

2 2026

FINGRID

TRANSMISSION SYSTEM OPERATOR'S MAGAZINE / RENEWING THE ENERGY SYSTEM / fingridlehti.fi



**CUSTOMER MANAGER
JARNO SEDERLUND
LOOKS TO THE FUTURE**

**Planning the main
grid years ahead**

Reliability is not a coincidence

An excellent transmission reliability rate is primarily based on pre-emptive maintenance, careful planning and continuous monitoring.

Transmission lines are regularly inspected so that any developing damage can be detected in good time.

“We conduct general inspections at intervals of one to three years. Targeted special inspections are also used to examine things such as conductor connections and wooden components,” says **Sami Liikanen**, Maintenance Manager at Fingrid.

The biggest challenges for maintenance are the varying weather and terrain conditions found

throughout Finland. Frost affects lines in the north, while acidic soil must be taken into account for structures in coastal areas.

Remotely readable sensors now make life easier, as they tell us when it’s time to start clearing snow from the lines. For new structures, sulphide-rich soil can already be taken into account during the design phase.

“We prepare for unexpected faults through careful advance planning, making use of data

gathered from inspections,” says **Jari Koskinen**, expert at Fingrid responsible for transmission line asset management in Southwest Finland.

In exceptional circumstances, service providers will have to take corrective action at short notice. Guidance is also provided with the aid of clear instructions and regular drills.

“Regular practice ensures that everyone keeps things clear in their minds. Larger-scale exercises are held every three years,” says Sami Liikanen.

Defects are detected not only through formal inspections but also during repair work. Damage may sometimes be found in connectors and cables, and in the worst-case scenario, this could even

disrupt the transmission of electricity to other countries.

“Our partners also keep their eyes open as they’re going about their business,” says Jari Koskinen. “And ordinary citizens are also actively reporting their observations.”

The main grid’s structure also plays a significant role in transmission reliability. Thanks to the looped configuration of the main grid, a fault can usually be isolated from the network, thereby allowing electricity transmission to continue along alternative routes. End users will not usually notice the disruption at all. ♦

Sami Liikanen and Jari Koskinen are supervising tower leg replacements in Harjavalta.

Electricity transmission reliability, %

99,99995

Towers inspected

20200

Condition records corrected

5600

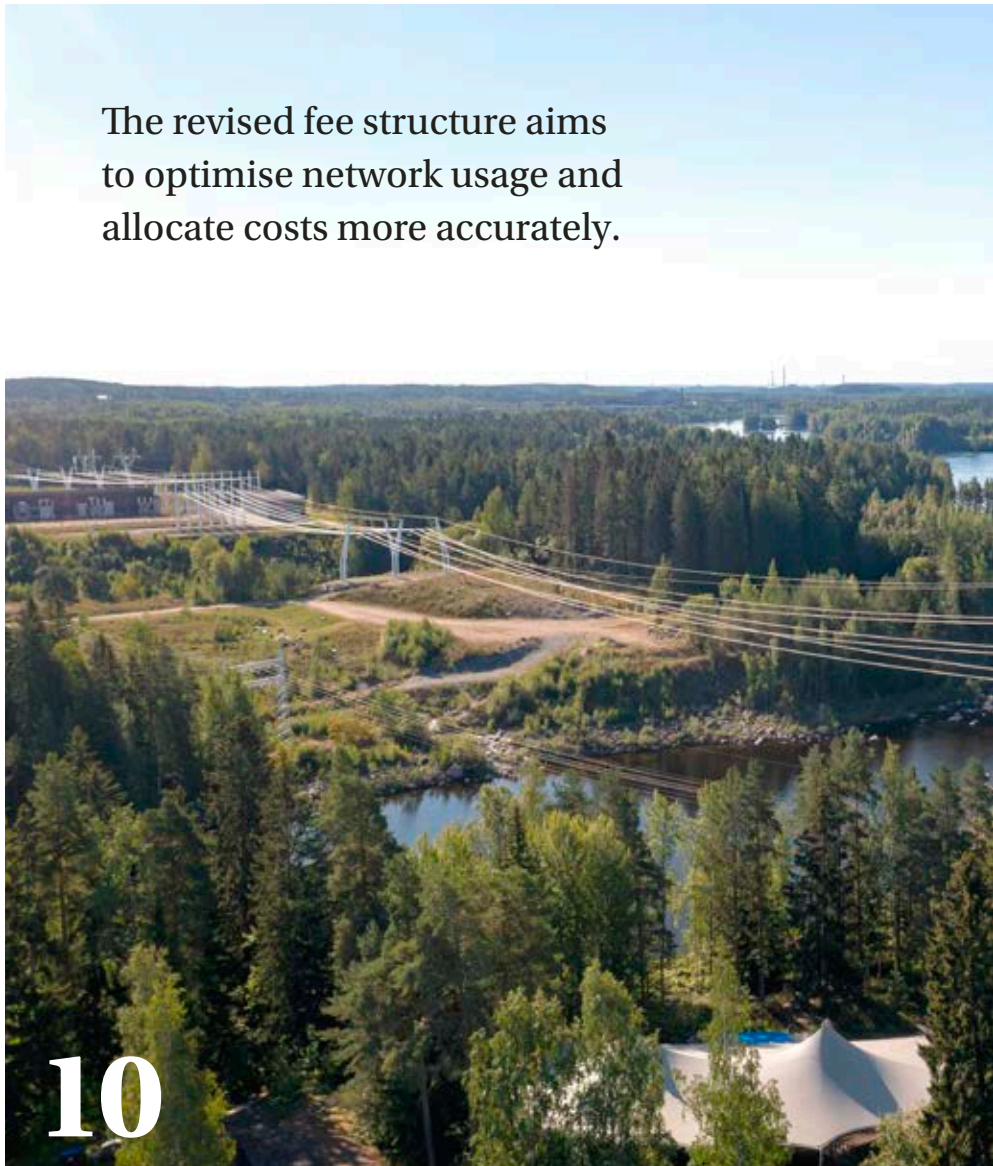
Data from 2025

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THE ENERGY SYSTEM

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The revised fee structure aims to optimise network usage and allocate costs more accurately.



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EDITORIAL

It's growing after all

ELECTRICITY CONSUMPTION has begun to grow in Finland. In fact, it has been rising for almost three years. Consumption will further increase over the next couple of years, as data centre investments driven by the AI boom go live and start using Finnish electricity – which is clean, reliable and the most affordable in Europe.

Electricity consumption and economic growth have historically been somewhat correlated. This year, we have finally seen some positive signs from the Finnish economy as well. This means that economic growth will hopefully pick up in the near future.

April's parliamentary elections are just around the corner. Consolidating recent economic growth will be high on the next government's list of priorities. And it is not possible to do that without talking about electricity, its price and Finland's power system. In fact, energy policy has increasingly become electricity policy. And electricity policy is inextricably linked to industrial policy.

Many recent speeches have called for a stronger industrial policy. Investing in a robust electricity infrastructure that creates the right conditions for growth and expediting permit processes are just two of the practical measures that enjoy broad consensus.

For many, industrial policy also means moving away from the logic of the free market and taking a step towards stronger steering of industrial development and more deliberate decision-making. When it comes to the electricity system, this means

carefully prepared and politically determined criteria for how grid connection capacity should be allocated among new customers (and particularly in areas with limited capacity), which new users should be prioritised, and how to prepare for increasing electricity consumption by existing industrial facilities. This issue warrants careful consideration, as demand for clean electricity will remain high for the foreseeable future.

Clean electricity is Finland's oil. But the question is, how can we best leverage our competitive advantage and create prosperity for everyone in Finland? We need the most effective solutions. Finland cannot choose which investments are profitable, nor can we compete in a subsidy race.

Fingrid's action plan – *Electricity for growth. Reliably.* – includes a number of concrete recommendations. Taking this action will ensure that the electricity system can enable future growth as well. We hold the keys to success in our own hands.

Mikko Heikkilä
Head of Public Affairs
and Communications
Fingrid



FINGRID

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Electricity consumption is growing – more dispatchable generation is needed

Growth in Finland’s electricity consumption is expected to accelerate in the coming years, driven particularly by new data centres and electric boiler projects.

