**3** 2022

# FINGRID

TRANSMISSION SYSTEM OPERATOR'S MAGAZINE / THEME: ON THE ADEQUACY OF ELECTRICITY / *fingridlehti.fi*

ARTO PAHKIN, FINGRID:

**"Fingrid, the distribution system operators and the authorities will work in close cooperation in the event of an electricity shortage."**

**The power system vision foretells the transformation of the electricity system**

**The need for electricity transmission will double in Helsinki in the coming years**

EVERY RESERVE POWER PLANT IS TESTED AND UNDERGOES A TRIAL RUN EVERY

**6 weeks**

**RESERVE POWER CAN BE ACTIVATED QUICKLY:**

IN 10 MINUTES,

**500 MW**

CAN BE ONLINE

IN 15 MINUTES,

**1200 MW**

CAN BE ONLINE

# Always ready

Fingrid is prepared for the event of electricity production disturbances. In addition to buying from the balancing power market, it has access to approximately 1,200 megawatts of reserve power. Reserve power plants are always on standby, but the full 1,200 megawatts is very rarely needed.

Fingrid is responsible for maintaining an instantaneous balance between Finland's electricity generation and consumption – known as balance management – as well as managing and rapidly recovering from disturbances.

Disturbances in the electricity network are caused by problems such as a faulty transmission link or a power plant going offline.

Disturbance reserve is called upon in situations like these, firstly with capacity from the balancing power market, and only then from reserve power. The reserve power plants rarely need to be started up, and even then, Fingrid typically uses one or, at most, a few of them for about an hour at a time. In the event of a nationwide electricity shortage, a lot more reserve power may be needed.

Disturbance reserve is dimensioned in such a way that it is enough to cover the power shortfall resulting from the failure of the largest power plant unit or the largest transmission link in the power system at any given moment. Fingrid owns nine reserve power plants, and it has right-of-use agreements with a further five power plants. These are not used for commercial electricity generation.

A startup reliability rate of approximately 90 per cent is maintained at the reserve power plants. This readiness is upheld thanks to correctly dimensioned maintenance and tested by trial runs that each unit undergoes every six weeks. Fingrid has an agreement with a third-party supplier for the maintenance of its power plants. ◆

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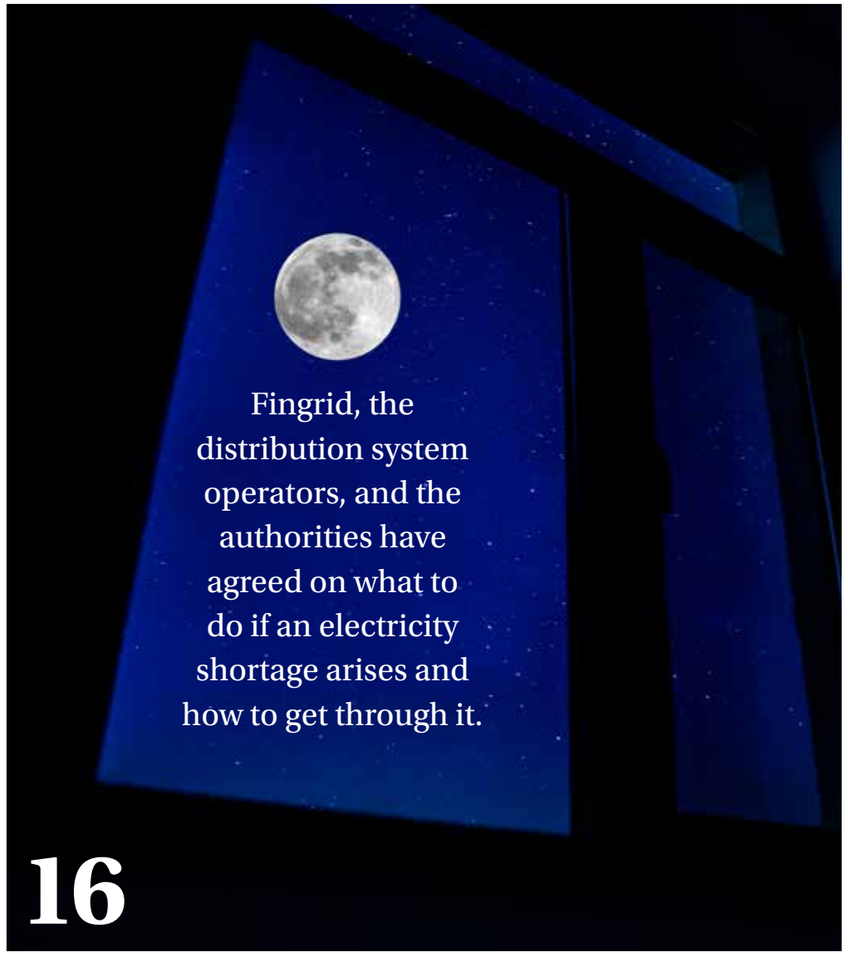




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# Focus on managing the energy crisis and an emission-free future

**THE ENERGY** market remains in an extraordinarily challenging state due to the war in Ukraine. A secure energy supply and affordable electricity now have a highly tangible value.

The high gas price has caused electricity prices to soar throughout Europe. However, the northernmost part of Europe has benefited from clean electricity production, and the electricity price in Finland has remained lower than the prices further south in the continent. We are lucky to be heading in an even better direction, as Finland is likely to become self-sufficient in electricity on an annual basis next year. Until then, however, we must prepare ourselves for high electricity prices in the winter.

The European energy crisis has raised uncertainties around the adequacy of electricity in the coming winter in several countries, including Finland. We published our first assessment of the adequacy of electricity for the winter back in August and updated it in October.

The message is clear: there are substantial uncertainties, so people in Finland should be prepared for power outages caused by possible electricity shortages this coming winter.

The message has been well understood, and people in Finland have joined the effort to save electricity: electricity consumption decreased in September by an average of seven per cent compared with the previous year. Action has been taken in homes and in industry – Finland is a nation that takes care of the security of supply.

While we deal with the crisis at hand, we are also looking resolutely to the future. Our investment programme to reinforce the main grid has continued as planned, and we have succeeded in driving forward our demanding transmission line and substation projects on schedule and on budget.

The most significant project was the Forest Line, which was completed in September. The new line strengthens the electricity transmission capacity between Northern and Southern Finland, enabling the efficient transmission of renewable energy output from the north to electricity users in the south. An electrifying Finland needs a strong main grid.

**Jukka Ruusunen**
President & CEO
Fingrid


FINGRID

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# RESPA 22 concludes a multi-year series of exercises

In September, organisations critical to the security of supply in the Helsinki metropolitan area conducted an exercise simulating an electricity distribution disturbance in the main grid and distribution network.

The two-day exercise involved a large-scale disturbance that paralysed the basic functions of society while the participants attempted to resolve the situation.

The parties affected by a major electricity distribution disturbance and various authorities, energy sector operators, and other businesses, and a common overview and situational awareness must be created and shared rapidly. During the exercise, communication tools were used effectively, and the organisations were able to monitor each other's communications and share information in their own communication channels. The technical readiness of the communication and situational awareness systems used jointly by critical infrastructure operators had improved since the exercises were in their early stages.

"Collaboration, effective technology and communication are key. Therefore, it is vital for everyone to deploy common systems and agree upon the terminology and contents of information exchange and situational awareness in advance," says **Arto Pahkin**, Fingrid's Control Centre Manager and chair of the steering group for the RESPA 22 exercise.

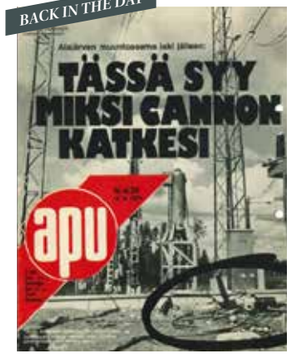
RESPA 22 was the final part of a series of exercises, known as JÄÄTYVÄ, held in various parts of Finland. The series began in the Kuopio region in 2017, and further exercises were conducted in Lappeenranta, Turku, Oulu and Seinäjoki. Nearly 500 people were involved in the preparation and execution of RESPA 22. The entire series of exercises involved almost 3,000 people. ◆

## More transmission capacity from west to south

**FINGRID** is building a new transmission line connection in the main grid from Huittinen to Forssa. The new connection will allow the growing electricity production surplus on the west coast to be transmitted to Southern Finland. This will significantly improve energy efficiency, streamline maintenance outages, and increase the fault tolerance of the grid. Construction will begin next year, and the connection will be completed in 2025.

