FINGRID CORPORATE MAGAZINE | FINGRID OYJ | 1/2015 | ELECTRICITY MARKET

FINGRID

Schoolchildren

IN THE II COMMUNITY KNOW ALL ABOUT ENERGY SAVING, P. 22

Why is electricity more expensive

IN FINLAND THAN IN OTHER NORDIC COUNTRIES? P. 4

Changes in energy production

REQUIRE POLITICAL DISCUSSION, P. 8

▸ Finland's largest cluster of wind farms is under construction in Ii. Read more on pages 14 and 22.

Corporate Magazine
Fingrid Oyj
18th volume
1/2015

EDITORIAL STAFF
Telephone: +358 (0)30 395 5267
Fax: +358 (0)30 395 5196
Postal address: P.O.Box 530, FI-00101 Helsinki
Street address: Läkkisepäntie 21, FI-00620 Helsinki
Editor-in-chief: Marjaana Kivioja
E-mail: marjaana.kivioja@fingrid.fi

Design by: Better Business Office Oy
English translation by:
Mester Translation House Ltd

Published by
Fingrid Oyj
www.fingrid.fi

Change of address:
reija.kuronen@fingrid.fi

Cover photograph: Pupils Matias Pakanen, Lotta Järvenpää, Valtteri Nevalainen, Kasper Eriksson, Helga Annala and Tuukka Kyllönen from the Ojakylä school in the Ii community know to turn off unnecessary lights. Read more on pages 22–24.
Photograph by: Mikko Törmänen

Printed by: Libris Oy, Helsinki
ISSN-L: 1456-2693
ISSN: 1456-2693 (Print)
ISSN: 2242-5985 (Online)

IN THIS ISSUE

EDITORIAL

FROM ENERGY POLITICS TO **POWER POLITICS**

One got the impression from recent general election debates in Finland that parties and their candidates have quite a simplistic impression of energy policies and related challenges. For most, it's simply a matter of choosing the forms of energy to generate electricity, heat our homes or power our cars. Favourable forms of energy should be promoted, and unfavourable forms should be phased out, and that's it. Unfortunately energy system challenges have become far more complex, in part due to overly simplified politics.

Most European countries are strongly increasing their use of renewable forms of energy. But since these are not yet always competitive, their implementation must be supported through sizeable public funding. This has an increasingly disruptive effect on the functionality of the energy markets, and of the electricity markets in particular. Renewable energy primarily receives its income from outside of the markets, but nevertheless enters the markets at a very low price. This drives the entire wholesale market price down and weakens the profitability of conventional thermal energy production. In many countries, conventional plants are being mothballed and plans for new investments have been put on hold.

A politician may think that this is precisely what we should aim for: as old production makes an exit, it paves the way for renewable energy. But renewable energy still requires well-functioning markets. The strongly intermittent and hard-to-predict wind and solar power require back-up capacity to balance production with consumption. That balancing power is precisely the production being driven off the markets.

Well-intentioned politics is therefore making things not only difficult for itself, but also leading to another significantly more challenging issue: how can we ensure the security of supply of electricity? This isn't just a Finnish problem; it applies to all of Europe.

Unfortunately the only actions we can take are difficult. The first solution would be to better integrate renewable energy into the marketplace by replacing price guarantees and other support with lighter grants for technology development and investment. The electricity markets would be given a new lease of life, and other necessary production would be kept on the markets. However, this does not seem like an easy feat from a political perspective, at least not on a European level.

Another solution would be to get the current emissions trading mechanism working. Everyone is in agreement about this market-oriented solution, but no-one seems to have found a way of making it work.

The third, and unfortunately perhaps the only feasible solution deals with various capacity mechanisms. These are used to guarantee a level of income for thermal energy and other flexible resources that makes them worthwhile on the markets and attractive to investors. This can be carried out in several ways, but all of these are centrally controlled non-market support arrangements.

But it's not all bad: energy technology is developing rapidly, solar energy is becoming competitive, demand-side management is moving forward and developments are taking place in electricity storage technology. We begin to find technical solutions if electricity markets are given the chance to work.

In Finland, the coming government should take a more comprehensive approach to energy and climate politics. They should view the system as a whole and take into consideration how political actions can affect the energy markets. Of course we must produce energy in an environmentally friendly manner, but in modern society we must also ensure uninterrupted supply. The consumer does not pay only for energy but also for the right to use it whenever they want. We must secure the system's ability to produce energy, to respond flexibly to demand and to stay in balance. From an electrical engineer's point of view: we should talk more about power (capacity) than energy.

Juha Kekkonen is Fingrid Oyj's Executive Vice President

One market, many prices

On average, wholesale electricity costs significantly more in Finland than in other Nordic countries. What should be done?

TEXT OUTI AIRAKSINEN | **ILLUSTRATION** BBO

Although electricity is sold according to supply and demand on the Nordic electricity exchange, Finns often have to fork out more for their wholesale electricity than their Swedish counterparts, for example. Last year in Finland, one megawatt hour of wholesale electricity cost an average of 36 euros, which was 14 per cent more than the average in the Stockholm area. At its peak, the price difference for an individual hour was no less than 164 euros.

"Last year there was one particular day in December when Finland saw five hours priced at over 200 euros. The difference was due to several coincidences: not only was there a cable restriction in place but there was also some power plant maintenance under way," explains Sales Manager **Sami Oksanen** from Nord Pool Spot.

The price differences are often caused by congestion, wherein buyers wish to purchase more electricity at the exchange price than transmission connections allow. "In Finland, we're lacking production due to structural reasons. The delays faced by Olkiluoto 3 and the closing of older plants mean that we have a significant lack of domestic production, and that's increased our need for imported electricity," says Fingrid's Executive Vice President **Juha Kekkonen**.

Another background factor is the shift in import focus, since it is less profitable to import electricity from Russia. "In Russia, electricity producers are nowadays paid separately for capacity availability, with payment collected from consumers and exports. Previously, Russian electricity was competitive, but now it's no longer worth buying electricity during hours which are subject to a capacity fee," says Kekkonen.

Nowadays there's also a demand for Nordic electricity in the Baltics, which adds further congestion to the transmission connections between Finland and Sweden.

Producers benefit but the industry suffers

Is the separation of the Finnish regional price from the Nordic calculated "system price" a problem? It depends on whom you ask. **Pasi Kuokkanen** is CEO of ElFi, which represents larger Finnish electricity buyers. He calculates that the price difference has a negative effect on Finnish industry amounting to hundreds of millions of euros in loss of competitive ability, even though companies of course strive to protect themselves against the price differences by purchasing derivative products.

"The fact that the price difference has been this great will continue to have an effect in coming years and on the prices of future products. The impact of contracts made in recent years extends to →

"The price difference has a negative effect on Finnish industry amounting to hundreds of millions of euros in loss of competitive ability. Investments in transmission connections alone will not solve the problem. We have to develop existing hedging products or introduce a new hedging product."

Pasi Kuokkanen, ElFi

"Finland and Sweden should be part of a single price area and work together to strengthen the Nordic network sufficiently quickly. We should try to move away from national electricity transmission system operators and towards truly joint-Nordic markets."

Simon-Erik Ollus, Fortum

electricity users as weakened competitive ability far into the future with regard to Sweden," says Kuokkanen.

Kymppivoima's Power Procurement Manager **Mika Laakkonen** works to find a balance in the middle ground between buyers and producers. "From an electricity producer's perspective, the Finnish regional price difference is favourable, but increases costs for electricity buyers. In the longer term, a harmonious, liquid market area without regional price differences will provide better opportunities for trade and increase market reliability," says Laakkonen.

In addition to the price of normal electricity, regional price differences also increase the price of imbalance power. For example, if transmission connections are congested, a disturbance in a power plant may cause the intraday price of imbalance power to fluctuate wildly.

So what should we do about the area price difference? According to Kuokkanen from ElFi, we can't put off dealing with industrial competitiveness, so investments in transmission connections alone will not solve the problem. "The fastest-acting method is to develop existing hedging products or to introduce a new hedging product to the market which would supplement the current ones. This would not rule out any structural solutions. We need a new connection between Finland and Sweden, but everyone knows that it would take time," says Kuokkanen.

Trade on EPADs modest

Finnish industry and retailers purchase electricity from Nord Pool Spot at the Finnish area price. On Nasdaq OMX's commodities exchange it's possible to take measures against fluctuations in the price of electricity by purchasing derivatives, whose holders can purchase or sell wholesale electricity at a determined price after a period of up to ten years. The more we believe, for example, that the price of electricity will rise in the future, the more worthwhile it is for electricity users to pay for a derivative which would entitle the buyer to pay for electricity at today's price. Measures can also be taken through bilaterial purchase and sales contracts on the OTC markets.

Taking protective measures is smart since the development in the price of electricity can be unpredictable. In addition to demand, the price is also affected by precipitation and temperature, political decisions and disturbances in production or in transmission connections.

Derivatives listed on the Nasdaq OMX provide good protection against changes to the system price. On the other hand, products which protect against regional price difference – that is, for example, the difference between the Finnish and Swedish area prices – or "EPAD" (Electricity Price Area Differential) markets are not properly functional due to low exchange volume. On such illiquid markets, purchase and sales offers can be very different from one another, meaning no trade takes place. Kuokkanen hopes for the development of the EPAD market – or the creation of alternative, parallel products.

"There are lots of companies who have to draw up a separate strategy for hedging against area price, since EPADs do not meet the same reliability criteria as a system price product. It's unfortunate and it increases the costs involved in the procurement of electricity," says Kuokkanen.

The more markets cash flows are divided amongst, the less exchange there is and the weaker the markets are. "Liquidity is dispersed over several areas since Finland has its own hedging products and Sweden has four different hedging products. If markets are structured in this way, liquidity is unavoidably dispersed. We should keep this in mind when thinking of alternative methods of organising hedging markets," says Nord Pool Spot's Oksanen.

According to Oksanen, up to 40 per cent of trade is speculative financial

Congestion income to strengthen the network

If it is not possible to transmit electricity according to the prevailing supply and demand on the markets, area prices will separate despite the joint power exchange. Currently Finland is the only Nordic country with a single electricity price area covering the entire country. Sweden, for example, is split into four areas.

"We're aiming to keep Finland as a single area, since it is good for the markets. Sweden followed the same policy, but was unable to live up with changes in internal production/consumption balances, which led to structural congestion," says **Juha Kekkonen** from Fingrid.

The congestion between price areas creates so called congestion income on the power exchange, which is divided on each border equally between the involved grid companies. In accordance with EU legislation, the income must be used to maintain and increase transmission capacity so that congestion decreases over time.

"Congestion income is a financing mechanism which forces grid companies to invest in the network when there is congestion of a permanent nature in the system," outlines Kekkonen.

Last year, Fingrid accumulated over 50 million euros from congestion income. Due to the unusually large size of the sum, in addition to investments, Fingrid also decided to lower its grid network tariffs.

trading, whose parties do not engage in any other activities on the electricity markets. However, he would not place hope in improving liquidity outside of the industry. "It is the task of marketplaces to create a market environment where trade is attractive, but players create liquidity by starting to buy and sell products," says Oksanen.

A grid company as market maker?

One method of improving liquidity is to obtain a market maker, that is, a party which commits to quoting buy and sell prices on the markets for a commission. All eyes are on Fingrid.

"If a grid company were to be the market maker for a product, it would be a step in the right direction for market functionality and send a positive signal about the reliability of the product. In any case, the grid company is active on the market hedging its own procurement, and I don't think it would disrupt market activity," says Kuokkanen.

