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model combines
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- an amazing investment

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System security and the market go hand in hand

The functioning of society depends on the security of the power system – when the power goes off, society is paralysed. Transmission system operators with system responsibility have been assigned a vital role in this work, and transmission system operators have internalised their role very effectively: it is the very purpose of their being. Maintaining transmission reliability and minimising the disruption of outages are essential aspects of a transmission system operator's day-to-day work.

Since the electricity market was opened up to competition in the mid-1990s and the transmission system operators were separated from power-generating companies, the transmission system operators have adopted an important role as facilitators of a functional market. This work includes developing the main grid and ensuring reliable transmission connections in line with the needs of the electricity market. It also involves everyday operations to underpin the functioning of the market. An integral aspect of this work is to develop the electricity market to meet future needs. Now, the focus must be on the free movement of electricity within the country and its borders, as well as on the mechanisms for balancing out generation and consumption as efficiently as possible, today and tomorrow.

Although some time has passed since the market was opened up, many transmission system operators still lack clarity as to their role in the electricity market. Every transmission system operator uses indicators of system security, but few of them measure their success as facilitators of a functioning electricity market, let alone use it as a factor of their corporate responsibility or remuneration schemes. Even Fingrid has found it slightly challenging because the market perspective is much more abstract than system security: when the power goes off, the impact is immediate, but a loss of market efficiency caused by a transmission system operator is more difficult to detect.

When transmission system operators balance system security against market efficiency, they face difficult decisions that essentially juxtapose two desirable outcomes every day. A very tangible example of this is the allocation of transmission capacity for market use. From the perspective of system security, substantial margins from transmission capacity could be reserved just in case they are needed, while the market perspective requires as much transmission capacity as possible to be assigned to the market. The European Union is not entirely satisfied with the actions of transmission system operators in terms of allocating transmission capacity, and, in response, it has introduced a new provision in the regulations to require at

least 70 per cent of the transmission capacity to be given to the market. At the moment, this matter is particularly relevant in the Nordic countries, as Sweden's transmission system operator has begun limiting electricity imports from Finland. Market operators think Swedes are violating EU regulations. "Have they forgotten about the market?" they wonder.

Finland is something of a backwater in European Union markets, so allocating transmission capacity is easier for us than the countries in the middle of the power system. Indeed, Fingrid endeavours to provide 100 per cent of its transmission capacity to the market. The functioning of transmission connections that affect the electricity market is extremely important to us, and we have made substantial efforts in this area in recent years. Our indicator of success from the market perspective is the harm that transmission restrictions cause to the electricity market when the free movement of electricity is restricted. Our indicators of system security and market perspectives are among the key factors guiding the company's activities. The indicators are also very effective as an aspect of our corporate responsibility and the remuneration of every Fingrid employee. You get what you measure!

Jukka Ruusunen
President & CEO
Fingrid



TSOs embrace collaboration to cope with the challenges of the Electrification Era and the Rise of Renewables

Society is going through a vast electrification process that is shaping life as we know it. For TSOs, this poses a lot of challenges: massive changes in the industry are necessary in order to enable full electrification.

TEXT | SAMI ANTEROINEN

PHOTOS | ISTOCK, ILLUSTRATION | OTAVAMEDIA



Right now, it is already clear that the power markets must be developed further in various regions and countries. Furthermore, the power systems and the electricity grid need to be developed in order to cope with the physical changes in production on our way to a fully carbon neutral power system.

Timo Kaukonen, Head of Operational Planning at Fingrid, comments that the need for electricity is going to be great and adjustments need to be made.

“In Finland, we are adding around 1,000 MW of wind power every year. Within a couple of years, we will be in a situation where wind power production reaches a level where the power system requires more flexibility, especially for congestion management such as countertrading and redispatching,” Kaukonen says.

NAIL THE FORECAST!

Fingrid is working hard to create possibilities and incentives for flexibility to the system. One key measure in this is developing better forecasting systems to cope with inaccuracies due to the weather changes in the coming hours and days.

According to Kaukonen, the creation of a more flexible power market means that all possible balancing power consumption and production is available on the market to make it work.

“The challenge here is the accuracy of forecasts in weather-dependent operations – but we are likely to achieve a sufficient level there. In addition, the flex market needs to have very

clear-cut rules in order to attract the needed flexible capacity,” Kaukonen says.

NORTH STANDS UNITED

Nordic RSC (Regional Security Coordination) is a joint office for the Nordic TSOs with the prime target to support the TSOs to ensure security of supply of electricity and to maximise the availability of the Nordic electricity grid for the electricity market. Director **Jens Møller Birkebæk** from Nordic RSC says that most TSOs – Fingrid as a prime example – have initiated two really major changes during the recent years that will likely prove to be the backbone in dealing with the future electrification.

“First of all, a full digitalisation of the power system, reaching from the charging of your electric car to the balancing of the entire national supply and demand at high voltage level. Second, intensified regional cooperation in operational planning, in balancing of the power system and in market development,” he says.

According to Birkebæk, TSO collaboration is simply the key in all of this:

“In my view, the energy transition will fail – or at least be extraordinary expensive for the society – unless TSOs are collaborating very closely bilaterally, regionally and even Pan-European,” says Birkebæk, adding that fruitful collaboration is exactly what the Nordic TSOs have done in the Nordic electricity markets for decades and only intensified of late.

TRANSPARENCY INCREASES TRUST

Nordic RSC, in itself, is a living proof of regional collaboration and digitalisation. Based on fully data-based decisions, Nordic RSC provides support to the Nordic TSOs to optimise the utilisation of the power system from long-term planning to close to real time.

“A major advantage of this is the transparency that data-based decisions are providing – this creates trust, because the basis for decisions will be visual for all parties and the best solutions across the region can be made for the benefit of the Nordic society at large,” says Birkebæk who believes that this transparent, trust-based collaboration will develop further in the coming years in all regions across Europe.

“We have recently seen incidents which brought the electricity system in continental Europe close to a collapse because of lack of or limited regional collaboration,” he cautions.

DIGITALISATION IS JUST GETTING STARTED

According to Birkebæk, new solutions are needed to solve the challenges of tomorrow – and this calls for innovation not only amongst traditional players in the industry, but also from new players.

“We have only seen the very early beginning of the advantages of digitalisation in our sector. Availability of data will enhance the opportunities for market-based innovation of new tools that can support electrification and the growth in electricity consumption without a proportional increase in new infrastructure,” he says.

Another challenge is safeguarding the open market while keeping the regional cooperation going. “We need to avoid national restrictions to trade also during the challenging times of the energy transition or maybe in situations where electricity prices are regarded too high.”

HOLD THE LINE

Kjell Arne Barmsnes is the chair for ENTSO-E Market Committee and well aware of the challenges facing the energy sector today. He believes that TSOs are working hard to make the transition happen.

“There are significant improvement plans for Europe such as improved market mechanisms and infrastructure expansions like offshore grids that will lay the foundation for the coming change,” he says.

Such a huge task requires broad shoulders – meaning everybody needs to contribute. “Electrification of Europe is not something you can do on your own: collaboration is needed on all levels.”

IMPROVED MARKETS AND COLLABORATION

Running markets more effectively – transitioning from a 60 minute resolution to a 15 minute one – is one important improvement to the market mechanisms. “The time resolution

“Digitalisation, including cyber security, becomes increasingly important in this transition.”

Kjell Arne Barmsnes

change is a prerequisite for balancing the system in a more effective way,” Barmsnes says.

According to Barmsnes, collaboration on regional and European level is required in all market timeframes to support the continued electrification. “We are moving towards European solutions and a European balancing market, and in doing so regional collaboration will still be important to handle regional specificities in support of the European solutions.”

Looking ahead, new solutions are needed to support the large penetration of renewables that are foreseen. Barmsnes observes that new and improved IT solutions with more and better data will be crucial in this regard.

“Digitalisation, including cyber security, becomes increasingly important in this transition.”

COLLABORATION REQUIRES COMPROMISE

Tahir Kapetanovic, as the Chair of the ENTSO-E System Operations Committee, has a good handle on the topic, as well. He says that TSOs are ready for the challenges of electrification and are, indeed, solving many of those challenges as we speak.

“What is needed is internal collaboration and willingness to compromise,” he says, adding that “nothing is more important” than TSO cooperation, if one wants to make the great leap to electrification successfully.

“There is still some egoism here or there and reluctance to adjust a bit your own goals for the greater good, but we have great examples of smooth collaboration that really works, like the decades-long cooperation of the four Nordic TSOs and also of the bigger ‘family’ of 29 TSOs of Continental Europe,” Kapetanovic says.

“The biggest challenge for the TSOs right now is that we must all be fully committed to the cooperation and mutual support in order to master this transition we are in.”

Patience is required, too, since change does not take place overnight:

“Even with the renewables coming in strong, natural gas will probably be around for 20-30 years.” •



*The author Jarno Linnéll is a Professor and Do-
cent of Cybersecurity and a member of the World
Economic Forum's Expert Network.*

The importance of electrical systems to society

We live in two worlds. One is the physical world, and the other is a digital world based on technology people have created.

We have adapted and evolved to live in the former throughout the history of humankind, but the digital world is still relatively new to us. While we are learning to live in the digital realm, we need to keep pace with the rate of change. It is said that everything that can be digitalised will be digitalised sooner or later. In fact, the most important target of digitalisation in the world at the moment is the person – in other words, we are digitalising the human brain. We are heading towards an all-pervading digital world.

However, we are already – and increasingly – living in a reality in which the digital and physical worlds merge into one another. It is easy to forget that the physical Finnish society and its critical functions are now highly dependent on the functioning of telecommunication systems and connections. In other words, if the digital world stops working, the impact will become immediately apparent in the physical world.

Various conventional boundaries and silos will become increasingly blurred in our thinking. Or rather, we will need to look at things more broadly and in new ways. For example, Finland's digital world requires electricity to function, but electricity generation and distribution are reliant on the digital world. If certain information systems stop working, electricity generation and distribution will also stop working. We have seen this occurring in practice in Ukraine. The digital world and electricity exist in very close interaction. They go hand in hand.