**fingrid.fi/en/grid/construction**

BACK IN THE DAY




## The Cannon fell silent

**FINLAND** suffered several nationwide power cuts in the 1970s, and the cause was eventually traced to the Alajärvi substation in Southern Ostrobothnia. The issue even made the front cover of Apu magazine in the summer of 1974 because a blackout occurred during the broadcast of Cannon, one of the most popular TV series at the time. Since then, substation technology has been modernised, and there have been no more major disturbances.



PROFILE

# Helping customers through the energy transition

Improving Fingrid's customer experience is the most important aspect of Development Manager Rami Saajoranta's work.

TEXT MINNA SAANO | PHOTO FINGRID

When I started working at Fingrid five years ago, my first job was to work out how to digitalise the workflows between customers and Fingrid in the My Fingrid service. The aim was to create a modern platform that could be further developed by adding new features and functionalities.

My Fingrid has made many operations quicker and easier. The service provides technical data, measurement and billing information, and reporting. The manual phases involved in communication and data collection between customers and Fingrid have been eliminated. One example of this is outage plans, which were previously compiled in Excel spreadsheets, by phone and email.

Now, all customers need to do is fill in the information in My Fingrid, and the data is stored directly in our systems, so we can plan the customer's process and ensure it goes as smoothly as possible.

I am currently developing Fingrid's customer journey, which we use to identify the critical touch points, where we interact with our customers, or we could help them more. In the future, we will focus on improving them.

We carry out a comprehensive customer satisfaction survey once a year to find out what customers think of our operations. We also collect feedback from people who attend our events, and we conduct surveys among our stakeholders.

The results of the customer satisfaction survey also form the basis for the remuneration of Fingrid employees.

My job allows me to see just how important Fingrid's role is as a facilitator of the ongoing energy revolution and help customers connect to the main grid." ◆

**WHO?**
Rami Saajoranta

**WORK**
Development Manager

**FAMILY**
Wife, two daughters and a dog

**FREE TIME**
FoxDo (Saajoranta's startup in the renovation business), Lone Star Dreamers (an a cappella vocal group), golf, jogging

# Forest Line complete

The transmission connections between Northern and Southern Finland were significantly strengthened in September with the commissioning of Fingrid's Forest Line transmission link.

Renewable energy has shifted the focus of electricity production towards Northern Finland, and the new connection will transmit electricity efficiently to consumers. Reinforcing the transmission capacity between the north and the south also helps to ensure that Finland remains a single price area.

The project began in 2019 and was completed on schedule. It involved replacing old transmission lines and building a new 400-kilovolt transmission line connection requiring more than 800 transmission line towers. Substations were also built and modernised. The connection runs from Petäjävesi to Oulu, and, with a length of 305 kilometres, it is the longest of Fingrid's four main transmission lines. ◆


Security of the energy supply Q3/2022

**99.99995 %**

## Updated website

**FINGRID'S** website has been updated to provide better service for different user groups. The Finnish-language homepage now contains shortcuts for parties connecting to the main grid, reserve providers, and landowners. The popular information page "State of the power system" is now at the top of the page, and open data has been given a separate section in the main menu. In addition, sections such as the main grid construction pages now have clearer structures and contents. The website was developed in cooperation with customers.

Fingrid's feedback service has also been modernised and integrated into our website. The service enables users to send us questions, feedback, and service requests linked to map locations, along with general feedback.

**fingrid.fi/en/pages/contacts/feedback**
**fingrid.fi**



COLUMN

PHOTO JARI AALTO

# The energy crisis is driving energy consumption into a new era in the home

**THE CHANGES** to the energy situation in Finland and Europe were thrust upon us uninvited and without warning.

We are in a better position than most other European countries, but despite this, households also need to save energy and look for energy-efficient solutions as one way of easing the situation.

Consumers have long been encouraged to make smart choices about the way they consume energy at home in order to save energy and make their homes more energy efficient. Only now that energy prices have hit new highs have people taken a keen interest in such efficiency measures. Many households are driven by financial necessity.

*The market is now open to new technologies and innovations that households could adopt without great expense.*

People need quick energy-saving measures in the home, and many have looked to energy advice for new and simple ways of making savings. However, the most significant means of making savings are the familiar ones: reducing the indoor temperature and the consumption of hot water, as well as using electrical devices sensibly – old tricks that should increasingly become part of people's everyday routines.

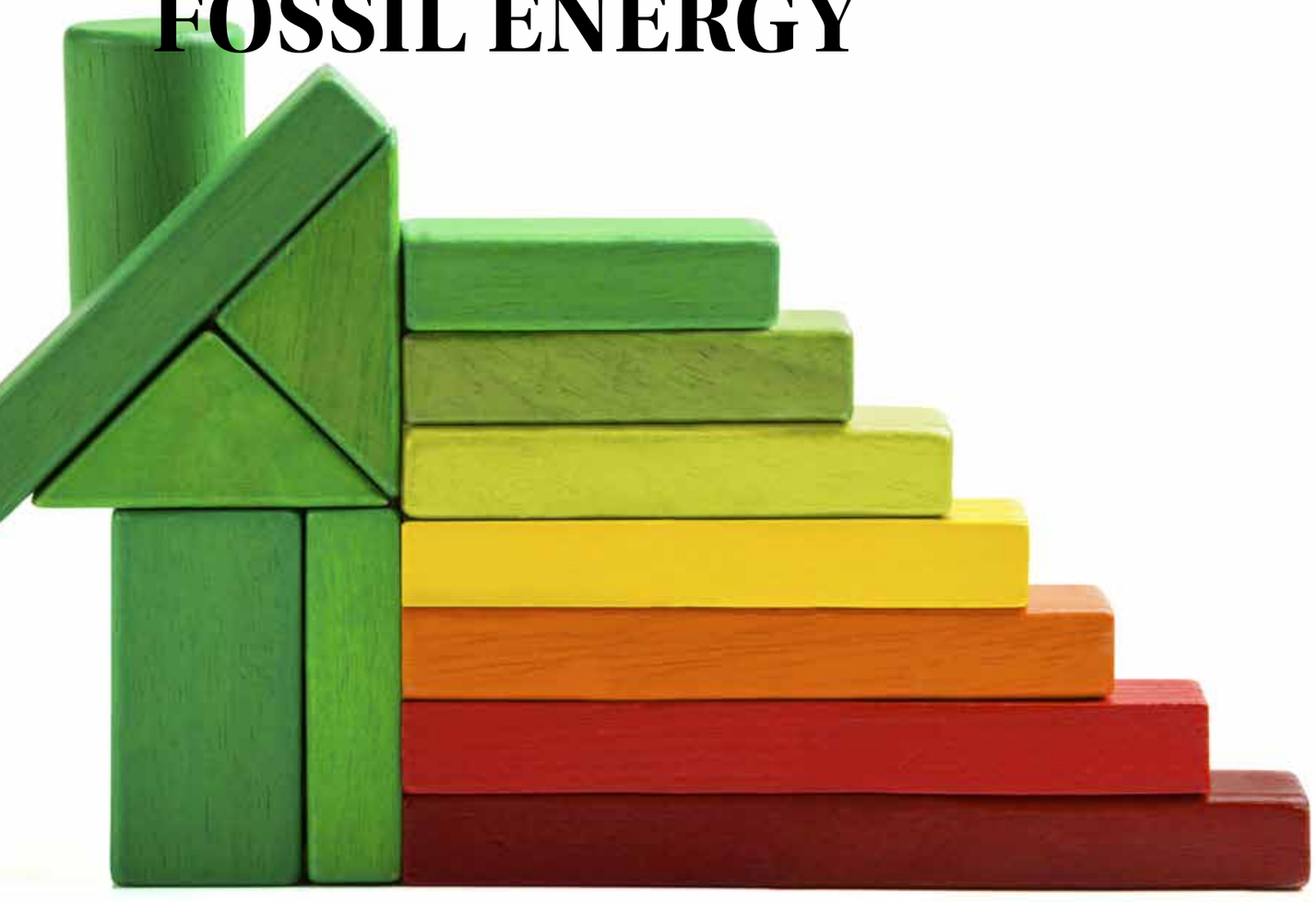
**THE BIG** question in the coming winter is how households and housing companies can be brought within the scope of demand-side management and encouraged to reduce their electricity use at times of peak consumption. Information and advice can increase consumers' understanding but may not be enough to push them to change their familiar routines and habits at home.

