Corporate magazine
Fingrid Oyj
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FINGRID

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Fingrid Oyj

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Cover photograph: Pirkanpylväs in Lempäälä in evening lighting. Photograph by Juhani Eskelinen.
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When it is time

Things tend to have a beginning and an end. This thing began when I agreed to accept a temporary post of three weeks. The temporary post changed to a permanent one, and three weeks extended to more than 35 years. That is a long time – and yet it is not, because the years and decades really went by fast.

Before this employment, electricity was just something that was there. You got electricity by putting the plug in the socket. I and my friends never really pondered on the origin of electricity – it just came from somewhere beyond the socket. We used electricity whenever it was needed, but we did not want to waste it. It was self-evident to switch off the lights when leaving a room; that was a pattern learned at home. If someone did not comply with the practice, such person could be even reprimanded.

Working with energy – mainly electricity – has opened my eyes to the world beyond the socket. That world produces and transmits a product which nobody has ever seen in its original state; you can only see, hear, feel and experience its consequences. There are many types of players involved in this phenomenon. Electricity can be handled and controlled more and more efficiently and productively, and its transmission with an abundance of ancillary problems never ceases to provide food for thought.

Pocket watch included in the treasures salvaged from the wreck of the St. Michel, which sank in 1747. Fingrid has sponsored underwater research on this valuable three-masted galliot, and published an illustrated reference book on the wreck and its treasures.

The invisible phenomenon requires man-made structures so that it can become a visible part of the everyday life and highlights of people, as light and aid.

My successor Tiina Miettinen will assume my position as the editor-in-chief of the Fingrid magazine. She views things with new eyes and ideas – and that's the way it should be. However, the policy of the magazine will probably remain the same: it is made for the readers, to provide information and background on issues and phenomena which ensure that the lights are kept on in Finland.

I would like to wish all the readers of the Fingrid magazine a warm-hearted Christmas time, and I would also like to thank each and every one of you for the past interesting years. I will now join the readership of this magazine. When it is time.

Leni Lustre-Pere

Leni Lustre-Pere retired from the position of Communications Manager of Fingrid Oyj on 30 November 2007.

More speed in European electricity market integration

In September, the European Commission submitted a proposal concerning changes to the shared rules for the electricity market in Europe. The Commission aims to speed up the integration of the electricity market. The proposals of the energy package focus on transmission system operators and on the authorities supervising them.

Text by Tiina Miettinen ■ Photographs by Tuija Sorsa and Juhani Eskelinen

For the transmission system operators (TSOs), the foremost changes brought by the energy package concern ownership of companies, strengthened status of the regulatory authority, promotion of TSO co-operation, and enhanced transparency in the wholesale market of electricity.

Ownership of TSOs has especially evoked a lively debate. In order to promote the functioning of the electricity market, the Commission proposes more distinct unbundling of the production and transmission of electricity and natural gas than presently.

The Commission has adopted a very strict stand in terms of TSO ownership. The market players should have no influence on the TSOs for example in the form of ownership or Board membership. There is an exception to this rule, because national governments could continue to be co-owners in both production and transmission just as long as they delegate ownership representation to various ministries.

According to the proposal, the unbundling of production and transmission can be carried out in two different ways. The primary goal of the Commission is full ownership unbundling, but an alternative presented is the ISO model (independent system operator).

In the ISO model, the grid would be owned by the former owner, but its operation and planning would be decided by another company, an ISO. This independent system operator would hence have a sort of a right of use to the grid owned by the other company. Howev-

er, the implementation of the ISO model has been made very difficult.

If the proposed ownership unbundling would be realised in its extreme scope, the TSOs could be government-owned companies, private companies, or some sorts of intermediate forms between these. The underlying purpose of ownership unbundling is not to have a certain type of ownership structure, but the objective is that no interest group has such control over a TSO that would compromise neutral operations.

Highly varied ownership structures in Europe

There are presently great differences in the ownership structure of TSOs in the various European countries. In some countries the TSOs are listed companies, in some countries the government owns the TSO either entirely or partly, and some countries have vertical ownership, i.e. production companies own the transmission system operator. Time will tell how the proposal of the Commission will evolve within the political drafting process. The decision-making process will probably take two to three years.

In Fingrid's view, the ultimate objective of the Commission to unbundle production and transmission is correct. This was the very reason why Fingrid was established 10 years ago, when production and transmission were separated in Finland. Right from the start, Fingrid has worked actively to abolish market obstacles.

However, in accordance with the narrow interpretation of the proposal of the Commission, production and transmission would not be sufficiently unbundled in Finland, and if the proposal becomes reality, it would also influence Fingrid's ownership structure. Fingrid's President and CEO Jukka Ruusunen thinks that the company will do well in the changing operating environment.

"Fingrid has worked actively to remove market barriers and been committed to impartiality and neutrality. This is indicated by the lowest grid tariff in Europe, excellent system security in electricity transmission, and our input in grid and market development", Jukka Ruusunen points out.

Fingrid's customers are in the best position to assess its performance. This is why the company conducts regular customer surveys concerning its operations. The customers have rated Fingrid's performance with an excellent grade in several consecutive years. Antti Koskelainen, Managing Director of Suomen ElFi Oy, which represents electricity users, also commends Fingrid's efforts.

"Fingrid has worked actively to remove market barriers and been committed to impartiality and neutrality."

"Fingrid is efficient on an international scale, and the Finnish transmission grid is in a good condition. Security of supply has been good, and the grid tariffs are competitive. However, there is always room for improvement. We feel that promoting demand flexibility is in the interests of the entire electricity business, and the TSOs have a natural role here. We also look forward to increased transparency concerning bottleneck revenues received by the Nordic TSOs and how to proceed in order to reduce these revenues," Antti Koskelainen states.

Fingrid's President Jukka Ruusunen thinks that Fingrid will do well in the changing operating environment.

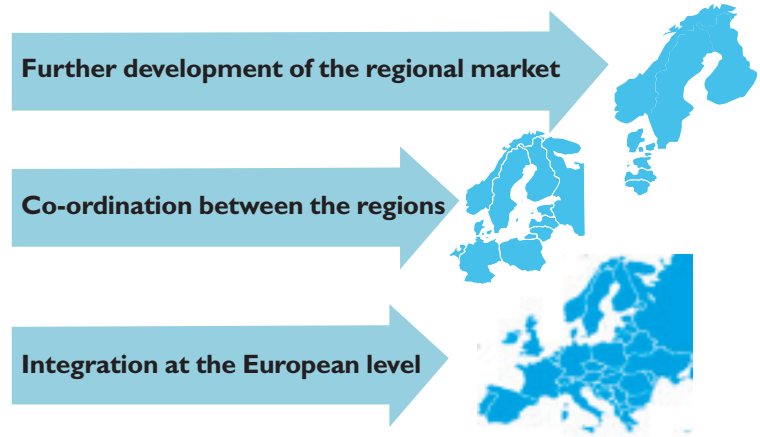
European co-operation between TSOs

In addition to the unbundling of ownership, the energy package proposes closer co-operation between TSOs. This would take place by the establishment of Entso, European network of transmission system operators, which is given a focal role in the EU's legislative process. Correspondingly, the national jurisdiction of the regulatory authorities and co-operation between them will be increased. This will take place by establishing an agency for the co-operation of energy regulators.

