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Fingrid Oyj 1/2014

FINGRID

Market integration progressing in leaps and bounds

The Virtuosi del Futuro youth orchestra entertained guests at the inauguration of EstLink 2 at the Haikko Manor.

FINGRID

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Cover photograph: EstLink 2 inauguration held simultaneously in Finland and Estonia on 6.3.2014. Raising a toast to the new connection were Fingrid's CEO Jukka Ruusunen, host Peter Nyman and Minister for International Development Pekka Haavisto, as well as Elering CEO Taavi Veskimägi who participated from Püssi, in Estonia.
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In this issue

EDITORIAL

Flexibility on the electricity markets

There are challenges ahead for the European electricity markets. The main reason is that the electricity system is undergoing one of the greatest changes in its history. In particular, there is a wish to significantly and rapidly change the structure of electricity production – faster and in a different direction than it is believed the markets would take it. This change is directed and steered by society, bypassing the market mechanism, which attempts to keep functioning in an increasingly narrowing niche.

Renewable energy is being added to the system via massive funding. System (and consumer) costs are on the increase, but the wholesale market price of electricity is decreasing. Traditional electricity production is becoming less viable and plants are having to close. However, they are sorely needed as wind and solar power fluctuate greatly and require backup production as a counterbalance.

As such, debate is under way as to whether it's worth paying to keep traditional production going. Originally, the energy sector was supposed to be for business activities, but it is rapidly becoming a black hole for state aid, as was the case for agriculture.

The market mechanism will still be needed in the future to balance production and consumption as effectively as possible. Renewable energy also requires an effective distribution channel – that is, markets – and a method of mobilizing other production when there is no wind or during cloudy weather. Therefore, the market model which has been agreed upon in the EU should extend from Western Europe to the entire continent.

The model requires some supplementation, however, as conditions have changed since the early days of the markets in 1990. Flexibility seems to be becoming a key word. Electricity production is fluctuating increasingly, as could also happen with consumption as things such as electric cars become popular. The entire power system is required to bend and stretch, be it consumption, production or the grid.

Electricity consumption nowadays does not really demonstrate flexibility by reacting to the price of electricity, with the exception of heavy industry loads. Demand response has been discussed for decades, but it is only now that developments in technology appear to be making this a reality, and not just for medium-sized corporate consumption, but even for households. Fingrid is launching several pilot projects with companies with the aim of using consumption loads in real-time system power balancing. More consumption bids have also come on to the balancing power markets, and hopefully we will see the same development on the spot and intraday markets.

A strong transmission network and sufficient connections with neighbouring countries are requirements for market flexibility. In surplus situations, the excess electricity can be sold elsewhere and in defecit it can be procured from outside. In the Nordic and Baltic countries, this works relatively well. Russia is more of a problem, where cross-border trade is volatile every day. However, this fluctuation is not caused by supply and demand on the markets, but instead by capacity market fees set by the Russian administration.

The most difficult question is how to ensure sufficient flexibility in electricity production. Poor profitability is a threat to capacity in many European countries, and a capacity remuneration mechanisms are under consideration. Unilateral national mechanisms can, however, pose an obstacle to effective European energy markets, and the Russian border is a good example of this. It is worth approaching the matter cautiously and targeting possible supportive measures at the subset of plants which are the most vulnerable and flexible. Sweden's and Finland's strategic reserve is an example of such a selective arrangement which disrupts the markets as little as possible. The European Commission, among others, supports it as one possible transitory solution.

Juha Kekkonen is Fingrid Oyj's Executive Vice President

EstLink 2 to connect the Baltic markets to the Nordic countries

The EstLink 2 connection is of great significance to the Estonian electricity markets, which opened up one year ago. "Alone, Estonia is too small a market area. "EstLink 2 is an important step towards functioning electricity markets," says the Estonian Minister of Economic Affairs and Communications, Juhan Parts.

TEXT SUVI ARTTI
PHOTOGRAPH MARKO MUMM

Inaugurated in early March, EstLink 2, the second direct current connection between Finland and Estonia will increase the electricity transmission capacity between the countries from 350 megawatts to 1,000 megawatts. Juhan Parts, the Estonian Minister of Economic Affairs and Communications, considers the new connection to be a fine demonstration of successful cooperation between Finland and Estonia. "We have had a good mutual understanding ever since project planning began in 2009, and we've made progress from there."

According to Parts, EstLink 1 and 2 are currently the only truly functional connections from the Baltic countries to the European markets. Two other connections are also under construction: the NordBalt connection between Lithuania and Sweden, and the LitPol connection between Lithuania and Poland. Once complete, these will link the Baltic countries even more closely to the Nordic and Central European electricity markets.

For now, there is still congestion within the Baltic markets. "Usually electricity runs from Estonia towards Latvia, which can result in congestion between the two countries. That's why we're investing in new cross-border connections," explains Parts. The situation will ease when a third connection between Estonia and Latvia is completed by 2020 and the transmission capacity between the countries will rise from 700 megawatts to 1,200 megawatts.

New connection to increase trust in electricity markets

According to Juha Parts, the widening of the electricity markets will have a positive impact on the Estonian national economy. "The availability and price of electricity are vitally important to competitive ability. A successful market arrangement brings stability, which is important for new investments."

Parts believes that a wider market area will increase both consumers' and investors' trust in the electricity markets. "No-one knows how the price of electricity will develop. For example, in the USA the price is fairly low, but in Germany it's high. In the Nordic countries, electricity is currently very affordable. If the markets function well, however, the price is correct and fair in any case."

In addition to consumers, Estonian electricity producers can also benefit from open markets if the producers' prices are competitive. It's probable that investors will dare to invest in new production facilities once the markets widen. "We have lots of unharnessed, renewable energy such as wind power, and technology is developing all the time. All new investments require sufficiently wide markets, →

ESTLINK 2

- 650 megawatt direct current connection between Finland and Estonia. Estlink 1 (350 MW) was completed in 2006.
- Total length approx. 170 km: 14 km of overhead line in Finland, 145 km of submarine cable laid along the Gulf of Finland seabed, 11 km of underground cable in Estonia.
- There will be transformer stations at both ends of the link, used for converting direct current to alternating current and vice versa. In Finland the point of connection to the grid is at the Anttila distribution substation in Porvoo, in Estonia the point of connection is at Püssi distribution substation in the east.
- The connection was handed over to owners and taken into commercial use on 7 February 2014. Available to markets during the trial use period 6.12.2013–6.2.2014.
- The connection is jointly owned by the Finnish and Estonian main grid companies Fingrid and Elering.
- Total budget approx. EUR 320 million. Costs are divided between Fingrid and Elering.
- The project received EUR 100 million of investment support from the European Union.
- Main contractors are Nexans Norway AS, Siemens AG and Siemens Osakeyhtiö, Empower Oy and Bouygues Energies & Services.

and this is where EstLink 2 is of great importance," says Parts.

The Estonian markets opened up in 2013

Estonia's electricity markets were opened up entirely at the start of 2013. The transition to the new system took place in phases: in 2010 the markets were freed up by 35%, as large-scale consumers were permitted to put their electricity procurement out to tender. Since the beginning of 2013, all electricity produced in Estonia has been sold through Nord Pool Spot.

"When moving to market prices, the price of electricity rose: the regulated price was EUR 32/MWh, while the average Nord Pool Spot price for 2013 was EUR 43/MWh. There was discussion in Estonia as to whether the price could even be considered a market price, as the market area itself is so small. Fort his reason, EstLink 2 is an extremely important improvement. In practice, Estonia and Finland are now the same market area all the time."

Juhan Parts points out that the opening up of markets was not a factor affecting the rise in price; since 2013 Estonia has no longer received concessions on emission allowances, and instead the country's production facilities, which mainly use oil shale, have had to pay for their carbon dioxide emission allowances.

The minister explains that the opening up of markets went very well, despite the significant change for consumers. "Up to 75 per cent of all households made a new electricity contract immediately in January 2013, which meant the consumers had to learn new skills: selecting an electricity provider and familiarising themselves with various kinds of contract."

Self-sufficient through oil shale

Estonia has long been self-sufficient with regard to electricity production, and in recent years the country has often exported more electricity than it has imported. The country's electricity production is largely dependent on fossil fuels: a total of 85 per cent of electricity produced in Estonia is from oil shale.

Juhan Parts believes that oil shale can be used responsibly. "Fossil fuels are not necessarily bad by default, just as other methods of energy production are not necessarily good by default. Oil shale production should be developed further to become more environmentally friendly. The utilisation of local natural resources is also in line with EU principles."

Despite the country's self-sufficiency, EstLink 2 will have a significant impact on Estonia's security of supply. "The EstLink connections' 1,000 megawatt transmission capacity corresponds to the average daily consumption of electricity in Estonia. If one of our power plants encounters disruption, the connections will ensure that there's enough electricity," says Parts.

The same terms to apply to electricity from outside the EU

According to Parts, the development of Latvia and Lithuania's markets is important for the development of the Baltic electricity markets overall.

"We have implemented a policy whereby all electricity produced in Estonia is sold through Nord Pool Spot. This is vital to the liquidity of the electricity exchange. In Latvia and Lithuania the situation is different: they still have many bilateral agreements, price regulation and support systems. As such, the market is not yet working based on completely shared principles," says Parts. He points out that all Baltic countries have stated their willingness to create functioning electricity markets combined with the Nordic markets.

One topic which is causing lots of discussion in the Baltic countries is the import of electricity from non-EU countries. Latvia and Lithuania import lots of electricity from Russia and Belarus, which naturally has an effect on the countries' electricity markets.

"Lithuania, for example, imports over 50% of all electricity consumed in the country from Russia. We certainly don't wish to prohibit the import of electricity from outside of the EU, but it should be produced on the same terms and according to the same environmental standards as it does within the EU," Parts stresses.

