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FINGRID OYJ'S GENERAL CONNECTION TERMS YLE2021

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1 Introduction

The purpose of this document is to describe Fingrid Oyj's general connection terms (YLE, hereinafter 'the connection terms') between Fingrid Oyj's (hereinafter 'Fingrid') electrical equipment and the electrical equipment owned or controlled by a contracting party connected to Fingrid's grid (hereinafter 'the Connecting Party'). By following the connection terms we ensure the system security of the grid and that the grids to be connected are technically compatible.

The connection terms define the type of the connection and functional requirements for the electrical equipment. In addition to this, the type of the electrical equipment to be connected defines which additional grid code specifications have to be followed. Grid code specifications have been presented separately for demand connections ('KJV') /1/, power generating facilities ('VJV') /2/, grid energy storage systems ('SJV') /3/ and high voltage direct current systems ('HVDC') /4/.

The Connecting Party and Fingrid shall agree on the connection in a separate connection agreement /5/ defining the rights, obligations and responsibilities concerning the connection. Before electricity transmission a separate Main Grid Contract /6/ is required between the Connecting Party and Fingrid.

The connection terms concern new connections to the grid and existing connections when additions or essential changes are conducted. The Connecting Party must agree with parties connected to its grid that their electricity networks and related electrical equipment also meet Fingrid's connection terms as well as other guidelines and requirements related to the implementation of the connection. The instructions, reports and requirements referred to in the connection terms are listed in Chapter 5 and they are available on Fingrid's website.

The connection terms are also applicable to backup supply connections connected to Fingrid's grid, which are only temporarily in use in disturbance or outage situations.

The connection terms do not apply to emergency connections meant for temporary power supply as agreed separately with Fingrid. An emergency connection is a separately built temporary connection which will be taken into use in case no backup supply connections are available. Fingrid's Main Grid Control Center will decide whether the emergency connection can be taken into use as per request by the Connecting Party.

The Connecting Party and Fingrid are responsible for that their electrical equipment meet the requirements of valid laws, decrees, standards and official regulations. If legislation or network codes require technical solutions that deviate from the connection terms, the legislation or network codes must be observed.

2 Grid Connection

2.1 Connection solutions

The grid connection solution and location to the main grid are specified on a case-by-case basis, by taking into account technical alternatives, the overall costs of implementation, the system security of the surrounding main grid, transmission capacity and environmental and land use perspectives. In order to safeguard the system security and functionality of the main grid, low-power electrical equipment must be connected to a distribution or high-voltage distribution grid.

The availability and system security are best controlled by making connections to the switchyards. Transmission lines between switchyards transmit and safeguard the necessary power for the switchyards in different operating situations. The Connecting Party's electrical equipment may be connected to Fingrid's 110kV transmission line, if the requirements specified in section 2.3 are met.

2.2 Switchyard connection

Switchyard connection means a connection of the Connecting Party's electrical equipment to Fingrid's 400 kV, 220 kV and 110 kV switchyard circuit breaker bay. The maximum power that can be connected to such a connection is specified switchyard-specifically, taking into account the system security and transmission capacity of the surrounding main grid. Connections of less than 250 MW shall be connected to a 110 kV or 220 kV switchyard. Connections of 250 MW or greater are primarily connected to a 400 kV switchyard.

Switching of transformers over 63 MVA shall be performed using synchronous switching controller (point-on-wave switching controller) in grids connected beyond 110 kV switchyard connections. If multiple transformers are connected beyond the same connection point, the switching shall be carried out in stepwise so that simultaneous voltage drop shall not exceed the target level¹ defined in report Power Quality in Fingrid's 110 kV Grid /7/.

When connecting to an air-insulated Fingrid switchyard or gas-insulated switchyard by an overhead line, the ownership and management of the lines end at the U-bolts on the terminal support and the top connectors of the connecting jumpers. The U bolts and connectors are owned by Fingrid.

When connecting to an air-insulated Fingrid switchyard by cable, the ownership and management of the lines end at the connectors of Fingrid's lines in the connectors of the Connecting Party's cable terminals. The cable, cable terminals, overvoltage protection devices of the cable and cable groundings are owned by the Connecting Party. The wires and their connectors connected to the cable terminal, the cable terminal racks, overvoltage protection device racks and rack foundations are owned by Fingrid.

