

An aerial photograph of a wind farm at sunset. The sun is low on the horizon, casting a warm glow over a dense forest. Several wind turbines are visible, with one in the foreground being particularly prominent. The sky is a mix of orange, yellow, and blue.

**FINGRID**

# **Green Bond Investor Letter and Impact Report**

**March 2024**

# Table of Contents

---

03

Green Bond Investor Letter  
and Impact Report

---

16

Independent Practitioner's  
Assurance Report

---

18

Annex 1. Projects financed under  
the EUR 100 million green bond

---



An aerial photograph showing a dense forest of green trees. Overlaid on the forest are several high-voltage power lines and their supporting pylons, which are made of metal and cross the landscape diagonally from the top right towards the bottom left.

# Green Bond Investor Letter and Impact Report

*"A carbon neutral Finland requires a strong main grid. Fingrid's role as a transmission system operator is central for Finland to achieve its climate target (carbon neutrality) by 2035. During 2023 Fingrid was able to connect 1510 MW new wind power and 410 MW solar power to the main grid. Green bonds play a significant role by enabling Fingrid to use green finance for its investment projects," says Marina Louhija, SVP, Legal, Compliance and Sustainability.*



# Fingrid's business has significant positive impacts on society and the climate

The starting point for Fingrid's corporate social responsibility work is our strategy where sustainability is an integrated goal and a corporate-level strategic choice. Fingrid creates significant positive impacts on climate and society.

The electricity transmission grid provides a platform for a clean power system. The positive impact resulting from the grid's enabling role in clean power production and consumption clearly exceeds the harm to biodiversity and people

caused by the transmission lines and Fingrid's own greenhouse gas emissions. Fingrid's Green Bond financing also promotes the global development of sustainable and responsible debt capital markets.

## Fingrid's business model

# 01

### RESOURCES

- › Personnel and expertise
- › Suppliers and business partners
- › Income and debt financing
- › Electricity from power plants and neighbouring countries
- › Grid transmission lines, substations and reserve power plants
- › Land required for transmission lines; natural resources and materials
- › ICT structures
- › Knowledge capital on electricity, markets and customers

# 02

### BUSINESS PROCESS

#### Adequacy of the electricity transmission system

- › Grid planning
- › Grid construction
- › Grid maintenance

#### Management of electricity system operation

- › Planning of the operation of the electricity system
- › Monitoring and control of the electricity system
- › Managing disturbances and the continuity of the electricity system

#### Promoting the electricity market

- › Developing market rules to enable a clean electricity system
- › Promoting the regional electricity markets
- › Ensuring the continuity of the electricity market

#### SERVICES FOR CUSTOMERS

- › Main grid services / Electricity market services

# 03

### IMPACTS

- › Enabling a carbon neutral energy system
- › Reliable electricity for society and business
- › Efficiently functioning electricity market
- › Promoting Finland's competitiveness
- › Developing the electricity sector and competence
- › Financial benefits for stakeholders
- › Employment impact and other local benefits from large capex projects
- › Local changes in land use and the environment and energy losses in electricity transmission

# 04

### CREATION OF VALUE

- › Fingrid's nationwide main grid creates a platform for a clean powersystem. Around 60 kilometres of new grid transmission lines and 15 new or expanded substations.
- › Electricity transmission reliability 99.9995%.
- › Wind power was connected to the main grid in the amount of 1,920 megawatts, which will indirectly result in an annual emissions reduction of 189,000 carbon dioxide equivalent tonnes in the future. The reliability of cross-border transmission connections was 98.0%.
- › Top cost-effectiveness in European energy regulators' comparison study. Third cheapest in ENTSO-E's European price comparison. Customers perceive that Fingrid works for the benefit of the whole of society (4.4/5).
- › Personnel feel their work is meaningful and are ready to recommend their employer (eNPS 75). LTIF 7.2. Absences from work 1.9%. Number of training days on average 5/employee.
- › One of Finland's largest corporate income tax payers (EUR 32 mill.). Payments to providers of capital EUR 163 mill.
- › Investments in the main grid approx. EUR 310 mill. Fingrid personnel's person-years 485 and service suppliers' person-years 663.
- › Direct CO<sub>2</sub> emissions and indirect emissions due to the company's own electricity consumption and losses totalled 65,000 carbon dioxide equivalent tonnes (Scope 1 and 2). 99% utilisation rate and 78% recycling rate for waste.

Fingrid promotes in particular these UN's Sustainable Development Goals



We have defined the linking of Fingrid's operations to the UN's Sustainable Development Goals published in 2015. Of the 17 goals, we promote especially the following:

### **Affordable and clean energy**

We secure a reliable supply of electricity and affordable transmission pricing in the main grid for society. Society's demand for disturbance-free electricity is growing and serious disturbances in the electricity supply are one of the greatest security threats. Our investment programme improves the reliability of electricity transmission. We also secure a functioning electricity market and are a pioneer in electricity market services. A strong main grid ensures that the wholesale price of electricity remains the same everywhere in Finland, thereby enabling investments throughout the country.

