FINGRID CORPORATE MAGAZINE | FINGRID OYJ | 3 / 2015 | TRANSMISSION GRID AND SYSTEM SECURITY

FINGRID

4 | Olli Rehn: Towards **common electricity markets**

5 | The new regulatory model **stabilises the tariff**

20 | **EIA** is cooperation

In October, Fingrid organised an afternoon for female technology students as part of the Women in Tech week. Read more on page 19.

FINGRID

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IN THIS ISSUE

4 **Finland is involved in the creation of a common electricity market in the EU**
According to Minister of Economic Affairs Olli Rehn, common markets are the most effective way to secure the reliability of electricity supply.

5 **The new regulatory model stabilises the grid tariff**
Allowed profit from main grid operations will increase and come closer to the European level.

6 **Ready to repair**
Fingrid prepares for disturbances in transmission lines by organising repair exercises for its service providers. In this autumn's exercise, participants also included substation maintenance providers.

10 **Operating instructions are ready in case of a power shortage**
Fingrid continuously monitors the balance between electricity production and consumption. If a power shortage looms, we know exactly what to do.

13 **Introducing network codes**
The RfG network code sets requirements on power plants.

14 **Demand response is worthwhile**
Demand response means more work for back-up generators.

16 **Fingrid invests in electricity transmission hubs**
The Länsisalmi and Kristinestad substations will be expanded.

18 **Looking for a direction on the European energy market**
The EU Commission outlined its thoughts on how the energy market should be developed.

19 **What on earth?**
Main grid development plan

20 **EIA is cooperation**
The aim of the EIA procedure for a transmission line project is to adapt the lines to their environment in the best possible manner.

22 **Seasonal changes set the pace for nature inventory**

23 **Nature column**
The most Finnish species of bird

24 **When should I roast my Christmas ham?**
And how much electricity is consumed by Christmas lights? Check the answers in Fingrid magazine's information package for the end of the year!

27 **In Brief**

30 **Weathering the climate**
Frost can snowball into snow crown-load

31 **Grid Quiz**

EDITORIAL

REIMA PÄIVINEN | SENIOR VICE PRESIDENT, POWER SYSTEM OPERATION, FINGRID OYJ

GENERATION ADEQUACY, FLEXIBILITY AND INERTIA

At any given time, we have to produce as much electricity as is being consumed. This law of physics is especially important to remember as the amount of weather-dependent renewable energy increases. Technology for storing electricity on a large scale is not yet available and is unlikely to be anytime soon. Since Fingrid is responsible for balancing production and consumption in Finland in real time, we closely follow changes in production portfolio both at home and abroad. We think about how to ensure that the lights stay on and industry can rely on a stable supply of electricity in the future, too. As a result, we have three challenges ahead of us: generation adequacy, power system flexibility and the power system's inertia.

Finland's own electricity production capacity is insufficient to cover our consumption during peak winter consumption situations. Recent closures of Finnish power plants have further weakened the situation. The need for imports in the coming winter will rise to a level of 3,400 megawatts on a very cold day. This means that over 20 per cent of the estimated peak consumption of 15,000 megawatts has to be imported from abroad. In total, we need more import than the total amount of energy produced by all of our nuclear power plants combined. Not even the commissioning of Olkiluoto 3 will stop us from being dependent on imports. According to calculations, transmission interconnections will be sufficient to import the necessary electricity, and neighbouring countries will have electricity to offer. We cannot, however, afford any faults at production facilities or in transmission interconnections, and the risk of short-term load-shedding has increased.

Consumption fluctuates strongly from day to day and hour to hour. Production follows consumption in order to achieve balance. Flexibility decreases when coal production and other condensing power production plants, which have good regulating capability, are permanently shut down. They are being replaced with wind power, which brings additional challenges to power balancing. The need to balance production with consumption is therefore increasing, but the number of power plants which are able to help with balancing is decreasing. The solution is closer cooperation with our neighbours in using regulating resources effectively. The role of consumption will also become more important. In the future, we will need a significantly higher amount of consumption participation to maintain power balance. Various mechanisms to increase demand response have been developed in pilot projects. We also need an economic incentive, which is currently lacking due to the low price of electricity.

The power system also requires kinetic energy, or inertia, which is produced by rotating mass in power plant turbines and generators. Inertia is needed during disturbances. When a power plant suddenly trips from the grid as the result of a disturbance, the rotating mass at other power plants momentarily ensures that no widespread outage occurs. The most inertia is produced by traditional power plants such as nuclear power plants and other thermal power plants. In southern Finland and southern Sweden, nuclear and thermal power plants make up almost one half of the inertia in the entire Nordic power system. There is little inertia in wind power, and none at all in solar panels. As the production portfolio changes, the overall amount of inertia in the Nordic power system will begin to decrease. In the next decade, this could occasionally restrict the use of large plants or transmission connections during low summer consumption.

"Close cooperation between various parties is key to finding the best solutions."

The Nordic power system, dominated by hydropower, will allow for a significant increase in renewable energy. This will, however, require some work. Close cooperation between various parties is key to finding the best solutions to ensure that generation adequacy, flexibility and inertia are sufficient in the future.

MINISTER OLLI REHN:

"**Common markets** are the most effective way to secure the reliability of electricity supply"

EU guidelines on climate policy and integration of electricity markets have a strong impact on Finland's energy policy. According to Minister of Economic Affairs Olli Rehn, the Finnish Government is committed to creating internal energy markets.

TEXT SUVI ARTTI | **PHOTOGRAPH** KESKUSTA

"The EU's common markets are the most efficient way to secure the reliability of electricity supply," says Minister of Economic Affairs Olli Rehn.

He explains that Finland is closely involved in influencing the development of European markets. "We are exerting influence in a proactive manner at all levels by offering solution models. With regard to retail electricity markets and smart grids, for example, the Commission has shown great interest in Finnish experiences."

The Commission's new, so-called energy union-related guidelines emphasise regional cooperation when promoting European integration. In Rehn's opinion, it is often more effective to operate at the regional level rather than at the centralised, EU-wide level.

"We have a long history of Nordic energy cooperation, and cooperation in the broader Baltic Sea region has also been fruitful. However, in some cases such as achieving the targets for renewable energy, a national approach is justified because of the structure of the energy economy."

The idea of combining main grid functions in different regions has also been proposed in the EU. In this matter, Rehn also favours looking for common operating methods, but he would keep the final responsibility for main grid operations at the national level for reasons of reliability.

"The transmission reliability of the Finnish main grid was 99.9974 per cent in 2014. Based on that figure, Fingrid is doing what is promises in its slogan, which is to deliver electricity reliably."

Self-sufficiency is important but not the only target

Based on a report commissioned by energy industry actors early this year, the gap between peak electricity consumption and production will increase in Finland in the near future, especially prior to completion of Olkiluoto 3. Olli Rehn says that this autumn the Government intends to issue guidelines concerning whether other reserves might be needed to supplement the peak load capacity system in order to prepare for consumption peaks.

Rehn would like to maintain self-sufficiency but not as the sole target.

"We have to maintain a certain degree of national self-sufficiency with regard to electricity, particularly with regard to peak power. However, this cannot be the only target, especially if the market offers the same product at a significantly lower price."

And how does the minister see the future? Rehn believes that in 2050 we will have open and advanced electricity markets with a variety of emission-free products, large and small producers, all competing equally with each other. In that situation, consumers will also have an active role in the market.

Regulation reform for more stable pricing

The rate of investment in the electricity transmission sector is continuing at a rapid pace. In the new regulatory model, allowed profit from main grid operations will increase and come closer to the European level so that Fingrid is able to keep the Finnish main grid one of the most reliable in the world.

TEXT SUVI ARTTI | **ILLUSTRATION** ISTOCKPHOTO

"Significant investments are still expected across the entire sector, with background factors including customer needs, electricity market development and changes to the Electricity Market Act. This will also be taken into account in the regulation. We will be allowed to earn somewhat more than we previously have, and that will allow us to carry out our basic tasks and the necessary investments," says Fingrid's CFO **Jan Montell**.

"We will be facing great challenges in the next few years as we prepare for massive changes to the European power system. Fingrid works hard for Finnish interests in Europe so that our power system remains reliable and able to respond to the challenges and opportunities brought about by renewable forms of energy."