He also points out that for Baltic countries this is a bigger issue than for Finland. "For historical reasons, we have so much physical transmission capacity to Russia that it would be possible to import all electricity consumed in Estonia from Russia. In Finland the corresponding share would be just 10 per cent."

Parts believes that the EU should clarify its policies concerning electricity coming from third-party countries so that the electricity imported does not affect fair competition or market openness.

Estonia, Latvia and Lithuania are all part of the same electricity system as North-West Russia. According to Parts, cooperation between Estonia and Russia is pragmatic. "Cooperation with regard to gas is also pragmatic and we have no problems with availability. On the other hand, the price is high and the market system is a monopoly."

In the long-term, the Baltic countries intend to desynchronise their electricity system from the Russian one and join the Central European system.

Balanced electricity price, environmental impact and security of supply

Juhan Parts says that Estonia admires the EU's work concerning the development of gas and electricity markets. Increasing energy-efficiency and expanding the markets are important objectives for Estonia. According to Parts, the Baltic Energy Market Integration Programme, subordinate to the EU commission, has been effective and has improved practices.

"It's important to keep a balance between the price of electricity, environmental friendliness and security of supply. The promotion of environmental issues cannot come at the expense of security of supply or competitive ability," he explains. Parts believes that EstLink 2 represents all three; environmental friendliness will improve through new investments, since investments bring stricter environmental standards.

It is also important for Estonians that the EU takes into account the region's special characteristics when drawing up energy policies. Parts points out that Estonia uses oil shale responsibly, just as biomass is used responsibly in the Nordic and Baltic countries. ■

Top marks for cooperation

Cooperation between the Finns and Estonians on the EstLink 2 project was excellent, said Fingrid's CEO Jukka Ruusunen and Taavi Veskimägi, CEO of the Estonian grid company Elering. The CEOs answered questions concerning the connection's effects on consumers and electricity markets.

How was cooperation between Fingrid and Elering on the EstLink 2 project?

Taavi Veskimägi: "We stuck to a schedule which was planned five years ago. This shows that the project groups from both companies carried out excellent work and understood each other completely. Full marks for cooperation."

Jukka Ruusunen: "Cooperation has been excellent. Trust was established right at the start of the project. Our contractors have carried out brilliant work. 10 points out of 10."

How important of a role does the connection have in ensuring the security of supply of electricity to Finland and Estonia?

TV: "EstLink 2 plays a crucial role as far as the security of electricity supply is concerned in both countries. For example, the average electricity consumption in Estonia was about 900 MW last year, so Estlink 1 and EstLink 2 combined can cover the total Estonian electricity demand most of the time."

JR: "The connection will improve the security of supply of electricity in both countries. During the peak consumption hours in Finland in the winter of 2014, electricity was transmitted from Estonia to Finland."

Is one risk of market expansion a rise in electricity bills for Finnish and Estonian consumers?

TV: "On the contrary. The first three months have shown that EstLink 2 has significantly reduced the price of electricity in Estonia. Better connections stabilise prices throughout the entire area."

JR: : "The expansion of markets makes the markets' functionality more efficient, and this in turn benefits consumers."

Will EstLink 2 increase congestion between Estonia and Latvia?

TV: "Since the completion of EstLink 2, congestion has moved to the border between Estonia and Latvia. This situation will ease up once a third connection between the countries is completed in 2020."

JR: "In the short-term, yes. In the long-term, new planned network reinforcements should reduce congestion. Electricity markets are incredibly effective in highlighting congestion - not apparent in closed systems - on the transmission network."

What are the next significant steps in market integration?

TV: "The harmonisation of market rules in the Baltic area, the completion of the NordBalt cable between Sweden and Poland, the third connection between Estonia and Latvia, a move away from the Russian electricity system and move towards becoming a party of the Central European system."

JR: "On a European level, we created the world's largest electricity market in February 2014! The Baltic Sea region is naturally a part of this process. Market functionality can be made more efficient in Latvia and Lithuania. There is also potential in the integration of balancing power markets and reserve markets in the entire Baltic Sea region. The planned new transmission connections are taking integration further."

"A wider market area will increase both consumers' and investors' trust in the electricity markets."

Minister for International Development Pekka Haavisto and Fingrid's CEO Jukka Ruusunen symbolically switch on the EstLink 2 connection at the Finnish end.

Inaugurations on both sides of the Gulf of Finland

EstLink 2 was officially inaugurated on the sixth of March. Inauguration ceremonies were held simultaneously in Porvoo, Finland and in Püssi, Estonia. A videolink connected the two celebrations.

TEXT SUVI ARTTI | **PHOTOGRAPHS** RIKU ISOHELLA, ANNIKA HAAS

In Püssi the connection was inaugurated by Elering's CEO Taavi Veskimägi and the Estonian Minister of the Environment Keit Pentus.

The inauguration of the new direct current connection attracted media interest in both Finland and Estonia.

Fingrid's CEO Jukka Ruusunen stated that EstLink 2 is a significant connection for both countries.

In Estonia, the inauguration was attended by representatives from all the Baltic countries. Shown are Daivis Virbickas, Robertas Staniulis and Liutauras Varanavicius from Lithuania's grid company Litgrid.

Around one hundred representatives of Fingrid's interest groups participated in the celebrations at the Haikko Manor.

In Estonia, the inauguration was held in the north at the Püssi transformer substation where the cable connects to the Estonian main grid. Elering's CEO Taavi Veskimägi.

Developing information exchange

In order for electricity markets to function efficiently, it must be possible for information to travel between various parties smoothly. The Electricity Market Act tasked Fingrid with the responsibility of developing the exchange of information, and Service Manager **Minna Arffman** has risen to the challenge.

TEXT OUTI AIRAKSINEN | PHOTOGRAPH JARI LAINE

When Minna Arffman began work at a local electricity company in her home region of Kajaani in the late 1990s, information concerning a customer's change of supplier was still sent by fax. Many things have changed in the electricity markets in the last decade or so, and the amount of data has increased dramatically.

Since the arrival of remote electricity meters, hourly electricity consumption information has been sent from Finland's approximately 3.5 million electricity consumption locations every day – and significant amounts of other data are also transmitted between electricity market parties.

Though the exchange of information on the electricity markets has seen rapid development, new services and increasing requirements will mean the need for ever more efficient information exchange and its utilization. Last autumn, the Electricity Market Act tasked Fingrid with the responsibility for the development of the exchange of information, and Fingrid responded by hiring Minna Arffman to establish and develop a new information exchange service.

"It's a unique opportunity to be involved in developing this kind of service. I can look at things from a range of perspectives and make use of everything I've learned and experienced until now," says Arffman.

The development of electricity market information exchange on a national level was a challenge from which even a newly-built single-family home in Viiala couldn't tempt her away.

A dash of old, plenty of new

Although the information exchange service is a completely new line of business for Fingrid, the company has not had to start from scratch. Other services which were until now taken care of by other parties have been made Fingrid's responsibility and include testing and certification services, meeting point database, contact information table and technical guidelines for the exchange of information.

"Instead of simply transferring the services, we also want to develop them. We took on the meeting point database service from Adato Energia without any modifications, but early this year we will be gathering information from electricity market actors on how the database can better serve them. Interviews with market parties are also under way concerning research into a datahub. The interviews are sure to provide us with feedback on information exchange, and I intend to immediately make use of the information in my own development work," explains Arffman.

The new distribution of work between Fingrid and the Finnish Energy Industries may cause a little confusion to begin with, but Arffman believes that the transition stage will remain short.

"Everything will become clearer once operations get started. If any questions are directed to the wrong party at first, it's no bother, since we work in close and successful cooperation with the Finnish Energy Industries," says Arffman.

In the future, Fingrid will be responsible for technical instructions of message exchange, but expertise relating to business processes will remain with the Finnish Energy Industries.

This spring, Arffman will focus first and foremost on the initiation and development of services, which in practice refers to gathering feedback and ideas from the field through meeting and interviewing electricity market actors and by participating in various working groups. As part of the development of information exchange, Fingrid will also research the establishment of a centralized database solution, known as a datahub.

Nordic regulations and standards concerning messaging will be taken into account during the development of the service, and these regulations and standards will allow for the establishment of common Nordic end-user markets in due course.

Arffman is forming an information exchange committee consisting of Finnish actors in the industry. The group will examine information exchange issues together with industry experts.

"If, for example, an actor contacts us and asks for information on how to proceed with a matter not set out in instructions, the matter will be dealt with by a group of industry experts. Then the group will issue the same recommendation to all parties," says Arffman.

Though Fingrid is bound by law to monitor compliance with messaging standards and codes of practice, Arffman points out that parties should also engage in discussion with one another in the future.

"If a party notices that it has received erroneous data, it should first contact the sender. If the contact does not produce results, and the error causes significant manual work and costs, for example, we are happy to help clear up the problem," explains Arffman.

Agreements due this year

Information exchange services will be launched by summer. Towards the end of the year, Fingrid will draw up service agreements with all electricity market actors concerning the information exchange service, and the terms of agreement will be approved by the Energy Authority.

For Arffman, early 2014 is jam-packed with travelling as she attends meetings around Finland and the Nordic countries. "In February I spent almost 50 per cent of my working hours on the road, but I don't mind at all. I just find this so interesting," she says.

Last autumn, Arffman was still the only employee working in Fingrid's new service, but another expert, **Lauri Jännes** joined the team this year.

"I believe that we'll remain a small but efficient expert team, working to face information exchange-related challenges. We encourage people to contact us with questions or ideas for development concerning information exchange," Arffman says.

The team is also responsible for the distribution of information, and Arffman regularly puts together new material and links to the information exchange service on the Fingrid website.

To counterbalance her work, Arffman spends time with her dogs, who take up a lot of her free time. "I'm quite easily enthused. I enjoy trying out new things in my free time – and sometimes you have to take risks at work, too," she says. ■

The information exchange service will be launched in spring. Further information on the service will be updated on the Fingrid website www.fingrid.fi (Frontpage -> Customers -> Information exchange services).