Some households can schedule their consumption sufficiently on their own and make efficient adjustments to their heating and ventilation. However, the majority of households will probably require more effective guidance and support for this change, and they may be looking for technologies that can handle things for them.

**THE MARKET** is now open to new innovations and technologies that are affordable and easy for households to adopt. They would help people to consume electricity at times when the price and production status are most favourable. Simple, easy-to-use solutions will gain quick uptake as everyday routines in the home must change in order to save energy – and not just through the actions of people, but with the help of technology. ◆

**Päivi Suur-Uski**
is an energy-efficiency expert specialising in energy consumption in housing and energy-efficient solutions for the home.

# WASTE HEAT FROM A DATA CENTRE REPLACES FOSSIL ENERGY



Espoo will soon be the site of a giant leap towards carbon neutrality. Several parties are working together to put the green transition into action by harnessing the waste heat from a data centre to heat buildings.

TEXT SAMI LAAKSO / PHOTO SHUTTERSTOCK

Some ambitious targets are in place for carbon neutrality: Finland aims to become carbon neutral by 2035, and Espoo, the country's second-largest city, is trying to get there by 2030.

Before Espoo and its 300,000 residents can reach this target, fossil energy needs to be eliminated from district heating production. Fortum has promised to do this by 2029. It has also set itself the milestone of stopping the burning of coal at the Suomenoja thermal power plant by 2025.

A solution has been developed to help Fortum reach this goal, exploiting heat that has, until now, been an undesirable by-product.

"Data centres can be built in urban areas. They generate a lot of waste heat, which can be used in combination with CO2-free electricity to provide district heating for citizens," says **Antti Kaikkonen**, Project Development Director at Fortum.

In practical terms, the waste heat is harnessed by sending the indoor air from the data centre through a heat exchanger, which transfers the thermal energy into water flowing in a closed loop to a heat production plant. The plant transfers the heat into the district heating system, which sends it onward to thousands of homes and workplaces.

Fortum aims to use waste heat from data centres to cover 40 per cent of the heat production in its area by the end of the decade. This could reduce carbon dioxide emissions by approximately 400,000 tonnes a year.

The benefits actually accrue in multiples as Finland gains data centres, jobs and wellbeing at a stroke. Furthermore, coal purchased from foreign countries can be replaced by clean domestic energy, making Finland less dependent on imports.

**Fortum aims to use waste heat from data centres to cover 40 per cent of the heat production in its area by the end of the decade.**

The decision was taken to build a data centre in Hepokorpi, Espoo, as the area is close to both the district heating and electricity networks.

"The entire project relies on the construction of a new substation near the data centre. Fingrid's new substation will serve the upcoming data centre while enhancing the electricity supply throughout Espoo as it continues to grow," Kaikkonen says.

## USING EMISSION-FREE ELECTRICITY AS AN INCENTIVE

Fortum set out to identify a partner for the data centre project that is compatible with Microsoft's goals.

"Sustainability is one of the most important drivers of Microsoft's business. The company has set itself the target of becoming carbon negative by 2030. That is why it is so important for us to have access to a reliable supply of $CO_2$-free electricity," says **Patrik Öhlund**, Director, Energy Markets at Microsoft.

Microsoft considers Finland a good place to invest and is establishing new data centres in Kirkkonummi and Vihti in addition to the one in Hepokorpi. These will supplement its global cloud infrastructure, which currently has more than 60 data centre regions and over 200 data

**Hepokorpi substation was designed by Virkkunen & Co architects. The design incorporates architectonic values that will make the substation a natural part of the urban environment.**

centres. These serve more than a billion customers in 140 countries.

"When we evaluated where to invest, one of the central factors was Finland's very stable and reliable power system. Furthermore, as Microsoft is committed to using 100 per cent renewable energy at its data centres, the fact that significant renewable energy production capacity will be built in Finland in the coming years was also important," Öhlund says, praising the Hepokorpi data centre project as a very innovative idea.

**Microsoft considers Finland a good place to invest and is establishing new data centres in Kirkkonummi and Vihti in addition to the one in Hepokorpi.**

### INCREASING CONSUMPTION REQUIRES INVESTMENT

When Fingrid's substation is built in Hepokorpi along with Microsoft's data centre and Fortum's heat pump plant, the entire project will be in final, functional order. The design focuses on ensuring that the building blends into its urban environment, and, to this end, timber construction will be one of the methods used. The substation will also have environmentally friendly ester oil transformers.

"Espoo's high-voltage network will require substantial reinforcement as the energy revolution causes the required electricity capacity to soar. At the moment, Fingrid's Espoo substation supplies all the electricity for Caruna's network. The new Hepokorpi main grid station is an important step in boosting the capacity distributed around the Espoo region," says **Jukka Ihamäki**, Regional Director at Caruna.

He points out that digitalisation and the green transition mean that many functions will be electrified.

"Electricity consumption is expected to increase dramatically in Espoo by 2030 due to heating, transport and also digitalisation. In the latter, data centres are the largest and most visible consumer," Ihamäki says.

However, not all the electricity consumed by data centres should be counted as additional to the previous electricity consumption: companies and organisations are moving their ICT systems out of on-premises data centres and into energy-efficient cloud services.

The rapid change also requires Caruna to invest tens of millions of euros. One of the most important projects is a cable link from Hepokorpi to Finnoo, which will ensure the supply of electricity to South Espoo.

The urban environment poses challenges of its own, as construction work must be reconciled with the existing infrastructure, urban fabric, nature and the future plans for a growing city.

**When Fingrid's substation is built in Hepokorpi along with Microsoft's data centre and Fortum's heat pump plant, the entire project will be in final, functional order.**

### CHALLENGES OF THE PERMIT SYSTEM

All the parties in the Hepokorpi project emphasise the importance of a smooth permit process so that practical progress can be made towards the carbon neutrality goals of Espoo and Finland, and companies are encouraged to invest.

The schedules are already tight due to the planning and construction alone, and the permit practices, with all the potential appeals, present an additional challenge.

"There are no shortcuts in the permit process, but it would be helpful if the excess delays could be eliminated. This would make the situation much easier, and we could get society electrified more quickly," Ihamäki emphasises.

He considers the Hepokorpi project an example of how Finland is an attractive country for foreign investors with its reliable supply of $CO_2$-free electrical energy.

