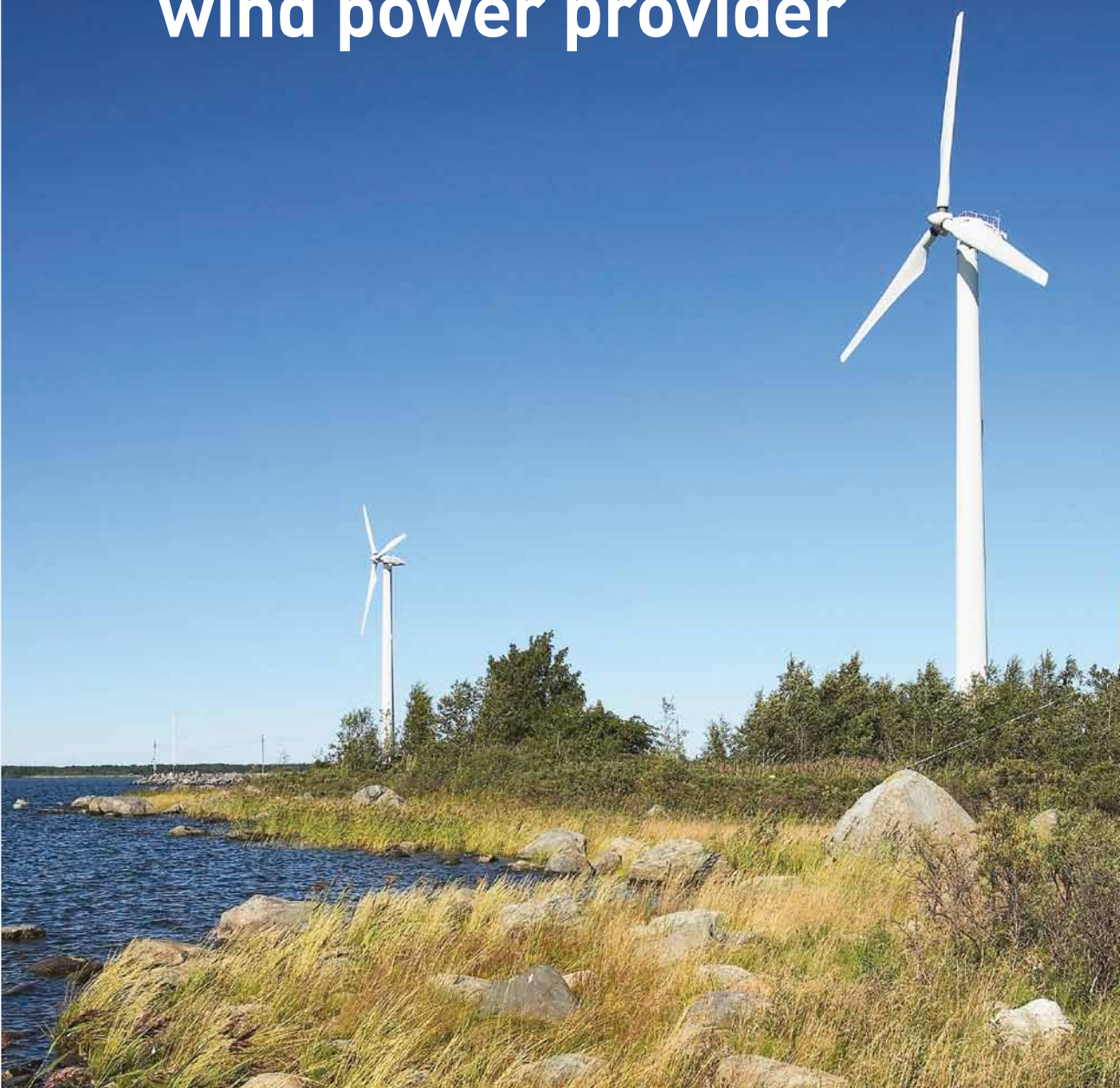




Guide for wind power provider





FINGRID IN BRIEF

Electricity is a necessity in everyday life in Finland. Society is powered by electricity.