WHO?

Minna Arffman

Age: 40

Home and family: Built a single-family home in Viiala, Akaa, together with her partner two years ago. Due to a long commute, she is now looking for a home nearer the capital region. She has a 17 year old son, Joonas, and three dogs.

Education: Vocational Qualification in Business and Administration, has completed courses in e.g. supervisory work and management. Learning about information exchange takes place through experience and active participation in industry operations.

Career: Worked at Loiste Oy (formerly E.ON Kainuu Oy) and at Elenia (formerly Vattenfall Verkko Oy) for 10 years in positions including leader of an electricity market information exchange team. Came to Fingrid last September to launch a new information exchange service.

Free time: Enthusiastic dog lover (participates in dog shows and a wide range of canine activities). She owns an American Staffordshire Terrier, Masi, and two Greater Swiss Mountain Dogs Iitu and Cava.

Motto: Where there's a will, there's a way (you can always find a way around obstacles).

Datahub would gather market information in one place

Should Finland change its electricity retail market information exchange from the existing decentralized system to a centralized model, known as a datahub? This year, a project is under way at Fingrid to investigate cooperation with various electricity market actors.

Currently, information exchange makes use of EDI (Electronic Data Interchange), which refers to the transfer of formatted data from one computer to another. "Though 80 per cent of information exchange works well, the current system experiences errors which have to be corrected manually. In Finland, which has around 3.5 million metering points, the rethinking of the process, and centralization of information and operations can be profitable if we can just shave off a few per cent of the errors," says Fingrid's **Pasi Aho**, who is the project manager responsible for the datahub investigation.

The idea is for the datahub to act as a centralized data storage location, where market actors can submit and receive information concerning retail markets. It will be possible to carry out automatic operations to further refine information in the datahub.

"The datahub will be able to do things which benefit all electricity retailers and network operators. Using open interfaces, an external service provider can also begin to offer targeted services to industry actors," says Aho.

There are currently 17 datahubs worldwide, of which the closest to Finland are located in Estonia and Denmark. The Ministry of Employment and the Economy will make a decision on the construction of a datahub in Finland in due course.

Suomen ensimmäinen 400 kV voimajohto valmis ensi kesän

Nopeata ja tehokasta pylväiden pystytystä

Suomen ensimmäinen, 400 kV:n jännitteellä toimiva voimajohto valmistuu koko pituudeltaan ensi kesänä, ja syyskesällä voidaan sähkön siirto Lapin porteilta maan eteläosien teollisuus- ja kulutuskeskukseen aloittaa tällä uudella jännitteellä, joka on kaksi kertaa niin suuri kuin korkein maassamme tähän mennessä käytetty.

Imatran Voima Oy järjesti päätyneen viikon alkana lehtimiehille kaksipäiväisen retkeilyn Vilpulan—Ruoveden maastoon, missä tutustuttiin mainitun voimansiirtojohdon vastimpiin pylväiden kasaus- ja pystytystöihin. Retkeilyä esiteltiä vakuuttavasti, että tästä

Hyvinkäällä valmistuu muuntoasema

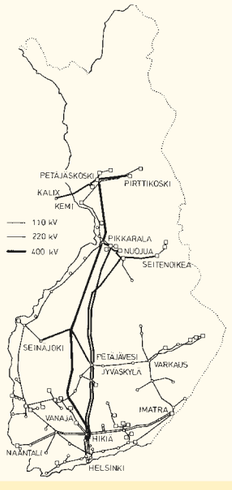
— Huhtikuun loppuun mennessä oli Hyvinkään muuntoaseman rakennustyössä tehty noin 215.000 työtuntia. Työtä on vaikeuttanut Etelä-Suomen oloissa poikkeuksellisen pitkä ja ankara talvi, mutta lisäksi ovat myös muuntoaseman masperäisubteet tuottaneet hankaluuksia. Kuitenkin ovat työt edistyneet niin, että ne voitaneen saattaa varsinaisten rakennustöiden osalta päätökseen suunnilleen aikataulun mukaisessa järjestyksessä.

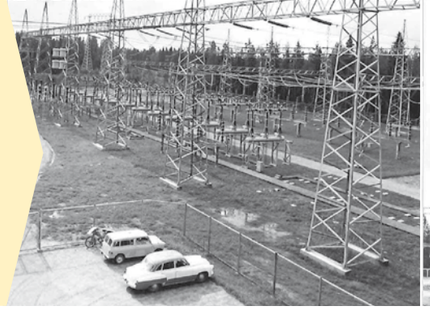
Edellä olevan kertoi Voima-Viestille Hyvinkään muuntoaseman rakennustyön työpäällikkö, ins. O. Murtomaa voimayhtiöiden pääkonttoorista.

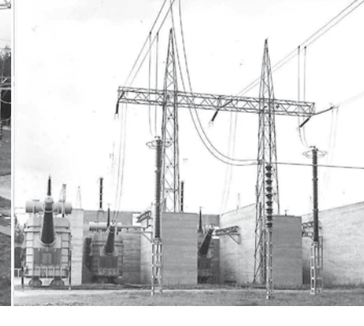
— Rakennusaineita on talvisen rakennuskauden kuluessa käytetty seuraavat määrät, jatkoi ins. Murtomaa: soraa 35.000 m³, sementtiä noin 17.000 pussia ja puutavaraa noin 210 standerdi-

Viemäri- ja vesijohtoverkko on tähän mennessä saatu kutakuinkin valmiiksi. Alueelle johtava pistoraide on valmis cräitä viimeistelytehtäviä lukuunottamatta. Myös pääkiten runko on valmis. Muuntoasemarakennus on pääosiltaan valmiina ja sen viimeistelytyöt ovat menossa. Henkilökunnan asuinrakennus on niinikään valmis. Ulkokytkinkentrien betonivalut ovat suurimmaksi osaksi suoritetut. Toukokuun puolivälissä, jolloin tässä haastattelu tehdään, on rakentamatta enää joitakin ulkekentiille johtavia kaapelikanavia. Samoin on tietenkin tekemätä kenttien tasaus- ja viimeistelytyöt, mutta ne jäävätkin siksi, kunnes sähköosasto on asinut pystytyn omat varusteensa.

Tämän kesän rakennustyöohjelmassa on talousrakennuksen rakentaminen. Tätä ei kuitenkaan vielä ole voitu aloitaa. [illegible]







Hyvinkää's substation to enjoy well-deserved retirement

The Hyvinkää substation was decommissioned last year. Built in 1959, the substation has lived through significant phases in the history of Finnish electricity transmission and grid development.

TEXT MIRA MUURINEN
PHOTOGRAPHS SÄHKÖMUSEO ELEKTRA, HYVINKÄÄN SANOMAT

Left: Articles from Uusi Suomi and Voimaviesti on the construction of the new power line and distribution substation.

Above: The Finnish grid in 1960.

Top right: The transformer substation building at Hyvinkää in July 1961.

Bottom right: The 220 kilovolt field and main transformer with back-up units in July 1961.

The Hyvinkää substation was Finland's first 400 kilovolt transmission line terminal station in southern Finland. The northern end of the line was located at Pikkarala in Oulujoki, from where the 400 kilovolt network continued via Petäjäskoski in Kemijoki to Pirttikoski.

The Hyvinkää substation was commissioned in 1960 when a 400 kilovolt voltage was connected to the Pirttikoski–Petäjäskoski–Pikkarala–Alajärvi–Hyvinkää line. Part of the 400 kilovolt line, the connection from Petäjäskoski to Pikkarala via Alajärvi, had already been in use at a voltage of 220 kilovolts. "The benefits of investments and much-needed transmission capacity were obtained faster this way," explains **Pekka Niemi**, security manager at Fingrid. He acts as the chair of the board of Elektra, which aims to preserve information and materials relating to electrical engineering.

The 400 kilovolt line runs uninterrupted for over 500 kilometres from Pikkarala to Hyvinkää and in its time, was impressive on both a Finnish and international scale. "One factor in the selection of the voltage was an example set by Sweden," explains Niemi. "There a 400 kilovolt voltage was taken into use in 1952. The Finnish and Swedish grids weren't connected with that same voltage until 1970 – prior to which the countries' grids were connected by a 220 kilovolt connection from Petäjäskoski to Kalix, completed in 1959."

At the Hyvinkää substation, electrical power obtained through northern hydropower was converted from a 400 kilovolt voltage to 220 kilovolts, which is more suitable for distribution and consumption. A 220 kilovolt connection ran from Hyvinkää to Hikiä and later on, to Tammisto, Virkkala and Naantali.

Significant reform

Niemi describes the design of Finnish power transmission as "quite an achievement". The production and consumption of electricity grew rapidly in a short period of time, so quick progress had to be made in power transmission: in 1960 it had been just thirty years since the commissioning of the first 110 kilovolt line.

The implementation of a more powerful voltage was a significant change for the Finnish grid, which had previously operated on 110 and 220 kilovolt power lines. The change allowed for remarkably more efficient electricity transmission along the north-south axis. "In the 1960s, northern hydropower produced so much energy that had the 400 kilovolt line not been constructed, we would have had to build several new 220 kilovolt lines, which would have resulted in larger power transmission losses and higher construction costs," Pekka Niemi explains.

Transformer substations, where the voltage was converted from 400 kilovolts to 220 kilovolts, featured autotransformers with a standard transformation ratio. One back-up transformer for each station was procured, which could be used to replace a phase unit if it encountered a fault. Along with the Pirttikoski substation, the Hyvinkää substation was the largest in Finland with regard to transformation capacity.

