Corporate magazine
Fingrid Oyj 1/2012

FINGRID

ADVANCING IN THE EUROPEAN ELECTRICITY MARKET

FINGRID
Corporate magazine
Fingrid Oyj
15th volume
1/2012

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Cover photograph: Fenno-Skan 2, the high-voltage direct current electricity transmission connection between Finland and Sweden, was inaugurated simultaneously in the two countries on 25 January 2012. In Rauma in Finland, the submarine cable was inaugurated by Arto Lepistö, Deputy Director General of the Ministry of Employment and the Economy, and Fingrid's President Jukka Ruusunen.
Photograph by Juha Sinisalo

Printed by Libris Oy, Helsinki
ISSN 1455-7517

In this issue

NORDIC MARKET under congestion

In European conferences, you often hear the view that the EU's internal electricity market is now further from reality than ever before. Even though market integration and harmonisation yield results, other measures by governments undermine the functioning of the market to the same degree, and even more.

At this point, reference is especially made to the energy and climate policy, where the position of certain technologies is supported and that of others weakened. And if some policy mechanism does not work, it is patched with a new one. As an example, when renewable energy was not boosted sufficiently by emissions trading, issues such as guaranteed prices and priority dispatch were brought to the agenda. While the viability of other types of production deteriorates as a result of these, a separate form of subsidy, capacity payments, are planned for them.

According to Eurelectric, which represents electricity producers, 70 to 90 per cent of the new electricity generation capacity in Europe already receives some kind of support. In other words, an ever smaller portion of power production is actually on the market, which means that the market mechanism will decline over time. However, the efficient distribution of energy, including renewable energy, would call for a market that works well.

These problems are lesser in the Nordic countries than in many other European countries, at least so far. The foundation of the wholesale market is still quite strong. Of course, there are some problems.

With the electricity user in mind, what has been positive is the fact that there have not been as many price spikes in the winter as in the previous years. This is probably so because the large-scale electricity users, such as manufacturing industries, are now able to better prepare themselves for the peak situations and, whenever necessary, bring downward elasticity to their consumption. Another probable reason is that the transmission connections to Continental Europe are used more effectively through market coupling.

Congestions in the transmission system and their drawbacks reflected on the market have been highlighted recently. The spot market in the Nordic countries has a uniform price in only 20 to 30 per cent of the time. In Western Continental Europe (Germany, France, Benelux), this figure is 60 to 70 per cent.

As an example, the border between Finland and Sweden was historically narrow last year for the needs of the market. There was a normal volume of capacity available, but it enjoyed unusually high commercial demand. In early 2011, scant water reservoirs in Norway and Sweden attracted electricity from Finland to the west, and when the rains came, the transmissions assumed the opposite direction in the summer. Once again, it was difficult to foresee the future, if only a few months ahead. Fingrid tried to schedule maintenance and other work which limits the capacity to times when the market situation is usually calm, but such situations did not emerge. This is why there were congestion hours in 23 per cent of the time last year, while the normal figure is less than 5 per cent.

The Nordic market was also affected by the division of Sweden into four bidding areas in November 2011. Many market players regard this as a demonstration of backward developments in the market. While the market should be integrated into larger entities, it is actually shattering into smaller areas. There are already 12 bidding areas in the Nordic market when also including the area of Estonia.

The bidding areas are the result of structural congestions in the transmission system. They restrict transmissions so often and so much that the construction of new transmission lines is the only sensible way to remove them. However, capital investments are a regrettably slow method to react to changes in the electricity consumption and production architecture and in electricity trade. Bidding areas attend to the problem, but hopefully only for the present.

Even though the introduction of bidding areas in Sweden complicates for instance area price hedging and competition in the retail market, it has some positive implications. The allocation of cross-border transmission capacity between Finland and Sweden is now more predictable and transparent. Capacity can no longer be restricted to keep Sweden as a single area. There is more market focus, when the physical reality of the grid is out in the open and taken into account.

However, transmission system operators must not use bidding areas as an excuse to dodge their responsibility as regards the strengthening of the system. You can always ask whether TSOs have anticipated the future needs sufficiently well and whether some congestions could have been avoided. In any case, all TSOs have major ongoing construction programmes.

Articles in this magazine describe the progress and benefits of the programmes to the market, and also how electricity imports from Russia have started to vary considerably, introducing a new factor requiring vigilance by the Nordic market participants.

Juha Kekkonen is Fingrid Oyj's Executive Vice President.

Outage revealed the advantages of the electricity market

Fingrid's President Jukka Ruusunen was kept busy at the end of February. A cable fault resulted in an interruption in electricity transmission on the Fenno-Skan 2 connection between Finland and Sweden. Fingrid was consequently not able to transmit all available inexpensive electricity from Sweden to Finland. **Text by** Vesa Kaartinen **Photographs by** Egert Kamenik, Juha Sinisalo and iStockphoto

The market price rose quickly so that Finnish consumers occasionally had to pay up to 20 euros more per megawatt hour for their electricity than consumers in the other Nordic countries. The highest price difference was more than 50 per cent.

"This is a telling example of how dramatically the functioning of the international trunk transmission network also influences the price of electricity in Finland," says Fingrid's President and CEO Jukka Ruusunen.

He goes on to present the calculations. "There is considerable leverage. A price difference of just one euro per megawatt hour translates into an additional price of almost one hundred million euros, or a corresponding saving, on an annual level. With today's example, we would be talking about a cost range of billions of euros."

"The open electricity market and an international transmission network are crucial issues for the future of Finland. They will ensure that we will have access to the most inexpensive electricity available also when our domestic production capacity is not sufficient," Jukka Ruusunen points out.

Chasing the net benefit

Nordic electricity co-operation began on a small scale as early as the late 1950s. In the 1980s, it began to expand rapidly when it was discovered that it was worthwhile trading mutually in the surplus of Norwegian hydropower, Swedish hydropower and nuclear power, and Finnish thermal power.

Jukka Ruusunen says that the Nordic electricity market is now a good foundation when Europe is planning co-operation of a new era in electricity trade. The idea is to generate electricity wherever this can be done at the lowest cost, and then transmit the electricity to areas of more expensive electricity production.

Jukka Ruusunen points out that the price advantage gained by the consumers is only one criterion. "From the point of view of national economy, the net benefit must ultimately come through efficiency. The open market ensures that electricity companies in the countries involved can use their capital efficiently. When electricity is sometimes imported and sometimes exported, the prices will settle to an overall reasonable level."

"If the prices were brought artificially down in an internal network or if a country was to concentrate on cheap imported electricity, the interest to invest in one's own electricity production capacity would dwindle over time," Jukka Ruusunen says.

Renewables call for balancing capability

Europe, and Finland with it, have confirmed their stringent climate and energy strategy for the coming decades. Jukka Ruusunen says that not even Finland could put the plans to practice if there were no energy transmission connections to other countries. Without international energy interconnectors, Finland would be in quite a trouble, if only considering the modest wind power capacity.

"If we wish to have a significant increase in wind power or solar power capacity, we need a sufficiently large system for balancing purposes. When the coal power plants will ultimately be closed down, hydropower is the only form of domestic production capable of balancing the system. And the domes-

This is how integration in the Baltic Sea region makes progress

In the next 10 years, there will be 44 network projects of pan-European significance in the Baltic Sea region. The estimated cost of the projects totals 45 billion euros.

Project	Transmission capacity (MW)	Projected completion in	Significance and justifications of project
Finland–Estonia, EstLink 2	650	2014	The project will link the Baltic countries more closely with the Nordic electricity market and enhance electricity supply security in the Baltic countries.
Northern Finland - Southern Finland, P1	700–1,400	2013–2020	The project will enable the connection of wind power and nuclear power capacity to the transmission system, enhance the functioning of the electricity market, and replace the outdated 220 kV system in Central Finland. The project will be executed in two parts.
Norway–Denmark (Jutland), Skagerrak 4	700	2014	The project will improve the functioning of the Nordic electricity market and supply security.
South-Western Finland	800	2015	The project will ensure system security in South-Western Finland and support the connection of generation capacity to the transmission system in Southern Finland.
Lithuania–Sweden, NordBalt	700	2015	The connection will integrate the Baltic countries more closely with the Nordic market and also add to the security of supply. The project may also involve offshore wind power.
Southern Sweden, Sweden–Norway, South-West link	1,200 (Sweden), 1,400 (Norway)	2014–2019	The project will consolidate the intersection in Southern Sweden and the interconnection to Norway, hence increasing the transmission capacity in the electricity market.
Denmark/Jutland–Germany (Holland)	1,000–1,550	2012/2014–2017	Continuation of the project for the reinforcement of transmission capacity between Jutland and Germany. A project parallel with this is the so-called Cobra link Denmark/Jutland - Holland (2016, 700 MW).
Central Norway	2,250	2015	The projects will strengthen the market mechanisms and enable the connection of wind power capacity to the system. Örskog - Fardal as the first stage in 2015, others later.
Poland–Germany	>1,000	2014 and later	The project will enable electricity transmissions and safeguard system security in the region of the Baltic countries, Poland and Germany.
Lithuania–Poland, LitPol	1,000	2015–2020	The connection will link the Baltic countries to Continental Europe and open a connection from Finland to the south also via the Baltic countries.
Norway–Germany, NorGer/NordLink	1,000–1,400	2018–2021	The project will consolidate the interconnections between the Nordic countries and Continental Europe both in terms of the electricity market and supply security.
Southern Sweden	1,200	2018–2021	Several 400 kV line projects related to nuclear power and renewable energy sources.
Norway–Britain	1,000–1,400	2018–2021	The project will enable the connection of the Nordic and British electricity markets, add to the security of supply, and enhance possibilities to connect renewable electricity production to the system.
Finland–Sweden, new AC connection	700	2020–	Connection of new power generation capacity and improving of electricity market mechanisms

The table contains a compilation of development projects for electricity transmission connections, perceived as important by Finland and Finnish electricity market players.

tic hydropower capacity is only a few thousand megawatts."

"Moreover, if there was no balancing power, we could not build large nuclear power plants in Finland, because the system would collapse every time a nuclear power plant tripped from the grid," Jukka Ruusunen points out.

He feels that the various options should be weighed from an assumption where there are no interconnectors to other countries. In that case, it would be mandatory to construct expensive balancing power capacity. According to Jukka Ruusunen, this would cost much more than the interconnectors.

Three directions

In Jukka Ruusunen's analysis of the adjacent regions of Finland, the west, south and east are all significant directions as regards the energy supply of Finland.

"In the west, we are affected by the Fenno-Skan submarine cables and also very much by how quickly the electricity transmission congestions within Sweden and between Sweden and Norway can be overcome. There is inexpensive balancing power available in Norway in particular, but due to the inadequate transmission network, it does not always reach us."

In the south, the EstLink 2 connection will almost triple the transmission capacity between Finland and Estonia. An electricity market revolution is also taking place in the Baltics in line with the EstLink connections: after a regulated market, the price of electricity will be determined by supply and demand as part of the electricity market of the Nordic countries and Baltic Sea region.

"The concept of Baltic Ring emerged in the 1990s; in other words a strong electricity network circling the Baltic Sea. Now it is becoming reality, when Latvia and Lithuania are getting involved in the shared electricity market, possibly as soon as within a year."

"The ongoing transmission connection project between Lithuania and Sweden plays a key role in the Baltic Ring dream. It will ultimately be implemented when the interconnectors between Lithuania and Poland will be ready," says Jukka Ruusunen. →

Changing needs

- Increasing production capacity (both wind power and planned nuclear power) will cause additional transmission needs in the north-south direction in Finland, Sweden and Norway.
- The transmitted power aims to continue to Continental Europe, which is why there is also a need for transmission connections between Scandinavia and Continental Europe.
- The Baltic countries, the British Isles and the Iberian Peninsula will be integrated more closely with the European market.