Market viscosity has also been noticed in the EU, where work to prepare network codes is under way. It's possible that the new network codes would see grid companies obligated to offer actors long-term transmission rights, which when purchased, could provide protection against regional price differences. These are financial products with a maximum duration of one year, whose value is based on the price difference between two bidding areas.

"Continental Europe uses products entailing long-term transmission rights. But the Nordics have developed financial markets, and the current drafting of network codes permits that transmission products do not have to be used in such areas," says Kekkonen.

Laakkonen from Kymppivoima doesn't consider long-term transmission rights to be a good idea. "It would be better to support the current market model and to strengthen transmission connections. If two competing marketplaces are formed, there is concern that it would weaken the liquidity of the existing market and further decrease the range of hedging products," outlines Laakkonen.

In any case, Fingrid has decided to investigate different alternatives.

"Both legislatively and from the perspective of a TSO's role, it would be problematic if Fingrid were to become a market maker. On the other hand, we are investigating the issue of long-term transmission rights in case the poor liquidity of the financial markets were to obligate grid companies to offer these in the Nordics, too," explains Kekkonen.

A need for network reinforcement

Though legislation would permit it, not everyone looks favourably on grid companies' participation on the financial markets. It would mean taking a risk, with electricity users ultimately ending up paying the price through increased grid fees.

Fortum's Chief Economist **Simon-Erik Ollus** believes it would also distort the markets. "Grid companies' primary task should be to strengthen the network to prevent congestion. We should strive for larger price areas," says Ollus.

Fortum has set a goal of a truly Nordic internal market wherein there would only be one regional price and Nordic markets would be treated as a single market from a regulative perspective, too.

"Instead of market models, we should speak out about how Finland and Sweden should be part of a single price area and work together to strengthen the Nordic network sufficiently quickly. We should try to move away from national electricity transmission system operators and towards truly joint-Nordic markets," says Ollus.

In an ideal situation, electricity would flow freely within the Nordics and the Baltics, as well as to continental Europe and Russia. The construction of transmission networks is, however, slow and expensive, and investment is not profitable if congestion is only a transient phenomenon. Ollus believes that to start with it would be enough to agree on the unification of price areas.

"Of course it would take time, but that's the direction we should be moving in. We just need the political will to do so, and actors must be willing to promote the matter. The ball is largely in the grid companies' court," he adds.

Ollus believes the current plans to strengthen the transmission network in the Nordics to be far too modest. For example, a new connection to Sweden might not be complete until 2024. The problem is that connection construction is not solely down to Fingrid.

"The Swedes aren't very enthusiastic about a third line up north. They say that they first have to remove their own internal congestion before constructing a transmission connection with us. Discussion is ongoing, but we cannot start work on a cable to their network alone," says Kekkonen.

Even though plenty of people would like to see faster network construction, Kekkonen is eager to point out that the situation could change. For example, at the time, Fingrid's decision to construct Fenno-Skan 2 was criticised, since the transmission between Finland and Sweden back then was easier.

"The situation could improve in 2–3 years due to e.g. the completion of Olkiluoto 3 or a change in the Russian situation," says Kekkonen. ■

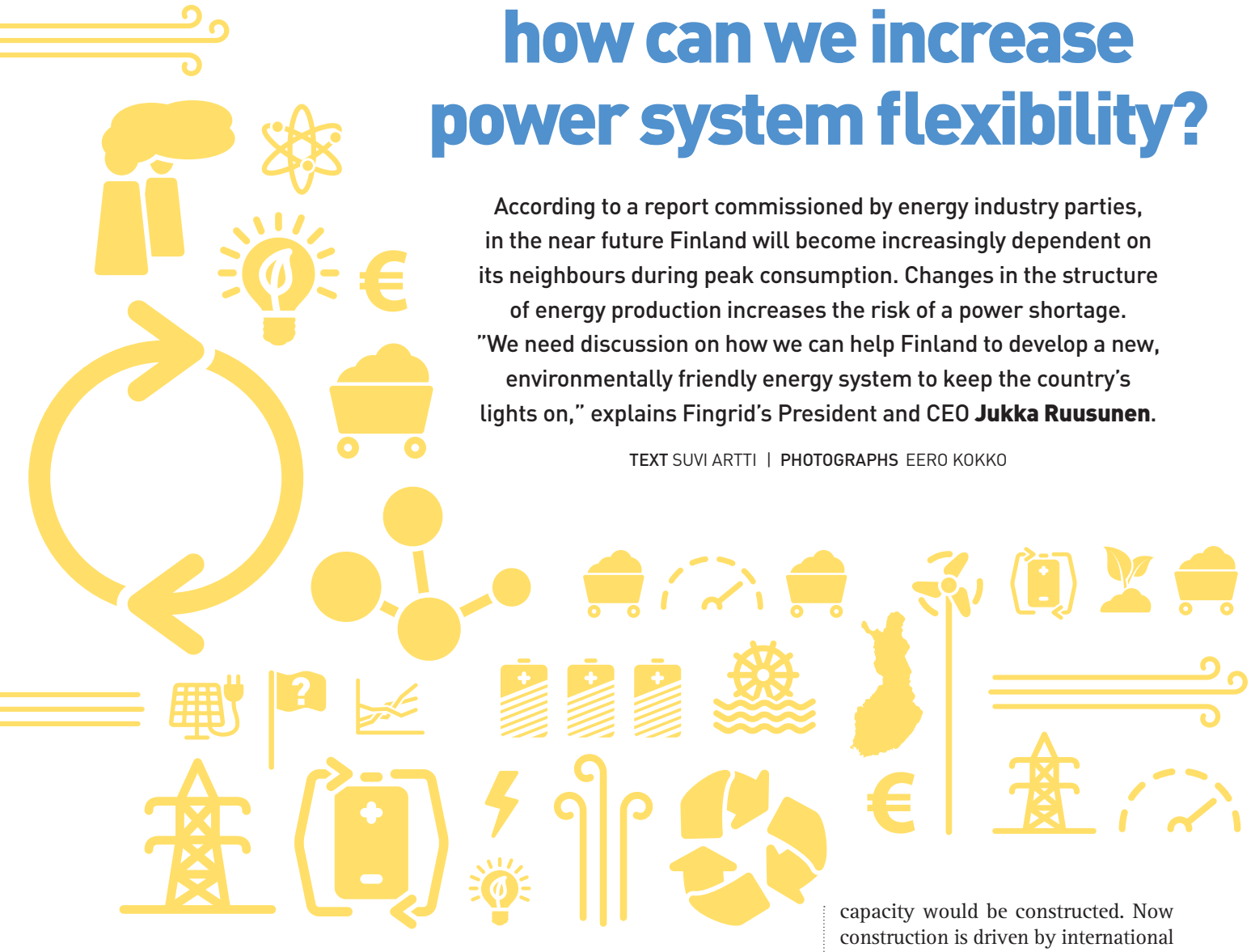
Fact

Liquid = easily converted or traded into cash, functional. On the securities markets, liquidity is better the faster and more easily an investment can be converted into cash. On illiquid markets, there is so little exchange that larger transactions cannot be made without having a significant effect on the price level of the securities.

A new energy palette – how can we increase power system flexibility?

According to a report commissioned by energy industry parties, in the near future Finland will become increasingly dependent on its neighbours during peak consumption. Changes in the structure of energy production increases the risk of a power shortage. "We need discussion on how we can help Finland to develop a new, environmentally friendly energy system to keep the country's lights on," explains Fingrid's President and CEO **Jukka Ruusunen**.

TEXT SUVI ARTTI | **PHOTOGRAPHS** EERO KOKKO



Finland's dependency on its neighbours is nothing new, since Finland has long imported a significant share of its electricity from the Nordic countries and Russia. Structural changes to electricity production capacity are a newer phenomenon. Production which does not react to price, such as wind power, is increasing. At the same time, flexible condensation production capacity is exiting the market as unprofitable, even though it would be needed to balance the system – after all, we still need electricity on overcast and still days. A system with little flexible capacity is more susceptible to disturbances.

Recent years have seen Fortum's Inkoo power plant and Pohjolan Voima's Mussalo power plant both closed "prematurely". According to a report commissioned by energy industry parties, more condensation capacity is expected to exit the market before the end of its technical service life. A background factor to this is the market price of electricity, which has long been low.

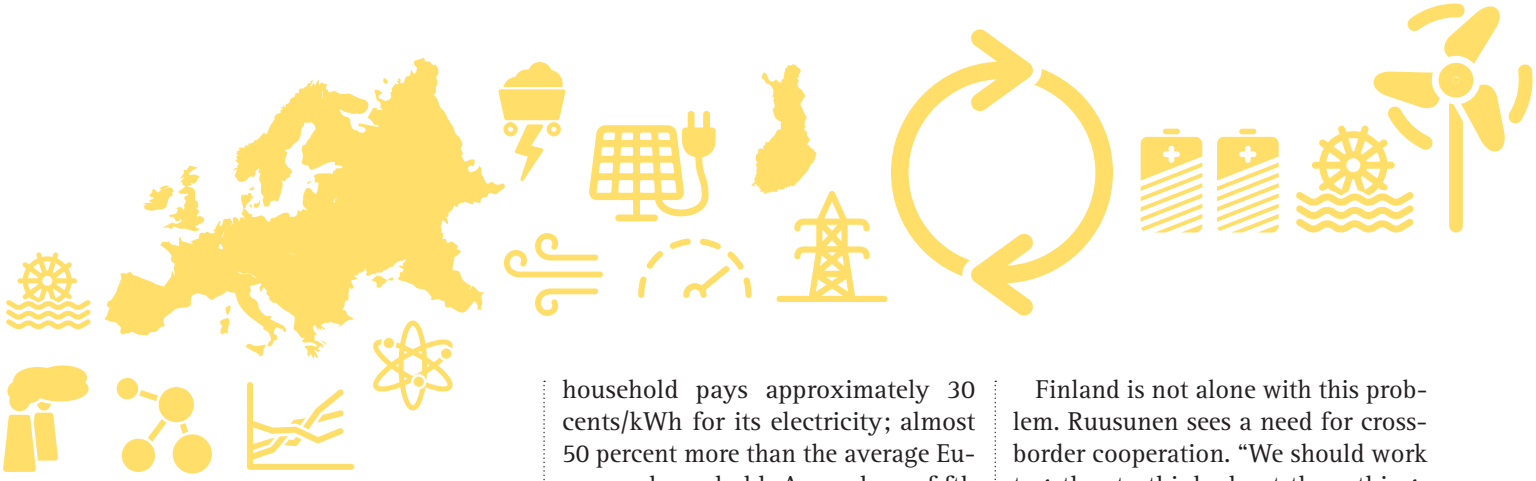
"Previously, when we still had the old electricity maintenance system, the state decided what production capacity would be constructed. Now construction is driven by international competition. We don't import electricity from other Nordic countries for fun; their capacity is more competitive than Finland's," says Fingrid's President and CEO Jukka Ruusunen.

"At the same time, subsidised capacity is being introduced to the market. This will result in a financial issue: who will maintain, or even construct, the capacity that's needed to balance the power system? The structural scarcity of flexible capacity will increase throughout the Nordics in the 2020s. What's worrying is that there are very few truly commercial production investments in sight. Currently, production mainly increases through financial support," says Ruusunen.

"It´s worrying that there are very few truly commercial production investments in sight."

Jukka Ruusunen

On the other hand, if a pure market economy is chosen, the price of electricity may occasionally rise very high. "In some parts of the United States, the market economy drives the price of electricity – and in those cases one thousand euros per megawatt hour is nothing," he adds. Ruusunen believes that Finns should consider their policy carefully, since it's difficult to change course later on.



