Corporate magazine
Fingrid Oyj
1/2004

FINGRID

Pertti Simola wishes to play IN AN OPEN FIELD

page 4

GLOOMY AUTUMN 2003 for power systems

page 8

ELECTRICITY MARKET facing major investment needs

The year 2003 brought considerable changes to Fingrid's operating environment. Directives and regulations which came into force and which are being prepared are outlining the European electricity market development. Partly as a result of these and partly due to national reasons, some major changes have been made to Finnish legislation and new amendments are being drafted.

The previous winter showed that the Nordic electricity market works. The outlook on this winter and on the sufficiency of electricity in the future have kept alive a discussion on factors which impede the Nordic electricity market mechanisms. Due to Fingrid's vital role, we are expected to contribute to the achievement of functional solutions.

The amendment of the Finnish Electricity Market Act, which entered into force in the autumn, expanded Fingrid's responsibility for the power system. The Act now contains an obligation relating to transmission system operation to maintain and develop system operation services and the transmission grid so that the conditions for efficient electricity market functioning can be safeguarded.

Even without the statutory obligation, Fingrid has followed this principle throughout its existence. The procedures developed together with issues such as grid investments in increasing the transmission capacity of cross-border connections, amounting to tens of millions of euros, are concrete indications of this. The action taken has attained general acceptance from the market.

Insufficiency of Nordic water reservoirs during 2003 represented a statistical extreme situation. Thermal power produced in Finland and Denmark was used for replacing energy which in a normal year would have been produced through hydropower in Norway and Sweden. This led to transmission needs in the grid where the transmission capacity was not sufficient in all situations.

Nordel, the co-operation organisation of the Nordic transmission system operators, has listed a dozen or so congestion locations in the Nordic grid in its Grid Master Plan published in 2002. The proper management of these locations would call for investments totalling several billion euros. The closest of such projects to Finland is the upgrading of the Fenno-Skan connection costing 250 million euros, which would be one of the smaller projects. The potential input in reducing congestions is so considerable that it would inevitably be reflected in the price level of the grid service as higher tariffs.

It can be said that such congestions which could have been eliminated through reasonable costs have been removed from the Nordic grid. From now on, there is a need for considerably more extensive input than thus far. The crucial question is whether all parties are prepared to pay for the investments needed by the improved functioning of the electricity market.

Timo Toivonen is the President of Fingrid Oyj.

FINGRID
Corporate magazine
Fingrid Oyj

7th volume
1/2004

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Published by
Fingrid Oyj

Cover picture: *"Music of silence II"* by Kristiina Lehtonen. More information on the artist on page 22.
Printed by Sävypaino
ISSN 1455-7517

In this issue

4

Pertti Simola thinks that a versatile energy production architecture is important for Finland in the future.

8

What did we learn from the power failures encountered during the autumn of 2003?

22

Kristiina Lehtonen's happy graphic art illustrates Fingrid's calendar for 2004.

Pertti Simola has looked at energy issues from the viewpoint of the senior management of the biggest single consumer of electricity in Finland since 1997.

Pertti Simola:

Finland should keep AN OPEN MIND to different types of energy production options

■ Pertti Simola, Vice President, Energy, of the UPM-Kymmene Group, feels that a possibility to build versatile energy production capacity is an important means for Finland to secure the supply of reasonably priced and sufficient energy over a long perspective. He believes that Finland, as part of the inter-Nordic power system, will cope well the foreseeable situations, such as the potential electricity production capacity problems to be encountered during this winter. "However, the market price of electricity may rise high when the weather turns really cold," Pertti Simola says in mid-December, when the weather is still mild.

TEXT BY MARIA HALLILA PHOTOGRAPS BY JUHANI ESKELINEN

The news concerning Pertti Simola's appointment as the new president of TVO, Teollisuuden Voima Oy, has just been announced. Until the beginning of May, he still views the Finnish energy outlook from the point of view of senior management of the biggest single consumer of electricity in Finland. He has held his present position at UPM-Kymmene since 1997. Before this, he worked in two other Finnish wood-processing companies and also in Ekono Oy (currently Elektrowatt-Ekono) in duties relating to power plant construction.

Concern over industrial competitiveness

As a prominent expert in energy issues, Pertti Simola regards the competitiveness of Finnish industries as one of the foremost future concerns. This competitiveness suffers from many burdens, such as the high electricity tax.

"The electricity tax paid by Finnish industries is almost ten times as high as the minimum level specified in the EU's directives. As an example, Finnish wood-processing companies pay almost 100 million euros of electricity tax per year," Pertti Simola says.

And there are new burdens coming. "We consider it a threat that alongside an electricity tax which is fiscal by nature, industries will also have to pay for emission trading."

Pertti Simola's list of topical energy policy issues also contains some positive things. He characterises the building of an additional nuclear power unit in Finland as "a great thing". Alongside this, however, he wants to raise the requirement to retain the position of peat.

"Peat is an indispensable support fuel when Finland aims to increase the combustion of wood, mainly chipped logging residues. Peat has a crucial role for instance in achieving even quality of the basic fuel," Pertti Simola says in justifying his requirement that the tax treatment and emission fees of peat should be made more equitable.

He also considers that the directives pertaining to waste combustion contain fatal stumbling blocks for small countries. Since these directives are rigidly categorical, they can even impair the utilisation of waste fractions which are less harmful to the environment.

Self-sufficiency as a morning gift

According to Pertti Simola, UPM-Kymmene's energy outlook contains no significant worries. "In 2002, the electricity self-sufficiency of our Group was approximately 70 per cent. In Finland, UPM-Kymmene's mills obtain practically all the required electricity from the company's own power plants or ones owned by our associated companies," Pertti Simola says.

UPM-Kymmene has 8 hydropower plants in Finland, which the company – as Pertti Simola puts it – obtained as a morning gift in the merger of Repola and Kymmene in 1996. The Group's main associated companies in energy production are Pohjolan Voima Oy (ownership 42 per cent) and Kemijoki Oy (19 per cent).

With its available hydropower capacity, UPM-Kymmene could cater for approx. one quarter of its electricity need in Finland in a year with a normal water situation. The Group accounts for some 15 per cent of electricity consumption in Finland.

More yield from forest energy

Pertti Simola says that UPM-Kymmene's energy matters have been managed in accordance with a determined energy strategy since the establishment of the company. According to him, the policy decisions adopted have worked so well that there has not really been a need for changes.

"One way to face the future challenges has been to increase the use of renewable fuels in energy production by our mills in Finland. This has enabled a decrease in the airborne carbon dioxide emissions from fossil fuels."

Logging residue energy has especially become a considerable replacement for fossil fuels for UPM-Kymmene. According to Pertti Simola, his Group is one of the biggest users of logging residue energy in Finland and one of its biggest purchasers.

Together with its subcontractors, UPM-Kymmene is developing harvesting technology for logging residue fuels. Pertti Simola believes that there are even new benefits which are not visible today.

One of UPM-Kymmene's main goals in its energy strategy is energy efficiency in production. In this respect, he considers that the Group has a good position with respect to its competitors. "Thanks to large-scale and modern production lines, we can produce the same amount of the end product at a smaller energy input."

Prediction skills needed

The proportion of energy costs in the production costs of UPM-Kymmene's mills range considerably depending on the product. "As an example, the energy costs in the production of sawn goods are only about 3 per cent while in the production of newsprint or magazine paper, which contain a high proportion of mechanical pulp, they are about 15 per cent, and even 20 per cent in certain products."

Due to a high degree of self-sufficiency, the share of electricity costs of all production costs have remained relatively stable.

The Group's electricity consumption grows by 1 – 2 per cent a year even though no new production lines are built. "The growth comes from increased processing degree and opening of various types of bottlenecks in production."

In describing the main duty of his unit, procurement of electricity needed in production, Pertti Simola emphasises three requirements: the economic efficiency, flexibility and reliability of energy supply. "In order to achieve these, you need to own the resources and manage them properly, and you also need modern planning tools and top expertise of personnel. You have to be able to predict both the short and medium term electricity need. At UPM-Kymmene, energy planning involves all mills, and the consumption forecasts are drawn up hourly, which is also the time unit used in electricity trade."

