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FINGRID

EVOLVING GRID

4 Fenno-Skan 2 subsea link nearing completion

8 New tower for fields to facilitate farming

12 Upgrading of grid on the west coast

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Cover: Fingrid's President Jukka Ruusunen (on the right) and Executive Vice President Kari Kuusela together with Nexans Norway's CEO Anne Liese Aukner following the loading of the submarine cable for the Fenno-Skan 2 link at Nexans's factory in Halden, Norway, at the end of May.
Photograph: Nexans/Henrik Iversen

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Editorial

EVOLVING GRID – MANPOWER AT A PREMIUM

Fingrid will spend approx. 1,700 million euros in the next 10 years to build and upgrade the Finnish electricity transmission grid. In practice, this means almost 3,000 kilometres of new transmission lines and about 30 new substations. The main reasons for the capital investment projects are the connection of new wind and nuclear power generating capacity to the grid, ageing of the grid, and promotion of electricity market mechanisms. We will increase the transmission opportunities to both Sweden and Estonia.

Within Finland, the most significant capital investment projects comprise the replacing of the outdated and insufficient 220 kilovolt network in Western Finland with a 400 kilovolt network. A new reserve power plant is also being built in Forssa to secure grid operation in possible disturbance situations. Fingrid is not the only company upgrading the electricity transmission system; this is a pan-European phenomenon. The same needs and goals also exist in other European countries.

One of the biggest challenges in our capital investment programme is the availability of skilled labour. The number of person-work-years at our work sites is currently about 500. This figure is almost twice as high as the number of Fingrid's own employees. The reason for this is that we order the projects from the contractors on a turnkey basis.

There is much work to do, and foreign personnel are already working at our sites. The use of foreign labour has been criticised at times, and it has been claimed that Finnish fitters no longer have enough work. In fact, we certainly have work for all Finnish installation professionals, but also foreign fitters, because of the great number of construction projects. There is demand for the same labour force also in Finland's neighbouring countries in corresponding grid work and also in the erection of wind turbines. This is why there is a threat of labour shortage rather than unemployment.

The labour shortage will not relieve in the future, because the large postwar generations are reaching retirement age in Finland. Will young people be interested in long-term assignments in conditions where their families and friends are far away and the Internet may not necessarily work at all times? There will definitely always be Finns who like to live and work in the outback, but will there be enough such people when the majority of the young live another life in facebooks and twitters?

The use of foreign labour involves accuracy with the terms of employment. Fingrid works in a socially responsible manner and makes sure, within the authority granted by law, that salaries conforming to Finnish collective labour agreements are paid and relevant labour laws and regulations are followed at our sites. We have also conducted related reviews in cooperation with the authorities of the Regional State Administrative Agencies. We aim to ensure that all employees are treated fairly. It is also our goal that Finnish and foreign labour have as equal competitive conditions as possible.

The use of foreign labour has also been criticised with respect to occupational safety. In the occupational safety reviews that I have conducted, I have discovered, however, that we Finns have much to learn from foreign contractors – and not just the other way around. It is a well-known fact that Finland lags behind in occupational safety almost regardless of the industrial sector. In this field, we need national efforts to root out recklessness and disregard of the safety requirements from our work practices. And it is not enough that we just present requirements; we need to embed safety in the attitudes and behaviour of Finns, as part of our culture.

No matter what the country of origin of the workers is, Fingrid must pay more and more attention to the clarity and unambiguous language of the guidelines and plans, because many of the employees are new, without decades of experience of our special circumstances and requirements. The significance of the experienced professionals becomes more important for the same reason.

It is also essential to develop good and safe working practices on a continuous basis. We have added safety ladders on new transmission line towers, work platforms have been installed on transformer decks, and there are additional minimum requirements concerning personal safety equipment at our sites. Still, there is much work left in the field of occupational safety. It is our distinct goal that everyone can leave Fingrid's site in good health.

Fingrid's Executive Vice President Kari Kuusela is responsible for asset management.

FINISH LINE IN SIGHT

in the Fenno-Skan 2 submarine cable project

Cable projects in electricity transmission always take years to complete. The Fenno-Skan 2 project, which reinforces the electricity transmission capacity between Sweden and Finland, was launched 7 years ago. The project has now reached the final stages: the subsea cable is being laid on the seabed, and the transmission connection will be taken into commercial use at the end of the year.

Text by Timo Kiiveri ■ **Photographs by** Kari Kuusela, Ulf Martinsson

There is already one high-voltage direct current (HVDC) submarine cable between Finland and Sweden. This 500 megawatt HVDC link, Fenno-Skan 1, was brought into commercially operation in December 1989. The full capacity of the link has been in use as a result of the liberalisation of the electricity market and increased electricity use.

Added system security

The need for additional electricity transmission capacity became evident when the Nordic transmission system operators listed five foremost congestions in Nordic electricity transmission in 2004. These were to be removed so as to promote the electricity market and transmission system security. Fenno-Skan 2 was one of the most important new transmission links. Additional transmission capacity is also needed between the Danish isles (Storebælt HVDC cable), between Sweden and Norway (Nea–Järpströmmen 400 kilovolt overhead line), between Norway and Denmark (Skagerrak 4 HVDC link), and the SouthLink HVDC link to reduce congestions in Southern Sweden.

When the need for the construction project was identified, the potential locations, and technical and economic boundary conditions of the Fenno-Skan 2 connection were weighed. Fingrid and Svenska Kraftnät signed an agreement on Fenno-Skan 2 in February 2005.

The criteria for the capital investment were straightforward. The purpose was to remove congestions in the market area, increase the electricity transmission capacity between Finland and Sweden by 40 per cent and join the market more closely together, offset the formation of price area differences between the countries, reduce the losses in the 400 kilovolt transmission grid in the Nordel area, and improve the transmission reliability of the power system.

The project organisation was established in the spring of 2005. Almost 20 years had elapsed from Fingrid's previous HVDC cable project, and there were challenges in many sectors. Svenska Kraftnät had more experience of the construction of links of this type, so the specifications did not have to be started from scratch.

The project was broken down into subprojects, with the foremost subprojects being the permitting processes in the two countries, submarine cable, converter substations, Dannebo–Finnböle DC overhead line, elevation of the voltage level of the Rihtniemi–Rauma DC overhead line, renewal of the electrode, and enlargements and feeder bays for the AC network in both grids.

Shortage of submarine cables

The permitting process was initially estimated to constitute a schedule risk. There was most concern about the environmental impact assessment procedure required by the overhead line in Sweden. These concerns were not misplaced; lively exchange of opinions took place in Sweden, extending to the ministerial level. The long-awaited network license was finally obtained on 17 April 2008.

Meanwhile, another major risk had materialised: the submarine cable business was booming, there being more buyers than sellers. So, when the cable contract was signed, it was known that the completion of the project would extend to late 2011.

The project utilised the slack in the schedule, and the other subprojects, with the exception of the converters, submarine cable and overhead line in Sweden, were completed in accordance with the original plan. Moreover, the outages in the nationwide grid during the construction work were arranged in reasonably favourable circumstances, without causing too much interference to the electricity market.

Still, there have been quite a few technical challenges along the way. Issues such as the link transformers and the dimensioning of the thyristor valves kept the designers occupied in the converter procurement. The negotiations with the supplier on the specification and dimensioning of the transformers lasted for several weeks.

In the implementation stage, differences emerged in the dimensioning and performance between the old and new Fenno-Skan link. The solution was found, and the old and new links will work well together in bipolar operation by changing a few components. The future parallel operation will be improved by the renewal of the control and protection system of Fenno-Skan 1 in 2012. After this, both links will have similar pole-specific control systems and shared bipolar control.

Unconventional design and implementation practices required special attention during the design and construction of the Rauma converter substation. Fingrid's and Svenska Kraftnät's experts have commented on nearly 4,000 technical implementation documents and analyses. Some of the challenges have been solved directly through assistance from knowledgeable on-site supervisors and contractors.

Test operation phase in August

The main components of the HVDC system were installed in Rauma and Finnböle in the spring of 2011. The

The cable was loaded onto the ship at Nexans' factory in Halden, Norway, in May. The loading took 10 days.

thyristor valves were tested as early as in the summer of 2010, and they have mostly been installed in Rauma. The installation of equipment for the converter transformers has progressed quite far, and the installation team moved from Rauma to Finnböle in May. The installation work for the AC and DC filters in the outdoor bays is advancing according to schedule at both ends of the link.

The control and protection system was tested in ABB's factory in Ludvika in Sweden for several months. The factory acceptance testing culminated in a test carried out with the customer. The permission to transfer the control system to Rauma, Dannebo and Finnböle was given on the basis of this test. The installation of the cooling system for the valves is almost complete both in Rauma and Finnböle.

ABB has recently begun subsystem tests at both ends of the link to ensure that each individual system, such as the HVDC converters, valve cooling, and DC and AC filters work as planned. High-voltage testing and electricity transmission tests will begin in August by the connection of the filters to the grid. The work will progress one subsystem at a time until power will be transmitted on the Fenno-Skan 2 link for the first time in September.

There have been many incidents along the way, from ill-heated saunas and flying squirrels to passionate negotiations.

During one month of power transmission testing, power will be transmitted across the scale and in both directions. Moreover, all the essential protection and control functions related to the control of the link will be tested. The basic tests will be carried out using the control functions of the link, while some of the faults and operating situations of the grid are simulated by making program changes. The test period is followed by a trial operation period of about two months. Fenno-Skan 2 will be taken into com-

FENNO-SKAN 2

- Power 800 MW at the receiving end
- Voltage 500 kV DC
- Current 1663 A
- Link length 299 km, of which 103 km is overhead line and 196 km submarine cable
- Line commutated converter (LCC) HVDC link
- Converter substations in Rauma (Finland) and Finnböle (Sweden)
- Co-operation project between Fingrid and Svenska Kraftnät
- Converter supplier: ABB AB/Sweden
- Project budget 315 million euros
- Commissioning at the end of 2011

SUBMARINE CABLE

- Type NOVA-L 500 kV 1x2000 mm^2 Cu
- Conductor 2000 mm^2, copper
- Oil paper insulation (MIND) – no soluble materials
- Voltage 500 kV
- Diameter 132.2 mm
- Weight in air 58.1 kg/m
- Double armour
- Power 800 MW
- Manufacturer: Nexans AS/Norway

Vital strengthening of market functioning

"The Fenno-Skan 2 cable link is a good example of how transmission system operators can contribute to electricity market functioning," says **Juha Hiekkala**, who heads Fingrid's electricity market development unit. The new link will enable more efficient competition in the Nordic electricity market. Fenno-Skan 2 will also consolidate the system security of the grid.

Justifications for the necessity of the new cable are easy to come by.

"Recent figures show that in the first quarter of 2011, congestions in the transmission grid on the border between Finland and Sweden restricted electricity trade between these countries for approx. 20 per cent of the time. The transmission capacity limited by maintenance work has not been sufficient to meet the high demand for exports from Finland to the other Nordic countries, resulting from the scarce water reservoirs. This is why the prices of electricity in Finland and Sweden in the first quarter were different from each other on considerably more occasions than in the previous years. Typically, there is less than 5 per cent of capacity shortage annually," says Juha Hiekkala.

If Fenno-Skan 2 had been in use from early 2011, the area price differences would have been very small, he adds.

"While the goal is to minimise the duration of transmission outages and schedule them rationally in terms of the market, their impacts cannot be completely eliminated," says Fingrid's Advisor **Petri Vihavainen**.

"The management of internal transmission congestions in Sweden has at times led to transmission restrictions which are disadvantageous to the functioning of the electricity market. When the Swedish electricity market is divided into four bidding areas from early November, the full capacity of Fenno-Skan 2 will become available to the market, and its transmission capacity will not be restricted on account of the electricity transmission constraint between Northern and Southern Sweden," says Juha Hiekkala.

The new cable link also represents an important contribution to transmission system security. Juha Hiekkala says that the increasing imports and exports of electricity will make it easier to balance the power system as the portion of renewable energy production capacity will increase in the coming years.

