

# 02 2021

# F I N

# G R I D

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The Main Grid Control Centre ensures the availability of electricity 24/7

Landscaped towers are elite of industrial design



TOWARDS CARBON NEUTRAL FUTURE

## Demand-side flexibility offers game space for future energy system

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## 20–21

**CASE**

Giving materials a new life

### THE FINGRID MAGAZINE

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PHOTO | SAMULI SKANTSI



## ...And a call comes in from the main grid control centre...

**I**n mid-March, everything should have been going fine on the Nordic electricity market. The winter had been cold, but the markets had reacted well. Fingrid had just been informed that the availability of high-voltage direct current transmission links had been world-class. The newly updated network vision had me thinking about new challenges; Finland is gradually becoming self-sufficient in electrical energy. With our growing wind power capacity and the third unit at Olkiluoto, we will begin exporting electricity to Central Sweden in increasing volumes alongside our imports from Sweden.

It is a Monday morning, and a call comes in from the main grid control centre. Over the weekend, the Swedish transmission system operator Svenska kraftnät (Svk) began limiting the transmission of electricity from Finland to Central Sweden. In fact, imports have been halted entirely. I recalled a moment last summer when Svk was forced to limit the transmission of electricity from Norway, leading to confusion in the electricity markets – surely history will not repeat itself on the border between Finland and Sweden...?

Customers start contacting us, and they sound concerned. They consider such a limitation a violation of joint European principles – can we trust in the joint European regulations? Customers highlight the importance of a predictable

environment and want to understand why the Fenno-Skan connection has been limited. What happened to the transparency and predictability of transmission system operators? Trust in the markets and predictability are paramount to market parties in order for investments in a climate-neutral energy system to be realised. Market parties expect to be able to rely on the regional infrastructure. What is Fingrid going to do?

The need for restrictions over the Fenno-Skan connection also seems to have taken the Swedish transmission system operator by surprise. The energy revolution seems to have proceeded more swiftly than expected, and it was not possible to forecast the overall impact of every aspect. Gradually, the situation becomes clearer. There seem to be several different challenges, and no individual measure can resolve the situation.

Something happened that should not have happened. On the other hand, we need to look forward. It does not help if we only get upset with our neighbours. We cannot resolve real challenges by getting upset. The key is to identify and acknowledge the impacts of the situation. Everything that can be done should be done in order to resolve problems. It is in Finland's interest to help Svk resolve its problems. Compliance with the legislation is to be assessed by those tasked with supervising competence.

Market parties and society expect better service and infrastructure they can rely on. A cultural shift is required to assure the openness of transmission system operators and the predictability of their actions. The traditional means of calculating transmission capacity and planning for outages are no longer enough. The Nordic Regional Coordination Center which will be established will improve the situation and increase predictability. Each transmission system operator ultimately bears the responsibility for meeting the expectations of the markets and society as a whole.

Svk will not be able to conjure up a new east-west transmission link before the turn of the decade. I believe smaller investments that can be implemented more quickly will be able to restore the transmission capacity. Network overloads occur rarely, but they could be eliminated by countertrading so that the transmission system operators would not always need to limit the transmission capacity in exceptional situations. In addition, exploiting the rapid power regulation features of high-voltage direct current transmission links could help Sweden address the challenges in its national grid.

**Juha Hiekkala**  
Market Development Manager  
Fingrid

# The Main Grid Control Centre ensures the availability of electricity around the clock

Fingrid's Main Grid Control Centre in Helsinki works all hours of the day to ensure that every village, town and city in Finland has enough electricity. The control centre handles routine tasks, as well as unplanned tasks when a swift reaction is needed to prevent disturbances in the availability of electricity. Some disturbances also affect the intra-day electricity price.

TEXT | OLLI MANNINEN

PHOTO | FINGRID

**T**

he control centre employs 22 operators and two managers who work in three shifts. Normally, the control centre is staffed by three or four people during the day and two at night.

7:00  
AM

## CHANGE OF SHIFT

The morning begins with the changing of the guard at 7 o'clock when the operators finishing their shifts and the incoming team review information about the grid's transmission capacity, any disturbances, the impacts of weather conditions and the state of the power system over the preceding 24-hour period.



2:00 AM

**INSPECTIONS ARE CONDUCTED AND CHECKS ARE CARRIED OUT TO ENSURE THERE WILL BE ENOUGH ELECTRICITY THE FOLLOWING DAY**

“The control centre does not go to sleep at night, although the pace of work is slower. In addition to system monitoring, the duties carried out at night include inspections of the events in the previous 24 hours, verifications of load and generation forecasts to ensure there will be enough electricity in the coming morning, or prepares up- and down-regulation”, Kaunola says.

8:00 PM

**DAILY OPERATIONAL CALL SUMMARISES THE EVENTS OF THE DAY**

The events of the past day are reviewed at a daily summary meeting between the Nordic countries. The Daily Operational Call addresses how smoothly trading has proceeded, how much transmission capacity is available for intraday trading the following day, the status of the grid, and preparations for challenges in the day ahead.

5:30 PM

**PRELIMINARY GENERATION PLANS FROM BALANCE RESPONSIBLE PARTIES**

During the coronavirus pandemic, the control centre has switched to a hybrid working model in which some employees work remotely.

Nowadays, most of the disturbances arising on the main grid can be handled

using remote control in contrast with earlier times, when technicians would need to travel to substations to solve problems. Over the course of a year, the employees at Fingrid’s control centre make up to 40,000 phone calls and carry out 57,000 remote actions on the grid.

4:00 PM

**THE INTRADAY MARKETS OPEN FOR THE FOLLOWING DAY, TRADING IN CROSS-BORDER CONNECTIONS OPENS**

The main grid must operate without disruption so that electricity can be traded on market terms, ensuring there is enough electricity available at all times. The control centre takes care of the balance in the main grid, the power system and grid management. In practice, 14,400 kilometres of transmission lines, 116 substations and 1,400 switchyard areas require constant supervision.

“The increase in wind and solar energy volumes makes the management of the main grid more challenging. Rapid changes in wind conditions or flooding in the north of the country

could cause imbalances and require other solutions for transmitting the electricity,” says **Juha Karjalainen**, who is in charge of managing the power system.

In the future, imbalance management will transition from one-hour monitoring periods to 15-minute monitoring, which is close to real-time monitoring. This will require more automation in the control centre, leading to additional monitoring requirements.

“In addition to automated monitoring, which is enabled by about 50 pieces of software, the control centre still handles some of its tasks throughout the day by telephone, as this is often the fastest way to get hold of the right people in the event of a disturbance,” Karjalainen says.

1:50 PM

**TRADES FOR THE FOLLOWING DAY ARE COMPLETED**

In addition to the day-ahead market, market parties can balance their electricity generation and consumption on the intraday market, where electricity is continuously traded close to the moment of delivery. After transactions on the intraday market, Fingrid balances out the hourly electricity consumption and generation via the balancing power market.

“Finland is dependent on imported electricity, so disturbances in the Nordic transmission connections have an immediate impact on the intraday electricity price. For example, if there is a disturbance in the northern transmission connection to Sweden, the need for and price of balancing power must be reassessed in order to maintain system security,” says **Rami Kaunola**, who is in charge of balance management on the main grid.

“Fingrid is tasked with keeping the transmission connections to the other Nordic countries open so that electricity can be traded as flexibly as possible on the Nordic exchange. This is our contribution to promoting the trading of electricity on market terms,” Uusitalo says.

10:30 AM

**TRANSMISSION CAPACITY NOTICES: MARKET PARTIES SUBMIT THEIR OFFERS TO THE POWER EXCHANGE**

From the perspective of the market, the most important job of the morning is to determine the electricity transmission capacities between different price areas. Finnish main grid is connected to the neighbouring systems via high-voltage transmission links from Sweden, Norway and Estonia,

as well as the direct-current transmission link from Russia.

“In the morning, we assess the available transmission capacity for the day ahead and submit the information to the power exchange’s systems. Market parties also submit their buy and sell offers, which form the basis for determining the hourly spot price for the day ahead,” says **Maarit Uusitalo**, Fingrid’s Control Centre Manager.

# Demand-side flexibility offers benefits for the carbon-neutral energy system of the future

Renewable energy is changing the power system production. As the volume of electricity generated by wind and solar power is intermittent, consumption needs to offer room for manoeuvre. This is known as demand-side flexibility.

TEXT | ARI RYTSY

PHOTO | ISTOCK

**R**enewable and variable electricity generation is dependent on the prevailing conditions. Such electricity is only available when it is windy or sunny. It is not possible to schedule generation for times of peak consumption in the same way as with conventional forms of electricity generation.

Fluctuations in the availability of electricity are also naturally reflected in the price of electricity. When the number and extent of price fluctuations increase, home automation, smart metering and new flexibility services will arrive to help customers.

“People are used to washing their laundry using cheaper night-time electricity after 10 pm. In the future, electricity may be cheapest between 2 am and 5 am or in the middle of a windy or sunny day,” says **Antti Paananen**, Deputy Director General at the Energy Authority.

**Fluctuations in the availability of electricity are naturally reflected in the price of electricity.**

For some time now, the reserve markets have made it possible to buy and sell electricity in order to maintain balance in the grid. Some

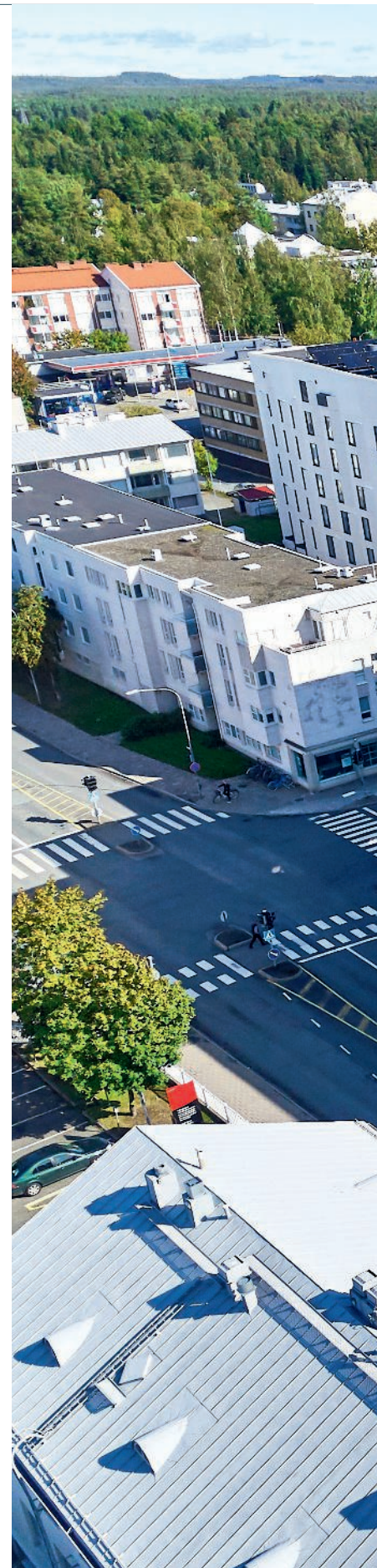
reserve markets are already capable of using demand-side flexibility, but in the future, it will be necessary to bring new, smaller resources and operators into different marketplaces.