A stable, predictable tariff

For Fingrid's customers, the new regulatory model means an increase in grid tariffs for 2016. The good news is that the new model will bring even more stability and predictability to tariff development. The model will be valid for eight years, while the previous model was only valid for four years at a time. Fingrid aims to make changes to tariffs one year at a time, and to communicate its surplus or deficit in allowed profit in connection with interim reports so that customers can better predict the development of tariffs for the next year.

The new model also increases transparency in the use of congestion income. In the future, this income will be monitored separately from other profit, so the fluctuations in congestion income will no longer directly affect the tariff. This will also show that the income truly is used directly to remove cross-border congestion.

In the new model, the significance of incentives will increase further. Incentives relate to innovations, cost-effectiveness and quality. "The Energy Authority monitors costs so that they do not get out of hand. The model punishes Fingrid more than before if quality slips or costs rise. As such, regulation is stricter than ever – and that's good, since our aim is continuous development in these matters," says Jan Montell.

Finland's grid tariff is amongst the lowest in Europe, a level which Montell says Fingrid aims to maintain. He also points out that the transmission system operator's investments benefit the entire national economy.

"Fingrid is owned by the state and Finnish pension insurance companies, so in addition to the company being a major taxpayer, our dividends also end up going back into the country. We invest over one hundred million euros into Finland on an annual basis, and employ not only our own personnel, but a large number of service providers' and their subcontractors' personnel, too."

FACT

Key factors affecting grid pricing

- Interest rate of the Finnish government's 10-year bond
- The Finnish area price of electricity
- Reserve prices
- Inflation
- The effect of temperature on electricity consumption

The terms of the grid service contract will be reviewed from 1.1.2016. What will change?

1. **Contract structure**
   - Valid until further notice.
   - The terms of service are enclosed as an appendix. If necessary, the terms can be updated as circumstances change.
2. **Pricing structure**
   - A step in a more power-based direction.
   - Production's share of payment will increase.
   - Payments will also be partially allocated to production behind the connection point.
3. **Reactive power and reactive power reserves**
   - Connection point-specific limits on use and provision of reactive power, updated annually.
   - Monitoring and invoicing by connection point.
   - The reactive power reserve will be obligation-based in the future.
   - Requested voltage support will be paid.
4. **Clarifications to terms of payment**
   - Electricity tax and related bank securities concerning taxpayers.

At the time of printing, no official decision on the new regulatory model had been made. The information is based on version 2 of the Energy Authority's guidelines. The final decision on the regulatory model will be made in November 2015.

Fingrid prepares for disturbances in transmission lines by organising regular repair exercises. Should a line encounter a fault, the fault is located, the site is protected, and the line is repaired according to well-rehearsed and pre-specified procedures.

TEXT SUVI ARTTI | **PHOTOGRAPHS** MATTI IMMONEN

Tree-proof line clearings have helped Fingrid's transmission lines to avoid the most severe damage in recent storms. Nevertheless, line faults occur from time to time for various reasons, around 2–3 times a year on average. "Line faults can be caused by high winds or ice load, which can damage the line or tower. Guy anchor rod corrosion and collisions involving agricultural machinery have also caused faults in the past," explains Fingrid's Maintenance Manager for transmission lines, **Mikko Jalonen.**

No major disturbances have occurred on the main grid since the 1970s, and Fingrid's customers are satisfied with its level of operational reliability. Since we have no experience of a widespread disturbance, practice is of the utmost importance. Fingrid regularly organises fault repair exercises to maintain preparedness amongst both its own and service providers' personnel. An extensive power outage is costly for society, so we must be able to act quickly if the time comes. →

The September exercise included a visit to the transmission line fault repair warehouse in Heinola. Also present were Vesa Malinen and Mikko Nykänen from Fingrid.

HOW THE FAULT REPAIR PROCESS PROGRESSES

FAULT DETECTION

The operations control system at the Main Grid Control Centre detects if there is a fault along a line and there is an electricity outage. Fingrid's representative for the maintenance area in question and a service provider are alerted to initiate fault patrol.

Substations also involved in exercises

For the first time, transmission line personnel were joined in the fault repair exercise by substation maintenance providers, who locate and repair equipment faults in substations and carry out local switchings required by transmission line and substation faults. Transmission line exercises are organised every three years, and the aim is to also practice disturbance clearance and fault repair at substations regularly.

With regard to substations, the exercise contained presentations on issues such as the loss of auxiliary power and the replacement of a faulty large transformer. The exercises also involved group work dealing with matters such as repairs at a substation in extreme weather conditions, faulty equipment in a GIS and bypassing the switchgear at a substation. The group work resulted in lots of good procedures for investigation and development.

"It was established that there was a need for the exercise, its lectures and group work, and the closing discussion gave us some good guidelines for the next exercise," says **Timo Heiskanen**, Fingrid's Maintenance Manager for substations.

Selecting a repair tower is a multi-stage task

Concerning transmission lines, Eltel Networks Oy's Planning Manager **Aki Tiilikainen** spoke about selecting a suitable tower at the fault site.

"First of all, we need to know which line we're dealing with. Then we begin to investigate initial information, such as the voltage level of the damaged line and the towers affected by the fault. Then we find out general information about wires, overhead ground wires, angles, spans, tower type, and so on."

Also important is how the fault occurred; is the reason external, or did it arise from foundation movement or corrosion of the underground parts of a guy wire, for example? We then find out whether or not there is more than one damaged tower and whether anything has happened to the surrounding towers.

The person responsible on-site provides his or her perspective on how to proceed with the situation. The planner, contractor and Fingrid representative must work in close cooperation to find the best possible solution.

A repair plan is drawn up based on the initial information. The first option to investigate is whether it is possible within the desired schedule to implement a final solution rather than a temporary fault repair tower: either an old tower from the fault repair warehouse or a new tower from an active worksite.

Participants in the exercise gained first-hand knowledge about the new fault repair towers.

FAULT PATROL

The Main Grid Control Centre calculates an estimate of the location of the fault site and the patrol begins to locate the site in more detail. A helicopter may be used if necessary and where possible, but storms can ground a helicopter. Information about a fault site can also be obtained from an external source, especially if the fault was caused by an external party.

If the disturbance is widespread and normal communication channels such as mobile telephone networks are unavailable, it is possible to use satellite telephones for communication and agree in advance on meeting points where communications are secure.

LIMITING AND PROTECTING THE FAULT SITE

The service provider searches for the fault site. Once the site is located, it is ensured that the fault poses no danger to external parties or the environment and additional damage is prevented. The fault site is cordoned off to prevent unauthorised access and the necessary security is arranged. Depending on the location of the fault, authorities are alerted to direct traffic and to provide executive assistance in protecting the site.

If the fault has caused a tower to fall over, or there is more widespread damage, it is ensured that no additional damage will occur to the grid. The fault site is isolated from the intact grid by supporting the intact, erect structures. After this, clearing of the fault site takes place. Clearing work is challenging since damaged structures pose a danger of collapse and some components contain unpredictable tensile forces. Clearing work is carried out carefully, since occupational safety may not be compromised even in the event of a fault.

It is important to find out information about the soil in order to find out what kind of foundation is required for the new tower. Attention should also be paid to whether the replacement tower fits in the expropriated area. The existing, reserved area for angle supports in particular, may be insufficient. If necessary, a cartographer is requested on-site.

Different tower types

There are several different kinds of tower in the fault repair warehouse: tall towers, short towers, towers equipped with different kinds of guy wires and towers meant for single and double circuits. Alternatives are ruled out fairly quickly once the terrain at the fault site is clarified and a suitable tower for the line is found.

"We have to think about what is suitable for each location. The wires, overhead ground wires, phase-to-phase spacing, chains and insulators all have to be taken into account. The heights of the preceding and subsequent towers determine the height of the tower we can use," explains Aki Tiilikainen.

The planner ensures that the type of tower is suitable for the site in question and a Fingrid specialist approves the solution.

New fault repair towers are versatile

In addition to old towers, new fault repair towers were completed in early autumn at the Heinola fault repair warehouse. The basis for their design was the need for a tower that could be erected in a range of different locations and which takes up less space in the terrain than a traditionally guyed tower, explains **Kari Lindholm**, Fingrid's Regional Manager for Southern Finland.

"The steel foundation used in these towers is entirely new. It can be adjusted as necessary to be taller or shorter, so the tower can be erected in a wide range of locations, even on a ridge or on bedrock," says Lindholm.