Electricity market liberated resources

According to Pertti Simola, electricity is a unique commodity for UPM-Kymmene in that it is a production resource and also a product which always finds an external buyer.

Even before the liberalisation of the electricity market, UPM-Kymmene was a significant seller of electricity, which sold one third of the production of its power plants to electric utilities and industries through long-term contracts.

Pertti Simola says that the electricity exchange has relieved the Group's energy business considerably. "It offered an oppor-

tunity to disengage ourselves from contractual sales, which do not represent a core business for our company."

"Use of common sense must be permitted"

The outlook for UPM-Kymmene's energy sector seems clear and positive, but the energy director also finds some causes of uncertainty. They are primarily related to changes in the operating environment, and may, according to Pertti Simola, impose not only threats but also some opportunities.

He says that right now, the EU's emission trade directive causes much headache for UPM-Kymmene and probably for many other major European industrial companies.

"We can expect to see considerable increases in the price of electricity. It is uncertain whether the price will soar to heights, but it is also unclear what other changes the emission trade directive will bring," Pertti Simola says.

He has experience of the application of directives to the conditions prevailing in a small country, and this experience gives cause for scepticism. He refers to the waste combustion directive, which prohibits the use of treated wood as a fuel in energy production.

"The categorical directive bans for instance the energy use of old railway sleepers, which are an important and very good fuel for us, in existing bark boilers. These sleepers are classified as waste, even though studies conducted by the Technical Research Centre of Finland indicate that their combustion in fact causes even less emissions than the combustion of peat," Pertti Simola points out and adds that he wishes that the use of common sense is permitted in the application of directives.

Co-operation for grid development

UPM-Kymmene is not only the biggest consumer of electricity in Finland but also the biggest transmitter of electricity in the national grid. Pertti Simola has watched Fingrid's operations first as a member of the Advisory Committee and since 2001 as a member of the Board of Directors. He says that "insider information" has strengthened his positive image of the Finnish grid operator.

"For historical reasons, the Finnish national grid is well balanced. It contains but few bottlenecks, which is why it does not cause problems to producers or consumers," he says.

"Fingrid's operations are efficient and reliable also on an international scale. I hope that it will pursue operational and grid development in the same manner as thus far."

Pertti Simola regards Fingrid's direct and regular contacts with its major customers as an important factor. "Confidential interaction concerning the future plans helps Fingrid to develop the national grid in a balanced manner, eliminate problems and hence consolidate the reliability of the national grid over a long term."

He does not agree with the recent statements concerning the necessity of an inter-Nordic transmission system operator. "I cannot imagine what benefits it could give Finnish electricity producers or consumers," he says in a determined voice.

The power failure which left Southern Sweden without electricity on 23 September also blackened out the Zealand region in Denmark. Airport personnel at the Kastrup Airport in Copenhagen instructed passengers who were awaiting their luggage in the extraordinary circumstances.

GLOOMY AUTUMN 2003
for power systems

■ Five exceptionally extensive power failures occurred in different parts of the world during last August and September. The disturbance situations had varying duration and impacts, but what was common for all of them was that they attracted great interest among authorities, media and the general public.

■ The disturbance situations complicated everyday life and the functioning of society in many ways, and the more extensive incidents caused considerable economic losses. This is why there is reason to examine the reasons and consequences of the power failures and to think what can be learned from them.

TEXT BY EERO KOKKONEN
PHOTOGRAPHS BY LEHTIKUVA, FUTUREIMAGEBANK

In line with the progress of modern society, electricity has become a vital basic commodity for people. Uninterrupted electricity supply is a necessity everywhere, especially in the most developed parts of our globe.

Uninterrupted electricity supply is influenced by the functioning of the power system at its all levels: in electricity production and consumption and in electricity networks of various levels between production and consumption. When there is a failure in the power system, the extent and impacts of the disturbance depend on the level at which the system fails.

United States on 14 August

The first one of the major disturbance incidents took place in the United States and Canada on 14 August in the afternoon, extending from the environment of Lakes Erie and Ontario all the way to New York. In the disturbance, 61,800 megawatts of consumption was lost, and the power failure concerned approximately 50 million people. At its longest, the failure lasted for more than 24 hours.

A few hours before complete blackout, production had been stopped for service purposes and because of faults. Approximately 2 hours before the failure, a 345 kilovolt line got disconnected from the transmission grid as a result of smoke created by a wildfire. During the hour preceding the failure – as a result of appropriate functioning of protection systems – several 345 kilovolt lines were disconnected from the grid in a cascade in the environment of Lake Erie, which caused extensive voltage and power oscillations in the grid. The disconnections were caused by overloaded lines, and at least in one instance by the line touching a tree top.

The cascade reaction continued, and lines and power plants were disconnected alternately from the system, until a wide area no longer had sufficient production to cover consumption, and there was no grid available for transmitting electricity.

Several grid and power companies are responsible for the power system in the area covered by the power failure. The events which led to the failure began to spread to the area of First Energy, a company operating south of Lake Erie, from where it spread to other grid areas. In the affected area, there are also four system operators (such as MISO and PJM), which take care of the daily reliability of the power system.

The analyses carried out after the failure have not disclosed considerable shortcomings in the co-operation between the various organisations during the disturbance, although the procedures and co-ordination between MISO and PJM at the connection points of different areas were insufficient. It has also been found that First Energy had distinct defects and shortcomings in its operation control system, for instance in the handling of alarms and in analysis tools. Moreover, management of trees in its transmission line areas has been insufficient (touching of lines with tree tops).

The operation control system of system operator MISO failed partly, which is why it was not able to follow the progress of overloading in the lines in real time. These shortcomings ultimately led to the total power failure of an extensive geographical area on 14 August. Within a few minutes, several rapid and large-scale changes took place in the power system, and these changes were already beyond control.

Helsinki on 23 August

Just over a week after the disturbance in the United States, a power failure occurred in the Helsinki region in Finland on 23 August at 20.22, also affecting partly the areas of Vantaa, Kerava and Sipoo. Electricity distribution was restored to normal within just over one hour after the beginning of the disturbance.

The failure started when an underground cable was made live after maintenance work. An earthing switch which was forgotten closed caused a three-phase short circuit at a 110 kilovolt substation.

These types of fault locations are normally separated from an intact network by means of protection systems. However, the first zone in the protection system of Helsinki Energy's 110 kilovolt network did not work, and the second zone protection did not have enough time to function before the circuit breakers of 400/110 kilovolt transformers activated at the closest substations in the national grid in the third zone of the protection system within 0.8 seconds.

The protection system of the national grid worked as planned. It is absolutely imperative that the type of

failure encountered in Helsinki must not spread to the national grid.

London on 29 August

Just under a week from the disturbance in Helsinki, on 29 August towards the evening, a power failure in London covered large areas of South London and parts of Kent. The failure caused very much harm both in overground and underground rail traffic. Electricity distribution was restored within 45 minutes.

The disturbance was preceded by a fault alarm of a transformer at a substation in South London. The transformer in question was disconnected on the basis of the alarm, and electricity transmission in the area continued without problems after this. Soon after this, an underground 275 kilovolt cable between adjacent substations got disconnected as a result of a fault. This resulted in a regional power failure since the switching on of back-up systems failed.

Sweden on 23 September

A month after the power failure in Helsinki, on 23 September after noon, there was a disturbance which left Southern Sweden and Zealand in Denmark without electricity. Almost 5,000 megawatts of consumption was lost in the power system, and the power failure concerned almost 3.5 million people for approximately seven hours at its longest.

The power failure was due to two consecutive mechanical faults in the Swedish power system. First, a valve failure stopped unit 3 at the Oskarshamn power plant in a situation where its production power was approx. 1,200 megawatts. Five minutes later, a mechanical fault occurred in a disconnector at the Horred substation near Gothenburg, which led to the collapse of the latticed body of the disconnector, causing a short circuit in both busbar systems as the disconnector body fell down. The protection system disconnected the entire substation from the other parts of the grid, and units 3 and 4 at the Ringhals power plant which were connected to the substation stopped while the production power of the plant was approx. 1,800 megawatts.