Before the implementation of the 400 kilovolt system, the effects of increasing the voltage and the transformers' function had to be gauged using meticulous network modelling. Lauri Mäkelä, a designer who began work at Imatran Voima Oy in 1958 remembers: "I was at Pirttikoski when the system was taken into use. I was especially interested in how well the results measured in the actual network corresponded to the network modelling. The congruence was extremely good. Implementation went well, and according to plan."

Part of the atom ring

In practice, the transmission of electricity from north to south using one 400 kilovolt transmission line connection was not entirely free from problems. A fault in one section of the line often caused major disruption throughout the entire network, as a result of which it could take hours for electricity to be returned all over the country. And outages were, of course, expensive.

In addition to security of supply, a sharp increase in electricity consumption also posed a challenge. Early on it was thought that the new 400 kilovolt line would be sufficient to secure the supply of electricity in Finland for a long time. "At first, plans were based on the backbone network of our grid being the 440 kilovolt network between northern and southern Finland, which would then be supplemented by the 220 kilovolt network in southern and central Finland," says Niemi.

As a result of increases in industrial production and export, at the end of the 1960s it was clear that the demand for electricity in Finland would grow faster than expected; between the start of the 1960s and the mid-1970s, electricity consumption had almost quadrupled. As a result, planning began in the 1970s to begin the supplementation of the 400 kilovolt network in southern Finland.

The result of this supplementary work became known as the atom ring. Large power plants from all over Finland were connected to it, including the Loviisa and Olkiluoto nuclear power plants. The transformer substation at Hyvinkää as such did not mark the end of electrification in southern Finland, but instead marked the start of a new phase.

Recent decades

The transformers at the Hyvinkää substation reached the end of their service life in the early 1990s and were decommissioned before the substation itself. In addition, the 220 kilovolt voltage had become unprofitable from a technoeconomic perspective. The Hyvinkää substation's transformation duties were taken over by the Hikiä substation in 1998, and the 220 kilovolt voltage was completely replaced with a 110 kilovolt voltage throughout southern Finland.

From 1998 to 2013, the Hyvinkää substation functioned solely as a connection station where lines branched off. Finally, in a project completed last year, the connection station too was transferred to Hikiä.

In the last ten years before its retirement however, the Hyvinkää substation still made history: the "H" frame for high-voltage lines which was decommissioned from the substation in 1999 was used as a frame for an ice and lighting installation designed by architect **Reijo Perko** and light designer **Tülay Schakir.** The piece, known as "Jääasema Fingrid" (Ice station Fingrid) was then the largest ice installation of its kind. Rather apt for an electricity substation which had been at the forefront of Finnish electricity transmission technology ever since it was commissioned. ■

Sources used in this article:

Archives from the Elektra electricity museum

Official Statistics of Finland (SVT): Energian hankinta ja kulutus [online publication]. ISSN=1799-795X. Helsinki: Statistics Finland [retrieved: 5.2.2014]. From: http://www.stat.fi/til/ehk/tau.html

Auer, Jaakko & Teerimäki, Niilo: *Puoli vuosisataa Imatran Voimaa. Imatran Voima Oy:n synty ja kehitys 1980-luvulle.*

Seppälä, Raimo & Hallila, Maria: *Yhteisillä linjoilla. Näkökulmia Suomen kantaverkon kehitykseen.*

The Hyundai plant area is extremely large. The plant which manufactures 400 kilovolt transformers, is circled in red.

Audits ensure device supplier responsibility

Fingrid has begun to audit the responsibility of its device suppliers.

TEXT OUTI AIRAKSINEN | **PHOTOGRAPHS** HYUNDAI AND EIJA ESKELINEN

To Fingrid, the order of three large transformers at just under nine million euros from the South Korean company Hyundai is an agreement to which it applied what is known as 'responsibility auditing' for the first time.

"We thought about responsibility in the early stages of the procurement. We decided to audit the candidate whose offer was best after a technoeconomic comparison," explains **Maria Joki-Pesola**.

There was no ready model for auditing device suppliers, so Fingrid came up with its own final auditing material, which takes into account the ISO 26000 responsibility standard, among other things.

"Even before then, we had a consulting agency carry out a report on the best practice for taking environmental responsibility into account in procurements," Joki-Pesola adds.

Fingrid's procurements are covered by the Act on Specialist Industry Procurements (Erityisalojen hankintalaki 349/2007), which outlines and provides guidelines on taking responsibility into account in procurements.

Auditing occupational safety, working conditions and environmental issues

Some suppliers were ruled out early on due to technical specifications as suppliers were required to have references concerning transformers delivered for use in sub-zero conditions. Of seven bidders who progressed to the offer phase, the South Korean company Hyundai Heavy Industries Co., Ltd. won the bid.

Before a final decision was made, Fingrid wanted to carry out the audit in order to ensure that Hyundai's transformer factory takes care of occupational safety, takes working conditions into account, respects its employees' rights and ensures environmental safety. The purpose of the audit was also to inspect Hyundai's management systems and its subcontracting chain management from a responsibility perspective. The audit was also justified since Hyundai is not only completely new to Fingrid, but is also from outside of Europe, meaning that EU regulations may pose challenges.

In addition to Maria Joki-Pesola, the project manager **Mika Väärämäki** and technical specialist **Timo Ojanen** also participated in the audit visit to Hyundai's production factory in South Korea.

The two-day, intensive visit to Hyundai's huge factory area, which employs tens of thousands of workers, began with an interview. Around twenty Hyundai managers responded to Fingrid's questions face-to-face. The Fingrid team also took a tour of the factory to see with their own eyes how the supplier's facilities took safety, working conditions and the environment into account in practice.

Social responsibility at a good level

"Around half of the work on a single transformer is carried out by hand, so the employees' wellbeing and, of course, safety issues, are a large part of the device delivery," explains Timo Ojanen.

Based on the audit, the employees' rights and occupational safety appear to be at a good level all round. The Hyundai factory area boasted exceptionally good occupational safety training facilities and an extensive orientation programme for new employees. Procedures for dealing with accidents and dangerous situations were systematic and the company's executive management was committed to minimizing accidents. In addition to interviews with the management and its own observations, the team also sought information by talking directly with employees.

"With the help of an interpreter, we asked questions about working conditions and working hours. Occupational healthcare, for example, was very well organized," explains Joki-Pesola.

With regard to ensuring subcontracting chain responsibility, however, the audit group found room for improvement.

Development needed for environmental safety

Though social responsibility matters at the Hyundai factory were in order, environmental responsibility issues were less familiar to the Koreans, and it was in this area that Fingrid found room for improvement. "We observed a few clear issues which require development with regard to chemical safety. When we pointed these out, the Koreans were satisfied and began to take action," says Joki-Pesola.

"It was surprising, since although Hyundai's market area is global, Fingrid was the first customer to carry out environmental auditing at the transformer factory. However, Hyundai's other customers had previously asked social responsibility questions – with regard to occupational safety and the use of child labour," Joki-Pesola adds.

"Hyundai took an open-minded approach to the audit and discussion was constructive," Ojanen says.

> "During a tour of the factory we saw how the supplier's facilities took safety, working conditions and the environment into account in practice."

A successful pilot projecte

The Hyundai audit was the first of its kind for Fingrid. It aims to use the experiences gained through the audit to further develop responsibility audits for device suppliers. →

An agreement on the purchase of transformers was signed at Fingrid. Shown here is CEO Jukka Ruusunen shaking hands with Young-Keol Joo. Behind them, from left to right are Dae Sung, Young Don Kim, Maria Joki-Pesola, Kari Kuusela and Mika Väärämäki.

Fingrid's entire personnel is involved in developing responsibility

In recent years, Fingrid has incorporated social responsibility in all its areas of operation. In line with state policies, Fingrid must provide public information concerning its responsibility. In addition to responsibility reporting, it also develops its working methods. In practice this is seen as actions such as cooperation with interest groups, occupational safety development, ensuring chemical safety, improvements in material efficiency and in participation in projects promoting natural diversity.

Work is guided by Fingrid's Code of Conduct, which each employee is required to comply with in his or her work. The Code of Conduct, approved by Fingrid's board, commits to the UN's declaration of human rights, ILO's declaration on fundamental principles and rights at work, the UN's Rio declaration on the environment and development, and the UN's convention against corruption.

In its responsibility reporting, Fingrid makes use of GRI (Global Report Initiative) reporting, which allows for the national and international comparison of the company's responsibility. Fingrid can compare its responsibility with that of grid companies in other countries.

Responsibility requirements extend to the subcontracting chain

Fingrid wishes to investigate responsibility throughout the supply chain. As observed with the procurement of transformers from Hyundai, it can prove challenging to ensure responsibility throughout the entire supply chain when procuring devices. Requirements set out in legislation, for example, may deviate from Finnish and EU regulations, and supply chains can be very long and multinational.

On construction sites, Fingrid has long required transparency of its subcontracting chains. Contractors must have their subcontractors approved by Fingrid and must check documents required by the Act on the Contractor's Obligations and Liability when Work is Contracted Out (Tilaajavastuulaki 1233/2006) for the entire subcontracting chain.

On construction sites, Fingrid's audits cover environmental, occupational safety and contractor obligations issues. Fingrid is also bound by legislation. Fingrid must know exactly who is on its construction sites and ensure occupational safety during all work phases.

Fingrid's suppliers are bound by terms of agreement concerning safety and environmental matters. Separate corporate responsibility requirements have also been set out for suppliers of goods and services. ■

"Until now, responsibility criteria set out in procurement-related legislation were simply recommendations, but in the future these issues will carry more importance", says Joki-Pesola.

Though the questions used in the audit proved successful, Fingrid nevertheless aims to develop the auditing model further. In the future, it will inspect the entire supply chain in more detail.

Fingrid engages in continuous cooperation with other grid network operators and shares its experiences of responsibility audits. This cooperation proved useful when developing questions for the pilot project. Great Britain, for example, also intends to implement a corresponding model in the near future.