Traditional concrete foundations are more affordable and are better suited to permanent solutions planned to last decades, as concrete is not susceptible to corrosion. But steel foundations are excellent for temporary use.

"A fault repair tower is a temporary solution. It may be used for a year or two – depending on the kind of work carried out on the line in question and the scheduling of transmission outages," Lindholm adds.

One advantage of the new towers is that they can be used almost anywhere. The same type is suitable for use with straight transmission lines, as angle supports and as section supports.

Pekka Toivanen, CEO of the company that designed the towers, Muotohiomo, describes the towers as "lego towers", since the components of the tower series can be used to construct many different kinds of towers. The colour codes show which components connect to one another: yellow fits yellow, red fits red, and so on. "We also took logistics into account during planning. The tower components fit into a trailer or the back of a lorry," says Toivanen.

In addition to the Heinola main warehouse, transmission line towers and transmission line spare parts are also stored at other locations around Finland.

FAULT REPAIR

After the fault site is cleared, the repair or replacement of the damaged structure begins. Even before this, investigative work with the service provider to find the best possible repair solution has begun and personnel at the fault repair warehouse have been alerted. Depending on the damage, it may be necessary to carry out structural and location planning for towers.

The fault is always repaired as quickly as possible. Repair usually takes at least a day. If the damage is extensive, repair and clearing may take several days. Work always aims at a permanent solution where time constraints allow. Dangerous structures are repaired immediately regardless of the electricity transmission situation. In the event of a widespread fault, the prioritisation of fault sites can also affect the speed of fault repair.

IN CONCLUSION

Once fault repair is complete, interim earthings are removed and the Main Grid Control Centre is notified that work is complete. After this, the line can be taken into use again. Final work includes tidying the fault site and documenting the changes that were carried out. The fault and the reasons behind it are investigated and the repair procedures are analysed. Experiences of the event are collected and relayed to all partners. If necessary, development procedures are initiated. This means that when the next fault occurs, we're more prepared than ever to act.

FULLY PREPARED FOR **POWER SHORTAGES**

Fingrid's Main Grid Control Centre monitors the balance between electricity production and consumption round the clock. If the situation begins to look worrying, we know exactly what to do.

TEXT OUTI AIRAKSINEN | **ILLUSTRATION** ANSSI KERÄNEN

Compared to last winter, which was mild, there could be difficult times ahead. Are electricity production and import sufficient to cover rising demand, if cold temperatures are forecast – especially after a grand total of 800 megawatts of flexible condensing power has been removed from the grid since last year?

The situation is much the same elsewhere in Europe. Support for renewable sources of energy has lowered the price of electricity such that the upkeep of traditional power plants – which work regardless of the weather – is no longer economically viable. Last year, Poland had to resort to restrictions on electricity consumption as cooling in the country's power plants encountered problems.

Fingrid's control centre keeps a close eye on the situation. We are able to predict the overall consumption of electricity in Finland fairly precisely into the next day, but over the long term, predictions can vary.

"If the weather forecast changes dramatically over the course of the weekend, the electricity procurement and production plans made on Friday might no longer be applicable. That usually means a very busy Monday morning for us," says Balance Management Specialist **Jouni Hakonen**, who works in the control centre.

The situation can escalate if power plants are removed from production due to faults.

Towards balance through information

Fingrid has a three-step procedure for managing power shortages, even though no situation has yet required escalation to the second or third step. When the control centre observes that the forecasts for electricity pro- →

"If the weather forecast changes dramatically over the course of the weekend, the electricity procurement and production plans made on Friday might no longer be applicable. That usually means a very busy Monday morning."

"So far, notification alone has been enough to uncover extra production capacity and to manage the situation."

duction and consumption clearly deviate from one another over the next few hours, the first step is to investigate whether or not we can find extra production to cover consumption.

"First we discuss how to proceed with a colleague in the control centre. If the situation becomes more severe, we begin to think about requesting assistance from a neighbouring country. In addition to Sweden and Estonia, we can also ask Russia for help in certain situations," explains Hakonen.

As transmission capacity is a finite factor, problems cannot always be solved through imports. Until now, however, we have managed to avoid starting up reserve power plants simply by communicating with other parties. Bulletins about the potential power shortage are sent from the control room to various parties via e-mail and text message. Then, we pick up the phone.

"We first ask parties to check and update their production and consumption forecasts. We also request more balancing power bids. So far, notification alone has been enough to uncover extra production capacity and to manage the situation," says Control Room Manager **Jari Siltala**.

Motivation is increased by the knowledge that the price of electricity can rise drastically in the next few hours, and as such it is profitable for other parties to increase their production and reduce their consumption where possible.

Restrictions on consumption in extreme circumstances

If the demand and supply of electricity cannot be balanced through an increase in imports and no extra megawatts are found through communication, we move on to the second step of the procedure. In practice, this means that Fingrid has to compromise its fast disturbance reserve to maintain balance between production and consumption.

"We must have fast disturbance reserves available at all times in case of the largest possible fault, and in practice this is most likely a loss equal to a single unit at Olkiluoto. Fingrid's disturbance reserves, such as reserve power plants, are procured to secure supply during grid and production faults; a power shortage occurs when much of the reserve has been taken into use to replace missing production. This means that the power system's capacity to withstand sudden and surprising faults is lowered," says Hakonen.

The third step is taken if the matter cannot be resolved even with the fast disturbance reserve. In practice, the transmission system operator would begin to disconnect consumption.

"We first notify parties that we are experiencing a severe power shortage and that Fingrid will begin to disconnect loads in order to manage the power. Attempts would be made to restrict load equally and to rotate through grid owners such that a single consumer would experience a maximum outage of approximately two hours," says Siltala.

MARKET DEVELOPMENT SEEKS SOLUTIONS FOR POWER ADEQUACY

Is it acceptable to restrict consumption in Finland under extreme circumstances? Fingrid's Executive Vice President **Juha Kekkonen** demands urgent public discussion on the matter, since the answer will have an effect on the sums required to maintain reserve capacity.

In addition to Finland, Sweden and Denmark have also become increasingly aware of the threat of a power shortage. In Sweden, the risk is heightened due to the closing of nuclear power plants, while in Denmark the system has for years been constructed around inflexible wind power.

The problem affects us all, so the Nordic transmission system operators have begun to work together to find ways to solve the problem. Together they are looking towards the markets: The price should better reflect the system's scarcity factors. Together, transmission system operators have drawn up a list of procedures with which to improve market functionality. One of these is a project which aims at getting the market actor's balance deviation, or imbalance power price to better correspond to the real costs of maintaining balance. Also on the drawing board is an idea in which production and consumption would be balanced every fifteen minutes rather than once an hour.

The Nordics are also considering the development of a joint market for adjustable reserves. A functional trading platform would encourage producers to maintain adjustable power plants. Increasing demand response in households would also be of use over time.

Transmission system operators feel that we should not begin to give economic support to the maintenance of traditional power plants, and the fluctuation in the price of electricity should not be politically regulated. On the other hand, support for the production of renewable energy should also be cut – or at least transferred from production to investments and technological developments.

EUROPEAN COOPERATION

PRESENTING NETWORK CODES

Network codes are rules compiled by the European Network of Transmission System Operators for Electricity (ENTSO-E). Their purpose is to harmonise the European electricity markets. This column will present the network codes one at a time. The code this time is *Requirements for Generators.*

The RfG network code sets requirements for power plants

The Network Code on Requirements for Grid Connections Applicable to all Generators (NC RfG) brings requirements for smaller power plants. The objective is to ensure the system security of the power system and secure fair competition conditions on the internal electricity market.

TEXT ANTTI KUUSELA

The RfG network code sets regulations for connecting power plants to the interconnected system. The code is intended to ensure the system security of the power system, fair competition conditions on the internal electricity market, and the connection of renewable energy sources to the grid. At the same time, the network code facilitates pan-European electricity trade. The code also sets obligations for different parties, which will ensure that the technical capacity of power plants is utilised in a transparent and non-discriminatory manner in order to guarantee equal operating conditions throughout the EU.

Also for small power plants

The scope of this network code extends to all power plants that are over 0.8 kilowatts in rated power. This is a significant change to the current practice, in which the national requirement (VJV2013) only sets binding conditions for plants with a capacity of more than 0.5 megawatts. The requirements have been divided into four categories according to the rated power of the plant and the voltage level of the connection point. Power plants in category A are subject to minimum requirements that gradually become stricter as power increases. Power plants in category D (over 30 megawatts of rated power) are subject to the full range of requirements. The requirements also differ according to the grid connection technology used at the plant. The line has been drawn between synchronous power plants and power park modules.