Two historic milestones were reached in electricity market developments in the Baltic Sea region at the turn of the year: The cornerstone of the EstLink 2 transmission connection was laid on 16 November 2011, and the Fenno-Skan 2 submarine cable was inaugurated on 25 January 2012.

Above: Taavi Veskimägi (on the left), CEO of the Estonian transmission system operator Elering, Juhan Parts, Estonian Minister of Economic Affairs and Communications, Krista Kiuru, Finnish Minister of Housing and Communications, and Fingrid's CEO Jukka Ruusunen sealed the time capsule of the EstLink 2 project in the structures of the Püssi converter station in Estonia.

Below: In his video message, the Finnish Minister of Economic Affairs Jyri Häkämies emphasised the economic significance of the Fenno-Skan 2 connection not only for Finland and Sweden but also for their neighbouring countries. "The more freely electricity can flow from country to country, the more efficient the market and the bigger the benefit to the consumers." In Finland, the inauguration ceremony was arranged at the Rauma converter station.

The political objective is that there would be international trade in electricity throughout Europe applying a single set of rules from 2014. The definition of the rules and practices of this trade is in full progress within the EU.

Import giving way to trade

Finland has imported electricity from Russia since the 1960s. But only imported. Now the goal is to make the electricity flow both ways.

Jukka Ruusunen considers it the first encouraging sign that in the EU's transmission system documents, the word "import" is changing to the term "trade" when the context is trade with Russia.

"Only gas and oil are bought from Russia, because the EU is short of these commodities. Instead, there is no reason why electricity could not be sold to Russia. The EU countries must make their own electricity generation so competitive that exports are also viable," Jukka Ruusunen emphasises.

There are already some signs to that effect. The price of electricity in Russia has occasionally risen so high that in a free market, electricity could have travelled from the Nordic countries to Russia, says Jukka Ruusunen.

"Russia has been holding back its deliveries, because a Russian electricity seller obtains a better price for electricity in Russia."

There is also a practical glitch: the large converter station in Vyborg can only transmit electricity from Russia to Finland, not the other way around. Jukka Ruusunen hopes that in connection with the next modification and expansion projects at the station, the Russians would modify the technology to enable two-way transmissions. In addition to technology, there is a need to create rules for two-way electricity trade.

What if technology fails?

Let's go back to the outage of Fenno-Skan 2 at the end of February. What if the technology fails elsewhere, too?

Jukka Ruusunen states that several alternative routes are required. The assumption in transmission system planning is always that it must be possible to operate the system even if individual transmission connections or large electricity generating units are out of use.

"Technology always involves risks. There can also be extraordinary situations for example as a result of natural disasters or political crises. In such cases, the key word is not efficiency but the security of supply. And if there is not enough electricity for all, it must be possible to circulate the deficit around Finland so that the disadvantage can be minimised. This, in turn, requires a well-functioning trunk network." ■

Challenges in the Baltic Sea region

- Potential electricity surplus in Norway and Sweden must be transmitted to where it is of most use.
- Renewable electricity production methods will increase the need for balancing capacity and the need to strengthen the internal networks.
- The interface between the EU and Russia must be enhanced.
- The change in the power balance caused by the decision of Germany to abandon nuclear power will also be reflected in the Nordic countries.

Savings and new products

"We can expect to see more competition in electricity generation and new products provided by the integrating market." This is how Senior Advisor Karl-Henrik Nordblad of Fortum sums up the benefits of new transmission capacity to the end users of electricity.

"Market integration together with a growth in electricity production based on renewable energy will increase the fluctuations of the hourly electricity price. These fluctuations will be greater in Central Europe than in the Nordic countries. In applications where price elasticity is available, electricity use can be optimised in such situations as determined by the hourly price; this brings cost savings," says Karl-Henrik Nordblad.

He points out that the system security of the power system will also improve as a result of the new electricity transmission projects, because the impact of individual power plant faults and transmission line failures will decrease, and the volume and use of system reserves can be optimised.

"From the viewpoint of electricity producers, the expansion of the market area will improve the opportunities to maintain and add to the generating capacity in the Nordic countries", Karl-Henrik Nordblad says.

He believes that Finnish companies have good facilities to compete in the new European internal electricity market.

Doubled transmission capacity

The leaders of the EU countries have set 2014 as the target year for the attainment of the European internal market for electricity.

In line with the planned network projects, the electricity transmission capacity between the Nordic countries and the rest of Europe will about double from the present within the next 10 years.

According to Karl-Henrik Nordblad, the market in Finland will be influenced in particular by the reinforcement of north-south transmissions within Finland and by the third 400 kilovolt interconnector between Finland and Sweden. In addition to these, he mentions the strengthening of the connections both within the Baltic countries and from them to Finland, Sweden and Poland.

"The new connections between the Nordic countries, Continental Europe and the United Kingdom, in turn, will level off the impacts of weather variations in the Nordic countries on electricity prices. They will also contribute to the cost-effective implementation of the renewable energy targets," says Karl-Henrik Nordblad.

Electricity and heat

Fortum's business focuses on the Nordic countries, Russia, Poland and the Baltic Sea region. The company's total power generation capacity in 2011 was 72.7 TWh.

- The company owns fully or partly 260 hydropower plants in Finland and Sweden, with a combined capacity of almost 4,700 MW.
- The company owns fully the two Loviisa nuclear power plant units, 26 per cent of the two nuclear power plant units at Olkiluoto, and about 23 per cent of the Forsmark nuclear power plant units and 43 per cent of the Oskarshamn nuclear power plant units, with a total capacity of some 3,200 MW.
- Owns 55 per cent of wind power companies Tunturituuli Oy, 16 per cent of Öskatan Tuuli Närpiö Oy and 25 per cent of the Olkiluoto wind plant, with a combined capacity of about 3 MW.
- Combined heat and power (CHP) plants and heating plants in 7 countries (total capacity about 10,000 MW).

The development plan for the European transmission system covers more than 100 major projects

ENTSO-E released the Ten-Year Network Development Plan (TYNDP) 2012 package for the European electricity transmission network in early March. The plan covers a total of more than 100 major projects to be executed in different countries, involving the renewal or construction of some 52,000 kilometres of transmission lines. TYNDP identifies the need to invest 104 billion euros in the upgrading of the European transmission system.

With these projects, the European TSOs aim to enhance the electricity transmission system to support the fundamentals of EU energy policy: market integration, the integration of renewable energy sources, and security of supply.

Comparing to the projects identified in ENTSO-E's pilot TYNDP 2010, the report finds that one in three planned investments are experiencing delays in implementation due to long permitting processes. This is why ENTSO-E considers the Commission's proposals on the fast-tracking of transmission infrastructure projects in its draft Energy Infrastructure Package and in particular the proposal on a one-stop-shop and defined time lines for permit granting procedures as a most positive step forward.

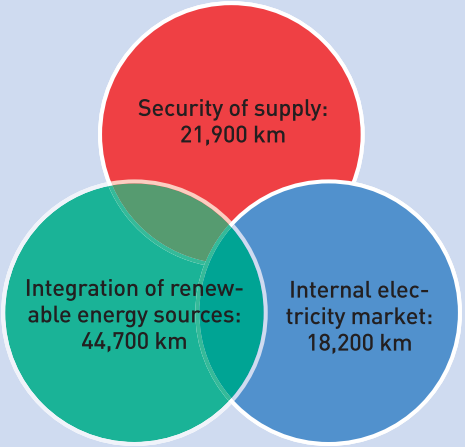
The TYNDP 2012 studies find that 80 per cent of the identified 100 bottlenecks are related to the integration of renewable energy sources (RES) such as wind and solar power. Such massive development of RES is the main driver behind larger, more volatile power flows, over longer distances across Europe, mostly north-south from Scandinavia to Italy, between mainland Europe →

and the Iberian peninsula, Ireland and UK; or east to south and west in the Balkan peninsula.

The commissioning of projects of pan-European significance could result in CO_2 savings of 170 million tonnes of CO_2, of which 150 million tonnes results from the connection of renewable generation technology and 20 million tonnes stem from savings due to further market integration.

With the release of the TYNDP 2012 package, ENTSO-E launches a public consultation on the documents, allowing all interested parties to comment on the package. All comments must be submitted via ENTSO-E's dedicated web consultation interface by 26 April.

Further information on ENTSO-E's project plan is available on the organisation's website www.entsoe.eu.



Planned pan-European grid construction projects divided on the basis of the main drivers.

ELECTRICITY TRADE between Finland and Russia

Co-operation works despite differences

The power systems in Finland and Russia differ from each other in terms of both their technical features and market mechanisms. Moreover, in Russia the ownership of the transmission system and power system management are distributed between several parties: the transmission system operator is SO-UPS (System Operator of the United Power System), but the transmission system is owned and developed by the network company FGC (Federal Grid Company). The control centre functions are taken care of by ODU, which is part of SO-UPS. ODU is responsible for the operation of the power system in North-West Russia and therefore also for the interconnectors to Finland. Electricity exports are in the hands of the electricity sales company INTER RAO UES, where the state has the majority holding and which has a practical monopoly in electricity exports in Russia.

Fingrid's Power System Control Centre keeps contact with ODU's control centre in St Petersburg in daily system operation matters. According to **Reima Päivinen**, Fingrid's Senior Vice President responsible for power system operation, the co-operation between the control centres works well, even though there is not always a common language for communications. If necessary, a mutually agreed code book is used. The operators of the control centre in St Petersburg and the operators of Fingrid's Power System Control Centre meet twice a year to discuss shared issues and the further enhancement of co-operation. Overall, the system security of the transmission interconnectors between Russia and Finland has been good, and there have been but few disturbances.

Fingrid makes 1,300 megawatts of transmission capacity on its 400 kilovolt Russian interconnectors available to the electricity market. Of the total capacity, 100 megawatts are left for the reserves needed in the power system.

In recent years, collaboration in the operation of the transmission interconnectors has been developed in two ways. "We have been developing an approach where, during major disturbances in the Finnish high-voltage grid, electricity could be obtained from Russia and the restoration of the grid could be started on the Vyborg connection. This would expedite the restoration of electricity supply in Southern Finland," Reima Päivinen says. There have also been discussions about a possibility to buy, alongside the present frequency controlled normal operation reserve, also fast disturbance reserve via the Vyborg connection.

First steps in direct electricity trade
Finding a balance between different market models

Electricity imports from Russia to Finland have been revised since last autumn. The objective is to develop electricity trade between the two countries to work with market focus. Due to the different kinds of electricity market models, there are some big challenges, but both parties have the will and motivation to achieve the common goals. **Text by** Suvi Artti **Photographs by** Eija Eskelinen and Jonna Monola

In August 2011, imports of electricity from Russia to Finland started to apply an experiment which takes into account the need for electricity in the countries better than before. Earlier, electricity imports from Russia were based entirely on bilateral trade, and the import volume was set in advance, before the daily market situation was known.

In the new method, some of the transmission capacity between the countries can be used as required by the market situation: an electricity market player engaged in direct exchange trade buys electricity from the Russian market and sells it directly to the Nordic electricity exchange Nord Pool Spot. Trade is also possible within the same day in the intra-day market, and the need for transmission capacity is determined on the basis of the market situations in Russia and Finland.

So far, the new method applies to 100 megawatts of the transmission capacity between the two countries, with the total capacity being 1,300 megawatts. Based on the experiences gained, the portion of exchange trade will be increased gradually.

Goal: two-way trade

Electricity is currently only transmitted from Russia to Finland, but the objective is to reach a truly market-driven situation where the price determines the direction in which the electricity moves. However, a transition to two-way trade still requires further development of the trading mechanisms.

Up until last autumn, electricity imports from Russia to Finland have been profitable almost at all times, but there would seem to be a need in the future for a possibility to transmit electricity both ways.