Almost every aspect of our societal and day-to-day activities need electricity and the functionality of the digital realm. Every company and organisation is highly dependent on digital services and electricity. At the same time, electricity dependency and malevolent

influences in the digital world – cyber threats – are becoming increasingly intertwined. Cybersecurity is no longer just a question of protecting hardware against various threats – it is a matter of safeguarding our society, business, and way of life.

We are heading towards a world in which we no longer differentiate between the safety of an electronic environment or digital and physical security. We only talk about safety, as digitality and the electronic world are omnipresent. Everywhere. So naturally, everyone understands their vital importance. •

The digital world and electricity go hand in hand and are now omnipresent.

The situational awareness system helps to visualise the operation of the main grid

Big changes are ahead for the processes and information systems in the Main Grid Control Centre, but system security must be maintained. To address this challenge, a situational awareness system was put into trial operation in the summer. The system means Fingrid's customers will receive even better service and a faster response in the event of problems.

TEXTS | PÄIVI BRINK

PHOTO | ISTOCK



WHAT IS SITUATIONAL AWARENESS?

Situational awareness is an understanding of the whole:

- *The prevailing conditions*
- *Incidents arising from the current situation*
- *Background information*
- *Estimates of how the situation will develop*
- *The readiness of various actors and parties*

Situational awareness can be divided into operational, tactical, and strategic situational awareness.

The Main Grid Control Centre has three jobs: managing the power balance, the power system, and the grid. There are as many as 20 different bundles of tasks under the main jobs. Dozens of information systems are needed to handle these responsibilities. Every operator at the Centre is tasked with creating situational awareness, which requires information to be retrieved from various information systems.

“Just about every process or partial process has a dedicated system that was built for it. As a consequence, the operators – in other words, the people – need to be able to take information from several processes and many systems. Lots will change in the coming years for reasons such as the 15-minute imbalance settlement period and the new Nordic balance management model, including the information systems. However, Fingrid needs to uphold the current level of system security throughout this. The situational awareness system tackles this challenge,” says **Mika Laatikainen**, System Development Specialist.

The order and colours of the cards change according to how critical the situation is in comparison with the metric set for it.

The situational awareness system combines the existing information and visualises it according to the choices of the Main Grid Control Centre operators. This enables it to create an overview of the main grid and the real-time electricity markets for users to interpret. This facilitates the work of operators.

“Better situational awareness can be obtained by consolidating the relevant data from source systems in a single place – the situational awareness system. There is a lot of data, so the system can be programmed to provide each user with only the information relevant to their work. At the

same time, information can also be shown to other Fingrid employees, thereby automating information sharing.”

METRICS ARRANGE INFORMATION IN ORDER OF IMPORTANCE TO THE USER

Information can be simplified by subject area using various metrics, which also enable information to be prioritised. Every subject area has suitable metrics defined for it.

“The system is structured like a stack of cards, where each card represents a part of the situational awareness of the main grid. The order and colours of the cards change according to how critical the situation is in comparison with the metric set for it. The system issues warnings and alerts when action is required. Users can click on cards to open a more detailed view of the subject, such as graphs, maps, history data, and forecasts. The things that are going well need less attention,” Laatikainen says.

SUPPORTING INFORMATION SHARING

In addition to the version for Main Grid Control Centre operators, a version of the system will be created for Fingrid’s internal users, such as the fault clearing groups. Information will flow more smoothly.

“One of the Main Grid Control Centre’s tasks is to communicate the situation to the various parties needed to clarify it. The situational awareness system sends information to the relevant support personnel automatically, so the support functions have access to the necessary information right away.”

The situational awareness system has been in trial use since the summer, and it will be officially deployed towards the end of the year. Subjects will be added to the system one by one.

“The system helps us to formulate a convenient overview of disturbances, which helps faults to be corrected more quickly. We can also offer the electricity market all the possible capacity, even in unforeseen circumstances. If an abnormal situation arises, our team improves its operability and corrects the faults swiftly. Our employees are looking forward to the deployment of the system because they find that it genuinely facilitates their work,” Laatikainen says, listing the advantages of the system. •

A market-based energy system is the key to sustainable growth





Henna Virkkunen, a member of the European Parliament, believes that a diverse, market-based energy system is the most effective operating model for Europe's sustainable growth economy. Investment subsidies for new energy sources are justified in the early phases of production, but over the long term, societally-funded energy needs to establish a competitive position in the market through demand.

TEXTS | OLLI MANNINEN

PHOTOS | MIKKO MÄNTYNIEMI

In Henna Virkkunen's opinion, other parts of Europe could follow the example set by the Nordic countries, which have been pioneers in promoting an efficient, market-based power system.

Virkkunen belongs to the largest political group in the European Parliament, the centre-right European People's Party. She is a full member of the Committee on Industry, Research and Energy, which focuses on building an energy union, promoting sustainable climate policy, creating growth and jobs, and fostering digital internal markets.

"For Finns, the items on the agenda often include our own natural resources – forests and expertise: how to promote sustainable forestry in Europe, how to cut emissions without harming economic growth, and how to create new work and innovation exploiting high-level expertise in Europe," Virkkunen says.

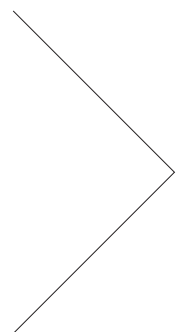
WHAT IS YOUR VIEWPOINT ON THE ROLE OF THE ELECTRICITY MARKET AS THE ENERGY SYSTEM UNDERGOES A TRANSFORMATIVE CHANGE?

It is absolutely fundamental at the European level. Finland has been a pioneer in developing an efficient, market-based energy system for 25 years. In the term, a lot of work was done at the EU level to enhance the operations of electricity markets. Substantial infrastructure investments were made to improve the functioning of electricity markets and ensure that energy moves across borders. Europe still contains a

large number of islands where energy only flows in one direction. Now, emissions trading has made it possible to transfer alternative energy system sources across borders.

ENORMOUS SUMS OF MONEY ARE BEING SPENT ON THE GREEN TRANSITION IN EUROPE. NEW TECHNOLOGIES, SUCH AS OFFSHORE WIND POWER AND HYDROGEN, ARE NOT COMPETITIVE ON MARKET TERMS, SO THEY NEED PUBLIC SUBSIDIES. WHAT ROLE DO YOU THINK THE ELECTRICITY MARKET WILL PLAY IN THE FUTURE? IS THERE ANY ROOM LEFT FOR MARKET-BASED ELECTRICITY MARKETS?

I think it is right to grant investment and innovation support for new technologies like offshore wind power or hydrogen in the early phases of development and production. In the long run, however, public subsidies are not a sustainable model. Instead, new technologies must gradually become more competitive in line with demand.





”I hope that Europe becomes the world’s first climate-neutral economic area.”

Henna Virkkunen, a member of the European Parliament

WHAT DO THE ELECTRICITY MARKETS IN THE NORDIC AND BALTIC SEA REGION LOOK LIKE FROM BRUSSELS?

Finland, Sweden, Norway, and Denmark have worked very closely together on their electricity markets. Other parts of Europe could learn from this. In recent years, new cross-border transmission connections have been built in the Nordic countries to enable hydroelectric power to be generated in one country and consumed in another. In order for Europe’s electricity market to function, it is important to have enough different energy sources and good cross-border transmission links between EU member states and with countries outside the EU. In the last term, there was wide-ranging legislative reform aiming towards a Nordic model. The Nordic countries have a very large number of energy producers. The Finnish electricity market alone has a hundred, while many other European countries only have a handful of energy producers. Consequently, households have only now begun comparing competitive electricity contracts, while this has been the norm in the Nordic countries for 25 years already.

THE CORONAVIRUS PANDEMIC HAS GIVEN RISE TO A NEW NATIONAL MINDSET. DO YOU BELIEVE THAT THERE IS ENOUGH TRUST IN COMMON ELECTRICITY MARKETS IN EUROPE WHERE EUROPEAN COUNTRIES BECOME INCREASINGLY DEPENDENT ON ONE ANOTHER FOR THE SECURITY OF THE ENERGY SUPPLY?

In my view, there is enough mutual trust between member states within the EU for a common electricity market, although there have been some disagreements in recent times over matters such as Poland’s stance on the use of coal. Situations like this are bound to arise in the future when all member states are required to generate electricity more efficiently and with lower emissions.

However, the EU’s reliance on imported energy is a greater concern. About half of the total energy requirement is still imported from outside the EU, and it

comes from fossil sources, such as coal or oil. This runs counter to the objectives of the EU Green Deal. During the coronavirus pandemic, the Ukraine crisis and restrictions on Russian gas imports raised the pressure to develop a self-sufficient energy industry in the EU. In Finland, we are in a good position, as our energy mix is diverse, and the generation of renewable energy is the second-highest in Europe, just behind Sweden.

WHAT TYPE OF FUTURE EUROPE DO YOU WANT TO HELP BUILD FOR THE COMING GENERATIONS?

I hope that Europe becomes the world’s first climate-neutral economic area. A major issue in the coming decades will be to transform industry and society so we can create an environmentally and economically functional and sustainable whole. The EU has set challenging targets for reducing greenhouse gas emissions. The targets must be addressed in a way that is socially and economically sustainable and does not discriminate against anyone. Finland and Europe could pioneer the battle against climate change and set an example for the rest of the world, encouraging everyone to take climate action. However, on a global scale, climate-neutral Europe alone is just one small factor. New technologies and innovations will play a key role in realising a climate-neutral world.

WHICH ENERGY QUESTIONS ARE THE HOT TOPICS AT THE MOMENT IN THE EU?