The biggest changes in comparison to the VJV2013 requirements involve the compliance process, compliance monitoring, and derogations from the requirements. In the compliance process, the grid owner for the connection point is obliged to monitor and issue operating permits in steps at different stages of a power plant project. The grid owner for the connection point can change the power plant's operating permit if it observes that the requirements are not being met during normal operation. According to the current practice, derogations from the requirements must be applied for directly from Fingrid, but the RfG network code will make the supervising authority, in this case the Energy Authority, responsible for processing derogation decisions.

In technical terms, the requirements are very close to the national VJV2013 requirement that is currently used. The largest technical changes are related to changing power classifications. The limit for the biggest power class will drop from 100 to 30 megawatts. The change governed by the network code means that the reactive power capacity requirement for wind power plants will apply in full to power plants of more than 10 megawatts.

New requirements to take effect in 2018

As a general starting point, the requirements of the network code will not apply to existing power plants or power plant projects for which procurement of main components has already begun. In conjunction with revision, new requirements can be applied to the extent that key components are renewed.

National implementation of the network code must be carried out within three years of the code taking effect. This will be done by making the conditions specified in the network code part of the national requirements: "Specifications for the Operational Performance of Power Generating Facilities" or the VJV. The code is expected to enter into force at the end of 2015. If this schedule is maintained, the new VJV2018 national requirement will enter into force by the end of 2018 at the latest.

Demand response means **more work for back-up generators**

Back-up generators ensure the electricity supply at many sites throughout Finland. A joint pilot project involving Fingrid, Enegia and Digita Networks Oy tested whether they could also be used to increase demand response in the national electricity system.

TEXT MIRA MUURINEN | **PHOTOGRAPH** DIGITA

Various back-up generators in Finland provide hundreds of megawatts of power. Electricity is vital to the operations of many organisations, so this equipment is needed to safeguard electricity supply in unexpected disturbances.

Power outages are rare in Finland, which means that back-up generators are idle most of the time. A joint pilot project involving Fingrid, Enegia and Digita Networks Oy tested whether such back-up generators could be used to meet demand response needs and bring added efficiency to the electricity market.

37 back-up generators

Digita has acquired back-up generators to ensure the flow of information in Finland even during electricity outages.

"Digita's television and radio network covers all of Finland and the telecommunications network must also function in crisis situations to ensure security of supply. The networks and main broadcast stations must be reliable because radio and TV networks are vital basic functions of society," explains **Jukka Asikainen**, Digita's Group Manager for Infrastructure Design.

"Enegia originally suggested that we participate in demand response. At that time, we thought that our existing capacity could very well be utilised to improve electricity grid reliability."

The pilot involved testing whether Digita's back-up generators could automatically start up if the electricity grid frequency dropped suddenly, for example, due to a disturbance in a power plant or transmission line. Of course, the power of a single back-up generator is very small on a national scale, but the power obtained from several sites can be aggregated and offered as a whole to a suitable marketplace.

The pilot included 19 Digita sites from all over Finland, for a total of 37 back-up generators ranging in size from 100–300 kW. Digita already had a control system that can be used to manually control back-up generators in different geographic locations from a single site.

Frequency measurement equipment was acquired for the pilot, and it sends an automatic start-up command to the back-up generators when the electricity grid frequency drops below a certain point. When the back-up generators start up, consumption at those sites is rapidly removed from the grid, thus reducing national demand for electricity. The energy measurement equipment required by Fingrid was also added to the back-up generators, and used to measure the load using back-up power and the back-up capacity of the frequency-controlled disturbance reserve.

Real-time power measurement is new

Enegia's task in the pilot involved providing the necessary data transmission between Digita and Fingrid and handling planning and reporting on daily reserve power.

"The biggest challenge in the pilot was implementing the real-time verification of reserve power required by Fingrid. Information about the back-up power had to be

The Kuopio radio and TV station.

sent from substations located in different parts of the country to us and Fingrid in real time. This data had not been previously measured on-site. Whenever you do something for the first time, it takes a while to find the right solution," says **Juha Hietaoja**, Senior Energy Specialist at Enegia.

Enegia has worked with demand response on earlier projects. "Our customers have been active on the Elspot market for a long time, but the Fingrid marketplaces require faster reaction and represent a whole new world for many operators. However, the better compensation that can be gained through fast reaction and round-the-clock participation in the markets made possible by our control room have attracted a lot of interest. These types of pilot projects are an excellent way of trying out new operating models and getting new parties involved in the markets," Hietaoja explains.

Development work continues

From Fingrid's perspective, the key element of the pilot project was finding out how fast back-up generators can react to changes in grid frequency. In testing, they started up very quickly, 15–30 seconds after a change in the system frequency. However, as the pilot progressed it became apparent that, from the power system viewpoint, even half a minute is a bit too much for the frequency-controlled disturbance reserve. When the rules for frequency-controlled disturbance reserve market change at the beginning of 2016, the required reaction time will drop to five seconds.

"We can't achieve five-second reaction with only back-up generators, but UPS (Uninterrupted Power Supply) systems that are combined with back-up generators at many sites make it possible to participate in the frequency-controlled disturbance reserve market. They can react to frequency changes rapidly, and can thus be used to handle the short-term start-up need before switching over to back-up generators," explains Juha Hietaoja.

All of the parties involved are satisfied with the pilot, even though the plans made at the start of the project were not completely realised. "Everything has worked well since we got the technical implementation arranged, and the extra start-ups of the back-up generators have not had any effect on our operations," says Jukka Asikainen. Assisted by Enegia, Digita is considering other options for utilising the technology built during the pilot.

"For example, it's likely that Digita's back-up generators can be utilised in the new balancing capacity market that will open early next year. Both electricity producers and major consumers can take part in this market," says Fingrid's Development Manager **Jonne Jäppinen**.

The pilot served its purpose, which was to provide the parties with information and ideas about what works and what does not. "This pilot was particularly interesting because there are so many back-up generators in Finland. You would think that we'll be able to find promising applications. For example, the new data centres being built in Finland will have a lot of back-up power that could be utilised," concludes Jäppinen.

Fingrid invests in electricity transmission hubs

Fingrid continues to invest in main grid development. Major investment decisions have been made recently concerning, for example, the expansion of two substations, one in Southern Ostrobothnia and the other in the Helsinki region.

TEXT SUVI ARTTI | **ILLUSTRATION** PARVIAINEN ARKKITEHDIT OY

An illustration of the impressive landscape portal that will be built at Länsisalmi electricity substation.

The energy sector is the largest industrial investor in Finland at this time, and Fingrid is among the leaders with annual investments of 100–200 million euros. In the current economic situation, this is a significant amount, especially when considering that the company employs a large number of service providers and their subcontractors in addition to its own personnel.

An impressive landmark on Ring Road III

Development of the main grid requires reinforcement for not only transmission lines and cross-border connections but also for substations. Electricity from Fingrid's main grid is transmitted to Helsinki and Vantaa via the Länsisalmi and Tammisto transformer substations located at the Ring Road III level. Approximately 800 000 customers receive their electricity through these substations. The increase in electricity consumption in the region and changes in Helsinki's electricity production make it necessary to reinforce the electricity transmission capacity.

Fingrid is reinforcing the Länsisalmi substation in order to ensure the electricity supply for residents in the area and secure functions that are vital to society. The substation's transformer capacity will double after the addition of a second 400/110 kV transformer. A 400 kV switchgear will also be built and the necessary 400 and 110 kV line arrangements will be carried out.

The substation will be extended from the existing single transformer field to a four-field switchgear. The substation will be a gas-insulated switchgear. As a result, the substation will not take up any more space than earlier because the reinforcements will fit onto the same plot of land.

The building's central location beside Ring Road III and the Porvoonväylä highway will be taken into consideration when designing and landscaping the substation. Parviainen Arkkitehdit Oy is responsible for the architectural design of the substation building and terminal tower of the transmission lines, which will be visible to the routes.

"The landmark of this substation will be an impressive landscape portal at the point where the lines connect to the substation. The old transformer bunker will be redesigned in line with the new look and the other old structures will be removed," says Project Manager **Jarmo Henttinen** from Fingrid.