The transmission grid did not withstand the overloading and oscillation caused by the stoppage in production, but the circuit breakers on the connections leading to Southern Sweden opened, causing the area to be left without electricity. At the same time, the Zealand region in Denmark was also left without electricity, because it was completely dependant on the power system in Southern Sweden at that time.

Italy on 28 September

The most recent major power failure last autumn took place in Italy on 28 September in the night. In the situation preceding the disturbance, consumption was approx. 24,600 megawatts, of which imports from the neighbouring countries accounted for almost 6,700 megawatts. At its longest, the power failure lasted for almost 20 hours.

The disturbance started during maximum imports, when a line feeding one of the two cross-border transmission connections between Italy and Switzerland got disconnected from the grid on the Swiss side of the border as a result of a tree touching the line. The reason for touching was either an elongation in the conductor caused by overloading or poor management of trees growing in the right-of-way, or both. An analysis into the basic reason still continues.

The disconnection of the line led to considerable overloading in the remaining connection. Analyses carried out after the disturbance suggest that it would have withstood this for approximately 15 minutes. However, the measures required by reduced transmission power were delayed, and the conductors stretched as a result of the overloading and ultimately touched trees. The protection system of the line worked, and the line was disconnected from the grid. After this, the disturbance progressed as a cascade reaction as the transmission powers of lines grew, and the lines were disconnected from the grid one by one as a result of overloading, ultimately separating the entire power system in Italy from the power system in the remaining parts of Europe and leaving the country without electricity.

What can we learn from these incidents?

The analyses concerning the disturbance in the United States have found that the operational reliability of the transmission grid has deteriorated over the years as the investments have not followed the pace of increased electricity transmission needs. It has also been found that it is necessary to develop management of vegetation in the transmission line areas, maintenance of a sufficient voltage level in the power grid, communication between various organisations, reliability of operation control systems, operators' disturbance clearance instructions, and practical exercises.

Even though the disturbance incidents in Helsinki and London were significant as they concerned the national capital areas, they cannot be compared to the grid level disturbances encountered in the United States or Italy. The disturbance situations in Helsinki and London were restricted to a relatively small regional network, and they were caused by relatively distinct misoperations or technical faults.

Based on the experiences gained from the disturbance in Helsinki, the compatibility of protection systems of various network operators and the functioning of all protection zones in various network switching situations will be verified. In London, the operational reliability of backup systems will be verified and developed.

The disturbance in Sweden was caused by two consecutive mechanical faults, which is why this disturbance cannot be compared directly to that in the United States, either.

As a result of the disturbance in Sweden, the issues developed include verification of rules concerning the operational reliability of the power system and technical requirements imposed on power plants, improving the busbar system at the faulty substation, reinforcing the transmission connections leading to Southern Sweden, intensifying the supervision of disconnectors, improvement of maintenance procedures, ensuring the functioning of remote control, and verification of communication procedures.

In the initial situation in Italy, there were some indications of potential overloading in the grid and of insufficient management of vegetation in the right-of-way. The disturbance progressed like a chain reaction, and it concerned several system operators, which is why it had many similarities with the disturbance in the United States.

As a result of the disturbance in Italy, UCTE, the co-operation organisation of European transmission system operators, has introduced new issues for development. These include verification of design criteria of the power system, verification of operative regulations and disturbance clearance instructions, grid stability analyses, and data exchange and communication between system operators.

Causes and consequences

The only clear common factor between the disturbance situations described above is total power failure. The progress of the disturbance in the United States and Italy had more common features than the other incidents. The other disturbance incidents were triggered either by a clear human error or by failed technology.

The liberalisation of the electricity market is not a valid reason for the disturbance situations. Insufficient co-operation and communication between system operators cannot be considered as a direct consequence of the opening up of the electricity market. The issues requiring further development after the power failures contain some similarities, but there are also differences caused by different types of power systems and operating environments. When examining the list of development issues, however, it can be seen that the failures have provided a due lesson.

The economic impacts of the power failures were enormous, since a total of approx. 93,000 megawatts of electricity consumption was lost in the power system in all of the above disturbance situations, and the longest power failure lasted for as long as 24 hours. In a Swedish analysis, it has been estimated that a power failure costs 5 euros per kilowatt hour in economic losses, which would mean that a power failure of one hour at the above power would cost more than 510 million euros.

The disturbance situations complicated the everyday life of people in many ways, and even caused deaths. System operators – not just those inflicted by the above power failures – aim to improve the operational reliability of power systems in order to prevent disturbance situations such as those described above in the future. This may also mean the building of new lines and substations. Projects such as these inevitably have some environmental impacts, which need to obtain approval from society.

New year brought a

DIRECT ROUTE TO THE REGULATING POWER MARKET

As of the beginning of 2004, the electricity market parties have been able to participate directly in the regulating power market maintained by Fingrid, which is part of the inter-Nordic regulating power market. The new opportunity is expected to increase regulation bids especially during peak loads.

TEXT BY PASI AHO AND ANDERS LUNDBERG
ILLUSTRATION BY TUIJA SORSA

How does the regulating power market work?

Fingrid is responsible for the continuous power balance between electricity production and consumption in Finland. In order to achieve this power balance, Fingrid maintains a regulating power market to which holders of production and loads can submit bids concerning their capacity which can be regulated.

Through the regulating power market, Fingrid can, whenever necessary, increase electricity production/reduce electricity loads or vice versa as required by the prevailing operational situation.

How is a bid submitted?

In the regulation bid, a holder of capacity shall state the following information on the capacity to be regulated: power (MW), price (euros/MWh), and the transmission area where the offered resource is located (north or south of 64° latitude).

Bids can be given from the beginning of the calendar day which precedes the hour under offer. The bids can be changed and cancelled up to 30 minutes before the beginning of the particular hour. After this, they become binding.

The bids are submitted to Fingrid using a specific web application developed for this purpose.

What are the technical requirements?

The offered regulation shall be capable of being implemented during the entire hour in question. The minimum capacity of one bid is 10 MW.

The offered regulations shall be capable of being implemented up to their full capacity within 10 minutes from the moment on which the order was placed. A corresponding time is valid when the regulation is potentially finished before the end of the hour. In any case, the regulation finishes at the end of the hour.

How are the bids used?

The regulation bids submitted to Fingrid for each hour are delivered to the Nordic regulating power market, where a Nordic regulating curve is established on the basis of all regulation bids by putting the up-regulation bids in order using the principle of placing the cheapest bid first, and the down-regulation bids are put in order using the principle of placing the most expensive bid first.

For balance management and maintenance of frequency, the bids are usually used in the price order in accordance with the Nordic regulating curve.

When it is time to activate a Finnish regulation bid, Fingrid places the regulation order by telephone. At the same time, the power and the starting moment of regulation are also agreed upon.

What changes now?

Until now, only balance providers have been able to participate in the regulating power market. A capacity holder who is not a balance provider has been able to submit bids to the regulating power market through its balance provider.

As of the beginning of 2004, a capacity holder has been able to submit regulation bids to the regulating power market also directly. This requires that the capacity holder has an agreement with Fingrid on participation in the regulating power market.

Why the reform?

In line with the reform, Fingrid hopes to obtain more capacity that can be regulated in the regulating power market especially from load holders, and consequently new tools for balance management. At the same time, the electricity market parties have more opportunities to utilise commercially their capacity that can be regulated.

Interested in co-operation?

More information on balance management, regulating power market and bidding rules is available at Fingrid's www pages at www.fingrid.fi or by contacting Fingrid's Balance Service Unit (Pasi Aho, tel. + 358 (0)30 395 5262 or Anders Lundberg, tel. + 358 (0)30 395 4171). Fingrid's www pages also contain the agreement template required.