In the coming years, we can expect to see heated debate in the EU on complex and conflicting topics of energy legislation, as the European Commission’s proposed Fit for 55 climate package is discussed in the European Parliament and member states. The Fit for 55 package aims to cut greenhouse gas emissions from 1990 baseline by 55 per cent by 2030. The Commission’s proposals are likely to see thousands of suggested changes before the legislation to enable a sustainable growth economy is finally ready. •

The Aurora Line is Fingrid's most important investment this decade

The third transmission line between Finland and Sweden, running from Pyhänselkä in Muhos, Finland, to Messaure in Northern Sweden, is proceeding as planned. Fingrid and Svenska kraftnät are jointly responsible for the project. The connection will reduce the price of electricity in Finland.

TEXT | PÄIVI BRINK

The new 400-kilovolt transmission line between Finland and Sweden will increase the transmission capacity from Finland to Sweden by approximately 900 megawatts and the capacity from Sweden to Finland by approximately 800 megawatts. The Aurora Line will strengthen the electricity connection between Finland and the other Nordic countries and indirectly benefit the Baltic Sea region as a whole.

“We need a third cross-border connection because there has not been enough transmission capacity from Northern Sweden to Finland for the last decade or more. Electricity has been cheaper in Sweden than in Finland, and we want to reduce this price difference. Finnish electricity consumers will be the clear beneficiaries of the new connection, as the price of electricity will decrease and the security of supply will improve,” says **Mikko Heikkilä**, Head of Strategic Grid Planning at Fingrid.

The Aurora Line will improve the main grid's fault tolerance and enable more renewable energy to be used.

“We can receive more balancing electricity generated using hydroelectric power from Northern Sweden. There are plans for hydrogen industry at the far end of the Bay of Bothnia, on the Finnish side and the Swedish side. The area already has a lot of wind power generation, and more will be built. The Aurora Line will support the coordination of these business areas and contribute to the energy transition.”

THE AURORA LINE WILL BE COMPLETED IN 2025

The project's environmental impact has been assessed, and Fingrid is currently applying to the Ministry of Economic Affairs and Employment for a permit to build the cross-border line. The final permit phase is also underway in Sweden.

As the project will be more beneficial to Finland, Fingrid will cover almost all the costs of the project. However, it may be possible to receive funding from the EU.

“The EU has stated that this is a Project of Common Interest that will benefit several EU member states in the Baltic Sea region. The EU granted approximately EUR 4.3 million in funding

under the Connecting Europe Facility for the design stage of the project. We are now applying for EU funding for the construction phase. The total cost of the project is estimated at EUR 270 million. Grants can be awarded for up to half of the total investment. We have discussed the matter with local representatives and actors in Brussels, and we have spread the word about the project,” Heikkilä says.

The grant application was filed in October, and the EU's grant decision should be received in early 2022.

“The Aurora Line is Fingrid's most important investment of the 2020s. Construction will begin next year, and the connection will be completed by the end of 2025.”

The connection will cross the Arctic Circle, and the name Aurora Line refers to the northern lights, Aurora borealis. Fingrid will be responsible for the construction project in Finnish territory, and Svenska kraftnät will be responsible for construction in Sweden. •



The single imbalance model makes it easier to combine consumption and production

The Nordic countries – Finland, Sweden, Norway, and Denmark – switched to a single price and single imbalance model for imbalance settlement at 1 am on 1 November. The Nordic balance model (NBM) program aims to respond more quickly to the changes of the electricity market where single price and single imbalance model is the first step on the journey.

TEXTS | PÄIVI LEINONEN

KUVAT | SAMULI SKANTSI

With the introduction of single price-single imbalance model, the consumption and production imbalances are merged to one balance instead of the previous system of separate balances for consumption and production. Production, consumption, and trades are calculated and settled for each hour, and the outcome is one imbalance for the balance responsible party in each hour.

In the earlier balance model, there were separate balances for production and consumption, and the imbalances were calculated and settled for both balances separately. In addition, the imbalances in the consumption and production balances were priced differently, but the single price-single imbalance model uses one price in the imbalance settlement period.

The introduction of the new model anticipates the future transition in 2023 when the market will switch to 15-minute settlement periods instead of current hourly periods. The single price-single imbalance model and the 15-minute imbalance settlement period will enable balance responsible parties and other market parties to create more accurate forecasts and imbalance management.

“Retailers aims to have their electricity purchases and sales in balance every hour. In practice, the retailer purchases electricity according

to a consumption forecast. Balance responsible party of the retailer has responsibility to correct possible imbalances.” says **Jani Piipponen**, Balance Services Manager at Fingrid.

The transition to the single price-single imbalance model will not directly affect the way private consumers use electricity, but provides the foundation for future balancing management services, where private consumers can be accessed via service providers.

“The single price-single imbalance model will contribute to the development of future aggregation models for various balancing markets, enabling a better combination of consumption and production.”

THE SINGLE PRICE- SINGLE IMBALANCE MODEL IS THE OUTCOME OF EXTENSIVE NORDIC COLLABORATION

In October 2019, the Nordic countries decided to implement a single price-single balance model for imbalance settlement. Preparations for the transition have called for substantial collaboration with the all parties in the electricity market in the Nordic countries.

“The Nordic countries have harmonised balancing market and common systems. Transmission system operators and stakeholders have worked together to develop these,” says **Marja Eronen**, Senior Expert at Fingrid.



The single price-single imbalance model will contribute to the development of future aggregation models for various balancing markets,

Jani Piipponen, Manager, Fingrid

The transmission system operators and the authorities work in collaboration to enhance the energy market. The single imbalance model now introduced follows the European network code. In the Nordic countries, imbalance settlement is carried out by eSett, a service company owned by the Nordic transmission system operators.

“In terms of the system changes for imbalance settlement, changes have been ready well before planned go-live. Stakeholders involved actively in the development of the model and were well aware of the changes,” Piipponen says. •



The Nordic countries have harmonised balancing market and common systems. Transmission system operators and stakeholders have worked together to develop these.

Marja Eronen, Senior Expert, Fingrid

How does Fingrid locate faults and disturbances in the main grid?



Finland's main grid has an excellent reliability of operation rating. There can be more than 350 disturbances per year, and faults are cleared swiftly. **Mari Kiuru**, Network Control Expert at Fingrid, answers our questions.

TEXT | PÄIVI BRINK

PHOTO | KIMMO RAUATMAA / LEHTIKUVA

HOW OFTEN DO DISTURBANCES OCCUR IN THE MAIN GRID, AND WHAT CAUSES THEM?

In recent years, there have been 300–350 disturbances in the main grid annually. The majority are transient and require little action to be taken. Natural phenomena and weather conditions cause most of the disturbances: thunder, wind, snow burdens, supercooled water, and birds colliding with transmission lines. Disturbances happen throughout the year.

HOW QUICKLY ARE FAULTS NOTICED AND RECTIFIED?

If there is a disturbance in the main grid, the control centre notices straight away. Most disturbances clear themselves thanks to the auto-reclosure function in relay protection, but sometimes we send a team to check the location. This is one way of preventing larger problems from occurring. Patrols are sent out to check transient faults on a random basis. For example, if there has been a thunderstorm, it is obvious what caused the disturbance, but during the winter, there may be snow that needs to be cleared from transmission lines.

Approximately ten per cent of all disturbances require a patrol team to check the location. The time it takes to clear a fault can vary dramatically. It can take up to a week to repair a fallen tower. Permanent faults are rare.

WHAT TECHNOLOGY IS USED TO LOCATE FAULTS AND DISTURBANCES?

Fingrid uses a location technique to discover the exact location of a fault. Substations have disturbance records and travelling wave meters. The travelling wave meters send a timestamp to the main application, which calculates the location of the fault based on the difference between the timestamps, the length of the line, and the velocity of the travelling wave in the line. The control centre receives an email if the travelling wave meter has obtained a true value from both ends of the transmission line. Disturbance recording begins when a circuit breaker opens, meaning that the power line is not energised. The control centre receives a record, and we interpret the data to obtain variables such as the voltage and current, as well as the duration of the fault.

HOW ACCURATELY ARE FAULTS LOCATED?

Travelling wave meters can trace a fault to the correct tower in almost every case, for a precision of approximately 250 metres. The control centre receives information on the location (the number of kilometres from the start point) within a few minutes of a fault arising. If the travelling wave meter does not provide a value, the estimated location of the fault is less accurate, and the potential range is a few kilometres.

What role do people play in locating faults?

Control centre employees quickly form situational awareness based on the information generated by the systems. Experience in analysing faults helps to identify the locations of faults more precisely. We send customers and Fingrid employees an email or text message notification immediately after the fault. Dedicated transmission line specialists have been appointed to coordinate fault clearance in different areas. •



Datahub's Customer Service Advisors Nelli Karjalainen (left), Jenni Mäkinen and Jenni Beckman are looking forward to next year and getting to the real work.

The new faces of Datahub's customer service

The centralised information exchange system for the electricity retail market, known as Datahub, will go live on 21 February 2022. On the same date, Fingrid Datahub Oy's operational customer service team will start working.

TEXT | OLLI MANNINEN

PHOTO | SAMULISKANTSI

Fingrid Datahub Oy's Customer Service Manager **Minna Arffman** says Datahub's customer service team members are looking forward to serving customers in their new roles.

Service Advisors **Jenni Beckman**, **Jenni Mäkinen** and **Nelli Karjalainen** and Specialist **Kerttu Korpelainen** are all part of the Datahub customer service team. They will provide customers with advice and information about using Datahub.

"Customer service is fundamental to the satisfaction of Fingrid's customers. We aim to

provide efficient, high-quality service to all our customers," Arffman says.

GUIDANCE, INVOICING, AND IMBALANCE SETTLEMENT UNDER ONE ROOF

Datahub's customer service team will provide customers with comprehensive advice and guidance on using Datahub and answer any other questions that arise.

The customer service team will also handle Datahub invoicing, guide new market parties into the market, and take care of imbalance settlement.

"Understanding our customers' needs, listening to them, and taking a solution-oriented approach in customer interactions are important qualities that will enable us to further improve our services," Arffman states.