"We should capitalise on the energy revolution and green transition that are now in train and boost employment and wellbeing in Finland." ◆

# THE ADEQUACY OF ELECTRICITY IS ESTIMATED PROACTIVELY

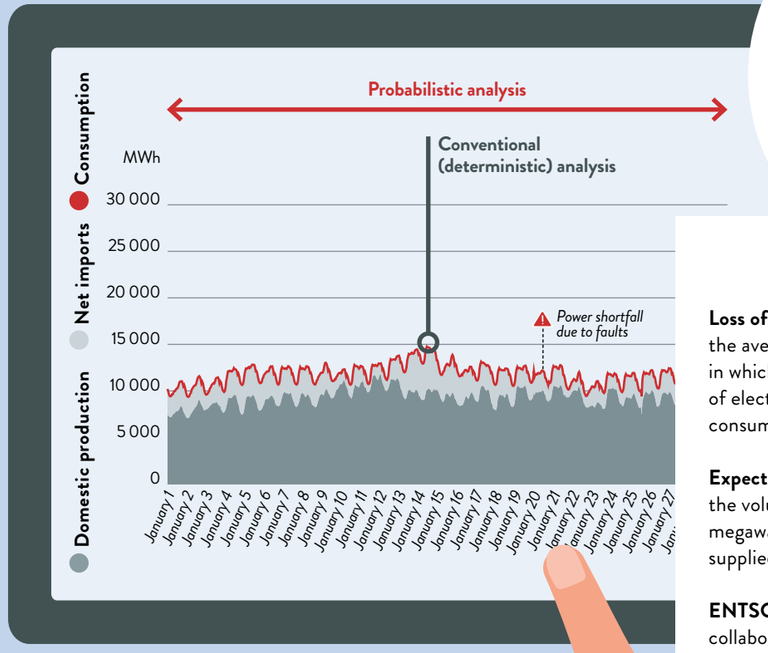
European transmission system operators are engaged in constant collaboration to estimate the adequacy of electricity in the coming winter and summer, as well as in the next few years. The estimates are based on a probabilistic analysis that simulates how the weather and any possible outages affect electricity production, transmission and consumption. The outcome is the expected number of hours when electricity shortages could arise in each country.

COMPILED BY JUSSI NÄRHI / INFOGRAPHIC BY LAURA YLIKAHRI

**FINGRID'S RESPONSIBILITIES** include estimating the adequacy of electricity in Finland. We also estimate the adequacy of electricity with other European transmission system operators because it is essential to take into account the power balance in the neighbouring countries in a common electricity market. Every year, we prepare estimates for the coming winter and summer seasons. We also prepare estimates with a time horizon of up to ten years.

Electricity production is increasingly affected by weather conditions, which vary from one region to another, as Europe transitions towards a clean electricity system by building renewable wind and solar power.

The probabilistic analysis simulates the electricity market throughout Europe hour by hour. The analysis considers how the weather and outages affect the power balance to reveal information such as the availability of imports from neighbouring countries to Finland when it is cold and not windy.




**Example result:**
Finland can expect an electricity shortage for
**2 hours in a year**

## Probabilistic analysis

Modelling electricity production, transmission and consumption hour by hour:

- Takes into account the influence of weather conditions on production and consumption using historical weather data (weather years)
- Takes into account the uncertainties in production and transmission with randomised outages
- Provides the expected power shortfall in each country in hours (h) and energy volumes (MWh) in the examined period
- Used on a national and pan-European level to review the adequacy of electricity in the coming winter and over the longer term

**35** weather years x **8,760** hours/year x **15** randomised outages = **4,599,000** simulated hours at the European level in one year.

### GLOSSARY

**Loss of load expectation** describes the average number of hours per year in which the market-based supply of electricity is not enough to cover consumption.

**Expected energy not served** describes the volume of electrical energy in megawatts that will, on average, not be supplied during these hours.

**ENTSO-E** is the association for collaboration between European transmission system operators. ENTSO-E and the transmission system operators work together to prepare pan-European studies of the adequacy of electricity.

**European Resource Adequacy Assessment (ERAA)** is a report compiled by ENTSO-E to assess the adequacy of electricity at the European level over the next ten years. The results of the report are used to determine the reserves needed to ensure the adequacy of electricity.

**Winter & Summer Outlook** is a report compiled by ENTSO-E to examine the adequacy of electricity at the European level in the coming winter or summer.

# TOGETHER, WE COULD MAKE IT THROUGH AN ELECTRICITY SHORTAGE

An electricity shortage occurs when electricity consumption momentarily exceeds the supply of electricity, and it becomes necessary to restrict consumption. Fingrid, the distribution system operators, and the authorities have agreed on what to do if an electricity shortage arises and how to get through it.

TEXT SUSANNA CYGNEL
PHOTOS FINGRID AND EEVA ANUNDI

In Finland, the adequacy of electricity depends on many factors, such as how electricity can be produced in Finland with wind power, hydro power, nuclear power, and combined heat and power (CHP).

The production capacity is strongly correlated with the weather: is there enough rain to fill the reservoirs at hydro power plants? Is it windy enough to generate wind power? The weather also affects consumption, which rises as the temperature falls below zero and more heating is needed.

During the moments of peak electricity consumption – generally in the mornings and early evenings – Finland's domestic production is nowhere near enough to cover demand. The functionality of the cross-border connections becomes a critical link in the chain, supplying Finland with electricity from Norway, Sweden and Estonia.

The cross-border connections are reliable, but unexpected reactions can occur in the electricity grid. Furthermore, we cannot say for sure whether our neighbouring countries will always have enough electricity to transmit to Finland.

If companies and individuals make sensible choices about how they use electricity, it will improve the adequacy of electricity. Demand-side management shifts the consumption of electricity from consumption peaks to other times, and it can be instrumental in preventing electricity shortages.

However, if electricity consumption exceeds the supply of electricity, an electricity shortage arises, and sections of the grid will be disconnected in turn for two hours.

Fingrid, the authorities, the electricity distribution companies, and other parties have clear operating models and responsibilities in such a situation so as to ensure a swift return to normal.

FINGRID

# Operational control

**FINGRID IS** responsible for communicating the various phases of an electricity shortage on its website, as well as directly to parties such as ministries and network operators so that they are prepared for it.

In the event of an electricity shortage, Fingrid will notify the distribution system operators of the amount of power to be disconnected and the timing of the disconnection. Local distribution system operators will disconnect consumption facilities, and the power cuts will last from one to two hours in each affected area.

Fingrid has a three-step electricity shortage scale for reporting on the criticality of the incident. When this article was written in mid-October, Finland was not on the scale at all. In other words, it was nowhere near experiencing an electricity shortage.

## Three-step electricity shortage scale

**1**

**ELECTRICITY SHORTAGE POSSIBLE.** Forecasts indicate that domestic production and imports will not be enough to cover electricity consumption in the near future.

**2**

**HIGH RISK OF ELECTRICITY SHORTAGE.** All the electricity production available in Finland is in use, and no more electricity can be obtained from Finland's neighbouring countries. Fingrid will have already started up the reserve power plants. It would not be possible to compensate for the shortfall caused by the largest possible fault.

**3**

**ELECTRICITY SHORTAGE.** Electricity production and imports are not enough to cover consumption, and Fingrid needs to exercise its right as the party responsible for the system to disconnect electricity consumers in cooperation with the distribution system operators.

**fingridlehti.fi > Jokaisen kannattaa nyt säästää sähköä**
**fingridlehti.fi > Kuntien pitää varautua sähkökatkoihin**

**"A three-step electricity shortage scale communicates the severity of the power supply status. In October 2022, Finland was not even at level one," notes Arto Pahkin, Control Centre Manager at Fingrid.**

PHOTO ALEKSI MALINEN

MINISTRY OF ECONOMIC AFFAIRS AND EMPLOYMENT

# Responsible for communication

**IN THE EVENT** of an electricity shortage, the Ministry of Economic Affairs and Employment is responsible for communication.

"If Fingrid announces that an electricity shortage is possible, we publish a press release to communicate the situation to everyone in Finland," says **Tatu Pahkala**, Senior Officer at the Ministry of Economic Affairs and Employment.

The same press release is also published on the ministry's website. The press release highlights the need to save electricity during the mornings and afternoons.

The ministry works with Fingrid, the Energy Authority and the National Emergency Supply Agency to keep its situational awareness of the adequacy of electricity up to date at all times. If an electricity shortage occurs suddenly – due to a fault, for example – it may be necessary to release information quickly.

"Our press release states the estimated duration of the electricity shortage and provides instructions on how to prepare for it and save electricity," Pahkala says.

"Our press release will provide instructions on preparing for the situation and saving electricity.

**Tatu Pahkala**
Senior Officer
Ministry of Economic Affairs and Employment

ENERGY AUTHORITY

# Balance between supply and demand

**THE ENERGY AUTHORITY** is responsible for monitoring the relationship between the electricity supply and demand in Finland and publishing a security of supply report in accordance with the Electricity Market Act in cooperation with other authorities.