In 2003

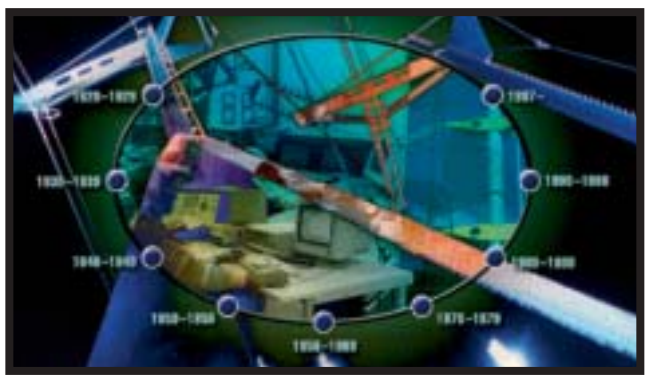
– 4,046 down-regulations were carried out in Finland

– 5,039 up-regulations were carried out in Finland. The average regulating energy was 39 MWh per regulation.

The multimedia presentation links the phases of the Finnish national grid to past phenomena and everyday life.

Knowledge and MEMORY THEATRE

on the milestones of the grid and history of time



A new type of a view of the history of the Finnish electricity transmission grid will open this spring. A CD-ROM multimedia presentation which is currently being finalised describes the milestones of the Finnish grid through versatile and modern means, offering links to the various eras.

Alongside text, there is much moving image, sound and photographs. According to Tuomo Olkkonen, who has compiled the material, the presentation represents memory theatre where one memory trace leads to another.

TEXT BY REIJA KURONEN PHOTOGRAPHS BY PHOTOGRAPHIC ARCHIVES OF ELECTRICITY MUSEUM ELEKTRA AND JUHANI ESKELINEN

The CD-ROM published as the result of active research and compilation which took approximately 18 months is a general and concise information package of the past decades of the Finnish electricity transmission grid, from the 1920s onwards. Alongside the geographical expansion of the grid, developments in working methods applied and descriptions of people who built the grid, Tuomo Olkkonen creates an idea of the past decades on a general level by linking the phases of the transmission grid to past phenomena and everyday life.

Significant historical works on the development of the transmission grid in Finland have been published earlier, but this work describes in parallel the building of transmission lines by Imatran Voima, the government-owned power company, and lines built by industries. The description of working methods has an especially central role in the presentation.

"I have had a great opportunity to draw up the first general presentation of the building of the national transmission grid in Finland," Tuomo Olkkonen says.

The figures describing electricity production and consumption at different times indicate how the Finnish industries grew and how the standard of living in Finland rose. At the same time, you can see how the degree of electrification of households developed in towns and in the countryside.

Grid building was the first national major project

The building of transmission lines commenced soon after Finland had become independent in 1917. This was required by the rapid industrialisation process which took place in Southern Finland between the World Wars, during which time the standard of living in Finland rose quickly.

As a result of the Second World War, Finland lost many of its power plants and parts of its transmission grid. These were replaced after the war by new hydropower plants built in the harnessed rapids in the rivers Oulujoki and Kemijoki in Northern Finland. These power plants provided electricity which boosted the growth of industry even further. In fact, the building of the major transmission lines from north to south is one of the foremost milestones in the expansion of the Finnish grid.

Tuomo Olkkonen says that Finland has quickly adopted the most recent technological developments for more than 100 years now. Transmission voltages tested in other countries were soon applied in the building of the Finnish grid. The main turning points include the introduction of the 110 kilovolt line in the 1920s, the 220 kilovolt line introduced in the 1940s, and the 400 kilovolt line introduced in the 1950s. "Successful execution of these projects goes to

There is extensive photographic material in the presentation. The work also contains 15 video clippings.

prove the great skills of Finnish engineers and builders," Tuomo Olkkonen states.

Electric light in homes was a symbol

The past phenomena are linked to the growth of the transmission grid. Technological advancements provided opportunities which changed the everyday life of people in concrete ways. As an example, the introduction of electric light into more and more homes between the World Wars was a symbol of those days, says Tuomo Olkkonen.

In addition to the history of the transmission grid and descriptions of everyday life, the past atmosphere is also conveyed through literary and music samples. There are descriptions by contemporary writers on the phenomena of the respective periods, treasures from the Finnish Film Archive, and musical performances. Especially the song about a mechanic by Rafu Ramstedt is a treat; a transmission line mechanic from the south shows off at the top of a tower and steals a bride from a local boy!

Graphic and general presentation

Tuomo Olkkonen's work creates an overall view of the decades during which electricity became an inseparable part of Finnish life, society and culture. The work is a graphic review of the development of the Finnish society over a time span of more than 80 years.

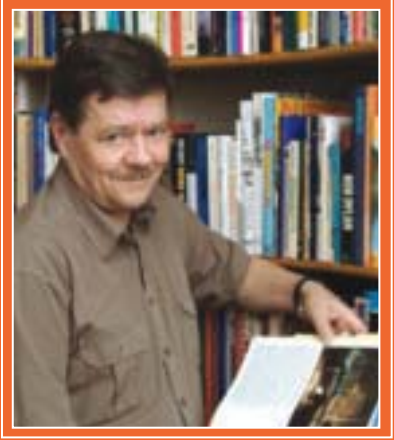
Alongside extensive photographic material, the past decades are described by 15 video clippings, the oldest ones of which illustrate the building of the transmission lines leaving from the Imatra Power Plant in the 1920s. The sound samples also add up to the overall presentation.

Tuomo Olkkonen has compiled most of the material used in his studies from the archives of Fortum, Pohjolan Voima and Electricity Museum Elektra. The visual design of the presentation was in the hands of Advertising and Communications Agency BBO, and Mediakeel Oy was responsible for the technical implementation.

And since the presentation is a multimedia work, it does not finish at 2003! The link page of the CD-ROM provides access to Fingrid's Internet pages to view the current state of the national transmission grid.

Tuomo Olkkonen is a Master of Social Sciences, researcher and historian, whose previous work was the history of A. Ahlström Osakeyhtiö, also published as a CD-ROM. His articles have been published in several Finnish encyclopaedias, and he has compiled videos on the history of Finland from the treasures of the Finnish Film Archive.

Tuomo Olkkonen has been involved in putting together various exhibitions describing the history of everyday life, such as the jubilee exhibition of the Council of State in 1984 as well as the Jukola – Jakomäki – Brussels exhibition at Science Centre Heureka in 1992.



Fingrid's present facilities in Varkaus are located at Päiviönsaari. When completed, the building was the biggest stone building in Varkaus.

Olli Tynkkynen, Senior Pastor, is satisfied with the location and size of the new facilities of the Parish of Varkaus.

Valuable property gains new occupants

Parish of Varkaus moves into Fingrid's facilities

The Parish of Varkaus has purchased Fingrid's office in Varkaus in Eastern Finland. The parish will move into the real estate located at Päiviönsaari in Ahlströminkatu during the coming spring. The facilities became unnecessarily large for Fingrid, which outsourced its maintenance operations in Eastern Finland, among other things, in conjunction with operational development a few years ago.

TEXT BY LENI LUSTRE-PERE
PHOTOGRAPHS BY JUHANI ESKELINEN AND MUSEUM OF VARKAUS

Fingrid's facilities, which were originally designed for 20 persons and for control room operations, became clearly too large when the number of personnel in the office decreased to seven. Fingrid's employees will move to their new office at Wredenkatu 2 in early March.

Declaration of Christmas peace from the balcony

Olli Tynkkynen, Senior Pastor of the Parish of Varkaus, is satisfied now that his parish will obtain new facilities, which are both larger and have better location than the former premises.

"I have never seen such unanimity in parochial decision-making as in conjunction with this transaction. Both the parochial church council and the personnel of the parish have had identical opinions about the purchase."

He thinks that the decorum of the building breathes with permanence which is in conformance with the objectives of the parish. Another interesting trait is that the building was completed in 1931, the year when the Parish of Varkaus also became independent.