DIGITAL SERVICES UNDER DEVELOPMENT

Datahub's customer service team will support customers between 7 am and 7 pm on weekdays.

"We are also developing digital services so customers can find the information and support they need at any time of day," Arffman says. •

Countering cyber scams: Employees play, learn and spot scams

Scam emails have become commonplace and are getting more professional. Companies need every employee's skills and activity to combat them. Fingrid has taken a gamified approach to learning how to identify scam emails.

TEXTS | SARI LAPINLEIMU

Phishing for passwords, sending invoices that divert funds to criminals' accounts, blackmail... Cyber scams were once the domain of a few lone trouble-makers and petty criminals, but they are not any more.

"We want to be prepared for cyber attacks, and we are doing our best to ensure that our employees are the strongest link in this chain," says **Pauli Laine**, Expert in Fingrid's Service Provision and Architecture Unit.

The chain has been reinforced with the introduction of a game that helps to teach employees to identify scams and report them to the in-house IT department. We have a Finnish partner that sends the messages, and the game involves every member of Fingrid's personnel, right up to the senior management.

The game began three years ago, and it has proven to be an excellent motivator and practical tool.

"When a user notices a scam message and reports it, the system reports whether it is responsible for the message – and if it is not, it reports the case to the information security unit, which investigates the scam. The user is shown a brief message and earns points for successfully identifying the message. As each user accrues points, the scams gradually become more difficult. This means that every employee receives messages that are suited to their level."

INFORMATION EVENTS AND REWARDS

In addition to the orientation, messages, and related information texts, information events are held for the personnel a few times a year. The events are recorded and form part of the training material. The events involve showing some of the scams targeting the company and reviewing recent global information security incidents. There are also rewards for players subject to various metrics.

The metrics vary from one extreme to the other: for example, an employee could win a bottle of sparkling wine for going "from zero to hero" (learning very quickly), encouraging a new

employee, or striving for perfection in terms of detecting scams.

"We have a few people who have reported an incredible number of scams, as well as some departments that have succeeded in reporting only real scams with 100% accuracy over a long period of time. Some people make quite a lot of mistakes at first but improve later on. Everyone has a chance – it is not necessary to be the best."

Gamification has proven to be an extremely effective way of learning. Since the outset, it has facilitated the work of the ICT department and revealed some harmful messages that have circumvented the automated information security filters and ended up in users' inboxes. These will be used to identify better protective measures and, in certain cases, to work with the authorities.

"Gamification has distributed the work of searching for scams among all the users. In addition, our skilled and vigilant employees are able to detect scam messages that are entirely free of fake information and were not detected automatically by the system," Laine says.

Our corporate culture is conducive to gamification: the Senior Managers lead by example, and the rate of activity among employees is more than 90 per cent.

Pauli Laine, Expert, Fingrid

"These include messages sent to employees from the hijacked accounts of existing contacts, and the messages do not contain any technical or formatting issues. Messages like these could contain a link to the company's own Sharepoint site and attempt to phish for user IDs or distribute harmful material." •

It may be a scam if...

- ...you receive a message asking you to click a link or, for example, pay a seemingly urgent invoice immediately. Scammers take advantage of people's distress.
- ...you receive an email about your user ID in several languages. The company's user IDs are managed by the in-house IT department, so messages are not usually sent in several languages, and they are definitely not sent from outside the company – or even by email.
- ...you receive a package, and there is no information about where it has come from, or the link is short and unidentifiable. It could also be a scam if you are asked to complete Customs clearance on a product or identify yourself by text message. So check the status of the package by looking at the original order confirmation and not a link in a text message.
- ...you receive a notification that your user ID has expired. Rarely used accounts are deleted automatically, but the service provider is able to restore them. Contact the service provider directly via a different channel than the message you received and check whether the link you have received looks like the service provider's website or login page. If not, it is almost certainly a scam.
- ...you receive a text message saying that you have won a prize draw – unless you have really taken part in a prize draw and given the organiser your phone number. Even then, check the draw result on the correct page/section – do not just believe the message.

Datahub consolidates information

Fingrid's Datahub stores customer, metering, and accounting point information in one place. Datahub is a quick, efficient, and easy centralised information exchange system for the electricity retail market. The information collated by Datahub is up to date, secure, and easy to trace. Datahub is part of Fingrid's smart, clean, and safe energy system.

TEXT | OLLI MANNINEN

IMAGES | ISTOCK, ILLUSTRATION | OTAVAMEDIA



CUSTOMER SERVICE

Data associated with electricity contracts, accounting points, and electricity consumption will be more rapidly available to various parties. This means faster, smoother customer service. For example, switching to a new electricity supplier will be quicker.



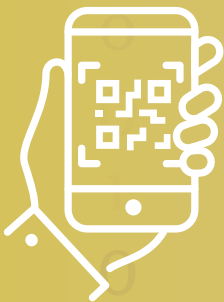
INFORMATION EXCHANGE

Thanks to Datahub, the exchange of information will be clearer and faster. Previously, information about accounting points and customer relationships was fragmented across various systems from one company to another, and the systems could not exchange information very quickly with each other. Information exchange is needed, for example, when a consumer switches to a new electricity supplier, and approximately 400,000 such switches take place every year in Finland.



PRIVACY PROTECTION AND INFORMATION SECURITY

Special care was taken to ensure privacy protection and information security when the system was developed. Personal data and accounting point information will be exchanged reliably and securely between the parties. During the information exchange, special attention is paid to ensure that data is only disclosed to parties entitled to it. All information entered into the system is traceable. Electricity consumers can view their information in the system, either in the Datahub customer service portal or via the online services of their own electricity company.



APPLICATIONS

The shared system will enable the development of new applications for electricity consumers, such as apps for saving electricity or monitoring consumption. Information can be used in applications if the customer who owns the data – the consumer – has consented to it.



UP-TO-DATE INFORMATION

Up-to-date information will improve the operations of all parties – the electricity consumers, electricity suppliers and the parties responsible for electricity transmission – since all data and transactions associated with the consumption of electricity are located in a single system, are up-to-date and equally available for all eligible parties.

Finland's Datahub will go live on 21 February 2022. Approximately 100 electricity suppliers and 80 distribution system operators responsible for electricity transmission will use the data provided by the centralised information exchange system.



3.8 MILLION ACCOUNTING POINTS

Accounting points include homes, sports fields, ice cream stands, industrial facilities, and all other places where electricity is consumed. The information systems of distribution system operators and electricity suppliers contain an abundance of information on each accounting point, such as contact details for the owner or occupant of the accounting point and accounting point consumption data.



IMBALANCE SETTLEMENT

In the future, Datahub will carry out imbalance settlement on behalf of network operators. This will free up the operators' time and resources to develop their own businesses.



ACER's Zinglensen: The European energy system is a great platform to build on

Christian Zinglensen is the new Director of the European Union Agency for the Cooperation of Energy Regulators (ACER). Taking office in January 2020, Zinglensen is motivated by the impact ACER makes in people's lives.

TEXT | SAMI ANTEROINEN

PHOTO | ISTOCK

The overall purpose of ACER is achieving a transition of the European energy system in line with the political objectives set, reaping benefits of increased energy market integration across Europe, and securing low-carbon supply at least possible cost for European businesses and citizens. Zinglensen believes that the transition of the European energy system entails an industrial transformation at a scale and speed not seen in several decades.

"It truly is an 'all hands on deck' type of task with both technical and political complexity on the rise," he says.

INTERCONNECTED & INTEGRATED

The European energy system has many strengths that are helping it cope with change. First and foremost, its electricity and gas system

is already significantly interconnected and integrated, underpinned by a comprehensive array of rules, oversight and governance mechanisms.

"There is much to build on," says Zinglensen, a Danish native.

As ACER turned 10 years in March 2021, now is an appropriate time to take stock of the milestones of the Agency. For example, all framework guidelines in the eight priority areas – identified by the European Commission in 2011 – were delivered by ACER in less than two years and, ever since, the Agency has been monitoring and providing solutions for the implementation of the resulting Network Codes.

"This is European energy market integration 'in action,'" Zinglensen says.

BRANCHING OUT

Zinglensen is also proud of ACER's market surveillance system in the framework of REMIT (the

EU Regulation for Energy Market Integrity and Transparency), an unparalleled effort worldwide in gathering and analysing data to deter and detect market abuse.

"That has been a huge effort over many years to establish and now it's set to truly shift gears."

Talking about cross-European infrastructure, Zinglensen states that ACER has developed into a strong input-provider, a role perhaps further strengthened by the new TEN-E framework being finalised between the European Parliament and the Council. Recently, ACER provided the Commission with a draft of new Framework Guideline on sector-specific rules for cybersecurity aspects of cross-border electricity flows.

"This is a completely new area for us – obviously important for the future of the power sector in Europe – in line with the increase in electrification of most energy-consuming sectors."



MIND THE EXPENSE

Zinglensen sees that ACER is very much becoming a “decarbonisation enhancing” Agency in the sense that much of what it does – in further integrating and future-proofing European energy markets – will be key for transitioning the energy system at lower cost.

“This lower-cost or affordability perspective will, in my view, likely prove a prerequisite for getting there in the end.”

According to Zinglensen, the EU will need to go further in integrating its energy markets in order to achieve the ambitious decarbonisation objectives at lower cost.

KEEP THE PROJECTS ROLLING

Addressing the pressing challenges for ACER, Zinglensen comments that building of new energy infrastructure in Europe is showing significant delays – what happens to the required aggressive infra scale-up, if the projects are stalling already?

Another challenge is more political:

“One may wonder”, he says, “if the current national discourse on climate and energy is fully in-tune with the need to further integrate our systems, and thereby also internalise a significant shift in respective net importer and net exporter roles of Member States”.

OVERCOMING THE PANDEMIC

Before joining ACER, Zinglensen was the first Head of the global Clean Energy Ministerial Secretariat hosted at the International Energy Agency in Paris (IEA). He started at ACER on 1 January 2020, becoming its second director – and had just nine weeks on the job before the pandemic lockdown struck.