When connecting to a gas-insulated Fingrid switchyard by cable coming outside of the fenced switchyard area, the ownership and management of the lines at the switchyard end at the Connecting Party's cable and the cable-side connectors of the

¹ The inrush current shall not cause a voltage dip, that is, an instantaneous voltage drop of over 10% nor a voltage reduction of over 6% measured as an average of ten RMS voltage cycles. A design basis value for a voltage drop during transformer switching at normal grid short-circuit power level shall be less than 3% (average of 10 RMS cycles).

cable terminations in Fingrid's GIS switchgear output. The connectors on the side of the circuit breaker bay's cable terminal of the switchgear in question are owned by Fingrid.

2.3 Transmission line connection

A connection to the transmission line means a connection of the Connecting Party's substation or transmission line to Fingrid's 110 kV transmission line. Because of the long geographical transmission distances in Finland, the transmission lines in the main grid are long and the substations are far apart. This is why a connection to Fingrid's 110 kV transmission line is permitted, taking into account the available transmission capacity of the transmission line and the following technical conditions:

- a. The maximum permissible rated power of a transformer is 40,0 MVA and minimum permissible short-circuit reactance is 48.0 Ω . If there is tap changer in the transformer, fulfilment of the requirement is applicable at the middle position.
- b. The total transformer capacity may consist of several transformers. The overall maximum capacity permissible for a transmission line connection is 65 MVA. Maximum load for the connection is 60 MW. The secondary side of the transformers connected to Fingrid's transmission line shall not be galvanically connected together.
- c. Instead of using separate transformers a single three winding transformer with maximum rated power of 63/31.5/31.5 MVA can be used if following conditions are met
 - o The mutual short-circuit reactance of both high voltage and medium voltage windings (Z_{12} ja Z_{13}) shall be at least 48.0 Ω at the middle position of the tap changer (eg. S=31.5MVA, $U_n=118\text{kV}$, $x_k=12\%$, $X_k=53\Omega$)
 - o Medium voltage windings (secondary and tertiary) shall not be galvanically connected during operation
- d. The inrush current of the transformer shall not cause a voltage drop at the connection point which exceeds the target level defined in the report Power Quality in Fingrid's 110 kV Grid. If the target level cannot be reached the transformer shall be equipped with single pole operated circuit breakers and point-on-wave switching.
- e. When connecting to a Fingrid transmission line of more than 100 km in length, the connectivity of the transformer size shall be reviewed separately.
- f. It must be possible to disconnect a connecting transmission line from the main grid as a normal operation measure by remote control. In order to speed up fault clearance it is recommended to equip the remote controlled disconnection with battery back-up so that the disconnection can be performed when the line has no voltage.
- g. The length of a connecting transmission line can be at most half of the distance of the connection from the closest protective circuit breaker in the main grid. The length of the connecting transmission line may be equal to the distance of the connection from the nearest protective circuit breaker in the trunk line if
 - o a circuit breaker equipped with protection relays if built at the connection point. The Connecting Party is responsible for building the breaker.
 - o a protection datalink (SVY) or equivalent protection solution is built

between Fingrid substations at both ends of the Fingrid 110 kV line. Fingrid is responsible for building the protection solution in its own grid.

Fingrid decides on solution to be chosen based on techno-economic considerations.

- h. The disconnecting switching devices of a connecting transmission line must be positioned as close as possible to the connection point.
- i. Transmission line connections are not allowed near a substation.
- j. The Connecting Party must ensure that the connection point can be earthed on the main grid transmission line, with the earthing having sufficient short-circuit strength. The connection disconnectors must have earthing switches on the main grid transmission line and on the side of the Connecting Party's electrical equipment in order to ensure occupational safety.
- i. The Connecting Party is responsible for the protection of its transformers. Bypass fault or artificial fault disconnectors are not permitted.

In a transmission line connection, ownership ends at the connectors of the connecting jumpers owned by the Connecting Party on Fingrid's transmission line.

When connecting by a cable, the technical implementation of the connection shall be agreed separately by taking into account the technical properties and the location of the cable.