### **Industry, innovation and infrastructure**

We maintain and develop an important electricity transmission infrastructure for the needs of customers and society and achieve climate goals. The extensive investments of our main grid development programme provide several hundred person-years of employment for our service providers. Our employment impact is spread across a wide area, as we invest in sites all over Finland

and purchase grid construction and maintenance services from external service providers. We are active in international cooperation and innovation activities for when future technologies are developed in this field.

### **Climate action**

The change in the power system production will transform our electricity system and contribute to combatting climate change. A strong main grid with robust transmission capacity is a prerequisite for curbing climate change. We enable the connection of clean energy generation into the main grid. We also ensure the adequacy of system reserves in the future and prepare for a reduction in flexible production capacity while developing the electricity market to suit the needs of a climate-neutral electricity system. We minimise power losses during electricity transmission as these have a negative impact on the climate.

Please read more about our corporate responsibility and sustainable development in our [Annual Report](#).

Fingrid's Green Bond eligible investments promote above listed SGD's in practice when e.g. renewable power generation is connected to our green bond financed substations and/or power transmission

losses are reduced following a transmission line upgrade financed with green bond.

Fingrid's target is to increase the amount of green financing. This is one of the company's Environmental, Social and Governance (ESG) targets reported in context of the annual report.

This Green Bond Report is aligned to the reporting requirements of Fingrid's Green Bond Framework and is intended to provide further insight into Fingrid's green financing activity.

Fingrid reports the estimated impact of CO<sub>2</sub>-equivalent (CO<sub>2</sub>-eqv) avoided thanks to the Green Bond investments. The estimated impacts of Fingrid's investments have been verified by an independent external party (Ernst & Young Oy) whose statement is included to this report on page [16](#). Fingrid uses its real-time CO<sub>2</sub> emissions estimate to calculate the estimated impact of CO<sub>2</sub>-eqv avoided. Further information of the CO<sub>2</sub> emission estimate calculation (for electricity consumed in Finland) is available at our webpage at [fingrid.fi/en/electricity-market-information/real-time-co2-emissions-estimate](https://fingrid.fi/en/electricity-market-information/real-time-co2-emissions-estimate)



## **Fingrid established a Green Bonds Framework as part of its financing strategy in October 2017**

Fingrid's 2017 Green Bonds Framework and environmental governance has been assessed by an independent third party: Center for International Climate and Environmental Research – Oslo (CICERO) who issued a Second Opinion. The Second Opinion as well as the Green Bonds Framework are available at our web page at [fingrid.fi/en/pages/investors/financing/green-financing/green-bonds-framework](https://fingrid.fi/en/pages/investors/financing/green-financing/green-bonds-framework)

Green bonds are issued under the company's Euro Medium Term Note programme which is listed on the Irish Stock Exchange (Euronext Dublin).



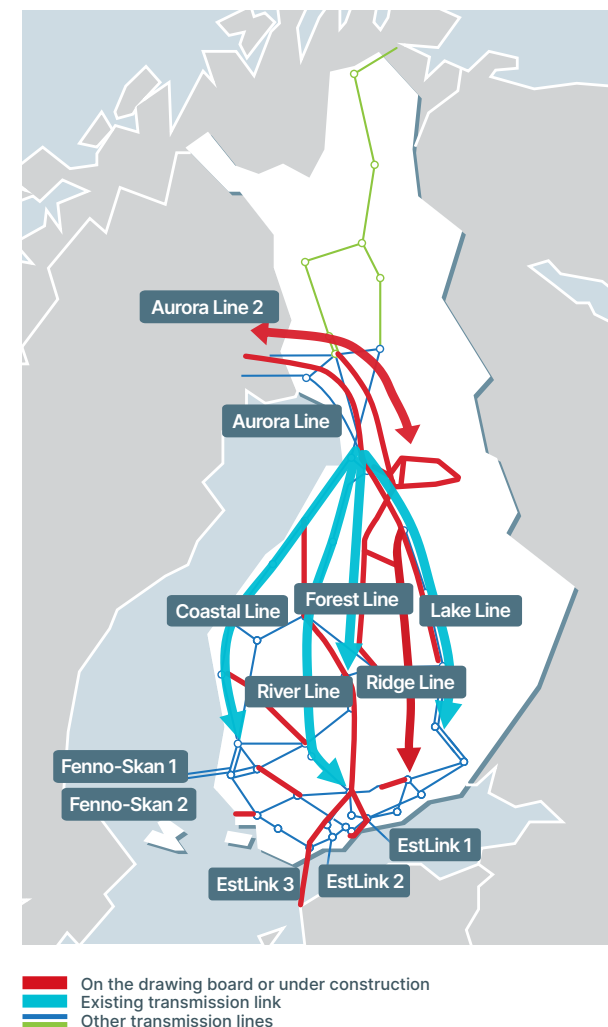
# Investments financed with Green Bonds

Under the Green Bonds Framework the company can finance investments which connect renewable energy, increase cross-border capacity, reduce electricity transmission losses and/or improve energy efficiency via smart grids.