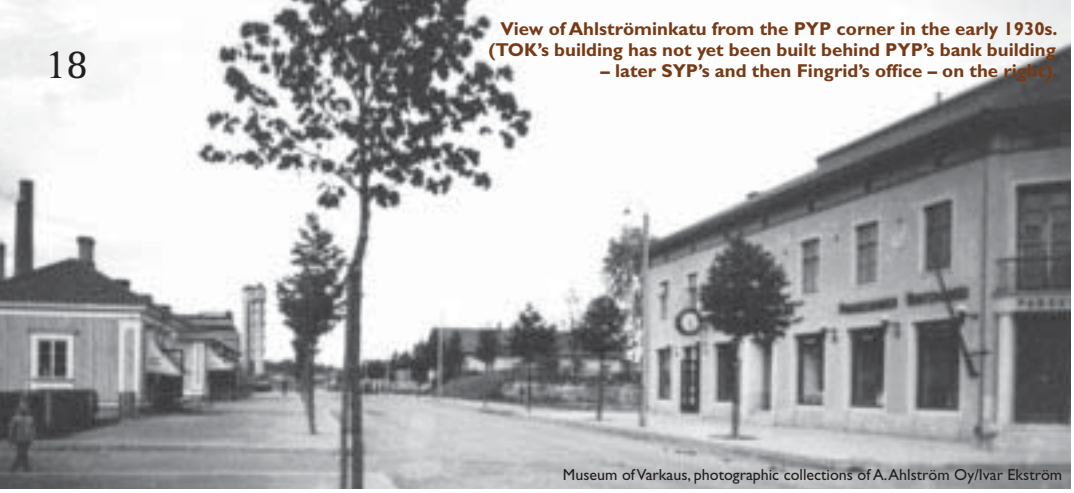
New traditions relating to the building are also being planned: "Maybe next Christmas we can declare Christmas peace to the people of Varkaus from the corner balcony of the building!"

Easier work and contacts

Olli Tynkkynen is especially pleased with the fact that all employees of the parish, who are now working in three offices in different parts of the town, can be located in a single building. "This naturally makes everyday work easier, and it also contributes to the atmosphere of the workplace," he states.

The parishioners also benefit from the centralisation: they can take care of all their matters in a single place, and the luminous facilities actually beckon you to sit down for a while, to be heard.

According to Olli Tynkkynen, the Parish of Varkaus has many challenges. "Unemployment is still a big problem, even though we have come down from the very high unemployment figures of the early 1990s. People suffer from



View of Ahlströminkatu from the PYP corner in the early 1930s. (TOK's building has not yet been built behind PYP's bank building – later SYP's and then Fingrid's office – on the right).

Museum of Varkaus, photographic collections of A. Ahlström Oy/Ivar Ekström

Museum of Varkaus, photographic collections of A. Ahlström Oy/Ivar Ekström

View of Ahlströminkatu and Antinpuisto. PYP's building on the left, post building (currently serving as a music institute) built in 1931 behind it, and on the right a residential building called Weikkola for bachelor clerks of the mill, completed in 1919. Weikkola currently houses Osmo Kaulamo Engineering.

At Fingrid's modern office, time is still measured by a fine old clock dating from days before digital displays.

anxiety and despair, and we try to help them and alleviate their fears. Alongside modern problems, even events which took place as far back in time as during the Civil War of 1918 continue to trouble people's minds. These scars are still unbelievably sore."

Building on former hunting grounds

The building protected by the National Board of Antiquities is located centrally at Päiviönsaari, which used to constitute the original centre of Varkaus.

The history of Varkaus dates back as much as 500 years. In the 16th century, men of power are known to have longed for the rich hunting and fishing grounds in the Varkaus region. **Erik Fleming** purchased an estate by the name of Varkaus to be able to hunt and fish in its grounds. A bailiff took care of the estate while Erik Fleming only used the estate during hunting and fishing trips.

The origin of the name of Varkaus (theft) has puzzled people's minds throughout times. One story has it that a gang of thieves who escaped from Savonlinna raged in the region, hiding their stolen treasures at Varkausmäki. On the basis of findings made in Lapland, it has also been suggested that the name comes from the Lapp word vuörka, which means a hiding place.

Naval base enlivened the region

It is certain that the Varkaus region has been inhabited for a long time, at first temporarily in conjunction with fishing and hunting trips and during temporary farming. The natural resources of the region were well known, which is why the Crown took over the rapids of Varkaus, and successful fishing and hunting trips were made to the region from Savonlinna, the administrative centre.

Life in Varkaus gained new vigour at the end of the 18th century when the Laivalinna naval base was established at Päiviönsaari. This turned Varkaus into a lively trading and market centre which gradually assumed urban characteristics.

Hydropower brought industries

Varkaus has always benefited from its powerful rapids. The height of the Ämmänkoski rapids is 4.6 metres, and the flow rate in the rapids is between 100 and 200 cubic metres per second. It was therefore no wonder that the rapids were soon harnessed for industrial uses.

One of the foremost industrialists locally was **Walter Ahlström**. Originally small-scale ironworks evolved into A. Ahlström Oy, an industrial corporation engaged in several fields of industry.

Local life also changed in line with industrial advancements. People came to work in Varkaus, and the workers needed housing and services both for physical and social needs. At first, the mill took care of all services required by the community: doctor, hospital, school, public order, rescue and poor relief. When Varkaus obtained borough rights

View of Ahlströminkatu at the turn of the 1940s and 1950s. The low market hall buildings are shown on the left, and A. Ahlström Oy's office buildings and mills are further down. Sawmill structures designed by Alvar Aalto, completed in 1946 – 1947, can be seen between the trees. In the middle are Toritalo and Shell's service station, and PYP's and TOK's buildings are on the right.

in 1929, these services were shifted to the borough.

Päiviönsaari as it was during the ironworks, with its sandy roads and wooden buildings in a forest environment, is now only a memory, and even the commercial centre of Varkaus has shifted to the other side of the bridge. However, there are clear signs of Päiviönsaari regaining some of its former status: the area is developing again.

Biggest and most handsome stone building in town

The history of Fingrid's Varkaus office, which has now been purchased by the Parish of Varkaus, is related to the development of banking as a result of higher industrial activity in the region. A bank was needed in the region as early as the 19th century. The matter took some time to develop, and in 1907, a nation-wide newspaper published an article which demanded a bank in Varkaus.

The bank was established three years later, in 1910, when the 51st branch of Suomen Yhdyspankki was opened in Varkaus. The bank first operated in the canal cashier's office, managed by **Vilho Tähtinen**, who served as the canal cashier. The bank soon obtained facilities of its own in Längman's house, which also housed the local post office. Nine years later, it moved to another nearby building, and Yhdyspankki's own building was completed at Päiviönsaari in 1931 amidst the recession.

Upon completion, the building was the biggest and most handsome stone building in Varkaus. The customers were served by three women clerks and a manager. In the early years, part of the building was rented to other businesses. The building has housed a drapery retailer, a jeweller's and a milk shop, among others.

When the bank expanded, it opened two branch offices in Varkaus. In the mid-1960s, the head office was also enlarged, and the entire building was renovated for the bank's own uses, also with a canteen for the bank's personnel.

The building was renovated again in 1979 by building more office space and by enlarging the downstairs facilities into a large bank hall. One entrance was replaced by a window. The bank operated in the building until 1993. When the bank moved to the Taulumäki office, two cash dispensers were installed in the building.

Renovation was a cultural contribution

Fingrid purchased the building in 1996 and renovated the valuable property using appropriate methods and materials. The building was included in the list of buildings to be protected in Varkaus, i.e. it must be preserved, and it must absolutely not be demolished. The interior of the building was revised completely, while the exterior appearance was retained in terms of the colours, windows, doors and roof structure.

One indication of the successful modification of the interior is a report by the association of local master builders, which was published after the building had been chosen the Building Project of 1997 in Varkaus: "The modifications have been carried out in style, beautifully and respecting the building in every small detail." The committee which appraised the building characterised the renovation as "successful cultural contribution which retains local building traditions at Päiviönsaari well into the future."

Sources:
- *Varkaus ympäripyöreästi: pyrähdys paikkakunnan historiaan*. Business Services of Varkaus, Cultural Services of Varkaus, and Museum of Varkaus 1999.
- *Varkauden teollisuus 175 vuotta*. Pentti Moilanen. Publications by the Museum of Varkaus IV. Pieksämäki 1999, Raamattutalo printing house of Sisälähetysseura.

IN BRIEF

Fingrid agreed on the updating of the XA/21 operation control system with GE Energy Services. At the back from the left: Peter Macro of GE, and Timo Toivonen and Erkki Turu of Fingrid. Front row from the left: Henry B. Stueber and Magued Eldaief of GE, and Eero Kokkonen and Matti Tähtinen of Fingrid.