Fingrid Oyj is responsible for the functionality of the electricity transmission system in Finland.

The main grid is the backbone for power transmission. Large power plants and factories, as well as regional distribution networks, are all connected to the grid. The power system encompasses approximately 14,000 kilometres of 400, 220 and 110 kilovolt transmission lines and more than a hundred substations and back-up power plants, which are needed in case of major interruptions in the electricity system.

We make sure that Finland obtains electricity without disturbances now and in the future. We participate in the EU's energy efficiency project by strengthening the main grid according to the new energy solutions.

In the current decade we will build approximately 2,500 kilometres of more transmission lines and about twenty new substations. Thus, we are developing the Finnish society and the wellbeing of every Finn.

We promote the functioning of the electricity market. Joint and efficient electricity trading in the European countries is trusted by our interest groups and a benefit for a consumer.

FINGRID POWER TRANSMISSION NETWORK

1.1.2015

- 400 kV grid
- 220 kV grid
- 110 kV grid
- HVDC
- lines of other companies



Base map © Karttokeskus Oy, Helsinki



**High
wind power
target in Finland**

The share of wind power in Finland's energy production is still relatively low. The target, however, is high, and the share of completed wind farm projects is increasing every year. In this guide we've gathered information which wind power providers need to know for as smooth constructing of a grid connection as possible.

According to Finland's climate and energy strategy, the production of wind power should be raised to 6 terawatt hours per year by 2020, which means around 2,500 megawatts. In 2013 this objective was raised to 9 terawatt hours. This is still distant, but the trend is upwards: at the end of 2013 the total capacity of wind power in Finland was approximately 400 megawatts and in 2014, the capacity is expected to rise to 500–600 megawatts.

Several hundred enquiries concerning wind power connections alone have been directed to Fingrid, and attempts are already made in the planning stage to find a connection solution which is both technically and commercially feasible. Some 10–20 per cent of the plans progress to implementation.

Fingrid has been actively involved in wind farm projects by planning grid connections and contributing to environmental impact assessments, regional land use planning and discussions with wind turbine suppliers. This is to ensure the reasonable execution of connection plans as a whole and to retain the

security and sufficient transmission capacity of the transmission grid.

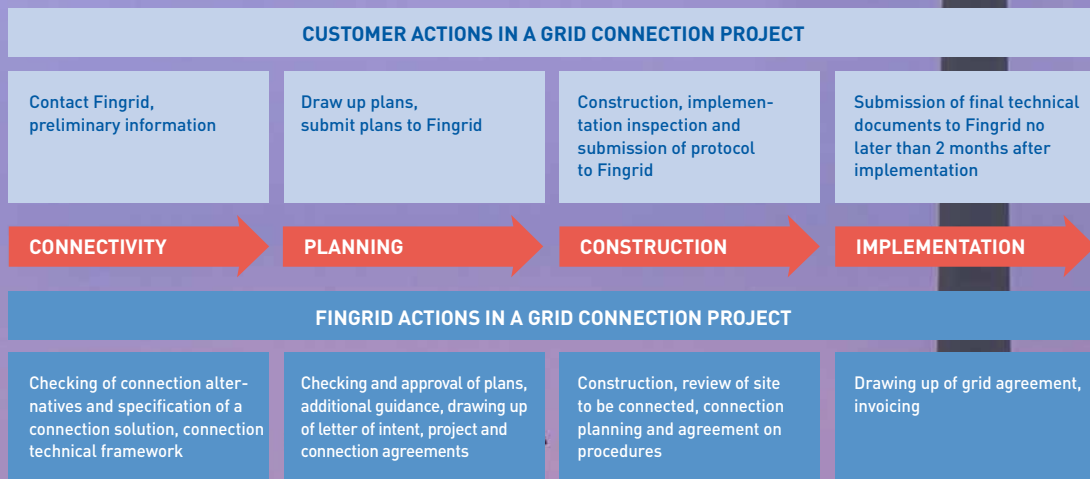
When Fingrid is involved in the planning process from the outset, the need to reinforce the transmission system does not

By contacting Fingrid during the early stages of planning possible changes in the connection can be included in the planning and construction schedules.

come as a surprise. The Finnish Government's wind power target is one of the reasons why Fingrid will use approximately 1,700 million euros over the next 10 years to build and develop the Finnish electricity transmission grid. In practice, this means about 2,500 kilometres of new transmission lines and about twenty new substations.