"In the future, Fingrid's device suppliers will answer responsibility-related questions before they enter a bid, and the same questions can be used in auditing at the end stage of the procurement process, if necessary," explains Ojanen.

No shortage of work when it comes to monitoring deliveries

Fingrid has plenty of work ahead of it concerning the Hyundai deal before the transformers arrive in Finland. Several visits to South Korea are planned, since the client will participate in planning meetings and delivery monitoring throughout the duration of the project.

The transformers, which weigh around 400 tonnes, will be assembled and tested in South Korea before being transported by sea to Finland.

"Two of the transformers will be delivered to Lapland where they will connect Lapland's 220 kilovolt network to the 400 kilovolt national grid. One of the transformers will be used at a substation located on the west coast," says project manager Mika Väärämäki.

The South Korean transformers should be connected to the Finnish national grid no later than 2016. ■

One step closer to joint European electricity markets

Price coupling was successfully introduced on the electricity markets of north-western Europe in early February. The aim is to optimise electricity production where it's cheapest within the limits of the network's transmission capacity.

TEXT MAARIT KAUNISKANGAS

"The arrangement is that the wholesale price of electricity in different power exchanges is calculated by simultaneously taking into account all purchase and sale offers in north-western Europe and the transmission capacities between bidding areas," explains Development Manager **Ritva Hirvonen** from Fingrid. Participating in the spot-market price coupling are the Nordic countries, Baltic countries, Germany, France, the Benelux countries, Great Britain, Austria and Poland. Spain and Portugal will also join the price coupling area during 2014.

Power and balance

Previously on the wholesale markets, energy and transmission capacity were purchased separately. Now they are purchased at the same time.

"Price coupling makes the use of transmission capacity between different countries more efficient. We aim at balance with as minimal price differences as possible," Hirvonen points out. The price may rise slightly in some areas as a result of price coupling. In low-priced areas, for example, the price will increase as electricity is transmitted to higher price areas elsewhere. In the long-term, however, fluctuations in price and price spikes will even out.

Competition will also increase due to price coupling, since there are many times the amount of electricity producers and users on joint markets compared to non-coupled markets. Over 2000 terawatt-hours of electricity are consumed in north-western Europe per year, which is around three quarters of total European consumption.

"The cheapest energy must be made available more efficiently. Cheap European production, such as Norwegian hydropower or German wind power will be easier to use when we work together. At the same time, we will be able to make the use of transmission capacity between different countries more effective."

From pilot project to the joint markets

Price coupling in north-western Europe is a voluntary pilot project carried out by power exchanges and transmission system operators and involves compliance with European network codes dealing with the allocation of transmission capacity. The first codes are expected to come into effect in early 2015.

Power exchanges and transmission system operators worked together to develop the necessary technology and processes for the pilot project. Software and processes were tested last autumn, and improvements were made based on the results of the tests. The implementation of price coupling was delayed to February of this year. EU member states aim for price coupling on day-ahead markets to cover all of Europe by the end of this year.

"It will take a few more years, however, before southern and south-eastern Europe join. In some south-eastern European countries, for example, there are not yet any power exchanges, and in some countries the infrastructure of electricity grids requires development," explains Hirvonen.

There's also room for development in the northwestern European price coupling area. There is not always sufficient transmission capacity, which causes price differences between bidding areas. Cooperation between grid companies in the planning and construction of transmission interconnections is important in order to reduce price differences in wide-reaching joint market areas. ■

Competition will increase due to price coupling, since there are many times the amount of electricity producers and users on joint markets compared to non-coupled markets.

Increased market functionality through demand-side management

As inflexible or difficult-to-predict energy production increases, methods of managing power balancing are being sought from consumption flexibility and the utilization of back-up power. "Nowadays, market prices fluctuate more than they did 5–10 years ago. The value of flexible and adjustable capacity is expected to increase," explains Janne Laine from Energiakolmio Oy.

TEXT SUVI ARTTI | **PHOTOGRAPH** MATTI IMMONEN

"In many cases, the more obvious benefits of demand-side management have already been recognized," says Janne Laine, acting manager for electricity market services at Energiakolmio, referring to heavy industry's active participation in the Elspot markets, for example. Nevertheless, he believes that electricity consumers' potential has been left untapped.

"We can make optimal use of flexibility in all market areas. In many cases, investments and changes to operating methods are required in order to encompass challenging sites," he says.

On the Elspot markets, the hourly price of electricity is always determined according to the most expensive form of production used. Demand is not currently very flexible; consumption remains at approximately the same level, regardless of how high the price is.

"Even demand-side management of one hundred megawatts can significantly reduce the spot price during many price-spikes. However, there are not yet sufficient economic grounds which would encourage industrial consumers to modify their processes according to the price of electricity," Laine adds.

He points out that everyone who has the possibility to cut down or move their electricity consumption from high-priced hours to a more affordable time can participate.

Janne Laine is the newest member of Fingrid's Market Committee. "The committee is an excellent forum for discussion and a great source of information on current issues. Now, especially, as electricity markets are increasingly integrating with the rest of Europe, it is interesting to hear the views of various actors concerning market development," he says.

Demand-side management on the Elbas and balancing power markets

Jyväskylä-based Energiakolmio's areas of operation include energy procurement and sales, as well as consumption efficiency services. The company is not only an independent portfolio manager on the Nordic markets, but is also responsible for power balancing. Energiakolmio's power balancing customers automatically have the opportunity for demand-side management and the company also manages demand-side management unrelated to power balancing.

"With the exception of a pilot trial which is currently under way, the smallest possible demand-side management bid on the balancing power markets is 10 megawatts, so individual actors often don't have enough power to offer. We aggregate demand-side management, that is, we combine individual electricity consumers' bids anonymously and then offer them on the markets as a single entity," Janne Laine explains.

"Our customer could be a large electricity consumer, for example, for whom it is possible to be flexible in consumption. The customer tells us how flexible it can be, and then we offer it first on the Elspot, then the Elbas, and finally on the balancing power markets."

The required reaction speed depends on where in the markets the offer succeeds. On Elspot markets, information is received on the previous day, whereupon an electricity consumer can make preparations and, for example, decide to not start up a machine during a certain period on the following day.

On Elbas markets, a reaction to a successful offer has to be made within one hour, at times, and on balancing power markets flexibility has to be available within 15 minutes of the approval of a bid. "In the best cases we have the opportunity to steer the customer's systems, which means that the customer doesn't have to take any action if the flexibility offer is accepted," says Laine.

Energiakolmio's control room operates around the clock and takes care of the management and activation of demand-side management offers either via the customer's local control room or through remote control. The control room also takes care of production customers' possibilities for flexibility and risk management.

Back-up power in demand-side management

Energiakolmio is also involved in Fingrid's newest demand-side management pilot project, which deals with the utilization of back-up power's potential for demand-side management on the markets. "Our project is based on the fact that back-up power plants spend the majority of the time in down-time, which also means that fuels become old. The objective is to use the plants on market terms," says Laine.

He hopes that the pilot projects will be more than just short-term trials. "Since the target is long-term development work, we hope to aim for more than we would in a pilot project lasting just twelve months. Our customers also do not want to make investments in a project lasting no more than a year."

"The project supports the management of power balancing throughout Finland. Our interest is to achieve the most efficient market functionality possible." ■

Electricity market actors come together

Actors from all over the market field come together in Fingrid's Market Committee to discuss current electricity market affairs. "It's an active group which is very good at providing feedback. Nothing is decided as a walkover," agrees the committee chair, Fingrid's Executive Vice President **Juha Kekkonen**.

TEXT SUVI ARTTI
PHOTOGRAPH MATTI IMMONEN

In the back row from left: Janne Laine, Mika Laakkonen, Harri Tiittanen, Mikko Lepistö, Karl-Henrik Nordblad and Ari Sormunen. In the front row from left: Sami Oksanen, Anne Särkilahti, Juha Kekkonen, Katja Lipponen and Jouni Väisänen.

The Market Committee is one of Fingrid's three customer committees. It acts as a channel for dialogue between Fingrid and electricity market operators; a forum for discussion which also provides advice and helps the company in the development of electricity markets.

The Market Committee has a special role as a forum which brings together various parties. According to Juha Kekkonen, it is one of Finland's only bodies which represents "the entire electricity market value chain". Its members include electricity producers, sellers, traders, consumers and the power exchange. According to its rules, membership of the committee must be rotated between companies. "Electricity markets are in a dynamic phase, so our member base has undergone changes naturally and no-one has been asked to leave," explains Kekkonen.

One important principle is that the information distributed in the committee is available to the entire market. "Openness is of the utmost importance when distributing information relating to the electricity markets. The material dealt with in the committee's meetings is published on Fingrid's website the same day. We make sure that no-one ends up in an insider position – even unintentionally."

Various interests

Recently one of the most important themes in the committee's meetings has been electricity market integration. The North-West European spot markets merged in February, and markets are also undergoing integration towards the Baltic countries and Russia.

"Some people are afraid that the widening of markets will drive up the price of electricity in Finland. What actually happens is that price varies according to situation, and on open markets, it's possible to buy electricity from the cheapest source," Kekkonen points out. He believes that it's impossible to develop markets in a way that would satisfy everyone. "Our aim is to put socio-economic benefits before individual interests."

Planned market regulations have been a central topic of debate for the last two years. "The committee's members have expressed hope that we deal with European issues because not everyone has the opportunity to actively follow the progress of EU regulations in their own place of work. We can distribute information on matters dealt with by ENTSO-E and also pass on information about the special features of Finnish markets to Europe."

Mulling over a market model

Congestion in the transmission network is a constant topic which has sometimes caused lively debate in the Market Committee. "When we investigated the possible division of Finland into two separate price areas, the committee gave a clear message: we should do everything possible to avoid separation into different price areas."