There are also numerous wind and solar power projects at an advanced stage of development, but their implementation will depend on investment decisions by electricity producers. Alongside them, the system will also need weather-independent, dispatchable generation, such as engine power plants.

Engine power plants can help maintain the balance of the power system, security of supply and competitive electricity

prices even when wind and solar power generation fluctuates.

“It is important that growth in electricity consumption is matched by sufficient and timely investment in electricity generation. New large-scale consumers with steady electricity demand should actively promote solutions that help ensure sufficient generation capacity and flexibility,” says Fingrid CEO **Asta Sihvonon-Punkka**.

More information:
fingrid.fi/en/current_news

Polymakers: the order of grid connections should be prioritised

Political decision-makers would like the order of grid connections to be prioritised, as shown by a survey commissioned by Fingrid this spring.

Connections to the electricity network are currently made in the order in which investment projects are completed. Projects that can be implemented quickly, such as batteries and electric boilers, can therefore move ahead of slower yet more economically and strategically significant investments.

Strategic prioritisation receives the clearest support. No less than 84 per cent of respondents would prioritise connecting socially critical functions to the main grid. There was also significant support for prioritising traditional industrial projects that

promote the green transition, as well as for steering electricity-intensive investments to regions where sufficient network capacity is already available.

According to the survey, the electricity network’s limited capacity requires political decisions, yet opinions on the solutions vary among the various political parties. About half of the respondents also supported a significant increase in grid investments, even if it would raise costs for consumers and increase the environmental impact of the electricity network.

Fingrid will invest a record-breaking EUR 5.2 billion in the main grid over the next ten years. Nevertheless, the rapid

growth in electricity transmission needs has caused congestion in the transmission grid in some areas. Allocating transmission grid capacity on the basis of public interest will require legislative amendments.

The survey was conducted by Aula Research Oy in April–May 2026. A total of 72 Members of Parliament and political influencers responded to the survey. Their responses have been weighted by political party in accordance with the distribution of seats in the 2023 parliamentary elections.

More information:
fingrid.fi/en/current_news



PROFILE

Will there be enough electricity in the future?

Vilma Virasjoki is involved in assessing the adequacy of Finland’s electricity supply.

TEXT MARJO KANERVA / PHOTO TOMI PARKKONEN

Iwork as an expert in the Electricity Market unit, which is responsible for areas such as developing the electricity market and its regulation. My job is to keep an eye on how the market is developing to ensure that we will have enough electricity in the future.

Europe has a single electricity market. Ensuring a sufficient supply of electricity is therefore a matter that concerns not only Finland but Europe as a whole.

Fingrid is responsible for maintaining the instantaneous power balance in the power system of Finland. We are also involved in making a medium-term adequacy assessment as a member of the ENTSO-E (European Network of Transmission System Operators for Electricity). These models extend into the next decade, and can be used to support national decision-making.

I am a member of an ENTSO-E working group in which we exchange ideas about topics such as electricity market modelling and renewable energy.

Our working group also discusses national solutions, such as capacity mechanisms aimed at ensuring a sufficient supply of electricity in the future. It is important to understand EU developments and framework conditions, and to learn from what is being done elsewhere. The approaches taken by other countries, and particularly the Nordic and Baltic countries, have an impact on Finland.

The electricity market operates within a complex regulatory environment. My job also involves following developments and debates relating to EU legislation. We aim to influence these developments through the ENTSO-E.

I joined Fingrid six years ago. I was previously working as a researcher at Aalto University, and my dissertation focused on electricity market modelling. I then realised that there is still plenty to explore and understand within this topic. The electricity market will undergo significant changes over the coming years during the transition from fossil fuels to renewable energy sources. My research background helps me to understand how this energy transition will affect the power system on a broader scale.

The people here are friendly and highly skilled, and I’ve really enjoyed working here. My job is an exciting combination of international collaboration and issues that matter here in Finland. I’m also constantly learning and working on new things, and I feel that my work makes a difference. ♦

WHO?
Vilma Virasjoki

POSITION
Expert

FAMILY
Partner, and two children aged 6 and 2

LEISURE PURSUITS:
Gym, yoga, reading



Progress in main grid construction projects

A STRONGER FOREST LINE

The route for the transmission line connection between Multia and Jämsä has now been selected. This connection will reinforce the Forest Line, whose terminus in Central Finland was moved from Laukaa to Jämsä on the basis of a reassessment. The route for the section between Vaala and Multia has already been selected.

TRANSMISSION LINE FOR EASTERN FINLAND IN THE EIA PHASE

Fingrid is planning a 400+100-kilovolt transmission line between Kontio-lahti and the Huutokoski district of Joroinen. The environmental impact assessment for this project should be completed by the end of next year, and it is hoped that the connection itself will be finished sometime in 2033.

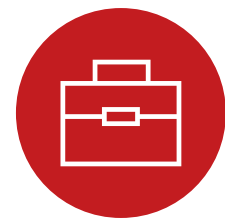
ROUTE SELECTED FOR THE HIKIÄ–INKOO TRANSMISSION LINE

A route has been selected for the transmission line being planned between Inkoo and Hikiä in Hausjärvi. A great deal of feedback on this project was received during the environmental impact assessment, and this feedback was taken into account when selecting the route.

ROUTE SELECTED FOR THE ANTILA–LÄNSISALMI TRANSMISSION LINE

A route has been selected for the transmission line between the Anttila district of Sipoo and the Länsisalmi district of Vantaa.

Feedback received during environmental impact assessments is taken into account in all route selection decisions for main grid transmission lines.



Changes to Fingrid’s ownership structure

The arrangements for the planned changes in Fingrid’s ownership structure have now been finalised. Following these changes, the Finnish State will have a holding of 59.5 per cent and OP Pohjola Kantaverkko Holding Ky a holding of 14.2 per cent. Other owners include Finnish pension and insurance companies.

More information:
fingrid.fi/en/current_news



Stakeholder Committee begins work

A new Stakeholder Committee has been established at Fingrid with the aim of strengthening dialogue between the company and society at large. The Committee will bring together stakeholders who have an interest in the main grid and the development of the electricity system, but are not Fingrid customers or do not directly represent customer interests. The Committee met for the first time in October.

More information:
fingrid.fi/en/committees

PRACTICAL QUESTION

How is Fingrid’s business financed?

“We aim to allocate the costs of building, maintaining and operating the main grid to our customers as fairly as possible,” says Fingrid’s Jussi Jyrinsalo, Senior Vice President, Customers and Grid Planning.



TEXT MARJUT MÄÄTTÄNEN / PHOTO TOMI PARKKONEN

1 How is Fingrid’s business financed?
Fingrid’s customers pay service fees that cover the company’s operating costs. “Congestion income” generated by cross-border connections is also used to offset certain costs.

The main services that customers pay for include main grid service, balance service and Datahub service. Main grid service provide customers with a connection to the main grid and ensure reliable electricity transmission through the connection point. Customers who use main grid service include distribution system operators and other parties that connect directly to the main grid, such as battery energy storage facilities and electricity production and consumption facilities.

Balance service is responsible for maintaining a continuous power balance in Finland and for the national imbalance settlement. Customers include balance responsible parties who pay balance service fees to cover both the reserve costs included in the balance service and other expenses.

Datahub is a centralised data exchange system for the electricity retail market. The system is managed by Fingrid, and electricity retailers and distribution system operators utilise it in their business operations. Customers pay service fees to cover their use of the Datahub and its development.

2 To what extent can Fingrid set customer fees?
The Energy Authority supervises the criteria used to determine Fingrid’s fees and their level. Unlike other European countries, Finland has an Electricity Market Act that limits individual increases in grid service fees to no more than 8 per cent per year. Customer fees are based on the costs incurred by providing the service.

3 What is the Finnish State’s role as an owner: does Fingrid receive funding from the State Budget, and has the State provided Fingrid with capital?