This will require independent aggregators. These operators will be outside the electricity supply chain, consolidating and selling on distributed flexibility resources. This will provide greater potential for flexibility in the electricity markets and for maintaining the power balance.

“In line with the EU’s Clean Energy Package and the policies of the Finnish smart grid working group, independent aggregators must be able to operate in all electricity marketplaces. The legislative work to underpin this is still in progress, and more detailed guidelines will be issued this year,” says Paananen.

## **NEW BILLING MODEL IMPROVES THE CUSTOMER’S POSITION**

The Clean Energy Package is accelerating the idea of more extensive exploitation of new electricity storage technologies that can store the surplus energy from occasional times of peak generation for later consumption. In principle, the intention is to allow storage to become an open, freely competitive business.











**“In the future, electricity may be cheapest between 2 am and 5 am or in the middle of a windy or sunny day,”**

Antti Paananen, Deputy Director General at the Energy Authority

“Energy storage will be influenced by whether there are enough market operators. So far, the role of network operators is unclear, but it is not the intention that they would compete for electricity storage with new flexibility companies,” Paananen states.

The Smart Grid Forum has also covered the streamlining of billing. End customers could be given the option of receiving a single bill from their retailer for both electricity consumption and the grid service fee. This would make it easier to obtain competitive quotes for electricity contracts and enable consumers to monitor their electricity costs.

“The Energy Authority sent the Ministry a recommendation on the streamlining of billing in July. The next phase will be drafting a law. This reform may be sent for the Government to debate next year,” Paananen estimates.

A regulatory amendment that took effect at the start of the year enables local energy communities to be formed by groups such as the members of a limited liability housing company who generate solar power using solar panels on a shared roof.

“In such cases, the shareholders can benefit from any electricity generated in excess of the housing company’s requirements, thereby redu-

cing the amount of electricity purchased from the grid,” Paananen says.

#### **FINGRID'S FLEXIBLE MARKET PROJECTS ARE PROGRESSING AS PLANNED**

The INTERRFACE flexible market project, which has received funding under the EU’s Horizon 2020 programme, involves developing and testing concepts for the large-scale utilisation of new flexibility resources. This project, which will run until 2023, involves 42 different operators from various parts of Europe.

Fingrid is involved in the Finnish-Baltic demo, which began at the start of 2019. The lessons learned during the demo will be applied to the development of new market structures and platforms in the future.

“Such new platforms could enable the coordinated sale of e.g. charging resources in numerous electric cars equipped with smart charging. Different operators – such as distribution system operators and transmission system operators – could benefit from the flexibility offered by smart charging,” says **Tuomas Rauhala**, manager of Fingrid’s Market Innovations unit.

Fingrid is currently refining its findings from the INTERRFACE demo as part of the three-year European OneNet flexible market project. OneNet’s themes include forecasting flexibility, visualisation, information exchange, modelling, trading and settlements.

“The OneNet project consists of a clarification phase and a piloting phase. The aim is to pilot a new approaches of purchasing market-based flexibility in some part of the main grid in 2023,” Rauhala says. •

## **Transformation of the electricity market visible in the drafting of laws**

**I**n September 2016, the Ministry of Economic Affairs and Employment set up a working group to study the opportunities that smart grids could present to the electricity market. The working group’s final report, published in 2018, proposed some tangible actions, and the Smart Grid Forum was set up to implement them.

The Ministry of Economic Affairs and Employment is also working on drafting a law concerning the electricity sector. **Arto Rajala**, Director General of the Ministry’s Energy Department/ Energy Markets unit, has been working on a project to moderate the price of electricity transmission.

“The project proceeded to Parliament at the end of January, and I spent practically two whole years working on

it. It is not directly related to the work of the Smart Grid Forum, but it is intended to facilitate small-scale electricity generation,” Rajala says.

A major reform of the electricity market is taking place on several fronts. Rajala understands that the drafting of legislation may appear fragmented to outsiders, as a large entity has been broken down into smaller pieces. This extends processing times and consumes resources. Nevertheless, the Ministry of Economic Affairs and Employment is ensuring a high quality of legislative drafting.

“We only ever aim to submit well prepared legislative proposals for the consideration of Parliament,” Rajala says. •



# Corporate responsibility at a network operator



*The author Antti Paananen is the Deputy Director General of the Markets department at the Energy Authority.*

**N**etwork operators hold monopolies, maintaining vital societal infrastructure, so corporate responsibility is an important aspect of their activities. The key role of these companies is to serve customers in every part of society. They should not take their monopolies for granted; network operators must work responsibly every day to earn the trust and acceptance of society.

The legislator has confirmed the position of network operators as statutory monopolies, so their position is secure. In terms of economic theory, network operators also hold natural monopolies, as it is not usually economically viable to construct additional parallel networks. Consequently, network operators do not face the threat of competition. However, in the worst case, this can lead to arrogance – the network operator may become convinced that it knows what customers need better than anyone else and operate in a way that disregards all other parties.

As a counterbalance to their monopoly position, network operators are subject to

certain requirements. Their activities are regulated and supervised. At the same time, network operators must be able to fulfil the expectations of society in a responsible way.

Networks are a critical aspect of modern society. Without functional electricity networks, citizens' lives would be much more difficult, and society would come to a standstill. Therefore, network operators must look after the functionality of their networks and the security of the energy supply.

Network operators must also develop their network infrastructure according to the needs of customers and society as a whole. Development must take place over the long term. Network investments are planned and made for decades, so operators must be capable of assessing trends in the needs of customers and society long into the future.

The ongoing transition to a low-carbon power system is a major change and one that will affect everybody. Network operators must play a part in promoting this change.

This requires network operators to connect industrial-scale wind power generators and

customers' own solar panels to the grid while enabling customers to access the market for demand-side management. A lack of adequate electricity infrastructure could slow down or even prevent society from reaching its climate objectives.

Network operators must also be independent and impartial. The functionality of electricity markets depends on their activities. Network operators must be carefully scrutinised if they intend to expand into activities that could give rise to market competition. An operator able to fall back on a monopoly position could easily become a destabilising influence that prevents new actors from entering the market and stops the market from developing.

There is a price for all of this, and customers ultimately carry the costs incurred by network operators. In practice, customers do not have the option of disconnecting from electricity networks – they must simply pay the network operator's transmission invoice as required. Therefore, it is entirely justified to require network operators to work efficiently and accept reasonable rates of return on their investments.

The fulfilment of these expectations is primarily the task of network operators themselves. However, regulatory oversight is an essential counterbalance to ensure that network operators meet the requirements imposed by the legislators who represent society. •

**Network operators must develop their network infrastructure according to the needs of customers and society as a whole.**

# Datahub Go-Live making good progress

The Go-Live of Fingrid's datahub, the centralised information exchange system for the electricity retail market, is progressing. A trial production run of datahub, covering the entire electricity market, began in June to test and verify the system's functionality. The observations and user experiences gained from the trial will help to improve the system further.

TEXT | OLLI MANNINEN

PHOTO | ISTOCK

**T**he trial production run, known as TUKO1, tested how users would log in to the datahub user interface in practice, how basic and metering data would be added to datahub and how data migration would be implemented.

**Saku Palanne**, Test Manager responsible for testing the datahub system at Fingrid, says that the datahub has been tested in phases throughout the project. The system's functionality is ready, but the aim of TUKO1, which took place in June, is to verify and test the production operation of datahub.

"During the trial, Fingrid's support request system received approximately 600 requests from parties involved in the trial. This demonstrates that the parties were actively engaged and the trial was a success. Market parties made a large number of observations and identified problems to be solved. They also highlighted some proposals for developments to improve the system's usability," Palanne says.

## LESSONS WILL BE LEARNED FROM THE OBSERVATIONS AND DEVELOPMENT PROPOSALS

Many of the observations were related to technical or functional errors. For example, some of the inputted data was not transferred in the correct format to the correct destination or

other corrections were required in the system's functionality. However, a large number of the support requests were questions of various types or support requests related to the party's own operations.

"A summary of the June trial will be prepared, and the problems and development proposals will be addressed so that these things are corrected by the time the second trial run – TUKO2 – begins in the late summer, and we can move forward with the implementation," says **Jyrki Autio**, a consultant from ProjectTOP.

The datahub development work makes use of ProjectTOP's Finnish software designed for testing IT projects and for project management. Autio is tasked with managing and coordinating activities during the Fingrid datahub TUKO trial runs to ensure that the 171 electricity companies involved in the trials know what to do during each phase of the trial and what types of expertise are required of partners certified for the trial.

"The entire sector has embarked on a major change: by openly sharing and exchanging data, every party will reach the desired objective. TUKO1 was an eye-opener for many operators in the sector, reminding them of the scope of the change afoot. The thirst for knowledge and need for training is enormous. Weekly information events were held online to communicate this in connection with the trial, and approximately 300 people attended such events," Autio says.

## DATAHUB WILL ALTER BUSINESS MODELS

Fingrid datahub will officially go live in March 2022, when the centralised database of metering, customer and accounting point information will be available to about 100 electricity retailers and more than 80 distribution system operators responsible for electricity transmission.

Centralising the information distributed across the systems of various different operators will also improve the service received by electricity consumers. Electricity contracts and the information related to accounting points and the consumption at such points will be available to different parties more quickly. This means that end-users will receive faster and more efficient customer service.

For example, it will be easier to switch to a different electricity retailer. The shared system will also enable the development of new types of applications for electricity consumers, such as apps that enable the user to save energy or monitor electricity consumption.

"The transition to a real-time, centralised information exchange system will lead to major changes in the sector and affect the business models of companies and job descriptions of employees in the sector," Autio says.

Automated, synchronised information exchange and data management enable new innovations and services to be developed.