Pure market economy or subsidised production

The change in the structure of energy production is unavoidable. "The electricity production system must be radically overhauled in order for us to meet our goal of no carbon dioxide emissions from energy production by 2050. Fingrid's network could be powered solely by solar power in 40 years' time. That's nevertheless a long way off, and we will also need electricity during the transition period," says Jukka Ruusunen.

"Right now we need political decisions to find out what steps to take to achieve the goal. Will we accept a purely market-oriented system, or will we choose subsidised capacity?" he asks. He believes that open, society-wide discussion is the key to solving this difficult matter.

Ruusunen gives Germany as an example of a system based on financial support, where renewable electricity production is financed through extra payments. The average German household pays approximately 30 cents/kWh for its electricity; almost 50 percent more than the average European household. Around one fifth of a German consumer's electricity bill is support for renewable energy. "The German example demonstrates that political decision-making can have a surprising amount of influence," says Ruusunen.

Finland is not alone with this problem. Ruusunen sees a need for cross-border cooperation. "We should work together to think about these things in at least the Baltic area. Political discussion is very national, and there is reluctance to seek international solutions. National solutions can prove expensive," he says.

Denmark is one example of a coun- →

REPORT: IMPORTED ELECTRICITY TO PLAY A GREATER ROLE

Energiateollisuus ry, Fingrid Oyj, Metsäteollisuus ry, Suomen ElFi Oy and the Ministry of Employment and the Economy commissioned Pöyry Management Consulting Oy to carry out an assessment of the sufficiency of Finland's electric power and the development of the electricity production capacity structure in the near future up until 2030.

According to the report completed in January 2015, Finland's current electricity production capacity is not sufficient to meet peak consumption needs. Our electricity production will be at its most deficient around 2018 before the completion of the third Olkiluoto nuclear power unit (OL3). We need to import approximately 2,800 megawatts of electricity during the peak consumption period of a normal year and this amount can reach up to 4,000 megawatts on an extremely cold winter's day. Finland's own production will not be able to cover consumption even after the completion of OL3.

Delays in the completion of OL3 and the exit of electricity production capacity from the market have an effect on the deficit in electricity production. A significant reduction in the amount of electricity imported from Russia has also decreased the traditional supply. Condensation capacity in particular is deemed unprofitable. In addition to nuclear power, other new production capacity to be constructed in Finland mainly comprises wind power, which cannot be relied on during peak consumption.

In neighbouring regions, production capacity exceeds consumption during peak demand, so there should be enough electricity for Finland to import. Sufficiency nevertheless requires cross-border transmission connections and the security of supply of Finland's own capacity.

try which has chosen wind power and "put itself at the mercy of others". "Denmark's system wouldn't work without its neighbours. Denmark is reliant on successful international trade."

Self-sufficiency is not an intrinsic value

One long-standing topic of discussion in the energy industry is self-sufficiency. "Politicians love to talk about self-sufficiency. But we have to remember that we can't have everything. If we increase the amount of wind power in Finland, our hydropower will not be enough to balance the system. Finland is entirely dependent on other countries and cross-border connections. There's no going back to the old, safe electricity maintenance system," Ruusunen says.

"It could be that in 2050 we are able to store a large amount of electricity. It would be wonderful if we were able to produce our own electricity through solar power and then store it in batteries. It would, however, require huge advances in technology to attain such a feat. Research is constantly under way on storage possibilities, but it's unlikely to be feasible any time soon."

Limiting electricity consumption in extreme cases

While we wait for technology to advance, cross-border connections play a vital role in securing Finland's supply of electricity, particularly in subzero winter temperatures. Recently Fingrid has invested in the maintenance of direct current or HVDC connections, and has succeeded in reducing the amount of disturbances.

Several simultaneous, significant disturbances at power plants or in cross-border connections can result in a power shortage, and in extreme cases, electricity consumption may have to be limited. A power shortage is a manageable situation, one for which Fingrid has prepared in cooperation with distribution network companies. As the grid owner with system responsibility, Fingrid holds the statutory right to ration the consumption of electricity.

"If we had to resort to rationing, the limitations would affect a small amount of electricity consumption for a brief duration. The price to society would, however, be high if the consumption of electricity had to be limited due to insufficient production capacity. The political significance of such an outage would be far greater than would be the case for an outage caused by a storm or a technical fault," says Ruusunen.

In the best case, demand can be cut using smart technology so that it wouldn't be a problem: for example, the hot water boiler in a detached house or a freezer in a shop could be turned off for a short while. Technology makes demand-side management possible for small-scale industry and households, which Ruusunen believes is an important tool for increasing flexibility in the power system. He feels that this should take place on market terms rather than through regulation.

"Demand-side management should be financially viable in order for the masses to go along with it. Now that electricity is so affordable, very few consumers make the effort to change their consumption habits according to the price of electricity."

"Hopefully that will all change and in twenty years we'll have more demand-side management and flexible production capacity whose maintenance is profitable on market terms," Ruusunen says. ■

"The significance of the security of supply is a question the next government will have to deal with."

Riku Huttunen

The pros and cons of self-sufficiency

The significance of the security of supply in Finland's electricity market politics is a question the next government will have to deal with, says **Riku Huttunen**, Director General of the Ministry of Employment and the Economy's Energy Department.

"A high degree of self-sufficiency with regard to the electricity supply has been a strategic target for Finland. Electricity is currently available from neighbouring countries at such a low price that it discourages market-oriented investments."

"The markets we operate on already extend to the Nordic and Baltic countries, and are continuing to expand. We benefit from wide-reaching markets through lower prices, among other things. On the other hand, we must be able to ensure the security of supply and sufficiency of power during peak consumption."

Huttunen points out that a lack of market-oriented investments is not just a national problem, but also a European problem. The Energy Union's target is stronger market orientation. "The EU's energy policy currently focuses on limiting actions which would distort the markets, so that's a step in the right direction."

GUEST COLUMN

Matti Supponen

Quo vadis, **Nordic power cooperation?**

The sun is shining in through a window overlooking the courtyard at the European Commission's Directorate-General for Energy building on Rue de Mot. The walls of my office are full of pictures and maps; this has been my room for ages. I'm in dire need of a wastepaper basket to recycle everything. In pride of place right in front of me is a Nordel grid map from 2001. In the direct sunlight it looks even more faded. Now and again I admire the names of the transmission substations: Alapitkä, Kassø, Letsi, Olsztyn Matki, Püssi, not forgetting Hasle, of course. Not necessarily the top tourist destinations, but nevertheless crucial to the European electricity markets.

An EU official at the peak of his career. The committee has just approved the network code for capacity allocation and congestion management (CACM).

The Nordel map has faded now, and even Nordel itself has faded out of existence since transmission system operators founded ENTSO-E. How is Nordic power cooperation doing? At first, it was easy to be a civil servant responsible for the Nordics: all I had to do was copy ready solutions and try to put them into legislation. For quite a long time, that was enough. Market coupling will continue to spread until it's reached even the most remote corners.

Cooperation, however, seems to have dropped off the face of the earth. There are more and more news stories about disputes. It's a shame that Sydvästlänken doesn't continue on to Norway; Norwegians are more focused on seeking greener pastures. In retaliation, the Swedes are concentrating on their own projects, with the Finns denied a new cross-border line into Sweden, etc. My Nordel map is so old that it still shows the Viking cable from Norway to Germany. The name has since been changed to a less conquest-oriented alternative (NordLink) and the direction of flow is easy to switch compared to Viking's plans.

And things have gone downhill otherwise, too. In the early electricity market years, NordPool had all of Europe in its grasp, but now there's a danger of going on the defensive and becoming a minor player. The European intraday project will most likely leave a bitter taste across the Nordics, and as yet there's no end in sight. In central Europe under the pressures of renewable energy, intraday markets are developing rapidly, which naturally goes hand in hand with industry leadership. Meanwhile the Nordics, so spoilt with hydropower, would still manage fine with hourly imbalance settlement.

But let's not be pessimistic. There's some good news, if you really think about it. The dispute over congestion between Denmark and Sweden was actually resolved, after being given a slight nudge. Finland and Sweden are participating wonderfully in saving the Baltics from the Russian Bear, despite some interregional disputes in the area. Estlink 2 was constructed in a top time, as if the difficulties associated with constructing transmission lines had not entered into people's consciousness in Finland at all.

When it comes to cooperation, it's far better to look to the future. The game is not yet lost. It's clear that national interests have to be taken into account. The Norwegians want to focus on their green cash machine, Sweden primarily wants rid of the congestion in the south and Denmark has withdrawn from the group of opponents to the capacity markets, perhaps with good reason. The Energy Union is bound to throw up issues requiring cooperation, and there's a vacancy for a frontrunner. Regional retail markets and their datahubs, truly joint-Nordic balancing power markets, TSO cooperation over system operation or even a regional support system for renewable energy sources could all be good places to focus on. Or is it nicer to jostle and argue with new partners from time to time? The Germans, the French, the Polish... we're spoilt for choice. Nordic power cooperation is dead, long live Nordic power cooperation! ■

Matti Supponen works for the European Commission. However, the views expressed in this column are the personal views of Matti Supponen. They have not been adopted or in any way approved by the European Commission and should not be relied upon as a statement of the European Commission's views.

Work never stops in **market development**

"The energy industry is extremely interesting, since each person has their own concept of how electricity should be used and produced. Electricity is at the heart of society in many ways," says Electricity Market Specialist **Mikko Heikkilä**.

TEXT MIRA MUURINEN | **PHOTOGRAPH** MATTI IMMONEN

MIKKO HEIKKILÄ

Age: 32

Lives in: Hermanni, Helsinki.

Education and career: MSc. (Eng.) from the Tampere University of Technology. Previously worked at the Pori Energia power plant and as a senior engineer at the Energy Authority.

Hobbies: Running and golf. Completed his first marathon last year and is planning his second this summer.

Mikko Heikkilä began work at Fingrid last autumn.

"Before moving to Fingrid, at the Energy Authority I was responsible for matters relating to the security of supply of electricity and for various supervisory tasks relating to the wholesale electricity markets. Of course, work at Fingrid is different in that as a company it is closer to the electricity markets. On the other hand, Fingrid is also a societal actor; we work for the benefit of all society and we are open and fair. We serve a large group of customers and we constantly have to think of the wider picture, just like an authority does."

Creating Baltic Sea markets

Heikkilä works in Fingrid's market development unit, through which he is also involved in the development trends of the Nordic and Baltic electricity markets.

"Nordic electricity market cooperation is going to once again take centre stage. The Baltic direction is a more recent development, cooperation there is not yet at the same level as it is in the Nordics. One of my tasks is to increase balancing power market cooperation with the Baltics now that countries in the region are creating their own internal balancing market. At the start of next year, the Swedish and Lithuanian grids will be connected by an undersea cable, meaning that the Baltics' significance on the Nordic markets will become even more important," explains Heikkilä.

"The EstLink undersea cables between Finland and Estonia have long been the only connection between the Nordic and Baltic countries, so for years Fingrid has been in a key position regarding the creation of the Baltic Sea electricity markets."

Another source of work are the European network codes, which Heikkilä says require grid owners to assess their own operating models and to justify their solutions.

"There's always work to be done when it comes to market development. Network codes require us to develop our operating methods and to increase cooperation and transparency both locally and regionally at a pan-European level."

Motivation from forward thinking

Heikkilä is fascinated by the energy industry's key role in society.

"Energy matters affect every individual person and every industrial sector. Fingrid plays a central role in the power system and electricity markets, so work here really offers a true vantage point to see what's going on around us. This job allows me to have an impact and to do things that have real societal significance. That motivates me."

