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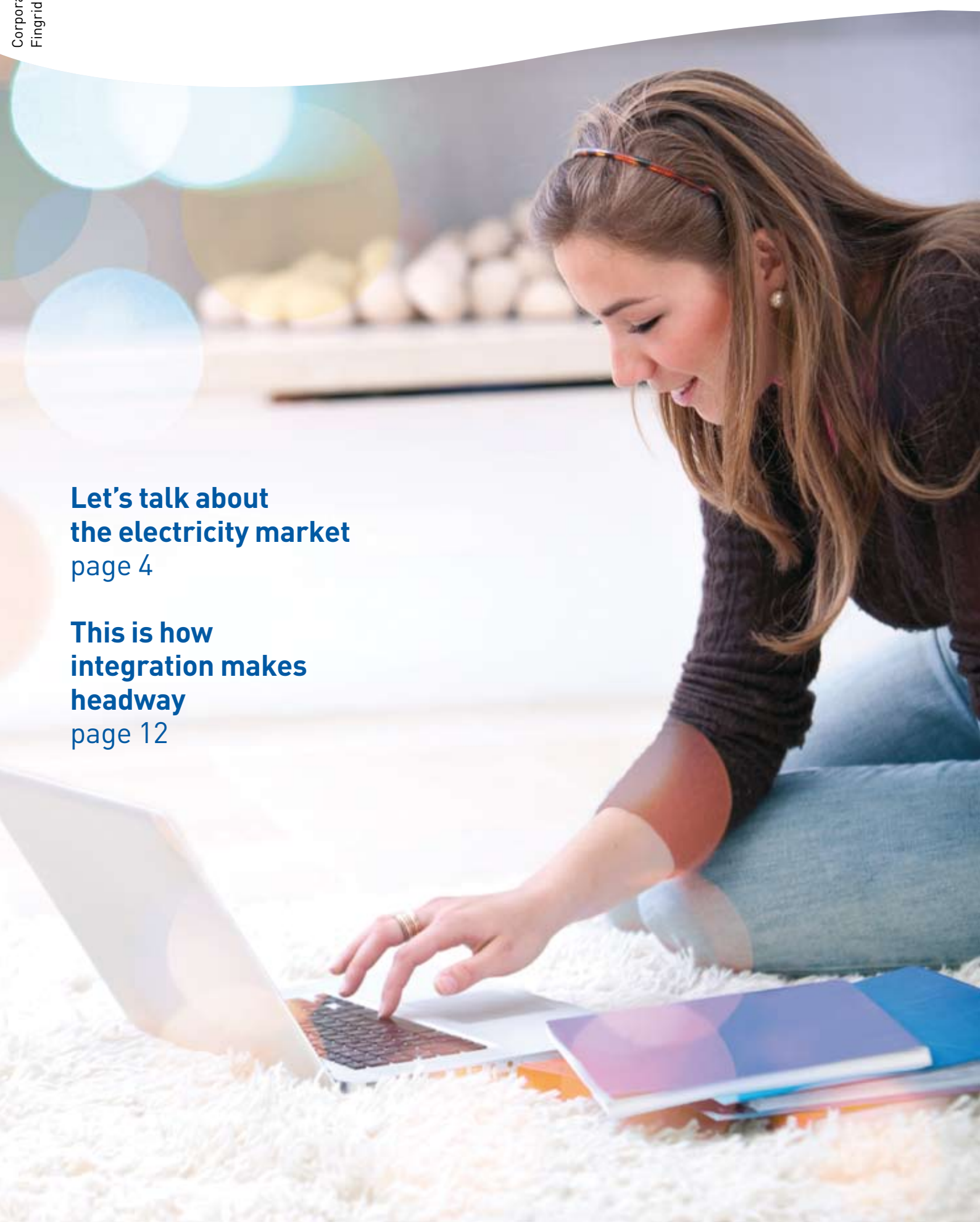
FINGRID



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FINGRID
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Editorial

WHAT IF?

Just like spring brings the migratory birds, so the peak electricity prices kick off the discussion on the functioning of the electricity market. There are many who think that a price of electricity which is momentarily 20 times as high as normally reflects the dysfunction of the market mechanisms. The related discussion in Norway and Sweden in particular has been lively, and even venerable parties demand measures as drastic as going back to the old monopoly system, where the price of electricity was stable and you were able to plan things over a long time horizon.

But what if the electricity market had not been liberalised in the mid-1990s? Would things be better now for the consumers? Finnish Energy Industries once attempted to draw up a study of the matter, but it was difficult to take an analytically firm grip of the topic.

So, maybe you will allow a little freer speculation. In a monopoly, the electricity prices would certainly be more stable and easier to anticipate than now. The dominating wholesalers would determine the prevailing price level through their long-term contractual tariffs. They would use these tariffs to forward their costs and cost risks to the large-scale users and retailers, and the latter would further transfer their costs and cost risks to the small-scale users.

There would be no price variation resulting from hydropower, because the wholesalers would keep its impact (i.e. benefit) to themselves. However, the risk of a price spike would be there. At least in Finland, when the wholesale buyer exceeded his ordered power in a peak demand situation in the old model, the price of the additional energy was easily 10,000 euros per megawatt hour, not 1,000 euros.

But in general, is electricity less expensive in a market economy than in a regulated economy? Power companies have intensified their performance after the market was liberalised. The operating processes have been streamlined, and many centralised functions have been outsourced to more flexible chains of service providers. Capital investments in particular are reviewed much more critically, and there is no more abundant overcapacity in electricity production. Productivity in the industry has soared.

Without these measures, electricity would be more expensive than now. Finnish consumers have obviously benefitted from the opening of borders for competition and from the closer integration with the other Nordic countries. During a high price of electricity, people just seem to forget that electricity has been very inexpensive for several years due to factors such as ample hydropower supply.

If there was no electricity market, it would also be more difficult to respond to the recent environmental and climate challenges. Where would wind power producers put their electricity if not to the market? The market also facilitates the use of support mechanisms for renewable energy, such as feed-in tariffs and emission trading.

But the old monopoly world also had some good traits. It involved an incentive to consumption elasticity in peak situations. In a way, there was a capacity market in wholesale trade, where the buyer had the above strong financial incentive to remain at his ordered power and therefore control consumption. At the same time, the producers were able to maintain the necessary peak capacity, which is a more challenging task nowadays.

In the present market, price spikes are signals to consumption of the merchandise running out and of a necessity to introduce the good old elasticity. It is just that now this incentive does not really work – not at least yet. Industries do respond to price spikes, but usually too late; not in the spot market but only in the balancing power market. And small-scale consumers cannot yet have electricity through a contract where they would save money by reducing their consumption during a price spike.

One could comment on the ongoing electricity market discussion by saying that the basic market mechanism works as such and that price spikes are one indication of this. But there are things that require improvement. There must be more price elasticity in consumption; large-scale electricity users are already going in this direction. Distribution network companies must involve small-scale consumers in the same process with new hourly electricity meters. The transparency of market information needs to be enhanced across the board. And transmission system operators also have to take care of their duty, in other words reduce transmission congestions in the grid.

Juha Kekkonen is Fingrid Oyj's Executive Vice President.

Doubts about electricity market integration?

Welcome to join the discussion

Text by Maria Hallila ■ **Photographs by** Juhani Eskelinen, Plugi and Vastavalo

The recent long leaps towards a single European electricity market have not just aroused enthusiasm among all electricity user groups. Fingrid works actively to promote market integration, but is also open to criticism. "We want to lay it out in the open. Anyone can contact us at any time if they suspect that we work against the best interests of Finland and Finns," says Fingrid's President Jukka Ruusunen.

According to Jukka Ruusunen, the role of the transmission system operator is to provide an unobstructed framework for competition within the electricity market. "Sufficient transmission capacity is the very necessity of efficient market mechanisms," he says.

Friday 22 January is one of the coldest days in Finland in the early part of 2010. This winter's peak electricity consumption of almost 14,200 megawatts is reached in Finland that morning. Electricity imports from the neighbouring countries are 2,400 megawatts, almost equivalent to the power of two nuclear power units.

Jukka Ruusunen takes a composed glance at his mobile phone, which shows Nord Pool's message of the price of electricity in the next day: 49.80 euros per megawatt hour. This is in line with the recent average price level in the spot market; the market works as expected, reliably.

"Finland is dependent on imports. Without imports, we could not keep the lights on in Finland," Jukka Ruusunen states, and the conversation takes a natural turn to the expanding electricity market.

Transmission capacity is the key

Decades of experience of Nordic electricity market co-operation is one of the cornerstones on which Fingrid rests as it aims to contribute to the integration of the pan-European electricity market.

"When there are unobstructed electricity transmissions across national boundaries, in other words when there are enough transmission lines, the market works efficiently and competition keeps the prices down."

"Last year, Finland and Sweden were part of the same price area for wholesale electricity for as much as 95 per cent of the time," Jukka Ruusunen says in referring to the globally significant example of a well-functioning market in the Nordic countries.

The volume of transmission capacity is a crucial factor preventing or promoting competition in the electricity market. Insufficient transmission capacity most often causes price differences between various areas.

"When there are unobstructed electricity transmissions across national boundaries, in other words when there are enough transmission lines, the market works efficiently and competition keeps the prices down."

Fingrid has worked hard in the Nordic electricity market and carried out considerable capital investments so as to enhance the cross-border transmission connections. This is reflected in fluent transmissions between Finland and Sweden: congestions resulting from insufficient transmission capacity on the cross-border connections between the two countries only accounted for 5 per cent of the time last year.

In Sweden, on the other hand, it will be necessary to divide the country into as many as four price areas in the next few years because of transmission congestions in the grid within Sweden.

"Such a situation would be disastrous here in Finland," Ruusunen says.

"However, at the same time it has to be said that despite Fingrid's capital investments, we cannot completely rule out the possibility that there might be two price areas in Finland some day," he points out.

Southern Scandinavia has conventionally been and continues to be the most problematic area in terms of the functioning of the Nordic electricity market. Because of inadequate transmission connections in Southern Norway, Denmark and Southern Sweden, there was a uniform spot price in the entire Nordic market for only a quarter of the time last year. Jukka Ruusunen thinks that this is absolutely not sufficient.

At the terms of system security and electricity market

Transmission system operators can influence the functioning of the electricity market not only by taking care of the sufficiency of transmission capacity but also through their work in system operation. TSOs can prevent transmission congestions through

Electricity market integration = rules + sufficient transmission capacity

Shared rules

- Market model: day-ahead, intra-day, balancing power market
- Transparency of market
- Uniform rules are a necessary but not a sufficient requirement for competition to work

In North-West Europe (1,500 TWh) in the coming years

Capital investments in transmission capacity

- Grid plans shared by TSOs: Ten Year Network Development Plan
- Permit processes and execution: at least 5 years
- Enable electricity trade across national boundaries: increased competition, prices come closer to each other as there is more transmission capacity

"2020"

Long process - will not happen overnight!

means such as making sure that outages required by maintenance and construction work on the grid are not performed during the peak periods of transmission capacity demand.

"From the point of business economy, it is not sensible to avoid congestions, because transmission restrictions mean income for the TSO: the more congestions on the border, the more money to the TSO. However, transmission congestions are a major disadvantage for the electricity market and for the entire national economy," Jukka Ruusunen says.

"Finnish electricity market players would certainly find it difficult to accept that the business aspect of their TSO would surpass the advantage of the market and national economy in the way the TSO regards the congestion income."

The transparency of the market also plays a role in its efficiency. Fingrid provides a wealth of information which helps the market parties to keep up to date with the market events.

This information is also of interest to electricity users. As an example, the image showing the state of the power system, which is updated in real time on Fingrid's website, has found its way to the screens of enterprises, media and even household consumers interested in the electricity market and sensible use of electricity, says Jukka Ruusunen.

Bonus for market promotion

According to Jukka Ruusunen, Fingrid has probably gone farther than any other company in the world in the ambition to promote the electricity market mechanisms. This is so because the degree of integration in the Nordic electricity market is one of the performance indicators used within the company – and even more: it is one of the quality criteria affecting the salary of each Fingrid employee.

"The more time Finland and Sweden constitute a single price area, the bigger the quality bonus received by Fingrid's employees," Jukka Ruusunen describes the arrangement.

The significant feature is that the bonus not only accumulates for the company's executives and specialists responsible for electricity market functions, but for the entire personnel.

Jukka Ruusunen says that this concrete quality objective which promotes the electricity market and affects the compensation of personnel has bearing in situations where, for example, the timing of transmission outages is being planned. Fingrid made about 1,000 outage plans and orders in 2009, although only some of them influenced the market. The duration of the outages varies from a few hours to several weeks.

Jukka Ruusunen illustrates the importance of outage planning with an example from Fingrid's transmission line site in Lapland last spring. It was not necessary to perform work requiring a transmission outage during weekends, so, in order to avoid congestions, Fingrid could have made the transmission capacity available to the market for weekends. However, outages were arranged on the Swedish side of the border also during weekends, and the impacts of these outages on the electricity market extended on both sides of the border.