Fingrid does not receive funding from the State Budget, and the State has not injected any capital into Fingrid. The State receives a return on its holding in Fingrid, just like the company’s other shareholders. ♦

Find answers to these questions online:

- What percentage of a household electricity bill is attributable to main grid transmission?
- How does an increase in electricity production or consumption affect grid service fees?
- How much does a 100-megawatt data centre or other industrial facility pay in grid service fees?
- How much does a 100-megawatt wind turbine pay in grid service fees?
- How much does a 100-megawatt battery energy storage facility pay in grid service fees?



A more efficient grid SERVICE CHARGES TO BE REVISED

Fingrid is planning a renewal of the fee structure for main grid services. The goal is to optimise network usage and allocate charges more accurately.

TEXT SUSANNA CYGNEL / PHOTOS FINGRID

The Finnish power system has undergone a fundamental transformation in recent years, as fossil fuels are gradually being replaced by renewable energy sources. The production of wind and solar power is dramatically increasing, and so is grid energy storage.

Although there have been significant changes in the electricity system, the structure of main grid service charges is still largely based on a model developed in the 1990s.

“The old fee structure is being updated to reflect today’s electricity system,” says Customer Manager **Laura Ihamäki** from Fingrid. She is the project manager for the fee structure update.

The update is not aiming to increase the total amount of main grid service charges collected by Fingrid, but rather to allocate the fees more accurately on the basis of the costs incurred. It

will also encourage customers to use the main grid efficiently.

“When the network is being used efficiently, it can serve more customers, which will in turn reduce the need for new investments.”

A POWER-BASED TARIFF WILL HELP TO SMOOTH OUT CONSUMPTION PEAKS

The update aims to make main grid service charges more transparent. Fees will be more clearly broken down into costs related to grid infrastructure, transmission losses, and maintaining the stability of the power system.

The vast majority of main grid service charges are currently based on electricity consumption, but the update would rebalance cost allocation between production and consumption.

One significant new feature is the input power fee. It means that service charges will be more heavily influenced by the magnitude of power

spikes resulting from electricity consumption in the main grid.

“The grid is dimensioned for peak power. If transmission peaks can be smoothed out, the current grid can serve more users,” says **Petri Parviainen**, Unit Manager, Main Grid Services at Fingrid.

NEW INVOICING MODEL FOR GRID ENERGY STORAGE

To date, grid energy storage facilities have been treated more leniently than other customer groups in terms of pricing, as they have been relatively few in number. But as grid energy storage facilities become more commonplace, greater consideration must be given to their consumption of network capacity.

“Grid energy storage facilities are an important part of our future electricity system, but their integration will require investments,” says Parviainen.

A pricing structure based on voltage levels has also been proposed, and this could encourage direct connection to the 400-kilovolt network. Location-based pricing would, however, require legislative amendments.

According to the Finnish Energy Authority, the update’s objectives are in line with European regulatory developments. Preparatory work must take into account the boundary conditions imposed by EU and national legislation.

“We support solutions that improve network efficiency, reduce the need for investments and keep customers’ costs down,” says **Tiina Karppinen**, Head of Unit, Economic Regulation at the Energy Authority.

The final decisions on the structure of main grid service charges are expected by the end of this year.

Customer feedback on preparatory work



ANNA PASMA
CEO
Oulun Energia Sähköverkko

1. Main grid service charges need to be updated. As our society becomes increasingly electrified, the efficient use of electricity networks will also become more important, and the new pricing structure will better facilitate this.
2. Pricing will be more transparent, more equitable and better aligned with the principle of cost-based pricing. It would also be more closely aligned with the power-based pricing used by distribution system operators.
3. It's important to ensure that the update does not undermine the prerequisites for investments in new production, grid energy storage facilities or electrification in Finland. The best outcome will arise from a model that both promotes efficient network usage and maintains a competitive investment environment.



KOSTI RAUTIAINEN
Executive Vice President,
Customers and new ventures
Caruna

1. It is positive that an increase in customers' consumption of peak power has been identified as one of the most important factors to consider in terms of system development. Although power-based pricing can influence behaviour, it's vital to ensure that we make adequate investments in the grid, so that electricity networks do not become a bottleneck for economic growth.
2. There are good reasons for improving the cost correlation between production and consumption when determining charges. The standardisation of connection points and invoicing interfaces will lead to greater clarity, and will also encourage customers to consider the power they draw from the main grid.
3. New structures must be able to stand the test of time, and their risks and impacts on customer behaviour must also be assessed. End customers should be informed of any changes in a transparent manner. Pricing predictability is important for ensuring the equitable treatment of end customers.



MAIJA RUSKA
VP, Finance & Control
and Strategy
UPM Energy

1. The new fee structure will encourage the consolidation of consumption and production at the same connection points, thereby reducing the need for investments in the main grid. There could be more incentives to steer the location of connection points, and these should also be extended to distribution system operators. New consumers and producers should be able to connect to the grid quickly, so that both economic growth and investments in the clean energy transition can be realised.
2. Increasing cost-correlation and improving transparency are the right places to start. All grid users will benefit if the fee structure encourages more efficient use of the grid and reduces the need for investments. Another positive aspect of the preparatory process has been its transparency and the dialogue with customers.
3. This will constitute a major change for some stakeholders. Fingrid must ensure that the update does not undermine the profitability of existing electricity production in particular.

Fingrid has invited both customers and other stakeholders to give feedback on the updated fee structure for main grid services. This feedback will be used to finalise the fee structure. Fingrid Magazine asked energy-sector stakeholders for brief comments on the update.



JOHANNES BRUNILA
Commercial Director
OX2

1. From the perspective of a transmission system operator, this update is justified, as the operating environment is changing rapidly. However, cost predictability is extremely important for both market operators and companies that are planning new investments.
2. It is positive that Fingrid understands how changes of this magnitude have a broad impact on many stakeholders, and is open to hearing about and discussing the potential challenges. Overall, Fingrid's ability to innovate and respond to the market is a clear strength.
3. The proposed change is significant and will affect not only projects that are already under construction, but also those that about to enter the construction phase. The input power fee for grid energy storage facilities should be more reasonable, or else the calculation logic for peak power should be reassessed.



JARI NYKÄNEN
Public Affairs Manager
Paikallisvoima ry

1. This update is necessary in our increasingly electrified society, but it must be implemented carefully. Locating production and consumption close to each other makes sense from an overall system perspective. It does, however, involve regional policy issues that require political guidance.
2. Fingrid has provided the impact assessments required for the planning process, and has taken the feedback from the comment process into account. I also endorse sharing costs according to the cost-causation principle. At this stage, I have a cautiously positive view of the update.
3. The impacts should be assessed in a variety of future scenarios. It would be a good idea for Fingrid to provide the promised operator-specific calculations in advance. The background calculations, however, are based on previous years and do not therefore take the increasing level of electrification into account. Operators will be required to perform extensive calculations that will take a great deal of time and resources. The impacts must be assessed throughout the chain.



MIKKO LEPISTÖ
Energy Manager
SSAB

1. The largest costs associated with the main grid stem from power transmission requirements. Energy transmission causes very little wear and tear on components. Shifting the tariff structure towards a more power-based approach is therefore a fair solution.
2. Overall, it's a good proposal, particularly because of its focus on improving fairness.
3. Electricity transmission is ultimately in the mutual interest of both producers and consumers, and neither could function without the main grid. Main grid transmission costs should therefore be split equally between production and consumption. It's vital to keep Finland's main grid in good condition and ensure sufficient capacity, as it's one of our country's greatest competitive advantages. The electricity market also functions best when there is adequate transmission capacity. The main grid is an enabler.

QUESTIONS:

1. What kind of impacts will the update have, and is it necessary?
2. What are the benefits of the update?
3. What else should be developed?

ELECTRIC BOILERS

– bringing balance to the power system

The power of electric boilers that use low-cost electricity varies depending on the wholesale and energy-weighted balance prices of electricity. Their power is also affected by demand for district and industrial heat.

Operational facilities, approx.

2000 MW
(June 2026)

Facilities under construction, more than

1000 MW
(June 2026)

Electricity consumption in 2025, approx.