Construction work will begin at the beginning of next year and the project is scheduled for completion in 2017. The investment is valued at approximately 18.5 million euros.

Fingrid is also planning the construction of a new 400 kV cable connection closer to the centre of Helsinki in the 2020s. The development of the Länsisalmi substation will help to implement that plan.

> "The increase in electricity consumption in the region and changes in Helsinki's electricity production make it necessary to reinforce the electricity transmission capacity."

Connecting wind power to the grid in Southern Ostrobothnia

The expansion of the Kristinestad substation will improve the reliability of the electricity network in Southern Ostrobothnia and allow for hundreds of megawatts of wind power to be connected to the grid.

Electricity produced by wind farms in Southern Ostrobothnia will be transmitted to electricity users via the Kristinestad substation, which is part of Fingrid's main grid, and the local 110 kilovolt grid owned by EPV Alueverkko Oy. Grid planning between the two parties resulted in EPV Alueverkko Oy, which operates in municipalities in Southern Ostrobothnia and Ostrobothnia, changing how it uses the grid in order to allow for the connection of significantly more wind power. The change requires expansion of the Kristinestad substation, which will also increase the substation's significance as a key electricity grid hub.

The decision to construct the Kristinestad substation was made in 2010, and even then possible needs to expand the substation were comprehensively taken into consideration. The substation was completed in 2014 and contains an extensive 110 kilovolt switchgear, a restricted 400 kilovolt switchgear and a 400/110 kilovolt transformer which connects the 110 kilovolt distribution network and 400 kilovolt main power transmission grid.

Now, another 400/110 kilovolt transformer will be added to the substation, and the 400 kilovolt switchgear will be expanded to a duplex switchgear. The investment will allow for wind power to be connected to the grid in Southern Ostrobothnia and provide electricity consumers in the same area with a reliable connection to the main grid. At the same time, the areas of responsibility between grid companies will become clearer, use of the grid will become easier, and the expansion of the substation will secure high grid availability and reliability even in the occurrence of various disturbances or maintenance outages.

Construction work on the investment, which is worth approximately 10 million euros, will begin next year, with the project due for completion in autumn 2017.

Looking for a new direction on the European energy market

The energy market guidelines published by the EU Commission last summer contain many elements to improve functioning of the electricity market. However, implementation of the package may prove challenging.

TEXT OUTI AIRAKSINEN | **ILLUSTRATION** ISTOCKPHOTO

The EU Commission's Energy Market Design outlines its thoughts on how the energy market in Europe should be developed. Originally created in the Nordic countries, the old electricity market model has begun to fall behind in a new operating environment where the share of renewable sources of energy, and their funding subsidisation in particular, is high.

"The Commission package is really a statement of policy concerning where we should go – without actually saying how to get there," explains Fingrid's Executive Vice President **Juha Kekkonen**.

He still believes that the Commission's guidelines represent a move in the right direction. "Price signals on the electricity market should be more visible and influential, renewable energy subsidies should be more market-based, and we need to avoid other production capacity remuneration mechanisms," lists Kekkonen.

Implementation is politically uncertain

Regardless of how clever the Commission's guidelines are, the package may be difficult to put into practice because in the EU, choices regarding energy sources fall within the scope of national competence. The elimination of subsidies for renewable energy sources will at least be politically impossible.

"On the other hand, the package emphasises regional process, which is a very good thing in our opinion. Europe is not a homogeneous region, and different areas are at different stages of development," says Kekkonen.

The Nordic countries are ahead of the rest of Europe, also in terms of developing the retail electricity market. For example, our consumer electricity prices follow wholesale prices and we use smart electricity meters, which make it possible to react to price changes on an hourly basis if necessary. A centralised information exchange solution, also known as a datahub, is also likely to open up new services for consumers. Such datahubs are currently under construction in the Nordic countries.

Regulation may limit development

After consultation, the Commission will begin preparing the issues presented in the package. The introduction of new regulations is likely to occur after this process, because the EU doesn't really have any other means of exerting influence. Fingrid's Kekkonen is concerned that detailed regulation may make the markets more rigid.

> "Regulation of market-related matters should always be avoided."

"Regulation of market-related matters should always be avoided. Limiting market dynamics often leads to a situation in which market development stops. Although the objectives take us in the right direction, the targets can be reached by means other than legislation."

Kekkonen believes that since the operating environment is in a state of constant change, it would be better to let ideas grow, technology develop and include the ordinary consumer in the market. For example, demand response, decentralised production and electricity storage are rising trends. Electric car owners will also play an active role in the balancing power market in the future.

IN BRIEF

An afternoon full of female energy

Fingrid organised an afternoon for female technology students as part of the Women in Tech Week.

Held by Fingrid on 12 October, the Networking Women afternoon for female students presented employment and career opportunities in positions related to the electricity grid.

"We need experts from different fields now and in the future, and we want to welcome women to the energy sector to develop Finnish society," says **Tiina Miettinen**, Fingrid's Senior Vice President, HR and Communications.

The event was part of the Women in Tech Week held in October by the Federation of Finnish Technology Industries and cooperating companies. The week was intended to highlight successful women working in technology fields and encourage women to choose technology as a career.

WHAT ON EARTH?

This column introduces terms relating to main grid operations.

Main grid development plan

As main grid owners and administrators, Fingrid and its predecessors have carried out main grid development planning since the main grid was constructed, and even a little bit before that. Along with the obligation to develop the main grid, the compilation and content requirements of the development plan were recorded in legislation in the Electricity Market Act, which came into effect in 2013. The compilation and publication of the plan will become an ongoing process as the development plan will now be updated every two years.

The key content of the main grid development plan is a description of how and with what kind of investments the obligation to develop the main grid will be met. In addition, the plan also sets out main grid development procedures and plans to develop cross-border transmission capacity. Unlike earlier plans, the Main grid development plan 2015–2025 has the appearance of a report, but the content is largely similar to the plan published in 2013. The plan was compiled and published this year with supplemented and updated content in areas where planning has progressed over the last two years. In addition, regional grid development needs were reported on in more detail.

An example of how an EIA progresses

- **Appointing a competent authority**
  The competent authority in transmission line projects is the Centre for Economic Development, Transport and the Environment (ELY Centre).
- **The party responsible for the project selects an EIA consultant**
  Fingrid selects the EIA consultant on the basis of competitive tendering.
- **Municipal meetings in the project area municipalities**

Project launch
The EIA procedure for a transmission line project takes place at the same time as preliminary route planning. The EIA procedure is a planning tool, not a permit procedure. However, the results of the EIA must be taken into account in later permit consideration.

EIA is cooperation

The EIA procedure is launched early on in the planning phase of a new transmission line. It provides important information about the project area for the purposes of route planning and decision-making. The EIA procedure gives residents in the project area a good opportunity to obtain information and express their opinion about the project.

TEXT MIRA MUURINEN | PHOTOGRAPH MATTI IMMONEN

The objective of the statutory Environmental Impact Assessment (EIA) is to prevent or reduce the various harmful environmental impacts of projects. The projects are diverse in nature, ranging from power plant construction to road projects. An EIA procedure is mandatory when more than 15 kilometres of 220 or 400 kV transmission line is built.

The EIA procedure gives residents the chance to obtain information about the activities planned for their surroundings. Residents can also influence transmission line routes by means of feedback. For Fingrid, which is responsible for the transmission line project, the EIA procedure is an important tool in terms of initial environmental data. It helps Fingrid to adapt the transmission lines to their environment in the best possible manner.

The environmental impact assessment examines different options for the project and their impacts on the following matters:

- human health, living conditions and well-being
- the diversity of the soil, water, air, climate, vegetation, organisms, and nature
- the community structure, buildings, landscape, cityscape and cultural heritage
- the utilisation of natural resources
- the interactions among them.

- **Compiling the assessment programme**
- **Display for public inspection of the assessment programme**
  - The ELY Centre announces that the assessment programme is on public display for inspection in the municipalities in the project area.
  - The project and assessment programme are presented at public events.
    Fingrid invites residents to public events by means of announcements in local newspapers.

A public event provides the opportunity to learn more about the project and transmission line routes with the aid of maps and to present questions about the project to the party responsible for the project, EIA consultant and competent authority directing the EIA.