Fingrid's operation control system to be updated

■ Fingrid has signed an agreement on the updating of the XA/21 operation control system with the system supplier GE Energy Management Services, Inc. (former GE Harris).

The update will enable an IT system structure with a better operational reliability and performance, capable of supporting the current operational model applied to grid operation in particular, and at the same time securing the functional backup procedures between Fingrid's Power System Control Centre and Network Control Centre. Moreover, the update will enable the introduction of new applications, and it offers high-quality data exchange in terms of data security with external systems and users.

The updating project will commence immediately, and the updated operation control system will be in use by the end of 2005. The total value of the project is approx. 7 million euros.

Fingrid's project team is headed by Erkki Turu, and the steering group comprises Eero Kokkonen, Kari Kuusela and Matti Tähtinen. The new functions and properties introduced through the update will be tested within a reference team consisting of various end user groups.

Reservations for cross-border transmissions from Russia confirmed

■ A total of 350 megawatts of electricity transmission capacity on Fingrid's cross-border connections from Russia have been confirmed for two importers.

Fingrid has confirmed an electricity transmission reservation of 100 megawatts for OstElektra GmbH and a reservation of 250 megawatts for RAO Nordic Oy. The reservations have been made in accordance with an account provided by RAO EES Rossii, the Russian company responsible for grid and cross-border transmission, and in accordance with its transmission capacity reservation terms. The transmission reservations have been effective as of the beginning of 2004.

1,050 megawatts have now been reserved of the total commercial transmission capacity of 1,300 megawatts on the cross-border connections from Russia as of the beginning of 2004. The remaining portion of 250 megawatts has been contracted to Scaent AB till the end of January 2004. This capacity portion can be reserved again as of the beginning of February.

New balance service agreements for a two-year period of 2004 – 2005

■ Fingrid has signed new two-year balance service agreements for 2004 – 2005 with a total of 24 balance providers.

The main changes to the former agreement include a reduction in the monthly fee, extreme situation fee introduced for extreme situations in balance management, balance providers' obligation to correct a significant balance deviation quickly, change in the calculation principles of guarantees, and shortening of balance settlement deadlines. The agreement contains an option of extending it until 2006.

New balance providers who started on 1 January 2004 are RAO Nordic Oy and OstElektra GmbH. Norsk Hydro Produksjon a.s, Sempra Energy Europe Ltd as well as Satapirkan Sähkö Oy, which starts to use Energiameklarit's open delivery, finished as balance providers.

The new balance service agreements can be viewed on Fingrid's Internet pages at www.fingrid.fi under Services/Balance services, and a list of balance providers and other market parties can be found under Electricity market/Balance settlement.

Learning about procedures in REGIONAL NETWORK SEMINARS

During the spring and autumn of 2003, Fingrid arranged regional network seminars in a total of 15 places, with approx. 250 representatives of Fingrid's partners from various energy companies participating in the seminars. The purpose of the seminars was to jointly examine the principles and procedures applied to the operation of Fingrid's 110 kilovolt network.

TEXT BY PEKKA NIEMI ILLUSTRATION BY TUIJA SORSA

The management of the power system and the principles applied to its operation have undergone great changes over the past few years. However, the development of the electricity market and introduction of new procedures have not changed the underlying facts. The equipment and lines require maintenance, and disturbance situations occur just like before.

There are approx. 60 owners of networks at the 110 kilovolt voltage level, and the number of points where the national grid and networks owned by other companies intersect with each other exceeds 500. Continuity and safety call for jointly agreed and accepted concepts and procedures.

Demand for information

Feedback was gathered from the seminars so that their success could be evaluated and so that network operation could be developed further. Opinions and views were asked of issues such as clarity of network operation, outage planning, informing about disturbance situations, and needs to develop safety and operational reliability.

The feedback gained indicates that the events were successful. They were considered as necessary, and they seemed to have matched up to the expectations. The participants wished that similar events would be arranged in the future, too. The topics to be discussed in these should include matters pertaining to responsibilities, safety, operational reliability and other topical issues.

The participants were generally fairly satisfied with the outage process applied to the national grid. Tight schedules and the contents and distribution of outage documents arouse some criticism. Fingrid was expected active interaction with its customers and more visits at the customer's facilities.

The feedback shows that informing about automatic reclosing and voltage dip occurring in the national grid require more improvements than other matters. The disturbance statistics added to Fingrid's Internet pages in early summer were regarded as a considerable improvement. Through these, especially those parties who are not directly connected to the national grid obtain information on disturbance situations quicker than before. The participants also wished to obtain real-time information on all disturbance situations occurring in the national grid.

Continued events and improvements on the way

The positive feedback gained from the network seminars encourages Fingrid to continue these types of events. There will be new seminars, and alongside operational issues, they will also focus on maintenance principles.

Information exchange between the parties will be enhanced through Fingrid's Extranet service on grid operation, which is currently being planned. The Extranet will provide up-to-date information on issues such as outages and disturbance situations.

"Necessary event"

Pasi Heinonen of Lahti Energia Oy participated in the regional network seminar in May in Hämeenlinna.

"I think that the event was successful and necessary. Fingrid has a vast number of equipment, and they have thought out the related procedures accordingly," Pasi Heinonen says. He has also participated in Fingrid's transmission technology seminar. The information obtained from this has been used at Lahti Energia in many issues, including the maintenance of transformers.

"I am interested in the principles of large-scale disturbance management," Pasi Heinonen also says.

Enchantingly silent images

FROM THE BIG PICTURE BOOK OF LANDSCAPE

The air is full of the scent or winter. A sharp wind predicts snow – at last. Kristiina Lehtonen, the graphic artist, views the skyline at Fiskars with anticipation and an open mind. For her, changes in the natural environment and in the surrounding landscape constitute part of that big picture book from which she takes the motifs for her delicate works.

TEXT BY: LENI LUSTRE-PERE PHOTOGRAPHS BY: JUHANI ESKELINEN

The eyes of the artist who illustrated Fingrid's calendar for 2004 see countless small things in the environment, details which burst into new kind of life in pictures.

"I love details," Kristiina Lehtonen says. She sprinkles these details in her images skilfully, as almost indiscernible elements.

These details can include, like in the January image in the calendar, rabbit trails between the dusk of trees or an Ural owl standing in guard among the branches. Or that tiny and watchful ermire which serves as audience to the lonely maestro in snowfall in the December image entitled "Hiljaisuuden musiikkia II" (Music of silence II). In Kristiina Lehtonen's images, the seeker is given the pleasure of finding.

Quiet and "born old"

The images in the calendar have been made using a metal graphics technique called etching aquatint. "This technique suits me well, because I like to work with details. It is also fascinating that you only see the final result after several etching times."

At the moment, making art is a pleasant profession for Kristiina, but this has not always been so. "I never thought that I would draw for a living. Somehow the pieces have just fallen into place, and here I am," she says in her shop in Fiskars, and adds that her dream job would be a light-

house keeper. ”But there is no occupation like that anymore now that everything is automated.”

Her second favourite job would be one of a nature scientist – one carrying out field research preferably in the archipelago. ”I am a pure hermit by nature. I love peace and silence more than anything else.”

Kristiina Lehtonen says that a predilection for silence and simple life are natural features in her. The modern media parade and all-prevailing consumption only cause anxiety.

”I think I was born old. In fact, I should probably live in the 19th century, because I cannot throw anything away. This is naturally in conflict with the fact that as the mother of three children under the age of 4 I do understand and appreciate things that were not available in those days. Functioning health care is one of these things.”

Art is everyday joy

Kristiina Lehtonen has a practical and calm attitude towards her work. ”People tend to talk about art as something refined and cultured, and maybe some prefer to regard it as the privilege of the few. However, that is not what creativity is all about. Each person is creative, and this manifests itself in everyday things and deeds. Some people are good at interior decoration, someone else can set the table beautifully, and some can use their words skilfully. It is really nothing more complicated than that.”