3 TWh

Estimated electricity consumption once all facilities under construction are operational

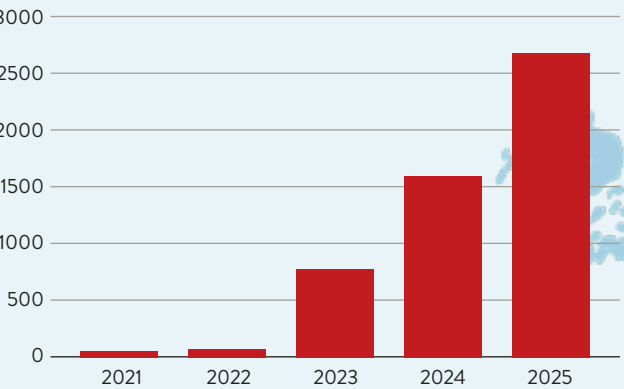
7–9 TWh

MW Power of electric boilers (Feb. 2026)

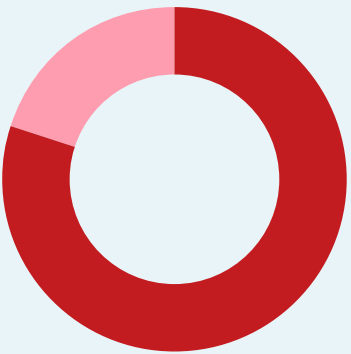


During the example week, the consumption of electric boilers ranged from zero to more than 1,100 MW.

GWh District heating by electric boilers



Source: Finnish Energy



80%

PRODUCE DISTRICT HEAT

20%

GENERATE HEAT AND STEAM FOR INDUSTRY

What is an electric boiler?

An electric boiler's water tank acts as a storage water heater from which heat is fed into the district heating network. Electric boilers are used to heat homes, schools and commercial premises, and to provide heat for industrial processes.

● More than 100 MW
● 10–100 MW

The electric boiler market is currently experiencing an investment boom. Most of the electric boilers installed in recent years are in southern Finland.

Specialists:
Risto Kuusi,
Senior Adviser, Fingrid
Veli-Petteri Liedes,
Specialist, Power System Reserves, Fingrid

NEW TECHNICAL REQUIREMENTS

The forthcoming technical requirements for consumption have now been revised. New requirements for renewable electricity production are also on the way.

TEXT KATARIINA KRABBE / PHOTOS FINGRID AND SHUTTERSTOCK



“A data centre may consume as much electricity as a large town, but from the grid’s perspective, it still appears as a single consumption point.”

Lasse Linnamaa
Unit Manager, Power System Engineering
Fingrid

Fingrid published a draft version of its new technical requirements for electricity consumption in June 2025. We then revised these requirements on the basis of feedback, and the first version of the final KJV2026 package was published for comments in June.

The new requirements will particularly affect facilities with a capacity of more than 30 megawatts. They are expected to come into force in early 2027 for all large-scale consumption facilities that are connecting to the electricity grid, once the requirements have been finalised by the Energy Authority. Some of the requirements are already being applied when a consumption facility is connected directly to Fingrid’s network.

“Unlike in the version circulated last summer, it is now power alone that determines who will be subject to the new requirements. So we don’t classify facilities according to their type of consumption,” says Fingrid’s **Lasse Linnamaa**, Unit Manager, Power System Engineering.

Paper and steel mills used to be the largest individual consumers of electricity in Finland. Many more large-scale electricity consumers are now connecting to the grid, and their electricity consumption is on a completely different scale.

“Examples of these major electricity consumers include electric boilers and data centres. A data centre may consume as much electricity as a large town, but from the grid’s perspective, it still appears as a single consumption point.”

THE MAIN REQUIREMENTS

Data centres are usually designed to automatically disconnect from the grid in the event of a disruption – even, for example, if there is a momentary drop in voltage caused by a distant lightning strike. Yet production has long been required to be resilient to disruptions, and must not disconnect from the grid.

“This creates a situation in which production exceeds consumption, and the grid begins to accelerate, that is, the frequency increases. Managing the power balance under these circumstances can pose significant challenges, and the system may not be able to adapt quickly enough,” says Linnamaa.

In fact, fault tolerance is one of the most important new requirements for consumption facilities. Even if the power drawn from the electrical

network by consumption facilities were to drop momentarily during a disturbance, within one second it should return to a level comparable to that before the disturbance. This will prevent an imbalance, and enable the network to continue operating normally.

“This is the most significant new requirement. And it’s also the most challenging for consumption facilities,” says Linnamaa.

A second requirement for consumption facilities is the ability to reduce their power consumption by 30 per cent during a power shortage, for example.

“This may also be challenging, as consumption facilities are not designed to adapt to the grid. However, I believe it’s also more beneficial for consumption facilities to put some advance thought

Projects are often designed as hybrid systems with integrated grid energy storage facilities.

into which loads could be shut off if necessary, rather than having to shut off their entire power supply.”

The third requirement concerns oscillation. For example, power levels may fluctuate continually during the AI training conducted by some data centres, which can lead to interaction phenomena. Oscillation limits are now being set.

The fourth requirement concerns controllability. “We can’t start calling every connecting party in the event of a serious disruption. We will instead send a signal requesting action, such as setting a 30 per cent limit. Customers can also choose to utilise these signals and the flexibility they afford, thereby enabling them to earn money on the reserve market.”

NEW REQUIREMENTS FOR PRODUCTION

Fingrid is also introducing new technical requirements for electricity production. These technical requirements will be published in early October, and will be based on Fingrid’s current technical requirements for power plants (VJV2024).

The new requirements stem from challenges in maintaining the stability of the electricity system when there are large quantities of wind or solar power in the same area. Interaction phenomena involving production facilities that are connected to the grid via inverters may lead to voltage fluctuations or even cause power plants to disconnect from the grid. Fingrid’s grid simulations indicate that these issues cannot be prevented if production and consumption facilities continue to connect to the grid as predicted.

“We have invested in stabilisation equipment, but customers should be responsible for ensuring that their own equipment operates in a stable manner as part of the electricity system,” says Linnamaa.

“That’s why we will be requiring new wind and solar power plants to be equipped with additional stabilisation devices, such as synchronous compensators or grid energy storage, if there is a significant amount of wind and solar power in the area. Customers will only be responsible for offsetting the grid impacts of their own power plants, that is, this will not resolve any issues arising from plants that are already connected to the grid.”

“The need for additional equipment and the total amount of equipment required will be determined according to the location of the power plant project’s connection point. We will take the regional characteristics of the grid into account, including any grid energy storage facilities that are already connected and contributing to the grid.”

Although there are alternative technologies that will meet the requirements, they will likely steer development towards grid energy storage, as customers can continue to use it commercially in the normal manner. For example, in an area dominated by wind power, a 100-megawatt wind farm would require approximately 30 megawatts of grid energy storage.

Even now, new projects are often designed as hybrid systems – for example, grid energy storage facilities are already being integrated into wind power projects.

“Connecting parties will often want to build their own equipment to meet the new requirements,” says Linnamaa.

“The new requirements are seeking to form a bridge between current inverter technology and grid-forming inverters. It will, however, take years before these stabilisation features can be implemented without separate installations. And we must be able to connect power plants to the grid before this.” ♦



The schedule is the biggest challenge

The new requirements may cause problems for wind and solar power projects that are already approaching the construction phase.

“We haven’t yet seen the exact details of the requirements, but we’ve been told that the technical equipment requirements for new service contracts are set to take effect as early as this autumn. If this is true, operators will have virtually no time to prepare,” says **Anni Mikkonen**, CEO of Renewables Finland.

She points out that a connection agreement can be signed only after the city plan has come into effect, the building permits have been issued, and everything is ready for an investment decision to be made.

“If we are then told that we should also invest in grid energy storage to support the network, that would mean not only additional costs, but also a new round of permit procedures. In the worst-case scenario, the grid energy storage facility will require a new city plan, in which case the project would return to the planning stage.”