- Opinions concerning the project and programme can be presented to the ELY Centre. Feedback on transmission line route planning can also be submitted to Fingrid via the electronic feedback system also known as the map service.
- The ELY Centre compiles a summary of the statements issued by authorities and the opinions.
- The ELY Centre gives Fingrid its statement on compiling an assessment report.

Assessment programme phase
The assessment programme is a report on the current state of the project area and a work plan concerning which project implementation options will be examined and how the environmental impacts of them will be investigated. The programme also describes how assessment-related communications and the participation of people living in the impact area will be arranged.

- **Studies related to assessing the environmental impacts of the project implementation options are performed.**

Assessment report phase
The results of the assessment work are compiled into an assessment report. This report outlines the impacts on people and the environment, compares different project implementation alternatives, and assesses their feasibility. The assessment report also presents a plan about how the environmental impacts will be monitored later.

- **Compiling the assessment report**
- **Public display for inspection of the assessment report**
  - The ELY Centre announces the display for public inspection of the assessment report in the municipalities in the project area.
  - The project and assessment report are presented at public events.
    Fingrid invites residents to public events by means of announcements in local newspapers.
  - Opinions concerning the project and the report can be presented to the ELY Centre.
  - The ELY Centre compiles a summary of the statements issued by authorities and the opinions related to the report.
  - The ELY Centre provides Fingrid with its statement on the assessment report and its sufficiency.
- **The EIA procedure comes to a conclusion**

After the EIA procedure
An EIA procedure usually lasts 1–1.5 years. After that, Fingrid selects the route for further planning and applies to the Energy Authority for a project permit in accordance with the Electricity Market Act and to the National Land Survey of Finland for a research permit, which is needed to perform terrain studies on the selected transmission line route. Based on the terrain study, the final route is planned as well as the locations of the towers, which is of interest to landowners. At this stage, landowners can still present their opinions on the planning solution or request a review.

Seasonal changes set the pace for nature inventory

The nature inventory that is part of the EIA procedure involves a biologist observing the flora and fauna in the project area during different seasons.

TEXT MIRA MUURINEN | **PHOTOGRAPH** VASTAVALO

Project Manager and Biologist **Marja Nuottajärvi** from FCG Suunnittelu ja tekniikka Oy has been involved in many of Fingrid's EIA procedures, as a project manager and as an expert in addition to performing nature inventories. She works all over Finland, because as an EIA consultant her job is to travel in the impact areas of different projects and become familiar with the flora and fauna in these areas.

"Each type of project has its own typical impacts on nature values, and the project location also affects what has to be investigated in the terrain. Transmission line projects are characterised by the fact that they can also have positive impacts on nature values. For example, it has been possible to restore some heritage landscape, such as meadows, for transmission line clearings."

Need for study determined during background work

The assessment begins with background work to survey the existing material regarding Natura and conservation areas located in the project area as well as symbols added to regional and master plans regarding nature in the area. Earlier observations about the habitats of endangered species may also be discovered.

"Once the existing information has been added to the route maps, we can see where the need for further investigation lies. The location of the project and matters learned during the background phase have a major influence on what we look for in terms of nature," explains Nuottajärvi.

The biologist and landscape architect are most likely to be out in the actual terrain. Sometimes, a land use expert or archaeologist may also be required on site. Land use and human impact issues are an integral part of the EIA procedure, but in many cases this is office work that involves studying regional, city and master plans. Information about impacts on people also comes from public events and opinions, and it can also be obtained by means of questionnaires if necessary.

Nuottajärvi emphasises the importance of information provided by local bodies and other stakeholders. "Local authorities, landowners and the rest of the general public may provide information and viewpoints that wouldn't have been taken into account otherwise. Rather than having the EIA consultant simply come in and take over, we want the process to proceed in cooperation with a working group made up of various experts from the EIA consultant and stakeholders. This is why public hearings and, for example, the electronic feedback system on the project website are important tools for EIA as well."

Pace of study progresses according to the seasons

Once they begin, it often takes more than a year to complete EIA background studies. Completing a study is linked to the progress of the growing season and things like the nesting and migration times of birds. Special methods exist for observations of species like the flying squirrel, bats and moor frog, which are strictly protected under the Habitats Directive.

"The best time to begin studies related to the EIA procedure is late winter. In that case, the work can begin with a flying squirrel study which involves searching for flying squirrel droppings at the base of trees in forest types suitable for the species," says Marja Nuottajärvi.

In contrast, a moor frog study must be performed in early spring, during the spawning season. "The study is made by listening for the frog's spawning noises and then carefully examining the spawn. The spawning season lasts only a few weeks, and the study has to be completed during that time," explains Nuottajärvi.

Bat observation is night work. A detector is used to observe bats, preferably at three different times during the summer. Nesting birds are studied by means of point counts or area searches, and migrating birds are studied from observation points in spring and autumn. An avian study can also include listening to night singers and observing feeding and territorial flights. A study of flora and valuable nature types is performed during the peak growing period of the summer.

Moor frogs spawn in early spring, and at that time the males turn blue in colour

NATURE COLUMN

Pertti Koskimies is a biologist and ornithologist, a prize-winning author and science journalist. He has extensively studied Finnish birds and different types of bird areas.

The most Finnish species of bird

A female, or hen, Western Capercaillie.

Photograph: Pertti Koskimies

What is the most Finnish bird? Certainly not the female Spotted Redshank, which arrives in Lapland in mid-May and sets out on its return journey in early June. It can't be the Common Cuckoo either, because it spends half of its life in the rainforests of the Congo basin and just two or three months here. The Arctic Warbler also settles for a quick visit, arriving in Finland after Midsummer and leaving in August. Swallows are said to be a sign of summer, and the Barn Swallow brings it all the way from southern Africa. Its spring and autumn migrations last three months, with the nesting and winter seasons taking up an equal length of time. Not very Finnish indeed.

If we go through our 250 species of bird to find the true Finnish 'survivor', the one that remains at home no matter what the conditions, there are surprisingly few candidates. The Black Woodpecker, Siberian Jay, Eurasian Eagle-Owl, Tawny Owl, Ural Owl, Crested Tit and Siberian Tit all spend their entire lives in the same forest plot, and the same generally applies to the White-backed, Three-toed and Lesser Spotted Woodpeckers and the Eurasian Jay, too. But there is only one group of birds that never leaves its home region under any conditions, and that is the grouse family.

The Western Capercaillie taking sudden flight with huge noise, Eurasian Black Grouse bubbling in the peatland, Hazel Grouse flitting through the fir groves, Willow Grouse screeching on the fells, and curious Rock Ptarmigan on the highest fell-tops in northernmost Lapland are incomparable Finnish survivors. The world of a grouse during its entire lifetime is limited to just a few kilometres of ordinary forest, swamp and fell. That is regional loyalty beyond compare.

During the winter, these birds of frost and snow are satisfied with pine needles and the catkins, buds and branches of deciduous trees. Their feet have evolved into snowshoes and shovels that the bird can use to dig itself under the snow as many as three times a day. Resting in snow burrows and having thick winter plumage saves energy, and the bird only comes out for an hour or two during severe cold snaps. The nutrition obtained from food gulped down rapidly is released steadily around the clock by virtue of a longer caecum that functions like a power plant.

Unfortunately, these species are no longer doing as well as earlier. Grouse populations have declined to a fraction of their former size due to the fragmentation of forests and drainage of peatlands due to modern forestry. The hunting of 300,000 birds per year further increases the mortality of grouse populations. The best way to help grouse would be for 1–2 per cent of Finns to leave their guns at home.

After all, one feels so much better when seeing a live grouse compared to a dead one.

When should I roast my Christmas ham?

and other topical questions

Now and again Fingrid receives questions about matters such as the use of transmission line areas or the sufficiency of electricity. We gathered together all the winter and Christmas-related questions in a single info package for the end of the year. Answers are provided by Fingrid's own Father Christmas, Mr. Jäppinen, and his elves. Wishing you a wonderful winter and festive season!

ILLUSTRATION ANSSI KERÄNEN

How much does it cost to use Christmas lights if the lights are on from early December until March?

Newer Christmas lights are most often LEDs, which consume significantly less electricity than traditional bulb lights. It's well worth plugging traditional lights into a timer to save electricity.