"Datahub will lay a new foundation for companies to develop their business models," Saku Palanne says. •



**"The transition to a real-time, centralised information exchange system will lead to major changes in the sector and affect the business models of companies and job descriptions of employees in the sector."**

Jyrki Autio, Test Manager, ProjectTOP



## Data protection carefully managed

**T**he trial production runs of Fingrid's datahub system are the first trials of the datahub project to use genuine production data and customer data instead of synthetic data. The data protection risks were minimised to ensure that no information is disclosed to unauthorised parties. The parties involved in the trial were required to complete the necessary certifications before participating. The TUKO1 trial ended before midsummer, when the system was closed, and it is no longer possible to log in. This prevents unauthorised access to the data and transfers of data between parties.

"During the trial, a few data protection observations were brought to our attention. They were immediately reviewed, and we identified how the risks would be rectified," Saku Palanne says.

There were no data leaks during the trial. •

## Real-time comparative information would provide added value

**T**opias Katajamäki, System Manager at Vaasan Sähkö, believes that the datahub Go-Live next year will have a significant impact on the business development of companies in the electricity market.

"When data transfer and sharing is automated, people will have more time for demanding brain work and creativity. There will be more time to focus on innovations, new services and developing business solutions," Katajamäki says.

Katajamäki was left with positive experiences from the TUKO1 trial thanks to the new expertise he gained, although participating in the trial via the datahub user interface called for extra manual work for the entire team.

"In the second phase, we will be able to use our own system, which will make the processes more automated and reduce the amount of time spent searching for information and copying it from one system to another," Katajamäki says.

He praises Fingrid's rapid responses to issues during the TUKO1 trial.

"Support requests were answered swiftly, and it was also possible to identify solutions to

issues that could be addressed in-house or by using Fingrid's resources," he says.

The information events arranged in connection with the trial were also good and provided the opportunity to ask questions and share thoughts with other participants.

However, Katajamäki hopes that Fingrid will provide an information page on the datahub user interface for the TUKO2 trial in order to indicate certain problems or resolved tickets.

"This would reduce the time we would need to spend looking for potential solutions on various websites," he says.

In addition, Katajamäki presents another development proposal.

"It would be great if it would be possible to receive comparison data during the trial to show how well each participant has fulfilled Fingrid's requirements. Company-specific reports or real-time indicators would help to assess how our company has progressed or learned and how it would be possible to improve our activities. This information would provide a eureka moment and encourage us to develop our expertise further," Katajamäki says. •



**“When data transfer and sharing is automated, people will have more time for demanding brain work and creativity.”**

Topias Katajamäki, System Manager, Vaasan Sähkö

# The Nordic balancing model program is progressing

The energy revolution and the transition to European markets require Nordic transmission system operators to make changes to their balance management and imbalance settlement processes. The joint Nordic balancing model program consists of several projects. The first of these – the single pricing model – will be completed this November.

TEXT | PÄIVI BRINK

**T**he aim of the project is to reform Nordic balance management and imbalance settlement so that we are ready for the transition to European reserve markets. The most significant changes to information systems will be made in late 2022 when 15-minute products are launched on the Nordic mFRR energy market alongside the existing one-hour products and the bid activation process is automated,” says **Maria Joki-Pesola**, Program Lead of the balance management program at Fingrid.

It is important that balancing service providers understand the forthcoming changes and prepare for them in good time, so they are able to provide 15-minute products.

“Fingrid aims to support market parties through this change by communicating the

changes in a clear and timely way and engaging in dialogue concerning the background to the changes and the practical implementation. The Nordic transmission system operators have recently updated their implementation guidelines for balancing service providers.”

In addition to the automation of the energy market, next year will see the transition to a new Nordic marketplace for the aFRR capacity market. The change will initially be national in scope, but all of the Nordic countries will ultimately operate in the same capacity market.

A single pricing model will be implemented this November to combine the consumption and generation balance into a single balance with consistent pricing.

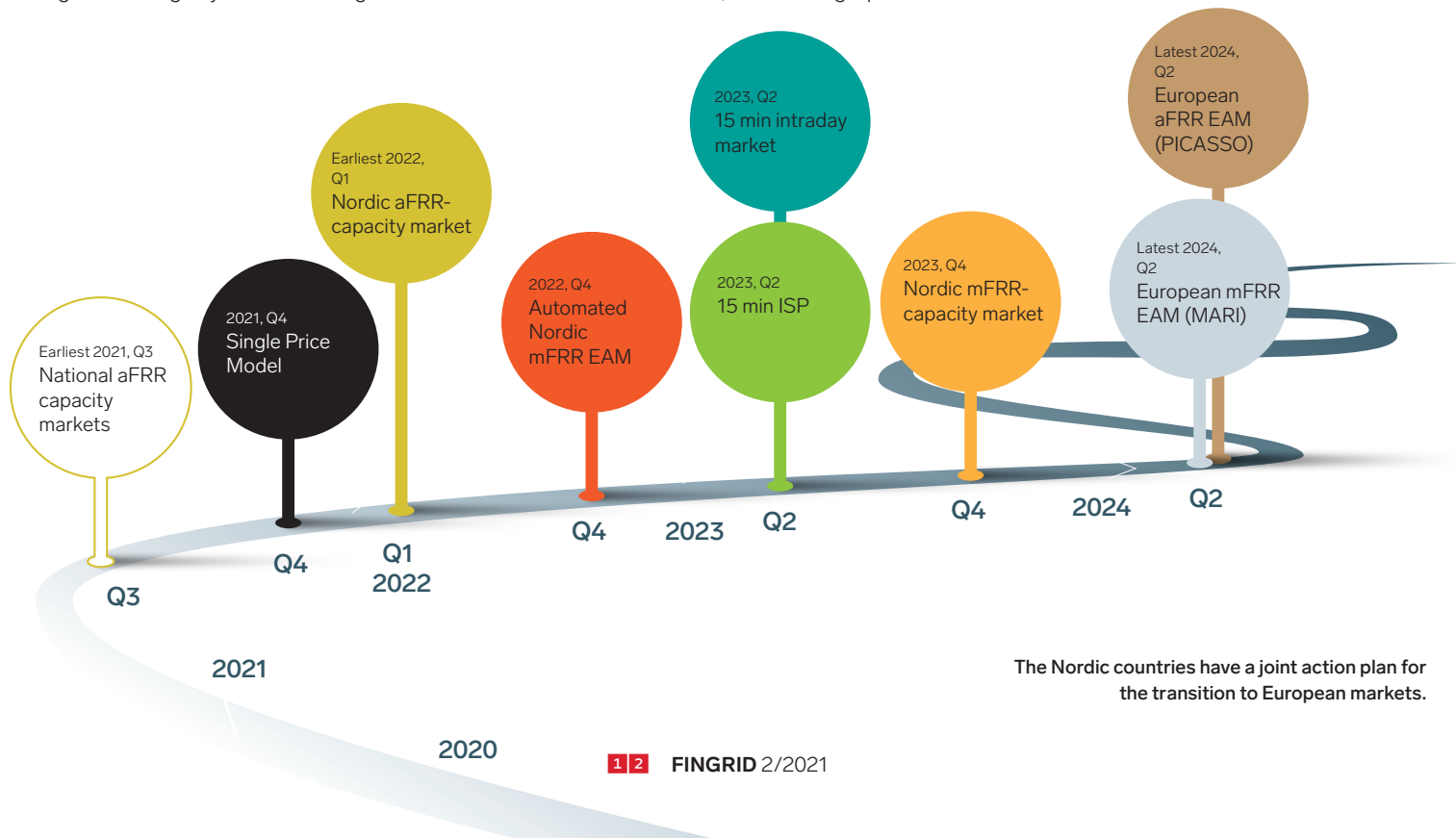
“The imbalance model in the Nordics will be harmonized according to European legislation for imbalance settlement, where a single price

and single position is a default pricing model. The transition to a single pricing is strongly supported by the Nordic stakeholders”, Joki-Pesola says.

## TRANSITION TO A 15-MINUTE IMBALANCE SETTLEMENT PERIOD IN 2023

The 15-minute imbalance settlement period and 15-minute intraday market will go live in May 2023. After this, only 15-minute products will be available on the mFRR energy market. This will enable the electricity market to become more real-time.

“New marketplaces and more real-time trading will require changes to the IT systems used by Fingrid and electricity market parties, as well as to energy metering. One way or another, the change will affect the entire energy industry,” Joki-Pesola states. •







## What is causing the dramatic rise in the prices of emission rights?

The price of emission rights has doubled in the last six months. At the end of May, the right to emit one tonne of carbon dioxide into the atmosphere was priced at EUR 54, more than double the EUR 25 price at the end of last year. The change is striking compared with the trend from 2013 to 2018 when emission rights cost just EUR 5–10.

TEXT | OLLI MANNINEN

PHOTO | RONI REKOMAA / LEHTIKUVA

### WHAT ARE THE FACTORS BEHIND THE TREND IN THE PRICE OF EMISSION RIGHTS?

“One of the main causes is the agreement between the EU Member States to tighten the emission targets for 2030 to 55 per cent. This foresees a more competitive market for emission rights. A further contributory factor is the rise in raw material prices, the fairly high price of natural gas, and the prices of electricity in Central Europe. Interest among funds and institutional investors in emissions trading also seems to have risen,” says **Jarmo Sillanpää**, Senior Portfolio Manager at Gasum, an energy company.

### WHAT IS THE FUTURE OUTLOOK FOR THE PRICES OF EMISSION RIGHTS?

Emission rights could drop in price if the economy and energy markets take a turn for the worse, which would reflect on emission rights. Fuel price ratios and changes in electricity markets have a rapid effect on emission rights. However, banks and emissions market analysis firms specialising in energy have fore-

cast prices as high as EUR 80–90 per tonne of carbon dioxide by 2030.

### HOW WILL THE RAPID RISE IN CO<sub>2</sub> EMISSION PRICES AFFECT THE TRANSITION TOWARDS A CLEAN ENERGY SYSTEM?

More expensive emission rights are likely to accelerate this development. Of course, the transition towards a cleaner energy system is already in progress – for example, we have seen large-scale investments in wind power. The rising price of emission rights will also increase electricity prices, thereby increasing indirect energy costs in industry.

### HOW WILL THIS AFFECT FUTURE INDUSTRIAL INVESTMENTS?

There will be more interest in renewable energy sources. If costlier emission rights make electricity more expensive, emission-free hydroelectric, wind and nuclear power will become more competitive. The electrification of industry and the consequent increase in electricity consumption will be major factors in the

Nordic countries this decade. The electrification of industry relies on competitively-priced electricity and reductions in emissions caused by processes thanks to renewable energy.