"From the autumn of 2011, electricity has been cheaper in Finland than in Russia in the daytime," says Development Manager **Juha Hiekkala** of Fingrid. He says that this is so for two reasons: the abundant water reservoirs in the Nordic countries and the Russian pricing system, where the price of electricity is divided into a spot price calculated at the nodes and into a capacity fee determined in the capacity market. The capacity fee only needs to be paid in certain hours, for example in March 2012 at 7–15 and 17–21 Moscow time. This is why there is a bigger profit to be made in electricity imports to Finland at night and in the afternoon, when the capacity fee does not need to be paid. Therefore, considerably more electricity is imported into Finland during lower prices than at other times.

Nodal point pricing applied in Russia may also influence the profitability of the trade: while the Nordic countries apply an area price system, where for example the whole of Finland is of the same price area, there are thousands of nodes in Russia, each with their own →

price. "Russia is a big country, where the distances are long and the transmission system is relatively weaker than that in Finland. The transmission capacity of the grid therefore becomes insufficient. Consequently, the price at the nodes is segregated, resulting in the fact that transmission management is a more complex task than in Finland," says Fingrid's Corporate Adviser **Risto Lindroos**.

The price of electricity in both countries is the sum of many different factors. One of the factors raising the price in Russia is the price of gas, which is on the increase. In the Nordic countries, on the other hand, the consumers have to pay 1 to 2 cents per kilowatt hour more than in Russia due to the EU's emissions trading scheme.

Variations in import volumes

Even though the first step towards fully market-focused trading has now been taken, there are still many challenges ahead. The different power systems and electricity market models in Finland and Russia keep the developers of co-operation busy.

Since last autumn, the volume of electricity imported from Russia has varied considerably within a single day. "Earlier, it was easy to anticipate the situation: there was a constant influx of imported electricity to Finland at the maximum capacity of 1,300 megawatts per hour. In the past few months, our customers have been puzzled: why do the imports from Russia go up and down," says Risto Lindroos.

In other words, the situation has taken a turn towards a direction which is difficult to forecast by the market players.

"The earlier constant imports from Russia were easier to handle as market information," he says. He points out that the imports from Russia are in no way small; they account for about 10 per cent of the total electricity consumption in Finland.

"When the various players make bids to the power exchange, they want to know in good time how much electricity is imported from Russia. Whether the import volume is 0 or 1,300 megawatts has a major impact on the market price level in Finland and Sweden."

Juha Hiekkala also emphasises that there is now even more demand for market information concerning the St Petersburg area. "The electricity generation situation in that area has a major impact on the price of electricity in Finland. As an example, information on the operation interruptions of large power plants would be valuable information in the Nordic electricity market, so that the market here could anticipate how much electricity is available from Russia."

Towards electricity trade between the EU and Russia

Fingrid and the Russian parties FGC, SO-UPS and the electricity seller INTER RAO UES are enhancing the trading mechanisms in a joint market group. Issues pertaining to cross-border power transmission are also solved in an operation group and in a technical group. Moreover, CEO-level meetings are arranged once or twice a year.

"There are many parties involved, so any progress takes time. However, the important thing is that there is mutual motivation to develop the trading mechanisms," says Risto Lindroos, who is a member of the market group.

Launching direct trade of electricity between Russia and Finland is also a first step towards more market-focused procedures in electricity trade between Russia and the EU. With this in mind, ENTSO-E and SO-UPS have established an expert group, which assembled for the first time in Fingrid's premises in January. Fingrid is represented in the group by Juha Hiekkala, who together with **Alexander Ilienko** chairs the group. ■

Vyborg is a major hub in electricity trade between Finland and Russia. Electricity imports from Russia started in the 1960s, and they grew to a whole new dimension in the 1980s as a result of the new 400 kilovolt interconnectors. A third cross-border transmission connection between the countries was finalised in 2003.

Nord Pool Spot: "Increasing market focus is welcome"

Nord Pool Spot welcomes any developments that will take electricity trade between Russia and the Nord Pool Spot area towards a market-driven approach.

"The liquidity of the Nordic electricity exchange is so good that the market can function even though the volume of electricity coming from Russia varies," says **Sami Oksanen**, Nord Pool Spot's Sales Manager in Finland. He adds that the introduction of direct trade in imports from Russia went smoothly, and the new procedure did not necessitate changes in the systems of the electricity exchange.

Representatives of Russian system operator: "This is a good start"

SO-UPS's representatives Alexander Ilienko and Fedor Opadchiy consider it important that direct electricity trade between Finland and Russia has been launched, even if the technical and legal differences between the countries impose a number of challenges.

"The first tangible results have now been attained," says Markets Support and Development Director Fedor Opadchiy in referring to the launch of direct electricity trade between Finland and Russia.

Mr Opadchiy and Alexander Ilienko, Power System Development Director, visited Fingrid in January to attend a meeting of the expert group of ENTSO-E and the Russian system operator SO-UPS. The two men say that co-operation with Fingrid employees runs smoothly.

They acknowledge that practical experience has demonstrated that a lot of work is still required to co-ordinate the two different market models. Still, they think that achieving the first phase is a fine result.

"We have now seen in practice that it is possible to join together two different markets, which differ from each other in terms of their modes of operation, legislation and trading mechanism," Fedor Opadchiy says.

"Much work still remains to be done and many different aspects must be taken into account. However, we and Fingrid people have a consistent view of the goals, and both parties have signed the relevant agreement. It is an important step forward."

According to Fedor Opadchiy, market-based trade is an important goal; there is no point in importing electricity from Russia to Finland if the price of electricity in Finland is lower. He points out, however, that when agreements are drawn up, everything must be founded on the physical transmission capacity.

"The objective is a full market basis, but the engineers have to determine what is technically realistic. We are balancing between technical requirements and commercial interests."

According to Mr Opadchiy, it is clear that there is no point in making major changes to the existing regulations and procedures of either market due to electricity trade between Finland and Russia.

"Everyone understands that Nord Pool's rules are not changed radically because of 100 megawatts and that we will not rewrite our own market rules on account of exports of 1,300 megawatts to Finland; this only represents a fraction of the Russian electricity generation volume. For this reason, electricity trade between the countries must adapt to the procedures of both parties."

Alexander Ilienko and Fedor Opadchiy have exclusively positive experiences of Finnish–Russian electricity market co-operation.

"We appreciate the expertise and motivation of our colleagues at Fingrid," says Fedor Opadchiy. "We need to build a bridge between different rules and mechanisms, and this will require extra efforts from each party. We see that Fingrid is motivated and properly driven to solve the problems."

The co-operation also goes without glitches on the practical level. One example given by Mr Opadchiy of well-functioning relationships is the fact that there were no problems in the introduction of the new procedures in the control centres when the direct electricity trade was introduced.

Alexander Ilienko also commends Fingrid's role in energy co-operation between Russia and ENTSO-E. "We are only at the initial stages in our co-operation with ENTSO-E. I believe that together with our Finnish and Baltic colleagues, we can find common ground to achieve our objectives."

Alexander Ilienko (on the right) and Fedor Opadchiy participated in the first meeting of ENTSO-E's and SO-UPS's expert group in Helsinki in January. The group endeavours to promote the introduction of increasingly market-driven practices in electricity trade between Russia and the EU.

Lesson to be learned from the **WINTER STORMS**

Two extraordinarily fierce winter storms traversed Finland on 26 and 27 December 2011. The storms brought down many trees, causing widespread outages in electricity distribution networks especially in Western Finland and also elsewhere in the country. Fingrid's transmission grid survived the storms well. Still, Fingrid's customers were indirectly subject to long-term outages.

Text by Timo Kaukonen **Photograph by** Otso Keränen

According to a survey conducted by Finnish Energy Industries, a total of 570,000 customers suffered from the blackouts at the end of 2011. The corresponding figure after the storms in the summer of 2010 was 481,000.

The electricity transmission lines owned by Fingrid did not experience faults caused by falling trees during the winter storms. Instead, trees that fell on four branch lines connected to Fingrid's 110 kilovolt network also caused outages of several hours on a trunk line in Fingrid's high-voltage system, required by switching operations and clearing work.

The longest outage periods in Fingrid's network were on 26 December on the Kolsi–Forssa line and on 27 December on the Hikiä–Forssa and Hikiä–Nikkilä lines. The longest connection point interruption on these lasted as long as 8 hours.

There were also some faults caused by fallen trees on the radial lines connected to the high-voltage system through a circuit breaker. These were reflected in the high-voltage grid as short voltage dips of less than a second before a circuit breaker was activated and during manual switching.

What made the clearing of the problems complicated was the fact that there were several simultaneous faults. For this reason, the fault location could not always be separated immediately by switching operations in the grid and electricity could not be restored to the intact part of the grid. There were also delays in the data compiled by fault recorders used in finding the fault location. These delays slowed down system restoration.

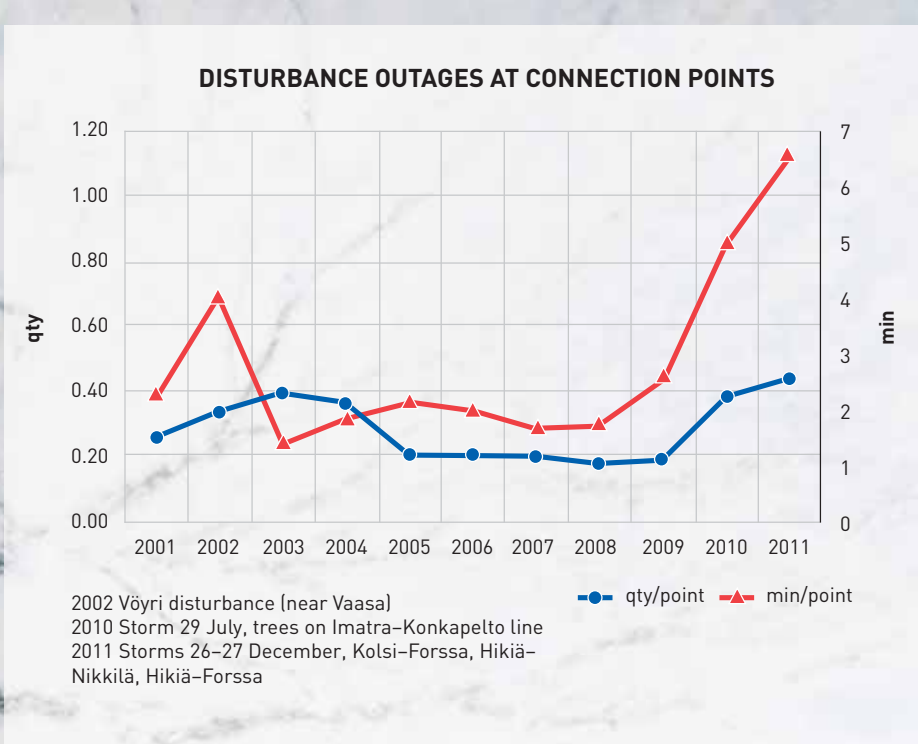
Even though the high-voltage grid survived the winter storms with little damage, its customers experienced long-term blackouts caused indirectly. As a result, the annual outage duration at the connection points rose to the highest value of this decade due to the storms.

Towards increasingly stable security of supply

The storms boosted requirements for improved security of supply of electricity, and a number of improvements are in the making.

The Ministry of Employment and the Economy is preparing legislative changes to encourage a reduction in electricity network disturbances and mitigation of resulting damage and loss. The means to this end include expedited use of underground cables and allowing cabling along roads, a legal requirement for network companies' contingency plans, increasing the standard compensations paid for blackouts, more efficient management of forests close to transmission lines, and improved communications to customers.

The most important action in preventing failures caused by falling trees is to keep the lines out of the reach of falling trees by regular clearing in the high-voltage grid, but also especially in



It must be the shared objective of Fingrid and regional network companies to correct any faults swiftly in all disturbance situations.

110 kilovolt regional networks, where many failures occurred this time. It must be the shared objective of Fingrid and regional network companies to correct any faults swiftly in all disturbance situations.