Kristiina Lehtonen wants to have colours, joy and people in her works. ”I want to produce balanced pictures, and I cannot produce them if I am angry. When I make art, I must feel good; after all, I do not wish to look at other people’s therapy sessions on my walls.”

Years ago, she made black-and-white images, which were downright gloomy in some people’s eyes. ”I guess I was trying to find myself back then. Luckily, I had good teachers who guided me in the right direction, to finding my own style and to the feeling of genuine achievement. I do not consider myself as a true artist in the sense that I would burst or perish if I could not create and make art at all times.”

Hermit in the archipelago… some day in the future

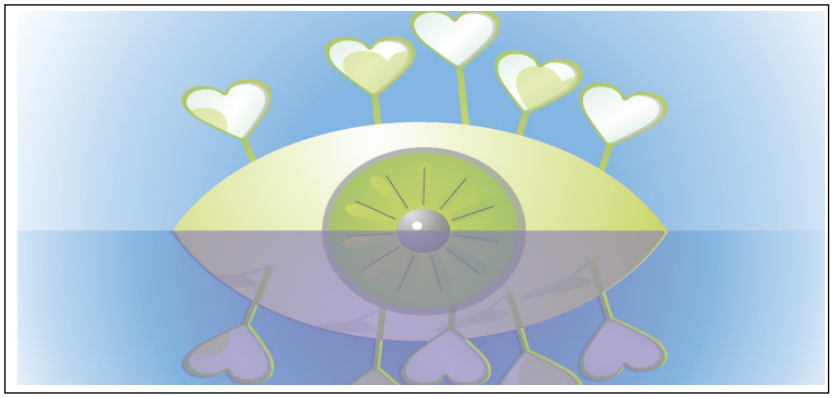
Born in Pori on the west coast of Finland, Kristiina Lehtonen says that she has settled in well at Fiskars, even though she would like to live in the archipelago some day – there is an eternal hermit inside her.

Fiskars, situated some 100 kilometres west of Helsinki, is an old ironworks community. She says that together with her husband, she drifted to Fiskars, currently an artisan, designer and artist community rewarded with the Europa Nostra award, almost haphazardly.

”We came here when my husband got a job here. We live in a house built at the end of the 19th century and really like it here. The windows offer a view of a forest, and deer tend to eat the apples straight from the apple trees. Here, I am living a forest phase, the time for the archipelago phase will come one day.”

Kristiina Lehtonen’s Galleria F is one of the many art and craft shops at Fiskars.

Kristiina Lehtonen
• Born in 1967 • Studies: Pori Art School 1988 – 1992 • Graphic artist, illustrator; ”happy graphics” • Lives and works in Fiskars, Finland • Several joint exhibitions in Finland and other countries since 1991; private exhibitions in Finland include an annual summer exhibition in Fiskars at Galleria F • Works in collections such as: State art collections, Town of Rauma, Porin Saskiat ry., Satakunta Co-operative Society, Tammiharju Hospital (Tammisaari), House of Humour and Satire in Gabrovo (Bulgaria), First Fund of Modern Prints (Rumania)



About beauty, truth and goodness

Since a small child, I have been interested in geography and anthropology and their research subjects, i.e. the Earth and various communities and cultures. It is fascinating to see how variform our planet is and how abundantly rich the spectrum of various races, nationalities and tribes is. The histories, traditions and dwelling areas of Finns and Finnic peoples alone provide much to wonder. I am happy that I have had an opportunity to see breathtakingly beautiful sceneries in different parts of the world, and I am happy that I have been able to see the beauty in people.

Indeed, there are many types of beauty. You have probably noticed how beautiful an African, Asian or Latin American person, woman or man, can be. European and North American eyes must obtain new messages from the mind, thinking, from changed attitudes. What may have previously been considered as ugly and of minor value may in fact be beautiful and valuable.

Beauty may also be concealed, more difficult to find, but it is all the more magnificent when it is found and when it surfaces. It is awesome to come to comprehend that a person, who is certainly thought by many to be "ugly", has in fact an infinitely beautiful gaze or beautiful words or beautiful deeds. It is certainly so that beauty and ugliness are proportionate qualifiers, or as the old saying has it: "Beauty is in the eye of the beholder".

I don't know whether it's all down to ageing, but during the past few years, I have noticed how the "ugly" months of the year, November and April, are in fact beautiful in their own way. In all their bareness and austerity, these months are simple, soothing, calming. What types of changes can you notice in your values? How has your way of seeing other people and things changed?

In saying that something which has been considered as "ugly" may be even beautiful, attractive and important when seen through other eyes or thoughts, I am not saying that for instance foul language and foul behaviour in a work community should be allowed. It is interesting to see that a great majority of us have a fairly congruent view of what is appropriate and what is not. However, the essential thing is that we have the courage to act in accordance with our conviction and to meddle in what is not good for our work community.

The concept of beauty that I am discussing here is one of the famous three virtues of the classical period: beauty, truth, goodness. These were and are values which people should follow and whose content should be discussed extensively and openly. There is certainly much demand for truth in today's world. So many things are covered in concealment, shamming, silence and downright lying. However, it is not wise to first try to correct others, but to begin with ourselves. It is a good start to ask: "How truthful am I with myself? What is true to me and about me?"

The challenge of goodness comes third. I don't think any one of us can truthfully say: "I do good things". Yet we recognise a good feeling within ourselves when we have been of assistance, when we have promoted something useful, when we have surpassed ourselves, and when we have abandoned some old trait of selfishness. I think that a conscious ambition towards doing good is such idealism that is needed. Idealism which is not about castles in the air but something concrete in a world infiltrated by evil. It is everyday deeds throughout the year, not good will only at Christmas time and in New Year's resolutions.

Lari Junkkari

Lari Junkkari is a theologian, writer, business coach, supervisor and trainer living in Tampere, Finland. He has a long career among Finnish migrants living in Canada and Sweden, working for the church in Finland, and in recent years as a value trainer of various organisations and as a management coach. His best known books have dealt with manhood ('Mieheksi joka olet', written together with Kaija Maria Junkkari) and on business values and ethics ('Yrityksen arvot ja etiikka', written together with Tapio Aaltonen). His most recent book 'Nykyajan paimentolaiset – työ ja koti maailmalla', written together with Kaija Maria Junkkari, discusses expatriates. His other professional interests include marital and family issues and human life cycle. His hobbies include nature activities and photography.

GRID ABC
This article series deals with the main operating principles, equipment units and components in the national grid.

SUBSTATION AND ITS PRIMARY EQUIPMENT

TEXT BY JANI HEIKKILÄ

Substations can be divided into switching stations and transformer stations. The former only connect lines of the same voltage level while the latter also connect lines of two different voltage levels. There can be one or more transformers at a transformer substation.

The transmission lines and transformers are connected to busbars located in the switchyard of the substation by means of switchgear. If the connection to the busbar is arranged by means of a circuit breaker, the busbar is referred to as main busbar. A busbar to which the connection takes place by means of a disconnector is called a transfer busbar.

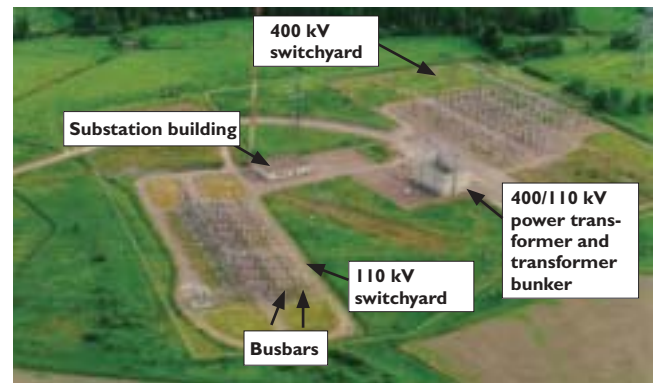
Switchgear includes circuit breakers and disconnectors. A circuit breaker can cut and close a load and fault current. A disconnector cannot cut a load or fault current. A disconnector can make the various parts of the substation dead for safe working and achieve a safe and visible clearance between open contacts between a disconnected circuit and the remaining parts of the substation.