According to the proposal, the new organisations would be given a European jurisdiction and area of responsibility. Entso's work would be much more binding than previous TSO co-operation. The new agency, in turn, would give comments on the regulations prepared by Entso, and it would supervise that the national regulators follow the Community Law.

Antti Koskelainen, Managing Director of Suomen ElFi Oy, believes that market integration will bring benefits to electricity users over a long term.

Parallel approach to a European electricity market



Not everyone considers that the proposals concerning increased TSO co-operation, made by the Commission, are sufficient. The Nordic energy ministers, among others, have appointed a work group to survey the establishment of a single independent system operator (ISO) in the Nordic countries.

Fingrid has not warmed up to the idea, because the establishment of an ISO would call for great changes in the legislation of the various countries and introduce additional bureaucracy. On the other hand, the actual grid operation – which the ISO model basically represents – is not a problem anyway. The ISO model does not bring a solution to the most critical issues such as promotion of grid construction projects. This is why Fingrid highlights the importance of TSO co-operation – both within Nordel and in the future increasingly so within Entso.

The co-operation has yielded results. The Nordic TSOs have agreed on constructing priority cross-sections with a total value of one thousand million euros. Once complete, these will reduce significantly market segregation in the Nordic countries. On top of this, Nordel has agreed on separate action, aiming among other things at increasingly efficient grid engineering processes, improved grid operation, effective use of reserves, and harmonisation of balance service. One important step was the decision to increase significantly transparent market information on the TSOs' own websites and on Nord Pool's Internet pages.

Strategic intent is vital

All in all, the energy business has a clear strategic intent to work so that the wholesale market of electricity becomes a European market. Nordel's efforts aim at this, as do the proposals in the energy package of the EU Commission. The matter also has great relevance to electricity consumers.

"Over a long term, the integrating market will mean stabler prices, more competition, better security of supply – all these are good things for the electricity users. However, there is the risk of increased electricity prices in Finland and elsewhere in the Nordic countries," Antti Koskelainen of Suomen ElFi says in commenting the developments in the electricity market.

Market integration will not be easy. According to Antti Koskelainen, the thing to consider in view of the scheduling of integration and functioning of the market is that market liberalisation is only taking the first steps in Continental Europe. The production architecture is different in various countries, ownership is more concentrated outside the Nordic countries, and the price level of electricity is higher than in the North.

The Nordic countries have been forerunners in electricity market developments, and there has been years of work for the shared market. Antti Koskelainen emphasises the importance of completing electricity market integration between the Nordic countries, for example by implementing the decided priority cross-sections as soon as possible.

"The undeserved extra income given by emission trading to power producers must be eliminated either by changing the emission trading system, or the market mechanisms and by allocating proceeds to investments in production capacity. In order to achieve better competition in electricity production, obstacles which impede increased market-focused supply of electricity must be removed from legislation and the permit procedures must be streamlined. Government must also promote the access of new players to the electricity market in order to further competition," Antti Koskelainen says.

Nordic countries, Baltic countries and Poland

BUILDING A SHARED PLAYING FIELD

Transmission system operators in the Nordic countries, Baltic states and Poland have launched co-operation in transmission grid planning. The objective is to accomplish an optimum playing field for the single electricity market of the future.

Text by Maria Hallila ■ Photograph by Eija Eskelinen

The representatives of TSOs in the Nordic countries, Baltic states and Poland gathered in Helsinki. The persons from the left: Jussi Matilainen, Olegs Linkevics from Latvia, Pertti Kuronen, Ramunas Ponelis from Lithuania, Artur Glutzek from Poland, Mikko Koskinen, Dalius Sulga from Lithuania, and Mart Landberg from Estonia. The group also includes Svenska Kraftnät's member Habib Sabbagh.

Representatives of transmission system operators (TSOs) in Finland, Sweden, Estonia, Latvia, Lithuania and Poland sat together at the same table in Helsinki on 14 November to discuss the joint issues concerning grid planning in the area around the Baltic Sea. In the history of electricity market integration in Europe, this meeting marked the turning of a new leaf.

"Co-operation between TSOs in the EU countries has increased in line with the clearer goal towards a European electricity market," says **Pertti Kuronen**, who is responsible for grid service within Fingrid.

A short look back in time indicates that up until the early part of this millennium, each country was responsible for its own power system and own cross-border connections. "Grid planning within Nordel co-operation was largely bilateral back then," Pertti Kuronen says.

He characterises the year 2002 as a

decisive turning point. It was then that the first Nordic Grid Plan was drawn up. Now, five years later, the need for co-operation extends to a great part of Europe.

According to Pertti Kuronen, the Nordic countries are adopting a practice where Norway and Denmark are responsible for international co-operation in grid planning with countries in western Continental Europe and the British Isles while Sweden and Finland take care of co-operation with countries in eastern Continental Europe and the Baltic countries. Planning between the Nordic countries is co-ordinated through Nordel.

Cross-border connections from Russia to Nordel are naturally primarily in the domain of Finland. Russia is an important partner in power exchanges also for the Baltic countries, which are connected to its power system.

The Baltic Grid plan extending to 2025 encompasses three significant transmission link projects: Lithuania - Poland, Lithuania - Sweden, and Estlink 2, the second sea cable link between Estonia and Finland.

Three major projects in the Baltic countries

The introduction of the Estlink cable between Estonia and Finland was a concrete push for grid co-operation between the Nordic countries and the Baltic countries. The cable inaugurated a year ago is the first link between the Baltic countries and the Nordic electricity market.

"The EU considers it important that the Baltic countries are connected to Poland so that they can become part of the European electricity market," Pertti Kuronen says.

According to him, the European Commission has prioritised the transmission link between Lithuania and Poland. This connection of 1,000 megawatts is included in the Baltic Grid plan shared by the TSOs in the Baltic countries, extending to 2025.