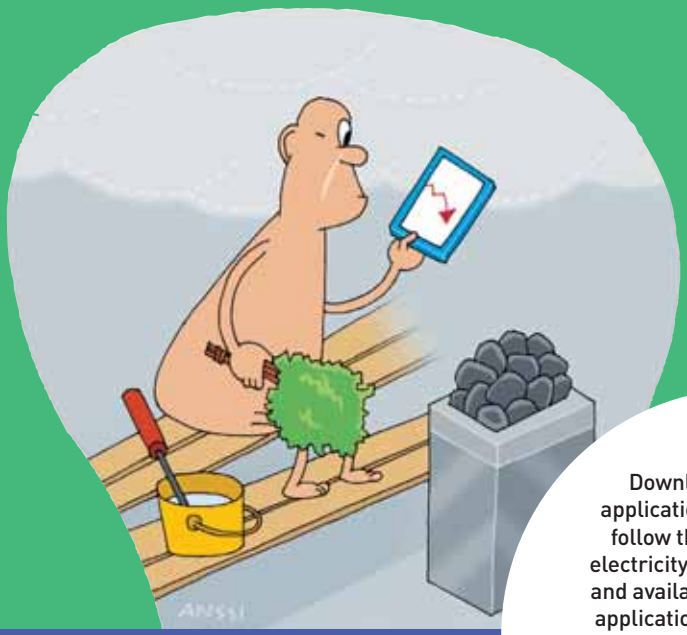
CALCULATIONS OF DECORATIVE LIGHT CONSUMPTION

Christmas lights	On continuously 1.12.–10.3.	Timed, 8 h/day 1.12.–10.3.
LED 8 lights / 0.5 W	€ 0.20	€ 0.07
LED 80 lights / 6 W	€ 2.30	€ 0.80
Old lights, 216 bulbs / 93.3 W	€ 34.60	€ 11.50

Calculated with price of electricity at 15.43 cents/kWh. (Source: Motiva)

With electricity consumption in mind, when is the best time to heat the Christmas sauna?

You are quite free to heat the sauna at any time during the Christmas holidays. Of course, it's better if we don't all heat our saunas at the same time and instead space them out over a longer period.



TIP!
Download the Tuntihinta application on your phone and follow the exchange price of electricity! Developed by Fingrid and available free of charge, the application allows you to follow the Finnish price of electricity published by Nord Pool Spot, the Nordic electricity exchange. You'll get the best use out of the application if you have an exchange-priced electricity contract with invoicing by the hour.

And when is the best time to roast my Christmas ham?

From a purely consumption-related perspective, there are no limits on when to roast your ham during the Christmas holidays, since electricity consumption is much lower than normal due to industry and other consumption having downed tools for Christmas. I usually roast my ham on the night of Christmas Eve, so that the ham is ready when we wake up in the morning. With regard to the price of electricity, it is also cheaper to roast your ham at night.

It's traditional to set out a Christmas dinner for pets and forest animals, too. Can I feed animals in line clearings?

It is possible to set up feeding places – and some have already been set up – for game and other animals. It is said that there should be good visibility from the feeding place to the environment, but it should also be fairly near some form of shelter. So what could be a better feeding place than the edge of a line clearing? It is best to agree on the location and set-up of a feeding machine (and shelter) with the line owner, but there are no real obstructions to this. Feeding should however begin much earlier than Christmas, well before the first snow, and should continue throughout the winter.

Can I get my Christmas tree from a transmission line clearing? Or wood for my fireplace?

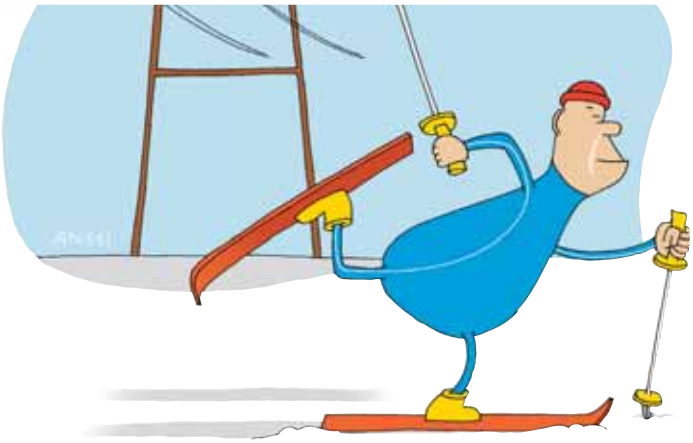
Transmission lines are located on expropriated land. As such, Fingrid does not own the land or the trees that grow there. You must always ask permission from landowners before taking a Christmas tree or firewood.

Why does Fingrid want to repair grid connections during the winter when demand for electricity is highest? Why not do it in summer?

Winter is the only season during which the land and swamps near towers are frozen and therefore allow heavy cranes to access towers. Meanwhile, consumption during the winter and international transmission are not usually high at the same time, since almost all power plants are in use and thereby reduce the need for transmission.

Can I ski in transmission line areas? What about if we set up a bandy rink in a line area?

Skiing is fine, but Fingrid does not recommend setting up a bandy rink. Permission from the property owner and a statement from Fingrid are always required when building a road, outdoor route, running trail or ski track.



During the winter I sometimes hear a hissing sound coming from transmission line areas. Where does it come from, and is it dangerous?

The sound you hear close to the lines is due to corona discharge. The phenomenon is caused by the ionisation of air in the vicinity of the surface of conductors and insulators.

Corona discharge may occur along 400 kilovolt lines especially in foggy and humid weather, snow or sleet, or if there is hoar frost on the surface of the line. The corona discharge and related sound are strongest in wet autumn weather and in winter. Corona discharge is harmless to people. F

Fingrid invites its stakeholders to innovate

An open application process is launched to find new ideas for developing main grid maintenance work and fault repair.

Fingrid has started an application process that involves looking for new partners and feasible ideas for developing main grid maintenance management. The objective is to reduce the number of main grid faults and resulting inconvenience to customers and society. For example, the ideas can be related to metering technology, ICT solutions, information processing, or meter data visualisation.

Fingrid's aim is to gradually expand innovation to its stakeholders in order to ensure that competence outside the company is also taken into account when developing company operations.

"We hope that this application process will provide valuable experience regarding open innovation," says Grid Systems Specialist **Kimmo Nepola**.

Ideas and project descriptions can be submitted until the end of this year. The application must clearly describe how the idea can be utilised in Fingrid's business, the novelty value of the idea, and include a proposal concerning how the idea can be implemented technically and operationally.

Fingrid will select 5–10 companies, whose proposals will then be refined in cooperation with Fingrid experts during January-February 2016. Following this, the companies will present their ideas to the Fingrid management, which will choose potential feasible projects in March 2016.

More detailed information on the application process is available on the Fingrid website, in the news article published 1 October 2015.

Responsible summer work at Fingrid

Fingrid won the large company category of the Responsible Summer Job 2015 competition. Among other things, summer employees appreciated their meaningful tasks.

Organised by T-Media and Taloudellinen tiedotustoimisto TAT, the competition was part of the Responsible Summer Job campaign, the aim of which is to challenge employers to offer young people more and better quality summer jobs. In 2015, a total of 262 employers participated in the campaign.

According to the campaign, the principles of a good summer job include meaningful work, induction and training, fairness and equality, fair wages, and a written contract and certificate of employment.

This summer, Fingrid offered a summer job to around thirty young people. Summer work was done at nearly all of Fingrid's offices around Finland and in all functions from technical tasks to company management. Also gaining job experience were four young people aged 14–17, who learned about working life at Fingrid for a two-week period.

The Responsible Summer Job competition asked for feedback on employers directly from young summer workers. Fingrid was especially appreciated for its meaningful tasks and responsible operating practices in recruitment and hiring.

Tiina Miettinen, Senior Vice President, Communications and HR, is delighted but not surprised by the award presented to Fingrid. Earlier, for example, the company has placed among the best in the Great Place to Work in Finland competition.

"Young students are an important interest group for the company. We want them to be also interested in Fingrid as an employer when they make the transition to working life later on. This is why we considered it important to ensure that summer jobs and the related processes are handled professionally in cooperation with supervisors and the entire work community," says Miettinen.

Terms of service for the electricity market information exchange service confirmed

The Energy Authority has confirmed Fingrid's method to specify reasonable returns and its terms of service for information exchange services.

According to the task set out for it in the Electricity Market Act, Fingrid has developed an information exchange service entity for electricity market parties. The objective is to promote the accurate exchange of information and develop effective procedures and the use of common messaging standards. Along with advice and guidance, Fingrid offers the contracting parties, for example, a metering point register service and message testing service. A report on a future information exchange solution, the so-called datahub, was completed in 2014 as part of information exchange services development.