### HOW WILL THE EMISSIONS TRADING MARKET AFFECT GASUM'S BUSINESS?

Gasum's lower-emission products, such as biogas and LNG, offer heavy-duty vehicles and maritime transport a route towards carbon neutrality. We also operate on the electricity market, and we provide our customers with guarantees of origin for electricity and long-term PPAs for wind power. We offer our customers channels for emission trading and risk management services. Most of our customers also have carbon-neutrality and emission-reduction targets, and we work with them to identify tools and solutions for reaching these targets. •

# Project to improve connection preparedness enhances main grid planning and construction

A development project due for completion in the summer was also supported by customer feedback groups. It is already possible to send connection enquiries using the map service on Fingrid's website.

TEXT | PÄIVI BRINK

PHOTOS | ISTOCK, LEHTIKUVA / HEIKKI SAUKKOMAA



## Project goals:

1. To provide Fingrid and its customers with consistent information about customers connection needs.
2. To provide customers with information about the possibility of connecting to the main grid and future outlooks.
3. To enable main grid connections to be made more efficiently and the grid to be developed proactively.





The project addresses a genuine need. Fingrid is often asked whether it is possible to connect to the main grid, and the number of wind power project enquiries in particular has rocketed. In the early autumn, there are more than 850 generation connection enquiries representing a total power output of more than 100,000 megawatts. Finland's current electricity generation capacity is just over 11,000 megawatts. Not all of these ideas will become a reality, but this shows that we are going through an unprecedented planning and construction boom," says **Jarno Sederlund**, the Customer Manager in charge of the development project related to connection readiness.

However, operators are facing substantial uncertainties, which make it challenging to forecast which parts of the main grid will need to be reinforced. The project aims to generate a better understanding of the types of connection requirements among Fingrid's customers and where they are located. In the future, the updated map service will also provide information about future outlooks and whether it is possible to connect to the main grid.

"The easy-to-use map service is publicly available on our website. However, all project enquiries sent using the map service are confidential. After that, interactions related to enquiries between Fingrid and its customers are handled

using the My Fingrid service, which ensures that both parties have access to the same information about projects. When enquiries are sent using one system, they are queued, and every single enquiry is processed. The members of our customer feedback groups considered the map service a good tool, and it will undergo further development in the rest of the year," Sederlund says.

Senior Expert **Janne Seppänen** and Expert **Juhani Tonteri** from Fingrid's Grid Planning unit are in charge of the second phase of the project, which encompasses an evaluation of the future outlook for the main grid.

"The map system will publicly display the connection capacity at various substations and transmission lines along with the published generation and consumption projects in planning. This will make it easy to see which parts of the power system have plenty of spare space. The map service shows the present capacity and an estimate of the connection capacity in the

coming years for both consumption and generation. Providing situational awareness of the grid plan creates opportunities for every party to work together and supports the formation of regional visions," Tonteri says.

**Katariina Saarinen**, Fingrid's Development Manager, Asset Management, is in charge of the third phase of the project.

"We are developing and enhancing our operating models for the planning and construction of the main grid. Building a transmission line takes several years, so it is very important to have a forecast of customers' connection requirements, situational awareness of the needs and plans, and a flexible investment programme. Everyone needs access to the latest information. Our customers will notice the outcome of this phase of the project when Fingrid's services begin running more smoothly. Our goal is to build the transmission connections required for Finland to become climate-neutral in a timely and cost-effective way," Saarinen states. •

**In the future, Fingrid's new map service will also provide information about the possibility of main grid connections and future outlooks. Read more: [fingrid.fi](https://fingrid.fi)**

## The General Connection Terms (YLE) are being updated



Fingrid began working on an update to its General Connection Terms at the start of the year. The YLE2021 terms were presented to the Energy Authority in April, and an updated version incorporating the Authority's feedback was submitted for confirmation in May. In June, the YLE2021 terms were presented at a public webinar, and stakeholders were asked to give their views. The final version was submitted to the Energy Authority for approval in August, and the aim is for the YLE2021 terms to take effect by the end of the year.

"It is once again time to update the ground rules for connecting to Fingrid's network. The terms are the same for everyone, and they aim to ensure the system security of the main grid despite the challenges posed by the energy revolution, including the unprecedented amounts of wind power output being connected to the power system. The new terms apply to new connections and changes to existing connections. The update will expand and clarify the technical requirements for connecting to a transmission line," says **Lasse Linnamaa**, Expert at Fingrid.

### Key changes:

- Harmonisation of terms with the existing technical system requirements (VJV, SJV, KJV, HVDC) and technical instructions
- Change to the technical specifications of 110 kV transmission line connections and transformer ratings
- Updates to the technical requirements for disconnection, protection and earthing
- - Updates to the division of responsibility for operations and liability for costs

# Grid energy storage supports

Flexibility is required to ensure that the power system is able to maintain a balance between generation and consumption as renewable forms of energy become more prevalent. Grid energy storage offsets brief generation shortfalls and enables rapid adjustments.

TEXT | PÄIVI BRINK

PHOTO | FINGRID

**G**rid energy storage can have many uses. It plays an important role as a reserve for the power system, as batteries can provide faster regulating power than a conventional power plant. Operators such as wind power companies sell electricity to their customers. If there is a shortfall in generation, they can take electricity from the battery. In the event of a network fault, batteries can also ensure the availability of wind farm electricity. In addition, batteries can compensate for reactive power in connection networks," says **Antero Reilander**, Customer Manager at Fingrid.

## Major grid energy storage facilities in Finland

Batteries of various sizes support the operation of the power system. Finland currently has about 50 megawatts of grid energy storage capacity.

- Neoen's grid energy storage facility in Yllikkälä: 30 MW
- Grid energy storage connected to a wind farm in Viinämäki, li: 6 MW

Forthcoming:

- Sinebrychoff and Siemens: 20 MW grid energy storage facility connected to Sinebrychoff's factory building in Kerava
- In the coming years, Elenia will build dozens of 0.6 MW grid energy storage facilities in sparsely populated areas to boost the reliability of its distribution network in the event of faults
- Pohjolan Voima is planning a 35 MW battery solution





# the energy revolution

Batteries have provided reserve markets with a new offering and additional competition.

“Fingrid purchases reserves to balance out generation and consumption in the reserve markets it maintains. Reserves may be provided by parties who have resources that can be used for regulation, such as electricity generation, batteries or flexible consumption. The power output of grid energy storage facilities can be regulated almost instantly. All providers in the reserve market are subject to the same terms and conditions, but additional ground rules have been drawn up for handling the limited energy capacity of grid energy storage facilities,” says **Pia Ruokolainen**, Specialist at Fingrid.



Finland could become a renewable energy oasis.

“We have the space for wind power, expertise in the field and an excellent grid. Industrial operators are also showing increasing interest in investing in clean electricity generation and storage in Finland,” Reilander says.

## MAIN GRID CONNECTION FEES DEPEND ON THE TYPE OF CONNECTION

Grid energy storage facilities can be connected directly to the main grid or be connected as part of an existing power plant, such as a wind farm. They can also connect directly to a distribution network.

“If a grid energy storage facility is placed in the customer’s existing connection network, Fingrid does not charge a separate connection fee

for connecting it to the system. If a grid energy storage facility is connected directly to one of Fingrid’s substations, we charge a connection fee, which is currently EUR 600,000. This is to cover the cost of building the necessary infrastructure, which consists of a switchgear station. If the customer’s battery is connected directly to a Fingrid transmission line, we charge the same EUR 600,000 fee because it takes up transmission capacity on the main grid transmission line. Fingrid can build connections to transmission lines in a few months,” Reilander says.

The main grid service fees for grid energy storage consist only of fees for input (EUR 0.90/MWh) and output (EUR 0.60/MWh) to and from the main grid. Fingrid does not levy any fixed charges. •

## Industrial operators are also showing increasing interest in investing in clean electricity generation and storage in Finland.

### Nordic region’s largest grid energy storage facility built in Yliskälä

Neoen, a French company, has built a 30-megawatt Power Reserve One lithium-ion battery facility in Yliskälä near Lappeenranta. The facility has an energy capacity of 30 MWh.

**N**eoen appreciates the solution-oriented approach in Finland. They contacted us in autumn 2019 to enquire about a quick connection for a large battery storage facility. A 110 kV switchgear station had been decommissioned at the Yliskälä substation, and it was possible to recommission it within six months by replacing the equipment. It normally takes 18–24 months to build a new switchgear station. Fingrid was able to lease part of its land in Yliskälä to Neoen. The battery storage facility was commissioned

in August 2020, and now we are checking whether Fingrid has any other plots of land that could be used in a similar way,” Antero Reilander says.

The locations of future batteries are most dependent on the purpose of use.

“Finland is an interesting place to invest in grid energy storage for operators in various industries, and battery prices have come down in recent years. Fingrid contributes to enabling new competitors to enter our market,” Pia Ruokolainen says. •







# The same tools for different goals?

The Nordic electricity market demands a new form of collaboration and foresight in order to overcome the challenges of tomorrow, says Fortum's Simon-Erik Ollus.

TEXT | SAMI ANTEROINEN

PHOTO | TOMI PARKKONEN

**T**he pan-Nordic electricity market established more than 30 years ago has been an undisputed success – but now, cracks are beginning to form in the union of the four Nordic countries. **Simon-Erik Ollus**, head of Fortum's Generation division, is concerned about current developments and says that the Nordic electricity market needs to change with the times.

“Up to now, we have had an oversupply of resources, so the optimisation of Nordic electricity has worked well. We are now entering a much more uncertain phase,” says Ollus, who has chaired Fingrid's Advisory Committee since the start of this year.

One factor is the decision by Svenska kraftnät, the Swedish transmission system operator, to limit the use of its export cables. This is the outcome of years of underinvestment in the electricity grid, as well as the closure of conventional power generation stations and significant additional wind power, which provides fluctuating levels of output.

“Svenska kraftnät faces major challenges in terms of the system stability in Southern Sweden. They have introduced some fairly drastic restrictions on the use of key transmission cables, resulting in uncertainty throughout the Nordic electricity market and disruptions in price formation,” Ollus says.

## DIFFERENCES IN THE NORDIC CAMP

According to Ollus, Nordic electricity operators are now pulling in different directions because they have different objectives: Finland aims to become carbon-neutral by 2035, while Sweden has postponed its targets by ten years.

“When we are aiming for different things but using the same tools, there is no way it can work,” Ollus says.

Finland is also facing a severe competitiveness challenge if there is no sensible way of electrifying industry in order to bring emissions down to zero. Whatever happens, electricity consumption in Finland is expected to double by 2050.