Principle drawings /12/ have been prepared for the transmission line connection, which show the indicative device layout and the required clearances.

2.4 Connection of electricity consumption and distribution networks

Distribution networks and demand facilities connected to the main grid and distribution networks and demand facilities offering demand-side management services connected to the Finnish power system shall fulfil Fingrid's Grid Code Specifications for Demand Connections (KJV).

2.5 Connection of electricity production

Power plants to be connected to the Finnish power system are required to meet Fingrid's valid Grid Code Specifications for Power Generating Facilities (VJV).

The connectivity of power plant units to the power system must be determined well in advance with Fingrid. The connectivity of a power plant depends on the ability of the Nordic power system and the border connections from Finland to withstand rapid power changes. The largest permitted stepwise power change that the Finnish power system can withstand in the connection point of a power plant without compromising system security is 1,300 MW.

In general, power plant shall be connected to Fingrid's switchyard circuit breaker bay. If the transmission capacity so permits, small synchronous generators of less than 5 MW or converter connected power plants of up to 60 MW may be connected to the Fingrid's 110 kV transmission line given that requirements presented in Chapter 2.3 are fulfilled. For transmission line connection, the short-circuit current

fed to the main grid shall be no more than 1.2 times the rated current of the power plant (300 ms after the beginning of the fault).

Fingrid's valid instructions must be observed in voltage control, the production of reactive power and maintaining reactive power reserves.

A power plant in excess of 1 MW connected to a Fingrid transmission line must be equipped with disconnecting relays.

Fingrid decides on a case-by-case basis if a communication link for disconnection ('EVY') of a transmission line connected power plant of over 5 MW is to be implemented as described in Fingrid's instruction for relay protection /8/. In case of transmission line connections, converter connected power plants of over 5 MW shall be primarily equipped with a local disconnection relay based on a combination of voltage and frequency conditions. Additionally, disconnection shall be verified based on real-time information exchange. A dedicated communication link for disconnection ('EVY') shall be built only when prolonged automatic reclosing can cause significant inconvenience to the transmission of electricity or to third parties, or reclosing of the transmission line is not reliable when using local disconnection relay.

Fingrid is responsible for the synchronisation monitoring relays of its transmission line.

2.6 Connection of a grid energy storage

Converter-connected grid energy storage systems which are to be connected to the Finnish power system and which provide system services shall fulfil Fingrid's valid Grid Code Specifications for Grid Energy Storage Systems ('SJV').

In the case of grid energy storage systems, the same principles are followed for transmission line connections as for the electricity production (see Chapter 2.5).

2.7 DC link connection

The connectivity of a high-voltage DC connection to the power system must be determined well in advance with Fingrid.

A high-voltage DC connection to the Finnish power system must meet Fingrid's valid Grid Code Specifications for High Voltage Direct Current Systems ('HVDC').

2.8 Modification of electrical equipment

To make additions or essential modifications to Connecting Party's own electrical equipment or to electrical equipment connected directly or indirectly to its grid, the Connecting Party must contact Fingrid well in advance. Fingrid shall examine the effects and possible needs for modifications on the main grid and sets possible requirements for the modifications performed by the Connecting Party. These types of additions or essential modifications include construction of a new transmission line, a substation, a transformer, an energy storage or power plant of at least 110 kV, or significant modifications to the technical system properties or protection of existing electrical equipment. Essential modifications also include modifications to the operation or to the properties of the Connecting Party's existing electrical equipment of at least 110 kV, and significant structural modifications in Fingrid's grid.

All additions and essential modifications must follow the connection terms (YLE) and applicable grid code specifications (KJV, VJV, SJV, HVDC) valid at the moment of concluding the binding procurement agreement for the equipment within the scope of the modification. If the Connecting Party and Fingrid fail to reach an agreement on the needed changes taken into consideration of the valid connection terms and grid code specifications valid at the moment of introducing the modification, the matter must be passed to the Finnish Energy Authority for resolution which will base on assessment of the requirements and the need to change or renew the connection agreement.