Petri Vihavainen also raises the sig-

mercial operation at the latest at the end of the trial operation period.

Demanding laying operation

The submarine cable will be laid on the seabed in two campaigns of approximately 100 kilometres each. Each lot weighs about 5,800 tonnes, which is equivalent to more than 200 trams used in Helsinki. The carrying capacity of the cable ship is 7,000 tonnes.

The loading of the cable onto the ship at Nexans' factory in Halden, Norway, took about 10 days, after which the c/s Skagerrak sailed to the coast of Sweden outside Dannebo, and the cable-laying operation began in mid-June. The laying of the cable at the Swedish end was very demanding, because approx. 5 kilometres of the cable was released from the cable ship and floated on air bags. The cable released from the ship was pulled to the inland substation of Dannebo, housing the 500 kilovolt cable terminal. The cable had to be taken under a road and through the biotesting area of the Forsmark nuclear power plant. From Dannebo, Fenno-Skan 2 continues as an overhead line to the Finnböle converter substation located some 70 kilometres away.

The cable-laying work will begin in Finland outside Rihtniemi in mid-July. The installation work in Finland is a little easier, since the land portion is only about 300 metres. Once the second cable lot has been laid and installed successfully, the cables will be connected together using a hair pin sea joint.

Finally, the entire submarine cable will be tested at a direct current voltage of 800 kilovolts to make sure that the cable has not been damaged during installation. On the Finnish side, the cable will be submerged on the seabed in a ditch about one metre deep. This protects the cable from mechanical damage and minimises disadvantage inflicted on commercial fishing.

Together in the same direction

It has been a long project which is not yet at the finish line, even though the end is already in sight. There have been many incidents along the way, from ill-heated saunas and flying squirrels to passionate negotiations. The initial situation which resembled a sports match between Finland and Sweden has turned into a very closely-knit project team where everyone has found their place and is now aiming at the same direction. ■

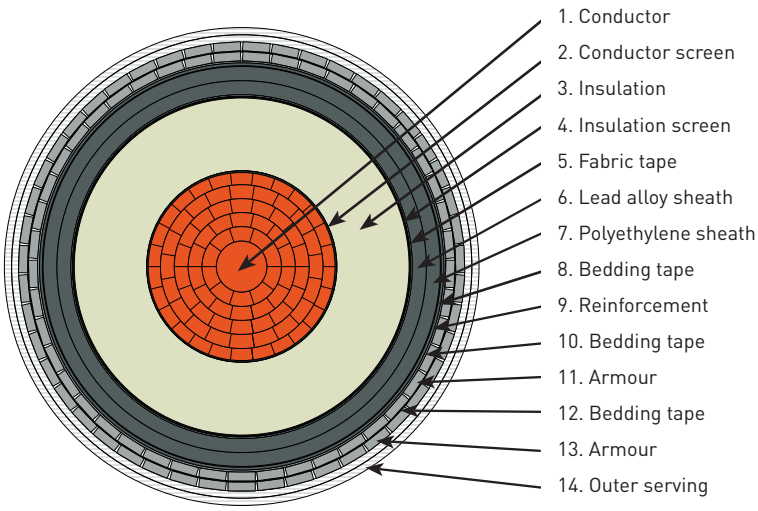
The kick-off meeting of the Fenno-Skan 2 project was held in Sweden in early June 2009. The photograph shows the project team consisting of Fingrid's, Svenska Kraftnät's and ABB's experts.

nificance of reduced transmission losses in export situations. The losses are reduced when the new link enables that electricity can flow to the main consumption area in Central Sweden through the shortest route. To date, it has often been necessary to route the transmissions via the northern cross-border connections.

Fenno-Skan 2 is a welcome link, which will benefit the entire Nordic transmission system and market area, Juha Hiekkala and Petri Vihavainen point out. ■

The Fenno-Skan 2 link will benefit the entire Nordic electricity market area, Juha Hiekkala and Petri Vihavainen say.

Structure of the subsea cable layer by layer



The new tower used on arable land stands firmly on four legs, without guy wires which impede farming work. The tower was test-assembled in May. This verified that the details fell into place.

New tower for fields to facilitate farming

In the future, transmission lines traversing the arable landscape in Finland will be built with more streamlined towers. The new tower type used on fields saves farmland and facilitates soil cultivation.

Text by Antti J. Lagus ■ **Photographs by** Muotohiomo archives

You can operate agricultural machinery more freely near the new tower than in the vicinity of conventional guyed towers.

"The idea of a tower which only takes up a small land area has existed for a long time, but it has not really been studied until a couple of years ago. The final impulse was obtained as direct feedback at an agricultural fair where Fingrid was represented," says Fingrid's Project Manager **Kari Lindholm**.

In the research and development project launched a couple of years ago, Fingrid together with design agency Muotohiomo Oy has developed a new type of a double-circuit tower for 400 kilovolt and 110 kilovolt transmission lines. Based on the experiences gained from the project, the tower type for 400 kilovolt lines will also be renewed.

Project of many challenges

The initial situation in design was challenging: The tower was supposed to be as unobtrusive as possible and, on the other hand, as inexpensive as possible.

Pekka Toivanen, Managing Director of Muotohiomo, says that towers are conventionally designed by means of CAD software, into which the parameters are entered. The software then calculates the lattice structure.

"Our way of working is to bring the issues into a new context. This gradually gives the result in the jigsaw puzzle."

Muotohiomo has designed a variety of industrial products ranging from Iittala's drinking glasses to a transmission line tower of tens of tonnes.

"Muotohiomo has produced some good ideas to serve as the basis of technical planning. We started from the basics, and then Empower Oy became involved in the technical design. We progressed step by step and did not attempt to restrict the assignment initially," Kari Lindholm says in describing the planning process.

The design of the new tower started from the foundations. This ensured that the tower will certainly stand firmly. The foundation type selected in co-operation with Empower and concrete manufacturer Betroc was a concrete element assembled of parts.

"In this way, the size of the foundations is minimised, and they can be transported easily. The foundations are made from two parts joined together. Each part weighs 3 tonnes. The four-legged tower is hence anchored to the ground using concrete foundations of 24 tonnes," Kari Lindholm says.

Room for turning under the tower

The first new towers will probably be installed on fields next winter. Kari Lindholm says that winter is a good period for transmission line construction, because frozen ground bears the work machinery well. Furthermore, cultivated land is not disturbed in the winter. Unfortunately, there is not always enough time to do all the installations in the winter.

"The new tower is transparent and airy. It has a lesser impact on the landscape than the traditional lattice design. This is of importance when there are many towers in an arable landscape. On the other hand, the idiom of the tower reflects Fingrid's brand," Pekka Toivonen explains.

"You can operate agricultural machinery in a different way near the new tower than in the vicinity of conventional guyed towers. We intend to tell about the characteristics of the new towers in person to those landowners on whose land these towers will be erected," Kari Lindholm says.

"The widest harrows and sprayers do not fit through the opening of the tower, which is 7 metres in the longitudinal direction and 14 metres in the cross direction, but we ascertained that the combine harvesters used in Finland can get under the tower."

The legs of the tower are surrounded by guards, allowing the soil to be worked quite near the towers.

Pekka Toivanen adds that since the new towers have no guys, weeding problems in the surroundings are also significantly reduced.

Good visibility increases safety

The lower structures of the new field tower are much more visible than the guys in the conventional towers.

"Agricultural machines occasionally hit the guys, and some have also snapped. The guy anchor rods made of round steel one inch thick, embedded in the ground, also tend to bend quite often," Kari Lindholm says.

The first field tower will be erected and test-loaded in July. Based on previous testing, Kari Lindholm expects that the new tower can be brought to actual production after potential fine-tuning.

Fingrid has individually designed and constructed free-standing landscape towers in some visible traffic intersections in different parts of Finnish. However, they are always tailor-made for the particular location.

Primarily for new transmission lines

The field towers will primarily be used in the construction of new transmission lines. They can be erected on existing lines if the line or one of its towers is renewed.

"The goal in the design of the field tower is reproducibility and thus lower costs. The new tower functions technically well and is visually appealing. Even though the tower brings some additional costs, I think that some savings can be achieved in maintenance," Kari Lindholm states.

The upper crossarm of the field tower rises to 31, 33 or 35 metres. The height of the tower is thus in the same range as that of a conventional 400 kilovolt tower. The 400 kilovolt line runs at the top and the 110 kilovolt line 11 metres below it. The required safety distance between the two is therefore attained. The spacing between two towers remains largely unchanged, i.e. at up to 400 metres.

The towers will be primarily made of galvanized steel, but they can also be painted in a desired colour. The service life of the towers is 80–100 years.

Steel bars are left in the foundation of a field tower during concreting, and the upper pillar element is fastened to these bars with bolts. The mounting and loading have been tested by the Tampere University of Technology. The tower is screwed to the four pillar elements with anchor bolts. The components are designed to be easily transported by truck.

The tower with the base weighs almost 40 tonnes, and Kari Lindholm points out that it is subject to high forces. A total of 17 conductors are suspended from a tower. Nine of these are in the 400 kilovolt line, six in the 110 kilovolt line, and there are also two overhead ground wires. The heaviest of these is the 400 kilovolt conductor, which weighs 2 kilos per metre.

The towers must also be designed to accommodate the winds and other demanding weather conditions; in the winter a considerable ice load may accumulate on the lines. ■

Designer Iikka Airas of Muotohiomo and Empower's Kosti Rintala studying the prototype and drawings.

Meeting beside the prototype of the field tower. Fingrid's project manager Kari Lindholm on the far left, and project manager Ritva Laine in the middle.

KNOW THE TERMS

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

A crossing statement is a letter of statement drawn up by the owner of a transmission line, containing instructions of the implementation of a crossing in the vicinity of the line. Crossing here means a project or activity in the transmission line area or in its vicinity – for example, it can be the construction of a ditch, road, water pipe or underground cable, or the arranging of a public event. The safety distances of buildings and various structures to a transmission line are also defined in a crossing statement.

As the owner of the transmission line, Fingrid has an obligation to provide projects with instructions on the safe use of the transmission line area and on operations in the vicinity of the line. This ensures safe working practices and that the project does not cause a risk to the transmission line or electricity transmission. Fingrid submits the crossing statement free of charge.

A crossing statement includes for example a map, information on the right of use of a land area expropriated for the line plus resulting limitations, information on the transmission line structures and underground earthing conductors, and working guidelines for the work in the transmission line area. The instructions and safety distances given in the statement are based on the expropriation decision and various safety guidelines and standards. As an example, the minimum distance between the road surface and the current conductors is specified in the guidelines of the Finnish Road Administration and in standards for overhead alternating current lines.

The crossing statement is typically requested by a landowner, construction project client, contractor, or authority.

How to request a crossing statement?

A crossing statement request must contain the following information:

- contact information on the party requesting the statement
- free-format description of the project or activity undertaken near the transmission line
- geographical information on the project, for example approach map and a map of the location of the project in relation to the line
- potential plans, layout drawings etc.

The request for a crossing statement can be sent to Fingrid by ordinary mail or e-mail. The request can also be made through the map feedback service on Fingrid's website, where you can pinpoint the project location on a map, fill in the statement request form and send the information as electronic feedback. ■

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Text by Max Isaksson

Photograph by Juhani Eskelinen

Fingrid examining the innovation capability of its organisation

Next autumn, Fingrid will participate in the OVI research project to be carried out in co-operation with the School of Business and Economics of the University of Jyväskylä. The project will investigate the responsible business culture of organisations and their innovation capability and leadership, especially the relationship between supervisors and employees.

According to Fingrid's Senior Vice President **Matti Tähtinen**, innovation is a particularly interesting aspect for Fingrid.

Material for the research study will be compiled through a questionnaire in the autumn of 2011. The preliminary results will be available at the end of 2011.