Permit process calls for patience

6



The development of a wind power project usually takes at least two years. After that it is to be decided whether a wind farm can be constructed at the site in question, and whether or not the project is viable. Wind farm refers to a project containing more than 10 turbines. Such projects call for an environmental impact assessment (EIA) procedure. An EIA is not usually needed for smaller projects, but in other respects the permit process is similar.

Firstly, there is a preliminary study of the general conditions to build a wind farm. The location must of course be windy and the land must be suitable for constructing. Nature values, impact on people, and other land uses have to be considered. It must be possible to build roads at a reasonable expense, and then there is the question of connectivity: there should be a suitable nearby connection point to Fingrid's grid or to a distribution network.

After the preliminary study, it is decided whether a wind farm is feasible. If it is, the next step in a wind farm project consisting of more than 10 turbines is the EIA procedure. This procedure partly overlaps with the land zoning. At the same time, wind conditions are measured and technical analyses are carried out. If, after these procedures, the project is given the green light, actual construction work can commence.

It is impossible to know beforehand which of the numerous planned projects will become a reality. Some projects never get to the finish line, and the size of many projects decreases as time goes on.

Fingrid treats every customer equally. Projects with extensive progress and most likely to realise will be agreed first.

Connection is agreed on with Fingrid

1. LETTER OF INTENT

- Environmental Impact Assessments required by authorities are under way.
- The land use process has commenced or a planning requirement decision has been made.
- The letter of intent is not binding and is valid for a maximum of 12 months.

2. PROJECT AGREEMENT

- A new distribution substation is constructed in the grid for the connection of an individual customer.
- Environmental assessments required by authorities have been carried out for the project.
- The customer pays the connection fee in three instalments.

3. CONNECTION AGREEMENT

- The plan (or planning requirement decision) is lawful.
- The customer is prepared to commit to connection fees and to the execution of the connection in accordance with Fingrid's technical terms.
- The customer must present plans for the execution method of its connection. An expropriation permit application concerning any possible connection line has been submitted to authorities.
- The connection fee shall be paid either in full when the agreement is signed, or in two instalments.
- The agreement shall come into effect once it has been signed and connection fees have been paid.
- The high-voltage section of the customer's connection must be complete within 24 months from the signing of the connection agreement; otherwise the agreement will become invalid.

4. MAIN GRID CONTRACT

- The customer has a valid connection agreement and technical terms have been met.
- The main grid contract will be drawn up before the implementation of the connection and provision of voltage.



Connectivity should be **determined in the early phase**

FACT

ELECTRICITY PRODUCTION SHOULD PRIMARILY BE CONNECTED TO A SUBSTATION

The connecting party's power plant is connected to Fingrid's grid through the switchyard of a substation, with the exception of small power plants of less than 5 megavolt amperes (MVA), which are to be agreed separately, or power plants of a maximum of 25 MVA, which feed to Fingrid's grid a short circuit current no more than 1.2 times the rated current of the power plant. These can be connected to a 110 kilovolt transmission line which is in ring operation, taking into account the available transmission capacity of the transmission line and certain technical conditions. If electricity production is connected to a transmission line, the connection must be equipped with a telecommunications connection and forced tripping to enable high-speed automatic reclosing in Fingrid's grid.

A wind farm in excess of 25 MVA must be connected to a substation. If a substation needs to be built for this purpose, the connecting party must pay the full price of the substation as the connection fee.

When a wind farm is connected to Fingrid's grid, it has to fulfil the same requirements as any other power plant. The connecting power plant must fulfil technical specifications set out in Fingrid's general terms of connection (YLE). Compliance with terms of connection ensures system security. The connecting power plant must also fulfil the specifications for the operational performance of power plants (VJV) in order to ensure the systems' technical compatibility.