3 Operational requirements of electrical equipment

3.1 Main principles

The Connecting Party and Fingrid are each responsible for the electrical safety, functioning, condition and operation of the electrical equipment under their control. The Connecting Party and Fingrid maintain and operate their electrical equipment in such a manner that the electricity transmission nor the operation of the power system are not unnecessarily disturbed. In order to ensure the maintenance of the system security, the Connecting Party and Fingrid are obliged to supply each other with operational and maintenance information.

The transmission lines with a rated voltage of 110 ... 400 kV must be equipped with shielding wires. The transmission lines are built and maintained with tree safety in accordance with the Electricity Market Act. The Connecting Party shall ensure the compatibility of the technical implementation of phase wires transposition with Fingrid.

The real-time information exchange is specified in the guideline for real-time information exchange, /9/.

3.2 Planning and supply of information

The connection terms define how the electrical equipment shall be connected and which functional requirements they shall have. The connection shall be designed to meet the connection terms. In addition to the connection terms, the connection shall be designed to meet connection type specific grid code specifications ('KJV', 'VJV', 'SJV', 'HVDC').

The Connecting Party must supply the preliminary plans of the connection for Fingrid's review well in advance before starting the implementation, hence the technical compatibility and electrical safety of the connection can be verified. The Connecting Party is responsible for the safe implementation of its electrical equipment according to the terms, for the necessary touch- and dangerous voltage clarifications, and for the actions required.

Fingrid shall submit to the Connecting Party a proposal concerning the location of the connection, information about the short-circuit currents and earth fault currents and information about the protection requirements. In transmission line connections, Fingrid also submits requirements concerning the distances of structures from Fingrid's transmission lines and towers. When the Connecting Party is dimensioning its electrical equipment, the Connecting Party must take into account the basic design values and their forecasts given by Fingrid. Indicative design values are given in the related instruction /13/.

The Connecting Party must submit to Fingrid the necessary information about the connection solution, the electrical equipment of at least 110 kV such as substations, transmission lines, transformers and compensation equipment to be constructed, and on the method of grid operation. The design documentation of the connection shall be provided as part of the compliance monitoring process of the grid code specifications. The compliance monitoring process depends on the type of electrical equipment to be connected. The grid code specifications are specified by connection type for demand and distribution network connections (KJV), power generating facilities (VJV), energy storage systems (SJV) and high-voltage direct current connections (HVDC). If necessary, Fingrid may request additional technical information.

Fingrid's electronic service is used to exchange information between Fingrid and the Connecting Party and to monitor the progress of the connection process, to which the Connecting Party obtains the necessary access rights from Fingrid. The Connecting Party is responsible for uploading information to the service and keeping it up to date.

During the planning of the connection, the Connecting Party and Fingrid shall agree on the energy metering arrangements. If the metering equipment must be located somewhere other than at a Fingrid substation, the Connecting Party must reserve sufficient space for the metering equipment delivered by Fingrid, the necessary auxiliary power supplies and instrument transformers with wirings and connections for communication purposes.

Before commissioning of the connection, the Connecting Party must deliver to Fingrid the design documentation of the connection and the grid to be connected. Delivery of the documentation is a prerequisite for issuing the operational notification. The updated final documents must be delivered to Fingrid no later than two months after the commissioning of the connection.

The measurement record of the earthing impedance must be submitted to Fingrid after the measurements, no later than one year after commissioning.

Once the connection has been commissioned, the Connecting Party must supply Fingrid with information about modifications, keeping trees clear of the line and changes in ownership as presented in section 2.8.

3.3 Frequency and voltage variation in the main grid

The Nordic Power System's nominal frequency is 50 Hz and the frequency is normally 49.9–50.1 Hz. The frequency of the grid during normal use may vary between 49.0–51.0 Hz and exceptionally even between 47.5–51.5 Hz.

The nominal voltage levels in the Finnish main grid are 110 kV, 220 kV and 400 kV.

Correspondingly, the design of the connection must be based on the normal connection point voltages of 118 kV, 233 kV and 410 kV respectively.

The normal voltage range of a grid with a rated voltage of 400 kV is 395 ... 420 kV, and in exceptional and disturbance situations the voltage range is 360 ... 420 kV.

The normal voltage range of a grid with a rated voltage of 220 kV is 215 ... 245 kV,

and in exceptional and disturbance situations the voltage range is 210 - 245 kV.