The study will provide information on the current state of Fingrid's responsible business culture and innovation capability, and the results can be utilised in development efforts. At the University of Jyväskylä, Lecturer **Elina Riivari** and Professor **Anna-Maija Lämsä** will be responsible for the compilation of the research material and reporting of the results. ■

UPGRADING OF GRID ON THE WEST COAST

Fingrid has launched a major project in Ostrobothnia on the west coast of Finland. The electricity transmission network from Pori to Oulu will be renewed during this decade, and the reinforcement of the grid will continue after Oulu up to Tornio.

Text by Maarit Kauniskangas ■ **Photographs by** Juhani Eskelinen

The project in Western Finland involves hundreds of kilometres of 400 kilovolt transmission lines and several substations. Fingrid is investing almost 300 million euros in the grid in Ostrobothnia. The transmission line and substation projects are part of the long-term development plan for the nation-wide transmission grid in Finland. But why in Ostrobothnia?

"The high-voltage transmission grid running along the west coast is mostly of aged 220 kilovolt network, which has now come to the end of its service life. Its capacity is no longer sufficient for the present electricity transmission needs," says **Pertti Kuronen**, Fingrid Oyj's Senior Vice President responsible for grid service.

There are many reasons for the additional capacity needed in Ostrobothnia: wind power, plans for new nuclear power plants, and increase in electricity consumption. Many wind turbines are planned in Ostrobothnia in particular.

In support of wind power

"A large portion of the wind power projects being planned in Finland are located in Ostrobothnia. Some 15,000 megawatts worth of projects are under examination, but it is likely that no more than 2,500 megawatts of these will become reality. This is so because the climate and energy policy applied by the Ministry of Employment and the Economy specifies that the feed-in tariff will be paid up to 2,500 megawatts. The production of electricity from wind power is subsidised by paying the producers a feed-in tariff on top of the price obtained from the market," Pertti Kuronen points out.

Wind power brings additional challenges to the transmission system. While wind power produces much momentary power at times, it does not produce energy in the same proportion. In other words, when it is windy, power is produced, but at other times supplementary types of electricity production are needed to meet the respective power demand. The alternative is that there is demand response in electricity consumption. A wind turbine must also be connected to the electricity network, a fact which has received less attention in some projects. The connection to the high-voltage grid or a distribution network and remaining connected to it cause costs to the operator of the wind turbine. When a power plant is connected to the transmission grid, it must also meet the specifications for the operational performance of power plants.

"New wind turbine projects have brought many new players to the energy business, and they are not always that familiar with the power system. This is why Fingrid has to be able to tell understandably about these grid issues, which is not necessarily an easy task," Pertti Kuronen says.

Project step by step

The first stage in the upgrading of the grid in Ostrobothnia will be completed this year. This is the Seinäjoki–Vaasa (Tuovila) connection, which will bring electricity to the existing 400 kilovolt transmission line Kristiinankaupunki–Vaasa–Kokkola.

"The Seinäjoki–Vaasa line will enable us to carry out the project in stages. This line allows a gradual strengthening of the grid while retaining high system security. Without the Seinäjoki–Vaasa line, the construction work would cause much higher system security risks," Pertti Kuronen says.

The next line in turn is the 400 kilovolt line from Ulvila to Kristiinankaupunki. The environmental impact assessment (EIA) of the project is complete, and the permitting process, expropriation of land, and general planning are now in progress. The transmission line is scheduled for completion in 2014. After that, the existing 400 kilovolt line from Kristiinankaupunki via Vaasa to Kokkola will also be commissioned. At present, it is operated as a 220 kilovolt line.

Good EIA award

The transmission line from Kokkola to Muhos near Oulu will be completed in 2016. The EIA for the project was completed towards the end of last year. Fingrid was awarded the "Good EIA" distinction of the Finnish Association for Impact Assessment (FAIA) for this EIA procedure. In the justifications of the distinction, the Association stated, among other things, that the suggestions of municipalities and local residents had been taken well into account in the EIA process, and

"The 220 kilovolt network running along the west coast of Finland has come to the end of its service life," says Pertti Kuronen. Its capacity is no longer sufficient for modern electricity transmission needs.

the feedback received had been taken seriously. In addition to the opinions of local residents and landowners, Fingrid had taken into account the nature assessments presented by the Centre for Economic Development, Transport and the Environment of Ostrobothnia when the company was finding options so that for example the Tyrnävä birdlife sanctuary would remain intact.

"The new transmission line will run mainly in the right-of-way of the existing 220 and 110 kilovolt lines and partly parallel with them. The same principle is also applied with the line built from Ulvila to Kristiinankaupunki. This means that the right-of-way does not need to be widened as much as if we were to build a new transmission line in a completely new location," Pertti Kuronen says.

The last stage of the project is the 400 kilovolt transmission line constructed from Muhos to Tornio. This line will run partly parallel with the existing lines and partly in a new right-of-way. The EIA of this part of the project has already been drawn up, but it will probably have to be updated. The transmission line is planned to be completed by 2020. The plans and schedules will become more accurate over time.

"Projects for the enhancement of the transmission system take a long time, usually over five years. In some European countries, the process may take up to 10 years or even more," Pertti Kuronen says. According to Fingrid's experience, the environmental impact assessment takes a year or two. About two years have to be reserved for the application of the permits, expropriation of land, and planning. The actual construction work takes a year or two. ■

The lines to be built and renewed in accordance with Fingrid's capital investment programme extending to 2020.

Pan-European grid planning

The Nordic transmission system operators have long traditions of co-operation. The voluntary co-operation has resulted in a well-functioning and reliable power system. Now the voluntary efforts are becoming official throughout Europe, and the jointly agreed principles are becoming part of legislation. This work is conducted within ENTSO-E, the European Network of Transmission System Operators for Electricity.

"The work carried out in Brussels has a direct impact on legislation, so it is important to be actively involved in it. As an example, we in Finland have good procedures concerning the connection of generating facilities to the grid, and it is important that the proven practices are retained," says **Pertti Kuronen**, Fingrid Oyj's Senior Vice President responsible for grid service.

Issues such as the new terms for the connection of wind turbines to the transmission system will be decided within the EU. It seems that they will come into force in early 2013. According to Pertti Kuronen, the goal in the negotiations within ENTSO-E is to accomplish connection terms that will work well in Finland, too. That which works in the highly meshed grid in Continental Europe does not necessarily apply to the Finnish grid, where the transmission distances are long.

"ENTSO-E draws up European ten-year network development plans, the first of which was published last year and the next one in 2012. All of the network projects with common benefits are covered by these plans, including the modernisation of the grid in Ostrobothnia in Finland," Pertti Kuronen says.

Co-operation is the key in grid planning. It is used for identifying the needs of electricity networks ranging from distribution networks and industrial networks all the way to European supergrids. Co-operation is also needed with the authorities and landowners. Moreover, grid planning is divided into regions, with Finland belonging to the region composed of the countries around the Baltic Sea.

"In the future, we are going to provide even more information of increasingly specific nature on the European ten-year network development plan and on Fingrid's own grid development plans. However, we promise to keep customer-specific projects confidential, because some of the projects involve customers' business secrets. But it would be important that Fingrid knew in good time also about these confidential projects so that the grid could be completed on time for them, too," Pertti Kuronen says. ■

Ulvila–Kristinestad-transmission line project reinforces the grid in Western Finland

Fingrid has launched the planning of a new 115-kilometre transmission line between Pori and Kristiinankaupunki on the west coast of Finland. The project aims to strengthen the power transmission network in the region and convert the aged 220 kilovolt network to 400 kilovolts. This is the first transmission line applying the new tower type for use on arable land.

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

The new 400 kilovolt transmission line between the Ulvila substation in Pori and the Kristinestad substation in Kristiinankaupunki will replace the technically outdated 220 kilovolt transmission network in the region. The project is part of the long-term development plan of the Finnish transmission grid, making preparations for integrating new generation capacity to the grid. In Western Finland, preparations must also be made for a significant increase in electricity transmission needs. Electricity consumption has grown particularly rapidly in the Vaasa, Kristiinankaupunki and Seinäjoki regions in recent years.

Fingrid has an extensive ongoing grid development programme, which covers the construction of about 3,000 kilometres of new transmission lines and some 30 new substations. Approximately 90 per cent of the new transmission lines will be built in existing rights-of-ways or parallel with them. This principle aims to reduce the inconvenience inflicted on landowners, and it is followed on the line between Ulvila and Kristiinankaupunki.

"We can construct the new power line mostly in the right-of-way of the old 220 kilovolt line. In some places the right-of-way becomes narrower, and wider in a few other places. The old 110 and 220 kilovolt lines between Elva in Ulvila and Leväsjoki will be dismantled, and they will give way to new 110 and 400 kilovolt lines on double circuit towers; in practice, the right-of-way becomes narrower on this part of the line. From Leväsjoki to Etelävuori, the right-of-way needs to be widened by approximately 6 metres, and further from Etelävuori the right-of-way will widen by about 30 metres," says **Ritva Laine**, Fingrid's Project Manager responsible for the project.

Good EIA co-operation

The project was preceded by a statutory environmental impact assessment, which received much feedback. Originally, there were plans for

a transmission line from Tahkoluoto to Ulvila and further to Kristiinankaupunki, but Fingrid decided to only build the connection between Ulvila and Kristiinankaupunki. The line between Tahkoluoto and Ulvila will hence not be built at least at this point.

The Ulvila–Kristinestad transmission line project headed by Ritva Laine is part of Fingrid's extensive capital expenditure programme.

"The EIA process proceeded normally, and I think that the co-operation with both authorities and local residents was good. Based on the feedback received, new options were introduced in Kristiinankaupunki as well as in the Pori and Pomarkku regions. The EIA procedure was highly relevant, and involvement by the parties concerned influenced the final transmission line route. Relatively most feedback was received from the Poikeljärvi region in Pori," says Project Manager **Mika Penttilä**, who took care of the environmental impact assessment procedure at Fingrid.

Construction to start in a year

The general planning of the transmission line project is in progress right now. In practice, this means detailed route planning and personal contacts with the landowners. The application for the expropriation permit will be submitted in the autumn of 2011.

"The requests for quotations concerning the construction contracts will be drawn up in the winter of 2011–2012. The practical work will commence in the early winter of 2012 by the removal of trees. Actual construction can hence start in more than a year, and according to the schedule the work will be complete at the end of 2014. We have two winters time to build; after all, winter is the prime time for transmission line construction," Ritva Laine says.

Transmission line projects are large-scale contracts, which must be subjected to international competitive bidding in accordance with legislation concerning public procurement.

"We do not know yet who the contractor will be in this project. This means that we do not know yet whether the workforce will come from Finland or elsewhere, but I do believe that the contract will be of interest to relevant service providers both in Finland elsewhere in Europe," Ritva Laine says.

New field tower model into use

The transmission line contract between Ulvila and Kristiinankaupunki is a fairly standard network construction project.

"These projects typically take years to complete, and this is also a fairly long line, 115 kilometres. However, the electricity outage arrangements in this project are trickier than normally. Customers must not be left without electricity even if the existing transmission line is de-energised. In this case, electricity must be supplied to the customers along another route," Ritva Laine says in describing the challenges of the project.

A new feature in this project is the new tower model designed for use on arable land*, with the tower having a new kind of structure. Still, conventional structures are used for most of the transmission line route, because the line between Pori and Kristiinankaupunki primarily runs in forest.

"We do not yet have user experiences of the new tower type, because its basic idea differs considerably from the traditional approach. In a way, it is a combination of various tower models. However, I believe that the tower model which facilitates farming will be received with satisfaction," Ritva Laine says.

* The new tower model for use on arable land is described in more detail on pages 8–10 of this magazine. ■

Ulvila–Kristinestad transmission line project in brief

- Total project budget: approx. 40 million euros
- Schedule: completed at the end of 2014
- Preliminary construction stages
  - removal of trees and clearing of vegetation, winter 2012–2013
  - foundation work, autumn 2012
  - transport of tower supplies to the site, assembly of towers, 2013
  - erection of towers, 2013–2014
  - installation of conductors, 2013–2014
  - final cleaning, 2014.
- Map feedback service for the line project available in Finnish at **http://fingrid.navici.com/ul-kd/**

Line route planner must be CONSTANTLY ALERT

Interaction has become an increasingly important objective in Fingrid's grid planning in recent years. The company wishes to hear the opinions of landowners and neighbours of the transmission line in the different stages of a transmission line project.