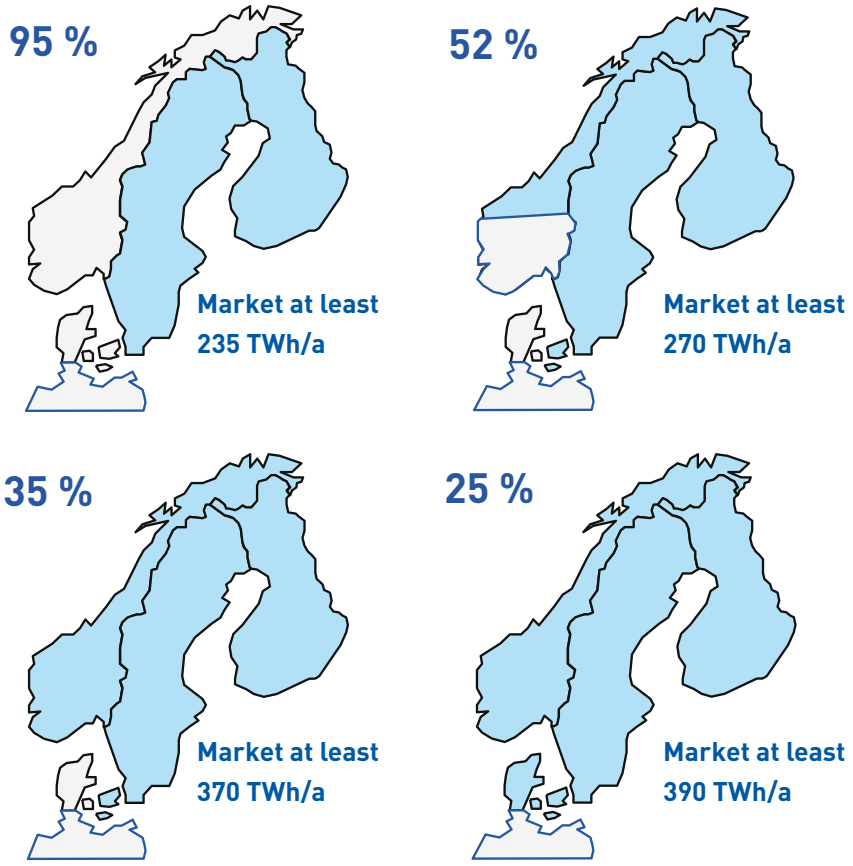
No reason for isolation

Benefits gained by national economy are often used as the argument when someone wishes to deny or question the advantages of electricity market integration.

"We have not got our message through among all target groups. We still come across accusations that by promoting market integration, we are 'bringing expensive electricity to Fin-

Nordic integration today

Scope of the uniform Nordic price area on an hourly level
1 January - 31 December 2009



"The only way in which we can influence the rules and solutions becoming favourable for Finland is to be part of the process."

land'," Jukka Ruusunen says with dissatisfaction.

He points out that market integration is in progress within the European Union completely irrespective of Fingrid. The borders will open up, new connections will be built and the rules will be established no matter whether Finland is involved in these efforts or not.

"The only way in which we can influence the rules and solutions becoming favourable for Finland is to be part of the process. The voice of Finland must be heard in Brussels. This is in the interests of all Finnish electricity users," Ruusunen emphasises.

"We have never reached anything by isolating ourselves."

The chief argument for a pan-European electricity market is an old truth: the bigger the market, the more efficient the competition. "Just as long as the rules are sensible and there are sufficient transmission connections," Ruusunen adds.

One example given by him is the very high price spike of electricity in December, caused by a cold front extending across the Nordic market area and Russia. Such a price spike would have been very unlikely in an electricity market covering the whole of Europe, he says.

10-year leap

Measured in electricity consumption, the pan-European electricity market is almost 10 times larger than the Nordic market; market integration will increase the size of the market from the Nordic 390 terawatt hours per year to 3,000 terawatt hours.

ENTSO-E, the network of the European transmission system operators, published recently the Ten Year Network Development Plan covering the first 10-year period. The plan provides the framework for the expansion of the market.

"The TSOs belonging to ENTSO-E are planning to construct 20,000 kilometres of transmission lines and cables in the next 5 years, and another 21,000 kilometres in the subsequent 5-year period," Jukka Ruusunen says with satisfaction.

In addition to ENTSO-E, there are several other parties within the EU, which have done good work for market efficiency and hence also for the benefit of Finns, Ruusunen argues.

"It was the competition office of the Commission of the EU that originally forced competition into motion. The entire Commission and also energy market regulators are on the side of the electricity consumers."

Jukka Ruusunen thinks that in 10 years, the operating environment in Europe will be completely different from the present.

"Just as long as the rules of the electricity market are sensible and once the pending transmission line projects become reality, it would be a wonder if competition did not work," he summarises the situation. ■

What you should know about the electricity market

Electricity is one of the everyday things that you take for granted, until there is no more electricity. Many people only think about their use of electricity when they get their electricity bill – do I use too much electricity, or would there be more inexpensive electricity available somewhere else? But do people really know how the price of electricity is made up? These questions are related to the way in which the electricity market works.

Fingrid and Finnish Energy Industries have published the guide "Hyvä tietää sähkömarkkinoista" (What you should know about the electricity market), which guides people to understanding the electricity market, how it works, and what kinds of impacts it has on society, the environment and the electricity bill of an individual consumer. An efficient electricity market calls for transparency and free competition.

Before this, there has not been information in layman's terms about the electricity market in Finland. The new guide intends to fill in this gap.

The publication describes the electricity market from the producers to consumers, where electricity comes from and where it goes to, how the electricity exchange works, how electricity is transmitted from power plants to consumers, composition of the price of electricity, buying and competitive bidding of electricity, and the electricity bill. The future outlook for the electricity market is also discussed.

The text of the publication has been written by **Maarit Kauniskangas**. An English version of the brochure will also be published on Fingrid's website. ■

The publication in Finnish can be downloaded as a pdf file from Fingrid's website at www.fingrid.fi/portal/suomeksi/uutiset/julkaisut/hyva_tietaa_sahkomarkkinoista

Industries and commerce require

a well-functioning electricity market and self-sufficiency in electricity generation

Finnish industries and commerce are primarily positive about the integration of the electricity market covering the whole of Europe. Electricity supply would be more secure in all situations in a single market, but there are some concerns about the potential rise in the price of electricity close to the level prevailing in Continental Europe.

Text by Maarit Kauniskangas ■ Photographs by Marjut Hentunen and Plugi

"The Confederation of Finnish Industries EK is pro free market and strictly against all kinds of protectionism. However, from the viewpoint of electricity users the risk with an electricity market covering the entire Europe is that the area price for Finland evolves towards the price level in Continental Europe," says **Mikael Ohlström**, energy and climate policy adviser of the Confederation of Finnish Industries.

The Nordic countries are accustomed to a lower electricity price, because the region has an abundance of inexpensive hydropower and nuclear power.

"However, it is out of the ordinary that in this winter the average exchange price of electricity has been higher here than in Continental Europe. On the other hand, it is expected that the price ratios will turn back to the normal order."

The Confederation of Finnish Industries believes that in a pan-European market, the price of electricity may become more even over a longer term. Also, with sufficient transmission connections and no problems on the connections, there will be no transmission congestions which raise the price temporarily now.

Not resting on imports

As the primary solution to be applied by Finland, Finnish industries suggest self-sufficiency, in other words adequate domestic electricity generation capacity in all circumstances. Unlike the other Nordic countries – and almost all EU countries – Finland is highly dependent on imported electricity. This is an expensive approach especially when large volumes of electricity are needed temporarily.

As an example, record volumes of electricity were consumed in Finland during the cold weather this winter. On 8 January, the highest hourly consumption was almost 14,100 megawatts (on 28 January approx. 14,400 megawatts). At that time, domestic electricity generation was 12,200 megawatts and imports of electricity 1,900 megawatts. Before noon, im-

"The availability of electricity must be secured in all circumstances and without costly price spikes."

ports were as high as 2,400 megawatts (on 28 January as much as 2,900 megawatts, i.e. one fifth of consumption!). Fingrid had to start peak load power capacity, because electricity supply was not sufficient to cover the demand in the Nordic electricity exchange. In several hours in the morning, electricity cost as much as 1,000 euros per megawatt hour (100 cents per kilowatt hour) both in Finland and Sweden. In a corresponding situation on 17 December 2009, the exchange price of electricity rose to a staggering 1,400 euros per megawatt hour.

The Confederation of Finnish Industries considers that Finland should not rely so much on electricity imports. Even though the Nordic and European market will integrate, there is not necessarily always enough electricity for imports. This is a major risk in today's society.

There is no reduction in electricity consumption in sight, despite that fact that the economic recession has decreased industrial electricity consumption. The price spikes of electricity, in turn, have already influenced some industrial enterprises. Major electricity users, which have hedged their purchase price of electricity, can make more money in a price spike situation from electricity not used than from their actual products. However, most enterprises do not have such an opportunity or resources.

"After all, it is not sensible to plan production on the basis of the price of a single factor of production, electricity. Price spikes have an effect on the electricity bills of enterprises, albeit with a delay, also when the enterprises have hedged their electricity purchases," Mikael Ohlström points out.

He characterises demand response in the use of electricity as a good feature in itself. Large-scale electricity users can decrease their production volume as agreed in advance or on their own initiative, for example during cold weather. If an industrial plant produces electricity temporarily more than what it needs itself, electricity can be sold to the exchange, and the additional supply hence restrains the price spike of electricity.

The climate and energy strategy of the Government of Finland also states that Finland should not be dependent on imports of electricity. Instead, Finland should be self-sufficient in all situations, which also means occasional electricity exports.

More generation capacity

"Energy solutions are adopted with a long view, for decades to come, not on the basis of passing economic cycles. The recent reduction in electricity consumption in Finland is chiefly the result of underutilised industrial production capacity due to the recession, and some mills have also been closed down completely. However, we have not been self-sufficient even during the period of reduced electricity consumption, because the power plants in operation at present cannot cover the current electricity consumption in Finland," Ohlström says.

Moreover, he points out that the closing of pulp mills has also reduced electricity consumption permanently in Finland.

"On the other hand, more electricity than ever before was consumed in Finland in January 2010, as much as 9.2 terawatt hours according to the Finnish Energy Industries."

The Confederation of Finnish Industries and the Finnish Energy Industries have estimated that 7,000 to 8,000 megawatts of new electricity generation capacity would be required in Finland by 2030. Of this, about 2,000 megawatts would replace outdated combined heat and power production (CHP), which will not be included in the generation portfolio of the future. The remainder of the capacity is separate condensing power production, which is needed for year-round electricity generation as so-called baseload power and also as peak power needed for only a small period of time annually. In practice, the baseload power capacity needed corresponds to three nuclear power units.

Towards a single electricity market

Mikael Ohlström cannot foresee a well-functioning electricity market covering the entire Europe in the near future.

"It is impossible to anticipate when the electricity market in Europe is completely uniform. There is constant integration as new transmission connections are built. Still, we will see regional price differences also in the future."

The price of electricity is also subject to political decisions concerning issues such as emission trading, taxes, feed-in tariffs and transmission tariffs.

"The vital thing is to make sure that the overall costs remain as low as possible. One way to achieve this is to make investments in sufficient carbon-neutral electricity generation capacity."

Before the market can integrate properly, transmission congestions must be eliminated. Moreover, the electricity grids and transmission connections in the various parts of Europe represent very different standards. Mikael Ohlström believes that the area of the Baltic Sea and North Sea will network first. On the other hand, for example Spain is highly interested in being involved in the process. They would like to sell electricity produced from wind power and solar power to the rest of Europe. However, wind power represents subsidised electricity production, so it will increase the electricity bills of consumers.

More electricity will be needed in any case, as fossil fuels are being replaced. At the same time, however, the total energy consumption is decreasing, since electric drives are most often more efficient solutions than fuel-based systems. Examples of this include heat pumps in housing and electric cars in transport. Many environmental protection measures, such as cleaning of waste water and scrubbing of flue gases, increase electricity consumption.

"The availability of electricity must be secured in all circumstances and without costly price spikes. The aids for this include both reliable transmission connections and sufficient domestic electricity generation capacity," Mikael Ohlström summarises. ■

INDEPENDENT DISTRIBUTION STARTS IN ESTONIA

Elering ensures a stable supply of electricity

The electricity distribution system in Estonia and all Baltic countries is in the midst of a rapid transition process. Distribution is being unbundled from production in accordance with European regulation.

Text by Antti J. Lagus ■ **Photographs by** Toomas Tuul and Annika Haas

Estonia took a major step into the new era at the end of January when its parliament passed a law that determines the basis of an open electricity market and how electricity distribution is separated from the state-owned energy company Eesti Energia into an independent company Elering.

In anticipation of the new legislation, Elering has served as an autonomous division of Eesti Energia since last December. That is also when the former Estonian Minister of Finance and former member of Parliament **Taavi Veskimägi** stepped on the Board of Directors of the company. He is now the Chairman of the Board of Elering.

Veskimägi believes that his past experience will benefit the company in negotiations with the key people in the administration – after all, Elering is a state-owned company with public interests.

"It creates trust in the market place when a system operator is independent of all the market operators. It's a delicate question because the participants are entitled to believe that there are no information leaks to third parties," says Veskimägi.

EstLink 2 ensures sufficient capacity

Elering develops the electricity transmission grid of Estonia with its investment budget, which Veskimägi characterises as expansive. The main focus lies in developing EstLink 2 and also other interconnections. After the commissioning of EstLink 2 and after having acquired, with Fingrid, the ownership of Estlink 1 from its current commercial operators, Elering and Fingrid will control connections of 1,000 megawatts between Finland and Estonia. The share of EstLink 2 of this capacity will be 650 megawatts.

"This is enough capacity to ensure that the electricity market in Estonia is going to function every hour. With more producers and feeders, we are going to get more security to our network."

"The EstLink 2 project is the cornerstone of Estonian security of electricity supply. It helps in proceeding with market opening and integrating the grids in the Baltic and Scandinavian countries according to the Baltic Energy Market Interconnection Plan."

After completing the Estlink initiatives and also while they are active, Elering will invest considerable amounts of money into the internal network in Estonia. In addition to the existing ring network, Elering is going to build a new 330 megawatt connection between Tartu and Pärnu and also strengthen the lines between the electricity-producing town of Narva and the capital Tallinn. A third interconnection line between Latvia and Estonia is also being considered.

According to Veskimägi, there still remain some questions in the calculations about the economic viability and the potential route of the new connection but he considers it quite realistic that the new line will be built.

Security of supply one of the main concerns

After the nuclear power plant in Ignalina in Lithuania closed down, potential bottlenecks between the Estonian and Latvian border have arisen. Most of the loss of electricity that resulted from the closing of Ignalina is covered in Latvia and Lithuania with imports from Russia and Belorussia, but Estonia also exports some electricity. Linking Estonia

"I am quite convinced that an open market is beneficial for the customers," says Taavi Veskimägi, Chairman of the Board of the Estonian electricity distribution operator Elering.

"The EstLink 2 project is the cornerstone of Estonian security of electricity supply. It helps in proceeding with market opening and integrating the grids in the Baltic and Scandinavian countries according to the Baltic Energy Market Interconnection Plan."

more closely with especially the Nordic countries increases the security of supply in the whole region.