## A NATIONAL PERSPECTIVE IS REQUIRED

According to Ollus, in the present situation, Finland needs to keep its national objectives in mind, as well as the Nordic and EU objectives.

**“We need a stronger national approach to the system.”**

“We need a stronger national approach to the system.”

Has the joint Nordic model reached the end of the line? Would it be better for each country to look after itself rather than worrying about the security of its neighbours' electricity supply?

“It would still be better for us to work closely and effectively together and take joint responsibility for the security of supply across the Nordic region, but this requires more visionary collaboration and sufficient political commitment,” Ollus says.

## THE PORTION MODEL INTRODUCES BALANCE

In the 2020s, one of the most vital factors will be a joint understanding of what the energy system of the future will require. Ollus believes in the “portion model”, in which fluctuating wind power is supported by flexible hydroelectric power and stable nuclear power.

“Wind power is driving development, but we also need the stability afforded by hydroelectric and nuclear power. Otherwise, we will run into problems. Sweden is now a good example of this challenge.”

Ollus believes that whatever happens, there will soon be an enormous investment cycle that will present many parties with opportunities. He says it is now essential to ensure that the pieces are in the right places – and he praises Fingrid for making a good start in its forecasting and scenario-based work.

“Fingrid has done excellent work to identify how the electricity market will develop.”

## LOOK TO THE FUTURE!

According to Ollus, this is exactly how a transmission system operator should operate: Fingrid needs to be one or two steps ahead of the rest of the pack to ensure that grid development does not get held up.

“The transmission system operator must ensure the security of supply in all circumstances by looking far enough ahead into the future.”•

# Giving materials a new life

Fingrid takes care of building and dismantling parts of the main grid. It is important to maximise the proportion of materials that are put to new uses.

TEXT | SANNA KEKKI

EXPERT | MAIJA NURMI, ENVIRONMENTAL SPECIALIST AT FINGRID

PHOTOS | ISTOCK, ILLUSTRATION | OTAVAMEDIA

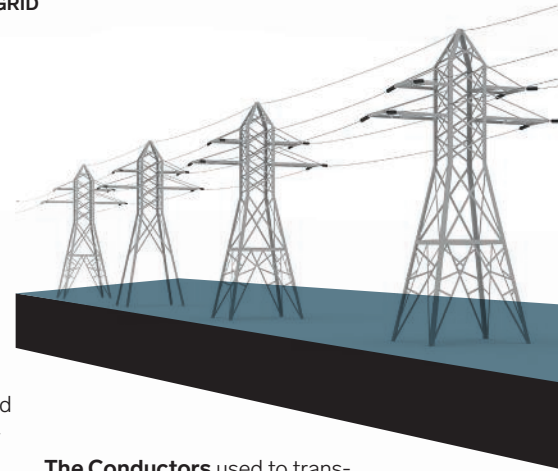


Waste arises from two main sources: when new sites are built and when old ones are dismantled. Most of the waste from new sites consists of packaging materials.

Waste is generated in larger volumes and greater varieties when old sites are dismantled. Every year, there are 20–40 projects that involve dismantling. The three largest types of waste are:

**Concrete**, which arises when old foundations are demolished, for example.

Concrete is used to create crushed aggregate that can be used in excavation work. For example, it can be used in road construction alongside or instead of natural rock material.



**The Conductors** used to transmit electricity.

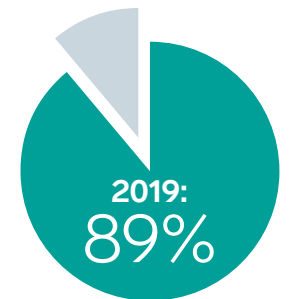
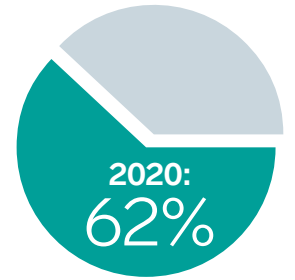
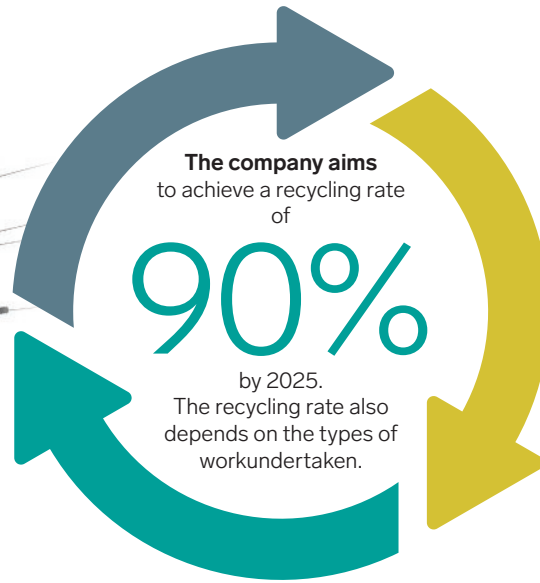
When transmission conductors are dismantled, they are processed by machine into fine shreds, and the various metals are separated out using a jarring plate and magnets. Aluminium is used to manufacture products such as light bulb frames.

**Steel**, which is in old transmission line towers, for example.

**It is important to reuse as much of the material as possible.**



Fingrid's recycling rate:



In 2020, the total volumes of waste were as follows:

Concrete:

1,924 tonnes

Steel structures, such as towers:

2,460 tonnes

Conductors:

974 tonnes

Waste oil from sources such as transformers:

27 tonnes

Old wooden towers:

78 tonnes

Examples of how materials are reused:

- Waste oil is sent for recycling, where it is used to make chainsaw oil for forestry machinery.
- Wooden towers are sent for incineration at a power plant supplying district heating and energy.

**Optimising the logistics** is a part of the recycling process. Lorries are not driven empty, and efforts are made to combine orders in the best possible way. Most of the recycled materials remain in Finland.

Fingrid's partner Fincumet handles waste transportation in every part of Finland.

# Energy Authority's decision on transmission rights will lead to changes in the electricity market

In June, the Energy Authority issued a decision requesting Fingrid to issue transmission rights for the cross-border transmission links between Finland and Estonia. When a smaller area is connected to a larger area with a more liquid hedging market, transmission rights will significantly increase the opportunities available to market parties to hedge against fluctuating electricity prices in that area.

TEXT | OLLI MANNINEN

PHOTO | ISTOCK



**TRANSMISSION RIGHTS** may be products entitling their holders to physical electricity transmission over cross-border transmission links or financial transmission rights (FTRs). The underlying asset of a FTR is the price differential between the areas. Holders of transmission rights are entitled to receive a payment if the price differential is positive in the direction of the transmission right. Transmission rights are allocated between buyers at an auction in a European marketplace where the price is determined in line with the marginal pricing at the intersection of supply and demand curves.

The granting of transmission rights carries several statutory obligations. The necessary procedures will require Fingrid to undertake many types of development work, and the Energy Authority must approve the proposed procedures before they are adopted. The schedule for the introduction of transmission rights will be finalised by the end of 2021.

**A**ccording to **Satu Viljainen**, a Senior Advisor at Fingrid and a specialist in electricity markets and EU integration, transmission rights between Finland and Estonia are an example of this type of scenario.

“Another example from nearby markets is the connection between Denmark and Germany, where Denmark – an area of lower liquidity – was connected to the high-liquidity German hedging market with the help of transmission rights,” Viljainen says.

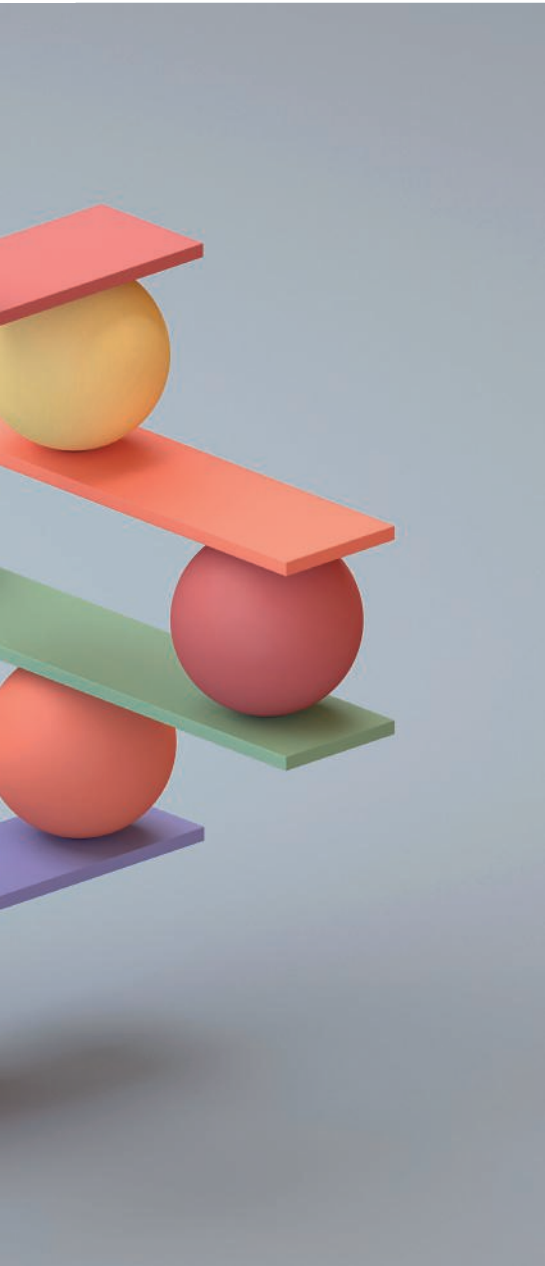
The liquidity of the electricity market refers to the market's capacity to fulfil transactions rapidly and efficiently so that the swift completion of trades – including large trades – has little

impact on the price. A sufficiently high level of liquidity is a characteristic of efficient markets: if liquidity is low, buying and selling can become difficult because there is little trading. Liquidity has a major impact on risk management and transaction costs.

**Jim Vilsson**, Senior Economist in charge of international electricity markets at the Danish transmission system operator, Energinet, says that parties operating in Denmark's electricity markets have responded positively to the long-term transmission rights (LTTRs) introduced a few years ago.

“Long-term transmission rights enable better market liquidity and more efficient markets,” Vilsson says.





# Transmission rights increase the flexibility and agility of the electricity market

**J**im Vilsson, Senior Economist at Energinet, says that parties operating in Denmark's electricity markets have responded positively to the long-term transmission rights (LTTRs) introduced a few years ago.