Heikkilä says that a forward thinking attitude that encourages development is characteristic of Fingrid.

"Attempts are continuously made to develop operations and the target is to be a role model for transmission system operators. From an employee's perspective, this increases motivation and challenges individuals to develop themselves, too," Heikkilä says in praise of Fingrid's amiable working atmosphere.

"Due to the nature of my job at the Energy Authority, I was often in contact with Fingrid employees and I'd already formed a positive image of Fingrid as a working community. There's plenty of room for different perspectives and engaging discussion. The atmosphere at work makes Fingrid a really good workplace." ■

A video presentation of Mikko Heikkilä is available at: youtube.com/fingridoyj

KNOW THE TERMS

This column presents and defines terminology in the electricity transmission business and related fields.

NETWORK CODES

By now we've all come across the term network code at energy industry seminars and on the pages of interest group magazines. The first electricity market network code will come into effect this year. Just what are these codes and how will they affect electricity market functionality up here in the north?

The unification of the EU energy markets is promoted though legislative procedures with so-called energy packages. The third and most recent energy package came into effect in 2009. The package, which thoroughly shook up the structure of the electricity markets, also determined the judicial position of network codes and a preparatory process for them.

The task of preparing the codes was given to ENTSO-E, the European Network of Transmission System Operators for Electricity, and to ACER, the Agency for the Cooperation of Energy Regulators. In the process, ACER first determines common policies, a framework, based on which ENTSO-E prepares a draft of the network code. Fingrid is also actively involved in this work. This phase lasts a total of 2–3 years.

Network codes are fine-tuned into their final form in a comitology process wherein representatives of EU member states approve the network codes. Finland is represented in the process by the Ministry of Employment and the Environment. Experiences of the first approved network code taught us that despite a long period of preparation, significant content changes can crop up just before the finish line. Finally, the network codes are approved by the European Parliament. At this phase, changes can no longer be made to the content.

***

After this multiphase preparatory process, network codes receive legal status in all EU member states. For legal reasons, some of the network codes have been renamed as guidelines, but this currently has little significance in practice.

Work is currently under way on approximately ten network codes divided into three main groups: market, system connection and system operations codes. Market codes legislate on e.g. the status of electricity exchanges, the specification of transmission capacity and balance management. System connection codes meanwhile deal with connection requirements set on production and consumption, and on the properties required of HVDC connections. Codes which apply to system operations legislate on e.g. system reserves and the management of disturbances.

***

What will we achieve through this exercise? Will the Baltic Sea region's electricity markets become better than ever? It could be that practical changes to the Baltic Sea region remain relatively minor. The network codes largely outline the Nordic market model, and no fundamental changes are on the horizon for the north. The process nevertheless requires Nordic actors to critically inspect their existing practices and market model, to carefully justify their practices and to further increase cooperation.

From a Nordic perspective, a significant change is a sizeable increase in processing by the authorities and in detailed regulation. In the future, authorities will confirm a huge number of market terms and technical details concerning network operations. Time will tell as to whether we will achieve a more balanced operating environment and more effective, functioning markets, or whether detailed regulation will delay progress.

At Fingrid the codes' entry into effect is keeping a large number of its personnel busy. The implementation of network codes has been designated a corporate-level strategic project. Most of the changes are prepared at a European level or in cooperation with neighbouring grid network operators, giving actors a fair chance to have their say. Expected changes will be communicated proactively and in advance to the markets and to interest groups. ■

TEXT MIKKO HEIKKILÄ

Read more on ENTSO-E's website
www.entsoe.eu/major-projects/network-code-development

Capacity Allocation and Congestion Management (CACM) in a nutshell:

Last December, EU member states approved the first network code: CACM. It sets out requirements for calculating transmission capacity and on the structure of day-ahead and intra-day markets. The outlined market structure primarily follows the Nordic market model. There are however some differences:

- the price for transmission capacity in congestion situations will also be determined on intra-day markets
- several electricity exchanges may operate in Finland
- Fingrid's method of hearing its interest groups' views will take on a more formal format
- The number of market rules confirmed by the Energy Authority is increasing.

CACM will come into effect in mid-2015.

WIND POWER AS A TARGET FOR INVESTMENT

Investment company Taaleritehdas is offering all Finns the opportunity to invest in the wind power business. The company used its first wind power fund to develop one wind farm in Honkajoki and two in Ii. Recently a second fund was opened, with dozens of wind turbines under construction all over Finland.

TEXT SUVI ARTTI | **PHOTOGRAPH** MIKKO TÖRMÄNEN

"There are around 85 billion euros just lying around unused in Finnish bank accounts. Our goal is to push even just 10 per cent of that into circulation to benefit the economy of Finland and Finns," says Taaleritehdas' Director of Renewable Energy **Taamir Fareed**.

Taaleritehdas is exceptional in Finland: an investment company which develops wind power projects from scratch. "We're not bankers; we're engineers," says Fareed, referring to both himself and Production Manager **Olli Hagqvist**. Both men are qualified electrical engineers and have worked on construction sites, including experience with installing wind measurement devices.

"In capital funding projects, such as wind power production, our role is to make it possible for customers to participate in projects they wouldn't otherwise be able to," says Fareed.

Taaleritehdas opened its first wind power fund in December 2010. "The fund was so popular that subscriptions tripled and the fund raising had to be closed earlier than expected. It's been great to see that Finns are interested in investing in wind power."

One hundred and eighty million euros were invested in the Taaleritehtaan Tuulitehdas I fund. The second fund, launched in summer 2014, will be around 300–400 million euros in total investment capacity. The fund was closed in October 2014, but it is still possible to participate in a profit-based bond with a minimum investment of EUR 10,000.

Permit processes require plenty of patience and knowledge

Taaleritehdas is acting as project developer, and as such is responsible for the wind power project right from the start, beginning with a multiphase permit application process. "On average, the permit process for a wind power project lasts from 2–4 years, while construction takes around one year. Construction is actually the easiest part when it comes to wind power construction," says Taamir Fareed.

He has learnt from experience that the only certain thing when it comes to wind power projects is that nothing goes according to original plan. "There are many things which can stop a project in its tracks, starting with swamp frogs. The only real key is to use an open and transparent working method and have a skilled project development team who can spot project obstacles in time."

"Though not even the best team in Finland can guarantee that everything will go to plan. For example, a Defence Forces radar can stop an otherwise perfectly feasible project from going ahead."

Taaleritehdas purchases construction in large entities: infrastructure, power plants, construction site supervision. NCC was responsible for infrastructure construction in the Ii projects. Construction site supervision was outsourced to Finnish Consulting Group.

German Nordex was chosen as the power plant manufacturer for projects in the first fund, and Taaleritehdas has been satisfied with its work. "Nordex is skilled with cold weather and has the market's quietest turbines, which are also well-suited to Finland's wind conditions: the turbines are tall and the rotors are large," explains Fareed.

Wind power: efficient and creates jobs

The wind farms completed in Honkajoki and Nyby in Ii are just the beginning. Taaleritehdas has projects under way in Ylivieska, Alavieska, Kankaanpää and in Myllykangas, in Ii. There are also around ten other projects in the pipeline all over Finland.

In Finnish conditions, we can produce significant amounts of energy using modern turbines. "There is still a mentality in Finland that wind power is for tree huggers. But the Ii wind farm, to name an example, produces a total of over 200 gigawatt hours of energy per year. The wind farm includes 27 turbines with a hub height of 120 metres and a rotor diameter of 117 metres.

Each turbine collects wind from an area of over a hectare. The wind farm under construction at Kankaanpää will feature even larger turbines which will utilise wind from an area of up to 1.3 hectares," says Taamir Fareed.

He points out that wind power also creates more jobs than you might think. "Currently there are over 350 people working on our construction sites, and a total of more than one hundred companies participate in the projects. After the construction phase, people are needed for the use and maintenance of the turbines. A farm with ten turbines requires a maintenance team of 3–4 people. If we include administrative tasks, production forecasting, electricity sales, insurance, and so on, the number increases drastically. According to a calculation by Sweco Ympäristö Oy, the wind power industry employs approximately 2,200 people in Finland, and the number could be significantly higher in the future."

Its effect on employment is noticeable in Ii, which is home to Finland's largest wind farm. According to Fareed, conditions in Ii are ideal for wind power. "Finland is full of windy places, but the area should also feature an electricity network to connect the farm to. In addition, the location should also be suitable with regard to population and environment. All of these pieces fall into place perfectly in Ii. Although after the turbines currently under construction are complete, there won't be any capacity in the electricity network anymore for further production."

Fair service from Fingrid

Taaleritehdas has received good service from Fingrid concerning the connectivity of wind farms. Taamir Fareed knows that it is essential to clarify connectivity well in advance in order for a wind power project to succeed.

"We've received help whenever we've needed it. A big hats off to Fingrid for its fair treatment of all actors. There are hundreds of projects under way in Finland, and Fingrid has to assess which of them will actually be implemented. They've done very well in this difficult task," says Fareed.

He does have one wish concerning the development of grid tariffs: "It would be good if the tariff would continue to be based on energy produced, rather than nominal power. The power fee is disproportionately harsh on wind power producers, since the number of hours of maximum production is relatively small."

Towards market orientation

Taamir Fareed believes that the entire wind power industry must invest in development in order to make the price of electricity from wind power closer to the market price.

"The level of support for wind power should decrease in the future, and the industry must be able to rise to the challenge. We also need clear, binding targets, since without those it isn't worth starting new projects. Now that the wind power train has left the station, it would be foolish to put on the brakes."

Wind power makes it possible for new kinds of actors to enter the energy industry. Ordinary citizens and investors can now own industrial production.

"We want to provide wind power investors with the feeling of ownership; something more than just their name on a piece of paper," says Fareed. As an example he mentions the trip to the Honkajoki wind farm organised for Taaleritehdas' investors. "One man looked at the turbines as he got off the bus and wondered 'do I own this?'. That's what we're talking about here. These are the investors' turbines, not Taaleritehdas'. We can achieve greater things together than we can on our own." ■

"The level of support for wind power should decrease in the future, and the industry must be able to rise to the challenge."

Taamir Fareed

GUARANTEE OF ORIGIN REGISTER NOW IN USE

Fingrid's daughter company Finextra's new guarantee of origin register was successfully taken into use on 1 January 2015.

The guarantee of origin service also implemented new terms of agreement. The terms are valid until further notice. Finextra also took up Finland's membership in the European Association of Issuing Bodies (AIB).

The guarantee of origin register is used to issue, transfer, cancel and annul certificates of renewable energy and the efficient joint production of electricity. Guarantees of origin are also transferred in digital format from the register to other countries' registers via the Hub, which is administrated by AIB. In addition to guarantees of origin for electricity, Finextra also issues the EKOenergia additional product symbol.

Finextra's guarantees of origin register contains 31 account holders. Approximately 270 power plants with a combined power of 7,400 megawatts are connected to the register. Of this, around 40 per cent is hydropower, just under 10 per cent is wind power, and approximately 50 per cent is other renewable energy. The register was implemented by Solita Oy, who is also responsible for maintenance and user support.

TEXT KAIJA NISKALA

DO GUARANTEE OF ORIGIN MARKETS WORK? We asked register users to assess the functionality of Finextra's service and of the guarantee of origin markets for renewable energy.

1. How is your company involved in the guarantee of origin markets for renewable energy?

2. How well do you feel that the guarantee of origin markets for renewable energy function?

3. Do you have any ideas or suggestions for development of the Finextra service?

Jere Anttalainen
specialist, processes and product development
Savon Voima Oyj

1. Our combined electricity and heating production power plants in Pieksämäki and Iisalmi, as well as 9 hydropower plants, are all registered on the guarantee of origin register. In addition, we are also looking to enter the LECs markets in Great Britain with regard to our hydropower.