In addition to the clearing of trees, it would seem necessary to consider more switching options in branch lines by adding circuit breakers or disconnectors and their remote controls at suitable locations.

Communications in a key role

The flow of information is the key in failure situations, which is why telephone and data traffic must be secured by duplexing the connections and by extending the back-up operation times of telecommunications equipment. To this end, Fingrid is carrying out a project where the operation control connections will be duplexed and the operation times of telecommunications batteries will be extended to 12 hours. Despite the contingencies, long-term disturbances in distribution networks can cause problems in communications. This is why it is important to agree with distribution network companies on securing electricity supply to the primary communications stations.

In a wide-spread blackout, websites and telephone communications will likely and probably also be congested, so their capacity calls for attention in advance. Telephone connections which serve power system operation can also be secured by systems employing various techniques which are not prone to failures for the same reason. One example of these are satellite phones.

The Touko 2011 major disturbance exercise held last spring revealed many important development issues, which intend to expedite power system restoration in wide-spread outages. These include the enhancement of the overall view of the state of the transmission system to a more easily understandable form in the various stages of the disturbance, and the rapid publication of disturbance communications with the correct content. Communications between the various parties have a key role during the entire restoration process.

Since the high-voltage transmission system has a meshed structure, there are much fewer wide-spread disturbances in it than in distribution networks. This is why it is necessary to practice disturbance clearing, system restoration and fault repairs regularly with the other parties involved. A sufficient number of spare equipment and spare towers must be acquired for disturbances, and their erection and the co-operation between the different parties need to be practiced sufficiently often. The old saying "practice makes perfect" also holds true here. ■

Timo Kiiveri
STEERING A MAJOR PROJECT AFTER THE OTHER

The final completion of one of Fingrid's largest projects in the past decades, the Fenno-Skan 2 submarine cable, was short of the finishing touches at the end of last year, when its leader Timo Kiiveri took on a new large-scale assignment. The harmonisation of Nordic imbalance settlement will keep the energetic project manager busy over the next 3 years.

Text by Maria Hallila **Photograph by** "HardTraining"

Work or leisure, Timo Kiiveri does not stay still for a length of time. He rather works with people than alone at his desk, feels more comfortable in the saddle of a road bike than on the sofa, and prefers speed skates to slippers.

In fact, Timo Kiiveri seems to personify the slogan used by Fingrid of the motivation of its personnel: "Full of power". Timo Kiiveri, 45, Master of Science in Engineering, MBA, has headed Fingrid's unit for large-scale projects for a few years now and also served as the line manager of as many as three main projects simultaneously.

"The projects change, but the title stays the same", Timo Kiiveri says with laughter. His first position as a project manager in 1996 was related to the refurbishment of substations. After that, the responsibilities and duties were linked with grid asset management until 2005, when the Fenno-Skan 2 submarine cable project between Finland and Sweden was launched.

"The more pressure at work, the more important it is to exercise," says Timo Kiiveri. Road cycling is one of his favourite sports.

Joy from co-operation

According to Timo Kiiveri, the end of December 2011 was a suitable point in time to withdraw from the 7-year cable project implemented jointly by Fingrid and Svenska Kraftnät. The outcome of the project – 800-megawatt high-voltage direct current connection – had recently been made available to the electricity market on schedule and only awaited the inauguration ceremonies.

"The result gives cause to both joy and pride," he says.

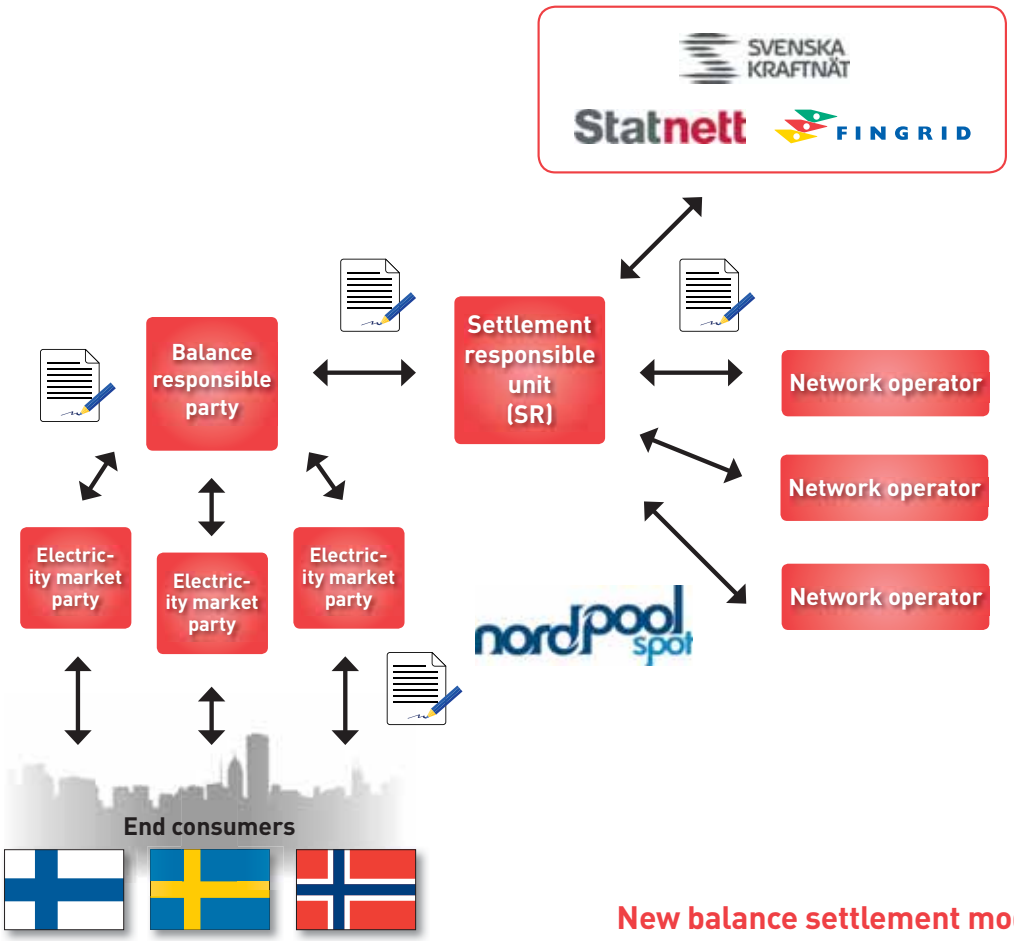
Fenno-Skan 2 has proved to meet the quality standards set on it, but what the project leader considers as the greatest source of joy is the fact that the co-operation of the project team was excellent throughout the work.

"During this project, I have really learned to appreciate and enjoy doing things together," says Timo Kiiveri.

One indication of the commitment of the project team is that the schedules during the course of the long project were kept very strictly.

Cappuccino or regular coffee?

The Fenno-Skan 2 project was not only the biggest project in Timo Kiiveri's career to date, but also a unique learning experience in Nordic co-operation.



New balance settlement model

He says that there were three aspects involved: "The first challenge are the cultural differences, then there is the diversity of people, and the third thing are the different practices of enterprises."

According to his recent experience, the most distinctive difference between the Finnish and Swedish working cultures lies in decision-making.

"We Finns prefer quick solutions. It is OK for us that those in charge make even big decisions on their own and that these decisions are then corrected a bit if need be. The Swedes, in turn, are known to like to discuss things in a large group, but when the issues at hand have been viewed from every aspect, things start to happen. The end result is just as good as that achieved with the Finnish approach, and sometimes even better."

Timo Kiiveri also sees differences in the working atmospheres and attitudes. He says that he has perceived the joy of work more frequently in Sweden than among Finnish workers. He is also enchanted by the manners and customs through which the Swedes bring a touch of luxury to everyday things.

"**Helena Walldén**, Fingrid's Chairman of the Board, summarised this aptly by stating that while a Swede chooses cappuccino, a Finn is usually content with regular coffee."

Small things can make a big difference, Timo Kiiveri says. "Does joy experienced amidst everyday work make you cope longer in the world of work? The project manager in charge of the transmission line in Sweden within the Fenno-Skan 2 project was closer to the age of 70 than 60."

Harmony in balance service

Solid experience of Nordic co-operation serves as valuable capital in the new project headed by Timo Kiiveri, aiming to harmonise and integrate balance settlement on the level of transmission systems in Finland, Sweden and Norway and between their bidding areas.

The project launched at the end of 2011 goes by the abbreviation NBS (Nordic Balance Settlement). Its objective is to outsource the operative management of balance settlement to a separate inter-Nordic balance settlement unit by 2014. The project has been prepared for a couple of years, and now it has reached implementation.

In addition to Timo Kiiveri, Fingrid is represented in the project team by balance service specialists **Pasi Lintunen** and **Mikaela Holmström**.

"A project as big as this also involves Fingrid employees other than those working in the Balance Service Unit. The role of the legal department is important, because the new arrangement will also require changes to legislation," says Timo Kiiveri.

The transmission system operators continue to carry responsibility for the national balance settlements even after the introduction of the new procedure. "To put it simply, the reform is about who does the work. Once the project is complete, balance settlement in the different countries will be carried out using uniform principles, and all balance responsible parties will obtain uniform service from a single source."

A key element in the reform is a single shared information system. The specification work of the system started in February. The country-specific service units in Helsinki, Stockholm and Oslo will continue to exist to ensure that all TSOs receive service in their own language.

The model in Europe

The NBS project endeavours to be the trailblazer in balance settlement matters in Europe. The goals of the project with costs of 8 million euros are associated with major EU-level political choices, which aim to promote the functioning of the electricity market: increasingly closer integration, and accomplishing a shared consumer market in the Nordic countries.

The change in the balance settlement system will influence all players in the Nordic electricity market. This is why its implementation will require a lot of discussion and collective reflection, Timo Kiiveri says.

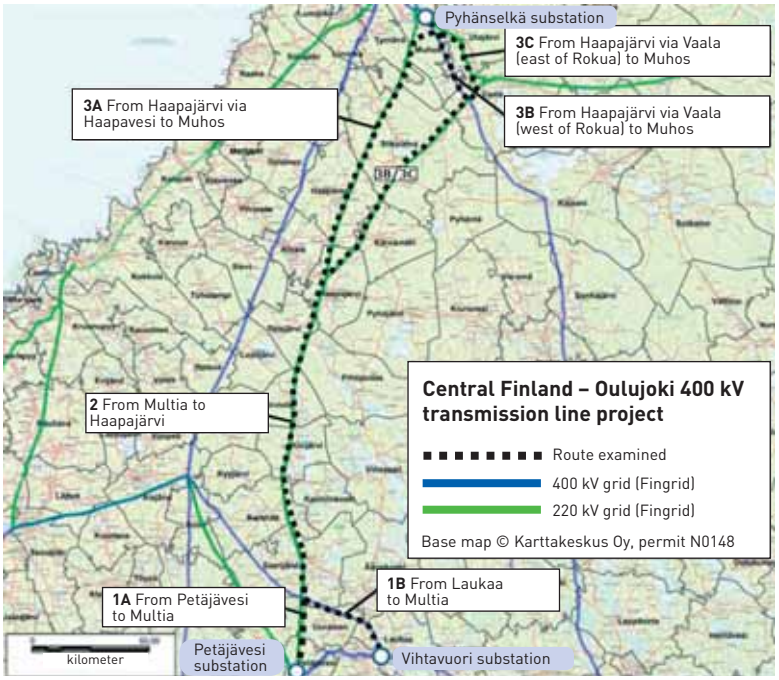
He adds that the first weeks in charge of the project have already shown that the viewpoint of a large, international enterprise on the reform is very different from that of a small, regional network company. For this reason, the project will be established a comprehensive reference group at the requirement of the Nordic authorities which supervise the energy industry so as to ensure that the market players in the relevant countries can get their voice heard.