"Today Estonia is a net exporter of electricity. Also Estlink 1 is used to export electricity from Estonia to Finland."

One of the main issues in the second energy review of the European Commission was the security of supply. Here one of the most important things is the Baltic interconnection plan. Veskimägi considers that the cable that has been planned to connect Lithuania and Sweden supports the security goal. He believes that the Swedish transmission system operator Svenska Kraftnät will more likely launch co-operation with its Lithuanian counterpart Litgrid UAB when distribution is wholly separated from a production and sales company.

Baltic interconnection plan steers future development

"The Baltic electricity market interconnection plan is a very important document for us. Elering is very committed to this plan. In my opinion all the participants should follow very closely the concrete steps that are laid out in the plan."

Especially after 2013, when the European power sector should be using a new quota system for emissions, it will be difficult for electricity producers to remain competitive in an environment where electricity is produced in third countries where European regulation does not apply. The European Commission is looking into this problem, and Veskimägi awaits eagerly the results of this work.

"If electricity which is not covered by the CO_2 quotas is allowed on the market, the competition will not be fair," reasons Veskimägi.

Nord Pool will strengthen the market

"Our decision to separate the system operator with its assets gives us a clear advantage especially if one compares the situation with our neighbours Latvia and Lithuania. Also the opening of the Estlink price area managed by Nord Pool Spot testifies to the fact that the market conditions here are more advanced."

The economic downturn has also affected the consumption of electricity in the Baltic countries, and the opening of electricity markets from the first of April is a proper time.

"Price is formed on the basis of supply and demand, and when demand has been dropping, it is good news for the consumers and industries. This makes it easier for the customers to adjust for the potential jump in price."

Seasonal reasons are also of importance in the varying supply and demand of electricity. Veskimägi adds that opening the market in April means that demand will drop after the winter season and supply based on hydropower will increase. This should help to keep the anticipated price hike in control.

"The opening of the Baltic power exchange may lead to a rise in the price level. We should bear in mind that we have cheap electricity because we don't take carbon dioxide properly into account in the price of electricity."

Veskimägi believes that electricity prices will rise in Estonia one way or the other because a large share of the Estonian electricity production capacity is obsolete and needs to be renovated before 2016. Seventy percent of the current installed production capacity cannot be used after 2016. With Elering steering the development of the Estonian power grid, Estonians should expect a stable supply of electricity. ■

THIS IS HOW INTEGRATION MAKES HEADWAY in the European electricity market

The Ten Year Network Development Plan of ENTSO-E, the network of the European transmission system operators, encompasses the first compilation of the grid construction projects in the near future, covering the entire Europe. The plan provides up-to-date information on the capital investment projects and also outlines the power system of the future.

Text by Maarit Uusitalo

ENTSO-E decided to publish its ten-year plan as a pilot project, before the so-called third legislative package of the EU becomes effective. The intention is to augment European knowledge of network planning and also to describe what grid reinforcements the transmission system operators (TSOs) have been planning.

Another objective of the early publication of the plan is to gain experiences of drawing up a plan of this kind and of the necessary European-level methods, and to test the process to gather opinions from the stakeholders. The experiences and opinions can be utilised in the next 10-year plan due to be published in two years.

ENTSO-E's final Ten Year Network Development Plan will be published in the joint EU conference of the energy industry in Florence in the summer of 2010.

Active data compilation and co-operation

The drawing up of the Ten Year Network Development Plan was launched immediately after ENTSO-E started its operations in the spring of 2009. The compilation of the necessary information has meant intensive work over the past six months. A separate task force has carried the main responsibility for putting the plan together, but several work groups and individual persons have contributed to the contents.

Free-format discussions with representatives of selected stakeholders were also launched at a relatively early stage, and contacts and co-operation were established with the organisation of the European energy regulators. The goal was to include ENTSO-E's suggestions in an expeditious pilot project and to obtain potential proposals concerning the contents.

Now that the first pilot plan is ready, all those interested have an opportunity to present their views of it through a consultation process.

Background, needs and challenges

The plan is highly comprehensive. It describes the background of grid development, challenges involved in grid planning, production and consumption forecasts and their mutual balance, needs concerning interconnections, planned capital investments, and technical and commercial analyses required in grid planning. The plan also reviews new technologies and the future of the grid.

One of the foremost challenges in network planning is that the permit procedures in the various countries are so different, and in some cases also slow. The plan presents views of improvement suggestions which enable grid construction projects.

The reviews of production and consumption forecasts are based on ENTSO-E's System Adequacy Forecast report published in January. It assesses the balance between the system on one hand and the electricity production capacity and consumption in the various countries on the other hand. These forecasts are based on the estimates of individual TSOs on the situation in the respective countries. Many member countries of ENTSO-E have not yet reported their binding plans for renewable energy, so this information will be specified after the summer of 2010.

The Ten Year Network Development Plan also contains an estimate of the impact that the known production plans together with the estimated trend in electricity consumption has on the EU's objectives concerning the CO_2 emissions of electricity production and share of renewable energy.

According to the estimates, the EU's objectives can be attained. Electricity consumption is expected to increase, but it will potentially replace some other forms of energy consumption, whereby the total energy consumption may very well reach the goals of the Union. It may not be possible to quite reach the objective with regard to a reduction in the carbon dioxide emissions; the outcome will depend on the use of coal or gas power plants. It is estimated that the share

of renewable energy in electricity production is approx. 25 per cent, but it may be that this needs to be higher.

Three main drivers

The drivers of grid construction projects can be divided into three groups: improving the conditions of the pan-European electricity market, integration of renewable energy sources, and security of supply. However, it is rarely just a single need that calls for grid construction projects, but several of the above-mentioned objectives often justify them.

All in all, the plan lists more than 400 grid construction projects of European significance, totalling about 42,100 kilometres of new transmission lines. The total length of the present grid is approx. 300,000 kilometres.

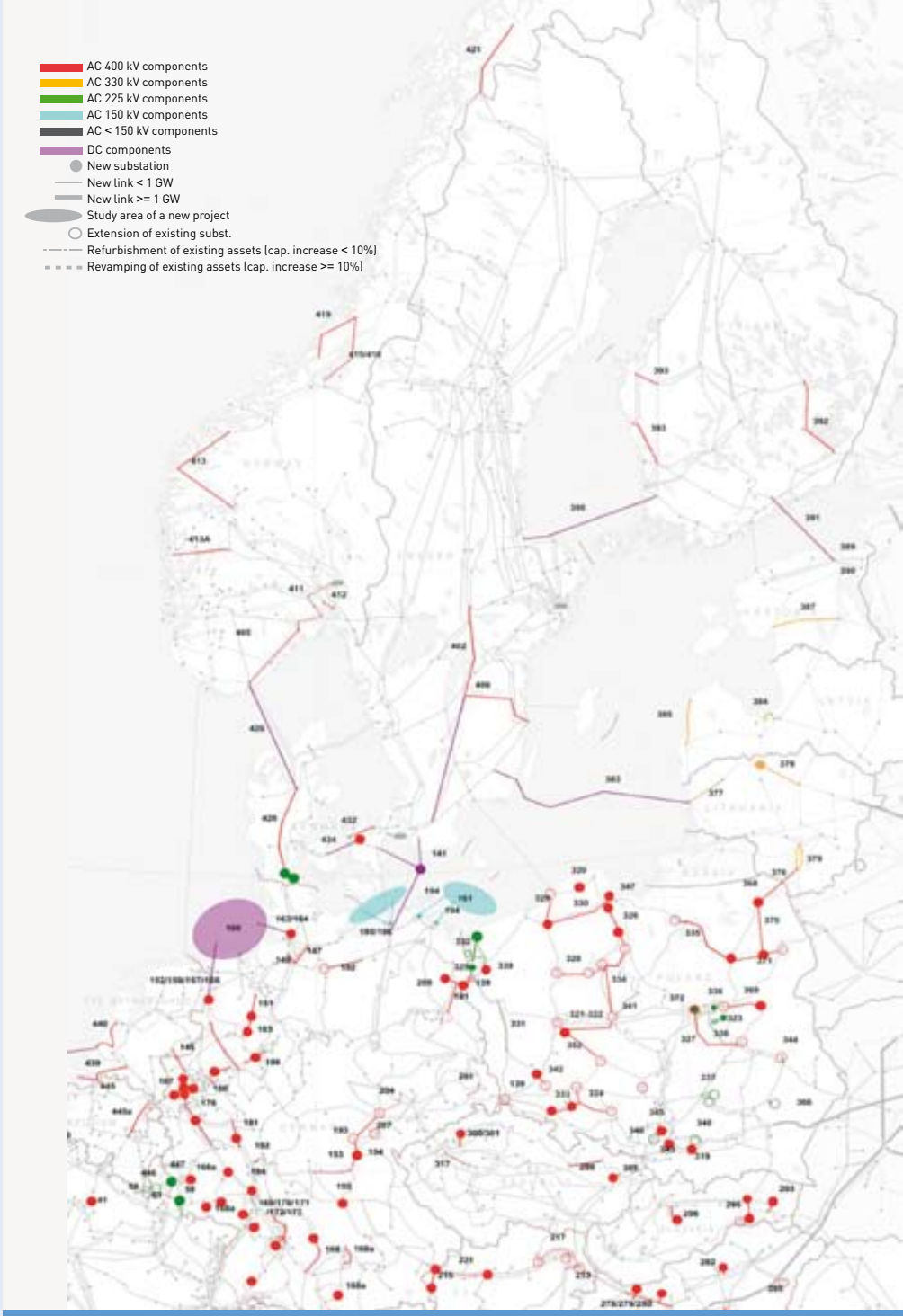
In 2010–2014, the estimated cost of the grid investments covered by the plan is 23 to 28 thousand million euros. The estimated cost of the grid investments in the Baltic Sea region is 11 to 13 thousand million euros.

Major projects in the Baltic Sea region

The capital investment needs for the Baltic Sea region and projects of European significance in that region were compiled within a regional group on the basis of earlier analyses drawn up jointly. These analyses include for example Nordic Grid Master Plan 2008 and Multiregional Plan 2009.

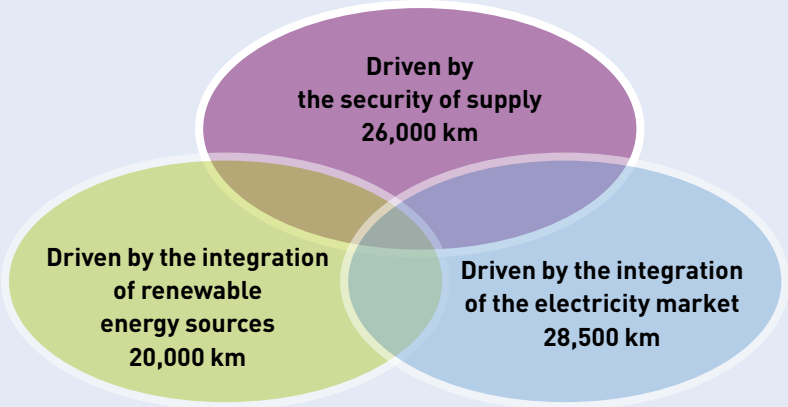
The needs and the corresponding projects are shown in the enclosed maps. The projects presented are in very different stages of planning. Some are already being constructed and some have been decided, while some of the long-term projects are only in their early stages of analysis.

In the coming years, market integration – connecting the Baltic countries to the European electricity market, eliminating congestions in the Nordic grid, and building of new interconnections to Continental Europe



Medium-term projects (due to be executed by 2014).

Planned pan-European grid construction projects in line kilometres, divided on the basis of the main drivers.



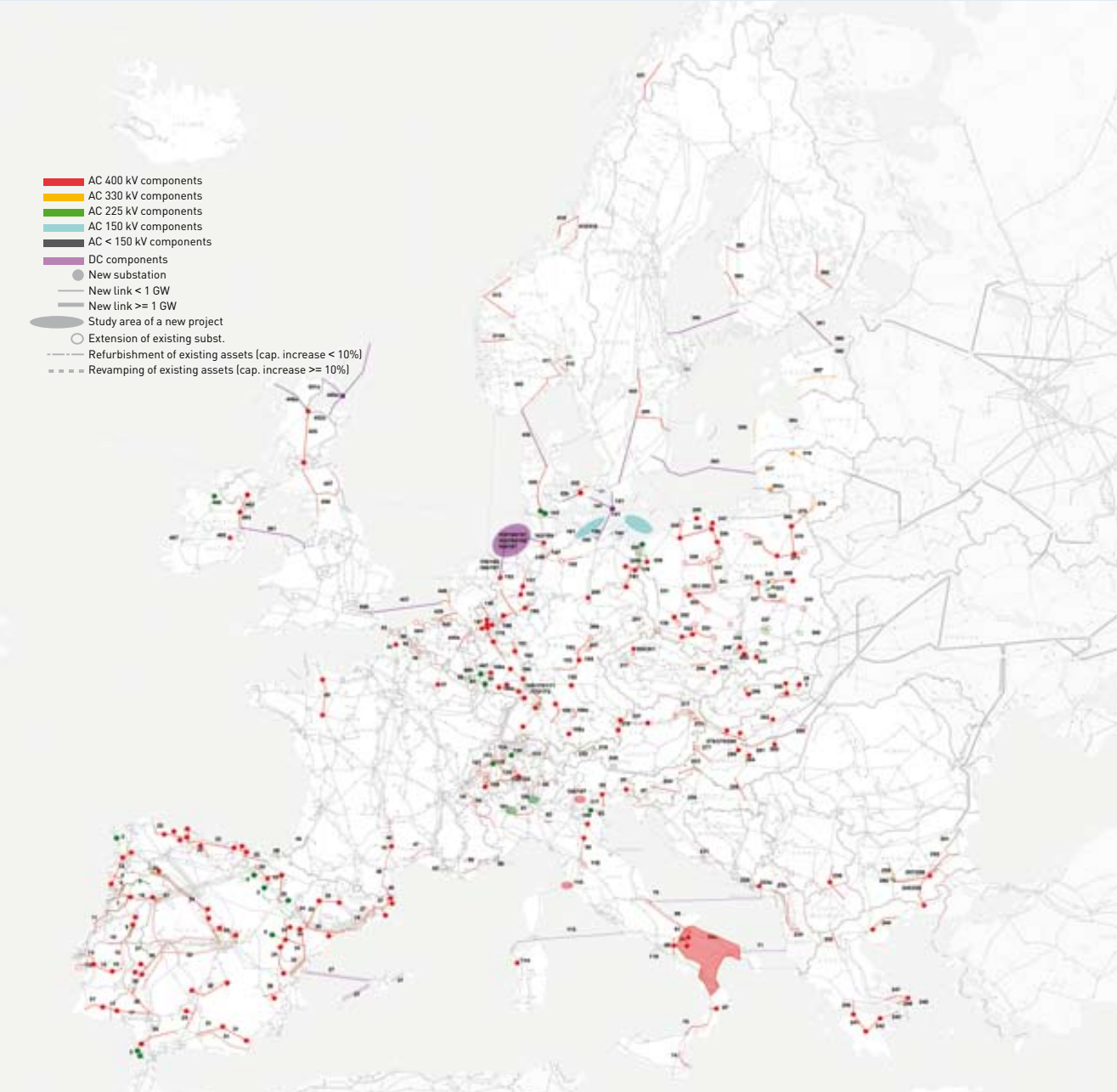
– will be the main driver of grid capital investments in Northern Europe.