The normal voltage range of a grid with a rated voltage of 110 kV is 105 ... 123 kV, and in exceptional and disturbance situations the voltage range is 100 ... 123 kV.

The Connecting Party's electrical equipment and electrical equipment connected to it directly or indirectly must operate and stay in operation within the presented voltage and frequency ranges so that the equipment meets the requirements set by Fingrid.

The Connecting Party must be prepared for changes in the electricity quality of the 110 kV connection point and dimension and protect its electrical equipment so that it can withstand the voltage and frequency fluctuations described in report Power Quality in Fingrid's 110 kV Grid /7/. The Connecting Party shall ensure that the exceptional voltage or frequency and the loss of voltage do not cause damage to the electrical equipment of the Connecting Party or other parties. If the Connecting Party needs uninterrupted supply of electricity or better overall electricity quality, this must be ensured through Connecting Party's own systems.

3.4 Parallel operation of grids

If the Connecting Party's grid or the Connecting Party's grid together with the grids of other parties constitutes a parallel operational grid with the main grid, the Connecting Party must agree on their parallel operation and potential action and costs arising from it with Fingrid in advance, before starting parallel operation.

The grid of the Connecting Party connected between two different connection points of the main grid must be operated radially in normal operation, and parallel use with the main grid is not permitted as the primary mode of operation. If, for technical and economic reasons, it is justified for the Connecting Party's grid or the Connecting Party's grid together with other grids to form a parallel grid (eg urban network) with the main grid, the Connecting Party agrees with Fingrid on the parallel operation of the grids. Parallel operation of the grid requires technical compatibility between the parallel network components.

3.5 Island operation

Island operation refers to a situation where one or more power plants feed a part of a grid which is separated from the main grid. The transition to island operation must not disturb the opportunities of other parties to use their connections to the main grid nor interrupt transmission connections in the main grid.

The power plants connected to the main grid shall provide support for the power system. Transition to island operation is permitted only when frequency and voltage of the power system are outside the limits defined in the grid code specifications for power generating facilities.

If there is both production and consumption connected to a single grid connection of the main grid and transmission of real power is balanced (around 0MW), The Connecting Party may disconnect its electrical equipment from the electricity grid according to terms agreed in advance with Fingrid, or switch itself from the main grid to island operation without advance warning so as to prevent a disturbance or hazard or in the event of faults or disturbance situations in the grid.

The Connecting Party and Fingrid shall agree in advance on the arrangements related to island operation. The Connecting Party shall be responsible for the implementation costs of island operation.

3.6 Grid earthing method

In Finland, the 400 kV and 220 kV grids are effectively earthed; the earth fault factor is 1.4 or less. The 110 kV grid, on the other hand, is only partially earthed and the earth fault factor is 1.8 or less. The earth fault factor means the ratio between the voltage occurring in a sound phase during an earth fault and the normal phase voltage.

The 400 kV or 220 kV neutral point of a transformer included in the Connecting Party's electrical equipment must be earthed by means of a current-limiting earthing coil unless the operation of the power system requires otherwise. The 110 kV neutral point of a transformer is only earthed at selected substations by means of an earthing coil to enable earth fault protection and to maintain a reasonable level of earth fault current. The Connecting Party and Fingrid shall agree on a needs basis on how to earth transformer neutral points, and on the responsibilities and obligations between the Connecting Party and Fingrid. There must also be a separate agreement with Fingrid on bypassing the earthing coil, for example by means of an earthing switch. It is recommended to equip an unearthed neutral point with an overvoltage protector to protect the transformer against overvoltage.

3.7 Connection of earthing systems

The earthing systems of the Connecting Party and Fingrid shall be connected together at the connection point.

More detailed technical information is given in Fingrid's earthing instruction /10/.

3.8 Protection of electrical equipment

The protection of the Connecting Party's electrical equipment (electrical protection or relay protection) must be compatible with the protection of Fingrid's grid. If needed, Fingrid shall give technical information to coordinate the protection of the connection and the main grid. With regard to protection, the design of electrical equipment must take into account the principles and requirements described in Fingrid's application instruction on relay protection /8/.