"It would be important that all parties can perceive this project as part of the big picture, beyond their own interests. However, that situation is still quite far at this point," Timo Kiiveri states.

One decision facilitating adaptation to the change has already been made: before the introduction of the new system, there will be a transition period of 18 months, during which time the reporting procedures and the functioning of the system are tested in practice.

In the meantime, many challenges remain to be solved, putting the project manager's and the entire team's co-operation skills, perseverance and ability to deal with uncertainty to the test.

In the first meeting of the team, Timo Kiiveri summed up the challenges ahead by quoting an experienced project leader: "You have to get used to shooting at a moving target." ■



Fingrid's longest transmission line project ever calls for

DIALOGUE IN PLANNING

The 400 kilovolt transmission line to be constructed from Central Finland to the Oulujoki river is the longest single transmission line in Fingrid's history to date. Construction work for the line project, which has progressed to the EIA stage, will probably be scheduled for 2017 to 2020.

Text by Ursula Aaltonen **Photograph by** Pasi Saari

The project is part of a considerable capital investment programme, within which Fingrid intends to build a total of approx. 3,000 kilometres of new transmission lines in Finland by 2020.

The ultimate reason for the construction of the line between Central Finland and the Oulujoki river further up north is the need to strengthen the south-north transmission capacity. The project also enables the abolishing of the ageing 220 kilovolt system in Central Finland and Ostrobothnia. Moreover, the new transmission line makes preparations for connecting to the grid and transmitting to the consumers the electricity generated by the planned wind turbines and nuclear power plants and for the development of the electricity market.

One indication of the size of the transmission line project is that it covers 22 municipalities between Jyväskylä and Oulu. The end points of the line are in the south in Petäjävesi or Laukaa and in the north beside the Oulujoki river in Muhos.

"When including the alternative route options, we are examining construction over a total distance of about 560 kilometres. Depending on the final route, there will be at least 300 and no more than 340 kilometres of new transmission line," says Specialist **Pasi Saari**, who serves as a technical expert in the project.

Most of the line routes examined, about 95 per cent, are located in the rights-of-ways of existing lines or in conjunction with them. The plan only covers about 30 kilometres of completely new line routes. "When a new 400 kilovolt transmission line is placed

parallel with an existing line, it means that the right-of-way needs to be made about 30 metres wider. On other hand, since the voltage level is raised, the towers are further apart from each other. The towers of the new transmission line are also on average about 10 metres higher than the towers of the existing 220 kilovolt line," Pasi Saari says.

EIA to support decision-making

The environmental impact assessment (EIA) conducted during the preliminary route planning of the project intends to help the identification and selection of the best route for the transmission line. The objective of the statutory EIA process is not only to promote the consideration of environmental aspects in decision-making, but also to increase public access to information and citizens' opportunities to contribute to projects.

EIA has two phases: in the first phase an EIA programme is drawn up. This is a plan of what effects will be studied and how the studies are to be made. The second phase of the EIA process is the actual impact assessment report, which compiles the results of the assessment work. The EIA report supports decision-making concerning the project.

Public EIA events are arranged both in conjunction with the EIA programme and report. "A transmission line project covers a large area, and we try to select the locations of the public events from all parts of the area. The feedback received also determines where the public events of the report phase will be held," Pasi Saari says.

In addition to its statutory role, the EIA process also plays an important part in interaction with stakeholders. "The EIA events are especially important to us because we can give the project a face; landowners and people living close to the line can see the people who work on the project," says Project Manager **Satu Vuorikoski** who serves as the EIA contact person in the project.

Natural values considered broadly

The EIA report created as a result of the assessment work examines the environmental impacts of both the construction and operation of the transmission line. The evaluation of the significance of the impacts constitutes an integral part of the assessment.

EIA assesses the environmental impacts of transmission line projects comprehensively – in terms of people, landscape, cultural heritage, natural conditions, land use, and businesses. "The assessment work involves many professionals such as biologists, landscape architects and sociologists. A total of 65 nature sites which need to be taken into account in the route plan have been identified along this transmission line route," says Project Manager **Lauri Erävuori** of Sito Oy, the EIA consultant in the project.

The EIA report utilises for example existing and new terrain and nature studies. "Typical environmental impacts emerging during EIA include land use impacts, landscape disadvantages, vegetation changes and impacts on livelihoods – for example that the transmission line area can no longer be used for forestry. The electric and magnetic fields caused by the line are also examined," Lauri Erävuori states.

The EIA report of the power line project between Central Finland and the Oulujoki river is expected to be completed during 2012. The information generated by the EIA process will be utilised in the selection of the final transmission line route, followed by field studies and more detailed general planning. The actual construction of the line will probably take place in 2017 to 2020.

"In the northern part of the project area, there are ecologically important Natura areas, which have already influenced the route plans," says Pasi Saari.

The Finnish Association for Impact Assessment gave the Good EIA Award of 2011 to Fingrid for the company's efforts in the environmental impact assessment for the 400 kilovolt transmission line project from Kokkola to Muhos. The justifications of the award stated, among other things, that Fingrid's contribution to the EIA process "has been genuine and the feedback received has been taken seriously".

"Of course, the award means a lot to us – it shows that we have been able to achieve the objectives set by us on the EIA processes and to work responsibly in accordance with Fingrid's values," says Satu Vuorikoski. ■

The environmental impact assessment (EIA) analyses the environmental impacts of the construction and operation of a transmission line. A total of 65 nature sites that affect the route plan of the transmission line to be constructed between Central Finland and the Oulujoki river have been identified along the planned route.

DISCUSSION ON THE ENVIRONMENT – and other things

About 20 local inhabitants have gathered in a school auditorium in Uurainen in Central Finland on a cold January evening. The event about to start is the public presentation of the environmental impact assessment (EIA) of the 400 kilovolt transmission line planned between Central Finland and the Oulujoki river.

Text by Ursula Aaltonen **Photographs by** Ari Nurmela

The event in Uurainen is the last of the three EIA events arranged in the assessment programme phase of the transmission line project. "The other events were held at the northern end of the project, in Haapajärvi and Utajärvi. The public events are open to all, but they naturally raise most interest among local landowners," says Specialist **Pasi Saari** of Fingrid.

In addition to Fingrid's representatives, the other hosts of the event include representatives of Sito Oy, the EIA consultant in the project. The event is chaired by Senior Inspector **Esa Mikkonen** of the Centre for Economic Development, Transport and the Environment of Central Finland, which serves as the competent authority in the project. In a couple of hours, the landowners obtain a comprehensive presentation of the planned power line project and its environmental impacts.

"In these events, landowners are especially interested in the project schedule, locations of transmission line towers, use of roads during the construction work, and expropriation compensations. However, since the project is only in preliminary planning, most of the issues are still undecided and we cannot give precise answers to these questions. As an example, the exact sites of towers are only decided during the more detailed general planning of the selected line route," Pasi Saari says.

People are also interested in topical issues. "The winter storms and the resulting blackouts have raised questions and discussions in these events about the weather reliability of transmission lines. However, Fingrid's transmission lines are built and maintained so that falling trees cannot reach the lines. Overall, the main grid survived storms at the end of last year very well," Project Manager **Satu Vuorikoski** points out.

Many channels of interaction

Fingrid's website provides a map feedback service, through which landowners and others can provide feedback easily in an electronic format. "The service is easy to use, and we receive quite a lot of feedback through it. The service also facilitates our work, because when the item of the feedback is indicated on the map, it is easier for us to react," says Pasi Saari.

"Feedback is important for us so that we can enhance our operations. This is why we encourage people to tell us their observations and concerns concerning construction projects. All feedback given to us is dealt with, and, if necessary, it is also communicated to the consultant assessing the environmental impacts and to the competent authority," Satu Vuorikoski says.

The EIA process does not take a stand on a factor that interests many landowners: the expropriation compensations paid for the right of use to the transmission line area. The expropriation of land and the compensations paid for this are only dealt with after the construction phase.

The compensation process is managed by the National Land Survey of Finland, which is an impartial body working within the Expropriation Act. Fingrid is not represented in the expropriation committee nor involved in deciding on the compensations. In addition to the land use right, landowners are compensated any damage potentially caused by land use. "It is important that damage inflicted on the landowners' land during construction work is either corrected or compensated immediately, before the closing of the site. The final expropriation compensations are paid later, after the actual expropriation proceedings have finished," Satu Vuorikoski sums up. ■

The audience of the EIA event in Uurainen raised questions concerning issues such as routes and tower locations of the new transmission line. Sito Oy's Project Secretary Taina Klinga helping to interpret the map (photograph above). In the photograph below, Specialist Pasi Saari (on the right) is providing an answer.

ABB to assume responsibility for the operation and maintenance of Forssa reserve power plant

Fingrid and ABB Oy have signed an agreement on the operation and maintenance services for Fingrid's new reserve power plant to be completed in Forssa in the autumn of 2012. The contract will be valid until the end of 2014.

With the Forssa plant, Fingrid has revised the service concept of its reserve power plants. Rather than buying separate operation and maintenance services, Fingrid has now concluded an agreement with ABB concerning total responsibility for the daily operation of the plant.

The agreement covers the daily operation and maintenance of the plant, reporting, preventive maintenance, repairs of faults, remote monitoring, inspections, area maintenance work, and responsibility for occupational safety at the workplace.

The Forssa reserve power plant contains a number of devices supplied by ABB, such as the Symphony automation system developed by ABB specifically for power plant processes, and other systems such as plant electrification.

"For ABB, this agreement is an important sign of trust. The requirements imposed on the maintenance of a reserve power plant are high, and we have put together a solid team of specialists to ensure the starting availability and reliability of the plant," said ABB's President **Tauno Heinola**.

Whenever necessary, the Forssa reserve power plant can be started from Fingrid's Power System Control Centre in Helsinki.

Photograph by Tiina Miettinen

Presidents Tauno Heinola (on the left) and Jukka Ruusunen getting acquainted with the reserve power plant to be completed next September.

Campaign on the dangers of transmission lines

"What you need to know before you do anything" is the theme of a campaign launched at the end of April, highlighting safety issues when working close to electricity transmission lines. Fingrid is the instigator and principal player in the project group of the campaign, also including 9 other organisations.

The two-year campaign covers eye-catching, informative and in-depth materials. The target groups from consumers to professionals are to be reached by using a variety of channels, from the Internet to various training sessions. The campaign website will be opened this spring at www.hengenvaara.fi.

In addition to Fingrid, the campaign participants comprise the following companies and organisations: Finnish Energy Industries, EPV Alueverkko Oy, Fortum Sähkönsiirto Oy, Helen Sähköverkko Oy, Infra ry, consortium of electricity companies in Eastern Finland, LNI Verkko Oy, Tukes, Vantaan Energia Sähköverkot Oy. The project manager of the campaign is **Marcus Stenstrand** of Fingrid.

IBM selected as the supplier of enterprise resource planning and network data system

Fingrid and IBM have signed a contract on the enterprise resource planning and network data system for use by Fingrid. The new system to be introduced in 2014 will provide up-to-date and reliable information on the transmission system. This will contribute to the efficient planning and reliable maintenance management of the power system. The value of the contract is 27 million euros.

The earlier system, which was tailor-made for Fingrid, has come to the end of its life cycle. The new system supplied by IBM consists of several commercial software products, which are integrated closely with each other. The objectives of the co-operation between the two companies include the development of operating models, transmission system planning, and safeguarding of reliable electricity transmission over a long term.

The software package is capable of, among other things, increasingly better management of transmission system maintenance, reliable planning of outages, and fast clearing of disturbances. The system can be used for drawing up project budgets and for placing orders for work with the service providers. The package enables mobile access to information anytime and anywhere wherever the information is needed.

"This is a major replacement investment, which not only renews our network data system but actually results in a new enterprise resource planning system. The objective is to upgrade the planning and life cycle management of Fingrid's electricity network and to enhance the existing procedures," says Fingrid's Executive Vice President **Kari Kuusela**.