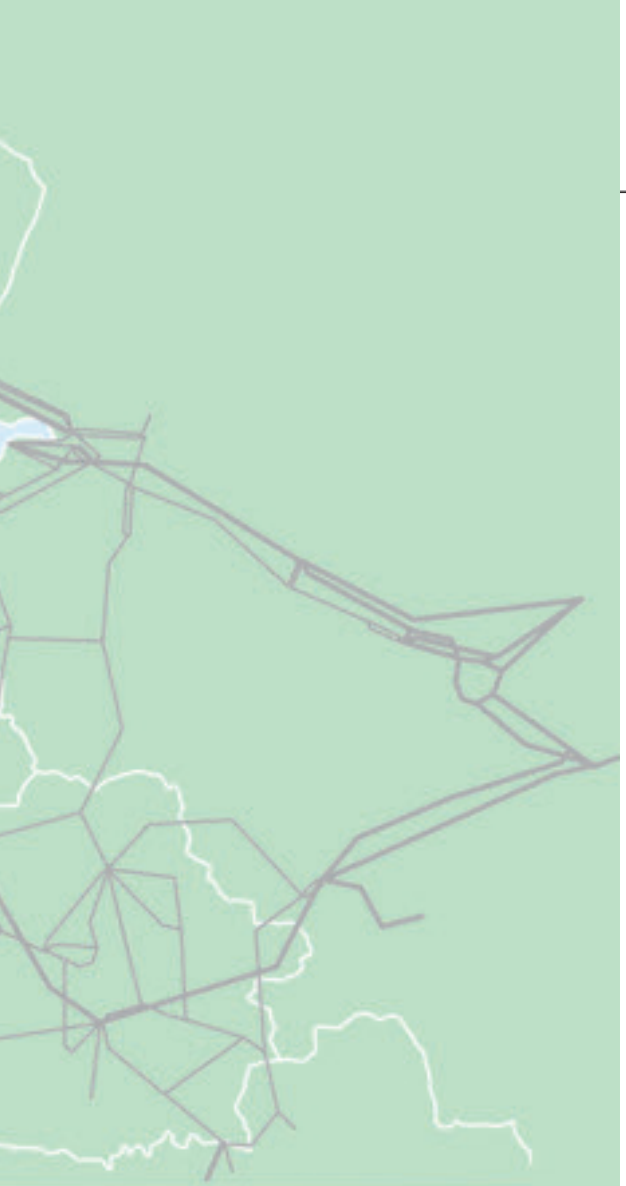
This Baltic plan also covers two other projects to be examined more closely: Estlink 2 cable between Finland and Estonia and a cable link between Lithuania and Sweden.

The Baltic Grid plan was drawn up by Baltso, the organisation of TSOs in the Baltic countries similar to Nordel in the Nordic countries.

According to Pertti Kuronen, the new version of the Nordic Grid Plan prepared by Nordel will be complete in the early part of 2008.

Optimum functioning as the guideline

What is the most sensible way in which to implement the planned transmission connections between the countries, and in which schedule? What is their mutu-



Co-operation in mutual grid planning involves the transmission system operators in the Nordic countries, the Baltic countries and Poland: Nordel's members are Fingrid, Svenska Kraftnät in Sweden, Statnett in Norway and Energinet in Denmark; Baltso's members are OÜ Põhivõrk in Estonia, Augstsprieguma Tikls in Latvia and Lietuvos Energija in Lithuania, as well as the Polish TSO PSE-Operator S.A.

al order of importance? What types of technical solutions are feasible? How to ensure the functioning and compatibility of the solutions?

These are among the questions to which the co-operation group, which has now started its work, is trying to find answers.

There are several aspects. In addition to the technical aspect, the projects are examined from the point of view of the overall interests of the market, and also from a socioeconomic viewpoint, where the issues reviewed include benefits to national economies and environmental impacts of the planned solutions, among others.

Fingrid's representatives in the work group are Pertti Kuronen and **Jussi Matilainen** as permanent members and **Mikko Koskinen** in technical special issues. Jussi Matilainen is specialised in electricity market analyses models from a technical and economic viewpoint, and Mikko Koskinen in power system dynamics and stability calculations.

"The main task of the work group is co-ordination, and its key objective is to ascertain the overall benefits given by the planned projects to the shared market area. We aim to maximise that benefit through joint efforts," Mikko Koskinen and Jussi Matilainen say.

They think that the work group is well equipped to reach the objectives, because co-operation was launched in a positive and constructive atmosphere. "You could sense a genuine desire to co-operation in the meeting. This is a good foundation, because the future decisions must be based on a shared view of what should be done," they point out.

It has been agreed that chairmanship in the work group changes each year. Fingrid chairs the group for the first year until the end of 2008.

"The main component in this co-operation is discussion and contacts between people. The continued co-operation between TSOs in the area around the Baltic Sea also carries considerable weight," Pertti Kuronen points out.

In addition to grid planning, there is also co-operation within market development and grid operation.

Olkiluoto Gas Turbine Power Plant inaugurated

Test start by Minister Anne Holmlund demonstrated the functional reliability of the plant

The Olkiluoto Gas Turbine Power Plant constructed jointly by Fingrid Oyj and Teollisuuden Voima Oy (TVO) was inaugurated on 19 November. The 100 megawatt plant will serve both parties. When necessary, the plant supplies power as fast disturbance reserve to the Finnish transmission grid. On the other hand, the new plant will secure the supply of auxiliary power to the Olkiluoto nuclear power plant units in case of a large-scale disturbance in the transmission grid.

Text by Maria Hallila ■ Photographs by Juhani Eskelinen

Everything ready for the start. Project Manager Martti Merviö (on the left) giving the final instructions to Minister Anne Holmlund. TVO's President Pertti Simola and Fingrid's President Jukka Ruusunen anticipating the big moment.

The inauguration start by **Anne Holmlund**, Finnish Minister of the Interior, showed that the gas turbines start reliably in the expected time of a maximum of seven minutes.

"The plant will certainly fulfil its objectives both as fast disturbance reserve and as a source of emergency power for the nuclear power plant units," Anne Holmlund said in the inauguration event.

Growing challenges for the electricity transmission system

In her inauguration speech, Minister Holmlund discussed the energy policy challenges to be encountered in the near future. The most crucial challenges are related to increased energy consumption and reducing the environmental impacts of energy production.

"Increasing energy consumption, higher power plant capacity and larger unit sizes of power plants also impose new, increasingly greater requirements on the electricity transmission system. The transmission system must withstand potential disturbance of plant units which are larger than presently," Minister Holmlund stated.

She pointed out that the Finnish society will need versatile energy sources together with energy production which corresponds to consumption. Alongside this, the system security of the power system is of utmost importance to all functions of society.

"Sufficient and reliable supply of electricity is absolutely necessary for the modern Finnish society," Minister Holmlund said.