Mikkonen estimates that such a project could be delayed by two to four years as a result of potential appeals – or jeopardised entirely, if the land lease agreement, zoning regulations or environmental restrictions do not allow the construction of a battery storage system. The permit process for renewable energy projects always takes a long time regardless.

However, actual construction will progress quite rapidly once the investment phase finally begins.

“You might wonder whether this requirement is even reasonable for renewable energy producers, but what’s mainly needed here is sufficient preparation time,” says Mikkonen.

“In areas with high levels of renewable energy production, there are also many standalone grid energy storage projects in the pipeline, and they will also help to stabilise the grid. For a while at least, it would be a good idea to monitor the extent to which planned battery projects are being implemented, and then determine whether there’s still such a great need for these requirements.”

When looking at the bigger picture, Mikkonen believes it is vital not to start imposing any requirements on the technical specifications of wind and solar power plants that are not required elsewhere in Europe. Power plant manufacturers won’t make changes for one tiny market alone.

Mikkonen says that the current government term has been marked by contradictions.

“We need economic growth and industrial investments based on the fact that we have access to additional renewable electricity production that can be built quickly. However, there’s also an increase in regulation and obligations. Elsewhere in Europe, every effort is being made to facilitate permit processes and the construction of renewable energy projects.”



NEW TRADING SYSTEM FOR THE RESERVE MARKET

Users will be able to test the platform next spring.

TEXT KATARIINA KRABBE / PHOTOS FINGRID AND SHUTTERSTOCK

The reserve market trading system is being modernised: after its 18 years of service, Fingrid is now replacing the old system with the state-of-the-art tool. A new system is required, as the market has become more complex and the volume of bids is rising all the time.

The new system will also be able to connect to the European MARI system, that is, the mFRR energy trading platform.

“The procurement of the new system has focused on scalability. For example, it can be further developed for potential new markets and as more operators enter the market,” says **Ilkka Hulkko**, Manager, Market Platforms at Fingrid.

“Development needs are constantly emerging from many directions. The electrical system is evolving and legislation is changing. Customer feedback is also pointing to some areas in which improvements are required.”

The new trading system is a customisable off-the-shelf solution. It is used by several other transmission system operators, creating opportunities for synergies. There is no need to do everything alone.

The system will also be used to regulate the power balance in the power system of Finland and to address any transmission management challenges – so it is not merely a marketplace.

BALANCING SERVICE PROVIDERS EAGERLY AWAITING THE NEW SYSTEM

The most noticeable change for balancing service providers will be the new user interface. It will be easier to use, more modern, more efficient and faster. It will also be easier for users to manage and update their bids.

“We are, however, aiming to keep the technical interfaces as unchanged as possible, so that the update will require as few changes as possible from operators,” promises Hulkko.

“Development needs are constantly emerging from many directions. The electrical system is evolving and legislation is changing.”

Ilkka Hulkko
Manager, Market Platforms
Fingrid



“Hopefully, we’ll be able to test the system as early as possible.”

Juha Hietaoja
Senior Energy Specialist
Gasum

The new system is being eagerly awaited, as the old one is already reaching its limits.

“The current tool works well for the most part. However, individual investigations can take a surprising amount of time if, for example, a bid submission doesn’t go through,” says **Juha Hietaoja**, Senior Energy Specialist at Gasum.

Hietaoja hopes that the update will not remove any of the excellent existing features.

“We operate in many different roles, and all of them can be easily accessed with a single login, and they all have good displays. I hope it stays that way.”

Gasum acts as a balancing service provider to Fingrid, and is also a service provider to several other balancing service providers. Gasum’s 24/7 control room manages a total of nearly 50 customer reserve facilities.

Established in 2023, NSC EnergyOpti Oy is a service provider that operates in the reserve market. From the perspective of this company’s operations, it is of the utmost importance that everything be as automated as possible.

“It would also be very important for us to be able to automatically extract data both by reserve facility and by customer,” says **Arttu Hämäläinen**, Energy Market Manager at NSC. “An intuitive user interface is essential in exceptional circumstances, for example, one that shows whether a change was successful or not.”

TRIAL PERIOD IN THE TEST ENVIRONMENT

The goal is to complete a version that can be distributed to customers during the early spring. There will also be webinars and training sessions. Closer to MARI platform’s connection, the users will also have the chance to test the new system in practice during a trial period. Fingrid will work with all stakeholders to ensure that bids are actually submitted to the new system.

“Hopefully, we’ll be able to test the system as early as possible, while there’s still time to make any necessary changes,” says Hietaoja.



The launch of new platform’s first phase is scheduled for autumn 2027. However, this schedule may change, as the idea is to join the MARI platform at the same time as the other Nordic countries.

Work to develop capacity markets will then begin immediately afterwards. The new platform’s launch is currently planned for early 2028.

“After that, we can start turning off the lights of the old system,” says Hulkko. ♦



“It would also be very important for us to be able to automatically extract data both by reserve facility and by customer.”

Arttu Hämäläinen
Energy Market Manager
NSC



The equipment is serviced on the basis of its actual condition instead of carrying out regular annual maintenance.

TEXT SUSANNA CYGNEL / PHOTO FINGRID

Sensors show when maintenance is needed

Digital condition monitoring and early intervention can keep key transmission grid equipment operating reliably for years.

Manufacturers generally give the service life of key substation equipment as 25–40 years, but careful maintenance can extend this by several years.

The manufacture of high-voltage switches and instrument transformers consumes a lot of energy and a variety of raw materials. Extending a device’s service life will therefore reduce both costs and its environmental impact.

“From an environmental standpoint, it generally makes sense to take good care of your equipment and use it for as long as possible. This will also be more cost-effective than purchasing a new device,” says **Mika Vartiainen**, an expert working with digital condition monitoring at Fingrid.

Fingrid is currently transitioning from time-based maintenance to condition-based maintenance. This means that instead of carrying out regular annual maintenance, equipment is serviced on the basis of its actual condition.

“Expanding the main grid will significantly increase the number of devices in need of servicing. Digital condition monitoring will free up resources that can be allocated to whatever maintenance is required at any given time,” says Vartiainen.

TARGETED MAINTENANCE WITH THE AID OF DIGITAL CONDITION MONITORING

Sensors designed to monitor primary devices at substations continuously collect data on their condition.

“A device’s service life alone does not indicate its actual condition, as this is also affected by factors such as frequency of use, the load, and environmental conditions,” says Vartiainen.

For example, a switching device’s performance can be assessed by measuring the time it takes for it to open and close. Any changes in the time taken may indicate an incipient fault.

The condition of the insulation in instrument transformers is monitored by measuring radio-frequency radiation in the surrounding area. Changes in these measurements can reveal incipient damage before it causes a disturbance.

If the monitoring detects an anomaly, it will be further investigated onsite.

“The device’s maintenance history will then be combined with field observations and measurement results to form an overall view that can be used to assess the actual condition of the equipment,” says Vartiainen. ♦

Extending a device’s service life will reduce both costs and its environmental impact.



TEXT SUSANNA CYGNEL / PHOTOS FINGRID

A TRANSMISSION LINE takes years to complete

The construction of a transmission line usually takes six to eight years. Most of this time will be spent on planning, environmental studies and permit processes long before the first tower is erected.

Electrification, renewable energy production and industrial investments are constantly increasing Finland's need to develop the main grid.

Fingrid keeps a close eye on its customers' projects, and engages in continuous dialogue with a variety of stakeholders to determine how the main grid should be expanded.

"Customer needs are the starting point for building the main grid," says **Tommi Olsson**, Unit Manager, Transmission Line Projects at Fingrid.

A more detailed assessment of transmission line routes will begin when customers' investments move into the planning and permit phases. Several alternative routes will be examined to determine which route the transmission line could follow.

ENVIRONMENTAL ASSESSMENTS AND PERMIT PROCESSES TAKE YEARS

An environmental impact assessment (EIA) will always be conducted for larger projects.

"The studies will examine factors such as the transmission line's impact on nature, the landscape and land use," says Olsson.

An EIA typically lasts one to three years, depending on the project's scope and any additional studies that may be required.