"The map feedback service available on our website has rendered contacts very easy. It is also easier for us to respond to the feedback when it is pinpointed on the map," says Fingrid's Adviser Pasi Saari.

Text by Maria Hallila ■ **Photograph by** Juhani Eskelinen

The map service available at http://fingrid.navici.com shows not only the transmission line routes but also the location of an individual tower on the map. The front page of the service contains instructions for viewing the maps and for submitting feedback.

The feedback channel opened last summer was applied for the first time to the 55-kilometre 400 kilovolt transmission line between the Seinäjoki and Tuovila (Mustasaari) substations in Western Finland.

Pasi Saari says that the service has proved to be effective even though the number of contacts to date has remained relatively low. The goal has been to respond to all feedback as quickly as possible.

"It takes time to adopt a new means of interaction," Pasi Saari says. The Seinäjoki–Tuovila line to be completed in October 2011 is built mainly in the right-of-way of the existing transmission line, which also reduces the need for contacts by landowners and other neighbours of the line, he adds.

Large-scale projects

However, the mailbox for Fingrid's map feedback system may be getting full very soon, because the company is currently carrying out the biggest capital investment programme in its history. In the next 10 years, Fingrid will build 3,000 kilometres of transmission lines and more than 30 new substations.

The large-scale projects are necessitated by the structural change taking place in electricity production in Finland in the next few years: the transmission grid must be prepared to take on a significant volume of electricity produced by wind power, nuclear power and other sources. Moreover, a continued good level of transmission system security requires that the older transmission lines are renewed.

Learning to know Finland

One of the company's construction projects is the 400 kilovolt line project reinforcing the north-south transmission capacity in Finland. This is the longest power line in Fingrid's history to date. According to preliminary

plans, its end points are in the south in Petäjävesi or Laukaa in Central Finland and in the north beside the river Oulujoki in Muhos. Depending on the route alternative, the length of the transmission line will be about 300–340 kilometres.

"If all the route options being studied at this point are included, we are examining 560 kilometres of line routes in the area of 22 municipalities," Pasi Saari says in describing the extensive preliminary planning project, which has been his main task since the beginning of this year.

In the preliminary planning stage, the route options are examined on a map, taking into account the environmental information stored in Finnish environmental data systems.

"We are not yet planning the actual tower locations at this point, but examining the general route of the line. The planner really gets to know Finland in this way," Pasi Saari says with a smile, and shows aerial photographs of rural landscape in Central Finland on his computer screen. The photographs indicate the route of the line and also the major challenges along the way: buildings, roads, waterways and nature protection areas.

The planned transmission line will run – like 90 per cent of Fingrid's present line projects – mainly in the right-of-way of the existing 220 and 400 kilovolt lines or parallel with them.

"When the voltage level of the line is raised, the right-of-way needs to be about 30 metres wider. The present examinations only involve about 30 kilometres of line route which runs in a new right-of-way," Pasi Saari says.

Despite this, the alternative routes include dozens of demanding special sites. They are all reviewed using map materials and by means of on-the-spot visits.

Disadvantages to a minimum

"We need to come up with technically feasible solutions which cause a minimum of disadvantage to the landowners," is how Pasi Saari encapsulates the criteria of his task.

He adds that Fingrid is well aware of the fact that when new lines are built parallel with existing ones, the disadvantages are inflicted on the same landowners. Even though there are fewer towers as the voltage level rises, the tower areas become larger.

Pasi Saari says that Fingrid takes the landowners' views and wishes seriously, and the goal is to use all means to mitigate the disadvantages caused.

In addition to the map feedback service, Fingrid also has other new issues of interest to landowners and farmers: the new type of unguyed tower for use on arable land is currently in the testing phase. Pasi Saari already sees a number of applications for it in the company's line projects in the next few years.

Objective: impartiality

The statutory environmental impact assessment or EIA procedure is the main channel for landowners and neighbours of the transmission line to express their views and wishes. The procedure aims to prevent the adverse environmental impacts of a transmission line by reviewing the impacts even before the final planning of the line begins.

The environmental impacts of 400 kilovolt lines are always ascertained by means of the EIA procedure, while a more concise environmental survey is drawn up of line projects of a lower voltage level of 110 kilovolts.

"The EIA process aims to increase the opportunities of citizens to contribute to and influence project planning. The objective is impartiality and increased interaction," Pasi Saari says.

The EIA procedure has been applied to grid construction projects since the early 1990s.

"Today, it is impossible to imagine that a viable 400 kilovolt line project could be accomplished without the EIA procedure, which takes into account the views of landowners and other plans related to the relevant area."

Fingrid also achieved positive auxiliary results in this respect: the Finnish Association for Impact Assessment awarded the company a distinction for the exemplary and commendable EIA procedure for the Kokkola–Muhos 400 kilovolt line project. The justifications of the distinction state, inter alia, that "the involvement has been effective, and the feedback received has been taken seriously."

Condition and concentration

The planning of transmission line routes is long-term work; the time span of a project from the initial stages to implementation is 5–10 years. Most of Pasi Saari's work days are spent at the computer, but field surveys are still also a prominent part of his work. A single part of a line requires two to three weeks of field days, depending on the length of the route.

This calls for good condition. Pasi Saari mentions his family and single-family housing as his foremost sources of energy. Volleyball provides good counterbalance to work at a computer screen. He has also taken on taekwondo in line with his son becoming interested in it. Taekwondo develops concentration and mind control – both are useful assets in the handling of large entities and search of optimum solutions. ■

New Chairman for Fingrid's Advisory Committee

Tapani Liuhala wants to see

FARTHER AND WIDER

Tapani Liuhala, Head of Networks Finland of Vattenfall Verkko, finds broad perspectives appealing. Serpentine roads in the Alps provide a far-reaching and unhindered view from the back of a motorcycle. In corporate management positions, Tapani Liuhala is accustomed to viewing things with a time frame of 5 or even 10 years. He thinks that Fingrid's Advisory Committee also provides a good vantage point to perceive the big picture.

Text by Maria Hallila ■ **Photographs by** Juha Tanhua

Tapani Liuhala has been involved in the work of Fingrid's Advisory Committee since February 2010. He has therefore had enough time to form a lucid opinion of the role and procedures of the 14-member co-operation forum which assembles four times a year.

"The Advisory Committee has brought about a solid and effective forum for discussion between Fingrid and its customers. It has augmented understanding of the company's strategies, objectives and their backgrounds."

Tapani Liuhala says that the discussion in the meetings of the Advisory Committee is lively. Energy matters carry more and more weight in society, and there are plenty of topical issues. "We had a workshop day a couple of weeks ago, and the meeting was constrained by a lack of time rather than a lack of topics," he says.

As the Chairman of the Advisory Committee, he feels that the enthusiastic atmosphere is an absolute advantage. "It is always easier to pull than push." As a corporate manager, he also wants to have an energetic team that gets things done.

Voice of customers

Tapani Liuhala thinks that the voice of different types of customers is well heard in the Advisory Committee. A large industrial company sees things in a different light than a regional network company.

"The diverse composition of the Committee is both a benefit and a challenge. There are many perspectives to a single issue."

Tapani Liuhala feels that the best part in the work of the Advisory Committee is that it gives an overall view of the transmission system operator's work and operating environment, both at a national and international level.

"Previously, I viewed things primarily through the eyes of the company I represent, but now I consider it important to rise one step higher so that I can better understand the significance of all sectors."

What the big picture means to Tapani Liuhala in its widest sense is that the interests of society at large are considered.

"Finland is in tough global competition. Coping in it requires that the basic infrastructure is in a good condition, and the power system has an absolutely crucial role here."

The requirements concerning the security of electricity supply are growing in every sector – both within households and large-scale industries – and the power system must be able to respond to these requirements.

"Electricity companies and the market take care of this response just as long as they are given the facilities and encouraging conditions to do this," Tapani Liuhala points out.

He also emphasises that government funding is not required by investments in the basic infrastructure.

"Moreover, the development of the electricity network promotes employment, improves competitiveness and increases overall economic activity. The work is done in Finland; it cannot be outsourced to developing countries."

In the same chain

Fingrid and electricity distribution companies which are some of its customers are links in the same chain when it comes to the supply security of electricity. The EU's environmental and climate policy objectives, to which Finland is committed, have also brought shared challenges to the parties working at the various levels of electricity network operations.

Tapani Liuhala considers it possible that wind power production in Finland will grow very rapidly as a consequence of the feed-in tariff act passed in March. According to him, the combined power of ongoing studies concerning new wind power capacity in Finland is even higher than the entire power demand in Finland.

"An increase in wind power production also requires the strengthening of the transmission grid. People tend to forget this often," Tapani Liuhala says.

Fingrid's capital investment projects worth 1,700 million euros have been on the agenda of the Advisory Committee recently. These projects will reinforce the Finnish grid for additional wind power and nuclear power production, among other things.

According to Tapani Liuhala, an increasing volume of small-scale wind power production may cause revolutionary changes to the usual operations of electricity distribution companies: the flow of electricity in the network may become two-way.

He quotes a German colleague of his in describing the impacts of the change on a conventional distribution company: "Four months of the year we are an electricity 'collection company'. The remaining eight months we pursue our traditional business: take electricity from the high-voltage grid and distribute it to the customers."

Smart network serves

Changes to be expected in the near future have convinced Tapani Liuhala of the necessity and opportunities of the smart electricity transmission network based on intelligent technology. Vattenfall Verkko is the first distribution network company, at least in Europe, to integrate information technology with electricity technology extensively in order to enhance network control and to provide its customers with an opportunity to, inter alia, monitor their electricity use on an hourly basis. Now the quality of electricity supply can be monitored all way to the customer's electricity meter.

Between 2004 and 2008, the company installed automatically-read electricity meters for all its 400,000 customers in Finland. At the same time, customer billing changed to

"The network must be developed so that it is sure to work in all situations."

consumption basis, with the former billing based on estimates left in history. This operation was a visible part of the energy savings project.

Tapani Liuhala says that the change of meters has shown that exact knowledge of one's own consumption increases awareness of energy conservation. Simplified billing has brought the company much positive feedback.

The smart network has also enabled improved service in fault situations. "If there is a power failure, the customer receives a text message to the mobile phone. Our network customers can use this service free of charge," says Tapani Liuhala.

Response to requirements necessary

The functioning and benefits of the fault message system have been tested in extreme conditions, since last summer's storms in Finland raged fiercely in Vattenfall Verkko's distribution network area in particular.

The consumers have given positive feedback for the fast service, but Tapani Liuhala thinks that the future will be challenging to network companies. With increasing requirements concerning electricity supply security, explaining the causes of faults and even efficient communications are not enough.

"We have to respond to the requirements. Explaining the faults by thunderstorms, snow loads or cold weather is not the solution in the hectic pace of technological advancements. Instead, the network must be developed so that it is sure to work in all situations."

Vattenfall Verkko decided a couple of years ago that all of the new network projects and replacement construction projects will be carried out using underground cables. The company has conducted active collaboration with universities, equipment manufacturers and earthwork contractors, aiming to improve the competitiveness of cabling. As a result, the life cycle costs of underground cabling in distribution networks have been squeezed to a level which is competitive with the construction of overhead lines.

However, there is much work left to do before Vattenfall Verkko's 60,000 kilometres of transmission lines have been buried underground. Tapani Liuhala considers it justified and important that network companies have better opportunities and incentives to implement the reform which supports the development of society.

"Our electricity network must be in such a condition that it does not cause any problems for businesses or households. We have quite enough other challenges in Finland, just to name our harsh climate," Tapani Liuhala says. ■

The requirements concerning electricity supply security are becoming stricter and stricter. Tapani Liuhala thinks that Fingrid and distribution companies which are among its customers are links in the same chain when it comes to the enhancement of electricity transmission.