Photograph by Eija Eskelinen

The agreement was signed by (from the left) Kimmo Joki-Korpela and Tuomo Haukkovaara of IBM as well as Kari Kuusela and Jussi Jyrinsalo of Fingrid.

"The system acquired by Fingrid will show the way for the entire electricity transmission industry," says **Kimmo Joki-Korpela**, head of IBM's business services and consulting in Finland.

Changes to the grid **connection practices and terms**

The Energy Market Authority confirmed Fingrid's new connection fee practice on 26 January 2012, and the practice came into force at the beginning of February. The new connection pricing will clarify the payments relating to the connections and the responsibilities of the contracting parties throughout the lifetime of the connection. In addition to this, the general connection terms and the specifications for the operational performance of power plants are being revised.

Text by Petri Parviainen and Tuomas Rauhala **Photograph by** Juhani Eskelinen

The number and connection method of connections to the high-voltage transmission grid have a significant impact on the system security and manageability of the transmission system. Moreover, from the customers' point of view it is very important that the pricing applied to the connections is fair and predictable.

In accordance with the new practice confirmed through the decision of the Energy Market Authority (record number 484/433/2011), the connecting party pays a standard-amount connection fee as a lump sum payment for its grid connection. The connection fee is specified annually for the various voltage levels and for substations and transmission lines using equitable principles. Through the connection fee, a customer reserves an agreed transmission capacity in Fingrid's grid. In addition to the connection fee, there are no separate fees for the operation, maintenance or replacement investments of the connection during the contract period.

The new practice concerns new grid connections, but it is Fingrid's goal to harmonise the practices gradually to also apply to the existing connections whenever connections are renewed.

The connection fees are reviewed every year based on the actual construction costs of the transmission grid.

If a new substation is built for the connection in the transmission grid, the connecting party bears the full construction costs of the substation. If new connections are constructed in the substation built due to the connecting party's need in the first 10 years either for a third party or for Fingrid, Fingrid will reimburse to the first connecting party the connection fee paid by him earlier to Fingrid. The connection fee of the substation valid at the time when the new connection is taken into use will be deducted from this.

General connection terms updated in 2012

The general connection terms (YLE) will be updated this year. In terms of the general principles and definitions, the specifications will concern issues such as the implementation method of transmission line connections, management of trees growing near branch lines as well as the cost-sharing principles and responsibilities of new and expanded connections.

With technical requirements and descriptions, the most important specifications will be related to the frequency and voltage fluctuation ranges and to the technical conditions of the connections, for instance as regards the switchgear required in the connection.

In line with the update, the previously separate principles of power plant connections and the descriptions of their technical conditions will also be made an integral part of the general connection terms.

Specifications for the operational performance of power plants renewed

Fingrid launched the first stage in the updating of the power plant requirements in December 2011, when the system technology requirements pertaining to wind power were specified by revising the wind power section in the VJV 2007 requirements. The update primarily concerns requirements imposed on wind turbines and wind plants in the size category of 0.5 to 10 MVA. The requirements imposed on the size category of 0.5 to 10 MVA are based on the requirements applied earlier to the size category in excess of 10 MVA, but the level of the requirements has been

Connection fees in 2012

• Connection to an existing 400 kV substation	2.0 million €
• Connection to an existing 220 kV substation	1.2 million €
• Connection to an existing 110 kV substation	0.6 million €
• Connection to a 110 kV transmission line	0.5 million €

Connections to transmission grid

Fingrid's customers are connected either to the substations or transmission lines of the company's transmission grid. New connections are always agreed upon in a connection contract signed between the connecting party and Fingrid.

The connection contract determines the ownership and liability limits between the parties, technical implementation, rights of use, responsibilities concerning operation and maintenance, and the fees to be paid. The contract period is at least 15 years.

Fingrid's general connection terms (YLE) and specifications for the operational performance of power plants (VJV), both which will be updated in 2012, constitute an inseparable part of the connection contract.

Fingrid endeavours to constantly improve these technical terms and connection practices on the basis of experience accumulated and customer feedback. The development of the specifications for operational performance has also been boosted by developments in the production technologies applied to renewable sources of energy.

relieved considering the typical connection methods and connection voltages of 0.5 to 10 MVA plants.

Moreover, the practices related to the system technology requirements of wind plants and the descriptions relating to the action required to verify the requirements have been specified considerably in the update of December 2011.

In 2012, Fingrid will revise the specifications for the operational performance of power plants completely. Even though the technical requirements themselves will not change considerably, the requirements will be renewed significantly as the document structure is changing and as the descriptions of the procedures concerning the verification of the requirements and the descriptions of the practices regarding the documentation of power plant data are becoming much more specific. In the future, measures related to the verification of the requirements and to documentation must be performed in the different stages of a power plant project, and the process will be described in a comprehensive manner in the requirements so as to clarify the procedure concerning verification and documentation.

One of key goals of the reform is to achieve a uniform package of power plant requirements, which brings together all of the essential technical requirements for a power plant project and descriptions of the subsequently required measures during the principal stages of a power plant project.

In addition, the reform will mean that there will be requirements of different scopes for generation units of various sizes. The purpose of the use of size categories is to better consider the needs of different parts of the grid.

In the full scope, the requirements will concern only those generating units which can have a significant impact on the transmission capacity between different areas in the power system. The requirements concerning plants typically connected to the lower voltage levels will become gradually more lenient, based on the typical connection voltages and connection methods of generating units of various sizes.

Further development in accordance with European principles

The grid connection requirements and the related practices are being harmonised on the European level, too. The European transmission system operators are preparing, at the assignment of the European Commission and on the basis of guidelines specified by the European energy market regulators, rules which describe a uniform structure for the technical requirements of power plants (ENSTO-E Requirements for Generators) in 2009 to 2012, and in 2011 to 2012 ENTSO-E is preparing a structure for the grid connection of consumption units (ENTSO-E Demand Connection Code). After being processed by authorities and the Commission, the codes will become European legislation in approx. 2014 or 2015, and the national requirements must be adjusted to the codes. In other words, the nature of the next stage of development of YLE and VJV will be determined on the basis of policy decisions made on the European level.

Fingrid has been actively involved in the preparatory work of the network codes and aimed to ensure that the transition from the present requirements via the requirements to be renewed in 2012 to the requirements based on the European connection codes would be as fluent as possible on the national level.

The Finnish players also have the opportunity to influence the contents of the network codes directly through the public consultation process and indirectly through lobbying organizations.

The connection requirements have an impact on all players, from electricity producers to device manufacturers. It is of prime importance to influence the European network codes and to comment on them so that the terms, requirements and pertinent practices can be enhanced also in the future in a manner that serves all parties concerned. ■

From everyday creativity TO INNOVATIONS

Organisational regeneration ability promotes well-being and productivity

A corporate culture which encourages creative ideas helps organisations to cope with the challenges. This promise is made by Professor Anna-Maija Lämsä and Researcher Elina Riivari of the University of Jyväskylä School of Business Economics. At Fingrid, an open debate is a conscious goal: the employees are encouraged to challenge themselves and each other in a positive sense.

Text by Suvi Artti **Photographs by** Juhani Eskelinen and Risto Jutila

Anna-Maija Lämsä and Elina Riivari would like to see new patterns of thinking and action in the Finnish life of work. They argue that aiming at mere economic growth does not contribute to overall productivity, let alone guarantee people's well-being.

The two researchers who have studied organisational responsibility and regeneration ability say that in order to cope with the present and especially the future challenges, organisations need information on how to act innovatively on one hand and sustainably on the other hand.

Anna-Maija Lämsä and Elina Riivari have studied the topic within a study focusing on ethically innovative organisations (OVI), where Fingrid was one of the enterprises analysed. The project aims to identify matters pertaining to the workplace atmosphere and whether the employees feel that they are employed by an enterprise which

Fingrid's staff in a group photograph at the Petäjävesi office in the spring of 2008.

works ethically right. In this respect, the research is ground-breaking: "Research into the ethical aspects of the organisational culture is very new, even in the international context," Anna-Maija Lämsä says.

Positive trouble-making

Fingrid has endeavoured to consciously hone its organisational culture towards a more open and interactive direction, says Senior Vice President **Matti Tähtinen**, who is in charge of personnel matters at Fingrid. According to him, strategic thinking requires the ability to question matters, and "positive trouble-making", in other words challenging yourself and others. "The world keeps changing, and it is a question of attitude whether we are ready to change and move beyond our own comfort zone."

Anna-Maija Lämsä says that an organisation capable of renewal and innovation can do something that formal control systems cannot attain: take advantage of people's ideas in the development of corporate operations. She encourages people to be open to new ideas. "There is everyday creativity all over organisations. The question is how to process it into regeneration and innovation. Encouraging leadership is one of the keys to this end."

Fingrid wishes to promote the open flow of ideas also by providing up-to-date technical systems and a physical setting encouraging this. "Our new premises to be completed towards the end of this year will feature technology that allows for example extensive video conferencing. Facility planning has also taken into account the different types of premises required by the different types of work stages," says Matti Tähtinen.

Experts of their own work

At Fingrid, innovation is promoted by encouraging the employees to open discussion and by giving them more responsibility, which also means increasingly greater confidence. The personnel have been coached to consider strategic thinking from the point of view of their own work.

This approach puts the emphasis on the employees, but Matti Tähtinen expects that work becomes more meaningful when everyone has the opportunity to influence the fluency of their own work. "The goal is to promote efficiency. At the different stages of the work, you can ponder whether things really have to be done in the same old way."

Due to its responsible role in society, Fingrid cannot just indulge in creative experimentation. "We work at the core of society, and just a small error made →

At Fingrid, an open debate is a conscious goal. This photograph is from an information session held last spring. Jarno Sederlund has the floor.

by us could result in the stopping of the whole of Finland, so we always have to play it safe," Matti Tähtinen points out.

It all starts from the organisational culture

Elina Riivari says that ethical sustainability, which is gaining more and more weight, not only means that ethical problems are avoided, but also that welfare and the good things are promoted. "However, it has become more complex to define a shared value basis. Common rules and guidelines do not cover all the situations you may come across in the world of work," she says.

Elina Riivari and Anna-Maija Lämsä say that the members of an organisation are driven by the organisational culture rather than rules and official instructions. According to their study, the ethical sustainability of the organisational culture is linked to the innovation ability of the organisation, mutual trust between the members of the workplace community, and to leadership. It has also been found that an ethically strong organisational culture enhances well-being at work and reduces the strain of work.

Superiors as role models

The two researchers behind the OVI study say that leadership has a focal role in the creation, enhancement and maintenance of the organisational culture.

"Superiors serve as role models for the employees in the organisation. This is why the superiors also have an important role in promoting ethically sustainable policies and practices. The example set by senior management seems to be a key factor in the development of innovation in particular," Anna-Maija Lämsä states.

Fingrid among the best workplaces

The results of the OVI study have not been publicised yet, but one convincing piece of evidence was recently obtained of the satisfaction of Fingrid employees: the company was selected as one of the best workplaces in Finland in a study by the Great Place to Work Institute in February.

The institute draws up a list annually of the best workplaces in Finland on the basis of a thorough evaluation. The evaluation is based on confidential feedback from employees and on a survey concerning the corporate values and practices, conducted among the personnel department. ■

GREAT PLACE TO WORK® Suomen parhaat työpaikat 2012 Finland

What is OVI?

The study Ethically Innovative Organisation (Organisaation vastuullinen innovointikyvykkyys, OVI) is a research project by University of Jyväskylä School of Business Economics. In addition to Fingrid, the study covering several branches of industry also involves a number of other companies.

The project intends to find out how responsible and renewable the employees find the practices of their workplace community. The significance of leadership, in particular the relationship between the superior and employee, on these factors is also under investigation.

The research project started in the autumn of 2011, and the results are expected in the spring of 2012. The data was collected in late 2011 by a questionnaire sent to the entire personnel.