"Environmental awareness has been steadily increasing. Regulatory requirements are increasingly coming from both Finnish authorities and the EU, which is being reflected in how projects are prepared."



"Customer needs are the starting point for building the main grid."

Tommi Olsson
Unit Manager, Transmission Line Projects
Fingrid

The transmission line's technical design phase will be next. Detailed construction plans will be drawn up, and supporting documentation for the expropriation permit applications will be prepared.

"The permit process is one of the longest phases of a project. It can take as long as two years to process an expropriation permit application," says Olsson.

Construction cannot begin until all of the required studies have been completed, the permits have been obtained, and the transmission line route has been expropriated. About five or six years will have passed by this point.

TWO WINTERS IN THE FIELD

Fingrid puts all project-related procurements out to tender before construction begins.

Actual construction work begins with clearing the site and removing the trees. The tower foundations will then be constructed, and the towers will be assembled and erected.

Finally, the conductors will be installed and the construction site will be cleaned up. All of this takes about two years.

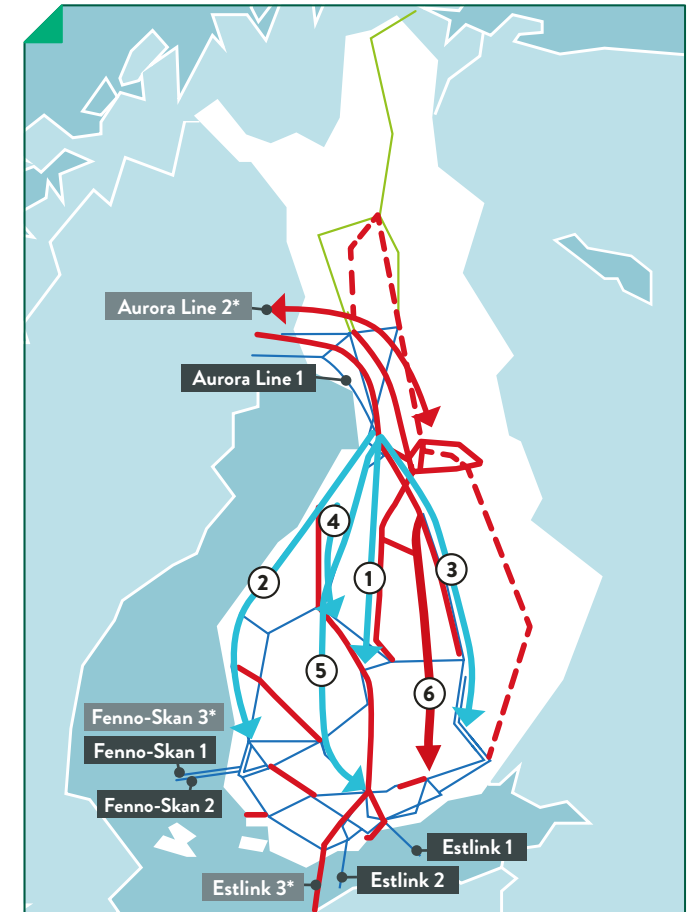
"We aim to make the most of the cold season, as winter is the best time to build transmission lines," says Olsson.

The frozen ground can support the weight of the machinery. So neither landowners nor the environment will be impacted as much as during other seasons, when machinery will sink into softer ground.

CONSTRUCTION WITHOUT POWER OUTAGES

The Finnish power system has been built up over more than a century, so it has grid components of various ages. New connections are being built while existing transmission lines and substations are being refurbished.

It is particularly challenging when a new section of the grid must be connected to the existing network. In such cases, it will be necessary to interrupt transmission connections, although electricity users should not notice this at all. "Work that requires service interruptions is planned with great care, so that it can be carried out safely while also ensuring the reliability of the electricity transmission system during construction," says Olsson. ♦



The main grid's most important trunk connections

1. The **FOREST LINE** is a north-south main grid reinforcement that was completed about ten years ago, and has significantly increased transmission capacity.
2. The **COASTAL LINE** was built to reinforce electricity transmission along the west coast and support increasing energy production.
3. The **LAKE LINE** is Eastern Finland's new trunk connection. Construction has been ongoing since late 2023, and the line is scheduled for completion in autumn 2026.
4. The **LOWLANDS LINE** enables wind power generated on the west coast to be transferred to Southern Finland, that is, to areas where electricity consumption is high. The connection is scheduled to be completed by the end of 2028.
5. The **RIVER LINE** is one of the main grid's oldest trunk connections. Some of its structures are due for renovation or replacement.
6. When completed, the **RIDGE LINE** will improve the reliability of electricity transmission. It is currently in the planning stage.

*¹) New cross-border connections under development

TEXT MARIANNA SALIN / PHOTOS JUHA METSO

Looking to the future **BRINGING MORE GROWTH TO KYMENLAAKSO**

Fingrid's Customer Manager Jarno Sederlund looks ahead to better serve new electricity consumers and producers. In southern Kymenlaakso, a local group brings valuable insight into the region's development.

On Monday 7 September, Jarno Sederlund wakes up at his summer cottage in Pyhtää. He turns on the coffeemaker, and makes sure that his electric car has charged overnight. He's a satisfied customer of Kymenlaakson Sähköverkko, but he's also a customer manager for Fingrid's main grid service, and the distribution network company is one of his customers.

After morning coffee and a unit meeting, he calls a project developer who has filled out a connection enquiry form on Fingrid's website. They go through the steps that will guide the project developer towards signing a connection agreement and building the connection.

"As the region's customer manager, I work with each of my main grid customers and project developers to determine everything that's required for making a new connection. At each phase, I direct them to either the appropriate expert or our My Fingrid service. This business model is unique in the Nordic countries, and I consider it one of Finland's competitive advantages."

Sederlund says that almost a hundred connection enquiries can be received each week from all across the country.

"Our forecasts indicate that fewer than ten per cent of these projects will actually be implemented, and identifying them is a challenge." However, these connection enquiries still help Fingrid to assess the main grid's development needs.

"We need all the help we can get, as main grid development focuses on the next five, or even seven, years."

LOOKING TO THE FUTURE

Sederlund is driving to Pyhtää Airport for his first meeting of the day, where he will be planning a connection for the Helsinki East business park with the project developers, the Mayor of Pyhtää, and Cursor, the regional development company for Loviisa and the Kotka-Hamina region.

"Even though this project is still in the zoning stage, it's a good idea to start looking into any electrical network connections that may be required and the next steps in the project."

To further clarify and broaden his outlook for the future, Sederlund will travel from Pyhtää to Kotka for a meeting that will also be attended by Cursor, the City of Kotka, and the local distribution system operators: Kymenlaakson Sähköverkko, Kotkan Energiaverkot and Haminan Sähköverkko.

It was Cursor, which promotes suitable investments for the region, that came up with



Customer meetings take Jarno Sederlund all over Finland, so he spends plenty of time behind the wheel.



“Now we have so many projects, and the situation is evolving so quickly, that we need to share information”

Jouni Pylvänäinen
CEO
Kymenlaakson Sähköverkko

Southern Kymenlaakso’s strengths are its well-established position in the process industry, the Port of Hamina-Kotka, its existing industrial areas and its educational institutions.

Heli Ala-Poikela
Senior Advisor
Cursor

the idea for these joint meetings a couple of years ago. They had noticed the same thing as network operators. Both companies that are choosing where to locate their operations and the network operators that serve them require information early on. They need to know about each other’s intentions and development plans, but there is little centralised data available about the current situation.

Local developers and network operators now meet a couple of times a year to assess how the area is developing and what that development will require from electricity networks.



Local stakeholders in the Kotka-Hamina region are working together to assess the grid needs arising from the region’s development, say Heli Ala-Poikela, Jarno Sederlund and Jouni Pylvänäinen.

“None of us can figure out the big picture on our own,” says **Heli Ala-Poikela**, Senior Advisor at Cursor.

SKYROCKETING GROWTH

When the team of developers meets in Kotka, they will review the publicly released projects that may eventually affect electricity consumption or production. They will also jointly assess the likelihood of each project being implemented.