The emphasis will shift after 2015, and connecting renewable energy sources to the grid will become the prime mover of more and more investment projects. The EU's 2020 objectives call for much new wind power. Moreover, new nuclear power capacity is also being planned in Finland, and a clear production surplus will emerge in the Nordic countries.

Power transmissions will change considerably from the present, requiring reinforcements to the north-south transmission links and new connections to the rest of Europe.

With respect to Finland, the plans concern Fenno-Skan 2, EstLink 2, a third AC cross-border line to Sweden, and a 400 kilovolt line to Norway that is being analysed at present. The plan also covers grid reinforcements within Finland, such as upgrading the 220 kilovolt network in Western Finland to 400 kilovolts, and grid reinforcements in South-Eastern, South-Western and Northern Finland resulting from changes in transmission needs.

The proposed grid investment projects will facilitate the integration of the Baltic countries to the European transmission grid. They will also promote the connection of the Nordic countries to the system in Continental Europe, thus accomplishing an increasingly coherent power system around the entire Baltic Sea. Furthermore, the projects will enable the connection of electricity from renewable energy sources to the grid, and hence they respond to the related electricity transmission needs in the system. ■



Medium-term projects (-2014) in the entire ENTSO-E area.

Price spikes in the ELECTRICITY market

This winter, the spot price of electricity has been very high at times. The cold weather has raised electricity consumption in the Nordic countries, the availability of nuclear power in Sweden has been poor, and transmissions from Norway to Sweden have been restricted. In December and January, there were price spikes on two days for a few hours.

Text by Erkki Stam ■ **Photograph by** Vastavalo

The first price spike occurred just before Christmas. On Thursday 17 December, the wholesale price of electricity rose to approx. 1,400 euros per megawatt hour (€/MWh) for two hours in the evening. At that time, Sweden, Zealand in Denmark, Finland, Central Norway and Northern Norway constituted a uniform price area.

The prices in Southern Norway and Jutland were simultaneously much lower (42 to 51 €/MWh) due to transmission congestions in these areas. During the price spike, the transmission capacity from Southern Norway was 100 megawatts below that in the surrounding hours. More than half of the nuclear power capacity in Sweden (some 9,300 MW) was not available. During the price spikes, electricity generation and consumption in the area of the uniform price were approximately at the same level as in the previous day and next day during the same hours.

Based on the published demand and supply curves, it seems that no demand response was offered to Elspot on the day of the price spikes. Demand reacted to the high prices only after Elspot. During the price spikes, the price level in Elbas was clearly lower than that in Elspot, and during the operational hour there was surplus generation in the Nordic countries. In order to maintain the power balance, generation was down-regulated by approx. 1,500 MW in the Nordic countries; some 500 MW of this was carried out in Finland. The volume of demand response in Finland in the operational hour was approx. 500 MW.

The commercial market balance achieved in Elspot during the price spikes was based on exports from Finland into Sweden at a power of about 70 to 350 MW. In the operational hour, electricity was imported into Finland from Sweden at a power of about 310 to 530 MW. Imports from Russia and Estonia were at the maximum volumes.

The other price spike took place in three hours in the morning of 8 January. The Elspot price at that time was approx. 1,000 €/MWh. There was more available nuclear power in Sweden than during the price spikes in December, but the transmission capacity from Southern Norway to Sweden had been restricted to zero. The market behaved in the same way as on 17 December. The same areas had a uniform Elspot price, the Elbas prices were lower, and generation was down-regulated in the operational hour in order to maintain the power balance. Within the uniform price area, electricity consumption was approx. 2,000 MW higher during the price spike in January than in December, and generation was more than 2,500 MW greater.

Nordic peak load reserves into play

Some peak load reserves were activated at market terms in Elspot, because no market balance between demand and supply could be accomplished in the uniform Nordic price area. In accordance with the agreed rules, peak load reserves were activated both in Finland and Sweden at a ratio to the reserved reserves. In December, the portion of peak load reserve activated in Finland was only about 16 MW. However, this volume was ultimately generated in Sweden on the basis of the Nordic operational situation.

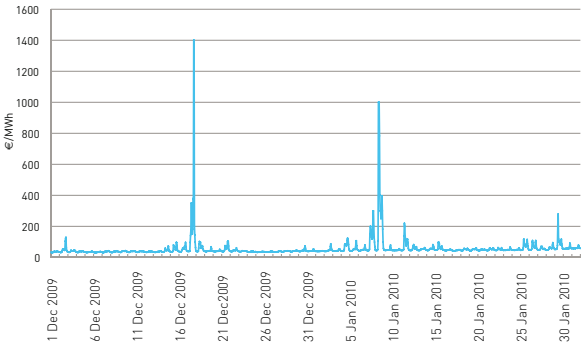
Peak load reserves were also activated in Elspot in January so as to maintain the market balance. The Finnish portion of these was approx. 101 MW. Moreover, the peak load reserve portion of Sweden was also generated in Finland.

The power balance in Finland did not require the activation of peak load reserves in December or January.

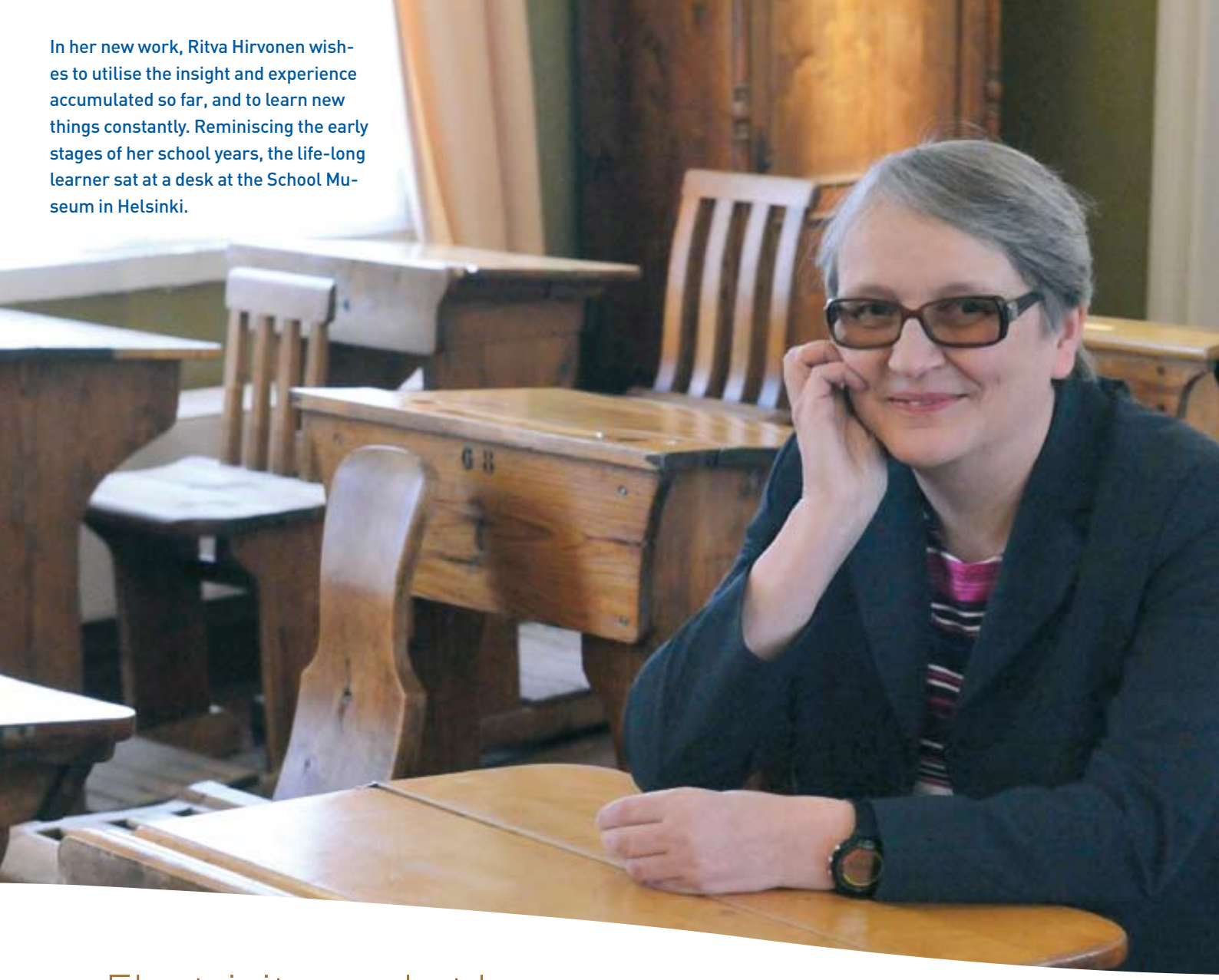
Temperature in Sweden affected the peak demand

The price spike in December coincided with the peak consumption of approx. 45,650 MW within the uniform price area in the same day. In January, the price spike was achieved in the morning and the peak demand of approx. 48,960 MW in the evening. The peak demand periods coincided with the peak consumption in Sweden on these days. ■

Hourly area price of electricity for Finland, December 2009 - January 2010



Elspot is a market place maintained by Nord Pool Spot, quoting the hourly prices in the day-ahead market on the basis of generation and demand bids.
Elbas is a market place maintained by Nord Pool Spot, used for intra-day trading of electricity up to one hour before the supply of electricity.



In her new work, Ritva Hirvonen wishes to utilise the insight and experience accumulated so far, and to learn new things constantly. Reminiscing the early stages of her school years, the life-long learner sat at a desk at the School Museum in Helsinki.

Electricity market has **CHALLENGES FOR LIFE-LONG LEARNER**

Fingrid's new Development Manager Ritva Hirvonen characterises herself as a life-long learner. She has viewed the electricity market from a number of perspectives during her career, most recently from that of regulators. She returned to Fingrid after 11 years, bringing with her new experiences and aspects to promote the functioning of the electricity market.

Text by Maria Hallila ■ **Photographs by** Juhani Eskelinen and ScandinavianStockPhoto

A desire to constant learning has been the leading idea for Ritva Hirvonen from the beginning of her work career. It has inspired her to broaden the perspectives and advance her expertise concerning the transmission grid, entire power system and electricity market.

With a degree of Licentiate in Technology in electrical engineering, her career commenced at Imatran Voima in 1984 in electrical engineering for power plants. She later went into power system planning and operation at IVO Voimansiirto Oy and later at Fingrid. This period of a total of 15 years also included writing a Doctoral thesis and taking an MBA degree in the 1990s.

An interest in science and research methodology and prospects took Ritva Hirvonen to the Technical Research Centre of Finland for four years. Her most recent position of seven years at the Energy Market Authority responsible for issues such as supervision of the transmission system has expanded her expertise and perspectives of the interrelations of technical, commercial and juridical factors.

Learning and promoting EU collaboration

When Ritva Hirvonen started working at the Energy Market Authority, Finland had just liberalised her electricity market a few years before.

"We were learning to operate in a free electricity market – and had already learned something," she says in

reminiscing the early stages of her career in regulatory duties.

The increasing expansion of the electricity market in recent years has also shaped the work of supervisory regulators: international matters have become more and more important. Ritva Hirvonen has participated in the international efforts and served as a chairperson in several European work groups. She considers that she has been in a vantage point in these duties, both learning and developing co-operation within the EU.

"The goal of a single European electricity market is still far and integration is not progressing at the pace that regulators would desire. The large players may occasionally decelerate the travel towards the goal, where the Nordic market approach could serve as the example in many respects," she describes the present situation.

"The sluggish developments are explained by the different kinds of operating environments and procedures in the different member states. It takes two or three years to pass the directives within the EU and another two years to implement them nationally."

The EU has expedited the integration of the energy market by means of directives for the single electricity market. The most recent one of these, the so-called third legislative package, came into force in the autumn of 2009. This brought new structures to the electricity market, such as ENTSO-E, the European Network of Transmission System Operators for Electricity, and ACER, Agency for the Cooperation of Energy Regulators.

According to Ritva Hirvonen, the establishment of ENTSO-E was a long leap forward for the electricity market.

"ENTSO-E is an official organisation of the TSOs, and it will draw up rules which bind its members legally. Adherence to these rules will be supervised both nationally and on a European level," she says.

ENTSO-E consists of 42 TSOs in 34 European countries, and there are great expectations towards its efforts.

Much to develop even in the model market

Ritva Hirvonen points out that the enterprises and regulators operating in the electricity market have a lucid joint goal: to enhance the market. She is also prepared to struggle to this end in her own work.

One of her foremost goals is to convey the best practices of the Finnish and Nordic electricity markets to the rest of Europe.