NATIONAL EMERGENCY SUPPLY AGENCY

# Sufficient reserves

**THE NATIONAL** Emergency Supply Agency monitors fuel availability and reserve levels and reports if a severe electricity shortage lasts for a long time. If the natural gas supply is disrupted, the National Emergency Supply Agency's main duty is to ensure a supply of reserve fuel.

MOTIVA

# Savings tips for citizens

**MOTIVA'S WEBSITE** provides the latest bulletins and lists of useful tips for saving electricity. Motiva's Down a Degree campaign will run throughout the heating season, encouraging everyone in Finland to make minor everyday changes to save energy.

**Reduce the temperature by one degree in the rooms where you spend time and by more than one degree in storage rooms.**

**Take shorter showers and avoid running the water unless you need to.**

**Use the sauna in an energy-efficient way: get in there quickly, do not take long breaks between turns in the sauna, and use a moderate heat.**

**Turn off equipment when you are not using it, and unplug chargers when you have finished charging.**

**motiva.fi**
**astettaalemmas.fi/en**

ELECTRICITY SUPPLIER

# Suppliers are not responsible for communication

**ELECTRICITY SUPPLIERS** are not expected to issue any special communications, but they can notify their customers of an electricity shortage according to their needs. Suppliers should follow the instructions from distribution system operators when they respond to customer enquiries.

DISTRIBUTION SYSTEM OPERATOR

# Informing consumers of power cuts

**IN THE** event of an electricity shortage, distribution system operators disconnect the power – in other words, they oversee managed power cuts – according to Fingrid's instructions. When a distribution system operator receives notice from Fingrid of an electricity shortage, the operator sends text messages and emails to the customers who will be affected by the power cut.

"The message will probably be sent an hour or more before the electricity shortage when it becomes likely that a power cut will be necessary. We will also announce the situation in the news sections of our websites, press releases and information banners on the electricity outage map. Naturally, our customer service team will also provide information," says **Heikki Paananen**, Head of Operations at Elenia, a distribution system operator.

"All our communications will refer to the press releases from the Ministry of Economic Affairs and Employment and Fingrid. We will ask customers to save electricity and prepare themselves for power cuts. Our free disturbance messaging service notifies the customers affected by outages due to an electricity shortage," Paananen says.

He advises anyone who has not yet subscribed to their network operator's disturbance messaging service to do so now.

If the need for power cuts arises so suddenly that the distribution system operator does not have time to send a warning message, the customers subscribing to the disturbance messaging service will be notified of the electricity shortage just after the power cut begins.

> The message will probably be sent an hour or more before the electricity shortage.
>
> **Heikki Paananen**
> Head of Operations
> Elenia

"Unfortunately, we cannot announce the areas that might be affected by electricity shortages days or months in advance because the switching status of our electricity grid can change, and the size of the load that must be disconnected or the duration of the incident are not known in advance," Paananen says.

In any event, the potential for an electricity shortage will be so widely publicised in the national media that customers will be informed to check their network operator's website or the electricity outage map for further information. If a power cut has already begun, the reason will be announced on the network operator's online electricity outage map. ◆

TEXT MINNA SAANO / PHOTO SHUTTERSTOCK

# The Market Committee aims to develop the sector

Fingrid has three customer committees, which act as a link between Fingrid and the representatives of its various customer groups. Tero Karhumäki, the outgoing Chair of the Market Committee, talks about the opportunities of committee work.

Kuoreveden sähkö is a small electricity company based in Jämsä, Central Finland. The company invests in maintaining a reliable distribution network and providing carbon-dioxide-free electrical energy.

Its CEO, **Tero Karhumäki**, has been on Fingrid's Market Committee for the last three years. Each member serves a term of three years before being replaced by a representative of a comparable customer group.

Karhumäki has chaired the Market Committee for the last year.

"Fingrid usually appoints a person who has served on the committee for a couple of years as the chair. I am sure that every committee member endeavours to contribute to the debate on electricity markets. The committee seeks solutions to problems in the sector and enhances the debate. It has the clear aim of pushing the sector forward," Karhumäki says.

He points out that the committee does not make decisions, and Fingrid is not obligated to take any action in response to the committee's discussions.

"It is important that our discussions are given consideration and that our viewpoints influence the decision-making process. The electricity market is debated in many forums, and I would like the views expressed and reiterated in such forums to have more of an impact on decision-makers. Otherwise, there is no point in all this committee work. Everyone who takes time to look for solutions does so in the hope that the committee will make a difference and Fingrid will listen to our viewpoints."

The impacts on the energy market due to the climate crisis and the war in Ukraine pose unprecedented challenges throughout Europe.

"War is not something you get used to, but we are gradually finding solutions to the energy crisis together. I am particularly concerned about proposals for a price cap on electricity production at a time when the need for electricity is increasing dramatically. Right now, we need just the opposite: we should incentivise producers by improving the conditions for investment. This will not be our last difficult winter. We need more production and demand-side management," Karhumäki says. ◆

**FINGRID'S** customer committees are the Advisory Committee, the Market Committee, and the Grid Committee. Each committee has 8–12 members representing different customer groups: electricity producers, distributors, consumers, suppliers and other electricity market parties.



COLUMN

PHOTO MATTI RAJALA/ETLA

# From the carbon footprint of the ICT sector to the carbon footprint of supply chains

**THE ENVIRONMENTAL** benefits and harms of various sectors have been the topics of much debate in Finland. However, the focus is on the greenhouse gas emissions of individual companies or sectors, which invites misleading conclusions.

Studies in China and Finland show the environmental impacts of the sector are several times higher when the use of carbon-intensive material, components, and intermediate inputs is included in the calculation of the carbon footprint of the company and sector.

Supply chains should be taken into consideration when managing greenhouse gas emissions in different sectors, as well as the calculation and optimisation of the comprehensive greenhouse gas emissions from end products and services while they are in use.

*Industries managing their greenhouse gas emissions should pay attention to their supply chains.*

**IN THE ICT SECTOR,** raw materials, hardware production, service provision, and usage throughout their life cycles cause negative environmental impacts. On the other hand, the multitude of technologies and applications supplied by the sector helps to forecast and optimise the efficiency of work in various sectors, the energy consumption of equipment, and emissions. Do the benefits outweigh the drawbacks?

The benefits and harms of the ICT sector are the outcomes of its procurement, its own carbon footprint, and the impacts on other sectors of the economy while its products and services are used.

However, there are some problems surrounding measurements, such as the reliability and timeliness of the available data, the definition of the sector, and taking into account the carbon footprint of supply chains and the usage of products and services throughout their life cycles. These can lead to the carbon footprint of the ICT sector being underestimated. It is particularly difficult to estimate the consumption of outputs in specific sectors.

**ACCORDING TO** the surveys we carried out at ETLA in 2020 and 2022, foreign inputs account for over 60 per cent of total procurements in the ICT sector. The procurements are from sectors whose greenhouse gas emissions were 77 times higher than the ICT sector's own greenhouse gas emissions in 2018. Most of the procurements in the Finnish ICT sector originate from Asia – mainly China – the United States, and some European countries.

The greenhouse gas emission intensity (tonnes per euro, also known as carbon intensity) is a metric that companies are recommended to use when they calculate their own greenhouse gas emissions, estimate the greenhouse gas emissions of suppliers, and compare companies and sectors worldwide. It is also important to understand the energy production methods used in different countries because this enables more accurate calculations of greenhouse gas emissions. ◆

**Timo Seppälä**
works as a Lead Researcher at ETLA Economic Research. He is particularly interested in digital production and service operations.

Helen will close the Salmisaari coal-fired power plant in the next few years. Fingrid, the City of Helsinki and Helen are working closely together to safeguard the electricity supply.

# TWICE AS MUCH ELECTRICITY WILL SOON BE TRANSMITTED IN HELSINKI

Fingrid, Helen Electricity Network, and the City of Helsinki are working closely together, as the need for electricity transmission in Helsinki is expected to double in the next few years. The upcoming new 400-kilovolt cable link will contribute to the green transition and the realisation of the Western Boulevard City.