Zinglensen admits that the past year-and-a-half period has been tough. “I really miss human interaction and all the energy it brings.” •



One may wonder if the current national discourse on climate and energy is fully in-tune with the need to further integrate our systems.

Christian Zinglensen, Director, ACER



Life beneath transmission lines

Fingrid is constantly on the lookout for new ways to take advantage of transmission line rights-of-way. Organic collection areas and insect hotels are among the latest experiments.

TEXTS | SARI LAPINLEIMU

PHOTOS | RIITTA VEIJOLA / LEHTIKUVA, FINGRID, ISMO PEKKARINEN / LEHTIKUVA



Additional income from organic collection products

There is a shortage of organic collection products like berries, birch leaves, spruce tips, chaga mushrooms, and sap in Finland. Landowners in transmission line rights-of-way can apply for organic certification for the area and sell collected products at a better price than ordinary products.

Picking berries and other natural products is not the only use for transmission line rights-of-way – the owner can apply for organic status

and receive better returns. This was the finding of a joint experiment by the Forest Centre and Fingrid to seek new solutions that benefit landowners.

“We want to encourage landowners to make the most diverse use of transmission line rights-of-way as possible. Among other things, we prepared nine idea cards to illustrate various alternatives and facilitate the utilisation of such areas. The idea cards also include a fact sheet on collection products,” says **Tiina Seppänen**, Expert at Fingrid.

Demand for natural, organic products has been growing in Finnish and international markets: for example, it has been necessary to import organic forest berries to Finland. More organic collection areas are required to meet the market demand.

According to the Forest Centre, Finland already has the world’s largest organic collection area measuring almost 4.6 million hectares. However, this area could be up to four times bigger because almost all of Finland’s forestry land is suitable for organic farming.

Insect hotels on transmission line towers

Insect hotels have become a familiar sight in the effort to counteract the loss of pollinators. Now they are being mounted on transmission line towers.

The number of pollinating insects has declined alarmingly due to the loss of insect habitats, insecticides, invasive species, and climate change. Approximately 75 per cent of cultivated plants require pollinators, especially bees, so the disappearance of these insects is a genuine threat to human food production.

Artificial nests known as insect hotels are one way of arresting the decline in pollinators. Fingrid has started an experiment in its areas in Kouvola, where it has mounted more than 60 insect hotels on transmission line towers.

“In general, it is not permitted to affix anything to transmission line towers without Fingrid’s permission. This is for reasons of electrical safety. This experiment has been carried out safely on our own land,” says Tiina Seppänen, Expert at Fingrid.

The results of the experiment seem promising. “A review conducted in July showed that most of the insect hotels had guests. One slightly amusing exception to this was cattle pasture areas, where we had to remove a few of the hotels because the normal residents of the fields refused to leave the artificial nests in peace.”

“Promoting biodiversity is one of our corporate responsibility goals. It calls for various kinds of action, both large and small. The #BeePower hotel pilot project also caused a buzz among Fingrid’s personnel: individual hotels have been popping up in increasing numbers outside employees’ homes,” says **Marina Louhija**, Senior Vice President in charge of corporate responsibility.

Find out more:
tiina.seppanen@fingrid.fi



ORGANIC COLLECTION PRODUCTS IN BRIEF

- Products can be called organic if they are collected in certified organic collection areas, such as forests, swamps, fields, verges, and natural pastures.
- Natural forest products can be utilised alongside wood products.
- Collected products are the kinds of products that can be picked according to Everyman’s Right, such as berries, mushrooms, and herbaceous plants like nettles and rosebay willowherb, or produce picked with the landowner’s consent, such as sap, spruce tips, resin, chaga mushrooms, and birch leaves.
- All organic produce, including items collected from forests, is monitored.
- One of the prerequisites for organic certification is that over the preceding three years, the area has not been used in any way that is banned under organic farming rules. (Some prohibited actions have permitted organic equivalents, such as certain fertilisers.) In addition, the collection of produce must not impair the stability of the natural habitat in the area or the permanence of species living in the collection area.



A wide range of areas can be put to use as sites for growing organic collection products. The products picked in Fingrid’s certified organic transmission line right-of-way include birch leaves for organic cosmetics. •

Demand for natural, organic products has been growing in Finnish and international markets

Research data on the use of concrete from demolition

TEXT | SARI LAPINLEIMU

PHOTO | ISTOCK

Significant quantities of demolition concrete arise on Fingrid’s worksites. In order to understand the environmental impacts of this, **Suvi Ollikainen** was commissioned to write her Master’s Thesis on the topic. The results of the research will be made available to all of Fingrid’s stakeholders.

“We use demolished concrete and brick waste in our substation projects, so we need to have a clear understanding of the environmental impacts of these materials, as well as the means of minimising the negative impacts,” says **Maija Nurmi**, Environment, Health and Safety Specialist at Fingrid.

Suvi Ollikainen’s thesis focused on the official permit procedures required in order to make use of concrete and brick waste, as well as the use of demolition waste in terms of costs and carbon dioxide emissions.

“Real-world figures on greenhouse gas emissions and actual monetary costs help when deciding whether it is possible to use concrete in various investment projects,” Nurmi states.

The research confirmed that it is almost always worth replacing natural aggregate with crushed concrete by both metrics and that the permit procedures related to utilising these materials vary greatly from one municipality to the next.

“Naturally, we will be happy to share our experiences, best practices, and the lessons learned from this thesis with our stakeholders. For example, we now have access to some clear formulas for calculating the profitability of reusing concrete in future projects,” Nurmi says.

In Finland, 80 million tonnes of mineral aggregate is used for earthwork every year.

Waste-based materials that are suitable for earthwork are produced in almost the same quantity. Crushed concrete has been reused for earthwork since the start of the 1990s.

“In many of its technical properties, crushed concrete is just as good as mineral aggregate, and its load resistance is even better than natural stone,” Ollikainen says.

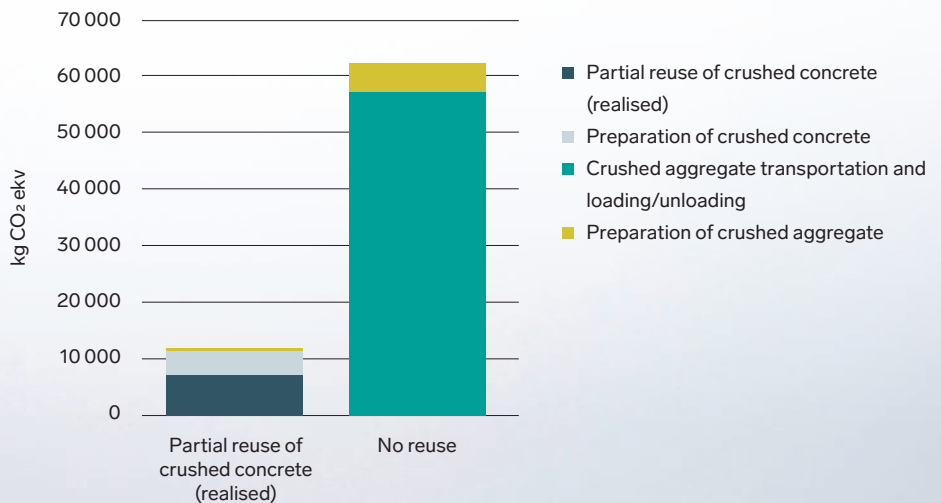
“Favouring reused materials is one way of promoting material efficiency and the sustainable use of natural resources. It also reduces the negative environmental impacts of construction projects. Efforts have been made to promote the use of recovered materials in earthworks with the help of legislation and various studies.”

The research confirmed that it is almost always worth replacing natural aggregate with crushed concrete.

Additional information

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GREENHOUSE GAS EMISSIONS FROM THE ALAJÄRVI STATION PROJECT WHEN CRUSHED AGGREGATE IS USED AND THERE IS NO REUSE OF MATERIALS.





Carbon neutrality vs the security of supply

The transition from fossil fuels to a carbon-neutral society is a major challenge from the standpoint of the security of supply. The National Emergency Supply Agency, which is responsible for ensuring that society continues to function in the event of a crisis or major disturbance, is undertaking four programmes to reform its approach, with the security of the energy supply and the energy revolution in a key role.

TEXT | OLLI MANNINEN

PHOTOS | ISTOCK, JUHA NENONEN, VESA TYNI

The National Emergency Supply Agency has initiated an extensive, long-term programme of work that seeks to moderate the impacts of transformative societal and economic changes on the security of supply. The entity consists of four programmes: Energy 2030, Digital Security 2030, Logistics 2030, and Region 2030.

“The implementation of the energy programme has initially set its horizon at 2025. The aim is to take a networked approach with businesses, the public sector and the third sector to seek the means of safeguarding the energy supply in the event of future crises and ensure that life can go on with a minimum of disruption,” says **Janne Kähkönen**, CEO of the National Emergency Supply Agency.

According to Kähkönen, the role of the National Emergency Supply Agency is to act as a comprehensive security of supply hub, expert and financier when programmes are put into practice.

“It is our job to bring together entities in the region and the sector so we will be able to jointly develop tools for ensuring the security of supply in a changing operating environment,” he says.

A COMPLEX WORLD IS VULNERABLE

We are dependent on energy in many ways. There needs to be enough of it available for every consumer. Finland has a lot of energy-intensive industry. The distances are long, so transporting people and goods requires energy. Our northern location means we need a lot of energy for heating. Society is also electrifying and becoming more digital. In the future, we will be increasingly reliant on the security of the energy supply and the disruption-free availability of energy.

“We are living in a complex and interdependent world that is vulnerable to risks of various types. A disturbance in electricity distribution, world trade, or international logistics could cause a chain reaction in which a shortage of critical materials could lead to long-term crises. For this reason, forecasting, preparedness, and self-sufficiency are vital,” Kähkönen says.