"Although transmission system operators will incur expenses in granting LTTRs, the overall economic benefits outweigh the costs," Vilsson says.

According to Vilsson, the focal point of transmission rights in Denmark will increasingly shift away from products entitling holders to physical electricity transmission over cross-border connections towards financial transmission rights (FTRs) over the next three to five years.

"Long-term transmission rights (LTTRs) enable better market liquidity and more efficient markets," he says.

Renewable green energy, which is expanding its market share, will also give rise to greater fluctuations in the electricity price, and market parties expect a wider range of tools for hedging against electricity price fluctuations.

"Parties are looking for more agile solutions in addition to annual and monthly auctions. The best tool for enabling the

development of dynamic, highly functional markets is open dialogue among market parties," Vilsson says.

According to Vilsson, the Danish electricity market is currently in a stage of very effective development thanks to market parties working in collaboration.

"Beyond the national borders, different countries have different views on the extent to which market parties should be involved in development work," Vilsson says.

In addition to cross-border connections with Sweden and Norway, Denmark is also connected to Germany and the Netherlands. An electricity transmission connection between Denmark and the UK is due to go live in 2024, emphasising the need to develop new LTTR products for the market.

"The UK electricity market is highly market-driven, and quarterly, weekly, weekend and seasonal FTR products are available. Dialogue between market parties and regulatory approval will be necessary in order for the same products to become available in the market via the DK-UK transmission connection," Vilsson says. •

## FROM LAISSEZ-FAIRE MARKETS TO STRICTER REGULATION

The introduction of long-term transmission rights reflects the trend of deeper European integration which began in the 2010s and has led to a significant increase in the amount of regulation in the electricity market. The Nordic electricity markets were subject to relatively loose regulation for a long time, but the situation has now changed. Until now, Finland has been able to derogate from the granting of transmission rights because market parties have had good enough price hedging opportunities in the electricity market.

The Nordic electricity markets were built largely around laissez-faire market principles. "It

is a prerequisite for an efficient electricity wholesale market that market parties have adequate opportunities to hedge against electricity price fluctuations. Ideally, the hedging options would be available on market terms," Viljainen says.

The Energy Authority's decision affirms that this will no longer be the case on the border between Finland and Estonia.

## THE SITUATION AT THE CROSS-BORDER TRANSMISSION LINKS BETWEEN FINLAND AND SWEDEN IS UNRESOLVED

The question of whether there are adequate hedging opportunities for the cross-border transmission links between Finland and Sweden is unresolved. The Energy Authority needs to

reach a decision on the matter together with the Swedish energy regulator. If the authorities fail to reach a consensus, the matter will be submitted to the European Agency for the Cooperation of Energy Regulators (ACER) for resolution.

The ability to grant transmission rights on the cross-border transmission links between Finland and the SE1 area of Northern Sweden would increase the hedging options available in Finland, as Finnish market parties would gain access to electricity price area differential (EPAD) products in the SE1 area, which has a generation surplus. Transmission rights are also highly suitable for situations in which it is necessary to connect adjacent areas with generating surpluses and deficits. •

# The elite of industrial design

The design of Fingrid's landscaped towers meets demanding steel structures. The latest impressive landmark, Viäntö, is at structural design stage in Savilahti, Kuopio.

TEXTS | SARI LAPINLEIMU

PHOTOS | FINGRID, LEHTIKUVA



Viäntö, Kuopio

**F**ingrid has gained a reputation as a pioneer in combining design and technical structures. Landscaped towers are examples of the company's approach to respecting the environment in built-up areas and on sites with sensitive landscape values. Fingrid has been building towers like these since the 1990s.

"Landscape towers are built on the basis of careful consideration in areas with sensitive landscape values or special cityscapes where lots of people spend time or pass through. Thanks to their large size, they become distinctive features of the area," says **Tommi Olsson**, Project Manager at Fingrid.

The landscape towers are being designed by a group of many including an architect and a steel structure and lighting designers. Transmission line modifications in Kuopio are designed and will be constructed under Fingrid's project management.

## SINIKURJET AND THE WONDER OF IMATRA

One example of a historically and architecturally valuable area is the Imatrankoski rapids, where Fingrid built a substation and five landscape towers in place of the old transmission line towers. Sinikurjet, a set of three landscape towers designed as a work of environmental art by Professor Antti Nurmesniemi, is a landmark at a grade-separated junction on Ring III in Espoo.

A 62-metre-high transmission line tower known as Pirkanpylväs is another example of a landscape tower. The tower is in the municipality of Lempäälä, beside the motorway from Helsinki to Tampere. The eye-catching work was designed by Jorma Valkama, an interior architect, and a system of lighting created by lighting designer Ilkka Volanen adds the finishing touch.

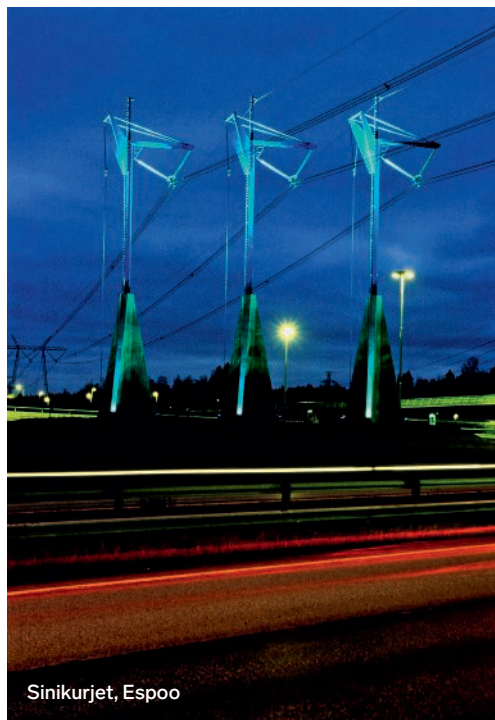




Imatrankoski



Vihti, Nummela



Sinikurjet, Espoo



Eurajoki

**“In principle, electrical installations come without any aesthetic goals, but they are beautiful almost by accident. They exude a sense of harmonious order and balance that fascinates and inspires me.”**

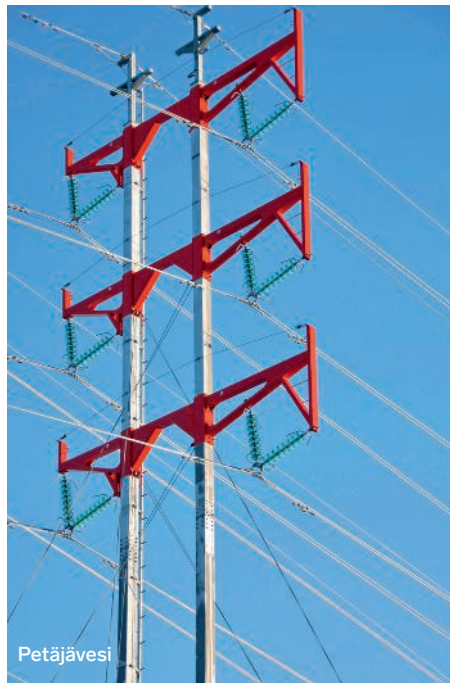
Bratislav Toskovic



Viherlandia, Jyväskylä



Pirkanpylväs, Lempäälä



Petäjävesi



Porvoo

### COSTS RELATED TO BENEFITS

Kuopion Savilahteen rakennettava voimajohtopylväs, Viäntö, on osa alViäntö, a transmission line tower being built in Savilahti, Kuopio, is part of the lighting, art, design and cultural programme for the area known as the Light Masterplan. The tower is scheduled for completion at the end of 2022.

“Savilahti is the largest regional development project in Eastern Finland and a significant area of growth in the city. The aim is to create a recognisable and desirable residential, educational and employment area that provides all of the aspects of a good life – including leisure and self-development,” says **Jukka Eskelinen**, Planning Engineer on the Savilahti project.

“The current transmission lines need to be moved to make way for new land uses, and they will remain a visible part of Savilahti. The Light Masterplan working group considered whether these contain the elements for making the area well known.”

The design group for the Savilahti project involved all of the operators in the area, including Kuopio (Sähköverkko Oy) and Kuopio University Hospital. The costs are divided in proportion to the benefits, and the City of Kuopio is making the largest contribution.

### SPACE FOR CREATIVITY

“The first consideration in designing a tower is always functionality, but there is also space for creative, open-minded architectural expression,” says **Bratislav Toskovic**, Senior Architect at Parviainen Arkkitehdit Oy and designer of Viäntö.

“There is a clear increase in the importance of electricity transmission in urban design and the motivation of electricity companies to make these buildings an interesting part of the cityscape. This is a good basis and foundation for the success of a high-quality design.”

The Viäntö design process was guided by the location of the tower at a “roundabout” connecting three transmission line routes and the desire to reinterpret a conventional steel lattice landscape tower. Special lighting is also being designed for the tower with the intention of applying lighting to a few other basic towers in the Savilahti area.

The name of the tower – Viäntö – comes from the English word Twist. It aptly describes the spiral form of the landscape tower – and perhaps a little of the local Savo mindset. •



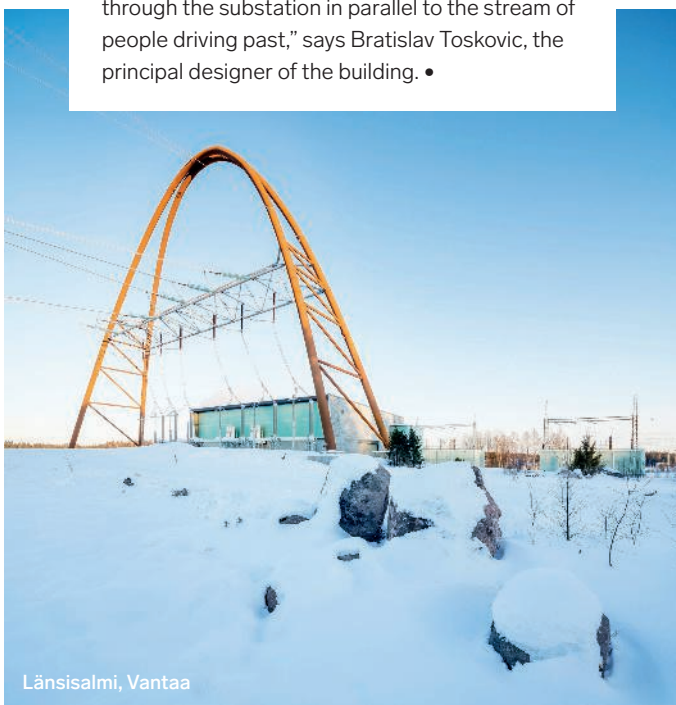
# A substation like a sweet treat

The inventive architecture of Fingrid's substation in Länsisalmi won the City of Vantaa's Marigold Architecture Award in 2018. It was also chosen as the best in its category at the World Architecture Festival, the largest event of its kind.