This year, the Market Committee will discuss how to make TSO procurement of reserves more market-based. The EU wholesale electricity market model is also under consideration. "The current model is challenged by renewable energy 'bypassing the markets'. How can we get the market concept to work better? This and many other matters are still quite unclear at this phase," admits Kekkonen.

Nevertheless, the Market Committee has plenty of work ahead of it. ■

KNOW THE TERMS

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

Guarantee of origin

Guarantees of origin for electricity are certificates which are used to verify the energy source and/or production method used in electricity production. In Finland, guarantees of origin for electricity can be granted for electricity produced using renewable energy or using efficient combined heat and power production. One guarantee of origin can be granted for each megawatt hour produced.

The aim of the guarantees of origin is to improve end users' opportunities to select the method used to produce their electricity.

An electricity seller must verify the origin of electricity sold as renewable using guarantees of origin. Electricity producers or users must also verify the share of electricity produced using renewable energy sources if the producer or user informs its customers through its other business activities of the origin of electricity it uses.

How is the origin of electricity verified?
Guarantees of origin are handled using a register used to grant, cancel, transfer and annul guarantees in electronic format. Electronic guarantees of origin can be transferred between EU and EEA states.

The verification of the origin of electricity takes place by cancelling an amount of electricity guarantees of origin which corresponds to that sold as renewable energy. The cancellation must be made no later than the end of March in the year following the sale.

Where does trade take place?
A guarantee of origin of electricity can be separated from the sale of electricity, that is, a guarantee of origin and the electricity itself can be sold to different parties. The trade of guarantees of origin themselves takes place between actors either through bilateral contracts or in the EEX exchange, where the trade of GoO (Guarantee of Origin) products began in summer 2013.

The trade window for guarantees of origin on the EEX exchange is open every Thursday for three hours. Trade focuses on three products: Nordic Hydro, Alpine Hydro and Central Northern European Wind. The listings for the products at the end of January 2014 were approx. EUR 0.14/MWh for Nordic hydropower, EUR 0.80/MWh for Alpine hydropower and EUR 0.35/MWh for windpower.

How are guarantees of origin granted to a power plant?
Guarantees of origin can be granted if the power plant's eligibility for the system is verified. Approved methods of verification are a certificate of verification issued by a certification body, a decision of acceptance into the feed-in tariff system for renewable energy and EECS verification.

Fingrid was named as the registrar of the guarantee of origin system from 1.3.2014. In order to be entered onto the register, an actor must make a service agreement concerning entrance into the guarantee of origin system with Fingrid's daughter company Finextra, or provide a power of attorney to a party which already has such a contract. In addition, this year a contract with the current service provider, Grexel, is also required. The granting of guarantees of origin of electricity can begin once the power plant's electricity production information is submitted to Finextra.

How are additional tags verified?
In addition to the guarantee of origin, electricity can also have additional tags. These include environmental and brand markings depicting the use of renewable energy sources and are used in bidding and marketing. The basic requirement for an additional tag is that the origin of the electricity is verified using a guarantee of origin.

Parties which offer additional tags can also set their own additional requirements for environmental or product markings.

Number of guarantees of origin granted in Finland
In 2013 guarantees of origin were granted to approximately 200 power plants and for a total of 18 terawatt hours of electricity production. According to preliminary statistics, just under 24 terawatt hours of electricity were produced using renewable energy in 2013.

TEXT KAIJA NISKALA, KIRSI SALMIVAARA, PENTTI SÄYNÄTJOKI
PHOTOGRAPHS VASTAVALO, ISTOCKPHOTO

Customer surveys to aid security of supply

Early this year, Fingrid sent a survey to its customers in order to investigate the capacity of large power plants to withstand disturbance. During the summer, we will also request information on how tree-proof branch lines are. The aim is to ensure the grid's security of supply in all situations using the information produced by the survey.

TEXT SUVI ARTTI | **PHOTOGRAPH** HELSINGIN ENERGIA

Fingrid bears system responsibility, or responsibility for ensuring that the electricity production and transmission systems are used and maintained in a technically appropriate manner. The maintenance of operational security is a central aspect of system responsibility.

"We aim to ensure that Finland is sufficiently powered," says leading expert **Pertti Kuronen** from Fingrid.

Power plants' capacity to withstand disturbance under the microscope

The capacity of large power plants to withstand disturbance was mapped using a survey sent at the start of the year to electricity companies which own power plants in excess of 100 megavolt ampere. The survey aims to update network models with the current power plant data and form an image of how power plants behave during various disturbance situations.

"We need as precise information as possible on power plants in order to be able to maintain security of supply and to determine reliable transmission limits," explains Kuronen.

"The survey provides us with valuable information on how power plants behave when they encounter disturbance. Protection data is also important. The compatibility of the power plant's and grid's protection is important in order to avoid the unnecessary disconnection of the power plant from the grid during disturbance. The disconnection of multiple plants from the grid during the same period of disturbance can in the worst case scenario lead to the loss of the power system." The costs of a nation-wide grid fault would rise to an estimated 100 million euros per hour.

> "We need as precise information as possible on power plants in order to be able to maintain security of supply and to determine reliable transmission limits."

Fingrid analysed risk factors based on the information received from the survey. Units which are fundamentally larger than the current plants will be connected to the grid in the future, and the use of the power system is rapidly approaching the limits of transmission capacity. The unit size of plants has had to be limited for the first time in order to maintain the security of supply as set out in the general terms of connection.

"When we receive updated plant information in our network models, we can calculate transmission capacity more accurately. In this way we can give electricity markets as much capacity as possible without endangering operational security. The most important thing is to provide Finland with an undisrupted supply of electricity," says Kuronen.

Power plant information at a single location

Before the survey was sent, Fingrid carried out a pilot survey in which the Pietarsaari-based Oy Alholmens Kraft Ab AK2 power plant and Helsingin Energia's Vuosaari plants participated.

The Alholmens Kraft power plant information documentation was available to Fingrid when drawing up the survey forms. "We examined the information together and Fingrid investigated the kind of documentation that power plants generally have. The aim was not for respondents to carry out new calculations, but instead for power plants to have the information ready," explains **Rune Forsbacka**, maintenance manager at Alholmens Kraft.

"Our AK2 power plant was completed in 2001 and is so new that all information is in electronic format and is relatively accessible. The search for information concerning older power plants could indeed be more challenging," he adds.

The Helsingin Energia power plants in Vuosaari were completed in the 1990s and as such, they too are fairly young. But the search for information was not entirely simple, as the information requested had not been compiled in a centralized location, explains **Atte Pihkala**, a network calculation expert at Helen Sähköverkko Oy.

Pihkala found the survey to be surprisingly detailed. "We gathered information from various places. Some information came from HelenVoima, which is responsible for the power plants, some came from Helen Sähköverkko and some from HelenService, which is responsible for maintenance. At least now the information is gathered in a single location," he says.

Pihkala hopes that the information produced by the survey will be available to all parties. "Network companies are interested in which kinds of power plants are connected to their grid."

With the future in mind, Atte Pihkala suggests that it's worth finding out the right contact people in advance to prevent the surveys from ending up in the wrong place. "When we received the survey in January concerning all four Helen plants, it was initially unclear as to whose responsibility it is to respond to the survey. After being sent back-and-forth within the company, the surveys eventually made their way to the right person," he says.

Branch line survey investigates tree-proofness

The tree-proofness of power lines has been a much-discussed topic due to recent storms and subsequent outages. The minimization of tree-related disturbance also plays an important role in the new Electricity Market Act.

During the summer, Fingrid will send a monitoring request to customers who own power line connections to Fingrid's 110 kilovolt power lines to investigate the tree-proofness of branch lines and examine how disturbance-free power line connections are. In line with a new practice, the survey will be carried out every 3–5 years.

With regard to tree-proofness, the survey aims to find out what preparations have been made for the correction of disturbance and faults, and how the clearing of branch lines, maintenance and power line inspections are carried out. The survey also asks whether the branch line connection has been carried out reliably.

"At first we investigated whether it was possible to carry out the survey as part of the network development and preparedness plan which distribution companies are bound by the new law to make. However, this was not possible as our survey focuses on just a small part of the network. For that reason we decided to implement the survey using our customer extranet," explains Pertti Kuronen.

The survey is designed to be as user-friendly as possible and will be implemented via the customer extranet service. "All you have to do is tick boxes. There's no need to send the relevant documents to us; they stay with the customer," says Kuronen. In order to facilitate its customers' work, power line connection model images and clearing and maintenance instructions will be uploaded to Fingrid's customer extranet service.

Elenia network manager **Jorma Myllymäki** welcomes the monitoring and approves of the survey. "Fingrid should distribute more information concerning the survey. We're interested in finding out how Fingrid will utilize the information it collects," says Myllymäki. He says that Elenia has not made any significant changes to the way it carries out clearing as a result of the recent storms and new Electricity Market Act. "We did however pay more attention to carrying out planned procedures according to schedules, and to ensuring that our high-voltage lines remain tree-proof." ■

Squirrels crossing

When construction began on a new transmission line in Pirkanmaa, an environmental investigation found signs of flying squirrels in the area. The flying squirrel is one of the most protected species in the EU, and its travel routes and resting spots are protected by law. Fingrid is now carrying out tests for the first time to see if it is possible to keep the squirrels' travel routes intact using landing trees.

TEXT MIRA MUURINEN
PHOTOGRAPHS VASTAVALO, ARI LEVULA

The opportunity to test the landing trees came when Tampereen Sähköverkko Oy began to construct a new 110 kilovolt line alongside Fingrid's 400 and 110 kilovolt lines.

When planning transmission lines' routes, existing line routes are utilized, as specified in the nation-wide land use objectives set out by the Land Use and Building Act. "The construction of new lines alongside existing ones is the most sensible solution all round," explains **Ari Levula**, Fingrid's regional manager for Western Finland. "Far less forest has to be cut down if we can avoid clearing an entire new area."