THE VALUE OF ENERGY ACCOUNTS FOR HALF THE STOCK BALANCE

According to Janne Kähkönen, the transformation of the energy system poses a challenge for energy stockpiling, as Finland is moving away from fossil fuels, which are easy to store, and replacing them with wind and nuclear power, which are currently more difficult to keep in reserve.

“It is still hard to say exactly how the various alternative technologies for energy generation and distribution will develop. However, I believe

that new technologies will create new opportunities, including ones for guaranteeing the security of supply. This will ensure that the electrification of society and the carbon-neutrality target of the green transition can be realised,” Kähkönen says.

At the moment, energy accounts for a major share of the National Emergency Supply Agency’s total buffer stocks. Fuels make up half of the balance sheet of stored materials, worth a total of two billion euros.

“Although we are heading towards the carbon-neutral era, our stockpiles will need to include fossil fuels as a backup system for a long time to come. In the future, we may well be the last party to have any coal,” he says.

PROGRAMMES IMPLEMENT THE REFORMED STRATEGY

The National Emergency Supply Agency’s four programmes will also promote its strategic objectives, which are to stockpile critical materials for society, forecast and analyse risks and threats, and develop networked operations.

“The coronavirus crisis revealed the vulnerability of healthcare with respect to the personal protective equipment, masks and visors that were needed. We have now contributed to the initiation of Finnish production of these goods to minimise our reliance on imports. The coronavirus also reaffirmed the importance of foresight and the need to be able to distinguish weak signals more systematically than before. Building a regular status overview and improving situational awareness will make it easier to prepare for future disturbances,” Kähkönen says.

Climate change affects the security of supply from two different angles. On the one hand, it necessitates new solutions for storing low-emission energy and electricity, and on the other hand, it calls for the ability to prepare for things such as extreme weather events.

“We are working on scenarios in an effort to reinforce our capacity to react rapidly to various crises and disturbances brought on by climate change,” Kähkönen says.

AIMING FOR A MORE NETWORKED, MORE OPEN, MORE TRANSPARENT ORGANISATION

Cooperation with various specialists and societal actors will be enhanced in the future by strengthening networking activities.

“The National Emergency Supply Agency’s sectors and pools are an effective way of maintaining and developing the capabilities of companies in various fields to respond to disturbances and emergencies. We aim to promote a networked approach, so we are able to identify the things that are important to companies. At the same time, we want to generate clear added value for the companies involved in our pool operations, incentivising them to participate in our activities,” Janne Kähkönen says.

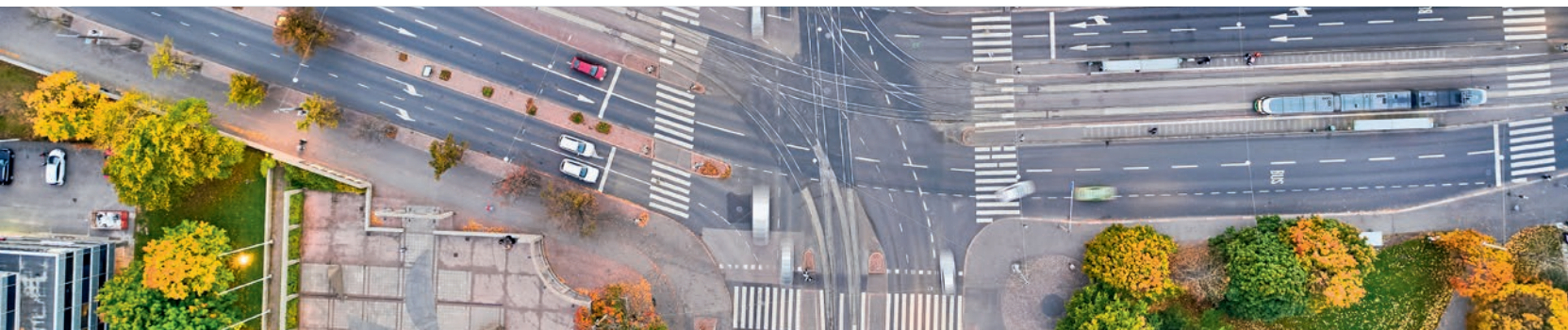
Kähkönen also wants to boost the National Emergency Supply Agency’s transparency and openness in the coming years.

“We have the obligation and the opportunity to inform society about our activities more extensively and engage in debate more actively in matters broadly related to the security of supply. At the same time, the security of supply involves some security-critical information, such as the details of stockpiles, which cannot be made public.” •



“I believe that new technologies will create new opportunities, including ones for guaranteeing the security of supply.”

Janne Kähkönen, CEO of the National Emergency Supply Agency



The coronavirus put Fingrid's preparedness to the test

Everyday life is returning to normal in the wake of the coronavirus pandemic. The crisis taught many companies about the importance of contingency planning and working on scenarios. The coronavirus demonstrated that Fingrid is on a strong footing with its preparedness plans.

When the coronavirus crisis began, the Power and District Heat Pool began analysing and maintaining situational awareness of matters related to the security of supply in the energy sector at the initiative of the National Emergency Supply Agency. The Power and District Heat Pool is chaired by **Reima Päivinen**, Senior Vice President of Power System Operations at Fingrid.

"Building situational awareness and issuing regular updates to the authorities was a smooth process, as the Pool's networks are well developed. Every few weeks, we worked with companies in the electricity sector to review the problems or challenges that had arisen or were foreseen," Päivinen says.

According to Päivinen, it is very important to sustain situational awareness as many stakeholders had a lot of questions for the authorities about matters such as power plant maintenance, especially in the early stages of the coronavirus pandemic. A large number of foreign workers and specialists are involved in maintenance work, and some operators were concerned about whether they would be able to work during the coronavirus crisis.

Like many other companies, Fingrid switched to remote working in spring 2020, which meant that Fingrid's Main Grid Control Centre in Helsinki would need to transition to a decentral-

ised operating model across several different localities.

"This was our way of mitigating the risk of all our operators in critical positions falling ill at the same time," Päivinen says.

JÄÄTYVÄ EXERCISE IN HELSINKI POSTPONED TO NEXT YEAR

Fingrid's internal remote working demonstrated that the company's IT infrastructure worked excellently and withstood the load. The webinars for stakeholders were also a success on the Teams platform for communication and collaboration. Some exercises were postponed due to the coronavirus pandemic. For example, the Power and District Heat Pool's Jäätyvä exercise in Helsinki was postponed to next year.

"Several actors from the energy sector are involved in the planning and realisation of exercises in addition to the authorities and municipalities in the areas selected for the exercises. For this reason, at least some of the people involved need to be present in person, and a command centre needs to be established in order for the exercises to succeed," Päivinen says.

All in all, Fingrid's operations went smoothly throughout the coronavirus pandemic, and the company made it through the state of emergency without any major issues.

"Maintenance of the main grid was carried out as scheduled, as was network construction

and refurbishment work. We did not accumulate a maintenance backlog during the coronavirus crisis. We made it through the extraordinary circumstances brought on by the coronavirus, demonstrating the value of making preparations for disturbances of different types. In the energy sector, it is in our genes. Threats have been analysed and exercises performed in advance, and now we can see how foresight and preparedness materialise in practice," Päivinen says.

WHAT WAS LEARNED FROM THE STRESS TEST?

The coronavirus crisis can be thought of as a stress test of the energy sector's security of supply and preparedness. What did the coronavirus teach Fingrid?

"We need to focus on fine details and put the lessons we have learned from this experience into practice. There is always something we can improve, even if things went well," Päivinen says.

He believes that the future of work lies at least partly in a hybrid model where some personnel work at the office while others occasionally work remotely.

"Despite this, there are lots of things that are easier to take care of when everyone is physically present. However, many international meetings can be held on Teams, reducing the amount of business travel and improving the carbon footprint of work. It is also a more cost-efficient approach," Päivinen says. •



"We made it through the extraordinary circumstances brought on by the coronavirus, demonstrating the value of making preparations for disturbances of different types."

Reima Päivinen, Senior Vice President, Fingrid

Electrifying, carbon-neutral Finland is an amazing investment



Fingrid is building a platform for the clean electricity system, which contributes to Finland's carbon neutrality goals and creates opportunities for new consumption investments. This development is built upon Fingrid's long-term grid planning work, which includes preparing a network vision, the main grid development programme for the next ten years, and an investment programme that results in the construction of the physical network.

TEXTS | OLLI MANNINEN

PHOTO | TIMO VIITANEN / LEHTIKUVA

What will Finland look like in the 2030s? A digitalised transport network, buzzing with autonomous vehicles, transports some employees to their workplaces while others work from home, engaging in virtual meetings enabled by data centres all over Finland. Concentrations of battery factories run on emission-free energy. Coal and peat are kept only in the emergency stores maintained by the National Emergency Supply Agency.

Electricity generation and consumption are increasing and diversifying.

"The digitalisation of work, cloud services, and Finland's goal of becoming carbon neutral require more electricity, and we have strong conditions in place to generate it in Finland. Fingrid's main grid is in good condition, the electricity network is advanced, and cheap electricity is widely available," says **Alpo Akujärvi**, Senior Advisor at Business Finland.

Diversifying energy generation, a reliable electricity supply, and a safe operating environment will boost Finland's attractiveness in the global competition for new company projects. According to Akujärvi, international data centres are now being placed in edge locations like Finland, as the markets elsewhere in Europe are becoming saturated.

"In the competition for data centres, one of Finland's strengths is its ready-made district heating network, which differentiates us from other countries. Fingrid's main grid is also exceptional by international comparison as large-scale investors and electricity consumers are able to connect to it directly, which increases cost-efficiency," Akujärvi says.

According to him, approximately 80 per cent of companies' IT infrastructure will be in the cloud by 2025. It has also been forecasted that approximately 65 per cent of global GDP will be produced either partly or entirely in digital form by the end of next year.

PREDICTABILITY AND FLEXIBILITY ARE FINGRID'S STRENGTHS

Electricity consumption and generation and the energy revolution as a whole are in full swing at the moment. The rapid leap forward puts pressure on Fingrid to take a long-term, proactive approach to the development of its grid and platform.