At the University of Jyväskylä, Researcher and University Teacher **Elina Riivari** and Professor **Anna-Maija Lämsä** are responsible for the compilation of the research material and for reporting the results.

Suggestion improving safety and economy brought a bonus of 5,000 euros

It is nowadays possible to replace the foundation element of a transmission line tower safely also while the line is energised. Transmission line installer Keijo Ahonen received Fingrid's suggestion bonus in November for his idea, which made it possible to develop a new work method that improves safety and brings savings.

Text by Maria Hallila **Photographs by** Matti Seppälä

The replacement of foundation pillars is an important part of the maintenance of power lines. This work has become thoroughly familiar to Keijo Ahonen, who works at Eltel Networks' Petäjävesi unit, during his career of installer of more than 40 years.

"The tower foundations have to be replaced, because erosion is relentless. There are thousands of transmission line tower foundations built in the 1950s, 1960s and 1970s, and the quality of concrete used in them varies. There has been shortage of concrete, gravel and clean water at the sites," says Eltel Networks' Product Manager **Matti Seppälä** on the background of foundation replacement.

Suited to all applications

Foundation pillars have been replaced even earlier while the line has been energised. According to Fingrid's Senior Transmission Line Specialist **Hannes Maasalo**, the work method used previously has not been completely safe. It has also required an excavator of 25 tonnes plus its heavy carriage at the site. "And the method has actually been mastered by only one transmission line installer in the whole of Finland," he adds.

Hannes Maasalo characterises the new work method based on Keijo Ahonen's idea as safe and easy to learn. The equipment needed in the work is suitable for all voltage levels and all types of towers.

"The excavator can be much smaller, a 14-tonne machine, which is a significant advantage when moving over soft terrain such as bogs. What also makes the work easier – especially in the winter – is that such an excavator can be transferred on an ordinary truck."

Speed is another benefit of the new method: at best, the pillars of up to four tower foundations can be replaced in a single day, if the towers are located close to each other.

However, the biggest cost savings come from the fact the pillar foundation of an ordinary tower and a small angle tower can be changed while the line is energised, without lengthy outages due to maintenance work.

"This is an important consideration especially when repairing the foundations of 400 kilovolt transmission lines," Hannes Maasalo points out.

Tested in practice

The essential component in the method is a beam which supports the tower leg in the air while the foundation pillar under it is changed.

Eltel tested the beam and work method successfully in the winter of 2011 in the maintenance work of the 400 kilovolt transmission line between Seinäjoki and Ulvila, where about 50 foundation pillars were replaced without transmission outages. Hannes Maasalo says that there were some really demanding tower locations among these. ■

The suggestion bonus awarded to Keijo Ahonen (on the left) last November came at the final stretches of his long work career. The bonus was presented to him by Hannes Maasalo.

The bonus-winning tool on which the tower leg is suspended in the air temporarily while the foundation pillar under the leg is changed. The tower leg only needs to be lifted a few inches.

KNOW THE TERMS

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

Emissions trading

Emissions trading is about the buying and selling of rights to emit greenhouse gases, which accelerate climate change, into the atmosphere. The objective is that the emissions of these gases are reduced in a cost-effective manner.

As a means of control, emissions trading is not a tax payable on the emissions nor a standard which determines plant-specific emission limits, but a mix of these two. The biggest emissions trading market exists in the area of the European Union. The emissions trading scheme is being prepared or implemented in many other countries such as China, certain states in the United States, Canada, Australia and Japan.

Emissions trading concerns mainly carbon dioxide emissions. Carbon dioxide is released for instance when fossil fuels are fired. Greenhouse gases are also emitted into the air from natural sources, such as volcanic eruptions.

More than 40 per cent of the greenhouse gas emissions in the EU are covered by emissions trading. In Finland, emissions trading is used for reducing the emissions from electricity and heat production, the wood-processing, steel, construction and chemical industries, and air traffic. Other sectors of industry, agriculture and most of transport and housing are excluded from emissions trading. Bringing their emissions to the level of the EU targets is in the hands of each member state.

In practice, emissions trading is conducted by enterprises. They buy and sell allowances to emit greenhouse gases into the atmosphere. One carbon dioxide tonne is equivalent to one emission allowance. The European Union's emissions trading scheme is referred to as a cap and trade system, where the permitted emissions have a total volume or cap, and the price of the emission allowances is based on supply and demand in the market (trade).

Each enterprise covered by emissions trading first acquires an emission permit, which in Finland is issued by the Energy Market Authority. The enterprise must annually notify the Energy Market Authority how much emissions its plants have actually caused. The enterprise must also disburse an amount of emission allowances obtained and/or acquired by the enterprise, corresponding to its verified emissions. If it transpires that the actual emissions have exceeded the quantity of the allowances, the enterprise has to pay a penalty which is considerably more expensive than the emission allowances.

If the enterprise does not need all the emission allowances it has received, it can sell them. On the other hand, if the enterprise needs more allowances, it must buy them. However, the price of emission allowances can go so high in the market that it is more profitable for the enterprise to reduce its emissions, for example by intensifying its production processes, by using a fuel with smaller emissions, or by cutting back its production.

Emissions trading only involves a certain number of emission allowances, and their quantity is decreasing year by year. This is why simply buying emission allowances cannot be a long-term solution. The goal is to reduce the emissions included in the EU's emissions trading scheme by 20 per cent from the 2005 level by 2020. The objective in Finland is to reduce the emissions excluded from emissions trading by 16 per cent and in the entire EU by 10 per cent.

From the beginning of 2013, emissions trading will shift over to centralised monitoring by the Commission of the EU, which means that the rules of the trading will be the same in all EU countries. Emission allowances will no longer be distributed on the basis of national allocation plans, but applying harmonised allocation methods for the various sectors.

Another change from the past practice is that some of the emission allowances will be allocated free of charge and some will be sold at auctions arranged by authorities. Electricity producing companies will be left completely without free emission allowances. They must acquire their allowances either from the auctions or from the market.

The total amount of emissions from plants covered by emissions trading should decrease year by year. This objective will be attained as the plants renew their production processes and shift over to use renewable and other non-emission energy sources. In this way, emissions trading influences the mutual competitiveness of different forms of electricity production, for example.

Since emission allowances are one factor of production just like raw materials or fuels, their cost is also included in the price of the product. For example, in power generation zero-emission or low-emission forms of electricity production gain a competitive edge, which is one of the goals of the emissions trading scheme.

However, the costs of emission allowances can be circumvented by moving production outside the EU, to an area where emissions are not restricted. This is called carbon leakage, and as a result of it the volume of emissions contributing to climate change does not actually decrease in the atmosphere.

Text by Maarit Kauniskangas **Photograph by** futureimagebank

Fingrid's annual review and financial statements 2011

Capital investments at a record-high level, profit decreased

The financial statements of the Fingrid Group for 2011 were published in February. A decrease in electricity consumption in Finland together with a rise in market-based costs undermined Fingrid's financial performance. The capital investments in 2011 were at a record-high level. Net borrowing is rising due to the company's sizeable capital expenditure programme.

"The extraordinarily high level of capital investments in euros is explained by the fact that several large-scale construction projects were in progress concurrently. It appears that the capital expenditure level in 2011 is the highest within the company's ten-year capital investment programme, in accordance with which Fingrid is going to spend 1,700 million euros in the transmission system and reserve power in the next 10 years. The capital investments will require additional borrowing and increases to the transmission tariffs in the coming years," says Fingrid's President **Jukka Ruusunen**. At the beginning of 2012, Fingrid raised the transmission tariffs by an average of 30 per cent. Despite this, Fingrid's transmission tariffs are among the most inexpensive in Europe.

Among the costs, especially the costs of reserves which safeguard the system security of the transmission system and the financial costs due to an elevated interest rate level were on the increase as compared to 2010. During 2011, Fingrid issued a bond valued at 1 billion Swedish krona under the company's international Medium Term Note Programme and signed a long-term loan of 20 million euros with the Nordic Investment Bank, NIB.

According to Jukka Ruusunen, the system security of the Finnish transmission system continued to stay at a good level in 2011. However, the disturbance duration per a grid customer's connection point was above the average. The disturbance duration was increased especially by faults in some customers' branch lines connected to the grid.

Congestions in the transmission grid restricted electricity trade between Finland and the other Nordic countries. The available transmission capacity was about normal, but the scant rainfall in the early part of the year increased the demand for electricity exports from Finland, and abundant hydropower capacity in the autumn boosted the demand for imports into Finland. In many cases, the area prices between Finland and Sweden differed from each other by dozens of euros per megawatt hour. The situation levelled off towards the late autumn, which was partly due to the fact that the Fenno-Skan 2 transmission connection was made available to the electricity market a month ahead of schedule. The connection increased the transmission capacity between Finland and Sweden by 40 per cent.

Grid revenue remained at the same level as in 2010 despite the tariff increase of 4.5 per cent. This was due to a decrease of 3.8 per cent in electricity consumption in Finland from 2010. The sales of imbalance power decreased to 146 million euros (160 million euros in 2010) mainly as a result of a lower market price. Cross-border transmission income on the connection between Finland and Russia decreased by 2 million euros from the previous year. Fingrid's congestion income on the Nordic interconnectors was 16 million euros (9 million euros).

The loss energy costs decreased by 2 million euros from the previous year due to the significantly lower average area price for Finland. The costs of reserves, which safeguard the system security of the power system, increased by 7 million euros and the depreciation costs rose by 1 million euros. The maintenance management costs and personnel costs remained at the same level as in 2010.

Fingrid's annual review and financial statements are available on the Internet at www.fingrid.fi (under Investors). Printed publications can be requested from Fingrid's communications.

Key figures:

- operating profit of the Group 57 million euros (74 million euros in 2010)
- operating profit of the Group in the last quarter 17 (23) million euros
- revenue 438 (456) million euros
- capital expenditure 244 (144) million euros
- equity ratio 25.7 (28.6) %
- interest-bearing net borrowings 1,020 (855) million euros
- the Board of Directors proposes that a dividend of 2,018.26 euros per share be paid

Fingrid's subsidiary Finextra to administer the peak load capacity arrangement

Fingrid's wholly-owned subsidiary Finextra Oy administers those statutory duties imposed on the transmission system operator that are not directly covered by system operation or system responsibility. At present, Finextra administers the peak load capacity arrangement.

Finextra is used for segregating the costs of the public service from the costs of the duties related to the actual transmission system to ensure the transparency of the various functions. Finextra's goal is to manage the tasks assigned to it in a cost-effective manner by utilising the shared resources.

The company's Board of Directors is chaired by Fingrid's President **Jukka Ruusunen**, and its President is **Pertti Kuronen**. In addition to the President, the practical issues are taken care of by **Kaija Niskala**.

Finextra buys most of its services from Fingrid and pays for them in accordance with the matching principle. If necessary, service providers are used. If the operations so require and whenever necessary, Finextra will have personnel of its own.

The Energy Market Authority supervises Finextra's operations and the reasonableness of its proceeds.

In the early days of Keijo Tujunen's career, there were no machines or helmets at the transmission line sites. The photograph shows the transfer of an erected wooden pole to its foundation.

Transmission line construction sites were the **Main scene in the career of the grid veteran**

The high-voltage electricity transmission grid in Finland was expanded by some 10,000 line kilometres after World War II until the 1980s. Keijo Tujunen, who recently reached the age of 95, served most of his work career as a site manager. He saw thousands of towers being erected in different parts of Finland.

Text by Maria Hallila **Photographs by** Juhani Eskelinen and Fingrid's archive

"The linesmen were a good crowd, and I liked my job. Much of the work was about being away from home. Not all liked it, but I always enjoyed the work," **Keijo Tujunen** says in reminiscing his active years as a site manager.

The first construction sites were put under his supervision right after the war in 1946, when he was employed by Imatran Voima. Two 110 kilovolt lines were being built in Eastern Finland: Varkaus–Kuopio and Juva–Mikkeli.