2. Since guarantee of origin trade usually takes place between two parties and only in some commodities exchanges, demand and supply are dispersed. There are also numerous product alternatives. On the other hand, background systems for the administration of guarantees of origin and fulfilment of obligations have developed, providing guarantee of origin providers and procurers with more effective methods of verifying and declaring origin.

3. The functionality of the electronic guarantee of origin register has improved. We are able to utilise the reporting offered by the system with relative ease using Savon Voima's Qlikview-based guarantee of origin and green electricity position management. One area for development could be the development of system interfaces to make them more automated and the development of file transfer to support .xls, .xml and .csv file formats.

Juha Kortessalmi
Senior Portfolio Manager
UPM

1. As Finland's second largest producer of electricity, UPM is a major producer of renewable energy, but also uses electricity in cellulose and paper manufacturing.

2. Currently there is clearly more supply than demand, which has forced the price of guarantees of origin down to a very low level. Renewable energy producers are left with little profit after system and administrative costs. Supply is increased especially by guarantees from outside the EU, which are approved in the system and which can be used to increase eco-friendliness in electricity procurement.

3. It should be possible to transfer fuel notifications from fuel databases or energy management systems directly to Finextra's register. Currently they have to be entered manually, which increases the risk of human error.

Suvi Viljaranta
Portfolio Manager
Enegia
Portfolio Services Oy
From 1 April 2015, Energiakolmio and Skapat Energia are Enegia.

1. We help customers to comply with the obligations under the legislation concerning guarantees of origin (GoOs) and we manage their GoOs and production plants in the guarantee of origin register. We trade and broker GoOs based on our European customers' wishes and we also sell GoOs directly to electricity end-consumers, who wish to procure electricity produced from renewable sources without changing their physical electricity delivery contracts.

2. International trading and transfers are possible with guarantees of origin. For example, an actor who does not have any of its own renewable production capacity can easily purchase renewable energy GoOs from the market. A well-functioning guarantee of origin system and the obligation to verify sold renewable electricity by cancelling GoOs increases market reliability, because the origin of electricity can be accurately tracked and the possibility of double-counting the renewable electricity is ruled out. An increase in the demand for renewable electricity would help to balance the guarantee of origin market, where the price level is currently low due to an abundance of supply.

3. I would like to warmly thank the team who works with guarantee of origin issues at Fingrid. From a highly active register user's point of view, the move to Finextra's guarantee of origin registry went flawlessly. I hope that the register will undergo further development and that users' wishes will be taken into account as well as they have been until now. An annual register users' event could be a useful way to exchange experiences and to discuss the system.

Juha Ruokonen
Portfolio Manager
Fortum Power and Heat Oy

1. Fortum is involved in the guarantee of origin markets both as a producer and seller of renewable energy. Fortum's production portfolio includes plenty of hydropower and bioenergy, as well as some wind power. The electricity sold by Fortum to households is one hundred per cent hydropower. We also offer our customers wind power, EKOenergy and Bra Miljöval-labelled products.

2. The guarantee of origin markets have developed gradually over the years. Wholesale market functionality has developed in a good direction in recent years. This has been driven by standard agreements and by an improvement in market liquidity. On the consumer side of the markets, there are still many differences between countries. For example, in Finland electricity sellers must use guarantees of origin when branding their renewable energy-based products, but in some countries this is not compulsory. Differences in guarantee of origin legislation from country to country complicate market functionality in general. Legislation and market frameworks should be harmonised.

3. Despite a challenging schedule, the implementation of Finextra's guarantee of origin registry has gone well. We would like to see the possibility to apply guarantees of origin to other forms of electricity production besides renewable energy. This would make it easier to brand various electricity products and would remove double counting of some forms of production.

Changes in electricity trading between Finland and Russia

Bilateral electricity trading has been possible between Finland and Russia since December 2014.

In January 2015, electricity trading between Russia and Finland began a practice wherein also bidirectional trade between the buyer and seller must go through the electricity exchange in Finland. Anyone importing electricity from Russia or exporting it to Russia must quote all electricity on a Nordic electricity exchange.

A new kind of tariff is also planned for electricity trading between Finland and Russia. "The most fundamental change is that until now, we have used a fixed tariff whereas the new tariff would be based on the price difference of electricity between Finland and Russia." The tariff would be a certain percentage of the price difference between the markets," explains corporate adviser **Risto Lindroos** from Fingrid. "The new tariff would cause significantly less disruption to cross-border trading than the previous model. Transmission between the countries is expected to increase as a result of the reform." The tariff proposal is currently being sent for hearing, and plans estimate the tariff to be taken into use in early June.

Another factor which may affect electricity trading between the two countries is Russia's decision to stop observing daylight saving time. During the summer Finland and Russia will observe the same time. "The decision to give up daylight saving time may also have somewhat of an effect on electricity trading," says Lindroos.

The Advisory Committee's role **is to look ahead**

CEO of Tampereen Sähkölaitos Oy **Jussi Laitinen** has acted as Chair of Fingrid's Advisory Committee since the start of the year. In his work with the Advisory Committee he is most interested in affairs relating to electricity market functionality and development.

TEXT MIRA MUURINEN | **PHOTOGRAPH** MATTI IMMONEN

According to Jussi Laitinen, the new Chair of Fingrid's Advisory Committee, a good example of the significance of the Advisory Committee's work is the discussion around changes to grid tariffs.

"Discussions reached a final result which worked with regard to the overall situation and which successfully combined several different perspectives. Your own horizons are broadened when you hear various customer groups' opinions and views on matters," says Laitinen.

"The role of the Advisory Committee is to look ahead and guide operations for the future. Electricity market development, cross-border connections and datahub and its development are all key themes in this work."

No shortage of topics for discussion

Members of the Advisory Committee are evenly elected from Fingrid's various customer groups having different needs: electricity producers, large-scale users, distribution companies and electricity market actors. Many organisations, such as Tampereen Sähkölaitos Oy, nowadays represent more than just one customer group.

"We're what you'd call a full-service company; we represent all sectors an energy company can operate in. Finding a balance between different perspectives isn't difficult – after all, the idea behind the Advisory Committee is to select representatives from as wide a range as possible. Personally I'm

Transparency is key

In accordance with Fingrid's articles of association, the Advisory Committee is an advisory body whose members are appointed by Fingrid's Board of Directors. The meetings do not share insider information, but all members appreciate the opportunity it presents to discuss and exchange views.

The task of Fingrid's Advisory Committee is to act as a link between Fingrid and its customers. The Advisory Committee takes a stand on the company's different activities and customer services from a customer point of view. The Advisory Committee does not make formal decisions, and instead acts as an advisory forum for discussion.

"The Advisory Committee is a good test bench to provide Fingrid with feedback on its operations and plans. We receive perspectives and points of departure for our operations from various customer groups evenly, directly and quickly," explains Advisory Committee Secretary **Jussi Jyrinsalo**, head of Fingrid's Grid Services and Planning department.

The members of the Advisory Committee make up a fair representation of all of Fingrid's customer groups. When appointing members, efforts are also made to include members from all over the country.

The term of office for each member is three calendar years, with one third of the committee's members changing each year. The chairmanship of the committee is rotated around the customer groups. The Advisory Committee currently has twelve customer members with two additional participants from Fingrid. The Chair of the committee is **Jussi Laitinen** from Tampereen Sähkölaitos Oy.

According to Jyrinsalo, transparency is key in the work of the committee. Material from meetings is available to all interest groups.

"Fingrid hopes that the members of the advisory committee will continue discussion on these topics in their own background organisations and act as a representative and mouthpiece for their entire customer group. All of Fingrid's customers should have the same information and the same opportunities to have an influence," says Jyrinsalo.

Members of the committee, from left to right: Ilkka Latvala, Jukka Ruusunen, Jorma Myllymäki, Juha Lindholm, Jussi Laitinen, Raimo Härmä, Stefan Sundman, Tuomas Timonen, Tapio Jalonen, Jussi Jyrinsalo, Jarmo Tanhua and Rami Vuola. Missing from the photo are Juhani Järvelä and Jukka Mikkonen.

interested in matters relating to electricity market functionality, efficiency and development, since these all require a comprehensive understanding of various industry sectors," explains Laitinen.

Matters to be dealt with in the Advisory Committee's meetings relate to services provided by Fingrid and their pricing, transmission system operation, network investments and the development of electricity markets. The objective is to examine all sectors of Fingrid's operations over the course of the year.

"Of course, there's no shortage of things to discuss, which is a challenge in itself. Different things are important to different customers, and that unavoidably increases the length of the agenda for the meeting. Chairmanship of Advisory Committee is an honour, and a brilliant opportunity in that it forces you to really familiarise yourself in more depth with the topics at hand," he says.

Laitinen commends the atmosphere on the Advisory Committee as development-oriented and forward-looking.

"The members all have the right attitude, and we try to find solutions together. During my membership both the number and quality of discussions have been a positive surprise. It's been encouraging to notice that discussions and feedback have had an effect on Fingrid's operations," says Laitinen.

European affairs and the future are hot topics

Recently the Advisory Committee has seen lively discussion on grid tariffs due to come into effect in 2016, electricity market development projects and development trends in the European electricity markets.

"Customers seem to appreciate that we keep them up-to-date on European-level affairs. It is often hoped that Fingrid would strongly act as Finland's representative on the European level, but in some situations you need to strike a balance. We also try to encourage customers to have an influence themselves," explains the Advisory Committee's secretary, **Jussi Jyrinsalo**, head of Fingrid's Grid Services and Planning department.

"With regard to European matters, I feel that Advisory Committee members could take more of a stand from a domestic perspective. In order for operations to be developed in a manner that promotes Finland's interests, it's important for members to get involved," says Jussi Laitinen.

He finds it important that Fingrid maintains and strengthens its position as European pioneer in technology and security of supply.

"Fingrid's current operating model and customer-orientation have worked well. But the world is a rapidly changing place, and we need ongoing development," he adds.

"For example I have great expectations concerning datahub. It is one way of making the entire industry more efficient since we're now in a situation where there are 80 distribution networks, 90 electricity sellers, and all of them have their own information systems. The collection of measurement data in a single place will be needed no later than when decentralised production becomes more prevalent. Datahub is a new area in which Finland can show that it is top in Europe." ■

DEMAND-SIDE MANAGEMENT IS WORTHWHILE

An increase in demand-side management creates new kinds of opportunities to maintain Finland's power balance. This series will present pilot demand-side management projects.

A FROZEN WAREHOUSE PROVIDES **DEMAND-SIDE MANAGEMENT** FOR THE ELECTRICITY MARKETS

In cooperation with a Finnish frozen warehouse, Fingrid and SEAM Group have carried out a demand-side management project which has resulted in a large consumption site acting as part of the Frequency Containment Reserve for Normal Operation for the first time ever in the Nordic countries.

TEXT MIRA MUURINEN | **PHOTOGRAPH** VALTTERI KANTANEN

The joint pilot project between Fingrid, SEAM Group and the frozen warehouse began early last year. It experiments with whether or not frozen warehouse can provide a Frequency Containment Reserve for Normal Operation (FCR-N) for reserve markets, and therefore help to make sure that the production and consumption of electricity in the Nordic power system remains in balance. The project is part of a wider Fingrid project which charts possibilities for increasing demand-side management on the electricity markets.