"Among regulators, the Nordic countries have attained the status of a model market. Various development projects tend to find out how the matter at hand has been solved in the Nordic electricity market. After all, we have excellent solutions to issues such as transmission congestion management, intra-day market for electricity, and balancing power market," Ritva Hirvonen lists.

However, there is still room for improvement. The researcher in her is intrigued for example by a desire expressed by some market players of analysing the management of long-term transmission capacity maintained by the TSOs: how to arrange a monthly and annual market for transmission capacity?

Another thing puzzling Ritva Hirvonen's mind is related to the compatibility and harmonisation of the market both on a European and Nordic level: how far must harmonisation go so that the market works better than now?

"Harmonisation means that there are identical rules on a certain issue in the market. Compatibility is a looser approach: the market can follow national rules which differ from those in other countries, but the rules are still compatible with each other," Hirvonen explains.

An example given by her is the Nordic balancing power market, where there are country-specific practices. Despite

this, the Nordic balancing power market works seamlessly together.

On the other hand, the Nordic intraday market for electricity is an example of harmonisation: there is a single electricity exchange, and the rules for this electricity trade are fully uniform in all Nordic countries.

Valued Finnish expertise

In addition to having insight into the Nordic electricity market model, Ritva Hirvonen has also represented a highly valued combination of features among EU authorities: Finnish expertise.

"You can go far with expertise and impartiality. There is trust in the impartiality and positive attitude of Finns towards the market. In order to ensure impartiality, the chairman in work groups is often selected from a small country rather than a large. In this way, Finland has gained a firmer foothold in international contexts than what our position and size would otherwise presume."

Ritva Hirvonen's solid technical expertise and experience have enjoyed demand within the EU, because technical specialists are in a minority among European regulators; most of the experts are economists and lawyers.

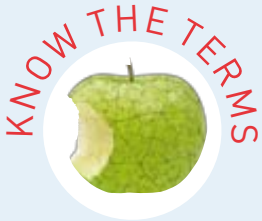
She feels that a technical background has also been an asset, if not a necessity, in national regulator tasks.

"When you interpret the Electricity Market Act and decrees, it is important to understand what the stipulations stand for," she emphasises.

Ritva Hirvonen says that in her regulatory capacity, she has also adopted a new attitude involving the recognition of facts and patience accumulated with the years.

"I have come to understand that it takes time for things to happen. Earlier, I wanted everything to take place swiftly, while now I have the patience to wait," she says.

And if, despite the above, her patience is put to the test, she has effective relief valves to release the pressure: nature, music, photography and house close to Savonlinna with its garden and forest work. ■



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

Corona losses

Corona is a partial discharge occurring in the air or some other gas on the surface of an electrode. A corona discharge causes power losses on an electricity transmission line, since the discharge converts electric energy mainly into heat. Since corona losses take place on a transmission line when the strength of the electric field on the surface of the conductor exceeds the dielectric strength of air, weather factors also have a significant impact on the losses alongside the voltage of the transmission line.

For example, at a high voltage and during heavy hoar frost, the losses may grow as high as to the sixth power of voltage. The structure of the line has a crucial impact on the corona losses. As an example, on a line with 2 sub-conductors, the corona losses are 2 to 5 times greater than in a line with 3 sub-conductors, depending on the voltage and weather conditions. In practice, the strength of the electric field on the surface of the conductor is sufficient for the creation of corona discharge only on transmission lines with a rated voltage of 220 kilovolts or higher. The primary weather phenomena affecting the losses are rain, snowfall, air temperature, air pressure, humidity, hoar frost and rime ice.

The volume of corona losses is not significant in beautiful weather. In such weather, corona losses are caused by air impurities and the uneven surface of the conductor. Increased air humidity decreases corona losses, because water vapour absorbs free electrons, which serve as charge carriers. On the other hand, humidity condenses into fog particles below the dew point, which increases the occurrence of corona. In snowfall, the corona losses are considerably smaller than in rain.

When it is raining, a drop of water or a snow flake may often cause corona discharge on the surface of the conductor even before the particle touches the conductor. When the drop or flake enters the electric field of the conductor, it distorts the field locally. As a result, the local field strength grows, and there is a discharge. In snowfall, the corona losses are about 2 to 6 kilowatts per kilometre. In rain, the overall corona losses are small due to reasons such as the local nature of rainfall.

Hoar frost accumulating on the conductors in the winter makes the surface of the conductor more uneven, causing great corona losses. According to a study, when the current of a 2-Finch conductor is approx. 300 amperes, no hoar frost accumulates on the conductor. Even at currents smaller than this, the structure of existing hoar frost changes, but the resistance losses alone are not sufficient to melt the hoar frost away. At daytime, radiation heat emitted by the sun accelerates the melting of hoar frost, but during cold periods hoar frost may remain on the conductors for weeks. In other words, the magnitude of the current required to melt the hoar frost depends crucially on the weather conditions, too. Various sources have stated that on a 400 kilovolt line with two sub-conductors, the corona losses may be as high as 80–100 kilowatts per kilometre with heavy hoar frost.

In the Finnish transmission grid, the majority of the corona losses are created in the winter, and corona losses account for about 10 per cent of the total annual losses. Momentarily, the corona losses in the Finnish grid may be over 150 megawatts.

Text by Vesa Vänskä

LESS EMISSIONS, MORE VERSATILE SERVICES

Comprehensive research programme expediting a smart grid

CLEEN Ltd, the strategic centre for science, technology and innovation in the energy and environmental industries in Finland, has launched its first research programme. CLEEN's Chief Technology Officer Jatta Jussila says that alongside the "Smart Grids and Energy Markets" programme, there are ongoing preparations for other research programmes.

Text by Pirjo Rautanen ■ **Photographs by** Juhani Eskelinen

CLEEN's strategic areas have been selected on the basis of existing expertise.

"We cannot be best in everything. Each research topic is chosen on the basis of solid national expertise in the particular area, with this expertise also possessing international significance. Funding applications for four research programmes by CLEEN are currently being processed by Tekes, the Finnish Funding Agency for Technology and Innovation, and the preparations for another five programmes are aiming at launching the programmes within a year," says Jatta Jussila.

CLEEN Ltd is one of the six Strategic Centres for Science, Technology and Innovation (SHOK) in Finland. CLEEN's vision is that by 2050, the energy and environmental industries will be the leading industrial sector in Finland and a global market leader in certain business areas.

Target: global competitiveness

The Strategic Centres for Science, Technology and Innovation, or SHOKs, were launched in Finland in 2004 when the globalisation report of the Prime Minister's Office was completed. The main objective set was that a few centres of expertise of international top level be established in Finland.

In 2005, the Government made a policy decision on the structural development of a research system, and a strategy was drawn up on this basis for creating innovation centres.

According to Jatta Jussila, CLEEN's research programmes represent new type of interdisciplinary co-operation.

"The purpose of the SHOKs is to accomplish comprehensive research programmes based on the long-term collaboration between the prime players, resulting in intensified innovation chains," Jatta Jussila says.

The goal is to come up with globally significant innovations, which increase the business and competitiveness of enterprises.

"New types of co-operation and innovations give enterprises a whole new spectrum of opportunities to work in the global market. New innovation-intensive jobs will also be created in Finland."

Renewable energy to the grid

CLEEN's owners comprise 28 enterprise shareholders and 16 research institution shareholders. All of them conduct their own R&D in Finland. The establishment of CLEEN was also prompted by the national target to help Finland achieve results conforming to the environmental goals.

The scope of the five-year research programme "Smart Grids and Energy Market" is 36 million euros.

According to Jatta Jussila, it was possible to launch this programme as CLEEN's first project thanks to the swift establishment of the research consortium.

"The energy market is a highly topical issue, which also expedited the launch of the project. Electricity consumption is expected to grow, but at the same time there is a need to cut down the emissions. Linking renewable energy sources to the electricity transmission grid is a challenge to which the smart grid can respond."

Joint innovation search

The chief objective of the research programme is to find solutions which enable and accelerate the introduction of new energy alternatives, such as decentralised production of energy from renewable energy sources, and demand response. The consortium encompasses technology suppliers, energy and network companies, and ICT businesses. All in all, the research programme covers 15 enterprises and 7 research institutions.

Jatta Jussila says that the programme consortiums work transparently.

"One of the important tasks is to devise smart electricity meters to provide interaction at the customer interface."

"The parties search innovations together. This represents completely new kind of comprehensive and interdisciplinary co-operation."

The work input of the participating enterprises comprises the most significant portion of the costs of the project. The enterprises also make money available for work carried out by the research institutions. Jatta Jussila says that the financial support provided by Tekes is significant. The budget for the first period of 18 months is 11 million euros, of which Tekes provides approx. 7 million euros.

"Since the research programme extends over a long period of time, the work plan must be split into stages so that the results can be reviewed against the future outlook. After all, it is impossible to make precise forecasts concerning the future, which is why it is important to adjust the course," Jatta Jussila points out.

Flexible and interactive grid

The electricity transmission grid of tomorrow gives the customers an opportunity to integrate into the grid and become an active player in it. A smart grid works in two ways.

"One of the important tasks is to devise smart electricity meters to provide interaction at the customer interface. Such a meter is capable of two-way communications, hence offering opportunities to come up with new services which facilitate the end users," Jatta Jussila says.

When the consumers are aware of their actual energy consumption, they can decide what they can and should do at a given moment. They are indicated the biggest loads in their household. End users can also be guided to decrease their electricity consumption during peak consumption. Consumers can be motivated to do this for example by controlling the price of electricity in real time.

A smart grid can also correct disturbances in electricity distribution. The grid adjusts itself so that no interruptions emerge.

New business and new services

For energy companies, a smart grid gives new ways to control electricity generation. In line with smart grids, customers are not only energy consumers but they can also be energy producers and store energy, hence becoming an active part of the system. According to Jatta Jussila, the wide-spread utilisation of renewable energy sources also from decentralised production units is one the arguments for the development of a smart grid.

"Energy companies can also provide their customers with new services," says Jussila.

Smart grid adds to system control

Fingrid is involved in the steering group and three work packages of CLEEN's "Smart Grids and Energy Market" research programme. It heads one package and follows the other two.

To date, we have conducted R&D to enhance system control on the level of the high-voltage grid. Now it is time to go beyond the conventional boundaries and seek new opportunities closer to the consumer," says **Jussi Jyrinsalo**, Fingrid's Senior Vice President responsible for system development.

He says that new trends are searched together with energy companies, IT enterprises and research organisations.

"We are using the research programme to find means to improve system control. The control can also be based on more comprehensive knowledge of issues as wide as the state of the entire inter-Nordic grid so that we can respond to various change phenomena."

"The plans will first be put into practice as separate parts, and along the way we intend to combine the various parts to benefit more numerous parties, and we also aim to make pilot projects of the solutions devised," Jussi Jyrinsalo says and adds that in a smart grid, information technology is embedded in the entire power system.

According to him, the biggest advantage brought by the integration of two types of infrastructure is that the transmission system can be controlled in a new way. "Up to now, the transmission

At present, Finns are not very active in subjecting their electricity supply to competitive bidding. This is expected to change in the future.

"An active consumer finds a company with versatile services which make life easier. I believe that there are already many consumers who would like to have comprehensive consultation on what kinds of energy solutions would be most sensible for their homes."

To benefit all Finns

Jatta Jussila says that Finland is now at the cutting edge in the development of smart grids. This will give Finland facilities to be among the first to introduce the new solutions.

Fingrid is also involved in the research programme. This is important for Finland, according to Jatta Jussila. "The programme would not be complete without Fingrid. The grid is an entity, and everyone must think together what requirements the new infrastructure imposes on the grid." ■

system has worked with a hierarchic architecture, with controls taking place in large generation plants. Generation has responded to demand. A smart grid enables a situation where, for example, generation can be located close to the end user, and demand can also be adjusted. The system works in two directions all the way to your home."

Consumers may also have their own energy reserves. As an example, energy can be de-charged from the batteries of electric cars back to the grid if the grid needs this. Homes may also have a receiver which identifies the price prevailing in the market and which sheds loads where electricity is not necessarily needed during the high price. "This gives consumers new opportunities to conserve energy and even sell it," Jyrinsalo sums up the benefits gained by the end users. ■

Beautiful but expensive

This winter has been exceptionally cold and snowy in Finland. A winter with much snow is beautiful, but it has also caused many challenges to the maintenance of electricity transmission lines. A lot of ice and hoar frost accumulates on the transmission lines.

Text by Reija Kuronen ■ **Photograph by** Risto Jutila

This winter, snow accumulating on the lines has put electricity networks to the test in areas where snow has traditionally not posed a problem. According to **Mikko Ahonen**, Fingrid's transmission line specialist in the regional unit for Southern Finland, there was exceptionally much hoar frost in Southern Finland.

"What was especially challenging was that there is not as much history data on the locations where hoar frost tends to occur in Southern Finland as in other parts of Finland," he says.

"Hoar frost just kept on accumulating during the winter. We had to drop ice loads as many as three times in some places."

Locations where snow tends to accumulate first on the transmission lines were followed actively. Larger areas were inspected from an aeroplane. During the most severe period, more than 10 work teams were dropping ice from Fingrid's lines.

The situation was also complicated by the fact that the snow and hoar frost situation was the same on the lines of distribution network companies, which is why there was shortage of resources and machinery during the worst snow periods.

An accident also occurred in the inspection work when an aeroplane on an ice load inspection flight had to do an emergency landing on Fingrid's transmission line area on account of engine failure. Luckily, there was no serious personal injury. One 400 kilovolt overhead ground wire peak was bent due to ice load but caused no disturbance.

The nature and transmission lines look beautiful in the winter when there is much snow, but the ice and snow accumulating on the lines are a costly phenomenon. They have kept transmission line maintenance personnel busy this winter.

The costs have also been raised by the fact that the transmission losses in the nation-wide grid were record-high. At their peak on 13 January 2010, they totalled 353 megawatts, of which corona losses accounted for approx. 150 megawatts.

All in all, the dropping of ice loads, repairs of damage and extra transmission losses have cost hundreds of thousands of euros. ■

You can always learn FROM CHANGE

A major change was made to the balance model used for the handling of electricity imbalances at the beginning of 2009. The related Nordic rules were also harmonised in line with the reform. The introduction of the new model ran without unsurmountable problems. The biggest factor contributing to the successful implementation was Fingrid's seamless co-operation with the balance providers. Thanks for this – and for all useful feedback – are due to the balance providers.