"Sufficient and reliable supply of electricity is absolutely necessary for the modern Finnish society"

She stated that the Finnish transmission grid is among the best in the world in terms of technology and availability. Still, there will be challenges in the future, too. She referred to Fingrid's future capital expenditure outlook: The company's capital expenditure in the grid will grow from an annual level of approx. 40 million euros to 100–200 million euros per year in the next few years.

"The capital expenditure will grow because electricity consumption is increasing, the ageing transmission grid needs to be renewed, and cross-border transmission capacity between countries needs to be enhanced further in order to promote the market mechanisms. Moreover, Fingrid has to increase its own reserve power capacity in order to ensure system security, just as has been done here in Olkiluoto."

In conclusion, Minister Holmlund stated that the Olkiluoto Gas Turbine Power Plant is an indication of the desire of Fingrid and TVO to contribute to improved operating conditions of society, security of supply of electricity, and safe operation of nuclear power.

Reserves ensuring system security

In his speech, Fingrid's President and CEO **Jukka Ruusunen** described the background of the Olkiluoto Gas Turbine Power Plant project.

In his speech, Fingrid's President Jukka Ruusunen described the background of the Olkiluoto Gas Turbine Power Plant project. "The outcome of negotiations with TVO was that by constructing the power plant jointly, for two different applications, both parties will derive benefits," he stated.

"One of Fingrid's pivotal tasks is to secure the operational security of the Finnish power system. For this purpose, Fingrid maintains reserves under specific agreements with industries and power plants, and by acquiring and managing for example gas turbine capacity," he said.

The total capacity of Fingrid's own reserve power plants is now 615 megawatts.

"Reserve power plants will have to be constructed also in the future, and Fingrid intends to construct some 200 megawatts of additional capacity by 2012–2013. Reserve power must be in-

creased in line with the construction of new large power plant units. This is a great challenge for Fingrid, and its total annual capital investments in the near future will rise to 100–200 million euros. The capital investment costs of the Olkiluoto Gas Turbine Power Plant have totalled about 50 million euros," Jukka Ruusunen stated.

Considerable synergy benefits

TVO's President and CEO **Pertti Simola** emphasised the considerable synergy benefits brought by the new Gas Turbine Plant.

"The construction of this plant represents an innovative co-operation approach, as a result of which one plus one is more than two. We have reached a cost effective and reliable technical solution which will meet fully the requirements of both Fingrid and TVO."

According to Pertti Simola, the construction of the Olkiluoto Gas Turbine Power Plant represents an innovative co-operation approach.

Pertti Simola added that safety comes first and foremost in all of TVO's operations. "The Gas Turbine Plant is extremely well suited to this culture. It provides yet another backup to the emergency power supply of our nuclear power plant units," said Pertti Simola.

Olkiluoto Gas Turbine Power Plant

Photograph by Martti Merviö

The heart of the Olkiluoto Gas Turbine Power Plant is formed by two 50 megawatt TwinPac aggregates representing proven technology, delivered by MAN TURBO AG. Both units contain two gas turbines and one generator which are coupled up.

The turbines manufactured by Pratt & Whitney from the USA have been developed from an aeroplane jet engine. The generators were manufactured by the German Siemens AG. The plant uses sulphur-free light fuel oil.

The plant reaches its full capacity of 100 megawatts in less than seven minutes from start.

The unmanned plant can be started and stopped by remote control from Fingrid's Power System Control Centre in Helsinki and from the control rooms of the Olkiluoto nuclear power plant units OL1 and OL2, and in the future also from the new unit OL3. TVO is responsible for the local control and operation as well as maintenance of the Gas Turbine Plant.

The Olkiluoto Gas Turbine Plant serves both Fingrid and TVO. Being responsible for the system security of the Finnish power system, Fingrid needs a so-called fast disturbance reserve of a certain magnitude to prevent a potential system disturbance from escalating into a nationwide disturbance. The Olkiluoto plant is a significant addition to the fast disturbance reserve.

For TVO, the plant secures the supply of external power to the nuclear power plant units also in the very rare situation where electricity cannot be supplied from the nation-wide grid through any of the existing connections. The connection to the Gas Turbine Plant is thus an additional backup for power supply for the nuclear power plant units.

Fenno-Skan 2 will be postponed by one year

■ The time schedule for the new HVDC interconnection between Finland and Sweden (Fenno-Skan 2) has been changed. The expected start of commercial operation is 30 November 2011. The postponement is mainly due to difficulties in submarine cable delivery.


Photograph by *Tuomo Kouti.*

Place where the submarine cable will go on land in Sweden.

Due to the huge world market demand for submarine cable interconnectors, no cable manufacturer was able to meet the required time schedule. All manufacturing capacity is engaged with other ongoing submarine cable projects. The next available manufacturing slot allows the start of production in late 2009.
The negotiations with manufactures continue, and the agreement on the procurement of Fenno-Skan 2 is expected early next year.
Fenno-Skan 2 will be an 800 megawatt and 500 kilovolt electricity transmission connection between Finland and Sweden. The connection will be a direct current link. The total length of the link will be approx. 270 kilometres, of which the actual submarine cable will account for some 200 kilometres. The extension will be carried out in co-operation between Fingrid Oyj and Svenska Kraftnät.

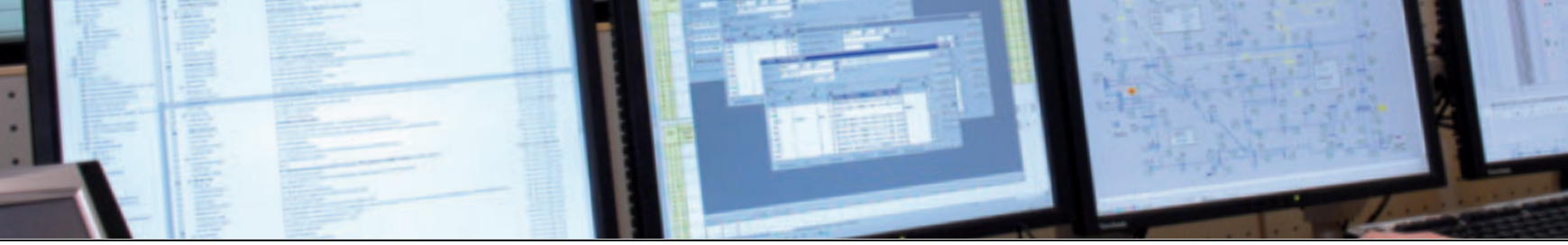

Photograph by *Juhani Eskelinen.*

A set of landscape towers was erected at Lapijoki in Eurajoki near the E8 road. The towers are illuminated by means of LEDs.