Rights-of-way made for single lines are so narrow that flying squirrels are easily able to cross them by gliding. When several lines are built next to each other, the clearing is wider, and the squirrels need a place to land before continuing on.

For that reason, Fingrid has placed thick, ten metre-tall tree trunks in a right-of-way in Pirkanmaa to act as landing trees for the flying squirrels. Between the landing trees, other trees were allowed to grow which are usable by the flying squirrels but will not cause safety risks to the nearby tall transmission tower.

The natural trees and the landing trees form a corridor in the clearing which flying squirrels can use to traverse the area.

Off to a good start

Ilpo K. Hanski, senior curator at the Finnish Museum of Natural History, has been involved in the evaluation and development of the crossing tree project with Fingrid. Hanski has studied flying squirrels for 18 years by monitoring their behaviour using radio transmitter collars. His feedback has resulted in the use of thicker crossing trees and longer distances between the trees, for example. "The trees have to be dotted around like natural forest, not in straight lines. The natural trees left to grow in the clearing make the area more protected for the squirrels," says Hanski.

It's difficult to say whether the flying squirrels will begin to use the routes built for them. "This project is in the pilot stage, but it's off to a good start," Hanski adds.

FACT

ABOUT FLYING SQUIRRELS

The flying squirrel is smaller than its brown-coated cousin, the red squirrel, and is active only at night. Its coat is grey all year round, though its underbelly is light-coloured. It is this skin, known as the patagium, which allows the squirrel to glide through the air. The squirrel can glide up to 75 metres at a time. It prefers to glide rather than jump from one tree to another.

The flying squirrel is extremely loyal to its territory and lives in the same area of forest and nests its entire life. Females live in territories some hectares in size, with males' territories reaching around one hundred hectares. Flying squirrels also always have several nests prepared.

The flying squirrel is classified as a vulnerable species in Finland. In Europe they are only found in Finland and Estonia. The greatest threat to the flying squirrel is a loss of habitat, and for this reason their nests and favourable resting sites are protected by law. As it is prohibited to limit the flying squirrels' movement in any way, this little creature can sometimes cause the relocation of entire construction projects.

WHERE TO SPOT FLYING SQUIRRELS

Flying squirrels can be found in southern Finland, especially in lush, spruce-dominated mixed forests. Since the flying squirrel is a nocturnal and quiet creature, it can prove elusive. When in the forest, keep your eyes on the tree roots: the squirrel's droppings are yellow in colour and resemble grains of rice. They are especially easy to spot in the snow in late winter and early spring.

He believes the trees could well be a success, especially after the winter when the females have chosen their nesting spot and the males are on the move. "If there are fertile females on both sides of the clearing, the males have strong motivation to cross it. Young squirrels who have not yet established their territory also move around a lot towards the end of the summer."

This year, no flying squirrels have been observed in the area. If new observations are made, the squirrels' behaviour in the area can be monitored using game cameras, for example.

If the flying squirrels begin to use the trees, their use can be extended to other areas if necessary. "Transmission lines are very long-term structures – when they are designed, decisions are made which can span up to one hundred years. The forest, on the other hand, changes and develops, and it could be that the flying squirrels' routes have changed completely in a few decades. It's also possible to use tree crossings in existing line areas, if there is clear need to do so for the squirrels' routes," explains Ari Levula. ■

The crossing trees are placed in two rows, but natural trees of a suitable height are also left to grow in the clearing.

MONITORING RESPONSIBILITY

In this column, representatives of Fingrid's interest group companies write about responsibility.

Responsibility requires networking

I am responsible for the sustainable development of Finland's largest electricity network actor. Our company is currently withdrawing from the Fortum Group and forming its own, independent entity. The company brand and name have not yet been made public.

As a responsible company, our aim is to create wellbeing for the entire society. This requires our company to be profitable and to provide our owners with additional value. We wish to use natural resources with careful consideration, evaluate the risks to the environment caused by our actions, and then minimise them. We carry out cooperation with our interest groups, which include not only our personnel, but our entire service chain, municipalities and other authorities, as well as network companies. We take the needs of consumers and our corporate customers into account in all our actions.

Our company has been part of the international Fortum Group and we have made use of Fortum's various national and international networks in our operations. After a change in ownership, our cooperation with Fortum will continue, but more emphasis will be placed on the significance of networks outside of our company. The idea of networking is that any participating party can concentrate on its core areas of expertise and everyone involved benefits.

We have outsourced services relating to network construction, maintenance and repair. In order to ensure responsibility, we have invested in the development of our public–private partnership operating model. One of the most important topics of cooperation is occupational safety. In order to develop occupational safety, at the start of the year we launched the "Ehjänä kotiin" (Home safe and sound) campaign which rewarded contractors' teams for maintaining a good level of safety. We also speak out for occupational safety on the industry's forum, the occupational safety committee run by Energiateollisuus ry, the Board of Finnish Energy Industries. I have been a member of the committee since 2008 and I currently act as chair.

We ourselves use – and require our contractors to use – Headpower Oy's industry-specific applications and content, such as safety and environmental instructions. We develop these together with other network operators and service providers.

We participate in cooperation with authorities both directly and through our cooperation networks. For example, we have taken a stand on proposed changes to legislation pertaining to prevention of unreported employment through the Board of Finnish Energy Industries' occupational safety committee and by being in direct contact with the Tax Administration and Regional State Administrative Agencies.

We also cooperate with authorities on environmental responsibility. For example, we aim to create a national oil spill processing model for our company for small, occasional oil spills which take place in the electricity network. For years we have ensured the sufficiency of cleaning procedures through samples and submitted cleaning reports to the regional Centres for Economic Development, Transport and the Environment. We operate in numerous Centre for Economic Development, Transport and the Environment regions, and their requirements and report processing procedures vary from region to region. We are starting cooperation with the Centres to agree on a uniform and nationwide method of operation.

The electricity network is part of the important infrastructure of society. We develop cooperation with municipalities, towns and other civil engineering actors on long-term societal and preparedness planning.

A responsible company has well-functioning cooperative networks with clear objectives. We believe that our responsible operations generate both direct and indirect wellbeing for all our interest groups. Taking economic responsibility, environmental responsibility and social responsibility into account in our operations in a balanced way supports the future development of society. ■

"Taking economic responsibility, environmental responsibility and social responsibility into account in our operations in a balanced way supports the future development of society."

Piia Häkkinen
The author acts as a sustainable development manager.

IN BRIEF

Fingrid's safety observation campaign saw results

As part of an occupational safety development project, Fingrid organised a safety observation campaign for its service providers' personnel from 1.11.2013–31.1.2014. The campaign activated people working on sites to report even small safety observations before accidents happen.

During Fingrid's safety observation campaign, a total of 95 safety observations were made on the company's sites, of which many dealt with tools, personal protective equipment and operating methods. All safety observations made during the pilot campaign period were relevant and improved safety on site. The observations were dealt with in site meetings, and many observations initiated good discussion.

In recent years, Fingrid has received few safety observations from contractors. The safety observation campaign demonstrated that there are often grounds for the observations. During the campaign, site personnel were given pocket-sized observation notebooks with which each worker on the site was able to report on safety deficiencies or provide development ideas on how to improve safety to site managers. Each safety observation was rewarded with a 10 euro gift card.

There were clear differences in observation activities between sites and contractors – some sites were very active while others did not report a single observation despite active campaigning.

Fingrid's aim is for the safety observation practice to remain in permanent and active use amongst service providers. The rectification of deficiencies and faults in an early stage can improve both site safety and contractor's operating models.

L&T to take care of waste management on Fingrid sites

Lassila & Tikanoja and Fingrid began cooperation on site waste management at the start of the year.

The three-year contract concerning waste management on Fingrid's sites was signed in November 2013. The total value of the contract is estimated at EUR 6 million over the entire contract period.

Cooperation began in December 2013 with an orientation of key Lassila & Tikanoja personnel with Fingrid's construction sites and operating methods. At the same time, cooperation concerning the promotion of occupational safety was also agreed upon by, for example, organising Lassila & Tikanoja Safety Walk model-style safety evaluations on Fingrid sites.

Fingrid increased its preparedness level due to storms

Last autumn, Fingrid raised its preparedness level to 1 three times as a result of powerful storms. The storms caused some disruption to the grid, but thanks to the high level of preparedness, these were quickly located and repaired.

The preparedness level was raised whenever winds gusting at a speed of over 20 m/s were forecast over land.

Different preparedness levels are an essential part of grid continuity management. Several levels are in use and they are implemented according to criteria which are agreed in advance. In raising the preparedness level, we are able to ensure that operations continue in all situations with minimal disruption. We do this through pre-planned and implemented arrangements and management models. Preparedness levels help to ensure the availability of Fingrid's and service providers' personnel and materials in cases of major disruption.

The maintenance of the grid's functionality also has an effect on society's security of supply. Through participation in the preparedness and planning of energy supply, Fingrid carries out work to ensure essential societal functions.

The National Emergency Supply Agency's HUOVI portal provides excellent tools for continuity management. The portal contains a maturity analysis, for example, with a separate section dealing with preparedness in the energy industry.

Towards Nordic balance settlement

A Nordic balance settlement company will begin operations in 2015.

The grid companies Fingrid, Statnett and Svenska Kraftnät have taken a great step towards Nordic balance settlement by establishing a Nordic service company named eSett Oy. The new company will offer balance services for parties on the Finnish, Norwegian and Swedish electricity markets. Operations will begin in the second half of 2015.

The company will strive to facilitate access to the Finnish, Norwegian and Swedish electricity markets through impartial and joint balance settlement regulations. As such, competition on the countries' electricity markets will increase and market operators' costs in the long term will decrease. This will simultaneously pave the way to a Nordic end user market.