A ground-breaking pilot project

Power plants have balancing capacity reserved in separate reserves which balance out the production and consumption of electricity in various situations. Under normal circumstances, this is carried out by the Frequency Containment Reserve for Normal Operation, which works automatically according to fluctuations in power system frequency. Now the pilot project's frozen warehouse is also acting as a reserve provider.

Last year, Fingrid sought partners for several pilot trials, of which this project is just one. The technical solution for the frozen warehouse was supplied by SEAM Group, which specialises in electricity consumption optimisation services.

"We had already discussed the possibilities of demand-side management with this actor previously, and the project was already quite well thought out. Once we heard of Fingrid's project, we knew we were thinking on the same frequency," explains **Jukka-Pekka Häkli**, CEO at SEAM Group.

The project is the first of its kind in the Nordic countries, and is also groundbreaking on an international scale.

"The frozen warehouse is the first consumption site in the Nordics to act as a Frequency Containment Reserve for Normal Operation. Previously it was only power plants that did so," explains **Mikko Kuivaniemi**, a Planning Engineer at Fingrid who has been involved with the project since autumn.

Behind Fingrid's demand-side management project is the need to guarantee electricity market functionality. Nuclear, wind and solar power, for example, are all non-flexible forms of electricity production which do not normally react to changes in the price of and demand for electricity. The more non-flexible forms of production are constructed in Finland, the more we need adjustable production – or more efficient demand-side management.

Häkli believes that there are plenty of untapped opportunities in the consumption sector for demand-side management.

"If we take new kinds of production resources into use, we cannot solve problems using familiar methods. Large consumers of electricity have a significant amount of adjustable capacity which it would be sensible to implement from the perspective of the national economy," Häkli points out.

Finding common ground

In the pilot project, the control automation on controllable objects – such as refrigeration devices, vaporisers and condensers – is adapted to react to changes in frequency and to adjust the devices' power. The consumption and production of electricity are balanced at the power system level in the short term according to the system's frequency.

The pilot project will last a total of six months, during which time data will be collected and operations will be reviewed by both parties. It is important that regulation does not in any way af-

fect the quality of products in the frozen warehouse. Fingrid, on the other hand, has its own criteria as to how to carry out the regulation.

"Consumption sites are an entirely new kind of resource to us and they behave very differently from power plants. Fingrid has strict requirements for reserves, and for the Frequency Containment Reserve for Normal Operation, the requirements were drawn up largely based on power plants. Fingrid's requirements require a great amount of flexibility from reserve resources, which can be challenging for consumption sites," explains Kuivaniemi.

"To adjust the frozen warehouse, we use compressors which were originally designed for a completely different purpose. Now we're collecting information as to whether or not we have to change the constructed regulation logics. SEAM Group programmed a system for the frozen warehouse which helps us to examine how the regulation works in real time. It has really made it easier to monitor the project," says Kuivaniemi in praise of the system.

Despite its challenges, Kuivaniemi says that the project has progressed as intended. "We see things from very different perspectives, so to begin with both parties had some problems with communication. Nevertheless, we soon found common ground. At the moment it seems like the frozen warehouse regulation works overall as we expected."

The advantage of the frozen warehouse in demand-side management is its ability to react to the need for balancing with a relatively quick response time. "A frozen warehouse is an excellent candidate for a regulation resource, since nothing changes in a -26 degree hall, even if you increase or decrease consumption occasionally. The regulation has no effect on the frozen warehouse's operations, and costs are relatively low, too," explains Jukka-Pekka Häkli.

Plenty of potential

In early 2015, the project had progressed to the point where the frozen warehouse was able to participate in the electricity reserve markets. Even now it is providing quotes and carrying out balancing, just like other reserve market parties. Currently the balancing power is 300 kilowatts, but it is possible to increase the power by a factor of up to three.

▸ Some of the people participating in the demand-side management project, from left to right: Jukka-Pekka Häkli from SEAM Group, and Laura Laitinen, Mikko Kuivaniemi and Jonne Jäppinen from Fingrid.

"On a national scale, this is of course a minor amount, but it is only a single site. If we are able to obtain numerous similar resources and combine them, there is huge potential," explains Mikko Kuivaniemi.

According to Jukka-Pekka Häkli, the lessons learnt from the pilot project can easily be applied not only to freezing equipment, but also to heating equipment, since the logics are largely similar. Major electricity consumers nevertheless differ greatly from one another, so it would not be possible to simply copy and paste the project as it is.

"Each site has to be investigated on a case-by-case basis. Something which works flawlessly at one site might not necessarily work at all in another," says Kuivaniemi. Nevertheless, the project has produced useful information that can be forwarded on.

"There is a project under way at a Nordic level which develops new requirements for frequency containment reserves, taking into account the requirements of consumption sites to act as reserve providers. That project has provided us with valuable experience as to what consumption sites are capable of and what their limitations are. It's well worth taking these into account when drawing up requirements for consumption sites, as well as when determining how to communicate said requirements," says Kuivaniemi.

Häkli believes that demand-side management projects have international potential. "Capacity similar to the frozen warehouse in this project can be found all over Europe, and implementing it is not prohibitively expensive or challenging. Finland is not lacking in engineering competence, and hourly measurement has long been in use. Here it's easy to develop and test these kinds of business models which could easily develop into a huge export advantage," says Häkli.

Häkli thanks Fingrid for their actions when searching for new solutions.

"It's great that Fingrid understood its role in the change and acted proactively. Of course there are always surprises when you do something for the first time, but all in all this project has progressed in a constructive way," he summarises. ■

Sustainable development powered by enthusiasm **in the Ii community**

The yard outside the Ii municipal office in Northern Ostrobothnia features three charging points for electric cars. "Iissä on ideaa!", or "Ideas in the Ii community!" in English, is written on the side of one of the cars being charged. The municipality is home to approximately 10,000 residents and it has come up with a brilliant idea to utilise local energy and reduce dependency on oil.

TEXT SUVI ARTTI | **PHOTOGRAPHS** MIKKO TÖRMÄNEN

The municipality of Ii is the only northern Finnish municipality to participate in the Kohti hiilineutraalia kuntaa (Towards carbon neutral municipalities, HINKU) forum. While the EU's official target is to reduce carbon dioxide emissions by 80 per cent by 2050, HINKU municipalities are aiming at the same target by 2030. The municipality of Ii has set off to a good start: its emissions during a review period from 2007–2012 had already decreased by 31 per cent.

Behind the ambitious targets and achieved savings are enthusiastic Ii residents. "I suppose I'm the first guilty party," admits Mayor **Markku Kehus**, who at the time of the interview in February is just two months away from retirement. Together with other Ii community residents, he has brought about a change for which both the environment and the municipality's budget are thankful.

Farewell to oil

One of the first sustainable development procedures in the Ii community was to give up oil heating. "It doesn't benefit anyone to use oil. Changing how properties are heated was an easy place to start," says **Ari Alatossava**, who is responsible for the development of the municipality's vitality and is the other driving force behind the energy saving campaign.

The method used to heat the municipality's properties has been changed from oil to renewable, local energy: geothermal heat, wood chip heating and district heating fuelled by wood chips, peat and pellets. Thanks to the new heating methods, the municipality is saving money and putting the savings back into the Ii municipality and the local area. Savings have also been achieved through

Ii's municipal staff primarily use electric cars for their business travel. "If we want to succeed in our goal of reducing carbon emissions by 80 per cent, our cars have to run on some other fuel besides petrol or diesel. That fuel could be electricity, ethanol, or perhaps in the future even hydrogen," say Mayor Markku Kehus and Ari Alatossava, CEO of Micro-polis Oy, which is the company responsible for the municipality's development.

Fact

CALCULATED SAVINGS

- Energy savings 4,818 MWh (2010–2014)
- Monetary savings €385,000 (2012–2014)

OIL CONSUMPTION:

- 367,492 litres in 2010
- 54,694 litres in 2014

ENERGY PRODUCTION IN THE II AREA IN 2014:

- Hydroelectricity approx. 400 GWh (Raasakka power plant)
- Electricity from wind power approx. 130 GWh (Vatunki, Olhava, Nyby and Laitakari wind turbines)
- Heat from wood energy, approx. 40 GWh (heat plants and separate use)

REGIONAL ELECTRICAL ENERGY USE, APPROX. 80 GWh

maintenance and adjustment procedures. An electricity consumption monitoring system has been installed in the municipality's properties, ventilation machines have been serviced and their run times have been adjusted.

The change in heating method will create new jobs in the area. "Wood chips are sourced from the local forest owner's land. One person fells the trees and another makes the wood chips. Using oil or coal wouldn't benefit the locals," says Mayor Kehus.

Another source of new jobs is the bioterminal under construction in Kuivaniemi in Pohjois-Ii, where wood fuel is collected from the area in a centralised way. Constructed by Oulun Energia, the terminal will be built in connection with a district heating plant which uses wood chips as fuel.

Ari Alatossava has made sure that all costs and benefits of the procedures are measured. That way, the municipality can present impressive figures not only on energy and monetary savings, but also on reducing carbon dioxide emissions.

Total savings of 85,000 euros were achieved in just one year by changing the heating method used in three schools from oil heating to geothermal heating. Investments pay themselves back after just 4–7 years.

Energy from wind and solar power

Residents of the Ii community have an unproblematic relationship with wind power. The first wind turbines were built in the municipality in the mid-1990s, and the population is happy to welcome new turbines. Now Finland's largest cluster of wind farms is under construction in the Ii community.

According to Markku Kehus, the key to successful projects is transparency and the ability of the municipality to stay within its own role.

"Our policy is to allow wind turbines as long as they are not built between the sea and the village, but a little further away from population centres." Knowing its own role means that the municipality takes care of permit processes and carries out zoning plans in close cooperation with project developers, but refrains from negotiating on the location of the turbines. "The project manager negotiates that with landowners, we don't get involved in that aspect," says Kehus.

He believes that open dialogue with residents and decision-makers is vital when it comes to wind power projects. "Together we've sought solutions which satisfy everyone."

Wind turbines provide the municipality with tax revenue, leasing income and jobs. "Construction site workers stay and eat in the municipality of Ii. That has a major impact on the municipality's economy," says Kehus. Once the turbines are complete, they will be serviced and maintained by people from Ii. Thanks to the area's history, there's plenty of competence around.

In addition to wind power, the Ii community also harnesses increasing amounts of solar energy to put to use. On the roof of the Technology Centre Micropolis is Northern Finland's largest solar collection system, with work carried out on a joint order solar energy system which will allow for any property owner in the Ii community to start using solar energy.

Redirecting cash flow to the municipality

According to the mayor, the people of the Ii community have truly embraced the idea. One example is the village of Pohjois-Ii, which has declared itself Finland's first carbon-neutral village. "This just shows that they've really understood the whole concept. It's been a lightbulb moment," says Kehus.

The municipality of Ii is a living example of how a single municipality can increase the use of renewable energy, improve its own energy self-sufficiency, create new jobs and redirect cash flow from oil companies to local business operations.

According to Kehus' calculations, if all Finland's municipalities were to take a leaf out of Ii's book, the country's trade balance would improve by up to half a billion euros. He admits however, that decisions are not only down to municipalities, but that the choices made by energy companies also have great influence.

Expert schoolchildren

Schoolchildren in the Ii community have really thrown themselves into energy saving. Informative events on energy and environmental issues have been held at all schools in the municipality, with three schools involved in the EU's Euronet 50/50 Max project. The idea is that schools can keep half of the money they make from energy savings for their own use.