New transmission connection from Olkiluoto to Huittinen commissioned

■ A significant new transmission connection in the Finnish grid from Olkiluoto to Huittinen in Western Finland was commissioned on 26 October 2007. The project with a total value of approx. 36 million euros included almost 100 kilometres of new transmission line with various line arrangements.

The new line will enable the connection of the upcoming Olkiluoto nuclear power unit to the grid and the transmission of electricity from the plant to consumption. The arrangements carried out also secure the grid connections of the present Olkiluoto power plant units.
Earlier, there were three 400 kilovolt lines from the Olkiluoto power plant to nearby substations. Now there are six lines. Until the completion of the third nuclear power unit, the additional lines will be used for reducing the transmission losses in the grid.
The overall project encompassed not only the construction of the new 65-kilometre transmission line but also several subprojects such as the new Olkiluoto and Huittinen substations, expansion of the existing substation in Olkiluoto, line arrangements between Olkiluoto, Junnala in Eurajoki and Lapijoki, and modification work on the 110 kilovolt double circuit line Olkiluoto–Rauma.



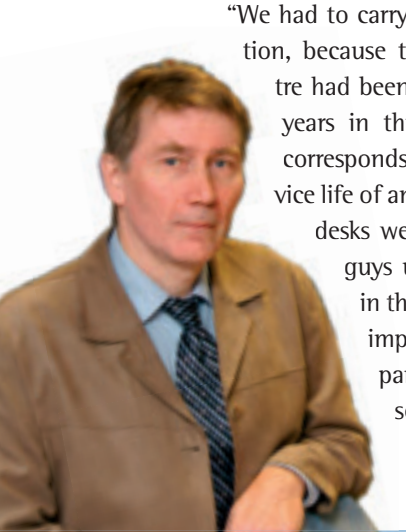
Fingrid's control centre in new facilities

Large flat displays and control desks resembling navigation bridges on ships create an impressive view. When you listen to the expert describing the functions taking place behind the desks, you become convinced: This is a place of important work.

Text by Tiina Miettinen ■ Photographs by Juhani Eskelinen

The place in question is Fingrid's modernised Power System Control Centre in the heart of Helsinki. The control centre was renovated during the summer and early autumn. For some time, the duties were managed in the simulator room, but the new facilities have been in use since mid-October.

"We had to carry out the modernisation, because the old control centre had been in operation for 10 years in three-shift work. This corresponds to a 30-year service life of an ordinary office. The desks were so worn that the guys used to get splinters in their hands. It was also impossible to find spare parts for the old large screens," says **Reijo Huhta**, Manager of Power System Control Centre.



Reijo Huhta, Manager of Power System Control Centre.

The renovation not only concerns new furniture and surface materials. In fact, almost everything in the control centre is new, because the renovation was carried out in conjunction with the updating of the operation control system and related hardware purchases.

There is now much more room available for working than before. Advanced display technology with flat screens has provided much more desk space. The renovation also enabled the placing of computers behind the displays in a separate space.

"This brought down the noise level in the control room considerably. It is surprising how much noise the computers emitted. You don't notice it until the computers are somewhere else. Now you can answer the telephone in a normal voice," Reijo Huhta says.

Displays and paintings

The large displays in the control centre indicate the state of the power system in Finland. Information on production and consumption volumes, active and reactive power of power plants, measurement data and status data on substations and many other things are updated on the screens in real time. To counterbalance the large displays needed in the work, the opposite wall will house paintings by **Paavo Pelvo** to make the room increasingly comfortable. In his works, Pelvo depicts birds and forest animals. The paintings do not represent typical art purchased for public premises, but that was not the intention, either.

"The control centre is not a public space available for visits, but it is a work room. We have also wanted to make it a functional and pleasant place for the operating personnel of 14 persons working in three shifts. We listened to the employees' opinions when we were selecting the works of art," Reijo Huhta says.

Pasi Kaunisto (in the foreground) and Jani Pelvo are satisfied with the functioning of the renovated control centre and with the reduced noise level.

24/7 control

The control centre attends to the state of the power system 24 hours a day, 7 days a week. When asked about the routines of control centre operators, Reijo Huhta lists many daily duties relating to balance management and supervision of the power system.

"In balance management, the work mainly comprises keeping contact with the electricity market parties and placing orders for regulating power in order to maintain the balance between electricity consumption and production. The electricity exchange must be supplied with correct information on Finland, in other words data on prices, volumes, production, consumption and imports," Reijo Huhta says.

"In a normal situation, we carry out regulation to control frequency. If there is congestion on the cross-border lines on the western border of Finland, Finland has to be regulated into an area of its own."

According to Reijo Huhta, the primary objective in balance management in the inter-Nordic system is to maintain the power system frequency, which describes the balance between electricity production and consumption. The power system is in imbalance if the planned electricity production cannot match the actual consumption.

"We had to carry out the modernisation, because the old control centre had been in operation for 10 years in three-shift work."

"When the power system is in balance, the frequency in the grid is 50 Hz. The frequency can vary between 49.9 and 50.1 Hz. If the frequency of the grid is below 50 Hz, consumption exceeds production. Correspondingly, when the frequency is above 50 Hz, production is greater than consumption."

Power balance is maintained by means of frequency-controlled reserves and manual regulation. Manual up-regulation or down-regulation is carried out in the regulating power market.

"The purpose of power system control is to ensure that the system is in a state of reliable operation at all times. The system must endure a single fault," Reijo Huhta says.

Flow of information

The transmission grid in Finland is monitored and controlled from Fingrid's control centres using an operation control system, which sends measurement, state and event information on the power system to the control centres. Measurement information includes powers transmitted on the transmission lines, voltages at substations, and production powers of power plant generators.

The control centres can send control commands to various actuators, for example to open or close circuit breakers or to start or stop gas turbines.

Measured information and events in the power system are also stored for later analyses such as grid planning.

PIRKANPYLVÄS in Lempäälä provided with lights

A special-design transmission line tower located in Lempäälä close to the Helsinki - Tampere motorway obtained a lighting system at sunset on 1 November.

Text by Leni Lustre-Pere ■ Photographs by Juhani Eskelinen

The dark blue transmission line tower named Pirkanpylväs is part of the 400 kilovolt line running from Ulvila to Kangasala.

Designed by Interior Designer **Jorma Valkama**, the tower softens the scenic impacts of the transmission line which crosses the busy motorway. The tower which soars to a height of more than 62 metres has become an established landmark in the region.

The lighting of illumination for the first time was observed from a bridge running over the motorway.

The lighting designed for the tower highlights its contours also during the dark hours of the day. The lighting system planned by **Ilkka Volanen** includes 32 module-controlled kinetic RGB lights installed in the body. The power of each light is 50 watts. The lights also feature 30/50 degree scatter lenses. The system is completed by two spotlights installed in the ground.