“Bilateral discussions used to be sufficient when there were only a few projects. But we now have so many projects, and the situation is evolving so

quickly, that we need to share information,” says **Jouni Pylvänäinen**, Managing Director of Kymenlaakson Sähköverkko.

Sederlund estimates that the region is growing so rapidly that the main grid’s capacity will have to be doubled over the coming years, and scarce resources will have to be carefully allocated until then.

Pylvänäinen says that investments in the distribution network have already doubled over the past few years. He gives several reasons for this: not only new industry, but also improvements to security of supply and the general electrification of society, such as battery storage facilities, e-truck chargers, shore power for ships, solar power, and electric boilers.

“A shared understanding of the situation helps us to develop the network and coordinate our plans. And all of us speaking with one voice will also help new operators entering the region,” says Pylvänäinen.

MAJOR BATTERY CLUSTER PROJECT LAUNCHED

Ala-Poikela considers southern Kymenlaakso’s strengths to be its well-established position in the process industry, the Port of Hamina-Kotka, its existing industrial areas and its educational institutions.

“The first data centre was built in the area more than 15 years ago, in a former paper mill in Hamina.

Its waste heat is fed into the region’s district heating network, and the project is still growing,” says Ala-Poikela.

She hopes to see more projects that combine elements such as industrial production, solar power production and the use of waste heat. Restrictions stemming from the Finnish Defence Forces’ area control systems significantly limit wind power construction in the region.

One of the region’s largest ongoing industrial projects is a battery material plant with a value of about EUR 800 million, which the Chinese-Finnish company Easpring Finland is currently building in the Keltakallio district of Kotka. It will begin manufacturing the cathode active material required for electric vehicle batteries next year.

The plant will be connected to Fingrid’s Kymi substation via the Kymenlaakson Sähköverkko network using a new 110 kV power line that is currently under construction.

“We launched discussions about the battery industry and its electricity requirements back in 2018. And at the other end of the time scale, we have projects such as battery storage facilities, which can be connected to the grid with six months’ or a year’s notice,” says Pylvänäinen. ♦

Supporting growth

Fingrid’s Main Grid Services Customer Managers pictured together. Front row (from left): Tommi Asp, Laura Ihamäki and Nick Nortamo; middle row (from left): Jarno Sederlund and Head of Unit Petri Parviainen; back row (from left): Antero Reilander and Markus Talka.



ACCELERATING the development of EU power grids

TEXT JUKKA NORTIO
PHOTOS LEHTIKUVA AND FINGRID

The EU is seeking to strengthen the development, interoperability and flexibility of energy transmission networks. Its goal is to meet growing demand for electricity and hydrogen, promote competitiveness, and achieve climate and energy goals.

The European Union will need to make substantial investments in its electricity and hydrogen networks by 2040. Although the current TEN-E Regulation has promoted cross-border energy infrastructure projects, many of these have progressed slowly.

The European Commission is now hoping to simplify and accelerate permit procedures for energy infrastructure, and also strengthen its own role in the planning of strategic cross-border networks.

COMMISSION TO ACCELERATE PROJECTS

The European Grid Package consists of communications and legislative proposals from the European Commission. It has two parts: the TEN-E Regulation and a directive governing network permit procedures. In Finland, the Ministry of Economic Affairs and Employment is in charge of implementing the TEN-E Regulation, while the Ministry of the Environment holds responsibility for the directive governing permit procedures.

“We need TEN-E, because Europe requires cross-border electricity network connections and not all of them will necessarily be market-based,” says **Maria Kekki**, a Ministerial Adviser at the Ministry of Economic Affairs and Employment.

The Grid Package is based on an observation made by EU rapporteur Mario Draghi: energy networks are one reason why the EU’s competitiveness is less than optimal. The permit process is slow, and there is no strategic

planning for electricity networks in Europe. The EU therefore wants to play a greater role in network planning alongside national transmission system operators.

Rapid changes in energy networks have contributed to this situation, such as a sharp rise in the proportion of green electricity production. Things also work both ways.

“The green transition requires a more strategic approach to the development of energy networks. Some European countries currently have differing views on the development of cross-border network connections,” says Kekki.

A BOOST FOR CROSS-BORDER PROJECTS

The Grid Package will progress over the next couple of years, both through negotiations between EU Member States and the European Commission and via decision-making in the European Parliament. Energy ministers from EU Member States discussed the Grid Package at their meeting in Luxembourg in late June.

The matter will be put before the European Parliament by this autumn at the latest.

The TEN-E Regulation will enter into force in the EU as is, that is, as soon as an agreement has been reached through negotiations between the European Parliament, Council and Commission.

Kekki says that the Regulation will come in force no later than the beginning of 2028. The Grid Package’s Permitting Directive must be integrated into the national legislation of each EU country before it can enter into force.



“We need TEN-E, because Europe requires cross-border electricity network connections and not all of them will necessarily be market-based.”

Cross-border network projects are funded through the CEF (Connecting Europe Facility). There have been positive experiences with the CEF during Finland and Sweden’s Aurora Line 1 project, which was completed at the end of last year. Fingrid and Svenska kraftnät received 50 per cent CEF funding for the project, which is the maximum amount available for a cross-border project.

“Many cross-border projects in Europe have stalled for years, as countries have been unable to reach an agreement on how to share the costs. Some countries also view these issues from the perspective of national protectionism. The Commission would now like to intervene in these kinds of projects,” says Kekki.

POLITICS SHOULD NOT OVERRIDE ACTUAL NEEDS

The European Commission is seeking to increase its clout in the planning of cross-border energy network projects, but this could lead to problems.

“To date, these networks have been built using a needs-based approach and from an engineering perspective. There is now a risk that political influence will increase, and this wouldn’t necessarily be in Finland’s best interests,” says Kekki.

Kekki says that a strengthening of the Commission’s authority would be unlikely to cause any major changes for Finland, as both our main grid and cross-border connections have been developed and maintained in an exemplary manner. But this is not necessarily the case in all EU countries.

“When it comes to hydrogen, the Commission may need to get involved in network planning, as we’re starting from scratch and there is no market to speak of at the moment.”

The Commission has also expressed a desire to change how bottleneck income is used in EU countries. The Commission proposes that these funds be partially redirected to savings, and thereby to the development of cross-border networks. Bottleneck income has so far been exclusively allocated to each country’s own transmission system operator.

“The original proposal has been revised to provide clarifications and limitations, such as how the change will apply solely to cross-border bottleneck income and income from which this earmarked portion is calculated. In practice, transmission system operators will be required to earmark this income for the development of their own cross-border projects,” says Kekki.

The European Grid Package

- An initiative proposed by the European Commission in December 2025.
- Its goal is to modernise, strengthen and accelerate investments in electricity and energy networks throughout the EU.

“Finland has advocated the view that bottleneck income should be used where it is accumulated. The use of bottleneck income is regulated by the EU’s Electricity Market Regulation, which we do not intend to open up further in this context with regard to the use of bottleneck income. But things are improving from Finland’s perspective.”

FUNDING FOR INFRASTRUCTURE MAINTENANCE AND REPAIRS

Finland has warmly welcomed the inclusion of a new category in the TEN-E Regulation for projects concerning the security and resilience of energy infrastructure. This is due to both the sabotage of undersea network infrastructure in recent years and changes in the security situation in the Baltic Sea region.

“We have considered it important for the EU to have a financial instrument that would enable us to improve the security of existing infrastructure. This could apply to, for example, Estlink 2. It’s great that this has now been included in the draft regulation.”

Finland has also strongly advocated for the repair of undersea energy infrastructure to be eligible for EU funding. At present, there is no financial instrument that would allow EU funding to be used for repairing infrastructure that has been deliberately damaged.

These negotiations have been difficult and are still ongoing.

“Countries in the Baltic Sea region have been actively involved in promoting this issue,” says Kekki. ♦

A GROWING NEED FOR PREPAREDNESS

“It’s important to avoid becoming overly dependent on either a single solution or solutions that are closely related.