**T**he Länsisalmi substation plays a significant role in the functionality of everyday life in the Helsinki metropolitan area: the electricity for almost 800,000 residents can be transmitted via the substation. State-of-the-art technology and a very high power rating are packed inside an exceptionally beautiful and modern shell.

Länsisalmi, between Ring III and the motorway to Porvoo, has had a substation for 27 years. In conjunction with a modernisation implemented in 2016 and 2017, a 50-metre steel portal became a landmark of the substation. At the same time, the station buildings were clad in glass panels with backlighting that is turned on in the evenings.

"The architectonic concept sought inspiration from electricity and light – the visual manifestation of electricity. In this area, energy flows through the substation in parallel to the stream of people driving past," says Bratislav Toskovic, the principal designer of the building. •



Länsisalmi, Vantaa



## Landscape towers have little cousins out in the field

Field towers are designed for practicality, lightness and minimal scenic impact.

**F**ingrid's field tower is a transmission line tower developed with the wishes of landowners and farmers in mind. The design seeks to maximise the amount of field area available for cultivation and facilitate earthworks.

The tower is free-standing, requiring no stays or supporting lines. The substructures stand out more clearly than conventional wire stays, and the bases are surrounded by protective structures. This provides space for work machines to move around, and earthworks can take place right next to the towers.

There are two models: a larger one for 400-kilovolt transmission lines and a smaller one for 110-kilovolt lines. The larger one was awarded the Grand Prix prize at the prestigious Fennia Prize 2012 design competition.

The towers are made from galvanised iron, and they have an estimated service life of 80–100 years. They can be painted if desired. The work phases required to erect and maintain the towers have been minimised, and efforts are made to time them so as to minimise the inconvenience for farmers.

**Additional information: [fingrid.fi](http://fingrid.fi)**



# Sonya Twohig takes the helm at ENTSO-E

For the new Secretary-General, the next five years is all about change, innovation and energy system integration.

TEXT | SAMI ANTEROINEN

PHOTO | ISTOCK

**S**onya Twohig is the new ENTSO-E Secretary-General. Twohig started at her new job in January 2021. She says that the first few months have been “great and challenging” all at the same time.

“The situation with COVID-19 is not a surprise, but what is surprising to me, is how well the organization is working in spite of the restrictions,” she reflects.

“I feel like we have all come together to share the difficulties and experience the joy when we get back together again.”

Discussing the position of ENTSO-E in Europe today, she states that the role of ENTSO-E is a “pivotal one,” as the organization is making an important and valuable contribution to the pressing energy transition.

“Together with all our TSOs across Europe – presently, we have 42 members – we are working on many tasks and projects with the ultimate aim to decarbonize the industry.”

## UNITED WE STAND

According to Twohig, the biggest strength in this undertaking is the members themselves – and the history of cooperation between them all.

“Even when a situation is difficult, if you can rely on each other for support, it makes all the difference. I like to think of it as a family of TSOs,” she says.

Looking ahead, Twohig assesses that the greatest challenge for ENTSO-E is to deliver the required changes in an efficient manner.

“We are always facing the challenge of resources, and now with COVID we want to ensure that our teams stay together, focused on the targets.”

## FIVE YEARS WITH ENTSO-E

Previously, Twohig served ENTSO-E as Head of Operations section, at ENTSO-E Secretariat, in which role she supported the European TSOs in the implementation of EU Network Codes and Regulations and furthering Regional Coordination initiatives among TSOs since February 2016.

During her five years with the organization, she has been fortunate enough to work with really interesting people, on major events and, also, on designing new legislation.

**“We are on the cusp of a transformational shift of the industry which I am very happy to be a part of.”**

“Organizationally, I have been working to transform the Secretariat to a more Member focused organization which is professional and skilled in achieving for our association,” she says, calling her time with ENTSO-E “amazing”.

## TRANSFORMATIONAL SHIFT IN THE MAKING

What about the next five years, then – what’s on the horizon for ENTSO-E? – Twohig believes that the next five years is all about change, innovation and energy system integration.

“We are on the cusp of a transformational shift of the industry which I am very happy to be a part of.”

A key part of the ENTSO-E alliance is the “Nordic camp”, with Finland, Sweden, Norway and Denmark forming a tight TSOs unit – a small family within the family. Twohig has noted the great collaboration and culture that the Nordic TSOs have nurtured for years.

“The Nordic TSOs work very well together, having developed a model that really works,” she says.

## ONE MODEL DOES NOT FIT ALL

Still, she doesn’t quite believe that the same concept of close collaboration would be a winner everywhere.

“We have tried the same model in our East Europe project, but it didn’t take quite as well,” she says, adding that “keeping it small” may well be the key to success in the North.

“When you have more players, it’s suddenly a lot more difficult to make decisions and get things done.”

## PASSION PLAYER

In her work, Twohig is motivated by the Members and their satisfaction. Her aim is to ensure, at all times, that the organization delivers great service and products.

“I am passionate about the staff and people we employ, the talent that we nurture and the paths we develop together,” she concludes. •





## Optimizing Optimism

"I am inspired by Sir Ernest Shackleton, the Antarctic explorer, who was a great leader, inspiring many people to overcome their difficulties.

Shackleton was an optimist which I am, too, and he showed great resilience. Even in difficulty he led his team to achieve major feats.

He said: Optimism is true moral courage and difficulties are just things to overcome, after all!"

Sonya Twohig

# Aiming towards the power system of the future

Connecting renewable forms of energy to the grid involves challenges that Fingrid tackles with R&D projects. New solutions are used to ensure the security of the energy supply and cost-effectiveness during the global energy revolution.

TEXT | ARI RYTSY

PHOTO | KARL-JOSEF HILDENBRAND / DPA, LEHTIKUVA

**T**he revolution in the energy sector calls for new, more effective operating models, procedures and services that can influence the creation of the power system of the future. Fingrid has made major investments in its research and development activities. The company is currently working on several innovative developments kick-started with European Commission funding under the \*MIGRATE research project.

“New electricity generation methods like solar and wind power will be connected to the grid differently than conventional power plants. The MIGRATE project has studied how transmission system operators need to prepare themselves,” says **Mikko Kuivaniemi**, Expert at Fingrid.

In practice, the question is how much renewable electricity generation can be connected to the power system using existing technologies before running into problems. The MIGRATE project also examined which new technologies will need to be developed if most or all of the grid’s electricity is generated from renewable sources.

**As the proportion of converter connected generation increases, the operability of the grid will need to be assured by other means.**

“This has not previously been considered a major problem in Finland or the other Nordic countries, as the proportion of converter connected generation has remained moderate so far. However, the situation is changing, and these challenges have become more relevant,” Kuivaniemi says.

## CONVERTER CONNECTED GENERATION PUTS THE GRID’S PERFORMANCE TO THE TEST

Preparing for the expansion of renewable energy and managing the power system are key strategic development themes for Fingrid. For this reason, the overview created during the MIGRATE project in terms of themes such as the challenges posed by the increase in the volume of converter connected generation will facilitate more detailed development work.

“Renewable energy imposes challenges related to factors such as the stability of converters, the management of outages and the operation of network protection. A lot of work is now being done in these areas, and solutions are being developed to prevent network instability,” says **Antti Harjula**,

Manager of Fingrid’s Power System Design unit.

Conventional synchronous machines naturally support the power system, but wind and solar power are connected via converters, which operate according to programmed algorithms and do not offer the same features to support the power system. As the proportion of converter connected generation increases, the operability of the grid will need to be assured by other means. Otherwise, we could face restrictions on the amount of renewable energy generated.

Fingrid’s participation in the MIGRATE project and the network vision published at the start of the year lay strong foundations for addressing future challenges. Fingrid’s Technology Manager **Jussi Matilainen** says that R&D always carries a certain degree of uncertainty and unpredictability over the end result. Forecasting is the only way to plan high-quality, cost-effective solutions for managing various situations.

“The European Network of Transmission System Operators for Electricity (ENTSO-E) recognises the value of R&D and has made it one of the focal areas of its operations. R&D will make it possible to exploit the full potential of solar and wind energy and cut carbon dioxide emissions,” Matilainen summarises. •

Read more about the project:  
[h2020-migrate.eu](https://h2020-migrate.eu)





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COMPILED MARJUT MÄÄTTÄNEN  
PHOTOS | ISTOCK, SAMULI SKANTSI



## Technical innovations effectively boost electricity transmission capacity

■ Fingrid's innovation work has resulted in a significant increase in the north-to-south electricity transmission capacity. The technology is known as shunt compensation, and it is a quick, cost-efficient and environmentally friendly way to increase the transmission capacity by hundreds of megawatts. The solution will benefit everyone in Finland, as it enables Finland to remain a single wholesale price area.

The electrification of society is increasing the need for electricity, especially in Southern Finland, while electricity generation is weighted towards the north. In recent years, wind power has accounted for a significantly larger share of the power system production. Wind power generation in Finland is weighted towards Northern Finland, so efficient north-to-south electricity transmission is required.

At present, four strong 400-kilovolt transmission lines pass through cross-section Central Finland in the electricity

system of Finland, and the transmission capacity of these lines is now being boosted with the help of shunt compensation. Technically, the electrical power that can be transmitted through cross-section Central Finland is constrained by the quality of the voltage under normal operating conditions at the substations south of the cross-section, as well as variations in the post-fault voltages. The outcome of the development work is that capacitors will be added to the main grid to stabilise the voltage, thereby significantly increasing the transmission capacity through cross-section Central Finland. However, this innovation is no substitute for future power line projects and the need to build new substations.

**Further information: [www.fingrid.fi/en](http://www.fingrid.fi/en) and [www.fingridlehti.fi/en](http://www.fingridlehti.fi/en)**

## Employment impact of the energy sector studied

Gaia Consulting has studied the direct and indirect employment impact of the energy sector in Finland.