Pirkanpylväs is a unique massive steel tower adapted to the surrounding scenery, weighing 65 tonnes. Its footing which rises one metre above ground level has dimensions of 11 x 7 metres, and the diameter of the pillar rising to a height of approx. three metres is almost four metres.

Fingrid has more than a dozen individually-designed landscape towers in Finland. The set of towers referred to as "Sinikurjet" (Blue Cranes) in Espoo is best known of these.

Landscape towers are placed in selected locations where the transmission line structures cross scenically delicate areas or busy roads, such as at Lempäälä. Landscape towers cost about five to six times more than ordinary towers used in transmission lines.

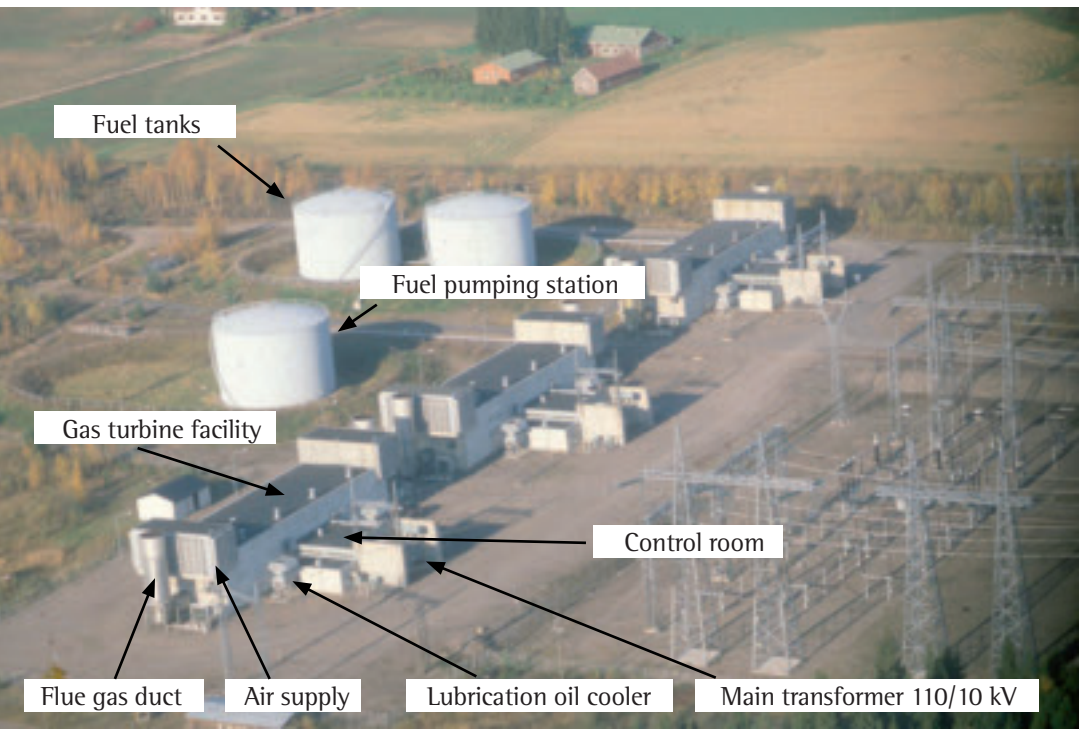
Ritva Laine, Project Manager for the tower project, and Fingrid's Executive Vice President Kari Kuusela.

Hannu Kiviaho, Chairman of the Technical Committee of Lempäälä, gave a speech on behalf of the Municipality of Lempäälä. The person sitting is Henna Levomäki, who has named the special-design tower.

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.

HUUTOKOSKI RESERVE POWER PLANT



Reserve power plants

Reserve power plants ensure the functioning of the power system in Finland in the event of a failure at power plants or in the grid.

Text by Toni Loivakari

Preparations for disturbance situations in the power system comprise frequency-controlled disturbance reserve and fast disturbance reserve. Reserve power plants are part of fast disturbance reserve.

Frequency-controlled disturbance reserve consists of active power reserve at power plants, activated automatically by a change in frequency, and of loads which can be shed. Fast disturbance reserve consists of manually-activated gas turbine capacity which is managed by Fingrid and of shed loads which must be capable of being activated in 15 minutes. Fingrid Oyj's Power System Control Centre starts the gas turbine capacity and sheds the loads in the event of disturbances.

Fast disturbance reserve is used for restoring the power balance of the grid in the event of a grid or production disturbance and to reduce electricity transmissions if the transmission limits have been exceeded. Fast disturbance reserve is also used for restoring the activated frequency control reserve and the potentially activated disturbance reserve, after which the power system is in a state which withstands a new potential disturbance.

Some of Fingrid's reserve power plants have a black start feature. Such plants can start into a dead grid without external electricity supply. In the event of a major disturbance, the black start feature can restore voltage to the grid. If there is no voltage available in Finland, the primary goal is to obtain it from a 400 kilovolt substation in Sweden.

Fingrid controls a total of 746 megawatts of reserve power plant capacity. Of this, 615 megawatts are its own capacity and 131 megawatts are rented through

contracts giving right of use. Fingrid owns 10 reserve power plants with a total of 21 units. The newest addition to the reserve power capacity was obtained this year with the introduction of the Olkiluoto Gas Turbine Plant of approx. 100 megawatts.

Most of the reserve power plants were constructed more than 30 years ago. Naturally, the control systems have been upgraded during this time to ensure that the plants remain operational. The plants have been in operation for very short periods of time, which is why their main machinery (power turbine and generator) is primarily in a good condition.

The reserve power plants are aviation gas turbines (17 units) and industrial gas turbines (4 units). Aviation gas turbines utilise engines which were originally used for gas generation for aeroplanes and which have later been modified for land uses. An aviation engine serves as a gas generator, and electricity production is based on a power turbine located on a separate shaft, installed after the gas turbine to utilise the thrust of the engine.

The advantage of aviation gas turbines over industrial gas turbines is that if the gas generator fails, it can be replaced with a new one quickly. The starting speed of aviation gas turbines to full power is approx. 5 minutes and approx. 10 minutes with industrial gas turbines.