Text by Pasi Aho ■ **Photograph by** Vastavalo

As a result of the reform, a model of two electricity balances was introduced in the Nordic countries: one balance for electricity production, and one for consumption and electricity trade. The pricing principles of imbalance power were also amended so that there is a separate price for the purchase and sales of imbalance power in the pro-

What do you think of the balance service reform?

Fingrid magazine asked five balance providers to present their views and experiences of Fingrid's balance service reform on the basis of one year with the new system.

Jari Aurojärvi, Planning Manager, PVO-Pool Oy

"Overall, the balance service reform has clarified the roles of electricity consumption and production, and it obviously facilitates the work of the transmission system operator. The reform took some of the opportunities of consumers with their own production to control the balance between their own consumption and production. Similarly, production disturbances in some forms of production are followed by a corresponding consumption disturbance; in the old system, these used to compensate one another, but not any more.

The commissioning project was a major effort at least for the bigger balance providers and naturally also for Fingrid. Commissioning went reasonably well, but there are still many things to finalise before we can say that the reform is ready.

Practice has shown that the agreed schedules and deadlines are necessarily not the best ones; as an example, data exchange between the various parties has not been given sufficient attention when drawing up the schedules. The users' action focuses too much around the turn of the hour, when you should make financially significant decisions in a hurry and under pressure. This is why the schedules should be amended so that the work would be distributed more evenly across the specific hour and so that there would be an opportunity to intensify production optimisation and submitting of balancing power bids."

Vesa Kankaanpää, Balance Provider, Vattenfall Sähköntuotanto Oy

"The harmonisation of balance service was a significant contributor to the Nordic electricity market. Fingrid has a great role and great responsibility in this process.

The reform clarified the balance structure partly, but at the same time it complicated balance matters for many end consumers. The reform did not change the foundation of imbalance management itself. The costs are made up in the same way and by the same factors as before."

Hannu Parkkonen, Energy Manager, Kuopion Energia Oy

"The considerable increase in the amount of money to cover the reserve costs, levied by virtue of the new balance service contract, is the foremost issue criticised by Kuopion Energia.

Of course, the model of two balances and the resulting system, measurement and operating procedure changes caused much work for us, too. However, we were well prepared right at the beginning of the new contract period, and the single-

duction balance, and a single price of imbalance power is used in the consumption balance for both purchases and sales. Moreover, the reserve costs included in the balance service were harmonised.

THE BIGGEST CHANGE in imbalance settlement was the establishment of a separate production balance in Finland. The magnitude of the change is indicated by the fact that more than 300 new imbalance settlement networks were specified for the production balances, involving more than 700 new items of data to be reported.

All this data needed to be reviewed and specified together with the balance providers. After this, the data had to be modelled in Fingrid's own imbalance settlement system and also in the systems of balance providers, and reporting of data had to be agreed. Corresponding challenges were encountered in the reporting of separate production plans before the hour. The supply of Fingrid's imbalance settlement system was delayed from the agreed schedule, which also complicated the overall work.

THE EXPECTATIONS AND EXCITEMENT culminated as the year 2009 was drawing to an end. Various computing and reporting problems emerged and were solved. Changes to the data systems were made at very rapid pace at times. The reporting of production plans became the major challenge in January 2009. Despite several advance analyses, the Ediel communications used turned out to be too slow, and the deadlines specified for reporting were a problem. Through collaboration between many different parties, the messaging system was brought to an acceptable level fairly soon, but this issue still calls for further improvement.

In March 2009, when the nation-wide imbalance settlement for January was beginning to be ready, an error after another emerged in imbalance settlement. However, most of the errors turned out to be specification or reporting errors, which were corrected soon. Still, imbalance invoicing for January had to be done using erroneous data. In August, following extensive analyses, it was finally found that the error was caused by the inadequate processing of a single piece of measurement data in the settlement systems of both Fingrid and the balance provider in question.

YOU ALWAYS LEARN SOMETHING from change. You can never put things in motion too early, and all the time reserved for something is always used up. The work conducted with the balance providers and other necessary stakeholders in advance is important, because the key is that everyone understands the things in the same way. Data system changes always add to the uncertainties involved in projects. ■

Further information on the balance model is available on Fingrid's website at www.fingrid.fi/portal/in_english/services/balance_services/

price model in the consumption balance gave real opportunities to "proper" imbalance management.

All in all, I can say that the present model is a better option for us than the old model of one balance and two prices."

Marko Pollari, Director,
Lappeenrannan Energia Oy

"Lappeenrannan Energia started as a balance provider at the beginning of 2009, when the new balance service model was introduced. We also became a member of Nord Pool Spot at that time, and since the municipal energy companies in Lappeenranta and Joutseno were merged as a result of the consolidation of the two municipalities, the turn of the year was a challenging period for us.

We had a good foundation for becoming a balance provider: our systems could be modified to respond to the new procedure, and we had an idea of what we were getting into. We have managed well with the production balance from the outset, but had some problems with the consumption balance in the early stages. It was difficult to anticipate and monitor the consumption balance since not all measurement and supply data could be entered easily in the energy management system, and the size of our balance also grew from the earlier as a result of the consolidation of municipalities.

We have made progress one step at a time, and even though there is always cause for improvement, we have attained a reasonably good level.

For a market party such as Lappeenrannan Energia, the present balance model works well in my opinion: the rules are there, and they are the same for all. Of course, it is to be hoped that the model will not be altered essentially, like splitting the production balance into periods of 15 minutes."

Pasi Valoranta, Managing Director,
Energiakolmio Oy

"The reform has been a good step towards an electricity market covering all the Nordic countries. The goal of a pan-Nordic approach was sensible in view of increasing competition, and the reform has facilitated the work of balance providers in the Nordic countries.

Operatively, the reform has complicated the management of electricity balances, since the management of consumption and production balances was segregated. We are still learning some aspects of the new procedures. As an example, there are now more reporting obligations because of production plans. The single-price system in the consumption balance is no longer as susceptible to errors in anticipating consumption, and this may have resulted in an increase in the volumes of imbalance power.

Fingrid published a useful update to its outdated imbalance settlement system at the same time as the new balance model was introduced. The problem was that its publication was delayed, and it contained many things to correct during the year."

FAULT CORRECTION tested in Nokia

Last November, Fingrid arranged a fault repair exercise for transmission lines together with contractors and energy companies in Nokia in Central Finland. An imaginary ice storm situation with a resulting power cut in a large part of Southern Finland was used for testing the co-operation between the various parties.

Text by Tiina Miettinen ■ **Photographs by** Juhani Eskelinen and Vastavalo

The two-day fault correction exercise was arranged so as to ensure continued repair readiness for transmission lines. The objective was to find issues requiring improvements in the joint efforts of various organisations so that guidelines can be later provided for these issues.

"After the previous exercise three years ago, we have upgraded issues such as the organisation of fault correction, and we have also procured more materials to be kept in stock for repairs," says Fingrid's Project Manager **Kari Lindholm**.

This time, the exercise focused on response to a situation where an ice storm is approaching Finland from the west, breaking transmission lines both in the nation-wide grid and in distribution networks.

"Exercises are important, because we cannot test transmission line failures in real life. Our society is highly dependent on electricity, so it is important to repair any failures as soon as possible. The ice storm scenario of the exercise may very well become reality some day," Lindholm points out.

The exercise brought together almost 70 grid maintenance management specialists and professionals of Fingrid and its customer and partner enterprises.

Big picture is important

The repair correction exercise was arranged in the form of team work focusing on issues such as supply of information when the communications are down. The exercise arranged from 4 to 5 November 2009 involved Fingrid and representatives of transmission line contractors and Fingrid's customers, i.e. electricity utilities. There were almost 70 representatives from Eltel Networks Oy, Empower Oy, EPV Alueverkko Oy, Fortum Sähkönsiirto Oy, Helsingin Sähköverkko Oy, Vantaan Energia Sähköverkot Oy, Vattenfall Verkko Oy and Voimatel Oy.

The exercise revealed that co-operation between the various enterprises is needed on many levels both during a crisis and in normal operation. Practical co-operation between control rooms works well, because it is part of everyday routines, but in other respects collaboration needs streamlining.

"Prioritisation of duties emerged as

"Exercises are important, because we cannot test transmission line failures in real life. Our society is highly dependent on electricity, so it is important to repair any failures as soon as possible. The ice storm scenario of the exercise may very well become reality some day."

the foremost task in the team work. If we have several failure locations that require repairs simultaneously, there is an inevitable shortage of resources and materials. The service providers gave a clear signal that network operators need to agree mutually on the allocation of resources," Lindholm sums up the feedback from the exercise.

The service providers have identical contracts on failure repair readiness with most network operators. This is why, according to Lindholm, it is clear that there are not enough resources simultaneously for all, not at least in situations like the ice storm of the exercise. The essential thing in such situations is to gain an overall idea of what items require repairs.

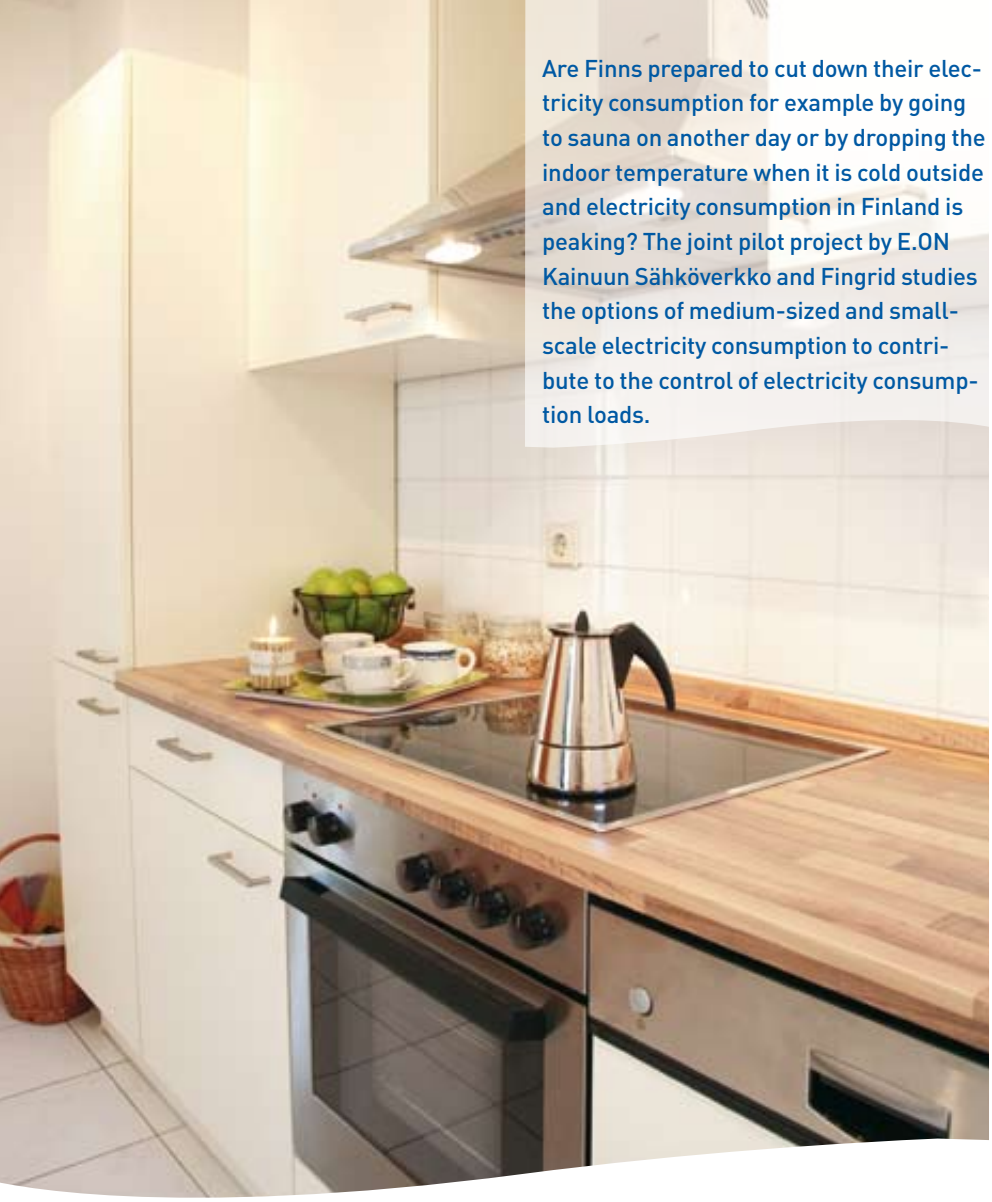
"The overall picture is obtained through co-operation between control rooms, and Fingrid compiles it to be used by a specific management team for failure correction. This management team agrees on the use of resources between the various parties in each individual situation," Kari Lindholm says. If necessary, assistance can always be requested from the other Nordic transmission system operators, with which Fingrid conducts constant and close co-operation.

"We make joint contingency plans for a potential major fault. We are aware of each others' contact persons, spare towers and materials, and agreed procedures for providing assistance," Lindholm says.

Repair material in Tampere

The exercise was arranged close to a new depot for failure repair material. Fingrid and Eltel Networks have signed an agreement on the storage of materials such as replacement tower sets for transmission lines until the end of 2014.

This material was earlier kept at the Hämeenlinna central depot. The new depot is located in conjunction with Eltel Networks' Tampere office. ■



Are Finns prepared to cut down their electricity consumption for example by going to sauna on another day or by dropping the indoor temperature when it is cold outside and electricity consumption in Finland is peaking? The joint pilot project by E.ON Kainuun Sähköverkko and Fingrid studies the options of medium-sized and small-scale electricity consumption to contribute to the control of electricity consumption loads.

Pilot project linking SMALL-SCALE CONSUMERS TO THE MANAGEMENT OF PEAK CONSUMPTION

How could small-scale electricity consumption contribute to levelling out electricity consumption peaks? What are the challenges and benefits of management achieved by household consumption? E.ON Kainuun Sähköverkko and Fingrid are investigating new opportunities to distribution load response and its utilisation in view of national economy. This takes place within a pilot project encompassing some 4,000 consumers.