The company's headquarters are in Helsinki and **Minnakaisa Ahonen** from Fingrid has been appointed CEO.

eSett

The Tuntihinta mobile application monitors the exchange price of electricity

Fingrid has published a free-of-charge Tuntihinta mobile application allowing users to follow the exchange price of electricity. The application is available for Windows, Android and iPhone telephones.

The Tuntihinta mobile application can be used to follow the regional price for Finland published by the Nordic electricity exchange Nord Pool Spot. The application sounds an alert if the price of electricity rises above a limit set by the user. The user can use the pricing information to reduce electricity consumption when electricity is expensive and make use of cheaper hours. The Tuntihinta service is of most benefit to consumers who have an exchange-priced electricity contract with invoicing per hour.

Videos about the electricity markets and Elvis system

Fingrid has published two new videos dealing with electricity markets and the Elvis asset and operation management system. The videos were published in both Finnish and English.

The electricity market video explains how Nordic electricity markets function and how the price of electricity is determined. A shorter version of the seven minute video, at just 3 minutes and 20 seconds, is also available. The Elvis video on the other hand, deals with an information system project aiming at complete asset management carried out in cooperation with IBM.

The videos can be found on YouTube under Fingrid Oyj.

Elvis making progress – first phase successfully taken into use

The first phase of Fingrid's asset and operation management system Elvis has been successfully taken into use.

Of the overall project, an electricity substation asset register and substation maintenance system, as well as a project portfolio for investment grid refurbishment projects projects have been taken into use. The electricity substation asset register and maintenance system will be taken care of using IBM's Maximo and ESRI ArcGIS applications which are integrated so that both applications use the same grid information.

Oracle's Primavera application, used in the project portfolio, is also integrated into the Elvis package, which means that project information is sent directly to the asset register and maintenance system after commissioning.

The design and implementation of the integrated Elvis system package is a major and challenging job for Fingrid and the system suppliers. The successful implementation of the first phase is a good foundation for further development.

In the next phase, transmission line information and protection and network calculation will be taken into use in the first half of 2015. These modules will also be integrated.

In the final phase of the project, also due in late 2015, operations-related tools such as outage planning, connection management and disruption management will be included in Elvis.

Fingrid's annual report and financial statements 2013: result improved, investments still at a high level

The review period for 2013 was a year of many successes for Fingrid. The development in result was strong and from an operational point of view the year was excellent. The Group's turnover was 543 million euros and profit for the financial period was 91 million euros. The result for 2013 was improved by a rise in grid network tariffs: grid profits grew to 321 million euros. On the other hand, Nordic congestion income decreased significantly. Grid investments were once again high: we invested around 209 million euros in the main grid. Investment portfolio management requires plenty of flexibility throughout the various sectors of the organisation. In addition to its own employees, Fingrid's service provider organisations also saw success, explains CEO **Jukka Ruusunen** in the 2013 financial statements.

Grid operational reliability in 2013 was excellent despite significant challenges set by our large-scale investment programme. The new main grid control centre demonstrated how well it functions in its first year of operations. Electricity markets in the Baltic Sea region also progressed thanks to the EstLink 2 connection. EstLink 2 has already made market activity more efficient and improved reliability in the supply of electricity in the area. The benefits to society are significant. The project serves as a model for all of Europe as to how cross-border cooperation can achieve great things when people on both sides of the border strive to achieve the same goal.

A new Electricity Market Act came into effect in Finland in autumn 2013. The act outlines the separation of grid ownership in line with EU requirements. The act has further specified the definition of grid and Fingrid was tasked with new responsibilities relating to matters such as balance services and the exchange of information on electricity markets. Fingrid's customer base will multiply as a result of these new tasks, and the grid network will extend to Helsinki in a few years' time.

Our development themes for 2013 were customer operations and responsibility. A new operating model, developed in close cooperation with our customers, was put into use in our customer operations. Fingrid's Advisory Committee invested a significant amount of time and effort in the new model. With regard to responsibility, we've developed responsible management and concretised Fingrid's responsibility targets. Responsibility is an essential part of a grid company's operations, and it is a central part of our strategy. When it comes down to it, the most important thing is how our customers and society see us.

For the first time, Fingrid's annual report for 2013 has been published in electronic format online. Over time, Fingrid aims to transition entirely to electronic publication of its annual report.

The annual report webpage is also accessible from portable devices, which makes it easier to read on tablets and mobile telephones.

The annual report can be found at **http://annualreport.fingrid.fi/en/2013.**

Lines over Ostrobothnia

POWERED BY ELECTRICITY

In this column, Fingrid employees put electrical devices to the test. Customer Manager **Jarno Sederlund** tested how the Tuntihinta mobile application affected the electricity consumption in a four-person family.

Tuntihinta put to the test
– Can an app help you to save electricity?

The Tuntihinta app launched by Fingrid allows users to follow the exchange price of electricity using their phone. The application sounds an alert if the price of electricity rises above a limit set by the user. The user can use the pricing information to reduce electricity consumption when electricity is expensive and make use of cheaper hours.

The Tuntihinta application is available free of charge on Fingrid's website at www.fingrid.fi/tuntihinta.

TEXT JARNO SEDERLUND

I began to use the Tuntihinta application to receive information on the hourly price of electricity and changes in price more easily. Previously it was slightly troublesome to retrieve the information from the Nord Pool Spot website. I set 7 c/KWh as the upper alert limit.

Monitoring the price changed our habits and reduced our electricity consumption. In January 2014, our family consumed almost 20 per cent less energy than in January 2013, though the month was over one degree colder on average compared to the previous year.

During the trial period we changed the optimization of our boiler heating. The boiler was mostly filled using cheap electricity and during the cheap feed-in tariff. In addition, we also used our fireplace more when the upper price alert sounded. We moved our use of the tumble dryer and dishwasher to cheaper hours. We did not compromise on using the sauna, but we did often move it away from price-spike hours (often between 5pm and 7pm) to after eight o'clock in the evening, when electricity was sometimes half as expensive.

At the same time, we also paid more attention to electricity consumption in general. We exchanged our showers for water saving models which show the temperature of the water using LED lights.

The average price* of the electricity we used in January was 4.6 c/KWh. If we had used "smart" automatic technology which would have continuously monitored the temperature of the boiler and always heat the boiler during cheaper hours, the savings could have been even greater – and without compromising on comfort. There are already smart products on the market, but their investment and usage costs are still too expensive compared to the additional savings.

The only – mild – problem we encountered was in the coldest week when the last person to use the shower for the day ran out of hot water. This led to a few complaints from my home customers (the children). We managed through these difficulties with some anticipation based on experience and by monitoring the boiler temperature.

I definitely intend to keep on using the application. Spot electricity contracts have their risks, as prices can rise suddenly as rapid changes can take place in production, consumption and cross-border transmission situations. In such cases, the alert limits set on the application sound an alarm.

Who is the app meant for?

For electricity consumers who have made an hourly price-based household contract this is a definite must-have app, provided that the user has the possibility to adjust its consumption (e.g. residents in single-family homes with water-circulation electrical heating and/or a heat-retaining fireplace). The application is also suitable for larger actors, perhaps industrial operators or small businesses, since it keeps its users aware of the hourly changes to the price of electricity.

The user of course, has to put in some effort in order to achieve economic benefit from the app, but it's worth keeping in mind that cheaper electricity is also more eco-friendly. When you heat your home during cheaper hours, you aren't just saving money on your electricity bill; you're also helping to conserve nature.

*The average price includes every hour in the month weighted with the energy consumption for the relevant hour, and the price includes VAT and a margin.

FACT

Electricity consumers: A four-person family with three sporty children who enjoy turning up the heating and taking hot showers.

Home: Post-war single-family home built in 1959 with an area of 250 square metres. The house features water-circulation radiator heating and an electrical boiler with a capacity of 1,500 litres.

Before the test: Electricity consumption 31,000 kWh in 2013 and 42,000 kWh in 2012. The family has an electricity contract based on hourly price.

Objective: To reduce electricity consumption to 25,000 kilowatt hours in 2014. An air-source heat pump procured last autumn will also help to reduce consumption.

Test period: January 2014. The test period fell during the coldest weeks of the start of a fairly mild winter.

GRID QUIZ

Competition to the readers of Fingrid Magazine

Answer the below questions and send your reply by fax (number +358 (0)30 395 5196) or mail to Fingrid no later than 31 May 2014. Address: Fingrid Oyj, PL 530, 00101 HELSINKI, FINLAND. Mark the envelope with "Grid Quiz". Participants have the chance to win three Finnish design Klapi sauna thermometers from Pauliina Rundgren HandiCrafts. Answers to the questions can be found in this issue.

1. What is the combined electricity transmission capacity of the EstLink connections?

- 650 MW
- 1 000 MW
- 1 350 MW

2. What is the longest distance a flying squirrel can glide?

- 35 metres
- 60 metres
- 75 metres

3. Why did Fingrid employees visit the Hyundai plant in South Korea?

- They were on a study trip to the transformer plant.
- They were learning more about Hyundai's occupational safety regulations.
- They were carrying out responsibility auditing concerning an order of three large transformers from the plant.

4. When did Finland first take a 400 kilovolt power line into use?

- 1960
- 1966
- 1979

5. What can you do with Fingrid's Tuntihinta mobile application?

- Play an electricity exchange game.
- Monitor the price of electricity on the exchange
- Compare different kinds of electricity contracts.

6. When were the Estonian electricity markets fully opened for competition?

- 2004
- 2010
- 2013

7. Fingrid raised its preparedness level three times last autumn. For what reason?

- Powerful storms.
- Electricity transmission congestion.
- Peaks in electricity consumption.

Prizes for the previous Grid Quiz (3/2013) have been sent to the following winners who answered correctly: Juha Louhelainen, Oulu; Kauko Vierimaa, Oulunsalo; Emilia Sormunen, Espoo.

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