Fingrid's Advisory Committee is a two-way information channel between the company and its customers. Fingrid uses the Committee to distribute information on its situation and plans. The representatives of the customer groups, in turn, can take a stand on the matters discussed within the Committee and also introduce their own proposals for discussion.

The Advisory Committee is a consultative body. Its mission is to contribute to transmission system operation in accordance with the principles of the Electricity Market Act.

News from **Europe**

Consumers are interested in reliable electricity supply at an affordable price. Trading across national boundaries benefits the market parties and consumers. This is the reason for a new market model, where sales and purchase bids coming from a large area can meet each other. In the future, electricity prices will be calculated as pan-European co-operation.

There are active efforts in Europe to develop electricity trading. Fingrid, the other transmission system operators (TSOs) in North-Western Europe and electricity exchanges in the region introduced a provisional procedure in November 2010, used for calculating the electricity prices in the area. In the past winter, this procedure curbed significantly the rise in electricity prices in Finland. However, expanding the provisional procedure to the whole of Europe is troublesome.

The TSOs and electricity exchanges in the region have been considering a permanent day ahead market coupling. One of the most pressing questions concerns the details of a price calculation algorithm. So far, it is also unclear who will pay the development, implementation and maintenance work related to market coupling. Competition legislation may also influence the co-operation. The permanent solution for North-Western Europe is supposed to be complete in 2012.

Even though many things are still undecided, the calculation of the wholesale market price will change in terms of some details. So far, fixed transmission capacity values for the next day are applied between countries. In a couple of years there will be a procedure, at least in highly meshed networks, where the transmission capacity in the shared grid is calculated on the basis of the respective power system situation. The new method gives larger uniform price zones. This would also mean more stable prices for consumers.

In terms of the intraday market, the European target is that the purchase and sales bids in the entire Europe participate in trading through a shared database. Some of the electricity exchanges and OTC traders, however, wish to trade past this database in the early stages, by reserving transmission capacity directly from the grid companies. After a transition period, this possibility would be eliminated.

Even though intra-day trading should continue in the present configuration as trading continuing from hour to hour, one new thing in the European target model is the pricing of the use of transmission capacity. It is not yet clear how the pricing will be arranged, and it will not be applied in the initial stages.

The developments which began in North-Western Europe must be disseminated throughout Europe by 2014 in accordance with the objectives of the European Council. A plan for the schedule of market expansion is currently being drawn up. Alongside the implementation of market coupling, the drawing up of network codes has already been launched.

Next European TYNDP underway

The single electricity market and the transmission of renewable energy call for strong transmission networks. The next version of the ten-year network development plan (TYNDP) of the TSOs is due to be published in 2012. The new TYNDP will be more advanced than its predecessor in that alongside the former national or regional plans, the new plan is also based on a pan-European approach where the network construction needs are derived from the EU's 20-20-20 targets.

This approach is based on the plans of the member states concerning an increase in renewable electricity. Market modelling will be carried out by means of a shared market database and scenarios, and technical network computation will be based on common input data. The assessment of the impacts of the projects will also be based on shared European criteria. Attitudes towards nuclear power may bring an interesting addition to the calculations. If Germany decides to abandon nuclear power on a grand scale, it will also reflect significantly on the necessary network investments.

The permitting process needs to be hastened so as to implement the capital investment plans sufficiently quickly. The EU's infrastructure package published towards the end of last year also aims to contribute to this. The law proposals related to the package will probably be given in late 2011.

In the long term, the European transmission system must be capable of substantially higher electricity transmissions than now. Renewable energy production is often located away from consumption centres, so the transmission distances are long. One of the goals is to build wind farms at sea, which also requires significant technical development work.

Fingrid facilitates communications to stakeholders

In the coming years, the European stakeholders will be consulted not only regarding the network codes but also the ten-year network development plan. In order to facilitate access to related information, Fingrid's website www.fingrid.fi will have a specific information section. It will include for example the TSOs' network codes, within which they are obliged to hear their stakeholders.

ACER's public consultation process concerning the framework guideline for transmission capacity allocation and congestion management was completed on 10 June. The guideline has a very significant impact on the EU's electricity market. The TSOs have also published a preliminary draft of the network codes concerning specifications for the operational performance of power plants. ■

Text by Risto Lindroos

Lively discussions **in the Grid Committee**

A number of important topics have been on the agenda of Fingrid's Grid Committee recently. Even though the advisory body does not make actual decisions, Fingrid takes heed of its opinions.

Text by Ursula Aaltonen ■ **Photograph by** Jonna Monola

The Grid Committee serves as a co-operation body in grid development between Fingrid and its customers. "It represents a miniature version of our clientele," says Fingrid's Executive Vice President **Kari Kuusela**, who chairs the Grid Committee.

The eight-member Grid Committee is one of Fingrid's three customer committees established in 2008. It assembles 2 to 4 times a year to discuss matters pertaining to the development of the Finnish electricity transmission grid.

"The Grid Committee provides an opportunity to contribute to the development of the entire electricity supply chain, from the power plant up to the end user. As a member of the Committee, I feel that I represent all of the 100,000 users of the network of Järvi-Suomen Energia," is how **Arto Pajunen**, Managing Director of Järvi-Suomen Energia and member of the Committee since its establishment, describes the role of the Committee.

Big issues on the agenda

The topics on the agenda of the Grid Committee in recent meetings have comprised wind farms, preparations for the next agreement period of grid service, and the introduction of a grid connection fee.

"Many things are happening in grid development right now. We have naturally wanted to listen carefully to our customers when we are making far-reaching decisions whose implications are reflected at least over the next tariff period, and even beyond," Kari Kuusela continues.

The May meeting of the Grid Committee covered for instance the scope of the high-voltage transmission grid. "The significance of the networks of Fingrid's customers on the reliability of the high-voltage grid also influences our own contemplation concerning the maintenance and protection of regional networks," Arto Pajunen says.

The planned grid connection fee has also been on the agenda of the Committee. "I think that a fixed connection fee would clarify the situation from the present. Another positive thing is that the basic improvements, maintenance and operation are included in the fee," says **Eero Vauhkala**, Manager, Regional Network, Finland, of Fortum Sähkönsiirto.

The major topics have taken much of the shared time of the Committee which assembles relatively infrequently. In the future, the goal is to also raise other issues which have received less attention before. "One

At the back (from the left): Petri Parviainen, Markku Hyvärinen, Jarkko Kohtala, Arto Pajunen, Kari Kuusela, Eero Vauhkala and Esa Kalla. Front row (from the left): Pasi Heinonen, Antti Timonen and Pekka Pöllari.

example is occupational safety – an important issue, which applies equally well to us and our customers," Kari Kuusela says.

Lively exchange of ideas

At times, there is very dynamic exchange of thoughts and opinions around the table. "The lively discussions are the best part of the work of the Committee. The Committee also provides a good forum for the broad handling of issues," says **Pekka Pollari,** Managing Director of UPM Sähkönsiirto.

Mutual exchange of information and thoughts is the very idea of the existence of the Grid Committee. "We have had the opportunity to express our opinion – and also influence matters – at an early stage, before official requests for statements," Eero Vauhkala says. He is also pleased with the fact that information and opinions travel through the Committee in two directions. "The Committee is also represented by customer groups other than network companies. The various customer groups do not necessarily have the same problems or interests."

Many voices heard

Membership in the Grid Committee changes, with the term of office of the members being at least 2 years. "We have wanted to make sure that all customer groups and regions – industries, power producers, countryside, and towns – are represented in the Committee equitably," says Kari Kuusela.

Arto Pajunen also considers it positive that so many voices are heard within the Committee. "Being involved in this group has expanded my view of the varied needs in terms of the grid service, seen for example from the urban and industrial points of view," he says.

What have been Fingrid's key messages to the members of the Grid Committee?

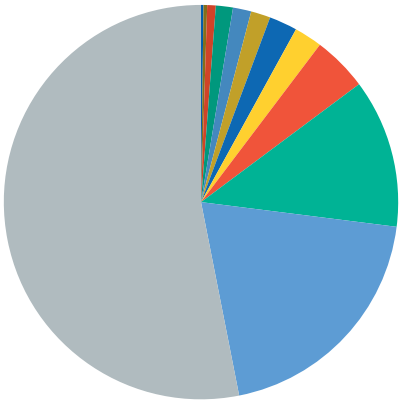
Concern about the state of the transmission grid in Finland and about system security, plus the related extensive capital investment programme, Arto Pajunen, Eero Vauhkala and Pekka Pollari state almost in unison. "The messages have been well received," Kari Kuusela says. ■

Change in Fingrid's ownership

Pohjolan Voima Oy and Fortum Power and Heat Oy have divested their holding in Fingrid to the State of Finland and Mutual Pension Insurance Company Ilmarinen.

The ownership arrangements are based on the EU's directive concerning the internal electricity market. The directive requires that transmission system companies are unbundled from electricity generating and selling companies by March 2012.

After the share transaction, the holding of the State of Finland in Fingrid is approx. 53 per cent and that of Ilmarinen approx. 20 per cent. The other shareholders have a holding of about 27 per cent. ■



Shares

- State of Finland 53.1 %
- Mutual Pension Insurance Company Ilmarinen 19.9 %
- Varma Mutual Pension Insurance Company 12.2 %
- Tapiola Mutual Pension Insurance Company 4.5 %
- Suomi Mutual Life Assurance Company 2.3 %
- Pohjola Insurance Ltd 2.3 %
- Mandatum Life Insurance Company Limited 1.6 %
- Tapiola General Mutual Insurance Company 1.5 %
- Tapiola Mutual Life Assurance Company 1.4 %
- IF P&C Insurance Company Ltd 0.7 %
- Imatran Seudun Sähkö Oy 0.3 %
- Fennia Life Insurance Company 0.2 %

Photograph by Juhani Eskelinen

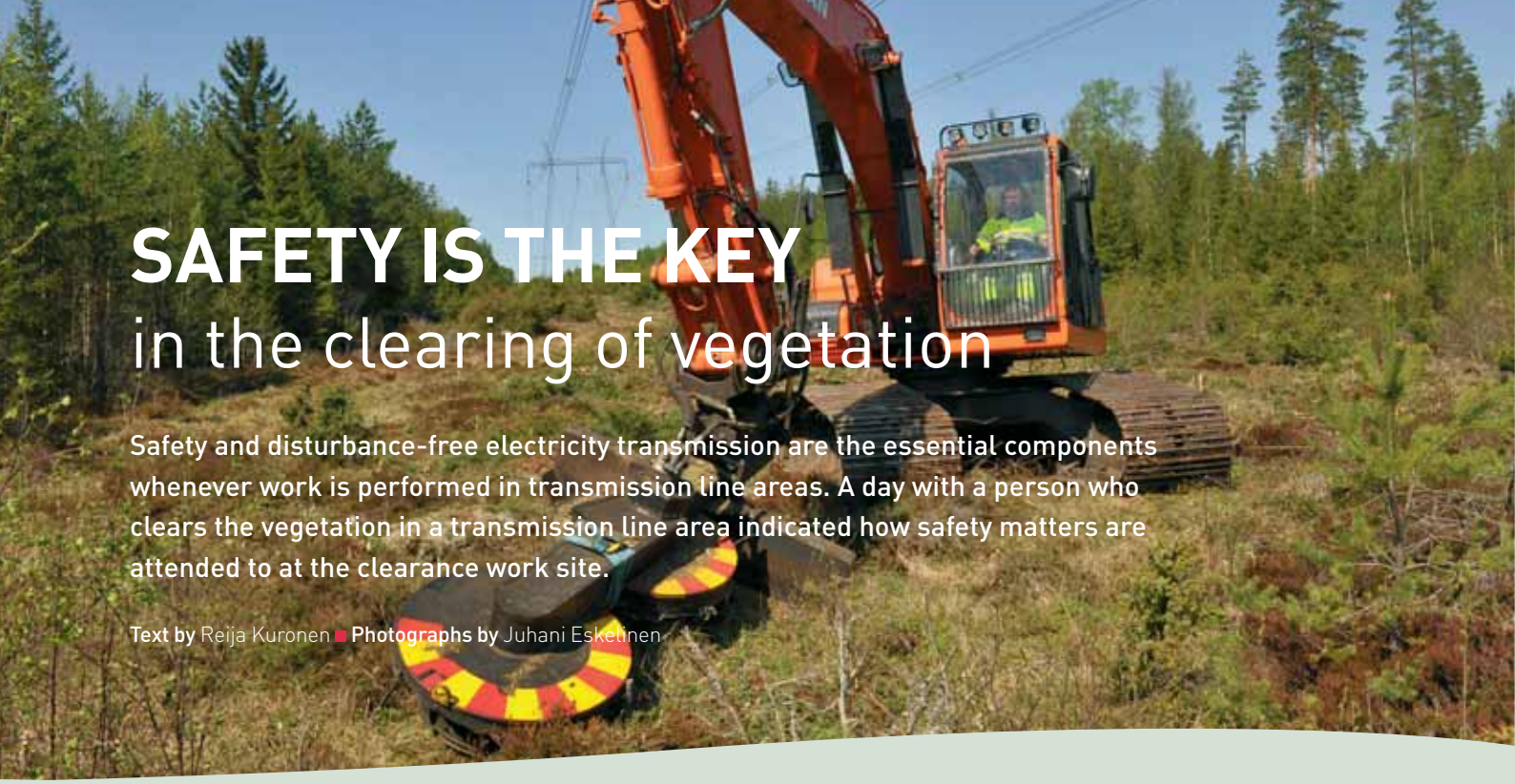
Helena Walldén elected Fingrid's Chairman of the Board