"Fingrid's strength is the flexibility of its operations. Large industrial projects are often long-term investments. Fingrid has had the capability to take the situation in hand and plan energy solutions and the development of the main grid with potential new partners at an early phase," Akujärvi says.

In the future, responsible players will be interested in clean energy. Finland's goal of becoming carbon-neutral by 2035 will accelerate the transition from fossil fuels to low-emission solutions. The shift in the structure of energy generation will be a strong driver of Fingrid's network development.



“We want to lay the foundation for a carbon-neutral Finland and create a clean electricity system. We are looking for solutions to address the new requirements introduced by the energy revolution by constantly improving the main grid and envisaging various scenarios to describe the requirements that the shift in the structure of generation and the accelerating pace of electrification in society could place on the development of the main grid and the power system as a whole,” says **Eveliina Seppälä**, Specialist who works in Fingrid’s Strategic Grid Planning unit.

THE NETWORK VISION AND THE MAIN GRID DEVELOPMENT PLAN ENABLE

The increase in weather-dependent generation, large new nuclear power plant units, a decrease in the amount of generation that can be readily regulated, the geographic location of new generation facilities in the main grid, and the pace of electrification in society are key trends from the standpoint of network development.

“We have analysed the energy revolution on two time horizons. The main grid development plan describes Fingrid’s development needs for the main grid and the plans until the start of the next decade. The network vision, which we have worked on with stakeholders, looks further into the future: it focuses on 2035, when Finland aims to be carbon-neutral,” Seppälä says.

The most significant variables in the future will be electricity consumption in industry, heating and transport, the generation and location of onshore and offshore wind power, the amount of distributed solar power, the amount of flexibility available from the supply and demand sides, and the future of nuclear power plants.

It is still hard to predict which of the scenarios in the network vision will become a reality, but it is already clear that large-scale wind power generation projects will lead to a significant increase in the need for electricity transmission capacity from northern Finland to the south.

The transmission capacity of the grid’s main transmission cross-sections – the Central Finland and Kemi-Oulujoki cross-sections – must be increased by several multiples in order to ensure that Finland remains a single bidding area for electricity trading and enable the same market price for electricity throughout the country.

From the perspective of the main grid, Finland’s target of becoming carbon neutral by 2035 is achievable. Making this possible will require significant investments of approximately EUR 3 billion over the next 15 years.

Fingrid has already updated its development plan on this basis, and it expects to invest about EUR 2 billion in the main grid over the next ten years. If a substantial amount of new, electricity-intensive industry arises in Finland or if Finland

becomes an exporter of electricity or fuels produced using electricity, even larger sums will probably need to be invested in the main grid.

IMPACTS OF THE HYDROGEN ECONOMY STUDIED

Hydrogen is currently the wild card of energy generation. The hydrogen economy has great potential, and Fingrid is currently evaluating the impacts of this potential on the energy transmission infrastructure in collaboration with Gas-grid Finland Oy, the national gas transmission network.

“Hydrogen is worth producing wherever there is a lot of affordable electricity available, so Finland could be a great place for this purpose. If the hydrogen economy becomes a reality, we need to know how to prepare for it as an electricity transmission company,” Seppälä says.

Electricity consumption will increase even further if products made using electricity, such as hydrogen, are also refined for export, or if affordable clean electricity attracts new industrial investments to Finland, such as data centres and battery factories.

POWER SYSTEM VISION STARTING UP

The debate that arose after the network vision was published highlighted the need to consider the entire future of the power system vision under various future scenarios.

“The scenarios in the network vision focused on the grid’s hardware requirements. We also need to think about the needs that each scenario will place on the power system as a whole, the operation of the system, electricity markets, and the grid,” Eveliina Seppälä says.

Next year, Fingrid will complete its power system vision, which aims to examine the grid’s requirements and describe the type of development needed in the electricity market to ensure that a carbon-neutral society can materialise. •



Google gets a good thing going around

Google's data centre in Hamina celebrated its 10th birthday in September. In ten years, Google has become a significant business partner and an active player that employs and trains top experts while revitalising the business structure in the Kymenlaakso region through its presence, thereby boosting the gross domestic product of Finland as a whole.

TEXT | OLLI MANNINEN

PHOTO | HEIKKI SAUKKOMAA / LEHTIKUVA

Lauri Ikonen, Google's Site Lead at the Hamina data centre, puts Google's investments in the Hamina data centre and the surrounding infrastructure at EUR 1.2 billion between 2009 and 2019.

"These investments have boosted Finland's gross domestic product by EUR 1.4 billion and created an average of 1,700 jobs per year over the same period. We are happy to be in Hamina and Finland," he says.

Google's Hamina data centre makes a major contribution to the region's economic growth and opportunities. Digital skills have risen in importance dramatically in recent years, and Google has made substantial investments in developing such skills in Finland.

"We have trained over 20,000 individuals and companies in the last two years. We remain committed to supporting 60,000 individuals and companies in Finland in the areas of job-seeking, company expansion, and digital skills development by the end of 2021," Ikonen says.

A CARBON-NEUTRAL TRAILBLAZER

Google's Hamina data centre also sets a good example to all other data centres around the world in the way it operates in accordance with sustainable development and achieves energy efficiency.

Its technically advanced cooling system was the first of its kind anywhere in the world. The cooling system in Google's Hamina data centre uses seawater from the Gulf of Finland to reduce its energy consumption.

Google is one of the largest buyers of renewable energy in the world. Google has enabled the construction of five wind power plants generating renewable energy in Finland via public procurement contracts.

"Google has been carbon-neutral since 2007. Since 2017, we have offset 100 per cent of the electricity we consume by investing in renewable energy. By 2030, we aim to be entirely carbon-free in terms of our electricity consumption worldwide, every hour of the day, every day of the year," Ikonen says.

Google seeks to develop more efficient, environmentally friendly data centres through continuous innovation.

"In the course of just five years, Google's data centres have increased their comput-



”Google’s image impact is significant.”

Harri Eela, Sales Manager , Cursor Oy

ing power sevenfold with the same amount of energy,” Ikonen says.

Google is now able to transfer server processing tasks from one data centre to another, wherever carbon-free electricity happens to be available.

“We have long had the flexibility to postpone processing until a more favourable time when we can make better use of carbon-free energy sources, such as solar and wind energy. Now we are able to utilise different locations based on where we have access to carbon-free energy,” he says.

A GREAT PARTNER

Ikonen says that Fingrid has been a great partner since the outset.

“It is difficult to predict the future of our business precisely, as things change depending on the market and other external factors. Fingrid is a flexible partner that understands our goals in Finland. It has supported us by providing useful feedback,” Ikonen says.

As the national transmission system operator, Fingrid is responsible for supplying electricity to its customers under all conditions.

“In our view, Fingrid has surpassed these expectations. Fingrid has provided us with a very high-quality service in all our projects. I am sure Fingrid provides the same standard of quality to all its customers. Fingrid has shown itself to be a reliable partner, and we are very happy with our current collaboration and look forward to working together in the future,” Ikonen says.

GOOGLE’S IMAGE IMPACT IS SIGNIFICANT

Harri Eela, Sales Manager at Cursor Oy, was involved in the negotiations that brought Google to the Hamina region from the very beginning.

“The draws of the South Kymenlaakso region are its location, excellent infrastructure, and good energy supply, as well as the Port of Hamina-Kotka. The significant competitive factors in Google’s case were the ready provision of electricity in a former paper mill, sufficient cabling, and a big enough plot of land. In addition, the possibility of an ecological cooling system using seawater was an important factor in Google’s decision,” Eela says.

Eela says that Google is an important reference customer for bringing new international entities to Finland.

“Google’s image impact is significant,” Eela says.

HOW CAN FINLAND MAKE ITSELF MORE ATTRACTIVE FOR NEW INVESTMENTS?

In Ikonen’s opinion, Finland is a good place for business, and foreign entities have a more positive view of Finland’s business environment than Finnish companies themselves.

“We should not rest on our laurels – it is always worth striving for better,” Ikonen says.

Finland’s ratings in international comparisons have improved in recent years. Finland ranked 13th in a study carried out by the FDI Vision for Finland Working Group in 2020.

“However, Finland failed to make the top ten with the other Nordic countries. For example, the Doing Business Index (DBI) compares the ease of doing business in each country. Finland placed 20th in this comparison in 2020, behind the other Nordic countries and the Baltic states,” Ikonen says.

In Ikonen’s opinion, Finland should focus on ensuring that the business environment is predictable and transparent from the perspective of safeguarding business activities.

“An important factor in attracting technology companies to the country is to have regulation that enables innovation. If companies are going to succeed, they also need a skilled workforce to draw upon,” he says. •



”By 2030, we aim to be entirely carbon-free in terms of our electricity consumption worldwide, every hour of the day, every day of the year.”

Lauri Ikonen, Site Lead, Google



Marja Eronen and Jani Piipponen are responsible for the introduction of the single price and single imbalance model

Preparations for the introduction of the single price-single imbalance model were going on for long time in Finland and the other Nordic countries. Marja Eronen, Senior Expert, has been responsible for Nordic cooperation in the project, and Jani Piipponen, Balance Services Manager, is responsible for the deployment of the model in Finland.

TEXTS | PÄIVI LEINONEN

PHOTO | SAMULI SKANTSI

WHAT AREA DO YOU WORK IN AT FINGRID?

Marja Eronen: I work with various market development tasks, either as an expert or a project lead. One of my roles has been to lead the Nordic working group in the single price-single balance model project and ensure that the Nordic countries begin using the single balance model on 1 November 2021.

Jani Piipponen: I have two main working areas first one includes imbalance settlement processes and customer cooperation with balance responsible parties and eSett. Second one includes the processes related to physical and financial procurement of main grid's loss power. In the single price-single balance model project, I have been responsible for the national deployment of the model, and I am also involved in Nordic development work on the model.

WHAT DID YOU DO BEFORE YOUR CURRENT JOB?

