of the power system of the future based on Fingrid's network vision. The matters for consideration will include future electricity consumption, electricity generation and infrastructure as the objective is to make Finland climate-neutral by 2035.

The event will feature several operators from the sector. Your host will be **Jukka Ruusunen**, Fingrid's President & CEO.

We look forward to welcoming you!

Further
information and
registration
[www.fingrid.fi/
current](http://www.fingrid.fi/current)

FINGRID

Läkkisepäntie 21, FI-00620 Helsinki • P.O. Box 530, FI-00101 Helsinki

Phone number for all offices: +358 30 395 5000

• fingrid.fi • fingridlehti.fi/en



@fingrid_ojy • Fingrid Oyj • @fingridfi • @Fingridojy

Hämeenlinna
Valvomotie 11
13110 Hämeenlinna

Oulu
Lentokatu 2
90460 Oulunsalo

Jyväskylä
Lutakonaukio 1
40100 Jyväskylä

Rovaniemi
Teknotie 14
96930 Rovaniemi

Vaasa
Runsorintie 1
65380 Vaasa

Varkaus
Wredenkatu 2
PL 1, 78201 Varkaus