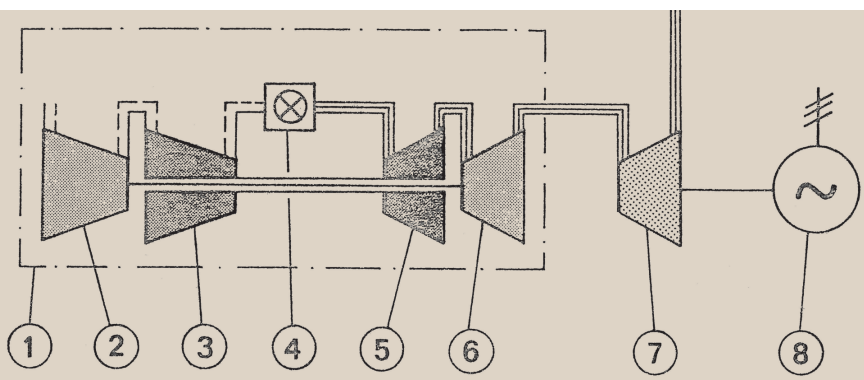
Trial runs are performed at the reserve power plants at intervals of 4 to 6 weeks. The trial runs are started from the operation control system. The trial runs intend to ensure that the plants can be started reliably. Remote starting from the Power System Control Centre always starts the plant directly to full capacity. The plants can also be started locally, either from a control panel or computer terminal.

The reserve power plants are usually started locally in conjunction with service. In this case, the gas turbine is initially run idle. This is to make sure that everything is alright before proceeding to synchronisation and switching to feed power into the grid. All the stages required by starting from the starting of auxiliary systems to synchronisation with the grid and further to full-power operation take place automatically.

The reserve power plant units are operated for about 10 hours a year, mostly in trial runs. The fuels used in the gas turbine power plants are light fuel oil and jet fuel.

The efficiency of gas turbines in the reserve power plants is poor because only their electric power is utilised. The flue gases which exit the unit are hot, i.e. they are not exploited. The production of one megawatt hour of electricity roughly takes about 350 litres of oil when the unit is run at full power. (The efficiency is slightly better at the new gas turbine power plant in Olkiluoto.)

Efficiency deteriorates rapidly when the unit is run at partial loads. Because of the high fuel consumption, the reserve power plants need to store considerable amounts of fuel for the necessary running time. Each plant has sufficient fuel for at least 36 hours of operation. The fuel supplies contain a total of approx. 10,000 cubic metres of fuel.



Operating principle of power plant with aviation gas turbine

The gas generator (1) contains a low-pressure compressor (2) and a high-pressure compressor (3) connected in series. These feed compressed air into the combustion chambers (4), into which also fuel is injected for combustion to take place. The resulting hot combustion gas expands in the compressor turbines (5) and (6), each of which drives its own compressor by means of shafts located within each other. The gas flow continues via a diffuser into the power turbine (7), which drives the generator (8) by means of a shaft.

Weekend in the OLD STYLE

Old cars are a hobby that easily captivates you. Last summer, the style of a world gone by drew Fingrid's transmission line specialist Mika Kuivalainen with his friends to Uddevalla in Sweden to the Old Style Weekend of old car enthusiasts. The eventful 2,000-kilometre drive was done in a Ford from 1939.

Text and photographs by Mika Kuivalainen, Mika Viitanen and Juha Vornanen

I and a colleague of mine first got the idea of a summer trip to Sweden to the Old Style Weekend in the Christmas party of our company last year.

"Will your Plymouth be complete enough for the trip by then?" my friend asked.

"I don't think so, but let's take your Ford," I replied.

"That's a deal!" we decided together.

The trip seemed interesting, so we started planning it right away. We also had to recondition the Ford to be a little more reliable; the previous longer trip had come to an end after 50 kilo-

A lot of tools were reserved for the trip. Mika Kuivalainen (on the right) and Mika Viitanen making the preparations.

During the weekend, the venue area was filled with some 300 old cars.

metres as a result of a blown cylinder head gasket.

The Ford we were going to use for the drive had been registered most recently in 1964. The motor was a 3.6-litre L-head V-8 with 95 horse powers. The electric voltage is six volts, and there are three gears forward (the second gear does not tend to stay engaged) and one reverse. The roadholding of the car has been improved by lowering the chassis by 10 centimetres. In other words, it is no museum vehicle.

Old Style Weekend is only for cars and motorcycles manufactured before 1956. Last summer, the event was arranged for the 12th time, and it has expanded from a meeting of a small group of enthusiasts to a fairly large-scale event lasting the whole weekend, with people driving long distances just to be there.

The event is arranged by a Swedish old-style hotrod club by the name of A-Bombers. The venue is in Uddevalla in Southern Sweden.

Almost all cars participating in the Old Style Weekend are more or less modified; the common denominator is an old style – no overtly decorated vehicles are allowed in the area, no matter how old they would be.

There were several guys we knew who would have liked to join the trip to Sweden, but it was decided that the number would be limited to three. There would not be much room in the car, because the trunk would be filled with spare parts and tools.

Each one of us had worked on old cars since our teens, so we embarked on the journey without the service vehicle offered to us.

Tuesday 31 July. **Juha Vornanen** and I started from Varkaus towards our first stage Längelmäki. It was drizzling, and at Jyväskylä it started pouring with rain. The windshield wipers of the car had not been installed, so we had to slow down a bit. The rain repellant applied on the windscreen seemed to do the trick.

We were travelling at an average speed of 75 km/h. After a while, we smelled the reek of burning in the car. Upon examining the matter under the hood, we noticed that the smoke came from the charger. We cooled down a while and continued with less lights switched on.

In Längelmäki, we changed the cooling system water because it had gathered rust, and checked the oil. The oil surface had gone down somewhat.

Wednesday 1 August. In Kangasala, we picked up some tools, supplies and the third member of our crew, **Mika Viitanen**. The tail of the car sank because of the weight and rested on the rubber bumpers. Then we headed for Turku and the harbour.

Thursday 2 August. We arrived in Stockholm as early as 6.30 in the morning. There was not much traffic in the city, so changing the lanes was easy: just stick your arm out of the side window. (The car does not have turn indicators.)

Onwards towards Gothenburg. The driving was smooth on the motorway, and petrol consumption was high (as was the consumption of oil, as we came to notice later). At best, we were doing 100 kilometres per hour, and that was not even all that the Ford had in it.

In the afternoon we stopped to have something to eat in a harbour restaurant in Mariestad. Our car seemed to interest tourists, who still did not venture on coming to talk to us. A small boy said to his father: “Look Dad, a gangster car!”

We arrived in Gothenburg just before the evening. Amidst the busiest traffic, the car lost its idle running, and the motor had to be kept going by pressing the gas pedal intermittently. Well, that’s easy to fix. We pulled over and lifted the hood. After investigating the problem for a while, we adjusted the carburettor a little, and lo and behold, the mo-

A magnificent Coupe Ford.

tor worked perfectly. The car spent the night in the hotel parking facility.

Friday 3 August. We wanted to add some lubricants in the car in the morning and started looking for Roger's specialist shop; we had seen its advertisement in a local hotrod magazine. We found the shop and got the suitable oil grade.