According to the Electricity Market Act, the service must be efficient and promote fair and non-discriminating implementation of information exchange. During the first phase of the service, Fingrid will sign information exchange service contracts with electricity suppliers and distribution network owners operating on the retail electricity market. As the information exchange services entity develops, the aim is to remove the specification-related limitations on contracting parties. In the future, information exchange service contracts will be signed at the same time as Fingrid grants party IDs to new electricity market parties.

Fingrid's service contract for information exchange services comprises the service contract, service description and price list. These documents are available on the Fingrid website under *Customers > Information Exchange Services > Service Contract*.

The contracts were sent to the contracting parties for signature during week 40.

Substation maintenance examinations held for the first time

Fingrid has introduced a validation procedure for maintenance work at electricity substations, which ensures the qualifications of the people performing local operational and maintenance work.

The validation of basic maintenance work on electricity substations was implemented as a new procedure this year. Validation refers to the right to perform certain electricity substation work in accordance with the basic maintenance agreement, such as transformer and switching equipment service, substation inspections, local switchings, or on-call duty.

Task-specific validation consists of the approved completion of one or more modules, such as local switching, disconnector, equipment fault localisation, and earthing. There are 19 modules in total. Each person who works alone must be validated for the task in question. At least one of a work pair or work group must be validated.

The module examinations are performed as written exams. The first examinations were held in spring 2015 and the validations were granted in the summer.

Arranging the exams was a major effort for Fingrid. All in all, 50 examination days were required and the various modules contained some 400 questions. A total of 80 service provider employees participated in the examinations.

According to **Timo Heiskanen**, Fingrid's Maintenance Manager, Substations, the examinations are also a learning event. After completing the exam, the correct answers were reviewed and inspired good discussion.

"Arranging exams on a scale like this was a new experience for us. We have different qualification requirements for service providers, and this new concept is the broadest of them," explains Heiskanen.

"Our service providers have been very positive about the examinations. Now they understand their situation and what they need to focus on in their own training. The exams also contributed to developing Fingrid's specifications and instructions."

In the future, module examinations will be held as necessary when there are changes in service provider personnel.

Alumni day reunites former Fingrid employees

In August, Fingrid organised an alumni meeting for its former employees.

The invitees were former Fingrid employees who have since moved on to work for another employer or retired. In addition to reconnecting with old friends, the guests enjoyed some music and snacks from the hotdog cart.

Occupational safety information magazine published

Fingrid published the latest edition of its occupational safety magazine for service providers in October.

The Safety on the Lines publication shares occupational safety information and best practices in addition to reviewing accidents and dangerous situations that have occurred at Fingrid worksites. The topics in this edition include the job description of a safety supervisor, the risks of demolition work, and the T3 reporting system. The magazine was published in Finnish, English and Croatian.

Lines over Ostrobothnia

WEATHERING THE CLIMATE

Liisa Rintaniemi is MTV News' meteorologist and will examine the factors behind recent weather conditions in this column.

Frost can snowball into snow crown-load

A few years ago, Helsinki was included in CNN's Future Cities series. One of the episodes in the four-part TV series demonstrated Finnish snow-how at its best. Presenter **Richard Quest** could be seen looking on in awe at how truckloads of ploughed snow were driven away from the city centre and dumped into the sea. The top journalist compared the scope and systematic approach of the maintenance work to a military operation. The series also visited the Helsinki-Vantaa airport, which has only been closed due to snow once in the 2000s; in 2003, planes had to be directed to back-up runways for half an hour because the snow disrupted the equipment needed for planes to approach.

What brought Richard Quest and CNN to mind? A tool that I received a tip about before I began to write this column. Ice that has accumulated on electrical lines can be manually knocked off from a helicopter using a rod made of composite material. I started to think about icy electrical lines and the remote forests they run through.

The formation of ice on lines is a chain of events all of its own, and involves a secret about water. Water doesn't always freeze below zero degrees Celsius. Under the right conditions, water can stay in liquid form in temperatures up to forty degrees below zero. In the atmosphere, this kind of supercooled water is more of a rule than an exception. There are two reasons for this. First of all, liquid water requires a seed nucleus to begin the process of forming a regular ice crystal. A small particle, aerosol or salt crystal will do, but there is a constant lack of suitable nuclei in the atmosphere. Secondly, and especially with very small droplets, surface tension can keep the drop together so forcefully that the ice crystal formation does not begin immediately after the temperature drops below zero.

Surface tension works in such a way that the smaller a droplet is, the lower the temperatures it can withstand in liquid form. Small droplets can be found in clouds and fog in particular. When supercooled fog droplets collide with structures in their environment, trees or electrical lines, they find the seed nucleus they were looking for. The water, already below freezing point, freezes immediately into a crystal once it comes into contact with an object. Fog is not always necessary; sometimes invisible moisture in the air can freeze on vegetation and structures to form beautiful hoar frost. In suitably windy conditions, hoar frost can increase rapidly in thickness, forming heavy snow crown-load, which is hard snow and ice. On the other hand, rain can also be supercooled, and this kind of freezing rain can help to form a rapidly thickening layer of ice.

In suitably windy conditions, hoar frost can increase rapidly in thickness, forming heavy snow crown-load, which is hard snow and ice.

Snow crown-load which forms on tree branches, however, is usually a combination of hoar frost and snow which has fallen on top of it. Hoar frost acts as a glue which helps to keep even heavy snow loads on branches. When the burden becomes too heavy for the tree to bear, it either snaps or bends, which can cause problems along lines if trees lean on them.

The reliability of electricity supply even to scattered population centres in a country where winter lasts from five to six months may well also have caused similar wonderment at CNN. After all, it takes a great deal of prediction and cooperation between various parties for Christmas lights to stay on in Savukoski just as reliably as in my own home in Vantaa! Would Richard Quest compare that to a military operation?

GRID QUIZ

Competition to the readers of Fingrid Magazine

Answer the questions and send your answers by 31.12.2015 to the address Fingrid Oyj, PL 530, 00101 Helsinki, Finland. Please write "Grid Quiz" on the envelope.

Three winners will receive Hannu Ylönen's book "Ammattina voimajohdot – Lentojätkästä voimajohtoammattilaiseksi". The book is a memoir from Ylönen's 40-year career in the transmission line industry. Answers to the questions can be found in this issue.

1. **What is the most significant advantage of the new fault repair towers compared with ordinary transmission line towers?**
   - Thanks to a telescopic mechanism, they are easy to erect.
   - They have a steel foundation the height of which can be adjusted.
   - Their guy wires extend over a larger area.

2. **What is Fingrid's first step when it's observed that electricity production won't be sufficient to cover consumption in the next few hours?**
   - Find out if assistance is available from neighbouring countries.
   - Start up a reserve power plant.
   - Compromise on the fast disturbance reserve.

3. **What was investigated in the joint pilot project carried out by Digita, Enegia and Fingrid?**
   - Utilising the television and radio network for Fingrid's disturbance communications.
   - Renting Digita's reserve power generators to Fingrid.
   - The potential of Digita's reserve power generators to participate in demand response.

4. **Starting from 2015, how will Fingrid ensure the qualifications of people performing local operational and maintenance work at substations?**
   - With written module examinations.
   - With a competence test at a substation.
   - With a mobile maintenance application.

5. **Which traffic routes are in the vicinity of the Länsisalmi substation that will be expanded?**
   - Ring Road I and Länsiväylä.
   - Ring Road III and Lahdenväylä.
   - Ring Road III and Porvoonväylä.

6. **According to estimates, when will the new technical system requirements for power plants enter into force?**
   - In 2017.
   - In 2018.
   - In 2019.

7. **Why is Fingrid unable to give permission to take a Christmas tree from a line clearing?**
   - Entering a line clearing is not allowed without a separate permission.
   - Fingrid does not own the land of the line clearing or trees growing there.
   - Vegetation in line clearings is protected.

Prizes for the previous Grid Quiz (2/2015) have been sent to the following winners who answered correctly: Marjut Honkavaara, Helsinki; Johanna Korte, Tenhola; Reijo Lehtonen, Valkeakoski.

MERRY CHRISTMAS AND HAPPY NEW YEAR

This year, we will donate the sum reserved for Christmas cards to the SOS Children's Village Association.

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