One of the schools participating in the project is the Ojakylä school whose pupils have become somewhat experts on energy saving. A club for 11-13 year olds teaches children to monitor the consumption of electricity, heat and water in school. The idea was to reduce energy consumption through a change in operating methods, explains **Maria-Riitta Paaso**, a primary school teacher at Ojakylä school who is responsible for energy.

The best part of the club was using heat and light meters, say **Helga Annala**, **Kasper Eriksson**, **Lotta Järvenpää**, **Tuukka Kyllönen**, **Valtteri Nevalainen** and **Matias Pakanen**. They demonstrate how to use the meter; its sensor shouldn't be on the table, but should instead be lifted to eye level in the middle of the classroom. The amount of light needed is just enough for the lux meter to exceed a reading of 300 lux in a normal classroom and 500 in a handicrafts classroom. For indoor temperatures, 21 degrees Celsius is sufficient.

"We had such an enthusiastic group that teachers lost power to their computers and projectors since the pupils unplugged them all from the power outlets," laughs headmaster **Markku Varanka**.

The project taught schoolchildren to turn off unnecessary lights and to use water sparingly. If the temperature was too high, it was reported to property management, who lowered the indoor temperature.

Minor energy-saving changes became habits that the children took home to their parents. "Turning off the lights when you don't need them has become a habit at home," says Matias Pakanen. "Earlier I complained that it's cold, but now I've noticed that I can just put on another layer of clothing," says Helga Annala.

The project will continue in the form of theme days relating to energy which will be held for all pupils from first to sixth grade. One memorable event was the no-electricity morning, when the pupils learnt how it felt to study by candlelight on a dark November day. The project is also visible on the school's walls, where the pupils have collected their energy-saving tips on posters.

Savings of up to 6,000 euros from three schools have accumulated, of which the schools will receive half for their own use. The Ojakylä school's share totals hundreds of euros. The student body will decide how to allocate the funds during the spring.■

▸ Kasper Eriksson, Matias Pakanen and Valtteri Nevalainen, who are students at the Ojakylä school, know that 21 degrees is enough for an indoor temperature.

The white stork, a visitor from across the Gulf of Finland

White storks' droppings cause disturbances on the Estonian grid, disrupting the transmission of electricity. The white stork is held to be a symbol of good luck but does not – and is unlikely to – nest in Finland, since we have little of the stork's preferred habitat of wetlands and meadows.

TEXT PERTTI KOSKIMIES | **PHOTOGRAPH** ISTOCKPHOTO

The black and white bird is almost the size of a crane, and is one of the most well-known and popular birds in Europe. The storks have little fear of humans and nest in church steeples, on top of chimneys and on transmission towers. According to records, the oldest nests still used today date from the 14th century. A stork that nests on the roof of a house is said to bring good luck and fertility to the household.

The white stork has lived alongside humans for as far back as we can remember. Storks benefitted from agricultural development and the clearing of forests into pastures and cultivated land, since they prey on frogs, moles, mice, snails, worms, crickets and other small animals found in open grasslands with short vegetation. The white stork is also well-liked for controlling the populations of animals which can spoil harvests.

Recent developments in agriculture, however, have not benefitted the stork at all. On the contrary, drainage, fertilising, compacted earth due to the use of heavy machinery, monoculture, drainage of wetlands and cattle-farming have all had a detrimental effect on the living conditions of all birds whose habitat includes fields. For decades, white stork numbers have declined in most western European countries. In the Baltic countries, where agriculture is not quite as modern as in the south, white storks have retained their numbers, and even thrived. There are around 5,000 breeding pairs in Estonia.

Although white storks make their home just across the Gulf of Finland, the species has never nested in Finland. Each year, approximately five hundred white storks visit Finland between late April and early June, mostly young and non-nesting individuals. They can be seen in open fields in southernmost Finland in flocks of between 2-10 individuals. It is doubtful that the white stork will choose Finland as a nesting spot any time soon since Finland has few of the wetlands and meadows that the stork prefers for feeding. The creation of a new population would require young birds to take a liking to our landscape, which is also unlikely due to the birds' loyalty to their home. Once mature, the storks most like to nest in their home areas. ■

White stork droppings cause problems for Elering

Each year white storks cause trippings to electricity transmission through the Estonian grid. In recent years, the Estonian 110 kilovolt grid has annually recorded 80–130 trippings due to unknown causes. Most of these trippings, taking place on summer nights around sunrise, are thought to have been caused by white storks. This view is also supported by a study commissioned by the Estonian grid company Elering and carried out by the Tallinn University of Technology.

"We encounter trippings when the storks sit on the power lines and leave droppings on the towers' insulators," explains **Märt Allika**, Head of the Power System Control Centre at Elering. He says that the trippings caused by the storks are typically short-term and that voltage is quickly restored through automation.

To deter the storks, Elering has used cone-shaped tower covers and attached "brushes" to the cross-beams. Insulators have also been replaced with new ones at problematic sites. Thanks to these measures, both disturbances known to have been caused by the storks and disturbances caused by unknown factors have decreased in recent years.

White stork nests in towers have also caused problems for Estonian distribution network companies, but the birds have not nested in Elering's towers since they feature a different structure.

TEXT SUVI ARTTI

EUROPE'S LIGHTS STAY ON **DESPITE ECLIPSE**

The solar eclipse that took place on the 20th of March this year put continental Europe's power systems to the test. Thanks to careful preparations, the solar eclipse did not cause any disturbance to the supply of electricity in Europe.

TEXT MIRA MUURINEN | **PHOTOGRAPH** ISTOCKPHOTO

The 20th of March was sunny with clear skies in many places, which provided a good opportunity to test out how well European power systems function under exceptional circumstances. In the area around southern Germany and northern Italy for example, where concentration of photovoltaics is the greatest of all the ENTSO-E area, the sun shone brightly throughout the eclipse.

Challenges caused by the eclipse are related to a significant increase in the production of solar electricity. According to statistics, solar energy's share of the electricity production capacity set for Europe in 2002 was 0.1 per cent, whereas in 2012 it had risen to 10.5 per cent.

It had been calculated that on a clear day the solar eclipse could cause a maximum reduction of up to 35,000 megawatts, a total of 7.5 per cent, in the overall electricity production of continental Europe. According to professor of engineering physics **Peter Lund** from Aalto University, the most challenging aspect of a solar eclipse is the sudden change in power, especially when the sun becomes visible again on a clear day.

Fact

During a solar eclipse, the Sun, the Moon and the Earth move in line with one another in space.

"Viewed from the Earth, the Moon seems to position itself in front of the Sun and casts a shadow on the surface of the earth. The Moon's orbit is slightly elliptical compared to Earth's orbit of the Sun, and this angle determines the path of a solar eclipse and whether it is total or partial," explains **Anne Liljeström** from Ursa Astronomical Association.

The solar eclipse in March was a total eclipse, but could only be viewed as such from sparsely populated areas in southern Iceland, the Faroe Islands and Svalbard. The partial eclipse was visible throughout Europe, and in Finland the Moon obstructed around 80–90 per cent of the Sun, depending on your viewing location.

The last solar eclipse that could be seen throughout Finland took place on 1.8.2008.

European power systems pass the test

The solar eclipse did not cause any disturbance to European power systems, since preparations for the 20th of March had begun in good time approximately one year beforehand.

ENTSO-E had carried out a comprehensive analysis of the effects of the solar eclipse, and grid network companies used the analysis to agree on joint operating procedures. New tools were taken into use in coordination and communication between grid network companies, for example. Before and during the solar eclipse, telephone conferences were held between control centres, which allowed for real-time balance management. Nordic grid companies had also found methods of supporting continental Europe during the solar eclipse using Nordic balancing power and peak load capacity.

In Germany and Italy, automatic peak load capacity was sufficient to cover the deficiency in solar energy production caused by the eclipse, and to reduce the change in power, Italy also restricted solar energy production. The situation on the European grid returned to normal at around midday, immediately after the eclipse.

In Finland the eclipse caused no disturbances to the power system.

"Around 10 megawatts of solar energy is produced in Finland at best, so the effects of the eclipse weren't really felt outside of detached homes equipped with solar panels," says Peter Lund.

"The issues raised this March may however become topical in Finland in the future, since solar energy is increasing in popularity worldwide. ■

More detailed information on the effects of the solar eclipse on electricity production can be found on ENTSO-E's website at entsoe.eu.

New landscape tower taken into use along Ring road III

In early March, a pair of landscape towers developed by Fingrid, Vantaan Energia Sähköverkot and design agency Muotohiomo were revealed to the public in Vaarala, Vantaa.

The new pair of landscape towers are located in a high-visibility spot along Ring road III, where it is visible to all motorway users driving westbound towards Helsinki along the Porvoonväylä road. The landscape towers are part of the second phase of a project to renovate Ring road III and which entails the renewal of four transmission towers.

"The initiative for the project came from the Finnish Transport Agency. The safety distances for transmission lines were not met in the right-of-way plan, so the lines had to be elevated," explains Fingrid's **Tommi Olsson**, who acted as project manager.

Erecting the towers in a frequently-trafficked spot was challenging and made additionally complicated by other construction and roadworks taking place in the surrounding area. The landscape towers were eventually constructed one component at a time. "Sometimes space restrictions were quite demanding, but all in all the project went well," says Olsson.

The pair of landscape towers were developed by Fingrid. One of the towers is part of Fingrid's transmission line, while the other is part of Vantaan Energia Sähköverkot Oy's transmission line. The area is already home to a terminal tower housing Vantaan Energia's waste-to-energy plant's 100 kV line, whose appearance as well as the surrounding environment and traffic were taken into account when designing the new tower.

"Roadworks in the area will be completed towards the end of the year, so we won't be able to see the final look of the area until then," explains Olsson.

The Finnish Transport Agency and City of Vantaa took care of the large majority of the project's costs. The landscape towers were developed in cooperation between Fingrid Oyj, Vantaan Energia Oy, Muotohiomo Oy and TLT-Engineering Oy.

Fingrid in social media

Over the last six months, Fingrid has strengthened its presence in the social media.

The first social media channel the company decided to use was Facebook, where it set up a profile in 2010. Since then, it has branched out to LinkedIn, YouTube, Twitter, SlideShare, Pinterest, Instagram and Flickr.

The channels all have their own tasks and areas of emphasis. Facebook is used to provide information about jobs, news and trade fairs. LinkedIn on the other hand focuses on industry issues and, with over one thousand followers, is also Fingrid's most popular social media channel.

Twitter is mainly used to provide news about the company. Fingrid began to use SlideShare at the turn of last year and it is where Fingrid's specialists publish their presentation material, with the aim of developing its application as a channel for the publication of presentations. As videos are becoming increasingly significant in communications, in recent months Fingrid has invested in the use of YouTube by reorganising the company's videos more clearly by topic.

Flickr and Instagram are used to share images. Fingrid began to use the Flickr image service in the spring for its "Send in your pictures of transmission towers" photo campaign, and all photographs sent in by the public are published on Flickr. Fingrid's Instagram account meanwhile is more free-format, though still focuses on image sharing.

Interested? You can find Fingrid's social media channels and related links on the company's website by clicking Company/Contacts.

Transparency regulation to increase electricity market data

Since the start of the year, a regulation which increases transparency on the European electricity markets has set new obligations for electricity market actors concerning the publication of market data.

Issued by the European Commission, the regulation concerning an increase in transparency came into effect on 14.6.2013 and a website publishing market data was opened after an 18 month transition period at the start of 2015. The website can be found at the address **https://transparency.entsoe.eu**.