TEXT VESA VILLE MATTILA
PHOTOS HELENA ROSCHIER AND VOIMA GRAPHICS/CITY OF HELSINKI

The volume of electricity produced in Helsinki will decline substantially when Helen closes its coal-fired combined heat and power plants in Hanasaari and Salmisaari in the coming years. At the same time, the city's electricity consumption will increase in step with its rising population and the electrification of transport and heating.

"In addition, we need to think about the technical functionality of the grid and how to integrate it into the increasingly dense urban fabric. We must also pay special attention to land use," says **Markku Hyvärinen**, Director of Business Development at Helen Electricity Network.

## ECONOMIC EFFICIENCY DEPENDS ON COOPERATION

Fingrid, the City of Helsinki, and Helen Electricity Network have been working together for a long time to safeguard the electricity supply and promote sustainable solutions for the electricity transmission system. A study that was carried out a few years ago led to the parties making a joint planning agreement.

Fingrid and Helen Electricity Network provide the technical knowledge and implementation, and the City of Helsinki lends its expertise in urban planning and land use planning.

"It is a matter of reconciling the objectives related to the urban structure with the needs of the electricity network in a far-reaching way," summarises **Aki Laurila**, Manager, Grid Planning at Fingrid.

**Eija Kivilaakso**, senior advisor in land use in technical general planning at the City of Helsinki, describes the parties' collaboration as essential and seamless. Hyvärinen from Helen Electricity Network emphasises the rationality of the arrangement.

"Economically efficient solutions depend on cooperation."

Homes, transport connections and services will be built for about 14,000 residents in the Vihdintie and Huopalahdentie area this decade.

## Converting five kilometres of overhead lines to underground cables will free up land for the planning of the Western Boulevard City.

### CONSTRUCTION OF A NEW CABLE LINK TO BE BROUGHT FORWARD

The largest development project is a new 400-kilovolt cable link from Länsisalmi in Vantaa to the energy block in Viikinranta, Helsinki, which is the site of the current Viikinmäki substation.

"We originally planned to build the new 400 kV cable by 2035, but land use and electricity requirements have brought the schedule forward. We are now planning to complete the 400-kilovolt cable link by the end of 2026," Aki Laurila says.

A solution was developed to enable the cable link project to be carried out earlier than first planned, with principles based on a previous study.

The earlier completion will allow Helen Electricity Network and the City to continue delivering on their plans for Northwest Helsinki without any obstacles.

### PLANNING OF THE WESTERN BOULEVARD CITY DISTRICT IS ONGOING

"When the 400-kilovolt cable link is finished, we will convert the 110-kilovolt high-voltage overhead lines running along Vihdintie to an underground connection. We will also move the current substation functions in Pitäjänmäki to a new site," says Hyvärinen.

Helen Electricity Network will make savings on its investments in Northwest Helsinki, as Fingrid's new cable link from Vantaa to Helsinki will strengthen the electricity network.

"We will get by with less power and excavation work instead of blasting a cable tunnel," Hyvärinen explains.

Converting five kilometres of overhead lines to underground cables will free up land for infill construction and the planning of the Western Boulevard City. Housing, transport connections, and services will be created for about 14,000 residents in the area around Vihdintie and Huopalahdentie by the end of the decade.

### LOOKING TO THE FUTURE

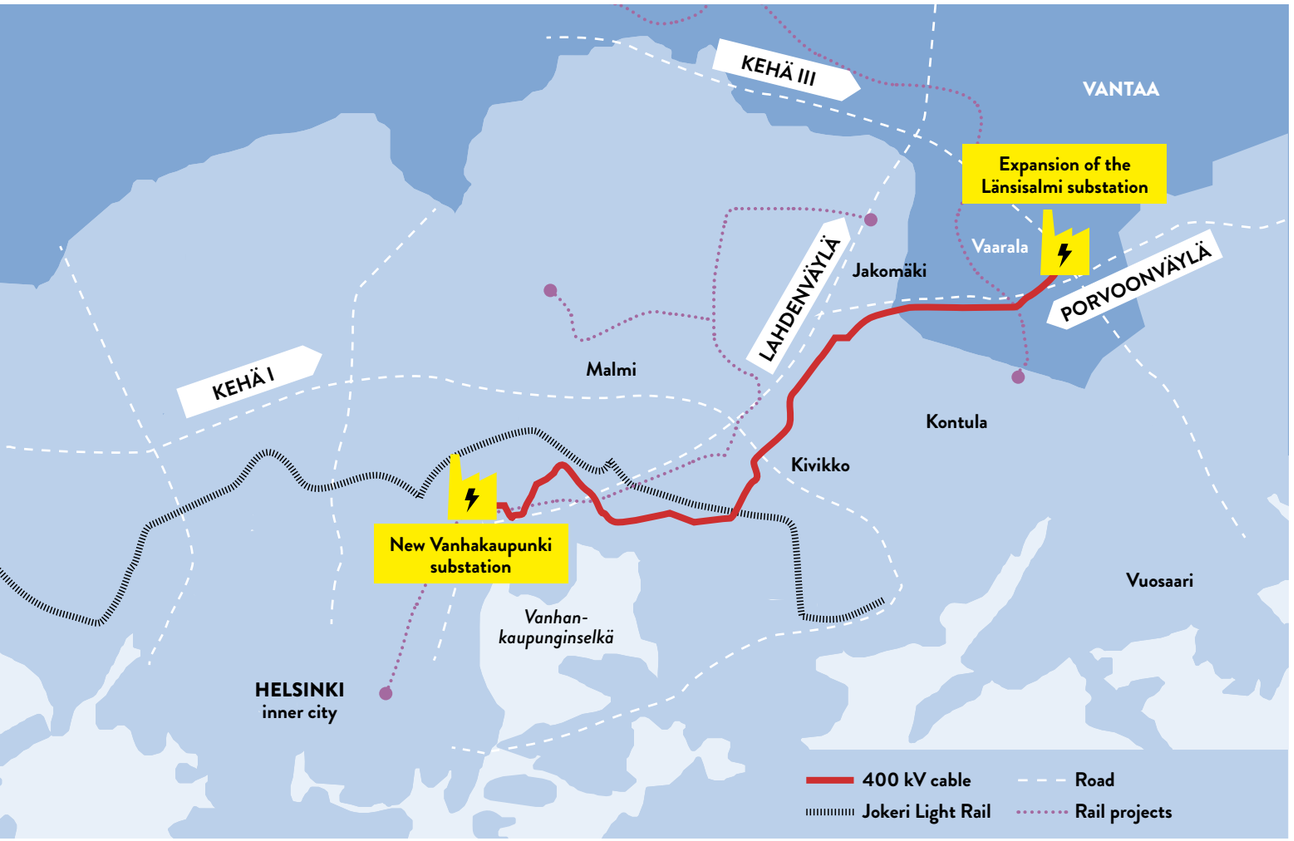
Kivilaakso and Hyvärinen say that Fingrid is making a necessary contribution to the functionality of the electricity network in Helsinki.

"Fingrid's experts are specialists in their fields, and they can quickly adapt to an unfamiliar urban environment," they say.

Expertise will continue to be required as the green transition in energy production and consumption will go on for decades. Lauri Ala-Mutka, Specialist at Fingrid, is tasked with analysing the adequacy of the electricity network and main grid in the Helsinki metropolitan area.

"Cities provide us with their forecasts of electricity consumption and production. We use these to forecast the need for electricity transmission as far ahead as 2040, and the forecasts are updated when necessary. Grid planning is an ongoing process."

In Helsinki, the main issues for Fingrid are the sufficiency of the 400-kilovolt connections and the main transformers. Ala-Mutka points out that Fingrid dimensions the main grid to withstand the loss of any critical component.




## The skill of building a cable link

An urban environment imposes many constraints on the construction of a 400-kilovolt cable link. Good planning helps to overcome these.