Fingrid Oyj's Annual General Meeting was held on 3 May 2011. The Annual General Meeting accepted the financial statements for 2010, confirmed the income statement and balance sheet, and discharged the members of the Board of Directors and the President from liability.

The Annual General Meeting accepted amendments to the company's articles of association. The foremost amendments concerned the reduction of the number of the members of the Board from seven to five, abolishing the stipulation that decisions by the Board require a majority of three quarters, and raising the number of members on the company's Advisory Committee from twelve to fourteen.

Moreover, the Annual General Meeting elected the Chairman, Deputy Chairman and other Board members as well as their personal deputy members for Fingrid Oyj for 2011. Moreover, two Board members and deputy members were elected. Their term of office will finish after the changes to the company's articles of association have been registered.

Helena Walldén, M.Sc. (Tech.) was elected the Chairman of the Board, and **Arto Lepistö**, Deputy Director General of the Ministry of Employment and the Economy was elected the Deputy Chairman. The other Board members are **Elina Engman**, Vice President, Energy, Kemira Oyj, **Timo Kärkkäinen**, Senior Portfolio Manager, Mutual Pension Insurance Company Ilmarinen, and **Esko Raunio**, Director, Private Equity Real Estate Investments, Tapiola Mutual Pension Insurance Company. ■



SAFETY IS THE KEY
in the clearing of vegetation

Safety and disturbance-free electricity transmission are the essential components whenever work is performed in transmission line areas. A day with a person who clears the vegetation in a transmission line area indicated how safety matters are attended to at the clearance work site.

Text by Reija Kuronen ■ **Photographs by** Juhani Eskelinen

There are a total of about 14,000 kilometres of Fingrid's transmission lines throughout Finland. By clearing trees and other vegetation growing close to transmission lines regularly and appropriately, Fingrid wishes to secure the safety of people and also the reliability of the transmission line. Vegetation in the right-of-way is cleared mechanically or manually every 5 to 8 years.

Safety not compromised

Machinery contractor and managing director **Mika Karjalainen** of Moto Pro Oy knows what it takes to ensure safety. Moto Pro Oy has been clearing vegetation in transmission line areas for several years. Mika Karjalainen says that the company clears more than 1,000 hectares of areas annually.

Fingrid's 400 kilovolt transmission line between Lieto and Rauma traverses diversified forest and arable landscape typical of South-Western Finland. We are visiting a site in Mynämäki, where the clearing of the line area commences at a hillside, one tower spacing at a time.

Mika Karjalainen presents the clearing machine which is designed and equipped to clear vegetation in transmission line areas and where no compromises have been made in occupational safety. The machine is equipped with three 6 kilogram fire extinguishers, 14 turnable Xenon lights, safety glass in front of the cabin, and guards protecting against ejected stones and branches. Each opening on the machine has been covered with dense gratings to prevent the chaff created in clearing from entering the machine and causing a fire hazard. The machine also has hose break valves, which prevent oil from leaking to the ground in the event of a hose failure.

The bottom part of the clearing head of the machine contains an accessory developed by the company. It serves as a guard against ejected objects, as a support on soft ground, and also as a scoop. The scoop can be used for clearing ditches under a line from branches and for opening ditches which have been blocked by the machine. The warning light flashes on the roof whenever the machine is running.

The machine operator's own safety-related equipment includes hydrocortisone for snake bites, a tourniquet, and a mobile phone and charger. There are first aid kits in the work machines and other vehicles.

Unobstructed visibility in all conditions

Mika Karjalainen says that the different conditions and seasons of the year bring their own challenges to clearance work. Attention must be paid to the various safety factors on the basis of the prevailing conditions. During the dry season, you have to be particularly vigilant so that sparks potentially created in the work do not cause a wildfire. In the autumn when it is dark, the efficient spotlights are aimed at the clearance area in every direction and at the transmission lines running above, because the machine operator must have constant visual contact with the line. A powerful head lamp is also standard equipment in the work. Clearance work in the winter brings its own challenges to safe working.

Mika Karjalainen settles in the cabin after first examining that everything is fine in the machine. The condition of the blades in the machine is inspected every morning before the work begins, and the blades are changed if necessary. There are also other inspections during the day every couple of hours to prevent the risk of the blades, which rotate at a high circumferential speed, from coming off. If a blade comes loose, it may fly a long distance.

It is a warm day in the late spring.

The conditions are favourable and visibility is good. The machine with its chain tracks rolls in the varying terrain with agility, and clearance work below a line can begin.

Information adds to safety

"The objective is to tell people about clearance work also at the work site whenever possible," says Mika Karjalainen. This contributes to safety; parents can warn their children not to go near the machine.

The transmission line area is wide, and Mika Karjalainen drives the machine to the edge of the area. The blades cut the thicket and other vegetation, and the clearance head moves nimbly from side to side, following the contours of the terrain. At this point, the terrain is dry and rocky moorland.

The chain tracks rattle a little, but the sound of the machine itself is surprisingly soft and quiet. You can even hear a cuckoo far away in the forest while the machine is running. The transmission line area becomes free of vegetation, and the depressions left by the machine are not easily discernible in the terrain thanks to the wide chain tracks.

Lumberjacks finish the clearing work

Mechanical clearance is followed by forest workers, who clear areas close to roads and houses, rugged gorge areas, areas around the towers, and very soft marsh areas. Trees with a thick stump and other large trees in the border zones also need to be cut manually.

Individual short trees are not cut because of landscaping, and Christmas trees grown in the transmission line area are naturally also left standing.

Clearance work requires precision, and the special nature of the work area requires unceasing concentration not only on the work itself but also on the environment. You need to observe everything taking place around the machine, whether it be an approaching person, a potential initial fire or other safety risk.

Do not go near an operating machine

Mika Karjalainen's machine continues the clearance work at a steady pace. Some dirt occasionally puffs in the air as the blade hits the soil. It is absolutely forbidden to go near the machine, because the blades eject branches and stones over long distances, and the air is also somewhat dusty.

Mika Karjalainen says that if the use of mechanical clearance will increase in the future, safety issues will become even more important. "However, the forest workers following the machine will continue to have an important role in the work."

Essential safety instructions and guidance material

Safety considerations are equally as important in manual clearance work, too. Work carried out in a transmission line always requires special skills and familiarity with the work, the correct equipment, and safety training. The clearance sequence is agreed in advance with the customer, and the risky locations and special areas are reviewed. Moreover, there are the customer's, in this case Fingrid's, tailored guidelines such as a manual for clearance work, which can be found in the work machinery and other vehicles. Safe working also requires constant contacts with the customer.

At the end of the day, Mika Karjalainen drives the machine to the edge of the transmission line area to await the next morning. Clearance machinery must never be left overnight in the transmission line area – again for security reasons. The cleared area resembling a roughly cut lawn can be distinguished clearly from the uncleared areas.

Safety issues are in a key role at Fingrid's sites. ■

GOOD TO KNOW

• Fingrid informs landowners by letter of the clearing of rights-of-ways and management of trees in the border zones.

• Special caution must be exercised when working and moving near the tower structures.

• Even minor damage inflicted on a transmission line may lead to serious consequences. A machine or its part hitting the tower structures can even cause death.

"The various seasons of the year bring their own challenges to clearance work," says Mika Karjalainen. During the dry season, you have to be particularly vigilant because of a risk of wildfire.

Grid ABC

This article series deals with the main operating principles, equipment units and components in the main grid. The articles published in the series previously can be viewed on our website at www.fingrid.fi.

Electrical safety in electricity transmission

Electrical safety involves many terms and concepts. Below is a summary of the most common issues related to electrical safety.

Text by Minna Laasonen

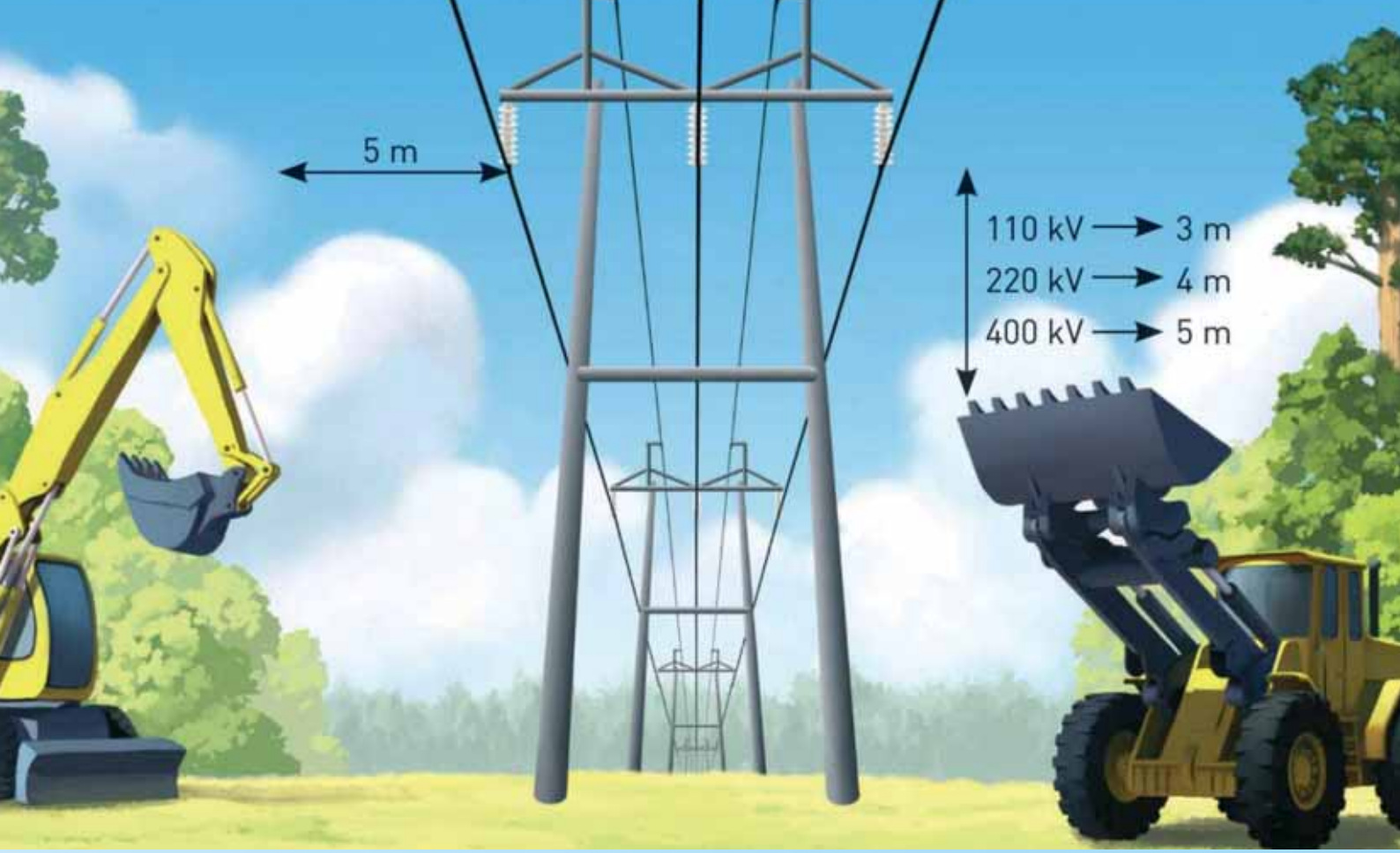
The human nervous system is associated with electrical phenomena. Even small external electric currents travelling through the heart may put the heart's own electrical system in disorder and cause ventricular fibrillation. Ventricular fibrillation can be fatal even in a short period of time. Besides heart problems, an electric current can also have other impacts, such as muscle spasms, breathing problems and burns.