The protection of the Connecting Party's electrical equipment and the protection of electrical equipment connected to it directly or indirectly as well as the protection of the main grid must uniformly and selectively operate in order to maintain system security in the grid.

The protection of the Connecting Party's 400 kV connecting lines must be implemented with equipment, configurations and plans approved by Fingrid. With the consent of the Connecting Party, Fingrid may tender for its own equipment and the equipment required for the protection of the Connecting Party's 400 kV connecting line, in which case the Connecting Party shall enter into a direct

agreement with the contractor tendered by Fingrid to implement the protection. The Connecting Party and Fingrid own their own protective devices and are responsible for their operational condition. Fingrid is responsible for the calculation of the settings for the protection devices.

It is recommended to use protection devices approved by Fingrid for the busbar and transformer protection of the Connecting Party's 400 kV substations. Fingrid calculates recommended values for the protection settings and makes its own specifications available to the Connecting Party if the Connecting Party uses protection devices approved by Fingrid.

For 110 kV and 220 kV connections, the Connecting Party and Fingrid are responsible for the proper operating condition of the protection equipment they own, for the suitability of this protection and for specifying the settings of this protection. If cable sections are connected to a grid or if the connection is to a resonant earthed 110 kV grid, the protection of the electrical equipment must be agreed separately.

Line protection in the main grid is designed to operate in the case of line faults in the main grid. It is not technically possible to use line protection in the main grid as a protection of a transformer of a transmission line connection or as a protection of a long radial transmission line. If a radial transmission line is connected to a transmission line of the main grid by a circuit breaker equipped with protection, the coordination and settings of the protection must be agreed with Fingrid well in advance.

The Connecting Party must ensure that the protection settings do not conflict with the grid code specifications applicable for the type of the connection.

3.9 Grid disturbances and faults

In the design and operation of the Connecting Party's electrical equipment, the Connecting Party must take into account the dead state caused by grid faults, the short-term voltage dips and as well as the effects of high-speed and delayed automatic reclosing generally used in restoring normal operation. The Connecting Party must take into account the effects of disturbances on the electrical equipment of other parties connected to the main grid through the Connecting Party's grid.

The Connecting Party and Fingrid must agree in advance on the principles concerning the investigation of disturbances. Fingrid maintains the instruction for recovering from serious disturbances /11/, which defines the division of responsibilities and procedures for resolving serious disturbances, as well as the principles for supplying electricity during a disturbance. If a fault or disturbance occurs in the grid, Fingrid has the right to disconnect the Connecting Party's electrical equipment from its grid without advance warning, if this is essential because of disturbance investigation or repairs. Fingrid must take immediate action to remove the disturbance from its grid.

If electrical safety or the system security of the main grid so require, Fingrid has the right to require an electrical equipment connected directly or indirectly to the Connecting Party's grid to adjust the active or reactive power within the limits set by the grid code specifications, and in extreme cases to disconnect the electrical equipment from the grid.

The Connecting Party and Fingrid must immediately inform each other of faults which have an effect on the other contracting party's grid operation, and must initiate

disconnection and safety measures as soon as a disturbance arises.

If faults that disturb the operation of the electrical equipment of the Connecting Party or a third party and which cause electricity quality or safety deviations exceeding normally acceptable limits, are detected in electrical equipment connected to the Connecting Party's and Fingrid's grids, the Connecting Party causing the disturbance must immediately correct the faults and shortcomings.

3.10 Transmission outages

If the Connecting Party's or Fingrid's electrical equipment needs to be temporarily disconnected from the grid because of service, repair, modification, inspection or other similar measures, and these have an effect on the other contracting party's operation, the Connecting Party and Fingrid must agree on the outage in advance.

If necessary, the Connecting Party is responsible for the replacement arrangements for its connections in cases of service, modification or disturbance to Fingrid's grid resulting in transmission outage. Fingrid is responsible for the replacement arrangements for power transmission in its grid caused by service and modification work or disturbances targeted at the Connecting Party's connections.

The Connecting Party and Fingrid shall plan their arrangements, schedules and measures concerning the outages so that the duration of the outage is not unnecessarily prolonged. Each party is responsible for its own costs.