Viktoria Neimane
Svenska kraftnät

– lessons learned from Ukraine

The war in Ukraine has underscored the vital importance of electricity supply to society as a whole. In Finland, too, it is increasingly important to prepare not only for storm damage but also for prolonged emergencies.

TEXT KATRI ISOTALO / PHOTOS FINGRID AND SHUTTERSTOCK

Our society’s dependence on electricity is growing rapidly, particularly as heating and transportation are being electrified. Yet at the same time, geopolitics is giving rise to new threats, and extreme weather phenomena are on the rise. It is therefore increasingly important to prepare not only for technical disturbances caused by natural phenomena, but also for cyberattacks and sabotage.

Close cross-border cooperation is one way to prepare, and is already commonplace in the Nordic countries. For example, overhead transmission lines running between Northern Finland and Sweden enable electricity to flow from one country to the other, even if production

has been interrupted in the neighbouring country. Resources are already being utilised through cross-border cooperation as well.

“The advantage of overhead lines is that they are faster to repair and harder to sabotage than submarine cables,” says **Tuomas Rauhala**, the Senior Vice President responsible for System Operations at Fingrid. Transmission capacity is being further increased in collaboration with transmission system operators in Sweden and Estonia.

When it comes to preparedness, Rauhala considers effective cooperation between all stakeholders in the sector to be of paramount importance – both nationally and internationally.

The Nordic countries have already been collaborating for a long time, and in particular when it comes to tackling serious disturbances caused by weather phenomena.

SWEDEN TRAINS CIVILIANS FOR ENERGY CRISES

Viktoria Neimane from the Swedish transmission system operator Svenska kraftnät also notes that security of supply for electricity must be designed to handle a broad variety of circumstances ranging from peacetime disturbances to war. The need to prepare for long-term disturbances has clearly increased. Neimane is responsible for Svenska kraftnät’s power system strategy.

“We must take preparedness into account very early on, during the system’s design and construction phases. It’s important to avoid becoming overly dependent on either a single solution or solutions that are closely related. This applies equally to technical solutions and personnel and processes,” says Neimane. Cooperation with a variety of stakeholders, including neighbouring countries, is also important from this perspective.

A new preparedness measure has been introduced in Sweden: training civilians to prepare for exceptional circumstances. A pool of about a thousand civilian reservists has been identified with the support of the Swedish government, and their expertise can now be rapidly mobilised as necessary in areas such as electricity network repair or securing hydroelectric power.

“Fortunately, neither Finland nor Sweden has ever faced the kinds of circumstances that we must now prepare for. But we have a very solid foundation for cooperation if such a situation were to arise,” Viktoria Neimane assures us. Her colleague Tuomas Rauhala agrees.

THE WORST-CASE SCENARIO CAME TRUE IN UKRAINE

Russia’s invasion of Ukraine has been both an extreme test and a lesson in how to defend the power system during a full-scale war. Several of the network operator’s employees were killed at work during the first missile strikes of autumn 2022.

We asked Ukraine’s network operator, NPC Ukrenergo, about its experiences of maintaining the main grid after this worst-case scenario was realised.

“At NPC Ukrenergo, we had already begun preparations to strengthen the resilience of Ukraine’s power system. We had been working with the government to identify critical transmission system facilities whose key high-voltage installations require protection from Russian missile and drone attacks,” says **Valerii Osadchuk**, Head of Communications at NPC Ukrenergo.

This protection was then quickly installed at all facilities. For example, the transformers at most substations are now protected by massive reinforced concrete structures. This has saved a significant number of valuable installations from damage during attacks. Some of the substations’ key components have also been moved underground. Preparedness also includes strengthening cybersecurity.

In-house expertise and equipment stocks are crucial in exceptional circumstances.

“Maintaining inventories of critical high-voltage installations has proven to be extremely important for emergency repairs. For example, power transformers are not readily available, and they take anything from several months to over a year to manufacture,” says Osadchuk.

The importance of having your own qualified repair personnel has taken on new – and fairly stark – dimensions.

“Outside contractors perform the majority of the work required by many transmission network operators. However, they may refuse to perform tasks that involve life-threatening risks. Which is why it’s important to have our own personnel.”

In fact, Ukrenergo’s employees have been acquiring unique expertise during the war years.

“In 2024, for example, we completed the delivery, installation and commissioning of a power transformer at a substation damaged by Russia in only 21 days, whereas a similar project in Europe typically takes three to four months.”

“Maintaining inventories of critical high-voltage installations has proven to be extremely important for emergency repairs.”

Valerii Osadchuk
NPC Ukrenergo

Specialised expertise is also required to implement backup control centres and additional secure communication links due to the continual threat of missile and drone attacks.

DECENTRALISED PRODUCTION IS COSTLY FOR AN ATTACKER

Maximising the decentralisation of the electricity system has proven beneficial in many ways, that is, by building thousands of small production facilities close to consumers. Experience from the war has shown that large power plants are extremely vulnerable to enemy air attacks in a full-scale war.

“Having twenty 10-megawatt facilities instead of a single 200-megawatt production unit makes it significantly more difficult and expensive for an attacker to cause a disturbance, as more missiles and drones are required to destroy the same amount of capacity in a decentralised system. Decentralised production also reduces the load on the electricity transmission network,” says Osadchuk.

ENTSO-E ASSISTS WITH ELECTRICITY IMPORTS

NPC Ukrenergo has also received international funding and donations to support its work.

The Ukrainian and European electricity networks were synchronised just a few weeks after the Russian invasion was launched, and NPC Ukrenergo was quickly accepted as a member of the European Network of Transmission System Operators for Electricity (ENTSO-E). This has opened up new opportunities for importing electricity and balancing production and consumption. ♦



Jussi Tuovinen
Lieutenant Colonel, Head of Information Management and Information Security Branch
C5 Division Defence Command Finland
Finnish Defence Forces

Individuals win matches – teams win championships

The headline paraphrases Michael Jordan in the wake of the World Cup. Messi, Ronaldo and Mbappé shone individually, but none of them lifted the trophy.

Individuals need an organisation – a team that is working towards the same goal. Outstanding individual players are valuable in team sports, but it is the team that achieves the result. The same analogy applies to many aspects of the real world, such as security and preparedness.

The war in Ukraine has sadly reminded us once again that battles are won on the battlefield, but we need all of society to win the war. This idea of “society as a whole” is also a goal. If a society does not function and is unable to provide services to its people, it cannot sustain itself or support its armed forces in combat. We need the whole team on the field. The same applies under normal circumstances.

In today’s challenging environment, corporate success also depends on collaboration. No company can succeed on its own, no matter how good it is. Companies are interdependent. A power outage will disrupt operations in all businesses, and the same applies to information systems, water supply and daily logistics. The Finnish Defence Forces also depend on companies and critical infrastructure.

So in 2024, the Defence Forces established the MIL-ISAC group in collaboration with Traficom’s National Cyber Security Center and private sector enterprises. The goal was to work with defence-critical stakeholders to improve the cybersecurity expertise and situational awareness of all team

members. This community was not formed solely to meet the needs of the Finnish Defence Forces, but rather to address each member’s need to work together to enhance their own security.

Over the past two years, teamwork has improved and the players’ trust in one another has grown through joint exercises and meetings. Trust is the most important driving force behind collaboration. Without it you cannot get to know the other members of your team. And if you don’t know your team, you also won’t know the strengths

and weaknesses of its individual members.

The MIL-ISAC team consists of a diverse range of members who now all share a common goal of improving security and preparedness under both normal and exceptional circumstances.. ♦

“Trust is the most important driving force behind collaboration. Without it you cannot get to know the other members of your team.”

New datasets in Open Data!

FINGRID Open Data provides developers of industry services and applications with free information about electricity markets and the power system of Finland. The service's latest datasets include information about the reserve market, grid energy storage facilities and transmission connections.

WHAT'S NEW?

- The charging and discharging power of grid energy storage facilities and their total installed capacity
- Average frequency deviation
- Electricity transmission via transmission links between Finland and Estonia, Norway and Sweden
- FCR-N balancing energy
- Up-regulation price for direct mFRR activation
- FI-EE aFRR capacity
- Avoided aFRR activation

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