In safe electricity transmission and use, electricity is isolated so that it is not in contact with people or animals. In practice, this means that the material in which electricity travels has been isolated by means of an **insulator**. The insulator is some poorly conductive material; as an example, the primary insulation in transmission lines is air. The suspension of a transmission line in the air naturally also calls for a **solid insulator**. The solid insulator may be made of for example glass or porcelain.

The insulator structure is required sufficient **dielectric strength** which refers to the ability of the insulator to withstand a certain voltage. If the voltage affecting beyond the insulator structure is greater than its dielectric strength, the insulating capacity of the insulator may be exceeded and a failure known as **breakdown** can occur. The breakdown can also occur via a tool such as a hoisting machine, long fishing rod or metallic tool if it gets into the air gap too close to a live part.

One important aspect of electrical safety is **earthing**. Earthing refers to the connection of an item to the ground, to the potential of the earth, as effectively as possible. Earthing can be done for different purposes. **System earthing** means that a part of a circuit is connected to the ground. **Protective earthing**, in turn, is needed so as to protect the users of electrical equipment: a part which does not belong to the circuit and which is susceptible to voltage, such as a metal pole or the shell of an electrical device, is connected to the ground for the eventuality that an insulation failure, for example, occurs in the device. For example, in most electrical devices the shell, which is touched, is provided with protective earthing. If the insulation structure of an electrical device is damaged so that the operator of the device can get an **electric shock**, fault current protection detects the fault by means of protective earthing and switches off the electrical current. **Temporary earthing for work** means that a part of the network is earthed for the duration of electrical work on the part in question in order to ensure the safety of electricians.

Well-performed earthing is important because it prevents the occurrence of dangerous **earthing voltage** and **contact voltage**. The earthing electrode used in earthing provides a resistance just like all other conductors. If a fault occurs, a voltage drop is created in this electrode as a result of resistance. This voltage drop is also referred to as voltage to earth. Limit values have been specified for voltage to earth because of safety reasons, among others. Contact voltage is the voltage affecting between



Safety distances to a transmission line when operating machinery in the vicinity of a line.

a point touched by a person and the ground. **Step voltage** is a contact voltage between the legs.

Electricity transmission and distribution networks are associated with a variety of concepts related to faults. Electricity transmission and distribution commonly use a three-phase system. If two or more phase conductors are together when insulation fails, the phenomenon is known as a **short circuit**. As an example, a piece of row cover flying from a field onto a transmission line may cause a short circuit between two or more phases. If one or two phases are electrically connected to the ground, this is referred to as **earth fault** or **two-phase-to-earth fault**. If a tree falls on the line, it often causes an earth fault. An earth fault may also be created along the smoke column emitted from a bonfire or other fire under a transmission line.

The goal is to disconnect that part of a transmission network, where a short circuit or an earth fault occurs, from the other parts of the network as quickly as possible. This is done primarily so as to prevent any hazard to people or the environment, but also in order to minimise the impacts of the fault on the transmission system and related systems and in order to keep the devices intact.

The fault is detected and isolated from the network by means of **protection**. Protection encompasses the **protective relays**, which detect the fault, and their auxiliary devices, plus circuit breakers needed to break the fault currents. The protection of a transmission network is arranged so that a defective component can be isolated from the rest of the network as quickly as possible. The most common fault in a transmission network is an earth fault caused by lightning. This type of a fault usually disappears in a very short period of time, and it does not cause a permanent fault situation. In order to avoid unnecessary longer-term interruptions, transmission lines usually employ **automatic reclosing**. This means that voltage can be connected automatically to a disconnected line after a short disconnection period.

Various types of equipment are used for cutting the electricity transmission path. A **circuit breaker** is a device which is typically used for cutting the flow of current in electricity transmission. A circuit breaker is able to break the normal load current and also a fault current occurring in the circuit in a fault situation. A **disconnector** is a device that provides a visible clearance between open contacts in the open position for maintenance work. A disconnector cannot be used for cutting a circuit. ■

Book *Sähköverkot 1 ja 2* by Elovaara J., Haarla L. (Otatieto 2011) has been used as a source of this article.

Second only to eagles, the osprey is the largest bird of prey in Finland. Its wing span is 150–170 centimetres. The osprey only eats fish, which it captures by diving into the water. Almost 10,000 pairs of ospreys nest in Europe, one third of which in Sweden and one eighth in Finland. Ospreys can be found in all parts of Finland.

The photograph shows an osprey chick.

NEW HOME FOR THE FISHING EAGLE

The osprey tends to nest at the top of the tallest tree. In Pietarsaari, a pair of ospreys placed their abode at the top of a transmission line tower. The unusual place posed a risk both to electricity supply and to the birds themselves, which is why Fingrid had a new home built for the birds.

Text and photographs by Pertti Koskimies

I was a young biologist in my early twenties when I was in a bookstore and found **Tiit Randla's** work *Eesti Röövlinnud, Kullilised ja kakulised* (1976), describing birds of prey, hawks and owls in Estonia. Many pieces of information in the book remained unclear to me, because the Estonian language contains words which do not exist in Finnish, which is a kindred language of Estonian, and about one third of the words seem confusingly familiar but mean totally different things in Estonian and Finnish. However, there was no uncertainty about the nesting place of the osprey; after all, I had had birds as my interest for a decade and I had also ringed ospreys in several summers: the osprey always nests atop a tree.

Artificial nests needed in the south

The osprey is one of the world's most widespread birds of prey, because it nests on all continents except the Antarctic. And almost everywhere it builds its nest in a tree top.

Ospreys have long wings, which are incompatible with flying among the canopy. It is easiest for the big bird to descend and rise against the wind. The highest tree tops are well suited to this, irrespective of the wind direction. This bird which is timid of people can also easily observe its surroundings from a high spot.

Before the age of efficient forestry, ospreys had plenty of suitable flat-top pines for nesting at beaches, ridges, swamps and islands. Since the bird is specialised to eat only fish, waterfronts are its original nesting environment. Jealous of fish caught by the osprey, people soon started to persecute this species, like other eagles, a couple of hundred years ago, which is why the birds had to go into hiding at the outback.

Because the osprey is a timid bird, most of the 1,200 pairs of ospreys in Finland still live in peaceful forest and marshland environments, in many cases at least a kilometre or two from the closest house or busy road. Flat tree tops with sufficiently sturdy branches tend to grow on marshes and rocky ridges, because managed forests only have trees of even age and length but no excessively tall trees for use by the osprey.

Since ospreys just cannot set up their nest, which weighs hundreds of kilos and may accumulate more than 1 metre high over the decades, in trees with a pointed top growing in managed forests, bird enthusiasts who ring birds have built thousands of artificial nests in Finland since the 1960s by cutting the tops of trees which are taller than the surrounding trees. Without these artificial nests – which provide a nesting place for more than 90 per cent of the osprey couples in Finland – the osprey would have disappeared almost completely from southern Finland. There are more suitable natural tree tops in Northern Finland, but since the waters there are not as rich in fish, the osprey population up north is less dense.

The male is responsible for catching fish from the courtship rites at the end of April until early September, when the nestlings become independent, because the female stays in the nest hatching the eggs and feeding the chicks. The male carries almost 100 kilos of fish to his spouse and chicks during a nesting season. From many nests, the one-way distance to the fishing grounds may be up to 20 to 30 kilometres, and fetching half a dozen fish means hundreds of kilometres of flying in a day.

From a tower to a tree top

In the lack of sturdy tall trees, some pairs of ospreys settle every now and then on transmission line towers, which are quite common nesting places further south in Europe. However, twigs dropping off the nests can cause short circuits, and a tower is not necessarily a safe nesting place for the osprey, which has been categorised as a species whose protection requires particular attention by virtue of the EU's bird directive. This is why electricity companies have not viewed tower nests favourably.

A few years ago, a pair of ospreys built a nest at the top of Fingrid's transmission line tower in Pietarsaari on the west coast of Finland. The Centre for Economic Development, Transport and the Environment of Southern Ostrobothnia gave an exemption permit last year for dropping the nest just as long as an artificial nest would be built in the same habitat at a suitable location. Besides, the nesting of the ospreys failed in the tower nest quite often, because at those altitudes storm winds treat the nest violently and may even throw nestlings out of the nest.

The tower nest in Pietarsaari was replaced with a new artificial nest last March before ospreys returned from Africa. Assisted by Fingrid's environmental specialist **Tiina Seppänen**, I built the birds a new nest in a peaceful forest area. The landowner gave his consent to the construction of the nest. We keep our fingers crossed that the fishing eagles accept their new home! ■

Pertti Koskimies is an ornithologist who has studied a population of about 50 pairs of ospreys in South-Eastern Finland since the 1970s. He has built more than 100 artificial nests for ospreys.

Pending EIA projects

Environmental surveys of the connection of new nuclear power facilities to the grid launched

Fingrid is making preparations for connecting additional nuclear power units to the Finnish electricity transmission grid. This summer, the company is launching the preparation of environmental impact assessment procedures for transmission lines related to nuclear power projects. The background studies will start in many locations in Satakunta, South-Western Finland and Häme, and later in Northern Ostrobothnia and Lapland.

Based on the Electricity Market Act, Fingrid carries transmission system responsibility and responsibility for grid development. The development of the grid takes into account the climate and energy strategy of Finland, the development and customer needs of the European electricity market, and the ageing of the grid. The new nuclear power plant units must be connected to the transmission grid so that they can feed the electricity produced by them and operate safely in all situations of the power system.

The grid reinforcements will require that the planning and environmental surveys of the projects are carried out in stages. The environmental impact assessment of the 400 kilovolt transmission line routes related to Teollisuuden Voima's Olkiluoto 4 nuclear power plant unit will be launched this autumn. The assessment will study the transmission line routes from Olkiluoto to Rauma and further to Ulvila, Forssa and Lieto.

The environmental impact assessment for the 400 kilovolt power lines required by the Fennovoima 1 nuclear power plant will only be made for the plant site selected. Fennovoima will build its nuclear power plant in Pyhäjoki in Northern Ostrobothnia or in Simo in Lapland.

Fingrid will make the decisions on the further planning and construction of the transmission lines later on the basis of the decisions made by the companies responsible for the nuclear power projects. ■


Photograph by Juhani Eskelinen

EIA procedure for transmission line from Central Finland to Oulujoki river being prepared

Fingrid is planning a transmission line of a higher voltage level between Central Finland and the Oulujoki river. The transmission line routes examined are located within several municipalities in Central Finland, Northern Ostrobothnia and Kainuu. The environmental impact assessment of the project will begin with nature surveys in the spring.