The procedure related to transmission outages is described in the Main Grid Service Terms and Conditions /6/.

3.11 Fulfilment of the connection terms

Fingrid has the right to inspect the connection and any subsequent amendments made to it and, if necessary, to request further clarifications. As far as the connection is concerned, the Connecting Party has a reciprocal right to inspect Fingrid's electrical equipment.

If it turns out that the connection does not fulfil the connection terms, the Connecting Party shall submit to Fingrid an account of the impact of the shortcomings on the operation of the connection, plus a plan concerning the measures for the correction of the shortcomings and the correction schedule. After the completion of the modifications, the Connecting Party and Fingrid must jointly verify that the connection fulfils the connection terms. The Connecting Party is responsible for the verification and for the related and possibly resulting measures and costs arising from it. If Fingrid electrical equipment is defective with regard to the connection, Fingrid is responsible for the corrective measures and costs.

If the shortcomings of the connection impact the operation of the power system, Fingrid as the transmission system operator has the right to interrupt or restrict the operation of the connection or impose obligations pertaining to the operation of the connection until the shortcomings have been corrected.

4 Agreements and responsibilities

The connection to the main grid shall be agreed in a connection agreement signed between the Connecting Party and Fingrid /5/. Fingrid's general connection terms constitute an integral part of the connection agreement. The connection agreement defines the ownership limits, rights, responsibilities and obligations of the parties, connection fee as well as the conditions for termination and amendment of the agreement.

The Connecting Party has the right to keep the 110 kV transmission line structures and telecommunication cables belonging to the connection in the substation area owned by Fingrid free of charge for the duration of the connection agreement.

In the event of a change in the Connecting Party's or Fingrid's assets, the responsibility for the measures and costs will be determined in accordance with the applicable connection fee principles /14/. These changes include:

- the need to relocate or modify the structures owned by the Connecting Party that belong to the connection in the existing substation area
- Fingrid's substation will be completely or partially refurbished at its existing location or rebuilt at a new location
- Fingrid's transmission line will be completely or partially renewed at its current location or built at a new location.

If the Connecting Party's own needs require additional structures or equipment in the main grid, these are agreed on a case-by-case basis and the Connecting Party carries the resulting costs. Once completed, the disconnectors built in a transmission line of the main grid are the property of Fingrid, and Fingrid is responsible for their operation, maintenance and replacement investments until a need for the device no longer exists. The Connecting Party is responsible for possible auxiliary power and control required by the disconnectors and for the costs of connection to remote operation. The disconnectors on the connecting line are owned by the Connecting Party.

The Connecting Party is also responsible for

- a) the modification costs in its electrical equipment, caused by an increase in fault currents in the main grid.
- b) costs arising from the transposition of possible phases required for the transmission lines.
- c) measures required in the grids of other parties connected to its grid directly or indirectly, and shall reach an agreement with the other parties on the costs arising.

Fingrid constantly monitors the developments both in solutions applied to the grid and in technical issues. Additionally, Fingrid keeps the valid connection terms and its other guidelines, requirements and pricing principles publicly available on its website (www.fingrid.fi).

5 References

The current versions of the documents listed in the references are available on Fingrid's website (www.fingrid.fi) on the "General connection terms" page.

- /1/ Grid Code Specifications for Demand Connections, KJV
- /2/ Grid Code Specifications for Power Generating Facilities, VJV
- /3/ Grid Code Specifications for Grid Energy Storage Systems, SJV
- /4/ Grid Code Specifications for High Voltage Direct Current Systems, HVDC
- /5/ Connection Agreement template
- /6/ Main grid contract template with appendices (eg. Main grid service terms and conditions, Grid service pricing)
- /7/ Power Quality in Fingrid's 110 kV Grid (report)
- /8/ Relay Protection for the Main Grid and Customer Connections (instruction)
- /9/ Real-Time Information Exchange (instruction)
- /10/ Earthing of Customer Connections (instruction)
- /11/ Recovering from Serious Disturbances, KH40000 (Instruction)
- /12/ Principle drawings for transmission line connection; "Mallipiirustus / 110 kV kytkinasema / Sijoituspiirustus"
- /13/ Indicative design values for grid components
- /14/ Connection Fee principles