The suitability of the grid connection should be examined as early on in the project as possible. This provides information on whether or not the planned wind turbine can be connected to the grid at the planned location. The final connectivity will only be confirmed once the customer has made an agreement with Fingrid.

Distribution network companies must also check connectivity to the grid with Fingrid before they are able to make an agreement with the wind power provider to be connected to their network.

The customer is obliged to inform Fingrid in good time of the technology planned for the wind farm. As an example, if there are plans to use a turbine type that has not been previously used in Finland, it must first be examined whether the turbine type has the technical specifications to fulfil the requirements. It must also be verified

whether the wind farm as a whole fulfils the requirements imposed on power plants to be connected to the Finnish power system.

Real-time active power and reactive power measurements, as well as circuit breaker status information must be submitted for all power plants in excess of 1 MVA to maintain grid operational reliability. Requirements for the real-time exchange of information are specified in the grid agreement. The connecting party is responsible for the organisation of measurements from the wind farm to Fingrid.

Even though the grid has a high electricity transmission capacity, there may be various technical restrictions depending on the location and the scope of projects. In these cases, new lines, transformers or circuit breakers may need to be constructed, and this may take several years. The volume of wind power to be connected to the transmission grid also depends on the location of other wind turbines in the same region.

Small wind turbines should be primarily connected to distribution networks. Each connection is individual, and there is no specific power limit for power plants that can be connected to Fingrid's grid. The wind farms typically connected to Fingrid's grid have a total power of over 15 megawatts. Connecting a smaller power than this to Fingrid's grid is not usually purposeful or cost-efficient.


CONNECTION PROCESS **STEP-BY-STEP**

1 The customer provides Fingrid with information on the power, type and location of the planned wind farm. The contact can be made easily for example through Fingrid's website using the form "Asiakkaalta tarvittavat tiedot" or the map service. The map service can be found in the shortcuts on the home page or directly at the address <http://fingrid.navici.com>.

2 Fingrid determines the connection solutions. Information on the preliminary connection solution can be obtained quite quickly. But if in the planning the strengthening of the main grid requires network calculations and preliminary analyses, the solution may need more time.

3 Once the preliminary connection solution has been specified, the customer obtains information, based on which the planning of the connection can start. There is an information package available on Fingrid's website for customers planning a connection to the grid. The package contains information such as technical conditions and specifications, and example drawings of connecting substations. The information can be found on the website under Customers > Grid connection. The specification of the preliminary connection solution does not mean that there is a binding agreement concerning the actual connection. If necessary, a letter of intent valid for 12 months can be concluded to serve as support for the customer and as a tool in negotiations with authorities and financiers. The letter of intent is not binding for either party.

4 The customer draws up detailed plans and delivers the plans together with any other necessary technical details to Fingrid for review. Information is exchanged and maintained in Fingrid's extranet service as the project progresses. The customer will reserve space for energy meters and submit to Fingrid an energy measuring circuit diagram for the planning of measurements.



5 Once Fingrid has examined the plans concerning the connection, the customer may begin construction.

6 A binding connection agreement does not enter into force before the agreement has been signed and the connection fee has been paid. The connection agreement determines the ownership and liability limits, rights of use, responsibilities concerning operation and maintenance, and the connection fee. Responsibility for the fulfilment of the specifications for the operational performance of power plants lies with the customer signing the agreement, not for example with the wind turbine manufacturer. The fulfilment of the specifications is verified by means of network tests or sufficient simulations.

7 The connection must be available for commissioning within 24 months from the signing of the connection agreement. If not, the agreement will become void. This procedure has been created to protect the parties involved: in this way, we can make sure that the wind power providers shall construct wind power instead of selling the reserved transmission capacity.

8 Before commissioning, Fingrid's operation specialist examines the new connection and verifies that the connection has been built as agreed and that the connection can be energised safely. The customer should notify the network operator of the open actor (electricity seller) two weeks before connection to the electricity network. Responsibility for the compliance of the equipment with the relevant standards always lies with the owner of the equipment. It is the customer's responsibility to make sure that the final technical documents are delivered to Fingrid within 2 months from commissioning.



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