Text by Maria Hallila ■ **Photographs from** the archives of E.ON Kainuun Sähköverkko and ScandinavianStockPhoto

Levelling out of electricity consumption peaks and increasing demand response are objectives where the benefits go to electricity producers, network operators and users of electricity. On a large scale, the control of peak consumption also has impacts on the national economy and the environment: if consumption peaks can be managed by means of response, there is a smaller need to construct new power plants, and the management of the power system is facilitated.

Large-scale industries have adapted their electricity consumption to variations in the electricity market since the 1990s. Developments in metering technology in recent years have given new opportunities to utilise also medium-sized and small-scale electricity consumption in the control of consumption loads. Consequently, these also facilitate the maintenance of power balance in the nation-wide power system and the control of extraordinary situations.

Functioning of smart meters put to the test

Remote-read electricity meters have created the framework where demand response can be expanded towards small-scale consumption. The opportunities afforded by new advanced meters together with their auxiliary equipment are surveyed in a pilot project undertaken by network operator E.ON Kainuun Sähköverkko and Fingrid, launched at the beginning of 2010.

"We are carrying out some actual controls applying both new and more conventional technologies. These controls are used for disengaging customers' electric heating for a short period of no more than about one hour," says Fingrid's Senior Adviser **Jonne Jäppinen**.

According to him, E.ON Kainuun Sähköverkko already has the versatile technical facilities in its present network for controlling small-scale consumption, chiefly electric heating. Customers with electric heating can also choose a tariff which is less expensive than the normal tariff. This gives the network operator an opportunity to shed electric heating temporarily.

The project also embraces issues such as anticipating the volume of shed small-scale consumption, reliability of implementation of load shedding, and potential delays and network impacts (volume of reconnecting power, loss-

es, impact on voltage) involved in this. In addition to technical experiments, the project also tests information supply and surveys the consumers' experiences.

The total consumption power of the approx. 4,000 consumers covered by the pilot project ranges from 10 to 20 megawatts depending on the outdoor temperature. The results of the project will be published in the late spring.

Based on national objectives

For Fingrid, the project is also related to many topical challenges stemming from the policy definitions in the energy and climate strategy of Finland.

"The ongoing and future construction of large electricity generation units and wind turbines will call for new means to secure the balance of the power system in extraordinary situations. Since there will be less flexible generation capacity in the future, it is necessary that consumption takes a more active role in maintaining the nation-wide power balance," Jonne Jäppinen says.

Can consumers also reduce their own carbon footprint by being involved in arrangements for electricity load response?

"Well, at least we can say that whatever is done to level out the consumption peaks by increasing response, it reduces correspondingly the need to construct new power production capacity," Jäppinen says. ■

Preliminary agreement signed on EstLink 2 cable connection

Fingrid and Elering OÜ, the transmission system operator in Estonia, have signed a preliminary agreement concerning the construction of a second direct current link, EstLink 2, between the two countries. The capacity of the planned transmission link is 650 megawatts and the costs of the project total approx. 300 million euros.

The preliminary agreement signed on 15 February will be followed by a final capital investment decision if the wholesale market of electricity opens in Estonia as planned and if the European Union's co-funding of 100 million euros for the project becomes reality. The final agreement between the parties on the execution of the project will be signed after the capital investment decision.

At present, there is one 350 megawatt direct current connection between Finland and Estonia. The new transmission link would raise the total electricity transmission capacity between the countries to approx. 1,000 megawatts. The new link will be brought to commercial operation no sooner than the end of 2013. The new connection will integrate the Baltic electricity market closer to the Nordic market and contribute to the supply security of electricity in the Baltic countries.

EstLink 2 is one of the reinforcements in the electricity transmission system suggested by the transmission system operators in the Baltic Sea region. The Commission of the European Union also considers the transmission connection between Finland and Estonia as very important, which is why it has proposed an EU subsidy of 100 million euros for the EstLink 2 connection. However, the subsidy requires that the project must be launched in 2010. The potential subsidy is part of a broader recovery package of the EU, aiming to stimulate economic activity in the Union and also support the strategic objectives, such as improved security of energy supply in the Baltic countries.

The electricity market in the Baltic Sea region has already been developed through collaboration between the transmission system operators in the region and Nord Pool Spot. As part of the enhancement of the electricity market, the Nordic electricity exchange will expand to Estonia on 1 April 2010, when price area Estlink will be introduced. The pivotal objective of the electricity exchange is to create a reliable market price for electricity throughout the Baltic region. In the next stage, the goal is to integrate the electricity markets in Latvia and Lithuania to Nord Pool Spot's trading system. ■

400 kilovolt line from Forssa to Lieto being planned

Fingrid is planning a transmission line of a higher voltage level between Forssa and Lieto in conjunction with the modernisation of the existing line.

At present, there is a double circuit line of 110 kilovolts included in the nation-wide grid between the Forssa and Lieto substations, originally built in the 1920s. This is part of the oldest transmission link in Finland, extending from Imatra to Turku.

The present 110 kilovolt transmission lines will be replaced with 400 and 110 kilovolt lines, which can be placed in the existing right-of-way using double circuit towers. The upgrade is required to renew the aged transmission line and to reinforce the nation-wide transmission grid. The 400 kilovolt line between Forssa and Lieto will reinforce the transmission grid in South-Western Finland, hence improving the system security of the grid in disturbances and enabling outage management also in the future.

The planned project also serves regional electricity transmission needs. The new 110 kilovolt line will have a higher transmission capacity than the present one, and it will secure electricity transmissions to consumption points in the region well into the future. The route of the line with a total length of 67 kilometres will run in Forssa, Jokioinen, Ypäjä, Somero, Koski Tl, Marttila, Tarvasjoki and Lieto.

The environmental impact assessment procedure will commence in the early summer. The construction and commissioning of the transmission line will take place in 2015–2020. ■

Road map of the transmission grid for executing the climate and energy strategy of Finland.

"The use of air heat pumps at the Vanaja reserve power plants saves more than 100 megawatt hours of heating energy per year," says Tuomas Juntunen of Fingrid's reserve power unit.

Reserve power plant heated by air heat pumps

Air heat pumps were installed at Fingrid's Vanaja reserve power plant last autumn. The pumps will decrease the heating energy requirement of the plant by one quarter. The annual savings are estimated to be in excess of 100 megawatt hours.

Text by Antti J. Lagus ■ **Photograph by** Veli-Matti Pitkänen

There are not yet decisions on installing air heat pumps at Fingrid's other reserve power plants. Assuming that heat pumps can decrease the need for heating energy by one fifth during a heating season, the total savings achieved at Fingrid's all reserve power plants would be as high as 500 megawatt hours per year.

The energy savings attained at the Vanaja plant translate into almost 70 tonnes less carbon dioxide emissions. If heat pumps were introduced at all reserve power plants, the reduction in the carbon dioxide emissions would be approx. 300 tonnes.

The Vanaja plant has three heat pumps: two of 30 kilowatts and one, which heats the control room, of 18 kilowatts. The pumps will pay themselves back in 4 or 5 years through saved heating energy.

Price of electricity influences the potential for savings

"The savings potential given by heat pumps may be even higher depending on the price of electricity. In this way, the payback time of the pumps is shorter," says **Jarmo Hämäläinen** of Fingrid's reserve power unit.

Fingrid has a total of 21 reserve power units in 10 different locations in Finland. These are plants which are started if there are disturbances in the transmission system. It must be possible to put electricity generation by the plants on line in no more than 15 minutes. Supply security is maintained by means of test runs at each plant at intervals of approx. 6 weeks.

The heat pumps were installed at the Vanaja reserve power plant in conjunction with the renewal of the electrical systems at the plant. The capital investment decision was made in early 2009, and the installation work commenced last autumn. The pumps commissioned in December have been put to the test in extreme conditions, since the weather in Finland has been very cold also in the Hämeenlinna region.

The efficiency of a heat pump decreases as the weather gets colder so that at minus 15 degrees Celsius, the efficiency is only 60 per cent, and at minus 20 degrees it is not worth while running the pump. This is why the pumps have been switched off in the coldest weather.

Surprising amount of condensation water

The procurement of the heat pumps was based on a Master' thesis written by **Tuomas Juntunen** of the Huutokoski reserve power plant. He devised a model for assessing heating at the plant. The same model was applied to the installation of the heat pumps at the Vanaja plant.

The Vanaja reserve power plant was commissioned in the early 1970s, initially to continuous operation. However, the gas turbine plant has not been used for baseload power generation since the energy crisis in the 1970s. Since the plant was originally designed for continuous operation, its heating was not given much attention, because the process creates an abundance of heat. As an example, the supply air fans in the turbine room blow 10,000 cubic metres of cold air per hour into the building.

According to Jarmo Hämäläinen and Tuomas Juntunen, who works as an engineer at Fingrid's reserve power unit, the heat pumps have been working reliably. The only surprise was the large amount of condensation water created by the pumps. The heating resistor in the water collection vat takes up some of the savings given by the pumps, but this heating ensures that the water reaches the rainwater sewer. ■

Fingrid involved in energy efficiency agreement

Fingrid is involved in the energy efficiency agreement administered by the Confederation of Finnish Industries. Based on the EU's energy service directive, Finnish industries must intensify their end use of energy by 9 per cent, and the agreement is used for fulfilling this requirement.

The enterprises involved in the energy efficiency agreement are committed to reducing their own energy consumption by first analysing where they can improve their performance and then by carrying out savings.

The major industrial users of energy have contributed to energy conservation efforts for more than 10 years. Now the energy efficiency approach is introduced systematically to a larger host of enterprises and to new business sectors, such as commerce and tourist and restaurant services.

The energy efficiency framework agreement between Finnish industries and government is valid from 2008 to 2016. ■

Scope and ownership limits of transmission grid specified

Fingrid studied the scope and definition criteria of the nation-wide transmission grid in Finland in co-operation with its customers and the Energy Market Authority in 2009. The discussions will continue this spring. The goal is to make the necessary changes effective at the beginning of the new contract period, i.e. by the end of 2011.

Text by Petri Parviainen

The scope of the transmission grid is an essential part of the contents of Fingrid's grid contract. This scope refers to the location of each connecting party's connection point to the grid, in other words the place where Fingrid's service meets the customers.

The scope and ownership limits of the grid are always specified when the contract period changes. This takes place on the basis of how the operation of a certain part of the grid changes, for example from ring operation to radial operation as a result of grid construction projects. These specifications are prepared carefully during the previous contract period so that the changes have been accepted and agreed with each relevant connecting party when a new contract period begins.

New contract period as the deadline

Fingrid started the ongoing scope analyses in 2009 aiming to bring the necessary changes into force by the end of 2011. The new grid contract period will commence at the beginning of 2012.

Fingrid intends to make some minor and individual changes based on a change in the operation of a part of the grid and to agree on these separately with the affected customers by the end of 2010.

During the ongoing process, some customers have presented criticism concerning the impartiality and expansion principles regarding the scope of the grid. In the autumn, Fingrid conducted discussions on the principles concerning the scope of the grid with these parties and the Energy Market Authority.

To support the discussions, the Energy Market Authority ordered an outside analysis of the grid criteria from Pöyry Management Consulting Ltd. The draft report was sent for comments to all network operators and energy companies in early February, and they were asked to submit their comments to Pöyry by 12 February. The report was specified on the basis of the comments received and submitted to the Energy Market Authority on 19 February 2010.

The discussions with the Energy Market Authority and Fingrid's grid customers, concerning the principles applied to the scope of the grid, are continuing this winter. Fingrid aims to draw the conclusions of the discussions and analyses by the summer so that the principles concerning the scope of the grid could be published after the summer, when the discussions with the relevant parties on the potential changes in the scope can also be launched.

Small needs for changes

Fingrid currently regards that there is no need to alter the scope of the Finnish transmission grid significantly. The needs for changes mainly concern some hundreds of kilometres of transmission lines. These lines have minor significance in view of transmissions in the nation-wide grid, or the lines are in radial operation or can be modified to radial operation easily. On the other hand, parallel to the nation-wide grid, there are some individual transmission lines in ring operation, owned by parties other than Fingrid. The company is interested in acquiring these into its ownership and making them part of the nation-wide grid.

It seems that there are matters to be discussed in the future, too. ■

Definition of transmission grid and expansion principle

- The transmission grid refers to the nation-wide ring-operated high-voltage electricity transmission network which connects the electricity generation and consumption areas to each other.
- The transmission grid also covers the cross-border transmission connections in free commercial operation.
- The transmission grid serves the Finnish society at impartial terms and conditions, creating the foundation for a well-functioning electricity market.
- The transmission grid is developed in co-operation with the customers, taking the pan-European objectives into account.
- The vital goals in grid development include high system security and a grid architecture which is technically and commercially optimal.

The scope of the transmission grid can vary based on the purpose of the grid

- Replacement and new capital investments in the grid cause constant updates to the scope of the grid.
- Expanding the transmission grid to a new area is decided individually in each case using local agreements, and based on the grid plans.
- A potential expansion stems from an increase in transmission needs and extensive needs for changes in a region, and ring operation required by system security.

At present, the contract period for grid services provided by Fingrid is four years. The terms of contract for the services remain unchanged during the contract period. The unit prices levied for the services can be adjusted annually during the contract period within the terms permitted by the contract. The long contract period intends to facilitate business planning by the customers and Fingrid.

Photograph by Juhani Eskelinen

New channel for landowners to give feedback on transmission line projects

Fingrid has published a map-based feedback and statement request service on its website, intended for the general public.

Through the easy-to-use map service, landowners and those living close to a transmission line can submit requests for action concerning an area indicated on a map, give feedback on Fingrid's transmission lines, or request a statement for a project requiring a permit in the vicinity of a transmission line.

Projects which may cause a risk to the operation of a transmission line or to general safety are subject to a permit. The most common such projects include building, excavation and soil extraction. The permit procedure is not nearly always about denying the work completely, but the procedure is used for giving appropriate instructions in order to ensure safety in the vicinity of transmission lines.