**THE** forthcoming 400-kilovolt cable link runs from Länsisalmi in Vantaa via the Kivikko sports park, Kehä I, Hallainvuori and the fields of Viikki to the energy block in Viikinranta.

"The impacts of construction on aspects such as land use, traffic safety, housing, nature and recreational areas were taken into consideration when the route was planned," says **Eija Kivilaakso**, senior advisor in land use in technical general planning at the City of Helsinki.

"In addition, the large cable must not become an obstacle to the planning and construction of other services, such as district heating and the water supply."

### A NEW OPERATING ENVIRONMENT

The cable link is expected to cost approximately EUR 100 million.

For **Aki Laurila**, Manager, Grid Planning at Fingrid, the operating environment is the greatest challenge facing the project.

"This is the first time we are building the main grid underground in the middle of a city. The permit application process is wider-ranging, there are more stakeholders, and we need different techniques than the ones we use to build overhead wires in the countryside," he says.

"We will carry out the project without needlessly disrupting the day-to-day lives of people in Helsinki and Vantaa. We will expedite the excavation work by preparing the piping in advance and pulling the cable through once the pipes are installed in the ground." ◆





# Pilot plant manufactures battery material from lignin

Stora Enso's Sunila mill refines lignin, a natural substance, into a carbon material known as Lignode. This new material is a sustainable substitute for synthetic and natural graphite, which are used as anodes in batteries.

TEXT ARI RYTSY / PHOTO STORA ENSO


Lignin is the second most prevalent macromolecule in nature after cellulose. Every plant contains it, and up to one-third of the material in trees is lignin. In nature, lignin binds together the fibres and cells in wood, making the plants strong and robust.

Lignin is a renewable, non-toxic raw material sourced from traceable forests. The carbon it contains can be a substitute for the non-renewable carbon in batteries used in consumer electronics, the car industry, and large energy storage systems.

The pilot plant operating at Stora Enso's Sunila mill dehydrates lignin, which is then heat-treated and ground into a hard carbon material with the technical name Lignode.

### ECOLOGICAL COLD RESISTANCE FOR BATTERIES

A study into the factory-scale expansion of Lignode is still underway, but Stora Enso estimates that the industrial-scale production of the material will require less energy than the production of synthetic graphite.

The company aims to replace fossil-based graphite, which mainly comes from Asia, with a renewable alternative as an anode material in batteries.

"A wood-based carbon material makes the battery charge more quickly and resist the cold better than one made with non-renewable anode materials. When an electric car can charge more quickly, there will be less need for charging infrastructure," says Production Director **Kari Nikunen**, Stora Enso, Lignin operations.

Lignin is also a potential substitute for non-renewable materials in many other applications. For example, lignin will make it possible to reduce the amount of oil-based bitumen in asphalt. Refined lignin can also be used as a timber adhesive and in the manufacture of coatings and special chemicals. ◆

TEXT MATTI VÄLIMÄKI / ILLUSTRATION FINGRID

# TRANSITION UNDERWAY **IN THE POWER SYSTEM**

Fingrid's power system vision is based on various scenarios for the future, foreseeing transformational changes to the power system. The vision is now under further development based on stakeholder feedback.

Fingrid's power system vision presents four alternative scenarios for the future. They all foresee the electrification of transport, heating and industry, further sector integration, and Finland reaching its carbon-neutrality targets. Wind power is the most important form of production. In addition, the scenarios vary in terms of the applications for hydrogen and the scope of hydrogen production.

Fingrid's **Eveliina Seppälä**, a Specialist and Project Manager of the vision, and **Risto Kuusi**, a Senior Expert, emphasise that the vision does not set out a ready-made viewpoint or proposal on how to address every issue. Instead, it explains the different perspectives and potential solutions, giving stakeholders some food for thought.

"The power system vision is the continuation of Fingrid's network vision, completed last year. The idea is to provide an overview of the energy sector in the midst of the energy transition. The scenarios are used as the basis for analysing the development needs of the main grid – what we need to prepare for and what is possible," Seppälä says.

### SUFFICIENT STARTING POINTS FOR DEVELOPMENT WORK

Kuusi says that the scenarios are intentionally extreme and challenging so that they offer the ingredients for further development.

"All the scenarios are possible, but the most likely outcome may be a combination of these scenarios."

The question of whether electricity consumption will increase by a large amount – or an absolutely huge amount – depends on how well Finland fares in attracting the kind of investments that demand clean energy.

"Our country is large, sparsely populated and windy, so the conditions are excellent for developing onshore wind power in particular," Kuusi notes.

### WORK CONTINUES ON THE VISION

Fingrid has now asked its stakeholders for their views on the scenarios used for the vision work and the power system of the future.

"We would like to thank our stakeholders for their feedback. It is great that parties in the sector are also able to set their sights on the future, despite the acute energy crisis we are going through now," Seppälä says.

The stakeholders who submitted feedback found the themes in the scenarios important, and the worldview in the scenarios was considered to provide a good basis for developing the main grid over the long term.

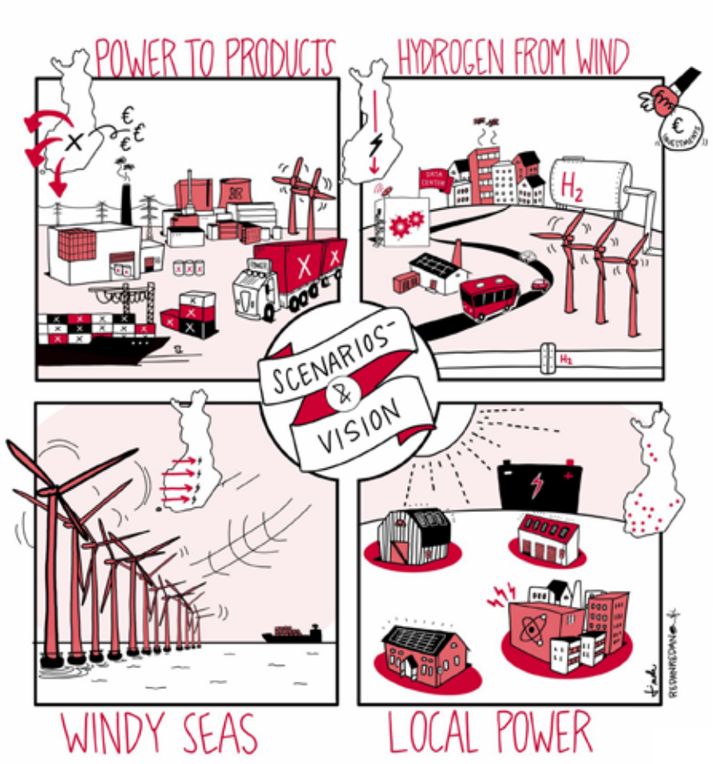
"One new perspective emerging from the feedback was that Finland also needs to consider the broader implications of the scenarios in areas such as our national or regional economies."

Fingrid is now using the feedback to revise its power system vision further.

"The final version of the vision will be published at the turn of the year, but, naturally, the dialogue will not end there," Seppälä says. ◆

## A massive rise in electricity consumption and production

- Annual electricity consumption is currently around 85 TWh.
- The scenarios envisage electricity consumption in 2035 ranging between 114 TWh and 180 TWh.
- The combined production capacity of wind and solar power was approximately 3,700 MW at the start of 2022.
- The scenarios foresee a combined production capacity of wind and solar power between 22,000 MW and 49,000 MW in 2035.




## Scenarios place various demands on the power grid

**THE POWER TO PRODUCTS SCENARIO** foresees Finland becoming an important manufacturer of P2X products, accompanied by a substantial increase in wind and solar power. The hydrogen needed for P2X processes is produced close to where it is consumed, and there is no centralised hydrogen storage or grid. This leads to significant increases in the need for electricity transmission and flexibility in the power system.

**THE HYDROGEN FROM WIND SCENARIO** envisages increased hydrogen production, with Finland becoming an exporter of hydrogen. The hydrogen system acts as an energy storage facility, enabling very large-scale onshore wind power production. The amount of conventional electricity production falls sharply. Onshore wind farms in the north generate a lot of energy that must be transmitted to the south.