ME: I have been with Fingrid for over a year. Before then, I worked 20 years at the Nord Pool power exchange, which focuses on the day-ahead and intraday markets. I was involved in European cooperation in various market development projects, and, most recently, I worked on promoting open competition among exchanges in various regions of Europe. I believe that my experience in exchange markets will be beneficial as transmission system operators develop their own marketplaces.

JP: I have been working at Fingrid for more than 20 years. At first, I worked as an operator in the control centre, which gave me a solid foundation for understanding the interconnections between operation and the markets. I moved from there to the imbalance settlement unit, where my work focused on the development of joint Nordic imbalance settlement. I participated in the establishment of the pan-Nordic imbalance settlement unit, eSett Oy. Over the years, my work has included the

development of the imbalance settlement and balancing models, customer collaboration, and working in the role of Development Manager in Markets.

WHAT MOTIVATES AND INSPIRES YOU THE MOST IN YOUR WORK?

ME: I am motivated by learning new things, being able to make an impact, and my colleagues. At Fingrid, I have been able to learn about the balancing markets— there is plenty for me to learn in this area. I also enjoy international collaboration.

JP: I am motivated by my colleagues and the level of expertise at Fingrid. My job description has evolved all the time, and I have had plenty of new challenges. Through my work I can be part of development of the significant changes and improvements in the electricity market.

WHAT CHALLENGES ARE YOU FACING IN YOUR WORK AT THE MOMENT, AND WHAT IS ON THE HORIZON?

ME: When my work on the single balance model is done, the other parallel projects, such as Flow-based, will be my next challenges. In the longer term, climate change and developing the electricity market to respond the needs of the electricity sector are common challenges for us all at Fingrid.

JP: One challenge is that the electricity market is becoming faster-paced and more unpredictable. The Nordic balancing markets will join to the common European platforms, and there will be more and more different factors affecting the entity as a whole.

WHAT DO YOU DO TO RELAX OUTSIDE WORK?

ME: A suitable balance between work and leisure time. Cleaning can also be relaxing – in moderation.

JP: Normal everyday life with my family and focusing on my children's activities. •

Marja Eronen
Senior Expert, Electricity
Markets, Fingrid

Jani Piipponen
Balance Services Manager,
Balance Services, Fingrid

Good customer satisfaction

■ According to Fingrid’s annual customer satisfaction survey, customers continue to consider our work to be good, and, in the main, the results have remained largely the same as in the preceding year.

The overall grade that customers awarded for main grid services was 4.2 (2020: 4.2), and the grade for electricity market services was 4.0 (2020: 4.0).

The experience of working with Fingrid employees has also remained the same. Fingrid’s greatest strength remains its expertise, with a grade of 4.5 (2020: 4.5). The grade reflecting service skills has improved since last year: this year it was 4.3 (2020: 4.2). Fingrid had the most room for improvement in the area of understanding customers’ needs.

We also asked our customers whether they would recommend our way of working with customers as a Net Promoter Score (NPS). In 2021, the NPS, on a scale of ±100, was +41, which is four units lower than in the preceding year. It is still a good store, especially for a monopoly.

Customers also gave us a lot of open-ended comments. The positive feedback included praise for the professionalism of Fingrid’s employees in customer-facing roles and the work the company does for the benefit of customers and society. The most negative feedback centred around the Datahub project’s schedule, costs, and communication. However, several customers also praised us for our communications concerning Datahub.

We thoroughly review all the feedback we receive and use the information to improve our operations.

Our customer satisfaction survey received 256 responses. The response rate was 33%, a substantial increase from previous surveys. •



One of Finland’s most important substations to be refurbished

■ One of the most important substations in the electricity system of Finland – Fingrid’s Rauma substation – will be refurbished. The substation contains a large amount of ageing equipment and requires modernisation and refurbishment.

The cross-border connections from the Rauma substation – FennoSkan 1 and FennoSkan 2 – enable a total of 1,200 MW of electricity to be transferred between Sweden and Finland. Rauma substation is

important to the functioning of the Olkiluoto nuclear power plant, and it also ensures the supply of electricity to the Rauma and Satakunta regions.

The refurbishment project will begin next year, and the modernised substation will be completed in 2024 or 2025. Construction requires precise outage plans to ensure that the refurbishment work does not disrupt the normal operation of the power system. •

Fingrid’s transmission reliability rate in Q3/2021:

99,99997%

Two-per-cent raise in the grid transmission fees

■ Fingrid is raising the fee for electricity transmission in the main grid by an average of two per cent in 2022. One particular reason for the increase is a rise in the costs of market-based reserves, which are used to balance out generation and consumption in the power system. According to the latest European comparison, Fingrid’s grid service fees are the second-lowest in a reference group of about 20 countries. We aim to remain among the least expensive transmission system operators in the future, thereby providing Finnish companies with a competitive advantage. •

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



Batteries as part of the energy system

The energy revolution requires the main grid and the entire energy system to be prepared for the fluctuations in generation output caused by renewable forms of energy. Batteries offer the possibility of the quick and accurate balancing of generation and consumption.

TEXT | PÄIVI BRINK

PHOTO | ISTOCK

Three battery types can be used to support the power system, the most common being lithium-ion batteries. “The lithium-ion battery was developed for use in home electronics, so substantial effort has been put into ensuring that the batteries are small and energy-efficient. However, the size of the battery is not usually such an important concern when it is used as a part of the energy system. The problem with lithium-ion batteries is the availability and cost-efficiency of lithium and cobalt. Thus, cobalt is replaced by a nickel-manganese-cobalt mixture or iron phosphate, and the potential for using sodium instead of some of the lithium is being studied. A further issue is fire safety, as lithium-ion batteries contain a lot of flammable material,” says **Pekka Peljo**, Associate Professor of Materials Engineering at the University of Turku.

Peljo’s research group is studying the possibilities of flow batteries. These involve storing energy in liquid rather than in a cell, like in other battery types.

“Flow batteries have a lower energy density than lithium-ion batteries, but they are water-based, so they are fire-safe. With a large liquid tank, it is possible to store up to 12 hours of energy. The batteries are suitable for use with wind power plants or charging electric cars, for example. However, vanadium – the raw material used in flow batteries – is quite expensive.”

The energy system could also use sodium sulphur batteries.

“The raw materials for sodium sulphur batteries are readily available, but the battery operates at a temperature of more than 260°C, which gives rise to some challenges. However, it is a good alternative for supporting the electricity grid. New raw materials offer interesting possibilities for the future,” Peljo says.

BATTERIES SUPPORT FREQUENCY REGULATION

Batteries are only used in the main grid for frequency regulation, and they are suitable for balancing out short-term fluctuations in generation and consumption.

“Fingrid purchases the power regulation capacity of batteries as a service in the reserve market – we do not have any batteries of our own. The advantage of batteries is the rapid, accurate regulation that they can provide. The present batteries are best suited to short-term regulation needs, such as disturbances, where the storage requirement is half an hour at the most,” says **Pia Ruokolainen**, Specialist at Fingrid.

In the coming years, additional batteries – both large and small – are likely to be built as part of the power system.

“Fingrid aims to make it as easy as possible to participate in the reserve market so we can make use of all suitable sources of flexibility. The use of batteries may also develop, and in the future, we may see other profitable applications for them in addition to frequency regulation,” Ruokolainen says. •

BATTERY TYPES OF INTEREST FOR THE POWER SYSTEM:

- *Lithium-ion batteries: compact and energy-efficient, but problems include the availability of lithium and cobalt, the price, and fire safety.*
- *Sodium sulphur batteries: readily available raw materials, but the battery operates at 260°C and materials sensitive to the air require insulation.*
- *Flow batteries: fire-safe but not particularly energy-efficient, requiring a lot of space. Vanadium, the raw material, is expensive.*

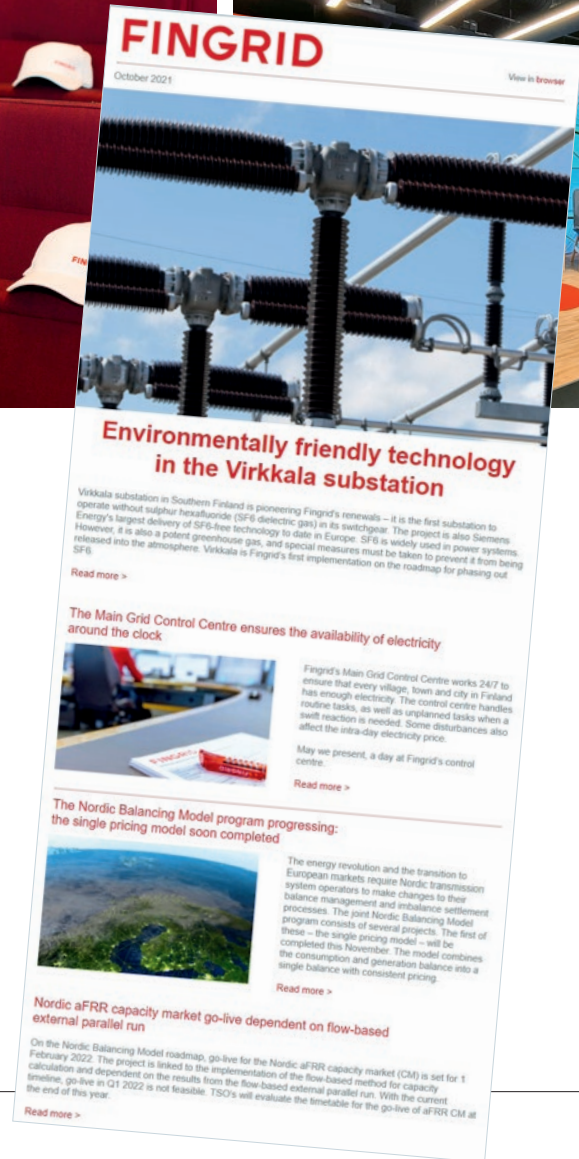
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Read our newsletter

Fingrid's newsletter is published four times a year.

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