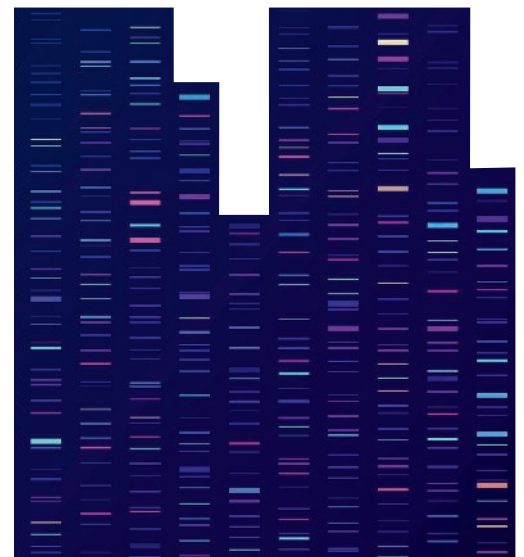
■ The study revealed that energy generation and transmission account for the sector's most significant employment impact, employing approximately 80 per cent of the personnel in the sector. The energy industry creates a substantial proportion of Finland's total income tax and corporation tax revenues. The sector's annual tax contribution is about EUR 1 billion, encompassing income, corporation and property taxes.

The Finnish energy sector's total employment is approximately 42,000 person-years. Of this total, direct employment accounts for 23,300 person-years, and indirect employment accounts for 19,000 person-years. According to the study, Fingrid's indirect employment impact is 2,280 person-years.

The study assessed the employment and tax impacts throughout the energy industry's value chain in five business areas: the fuel chain, energy generation, energy transmission and distribution, energy sales, and selected added-value services. The model used in the project was developed by a consultancy to output data on the direct and indirect employment impacts of a business.

The calculations were based on data for 2019. The study was commissioned by Finnish Energy.

**Further information: [www.energia.fi](http://www.energia.fi)**







## Studies of the impacts of the hydrogen economy

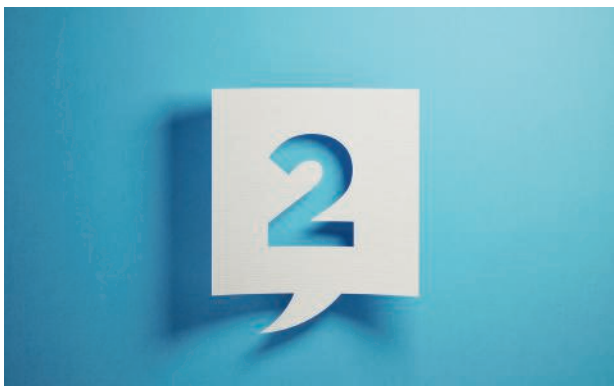
■ Fingrid has begun studying the impacts of the hydrogen economy together with Gasgrid Finland. Cleanly produced hydrogen has been identified as one significant opportunity for curbing climate change. It may also be highly suited to many sectors of industry that would otherwise be difficult to clean.

The electricity grid, a potential hydrogen network, and energy storage possibilities will play a significant role in creating Finland's hydrogen economy. The aim is to study the possible future development pathways for the production and consumption of hydrogen in Finland, as well as the requirements that these will place on electricity and gas transmission system operators. The collaboration involved investigating the impact on the energy transmission system as a whole if Finland had a hydrogen network operating nationally and providing opportunities for exporting hydrogen. •

## Finland has the second-lowest transmission tariffs in Europe

■ According to a comparison by ENTSO-E, the price of electricity transmission on Finland's main grid is the second-lowest in Europe. The comparison covered 36 countries. Nineteen of the countries were similar to Finland: EU/EEA countries with a large land area and a main grid operating at different voltages. The lowest prices among countries in this group were found in Slovenia, Finland and Norway.

In line with Fingrid's value pledge, our services are among the least expensive in Europe. In addition to low prices, we have been able to ensure a reliable, undisrupted electricity supply to customers, and we have ensured that a uniform price area exists throughout Finland. The transformation of the power system has substantially increased the need for investments in the main grid, but Fingrid has been able to keep its prices low by operating cost-efficiently. Tariffs have decreased by more than ten per cent since 2017. •



## Janne Seppänen becomes a Professor of Practice at Aalto University

■ Janne Seppänen, a Senior Expert at Fingrid, has taken up the position of Professor of Practice at Aalto University. The position is part-time, and he will continue to work at Fingrid.

"In recent years, Finnish universities have lacked extensive education on high-voltage electricity transmission systems and research groups focusing on this area. I am now trying to address this shortfall. I plan to establish a research group specialising in electricity transmission. I am also looking forward to teaching and guiding students towards jobs in the sector," Seppänen says.

The energy revolution will increase the need for experts throughout the energy sector, and the electricity transmission sector will become a major employer in the near future. •



# Jarmo Henttinen, substation moderniser

Project Manager **Jarmo Henttinen** has taken charge of the repair work at several substations that Fingrid has overhauled in recent years, as well as the construction of new substations. The overhauls of the Imatra and Länsisalmi substations, among others, have had a substantial visible impact on nationally significant landscapes.

TEXT | PÄIVI BRINK, PHOTO | SAMULI SKANTSI

## WHEN DID YOU BEGIN WORKING IN YOUR CURRENT ROLE AT FINGRID?

I started working for Fingrid in 2014 in my current position as Project Manager. I had previously worked in a similar role for Helen Electricity Network, and before that, I worked for a contractor, delivering similar contracts. I am an electrical power engineer by training.

## WHAT DO PROJECT MANAGERS DO AT FINGRID? WHAT DO YOU LIKE ABOUT YOUR WORK?

I mostly manage overhauls of old substations, but I also manage some new substation construction projects. Projects typically last two or three years, which adds some variety to the job. I am involved in the entire process, from the planning phase through to completion. The Grid Planning unit prepares the preliminary design for the substation, and I work with the project manager to consider the implementation and schedules so that Fingrid can make a decision on

whether to invest. After this, the project manager leads the physical implementation process. This is teamwork. The team includes Fingrid's project group, external designers, construction supervisors and contractors. I work with people from various organisations with the aim of achieving a high-quality outcome, and I like this work. I generally spend about half my working time on worksites and half in the office. On worksites, I monitor the progress of the work and attend design and worksite meetings.

## WHAT IS HAPPENING IN YOUR WORK AT THE MOMENT?

At the moment, I am working on overhauls at the Virkkala and Tammisto substations. Fingrid is one of the first companies in the world to pilot the use of more environmentally friendly substation switchgear, which is being implemented using new technology at the substation in Virkkala, Lohja. The Tammisto substation, on the other hand, is an example of great urban

construction in a highly visible location next to the Jumbo shopping centre in Vantaa. It was an interesting project because the substation is in a historical, protected national landscape. The National Board of Antiquities approved a modern building for the Imatra substation and stylish landscaped towers in the vicinity. The Länsisalmi substation, which is located near Ring III and was completed a few years ago, won an international architecture prize. Landscaped transmission line structures played an important role in this location. I have been involved in building great substations in great places.

## WHAT DO YOU DO IN YOUR FREE TIME?

At the moment, I spend my free time with my family. We have two small children, a dog and a detached house, so there is not much time left for anything else. I try to play tennis a couple of times a week. •

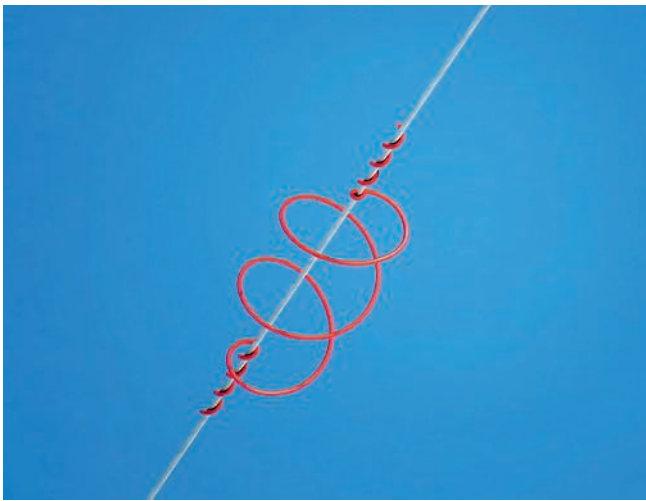


*Fingrid initiates discussion on topics related to its industry. In this series, we participate in the discussion by highlighting electric novelties and current phenomena. You can suggest a topic for this page via e-mail: [viestinta@fingrid.fi](mailto:viestinta@fingrid.fi)*

# Stop collisions!

The balls, plates and spirals on Fingrid's transmission lines minimise the number of bird collisions.

TEXT | SARI LAPINLEIMU  
PHOTOS | RISTO UUSITALO



be suspended for the duration of the procedure – unless the spirals are installed on a new line at the time of construction.”

The need for warning markings on new lines is highlighted by environmental studies or environmental impact assessments (EIAs). The hazardous locations along existing lines are often reported by residents or bird associations. The information is sent to an external ornithologist, who studies the terrain and birdlife information about the area and issues a recommendation. Then, the ball is in Fingrid's court.

“We examine the technical aspects of installation and consolidate the suggestions accrued over the course of the year. We also keep landscape considerations in mind. The cases are prioritised and allocated funding from the budgets in the coming years. It takes some time to get these markings installed.” •

**R**ed and black balls attached to transmission lines are a familiar sight for Finnish people. These warning signs have been fixed to the lines in an effort to minimise the number of injuries and deaths due to bird collisions.

The risk of collisions is highest during the spring and autumn migrations. Large, swan-like avians face the highest risks because they do not have the agility to change course quickly.

“The markings reduce collisions by 50–90 per cent. There are no precise figures because this would require constant monitoring in the form of visual observations on-site or counts of fallen birds. Continuous monitoring is challenging, and counting the number of dead birds is impossible in practice because nature deals with the bodies so quickly,” says **Tiina Seppänen**, Expert at Fingrid.

The first anti-collision measure to be deployed was the warning ball, but Fingrid is increasingly experimenting with spirals and reflective plates. The relevant criteria are the installation technique, durability and permanence, which the Finnish climate puts vigorously to the test.

“Bird warning balls can be installed on the earth wires of transmission lines from the ground without any transmission outages. The plates can also be installed on live wires. The spirals are installed using a trolley, so electricity transmission must



**Report a hazardous location:**  
[tiina.seppanen@fingrid.fi](mailto:tiina.seppanen@fingrid.fi)

# Fingrid Current

**Tuesday 23 November 2021, 1pm–4:30pm**

Theme of the event: the electricity market and the means of supporting Finland's competitiveness with the help of the electricity market. The event is invitation-only, but a virtual broadcast will be made available to everyone.

**We look forward to welcoming you!**

Further details:  
[www.fingrid.fi/en/  
events](http://www.fingrid.fi/en/events)

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