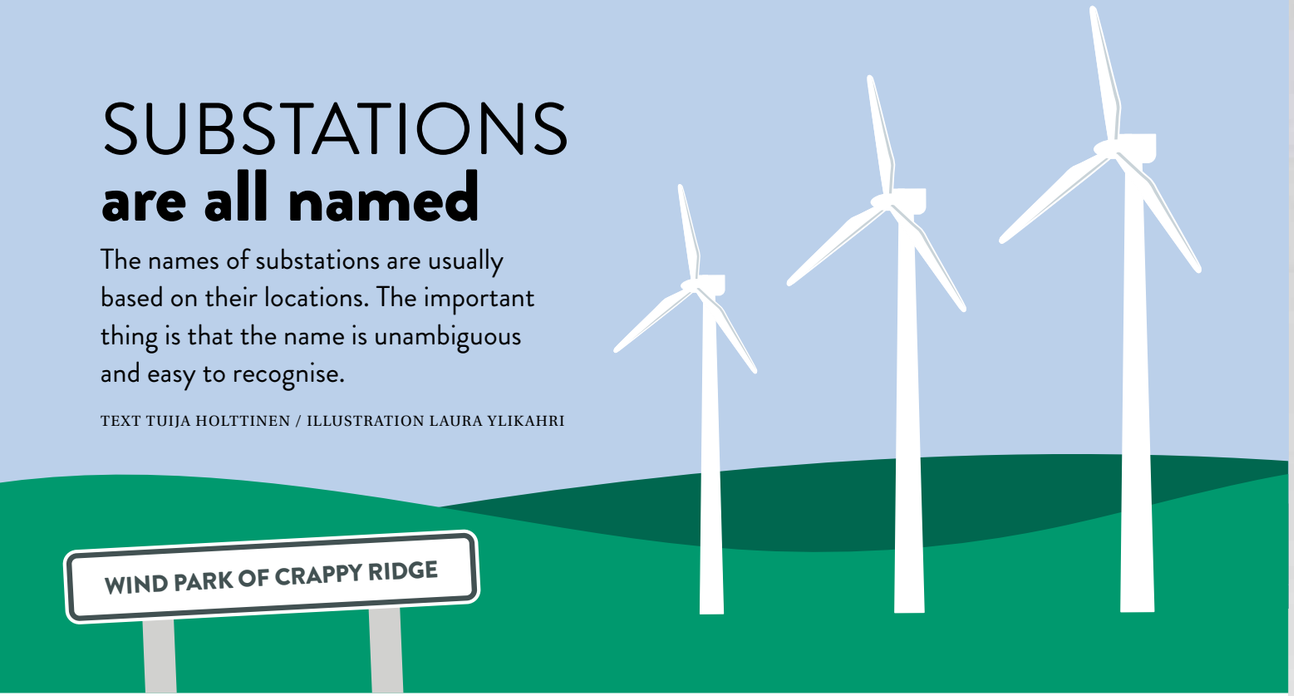
**THE WINDY SEAS SCENARIO** is based on increased electricity consumption as fossil fuels give way to electricity and fuels made using electricity. Offshore wind power is the dominant form of production. Electricity production is increasingly focused on the west coast, and the energy must be transmitted to consumption centres.

**THE LOCAL POWER SCENARIO** foresees a more moderate increase in electricity consumption than the other scenarios. Several different technologies are used to produce the extra electricity: wind power, solar power, and SMR nuclear power. A relatively larger proportion of production is located in Southern Finland near the consumption hubs.

# SUBSTATIONS **are all named**

The names of substations are usually based on their locations. The important thing is that the name is unambiguous and easy to recognise.

TEXT TUIJA HOLTTINEN / ILLUSTRATION LAURA YLIKAHRI




Substations are nodes in the grid where electricity is distributed onto different lines. Fingrid currently has 120 substations in Finland, and more are being built all the time. Each one has a unique name, with an abbreviation used in the management systems and documentation.

"Historically, the grid was a sparse network, and efforts began in the late 1920s to build power grids in earnest. Substations were traditionally named after the localities or districts in which they were built, such as Imatra substation, Hikiä substation, and Virkkala substation," says **Aki Laurila**, Manager, Grid Planning in Fingrid's Grid Planning Unit.

**Jukka Schreck**, Connection Coordinator in the Grid Services Unit, says that with the addition of 20 new substations this year, it will not be possible to name them after their localities – a longer nomenclature will be needed.

As a rule, existing place names are the first option.

"It is crucial that the place name is as descriptive as possible, easy to recognise, and unambiguous. It is important to have unique names and abbreviations to avoid confusing one substation for another," Schreck says.

"It is also important to stick to a name once it has been chosen and not change it," Laurila adds.

Usually, a substation designer who knows the area proposes a name. Fingrid checks that the name is not already in use and makes sure it can be easily abbreviated into just a few letters.

### ARKKUKALLIO, SELLEE AND KELLARIJÄNKÄ

The duo, known for coming up with the names of many substations, recall some interesting names.

"Of course, Paskoonharju [Crappy Ridge] wind farm in Ostrobothnia is a pretty memorable one, but as you get closer to Lapland, the names naturally become rather interesting," Schreck says.


He remembers a 400-kilovolt substation in Tornio whose name – the unusual-sounding 'Sellee' – was on the base map of the area.

"Arkkukallio [Casket Rock] at the boundary between Kristinestad and Isojoki and Kellarijänkä [Cellar Bog] in Kemijärvi are also interesting old names," Schreck says.

Fingrid always tries to find a local name for its substations, and they are not named according to any companies.

"We want substation names to be long-lasting and permanent, whatever may happen in the sector," Laurila and Schreck point out. ◆





TEXT MINNA SAANO / PHOTO SHUTTERSTOCK

# Texas in the eye of the storm

The power system in Texas was unprepared for snow, ice and frost. A series of storms tore through the state in February 2021 and brought the power system to the brink of collapse.

Texas was ravaged by three consecutive winter storms caused by polar jet streams in February 2021.

The temperature fell to the lowest levels recorded for decades – close to -20°C. Poorly insulated houses, mainly heated by electric radiators, quickly became cold.

The storms lasted several days, and the extra heating required in this period increased the electricity consumption in Texas dramatically.

"No preparations had been made for the possibility of snow, ice and frost affecting electricity distribution and production. For this reason, the Texan electricity distribution, transmission and production infrastructure was highly vulnerable," says **Antti-Juhani Nikkilä**, Expert at Fingrid.

The difficulties mounted as the storm went on – equipment in coal and natural gas power plants broke down, fuel could not be delivered to the power plants, wind power turbines froze in place, and there were problems with nuclear power plants. On top of this, the potential for electricity transmission to other parts of the United States and Mexico was limited.

An electricity shortage arose throughout the state of Texas.

"The power system was very close to a total collapse. The peak load was nearly 70,000 megawatts before ERCOT, the transmission system operator in Texas, began limiting consumption by enforcing power cuts."

### MASSIVE IMPACTS

The power cuts directly affected 11 million households and companies. Hundreds of people died of hypothermia and in accidents. The power cuts led to water supply outages, and shops were forced to close their doors. Fire hydrants stopped working, making it difficult for the emergency services to respond to fires.

During the crisis, the electricity price rose to unprecedented highs, causing some energy companies to go bankrupt.

"The problems that the Texan power system would experience under winter conditions had become apparent earlier, but nothing was done. Since the crisis, legislation and various sets of measures have improved the power system's capacity to operate in cold conditions, both in the state of Texas and in the Federal United States," Nikkilä says. ◆

# Turn the temperature down a degree to ensure energy for us all

We are used to the occasional chilly blast up here in the north.

We know what a dark autumn November and an icy breeze form the east feel like.

But come what may, it can't take our energy from us. Let's just keep it cool.

ASTETTA ALEMMAS

**How to save energy:**

| | | |
|---|---|---|
| **Drop your room temperature a degree lower** | **Take your showers a degree shorter** | **Schedule your electricity use a degree better** |

More energy-saving tips **astettaalemmas.fi/en**

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