Then we headed north towards the venue some 70 kilometres away. As we left Gothenburg we drove back and forth on the large bridges just because they are so impressive.

We also admired the maritime sceneries along the way. Towards the afternoon, we started to spot other old cars, too. We arrived at the venue after four o'clock. There were already many cars there. We picked a place at the side.

More and more magnificent cars converged on the area. Most of the cars travelled noticeably close to the ground, and many only had a primer paint on. The great thing about this hobby is that you can also drive an incomplete car – in fact, these things do not necessarily ever get ready. The atmosphere became denser towards the evening, and the sound of a double bass started to emanate from the main marquee, soon to change into rock'n roll.

Saturday 4 August. The programme in the afternoon included an uphill race. There were 32 cars in the race, trying to reach the same time on the route which they drove through twice. The race had attracted a large audience and also cars that had not been seen at the actual venue.

On the way back, we tried to trim the driver side brakes which dragged a little. On Saturday, the number of cars had grown from Friday; during the entire weekend, some 300 cars participated in the event. There were also some Finnish register plates.

The atmosphere in the area was very relaxed and straightforward. We talked with many local and Norwegian car enthusiasts about cars and much more. We were invited to a couple of smaller events next summer.

The programme on Saturday evening was pretty much like the one on Friday, although now there were more bands. I think the main performer came from Australia. Lights had been installed in the trees, and the old cars looked magnificent in the twilight. The banging of straight exhaust pipes could be heard every now and then.

Sunday 5 August. We had some time before noon to do shopping in the stalls and to admire the handicraft skills of other car devotees. Handiwork is an essential part of the old car hobby, because you cannot always find parts for the cars in just any shop. We embarked on the return journey at a moderate speed, because we still remembered the brake problems encountered on Saturday. Unlike some other problems, the brakes had not improved while the Ford had rested overnight. So, we continued towards Stockholm by stopping frequently to cool the brakes. The brake cylinders were also tuned on one occasion. As a result of all this, we had to abandon the idea of crossing the Baltic Sea the same night.

Monday 6 August. A hot day. We parked the car in Stockholm and walked in the city centre. We came to the harbour before the evening.

Tuesday 7 August. Arriving in Turku in the early morning, we started the final leg home. The constant driving, monitoring of oil pressure and cooling of brakes started to make us weary. We unloaded part of the cargo together with Mika Viitanen in Kangasala.

The smell of petrol emerged in the cabin. We examined the engine room and discovered that the base of the joint of the petrol pump leaked slightly for some reason. We tightened the joint. That didn't help any, the smell continued. We continued cautiously. The brakes were cooled for the last time in Pieksämäki, and the Ford picked up speed as home approached.

We came home exactly one week after starting the excursion. The Ford had covered 2,090 kilometres during the week. A good trip – glad we made it!

Winter fires

Photograph by Vaseavil

What a great idea! I see the light!

Creativity comes to us as light. In the darkness that surrounds us towards the end of the year, light is especially necessary and welcome – and at a premium. You're lucky just to have come up what to give people for Christmas. You just cannot think of a single New Year's resolution. The accounts have been closed. Your spouse is waving the summer travel brochures and demanding you to make up your mind.
Let me just crawl into my own bear's lair, where nothing new requires my opinion and where nothing old obtrudes to bore me.

Resting and lazing about are a good foundation for the flood of intelligence and ideas. So that light would appear as light, darkness is needed at the background. Candlelight is wasted in sunshine. There is no point for anyone to go ahead at full speed continuously. This does not produce light, only debris.
Luckily, we all are different from each other. Creativity is reflected in us in many ways. Some are productive and tireless like a combustion engine which makes all its energy available. The pistons move constantly. Ideas are emitted, the journey continues, lights glimmer.
Others are like a star which sacrifices itself in an immense one-off flash, which suffices for many for a long time.
Yet others are like a torch, modestly and secretly wise, which employs creativity whenever needed. The precise and seemingly low-powered action of such persons reveals everyday secrets even when the more intense sources of light have failed.
And someone else is the Gyro Gearloose of the workplace, someone whose lamp does not really provide light but whose creativity is manifested in the resourcefulness of human relations and mastering of social situations. Such a person is an angel without wings but with an inventor's hat.
The essential thing is that people can twinkle in their own way for most of their lives.
"Most" can refer to the biggest portion of time spent. On the other hand, people can endure amazingly much other types of work or being if "most" is perceived through significance and if the person has the facilities to put his or her biggest and most important things into practice in a creative and good manner.

In the energy balance of creativity, power is also created from highly varied sources and using very different types of resources.
Some seek the most natural alternative in everything they do; the way of the water, wind, a soft and ecological option. At the same time, such a person must be prepared to accept the risk that rain does not come regularly and wind cannot be ordered; there is bound to be some energy deficiency. You need to be prepared to wait for the resources to replenish.
Others rely on peat; and indeed, they may really be down to earth. Such people derive the power from the wisdom and energy of past forests. Utilising these is a slow process, but the persons in question think that they will learn something from it, too.
Someone else drills oil wherever possible. The entire world is his energy field, competition is stiff and yield is uncertain. But that person is driven by the visions and fury of seeking, reclamation and utilisation. Who cares if the resources are not renewable and there is nothing left for posterity.
There are also those who seek the ultimate power. Energy must emerge and it must be produced efficiently. The mental efficiency must be high so that it is worth the while being a human being and coming up with ideas. The risks are high – but isn't the whole life about a single great risk which people tackle by means of the technology they have developed?

No matter whether the light of creativity is blindingly bright or steadily dim and no matter whether the energy needed to produce it is high-yield or not, there is one thing to be hoped for: that the light of insight would also illuminate right and wrong.
Mere inventiveness, cleverness, resourcefulness and skilfulness are not wisdom. Even the most ingenious creativity can create bad things – and in many cases just that. Light in itself is, of course, beautiful, but the essential issue is what we use it to reveal and indicate. Creativity in itself is a gift but intended for sharing.

I wish you pleasant moments in the twilight! And wise thoughts beyond the winter season and turn of the year towards the light of spring. Maybe during this hibernation you inadvertently come to notice that you emanate a natural shine and discover how you can ensure that the energy required by this will be of a renewable sort from now on.

Hilkka Olkinuora is the columnist of the Fingrid magazine. She presents herself as follows: "Minister and journalist from Tampere, wrote earlier of economy, nowadays also again a student. Also works at workplaces, and discusses electric encounters in this magazine."

This year, WE DONATE THE SUM RESERVED
for our Christmas greetings to the Disaster Relief Fund
of the FINNISH RED CROSS.

FINGRID OYJ

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