Finland and the other Nordic countries have been trailblazers when it comes to publishing electricity market data. New to the Nordics is the hourly production information for production units in excess of 100 megawatts, which is published at a delay of five days. Also new are production energies published per hour, by type of production and by country. Publication takes place at a delay of one hour. In addition, all European grid network companies will publish longer-term consumption forecasts and more detailed data concerning congestion management procedures, reserves and the balancing power markets.

Fingrid aims to forward on market data effectively and in a manner that causes minimal burden to market actors. Data will primarily be gathered from existing source systems, from which Fingrid will forward data to ENTSO-E's website.

The transparency regulation, a manual of procedures to supplement the regulation and instructions concerning the publication of market data can be found on Fingrid's website in Finnish at fingrid.fi by clicking Asiakkaat > Sähkömarkkinainformaatio.

Long-term work towards zero accidents

For several years, Fingrid has paid special attention to occupational safety and its development.

Occupational safety on Fingrid's sites has improved significantly thanks to an occupational safety development project launched in 2011. In 2014 the level of occupational safety was higher than in previous years. The combined accident frequency of Fingrid's personnel and service providers was 6 (incidents per one million working hours), and no serious accidents at work resulting in over 30 days of incapacity to work took place at all.

Nevertheless, there are still plenty of challenges when it comes to occupational safety. In early 2015 several accidents at work leading to absence took place on Fingrid's sites, as well as serious dangerous situations which could have been prevented by paying more attention to safety attitudes, the efficient flow of information and the safe planning of work.

We are still working to promote safety. In 2015, the occupational safety development project will focus on large entities, such as safety management, orientation, risk assessment, orientation and the development of reporting. All accidents can be prevented through proactive safety work.

Memoirs of transmission line professionals to be published

Hannu Ylönen's memoir "Ammattina voimajohdot. Lentojätkästä voimajohto-ammattilaiseksi" will be published in May.

Ylönen's memoir will focus on the transmission line industry's development phases from the late 1940s onwards. The book outlines the grid network's phases from planning, construction and maintenance perspectives, and features interviews with around 120 professionals. Ylönen has made a nearly 40-year career with Fingrid and Imatran Voima. The memoirs are published by Fingrid Oyj.

IN BRIEF

Fingrid's annual report and financial statements 2014:

Major investments continued, finances on a stable foundation

The financial year 2014 was a success for Fingrid. Despite major capital expenditure in recent years, Fingrid's finances are on a stable foundation. Profitability development was strong and, from an operational point of view, the year was excellent. The consolidated turnover amounted to EUR 567.2 million and profit for the financial period to EUR 106.5 million. Finland's national grid achieved excellent operational reliability.

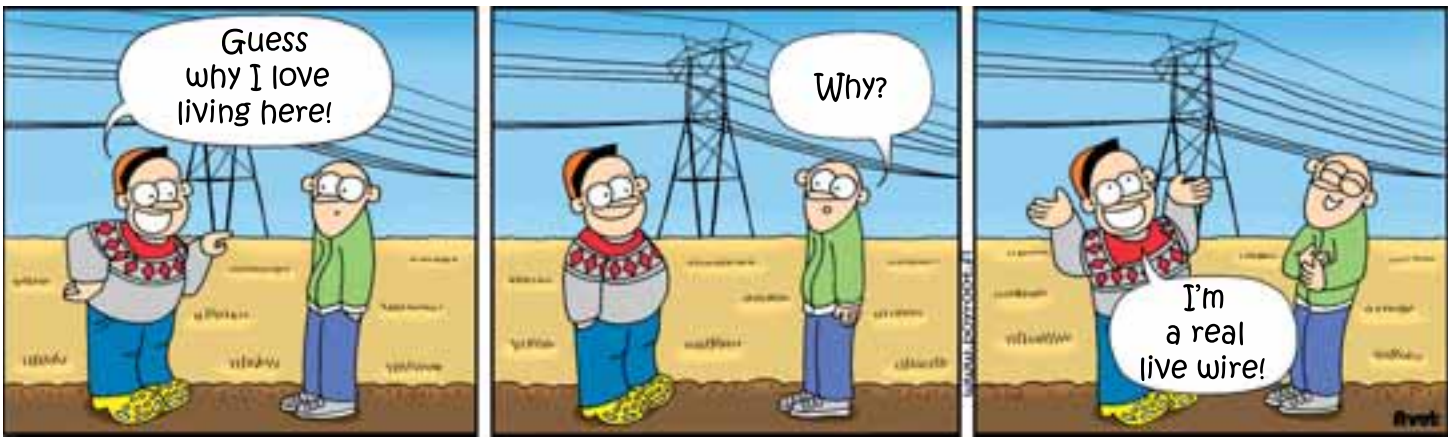
Fingrid's credit ratings remain among the top company ratings in Finland. The creation of shareholder value and customer focus is well balanced. The company's dividend payout capacity complies with the targets set by the owners, while grid fees are among the lowest in Europe. Fingrid is one of the best Finnish companies as a payer of corporate income tax. Grid fees were lowered by nearly 50 per cent in December 2014, and for 2015, it was decided that grid fees will be decreased by an average of two per cent of the 2014 level. Overall, the customers were very happy with Fingrid's operations.

Cross-border connections have been a major focus of capital expenditure during the recent years. In 2014, Fingrid also invested heavily in the modernisation of the Ostrobothnian grid system and East–West transmission connection. The growth of renewable energy in Finland is apparent in Fingrid as well, with a high number of wind-power-related substation projects under way.

As the electricity market continues to develop, Fingrid has, in addition to its traditional role as a wholesale market developer, assumed a more prominent role in the development of retail markets. These efforts include enhancing the exchange of information and developing balance services. A concrete example of this is the proposal of a Finnish data hub for future information exchange, the realisation of which would signify a major step in the digitalisation of electricity retail markets.

Fingrid's annual report can be found in Finnish and in English at **http://annualreport.fingrid.fi**.

Lines over Ostrobothnia



WEATHERING THE CLIMATE

Liisa Rintaniemi is MTV News' meteorologist and will examine the factors behind recent weather conditions in this column.

The non-winter

Last year's winter was like an unnoticed guest, popping in for a flying visit and leaving without much of a trace. In much of the country we had to wait until the turn of the year for colder weather, and meteorological spring began soon after mid-February in the southern and central parts of the country. In the more densely populated areas of Finland, winter passed us by in a non-eventful manner, with just small cold snaps and modest snowbanks. Those cross-country skis so many of us bought a couple of years ago remain confined to the shed. Last winter was characterised by a lack of long-term areas of high pressure, which often bring with them plummeting temperatures and the highest national levels of electricity consumption.

The winter of 2013–2014 was also exceptionally mild in the majority of the country. The media gives plenty of attention to meteorological oddities which occur in two consecutive years. We start to wonder if it will even become a permanent occurrence. From a meteorological perspective, however, it's irrelevant whether or not the phenomenon in question occurs in consecutive years; it's far more interesting to check periods of decades and search those for trends instead.

Why have recent winters been so mild, and where have our long periods of sub-zero temperatures gone? Meteorologists often explain the situation by examining the prevailing weather conditions on a larger scale: An area of low pressure over the North Atlantic has sent us mild weather from the Atlantic Ocean. Air flow from the west has also provided optimal conditions for the occurrence of Foehn winds. The warm Foehn wind which blew over the Norwegian mountains to Sweden and Finland at the end of February served as the first herald of spring.

But examining large-scale weather conditions only answers some of our questions. Exactly why this type of weather has been so prevalent remains unanswered. Science is not yet able to give us a certain answer. It could just be pure coincidence. On the other hand, the intricacies of the atmosphere, sea, and permafrost are only just becoming clear to us. Various factors are connected to one another with invisible thread, and when one changes, it can shake things up and put another factor in a different position. As the climate undergoes change, it is increasingly important to understand these connections. For Finland, the amount of snow and ice cover in the Nordic countries and surrounding areas is proving to be one of the most significant variables. It's beginning to dawn on us how the drastic reduction of sea ice in the polar region of the northern hemisphere affects the climate. Recent studies have indicated that open water in the Barents Sea to the northeast of Finland may increase southwesterly flows in Finland and western Russia, in which case our weather would become warmer not only because of the atmosphere, which is already warming up overall, but also by our climate becoming more maritime.

Although we know that the climate is warming up, no-one can promise that cold periods will disappear entirely. We must continue to prepare for long periods of extreme cold. They will still be part of the Finnish climate in the future, even if they become rarer. We must also remember that while the last two winters in Europe were mild, North America and Asia saw colder than average winters. Will they swap over again next year? ■

GRID QUIZ

Competition to the readers of Fingrid Magazine

Answer the questions below and send your reply by fax (number +358 (0)30 395 5196) or mail to Fingrid no later than 31 May 2015. Address: Fingrid Oyj, PL 530, 00101 HELSINKI, FINLAND. Mark the envelope with "Grid Quiz". Participants have the chance to win three weather stations. Answers to the questions can be found in this issue.

1. According to calculations by Sweco Ympäristö Oy, how many people does the wind power industry employ in Finland?

- Approximately 800 people
- Approximately 2,200 people
- Approximately 3,100 people

2. Who or what represents Finland in the comitology process wherein EU member states approve network codes?

- Fingrid Oyj
- The Ministry of Employment and the Economy
- Finland's European Commissioner

3. How many account holders operate in Finextra's guarantee of origin register?

- 31
- 74
- 270

4. A demand-side management pilot project featured in this issue mentions a participating company, but what industry does that company operate in?

- Baking
- Supermarket
- Frozen storage

5. How much will the municipality of Ii save in one year after changing the heating system in three schools from oil heating to geothermal heat?

- € 40,000
- € 65,000
- € 85,000

6. Why are white storks causing a headache in Estonia?

- According to folklore, if a white stork nests on the roof of a house, it brings bad luck to the household.
- The storks cause disturbances in electricity transmission as they fly into transmission lines.
- Their faeces cause disturbances if it accumulates on the insulators of transmission towers.

7. Why ccould the solar eclipse cause problems for the power system in areas which make use of lots of solar energy?

- We needed more lighting than usual during the eclipse, and this increased consumption.
- Individual countries' peak load capacity was insufficient to cover the amount of solar electricity lost during the eclipse.
- Changes in power caused by the solar eclipse are sudden and abrupt.

Prizes for the previous Grid Quiz (3/2014) have been sent to the following winners who answered correctly: Jani Pulli, Nakkila; Mikko Vehniäinen, Vaala; Jukka Rajala, Tampere.

FARMARI
JOENSUU 2.-4.7.2015

See you in Joensuu!

Fingrid will be participating in the Farmari agricultural fair in Joensuu 2–4 July 2015.
You are welcome at our stall to discuss transmission lines and their impact on your environment.
Our experts will be there for you.

Fingrid Delivers. Responsibly.

FINGRID OYJ

Läkkisepäntie 21, FI-00620 • P.O. Box 530, FI-00101 Helsinki • Tel. +358 30 395 5000 • Fax +358 30 395 5196 • www.fingrid.fi

Hämeenlinna
Valvomotie 11
FI-13110 Hämeenlinna
Finland
Tel. +358 30 395 5000
Fax +358 30 395 5336

Oulu
Lentokatu 2
FI-90460 Oulunsalo
Finland
Tel. +358 30 395 5000
Fax + 358 30 395 5711

Petäjävesi
Sähkötie 24
FI-41900 Petäjävesi
Finland
Tel. +358 30 395 5000
Fax +358 30 395 5524

Rovaniemi
Teknotie 14
FI-96930 Rovaniemi
Finland
Tel. +358 30 395 5000
Fax +358 30 395 5611

Varkaus
Wredenkatu 2
FI-78250 Varkaus
Finland
Tel. +358 30 395 5000
Fax +358 30 395 5611