Most of the work was carried out by men and horses. "The tower pits were dug with shovels and the concrete was mixed in a manual mixer. Gravel was brought to the roadside by lorries, and from there onwards the loads were drawn by horses."

Excavators and bulldozers appeared at the construction sites in the next decade. Finland craved for electricity, and rapids in Northern Finland were harnessed for power generation. Keijo Tujunen assumed responsibility for the construction work of two transmission lines starting from Petäjäskoski on the river Kemijoki: one of the 220 kilovolt lines ran to Pirttikoski and the other to Kukkolankoski.

A lot of men were needed for the work. As an example, 300 men were hired in a single summer to paint the towers. "Many lost their courage as early as at the foot of the tower – or at the latest when they had to grab a paint brush up on the tower. Anyone who was able to work high up on a tower was hired," says Keijo Tujunen.

The steel towers and the crossarms of wooden poles were given three coats of paint: primer, intermediate layer, and a top coat of aluminium colour.

Petäjäskoski was Keijo Tujunen's base for 8 years, until 1964. The magnificent cross-country skiing and fishing opportunities were among the natural fringe benefits of the worksites up in the north. Being interested in sports, Keijo Tujunen could accumulate up to 60 kilometres on skis in a single day.

One of the highlights during the heyday of transmission line construction in Northern Finland was the completion of the transmission link between Finland and Sweden at the turn of the 1950s and 1960s.

"In order to connect the electricity networks between the neighbouring countries, ropes were propelled across the river Tornionjoki from the Kukkolankoski worksite by means of rockets to the Swedish side so that the 220 kilovolt conductors could be drawn across the river. A former artillery officer who belonged to my crew took care of the shooting. There were media representatives and other people to witness this significant and unique event," Keijo Tujunen reminisces the history of the creation of the Nordic electricity market.

The knowhow of Finnish grid builders has also enjoyed demand elsewhere in the world. Keijo Tujunen worked as an expert in electrification projects in Iraq and Egypt in the 1960s.

In Finland, his experience and expertise were utilised in a number of line projects in the 1960s and 1970s, too. He managed these from the head office. He also served as the construction manager in the electrification of Finnish railways, which commenced in 1964, on the first section Helsinki–Kirkkonummi.

Keijo Tujunen retired in 1980 from the position of the head of the Imatra operation district, a position he took care of for the last 4 years.

What is the secret of his long life and good health? The active and vivacious 95-year-old man is often asked this question. Keijo Tujunen admits that he wonders at his high age himself.

Even amidst the irregular factors of his work, there has been one constant thing: sports in its various forms. He believes firmly in the role of physical exercise as the foundation of well-being.

"I also eat a lot of fish," says Keijo Tujunen and reveals that he is a "reasonably good cook". Self-made burbot soup is an absolute winter favourite. ■

Keijo Tujunen has been playing tennis on a regular basis for almost 50 years. The regular Wednesday game with former colleagues is still one of the highlights of the week for the 95-year-old veteran.

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 25 May 2012. Address: Fingrid Oyj, PL 530, 00101 HELSINKI, FINLAND. Mark the envelope with "Verkkovisa". **You can also send your reply to Grid Quiz online. The link can be found on the home page of our website www.fingrid.fi.** Among all those who have given right answers, we will give 5 indoor thermometers made of curly birch as prizes by drawing lots.

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

1. The early stages of Nordic electricity co-operation date back to the
- early 1950s
- turn of the 1950s and 1960s
- 1970s

2. According to Eurelectric, how many per cent of new electricity generation capacity in Europe receives some kind of support?
- 20–30 per cent
- 50 per cent
- 70–90 per cent

3. Fingrid's ongoing OVI project is related to
- the company's new head office which is under construction
- ethically innovative organisations
- contingency plans for a major disturbance

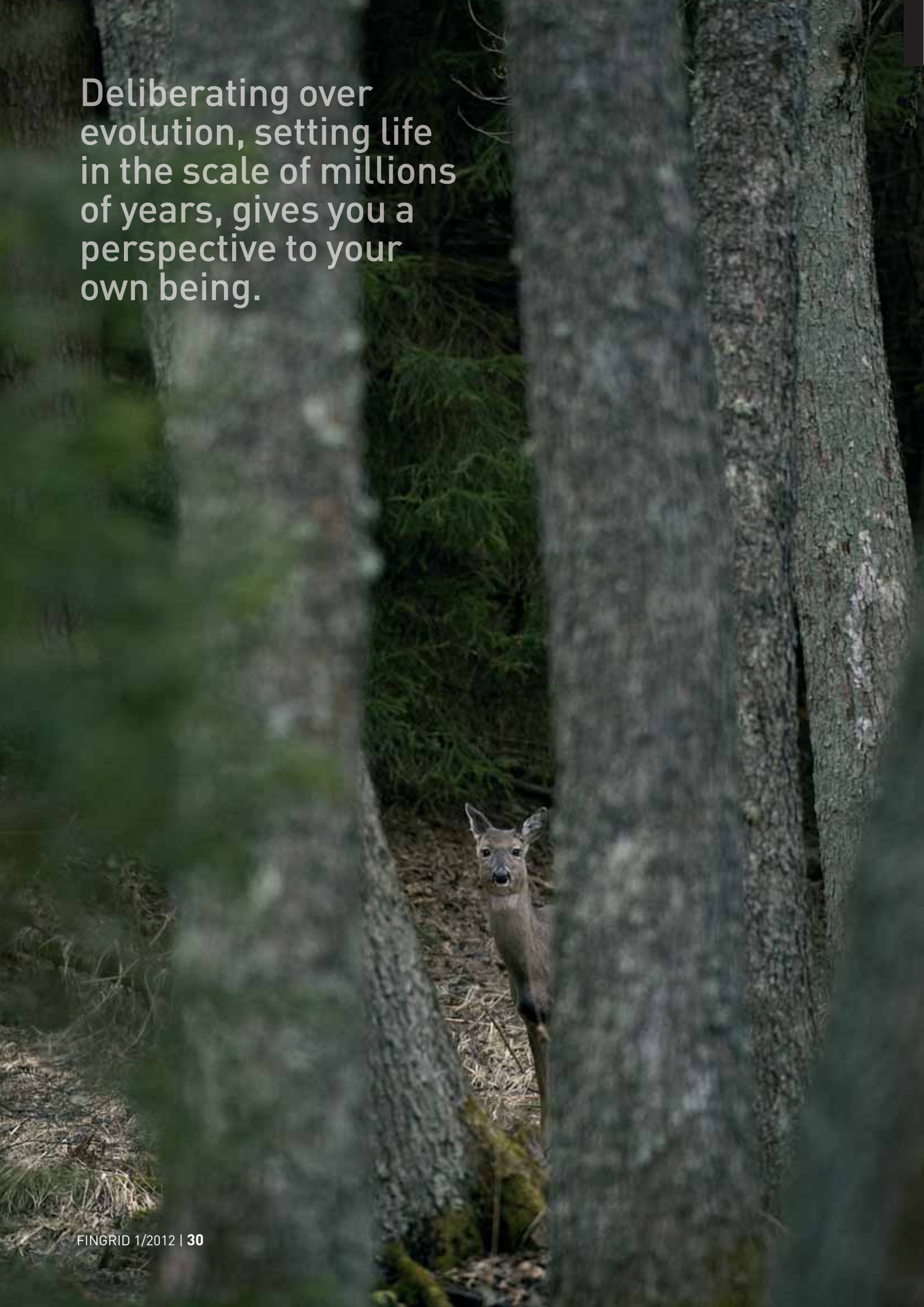
4. A system known as cap and trade is related to
- emissions trading
- cross-border transmission fees
- work of electricity exchanges

5. Kukkolankoski, which is related to the history of electricity transmission between Finland and Sweden, is located on the river
- Kemijoki
- Tornionjoki
- Oulujoki

6. SO-UPS operating in Russia is
- the Russian system operator
- an electricity selling company
- a network company

7. In the Nordic spot market of electricity, there has recently been a uniform price in
- 15–20 per cent of the time
- 20–30 per cent of the time
- 30–40 per cent of the time

Winners of prizes of the Grid Quiz in the previous Fingrid magazine (3/2011): Liisa Ahola, Oulu; Mikko Koskimaa, Sodankylä; Kyllikki Käck, Lahnalahti; Martti Uppala, Rovaniemi; Marketta Valli, Ilmajoki.



Deliberating over evolution, setting life in the scale of millions of years, gives you a perspective to your own being.

The charm of animals

The lakeside forest in April is clad in the colours of early spring: needle and moss green, warm brown and alder grey. In its winter fur, the white-tailed deer gazing at me behind the alders is a perfect match in this palette. It is standing still, and I stand equally as still watching the beautiful animal. Its eyes are large and dark, its ears are turned towards me; the deer is graceful and harmonious in its proportions. It looks calm, but I know that it is alert and ready to run away in an instant.

However, it does not run away. After looking at me for a while, it grabs some grass in its mouth, takes a few steps and disappears for a moment behind the trees. Once in plain sight again, it concentrates exclusively on eating. It walks with its muzzle against the ground, seeking the first green shoots of the spring. Every now and then it raises its head, turning its ears towards me and spreading its nostrils to inhale the scent.

I think I will never get tired of watching animals; their beauty is mesmerizing. Each species is an unparalleled master of its own life, adapted exactly to the way in which it lives and feeds. It is this purposefulness that renders each species beautiful, but there is something special in mammals. They are the closest thing to us humans, and we can interpret their body language to some degree. They let us in on some of their secrets.

Our Northern animal species do not have bright colours or special patterns to show off with. The austere conditions have shaped them to have a "serious" appearance, just like us Northern people. But they have abilities which help them to cope here. That female deer has lived through a particularly snowy winter, but it seems to be in good condition and health. How has it spent its winter? It cannot be easy to move in deep snow with those small hooves.

Deer gather into herds for the winter. They find their way to feeding sites or disappear into sheltered spruce forests with plenty of bilberry stems to eat. Together, they trample a network of paths, which can also be used when fleeing the lynx. But the white-tailed deer has yet another survival method for the hardest times: it settles down, lies in a sheltered place and adjusts its vital functions to a minimum. In this way, it saves energy by consuming as little as possible of the subcutaneous fat accumulated during the summer.

Knowing facts like that makes me even more interested in animals and grows my respect for them. Deliberating over evolution, setting life in the scale of millions of years, gives you a perspective to your own being and makes every encounter unique and valuable. The white-tailed deer, a newcomer from America, resting among the alders is the result of a long process. The climate in which it has lived, the predators that have hunted it, diseases, parasites and many other things have moulded it to become just like that, and finally people have moved it here across the ocean. Only four individuals grew into a strong population, with one of their heirs standing there and looking at me.

In its native America, the white-tailed deer has spread from the Peruvian rain forests all the way to the coniferous forests of Canada. The individuals brought to Finland came from Minnesota, where the natural conditions correspond to those in Finland, so the deer became a success story. Some luck was also needed – none of the deer brought here carried diseases or parasites that would have been a danger to our indigenous species.

The deer suddenly freezes in place, and its ears turn towards the dark wall of the spruce forest. It listens for a moment, then starts off with determination, disappearing among the tree trunks. Its ears received some message, even though mine did not hear a thing. Maybe its herd was resting in the woods and started off, calling it along.

The brief encounter is over. As always, it leaves behind small questions that do not need to get a response. It also leaves me with a clear feeling that I am privileged – I have the opportunity to marvel at the beauty of animals for a living.

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), "Huuhkajavuorella" (together with Leo Vuorinen, Maahenki 2008) and "Viimeiset vieraat – elämää autiotaloissa" (together with Kai Fagerström and Risto Rasa, Maahenki 2010). Heikki Willamo's special objects of interest include forest nature in Southern Finland, Northern rock art, and myths related to animals.

FINGRID OYJ

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