The map and feedback service facilitates requests for statements, and it is also easy for the person giving the statement to see immediately which line and its exact location the request concerns. If the line in question does not belong to Fingrid, the party requesting the statement can be forwarded to the proper network owner.

The user can use the new service to study the location of an individual transmission line or tower on a map. The service also covers all transmission line areas cleared of vegetation in 2009 and areas where clearing work is planned in 2010.

The testing stage of the map feedback service examines the suitability of the concept for use as Fingrid's feedback and interaction channel. The testing stage will extend until the end of April 2010.

"The idea for this project came from Fingrid's two values, transparency and responsibility. By this service, we wish to improve our contacts with landowners and other stakeholders. The foremost benefit of the reform is that feedback can be linked to a precise location on the map," says Fingrid's Land Use Manager **Ilkka Alm**.

"We are constantly developing our services intended for landowners, and we hope that we receive much versatile feedback. In the future, we may expand the service to transmission line projects which are under planning. In this first stage, the map feedback concerns the existing transmission grid," Ilkka Alm says. ■

The map feedback service is available at http://fingrid.navici.com/. It can also be accessed from Fingrid's website www.fingrid.fi.

Fingrid Group's annual report published on the net shortly

The financial statements of the Fingrid Group for 2009 were published in February. The annual report, annual review and financial statements will be available on the Internet at www.fingrid.fi (under Investors) by the end of March. Printed publications can be requested from Fingrid's communications.

Revenue of the Fingrid Group in 2009 was 359 million euros (382 million euros in 2008). Grid revenue decreased slightly despite the 4.5 per cent tariff increase carried out at the beginning of the financial year. This was due to a reduction in industrial electricity consumption in Finland.

The IFRS operating profit of the Group was 51 (68) million euros. Of the change in the fair value of electricity derivatives, +2 (-14) million euros were recognised in the income statement and a total of 16 (-44) million euros in equity and to reduce the tax receivables.

The Group's profit for the year was 25 (28) million euros. The return on investment was 3.9 (5.8) per cent and the return on equity 5.7 (6.6) per cent. The equity ratio was 27.2 (26.7) per cent at the end of the review period.

Fingrid is making capital investments totalling 1,600 million euros in the transmission grid and reserve power in the next 10 years. The investments on an annual level are about 100–200 million euros. The capital investment programme aims at retaining the high level of system security and promoting the functioning of the electricity market, and it takes into account the policy decisions specified in the climate and energy strategy of Finland. The extensive capital investments have a negative impact on cash flow and will require additional borrowing. This is why Fingrid will have to raise its transmission tariffs in the coming years. ■

Fingrid's score in customer survey: 8.7 on a scale from 4 to 10

In November, Fingrid arranged the annual survey among its customers. The customers consider that Fingrid has succeeded fairly well in its main duties.

The customer survey was arranged among Fingrid's grid, balance service and cross-border transmission customers as well as electricity market parties. A total of 78 customers, who represented the various customer groups very well, responded to the survey. The response rate was just under 40 per cent.

All in all, the respondents thought that Fingrid's efforts are responsible. The company was rated fairly well in cost efficiency and impartiality, while transparency called for more enhancement than the other issues, according to the respondents.

On a scale from 1 to 5, Fingrid's grade in the system security of the transmission grid was 4.38, in the maintenance and construction of the grid 4.37, and in the promotion of the electricity market 3.82. ■

In your opinion, how well has Fingrid succeeded in its main duty? Scale: 1 to 5 (1 = I disagree fully, 5 = I agree fully)						
	1	2	3	4	5	average
Fingrid takes good care of the condition of the grid and constructing additions to it						4.37
Fingrid ensures the system security of the grid reliably						4.38
Fingrid promotes the electricity market mechanisms actively						3.82
TOTAL						4.19

Encounter

The female elk is lying on a small knoll. The late winter sun is heating her back, she feels drowsy, and her eyes close. Her jaws are making a rhythmic motion as she is chewing the cud of a meal of twigs which she had earlier. Her two calves, both bulls, with small bumps of antlers on their temples, are lying side by side a little farther away. It is quiet in the forest, nothing is disturbing the peace of the elk family.

I am sitting less than 20 metres from the elk mother, and I can see every little detail of her. I can hear her stomach groan and the sound of her breathing as she exhales into the frosty air. Her ears are erect, vigilantly scanning the surroundings. The ears convey my each movement to her half-sleep, and the elk opens her eyes as soon as I change my position. However, the animal is at rest; it trusts me.

There is magic in the moment. I feel a strong companionship with the elks. It is easy for me to understand how my forefathers had great sense of respect for that magnificent animal, which was their primary quarry for thousands of years. It provided much meat, a large and strong hide, bones and antlers for making utensils, veins for sewing, and ligaments for bows. But an elk was much more. It was a holy animal born in heaven, immortalised on the mountain faces of ancient shrines in the red colour of life. It was the powerful totem animal of shamen, in the form of which they travelled between worlds. The elk had an important role in the life of our ancestors – both in the mental and material, in special occasions and everyday life.

After a couple of hours in place, the elks get up. The mother takes a couple of steps towards me and starts to eat tips of branches in a stunted pine. It is impressively large, more than two metres high with its tall legs, and certainly 300 kilos in weight. Its muzzle is long, and its lips go through the pine twigs like the most sensitive fingers. Its entire being reflects adaptation to the northern forests. It is only when there is a metre of snow that it finds real problems in moving in the forest. It can survive on branches and twigs for almost 6 months, and its fur 10 centimetres thick repels even the coldest weather.

The elk had an important role in the life of our ancestors – both in the mental and material, in special occasions and everyday life.

The elks eat for a while, moving a few hundred metres away and then laying down again to chew the cud. I follow them at an appropriate distance and also turn to my packed lunch. Life is easy, we are living to the pace of the elks.

It is a great experience to encounter a wild animal like that, and even though several years have elapsed from that moment, I can still recall it down to the minutest details. That encounter, and many more that I experienced with the elk family. During the autumn, I won their confidence, and I followed them occasionally until the spring. The link broke when the snow melted. The female elk was getting ready for giving birth to new calves, and the young bulls went their own way. One evening in early summer, I met the mother once more. It had two beautiful calves. She was cautious, keeping her distance for a while, but ultimately let me come closer at nightfall. In the dark of the night the elks finally disappeared from my life.

The last encounter made me play with an idea: maybe the mother elk wanted to show her new calves to an old acquaintance. Just once, so that I would know. Then she took the calves to hiding, protecting them guided by her maternal instincts. Of course, that is just imagination, but it is a funny and symbolic thought. The reality is less nostalgic. The sense of togetherness was very one-sided. For the elk family, I was just a human being who insistently endeavoured to get close to them. Once they were assured that I posed no danger to them, they accepted me as one of the inhabitants of the forest. That's all.

However, for me the close encounter with these familiar individuals was something more than a mere random meeting with an animal. I have gazed elks in magnificent places on misty shores and in the dusk of summer nights, but it was only the days spent with the familiar family that revealed to me both sides of this magnificent animal: On one hand the glorious creation of evolution, a large and gorgeous animal, which is so well adapted to our harsh conditions. On the other hand, a creature created by human imagination – a heavenly mythical being to which we owe so much. ■

Heikki Willamo, columnist of the Fingrid magazine, is a photographer, author and journalist from Karjalohja. He has published several nature books for both children and adults; most recently "Hirven klaani" (Otava 2005), "Pyhät kuvat kalliossa" (together with Timo Miettinen, Otava 2007) and "Huuhkajavuorella" (together with Leo Vuorinen, Maahenki 2008). Heikki Willamo's special objects of interest include forest nature in Southern Finland, Northern rock art, and myths related to animals.

Elektra's new exhibition:

From Pong to Playstation – more than 50 years of electronic games

Electricity Museum Elektra will open its doors again in May. In addition to the basic exhibition, there is also a new department presenting the history of electronic games. The exhibition sheds light on the game culture and on the usage and cultural history of the equipment from a number of perspectives. You can also play the games yourself and reminisce games from the past decades.

The rise of electronic games started in 1958 with the forefather of Pong, an experimental game called "Tennis for Two", which was played on the display of an oscilloscope. However, there had been electromechanical board games as early as the 1930s.

Playing and consoles have gone through many changes over the years, and the phenomenon is not just about entertainment. It can be part of the educational system, and it has a major role as a component of modern society and various subcultures. On the other hand, playing also involves various side-effects and problems.

Games are also played with an educational intent, for example in hospitals, where simulators are used for practising surgical operations. Even though some games are used for teaching, their environment and technology are often identical to those of entertainment games. The platform is a device with a processor, used by the player in an artificial environment created by the programme for controlling various issues which respond to the player's action by means of artificial intelligence. In a more advanced configuration, the corresponding technology is applied for example to military uses in fire control systems. At best – or worst – the games and the real world resemble each other to a baffling degree.

Electricity Museum Elektra with its special exhibitions is open to the public in 2010 in May Tue–Fri at 12–16 and in June to August Tue–Fri 11–18 and Sat 10–17. At other times, the museum is open by appointment. Address of museum: Valvomotie 11, 13110 Hämeenlinna, Finland. ■

Elektra takes you on a journey into the history of electrification. The museum houses everyday exhibits you may recognise, and special rarities from decades gone by. How did electricity come to towns, countryside and homes? The exhibitions combine electricity production, electrical engineering and industrial development to the everyday life.
www.elektra.fi

Take part in a SLOGAN competition!

We are looking for a new slogan for Fingrid

Join in to come up with a new slogan for Fingrid. Don't hesitate to make a suggestion – your slogan may very well carry the core message for communications by Fingrid in the near future. The slogan competition will continue until the end of April.

A corporate image is composed of a number of factors: the action and operations of a company, its communications, and visual elements. The slogans are concise, carefully-deliberated messages. They are used in all communications from brochures to campaigns. A slogan indicates how the company wishes itself and its products to be perceived, experienced and remembered by others. A successful slogan crystallises the core idea of the company.

Fingrid has had several slogans in the past. Our present chief slogan is "Valot päällä valtakunnassa" (Keeping the lights on in Finland), which reflects responsibility, system security and the scope of the corporate operations. "Pidetään huolta linjoista" (Taking care of the lines) contains a message of ensuring sufficient transmission capacity

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 16 April 2010. Address: Fingrid Oyj, PL 530, 00101 HELSINKI, FINLAND. Mark the envelope with "Verkkovisa".

Among all those who have given right answers, we give 5 Finlayson's white cotton tablecloth sets as prizes by drawing lots. We will inform the winners in person.

The answers to the questions can be found in the articles of this magazine.

1. The efficiency of an air heat pump
- ○ deteriorates as the temperature goes considerably below zero
- ○ improves as the temperature goes considerably below zero
- ○ is insensitive to sub-zero temperatures.

2. In 2009, Finland and Sweden constituted the same price area for electricity for
- ○ 60 per cent of the time
- ○ 80 per cent of the time
- ○ 95 per cent of the time.

3. Most of the corona losses in the transmission grid are created
- ○ during thunder as a result of lightning
- ○ in the winter when there is much hoar frost
- ○ when it rains as the droplets touch the conductor.

4. The contract period for Fingrid's grid services is
- ○ two years
- ○ four years
- ○ six years.

5. How many kilometres of new transmission lines and cables are the companies belonging to ENTSO-E, the network of the European transmission system operators, going to build in the next 10 years?
- ○ approx. 11,000 kilometres
- ○ approx. 20,000 kilometres
- ○ approx. 42,000 kilometres.

6. The cold winter with much snow has meant extra costs to the transmission system operator. How much money has Fingrid used for dropping ice loads and repairing the damage and for extra transmission losses?
- ○ tens of thousands of euros
- ○ about 100,00 euros
- ○ several hundreds of thousands of euros.

7. The abbreviation SHOK stands for
- ○ an intense electric shock from a transmission line
- ○ strategic centre for science, technology and innovation
- ○ price spike of electricity in the market.

8. Electricity museum Elektra, which presents the history of electrification in Finland, is located in
- ○ Hämeenlinna
- ○ Varkaus
- ○ Tampere.

Name _____

Address _____

Post office _____

E-mail address _____

Telephone number _____

Winners of prizes of the Grid Quiz in the previous Fingrid magazine (3/2009):
Petteri Helisten, Kuopio; Salme Jokinen, Kauniainen; Tuomo Jokinen, Helsinki; Reijo Lehtonen, Valkeakoski; Martti Uppala, Rovaniemi.

and the good condition of one of our national asset. "Virtaa riittää" (Power in people) describes the expertise and motivation of our personnel. In the early years, our message was: "Fingrid huolehtii, että Suomi saa sähköä häiriöttä" (Fingrid makes sure that Finland obtains electricity without disturbance).

Our new slogan should encapsulate the message of Fingrid's vital duty in society, not forgetting the expanding connections beyond national boundaries. Fingrid's vision is to be the forerunner in transmission system operation, and the new slogan should communicate the reliability of our operations and the expertise, professional skills and co-operation ability of our personnel. Moreover, we wish that the slogan contains a message of our future direction.

In accordance with Fingrid's values, it is our duty to enhance the power transmission system, transmit electricity reliably, and promote the functioning of the electricity market. The customer ultimately draws the benefit for transparency, impartiality, efficiency and responsibility in the form of reliable electricity supply and well-functioning electricity market.

The slogan competition is open to all. The jury consist of Fingrid's communications team (Jukka Ruusunen, Kari Kuusela, Tom Pippingsköld, Matti Tähtinen, Jyrki Uusitalo, Tiina Miettinen, Pekka Niemi, Katja Lipponen, Sirpa Kulmala). The person with the best suggestion is awarded a gift voucher of 500 euros to Stockmann department store. Among all those who have participated, we give three cast iron pots designed by Timo Sarpaneva as prizes by drawing lots.

Anyone taking part in the slogan competition also concedes the usage rights concerning the slogan and its further development to Fingrid. Fingrid has a right to utilise the suggestions received in the manner of its choice.

What kind of a slogan describes Fingrid's efforts now and in the future? Send your suggestion – one or more – to Reija Kuronen, reija.kuronen@fingrid.fi ■

FINGRID OYJ

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