In addition to switchgear, there is a need for voltage and current transformers by means of which it is possible to measure the voltages and currents at the substation. Voltage and current transformers are jointly referred to as instrument transformers.

Control signals for switchgear, power supply to the actuator motors and heaters as well as the transfer of current and voltage measurement data is carried out along cables from the field instruments to the substation building.

The current and voltage data from the instrument transformers is transferred to the electronic protection and control equipment located within the substation building.

The purpose of protection equipment or protection relays is to separate a faulty part of the grid from the remaining parts of the grid selectively, quickly and reliably. Protection relays give the operating signals to circuit breakers when there is a need to separate a faulty part of the grid from the remaining grid. When the protection relays work appropriately, a fault in one part of the grid does not spread to the entire grid.



Substations are nodes in the transmission grid used for distributing electricity transmission to different lines.

The substation equipment require electricity to work. The 230 volt alternating current required is supplied to a switching substation from a local distribution network through a 20/0.4 kilovolt transformer. At a transformer substation, the 230 volt alternating current is obtained from a 400/110 kilovolt power transformer, which includes a separate 20/0.4 kilovolt transformer.

The substation building also contains accumulator sets for securing the electricity supply of the substation itself in all situations.

A substation mainly consists of factory-made and tailored electrical equipment such as transformers, switchgear and instrument transformers. If necessary, the substation can be extended, for instance for connecting a new line to the substation, by purchasing more similar equipment. Equipment can also be shifted from one substation to another.

A substation also has fixed structures. These include an earthing network covering the entire substation area and dug into the ground, foundations and steel structures required by the equipment, cable troughs, concrete bunkers and protective basins of transformers, roads, fences, and substation buildings.

The substation building contains rooms for protection, auxiliary power, remote control and communication equipment. The substation building also usually has a toilet and a small storage room and repair shop.

All in a day´s WORK

In this column, Fingrid's employees write about their one day at work.
This time, the article has been written by **RAUNO LASSILA**, who works as Operation Supervisor at Fingrid's Hämeenlinna office.

OUTAGE PLANNING AND UNPLANNED OUTAGES

I usually wake up early in the morning to wait for the alarm clock to go on despite I have got up several times during the night to put our 18-month daughter back to sleep. Night-time searches for the comforter amidst the bedclothes are apt to confuse normal day routines, but after reading the morning newspaper accompanied by porridge and a couple of cups of coffee, I get started and bid farewell to my family, which still continues its sleep. Our daughter also sleeps just fine, naturally.

During my 15-minute commuting to work, my mind goes through the things that I have planned for today. As I arrive at work just before 7, I am anticipating a normal day at the office. A couple of outages are scheduled to take place in about two weeks, so their outage plans should be processed into outage suggestions. The busiest period of the year in terms of outage planning is already behind, so it seems that I will have time for things other than planning future outages.

After I have installed my laptop to the docking station and while I am waiting for the computer to start, I check whether substation equipment has caused night time work for on-duty personnel of the service provider. It seems to have been quiet in this respect. I also glance at the state of the grid; the current situation and changes influencing the beginning of the outage scheduled for this morning.

E-mail has become a factor which crucially guides the progress of the day at work. I notice that just before I had left work yesterday, I had received an electricity safety agreement relating to a line outage due to begin next week, to be completed and sent for distribution. This matter belongs to the category "complete sufficiently early", so I attend to it right away. I check the electricity safety precautions with the person responsible for the work, and I record these in the agreement. After going through the agreement once more, I send it for distribution to the other persons concerned.

For an outage scheduled to begin in about two weeks, I need some more information, so I pick up the telephone. With the person responsible for the work, I check issues such as starting and finishing times of work, and the equipment that will be serviced by the team. On the basis of this information, I define a sufficient outage area and for instance where to place work earthing, which prevents the access of voltage to the site. I also remind of the drawing up of an electricity safety agreement. We also ensure that the team knows the local area sufficiently well to be able to work at the substation. With customers connected to the grid, I verify their shift-over to standby electric supply for the duration of the outage and agree on earthing to be placed at their substations. I also call the supplier of operation services to verify the availability of local switching during the particular moment, and study whether the grid status will continue to remain favourable for outage execution.

I attend to the duties of Operation Supervisor for the first year, which is why almost all outages involve new things for me. This is why it probably takes me a little more time than normally to find out and verify the information. When I am happy with the outage plan I have drawn up and when I believe that the Network Control Centre can prepare the switching procedure on the basis of the plan and carry out the outage, I can update the plan into an outage suggestion and send it forward.

I notice that it is time for the morning coffee break. This explains the silence in our room of three persons. The results and events of yesterday's ice hockey match are discussed during the morning coffee break. The local team had won the match, but even a small gang such as ours includes those who feel that unjust umpires and blunt skates had taken something off the game.

Refreshed by coffee, I go through the outages scheduled for the remaining days of the year and make sure that the Elnet outage application contains information on outages known to take place in my area of responsibility.

As far as outages are concerned, it starts to be quiet at this time of the year. The planned service outages have been taken care of, and eyes have already been turned to the new year. In fact, it would be high time to obtain information on outage needs for the coming year, so I send a related reminder by e-mail to those concerned.

Next, I reach for my in-tray to pick the updating of the substation instruction for the Rauma substation. A new model has been developed for the contents and appearance of substation instructions, and all substation instructions must be updated accordingly.

For a fresh Operation Supervisor, updating a substation instruction provides an excellent opportunity to learn in detail about the equipment, operation and above all about the special features of each substation. The substation documentation and even the drawing file become more familiar in line with the updating work. To find out about details, you sometimes need to ask advice from the more experienced experts, but they do not seem to be too tired to answer.

After lunch, my computer reminds me of duties for which I have once decided to dedicate this day. This means that the updating of the substation instruction has to be postponed.

The most urgent thing on the agenda is to define roughly the needs related to the graphics tool used in outage planning. After small effort, I have the necessary text, and I also edit the appendices of the document. The whole lot is ready to be sent for comments to the other member of the team, after which we decide to send the document forward.

Next, I tackle a technical service agreement whose content and scope need to be reviewed. It takes some thinking to figure out how the equipment in question and the content of the agreement could be as sensible as possible and above all as simple as possible from the viewpoint of grid operation.

Just as I am grasping the heart of the matter, the telephone interrupts my thoughts. The replacement of memory units of transformer gas analysers seems to be in progress, and an electrical safety agreement needs to be signed with the party carrying out the work. The team is already on the move, so the agreement needs to be drawn up immediately. This time the electrical safety agreement is primarily drawn up in order to ensure proper communication, so it is sufficient that I complement the agreement I received by e-mail and distribute it to the parties concerned.

My plans to have a cup of coffee are interrupted by a telephone call from a person who plans outages at a customer company of ours. The customer informs me of work to be carried out on their line next Monday. This work also calls for switching work at one of our substations. During the telephone conversation, the switching situation required becomes clearer, and it also turns out that the protection settings of the substation would have to be changed. I tell the customer that they should contact us a little earlier next time. I make sure that the switching suits the grid situation and the schedules of the Network Control Centre. The deviating protection settings have already been calculated for a similar situation which took place earlier, so it is sufficient that I order a person to carry out the switching work. Since the schedule is urgent in this case, I use the telephone to also make sure that local switching is available. A few more telephone calls with the customer clarify the progress of the whole thing, so I can complete my plan.

I have already had a full working day of 7 $^{1}/_{2}$ hours, but I continue it by commenting on an agreement which I had started earlier. Before going home, I take another look at my task list and reflect what I had thought I would accomplish today. I notice that I had managed to finish some of the things I had intended. Again, much of the day was filled by matters that were not on the agenda in the morning.

I have not had problems in filling my evening programme recently, although I try to squeeze in some things of my very own every now and then. After browsing through a few children's books with the kids, I can continue drawing the final electrification plans for my garage. The final inspection of the building is approaching, so the drawings need to be in order, too. I do not have time to take outdoor exercise today, but once the kids are in bed, I have time for the exercise bicycle and a light work-out.

A friend of mine once said that one of his evening hobbies is watching films halfway through. I have recently joined him in this hobby, with the exception that I am fast asleep before the first commercials.

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