The north-south transmission capacity in the Finnish grid needs to be upgraded by a new 400 kilovolt power line from Central Finland to the Oulujoki river. The present transmission grid cannot manage the future electricity transmissions without harmful transmission capacity restrictions or without jeopardising system security.

According to preliminary plans, the end points of the new 400 kilovolt line are in the south in Petäjävesi or Laukaa and in the north beside the river Oulujoki in Muhos. Depending on the route alternative, the length of the transmission line will be about 300–340 kilometres. The transmission line routes will be located within the following municipalities: Petäjävesi, Uurainen, Multia, Saarijärvi, Karstula, Kivijärvi, Kinnula, Reisjärvi, Pihtipudas, Haapajärvi, Kärsämäki, Nivala, Haapavesi, Siikalatva, Vaala, Liminka, Tyrnävä, Muhos, Utajärvi, Jyväskylä, Laukaa and Äänekoski.

In accordance with the nation-wide land use objectives stipulated in the Land Use and Building Act, the objective is to primarily utilise existing rights-of-ways. Most of the planned transmission line will be located in the right-of-way of the existing 220 or 400 kilovolt transmission lines or parallel with them. Line routes in new rights-of-ways are being examined on short distances, the total length of which is less than 30 kilometres. ■

”For me, the midsummer night is not complete without the scent of the twinflower”

Small is beautiful

The world-famous Swedish botanist **Carl von Linné** was a perceptive man. When he created the taxonomy of species and a binomial scientific nomenclature, he gave his own name to one of the smallest. The twinflower became *Linnaea borealis*, the northern Linné. After being knighted, he used the twinflower in his coat of arms, and it was later elected the provincial flower of his native region Småland.

Linné named a tremendous number of plants, including stately orchids, lilies, and who knows what. Yet, he chose the twinflower as his namesake – an evergreen plant, which is very inconspicuous most of the year. The stem of up to 2 metres with double leaves creeps among moss, rising on fallen tree trunks, stones and stumps. It disappears on the bottom of the forest, it is overshadowed by the larger plants, only revealing itself to those who know where to look for it.

Before Midsummer, the twinflower suddenly becomes visible and shows why Linné opted for it. It elevates its flower stem with two pink nodding bells at each end. They only come about 10 centimetres above the moss, so the plant still keeps a low profile. The stems occur individually or in small groups, but in some forest openings twinflowers may form a thick blooming mat of up to a few square metres.

I agree with Linné; I would have also wanted to have the twinflower as my namesake. I think it is the most beautiful flower in Finland, and it encapsulates unspeakably the whole essence of the Finnish forest. You have to see the forest for the trees! You need to look closer and in more detail. Only then can you see the enormous spectrum of details, the beauty of the twinflower. Like all things small and fragile, you have to approach it with humility. When you go down on your knees, the delicacy of the bells is manifested in all their sensitivity. Inside them is revealed red embroidery, just like small and subtle miniature painting.

I do not know by what criteria Linné chose the twinflower, but for me it has always represented not only delicate beauty but also the importance of details. It is an as inseparable part of forests as the pine, spruce, blueberry, moss or crested tit. It is one of the rare flower plants in the kingdom of mosses and lichens. It contents itself with little, and it grows in moorlands and also thrives in dry pine forests. In Lapland, it climbs to the fells in the birch zone, but it can also be found in the bare fell, amongst junipers and the last short crooked birches.

However, the twinflower reveals its finest characteristic when dusk falls. It is then that it emanates a sweet almond scent, while the summer night's magic lamp lights its flowers into a glow. They shine their dim light like street lamps above the smallest pathways in the moss.

For me, the midsummer night is not complete without the scent of the twinflower, and the glimmer of the small flower groups gives the dim the final touch. The message of the twinflower is important. The small and mundane is just as valuable as the great and rare. To coin a phrase: beauty is in the eye of the beholder. ■

The small and mundane is just as valuable as the great and rare.

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.

Photograph by Jonna Monola

Harri Kuisti of Fingrid (closest to the camera), Marko Kukkonen of Fortum and Pasi Mantila of PVO Pool thinking about the starting problems of a power plant. Fingrid's Antti Puuska is giving instructions to network companies.

The largest disturbance exercise in Finland tested co-operation

Finnish electricity companies and authorities joined their forces in arranging the comprehensive Touko 2011 exercise at the end of May. The exercise tested the co-operation between the various parties in a serious and prolonged disturbance in the power system. In the exercise, there was an imaginary blackout in the nation-wide high-voltage electricity transmission grid in Finland south of Oulu on a cold winter day.

The disturbance exercise lasting 24 hours was arranged so as to enhance co-operation and procedures between authorities and electricity companies for disturbance situations. The objective was to test the management of the overall situation and forwarding of status information to all parties in a difficult situation where much of Finland is without electricity.

The exercise was based on a realistic yet very rare disturbance in the high-voltage transmission grid. The exercise simulated an imaginary cold winter day like the ones experienced last winter. The exercise began with a wide-spread disturbance in the high-voltage grid as a result of an accident and consequent faults. Co-operation between the various parties was put to the test when electricity was restored to the high-voltage grid in stages.

The exercise involved some 200 persons and about 30 different organisations. Regional energy companies that took part in the exercise worked in their respective areas.

One of the messages of the exercise to the general public is that you should be prepared for blackouts. Local electricity companies provide advice and assistance in these matters. The Finnish Ministry of Defence has published a guide on how to cope with a long-term blackout (Pahasti poikki. Näin selviät pitkästä sähkökatkoksesta). The guide gives practical tips for consumers of what to do if there is no electricity. The guide in Finnish is available online at **http://www.defmin.fi/files/1275/Pahasti_poikki_nettiversio.pdf** ■

Sheep with a summer job again

Sheep have again started their summer work in Nokia: grazing on transmission line areas in the Hätilännotko greenbelt area and on the Luoto island. The sheep are at work for the second summer now, as good results were attained last year from the joint project between the town of Nokia, Fingrid and Vattenfall.

Environmental management with rural methods has turned out to work well in the development of open, meadow-like areas. It is often difficult to take care of sites with significant natural and landscape values by means of machines. Grazing animals can move in difficult terrain, which is why the project on environmental entrepreneurship decided to try landscape grazing in Nokia, where rural entrepreneurs produce landscaping services on Fingrid's and Vattenfall's transmission line areas.

The four-legged landscape managers began their work in Nokia in the Hätilännotko greenbelt area and on the island of Luoto at the turn of May and June. Sheep also began similar work in the nationally valuable landscape area in Vesilahti at the Kirkonkylä lakeside scenery.

Co-operation in the field of landscape management in the Pirkanmaa region has also received outside attention: the project was awarded as the best development project in the national Best Practices competition in 2010.

Management plans for a total of 16 sites in Nokia, Sastamala, Urjala, Vesilahti and Virrat have been drawn up within the project. One special area within Fingrid's transmission line areas are the meadows inhabited by the butterfly false heath fritillary in Tampere at Pohtola. Systematic management of meadows and fields in built-up areas by agricultural means represents productive and cost-effective environmental management. The co-operation at the sites will also continue after the project ends next year. ■

Photograph by Futureimagebank

More reserve power to the grid

Fingrid and Lappeenrannan Lämpövoima have agreed on the use of the Mertaniemi 2 gas turbine power plant as part of fast disturbance reserve in Finland.

The need for fast disturbance reserve will grow in 2013 when the Olkiluoto 3 nuclear power unit will be connected to the Finnish transmission grid.

The Mertaniemi 2 gas turbines owned by Lappeenrannan Lämpövoima feature a power of 2x35 megawatts. Together with the agreement for the Mertaniemi 1 power plant signed earlier, the total reserve power capacity of the power plant area will increase to approx. 100 megawatts. The plants can be started to full power from Fingrid's Power System Control Centre in 15 minutes.

The length of the agreement period is 15 years. The total value of the agreement is more than 30 million euros. ■

Energiakolmio continues as Fingrid's portfolio manager for loss energy

Fingrid Oyj and Alpiq Eurotrade with Energiakolmio Oy serving as its tied agent have signed a three-year contract on portfolio management for Fingrid's loss energy.

Fingrid's objective is to hedge itself against sudden changes in the market prices of electricity and hence secure an even and predictable grid tariff.

The service also covers trading in the emission rights of Fingrid's reserve power plants, portfolio management reporting, and hedge accounting. Fingrid continues to make the purchases of physical electricity itself by buying electricity in the electricity exchange.

Fingrid now subjected portfolio management for loss energy to competitive tendering for the fourth three-year period. The losses in the Finnish electricity transmission grid total just over 1 terawatt hours per year, which accounts for about 1 per cent of all electricity consumption in Finland. Loss energy purchases are hedged in full in advance by spreading the hedging over several years. ■

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 15 August 2011. Address: Fingrid Oyj, PL 530, 00101 HELSINKI, FINLAND. Mark the envelope with "Verkkovisa".

Among all those who have given right answers, we give 5 household energy savings packages as prizes by drawing lots.

1. The osprey nests in Finland

- only in the south of the country
- only in the north of the country
- throughout the country.

2. The new tower type developed by Fingrid for arable land is designed

- for 110 kilovolt transmission lines
- for 400 kilovolt transmission lines
- as a double circuit tower for 110 and 400 kilovolt transmission lines.

3. The acronym TYNDP is associated with

- the ten-year network development plan of the European transmission grid
- the Nordic harmonisation of imbalance settlement
- market coupling in the European electricity market.

4. How much of Fingrid's present transmission line projects are planned in the right-of-way of existing lines or parallel with them?

- 60 per cent
- 80 per cent
- 90 per cent.

5. One of the reasons why Fingrid was granted the Good EIA Award was that the Tyrnävä bird sanctuary was taken into account in route planning. This important bird sanctuary is located along the

- Ulvila–Kristinestad transmission line route
- Ventusneva (Kokkola) – Pyhänselkä (Muhos) transmission line route
- Seinäjoki–Tuovila transmission line route.

6. Trees and other vegetation in Fingrid's transmission line areas are cleared at an interval of

- 4–5 years
- 5–8 years
- about 10 years.

7. Contact voltage is a voltage

- affecting between a point touched by a person and the ground
- created by the touching of two live conductors
- created when two persons touch each other.

Name _____

Address _____

Post office _____

E-mail address _____

Telephone number _____

Winners of prizes of the Grid Quiz in the previous Fingrid magazine (1/2011): Seija Aholaakko, Imatra; Emilia Koskimaa, Rovaniemi; Manu Matila, Oulu; Reijo Pajula, Harjavalta; Liisa Sormunen, Niittylahti.

Powering Finland

NOW YOU CAN REACH US EVEN MORE EASILY!

Fingrid has opened a new easy-to-use map-based service to the general public on the company's website. Through the service, landowners and those living close to transmission lines can submit requests for action at sites pinpointed on the map, and give feedback on issues such as planned and ongoing transmission line projects. The map service also provides information on transmission line areas to be cleared of vegetation in 2011. The service in Finnish is available on our website at **www.fingrid.fi**.

FINGRID IS RESPONSIBLE FOR THE NATION-WIDE HIGH-VOLTAGE ELECTRICITY TRANSMISSION GRID IN FINLAND

About 75 per cent of all electricity used in Finland is transmitted through Fingrid's grid. Fingrid maintains the grid in good condition and expands the grid in view of the customers' future needs. The objective of Finland to reduce the carbon dioxide emissions and to increase the portion of renewable energy sources in electricity generation also calls for reinforcements in the transmission capacity of the grid.

In the next few years, Fingrid will construct almost 3,000 kilometres of new transmission lines and about 30 substations in different parts of Finland.

Welcome to our stand in Hall A (section 4) in the Farmari 2011 exhibition in Pori from 1 to 3 July to find information on transmission lines, their significance, and the impact of present and new lines on your environment. Our specialists are at the stand to answer your questions.

FINGRID OYJ

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