These investments are facilitated by market developments in recent years as condensing power plants and combined heat and power plants are being shut down in Southern Finland. The energy deficit is met mainly by renewable power generated in Northern Finland, Sweden and Norway. This new geographical distribution of energy generation requires more transmission capacity across the Swedish border and from North to South.

Wind power generation in Finland has increased tenfold in the last decade.

Regarding green bond eligible investments, Fingrid has invested heavily to connect new wind farms and has also increased capacity as well as reliability of the grid for existing hydro power. As part of its long-term investment plan, Fingrid has been renewing several old power lines with modern structures reducing electricity transmission losses significantly. This includes projects where one of the company's oldest East-West connection, the Iron Lady, from 1928 has been replaced with new power lines mainly on the existing right of way.



The image does not show 110 kV connections.

## Inaugural Green Bond issued in November 2017

Fingrid issued on the 23rd November a 10 year, EUR 100 million green bond with a coupon interest of 1.125 per cent. The issue was the first ever Finnish corporate green bond issue. The bond is listed on the London and Irish Stock Exchanges and is also included into the Climate Bonds Initiative's global green bond database.

The proceeds of EUR 100 million from the November 2017 Green Bond were allocated in accordance with the criteria and decision-making process for eligible projects defined in Fingrid's Green Bonds Framework. Fingrid's Steering

Committee for Finance and Business Development unanimously approved in December 2017 the following list of eligible projects totaling EUR 154 million and decided that an amount equal to the proceeds from the inaugural green bond i.e. EUR 100 million shall be allocated to refinance and finance these committee approved eligible projects. An amount equal to the proceeds from the inaugural green bond i.e. EUR 100 million was fully allocated to refinance and finance committee approved eligible projects at the end of 2018.







In 2023 Fingrid established a Green Finance Framework and a Green Euro Commercial Paper Programme. The new Green Finance Framework integrates Fingrid's sustainable strategy, which enables Finland to reach its climate goals, further into the company's financing activities. For more information on the Green Finance Framework, the Second Party Opinion, and the Green ECP Programme, visit Fingrid's website at [fingrid.fi/en/green-finance-framework](https://fingrid.fi/en/green-finance-framework)

## Allocation of green bond proceeds to approved eligible projects

Project		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Refinance	Reconductoring of Isohaara-Raassakka 110 kV transmission line			1							
	New 220 kV substation Kuolajärvi		1	3	1						
	New 110 kV substation Siikajoki		1	3	1						
	Refurbishment and expansion of Taivalkoski substation			1	4						
	Expansion of Tuovila substation		1	3	1						
	Expansion of Pirttikoski substation and a new 400/220 kV transformer		1	6	1						
New projects	New Hikiä-Forssa 400 kV transmission line	4	9	16	4						
	New 400/110 kV transformer substation Isokangas		1	3	13	1					
	New 400/110 kV transformer at Kristinestad substation				6	1					
	New Hikiä-Orimattila 400 kV transmission line					2	9				
	New Lempiälä-Vuoksi 400 kV transmission line						2				
Totals for MEUR 100 allocation	Refinance MEUR 62	4	13	32	12						
	New projects MEUR 38		1	3	19	4	11				
	<b>Total MEUR 100</b>	<b>4</b>	<b>14</b>	<b>35</b>	<b>31</b>	<b>4</b>	<b>11</b>				





## Description of projects

Project	Description
Reconductoring of Isohaara–Raassakka 110 kV transmission line	Conductors were changed to connect more wind power and reduce losses
New 220 kV substation Kuolajärvi	New substation for connecting new wind power
New 110 kV substation Siikajoki	New substation for connecting new wind power
Refurbishment and expansion of Taivalkoski substation	A substation was refurbished and expanded in order to connect new wind power and existing hydro power
Expansion of Tuovila substation	Part of new 400 kV network on western coast that enables connection of new wind power, better transmission capacity for FI–SE cross-border lines and north–south connection
Expansion of Pirttikoski substation and a new 400/220 kV transformer	A new transformer that enables more wind power and reliable connection for existing hydro power
New Hikiä–Forssa 400 kV transmission line	Old 110 kV line was replaced by 400+110 kV power line resulting in significant drop in losses
New 400/110 kV transformer substation Isokangas	Network was enhanced in order to connect new wind power and existing hydro power
New 400/110 kV transformer at Kristinestad substation	A second 400/110 kV transformer was needed to connect more wind power
New Hikiä–Orimattila 400 kV transmission line	An old 110 kV power was replaced with 400+110 kV power line to increase capacity to Lahti region. Old coal fired CHP is going to be shut down and replaced with bio district heating plant. New power line results also in significantly lower electricity transmission losses
New Lempiälä–Vuoksi 400 kV transmission line	Old 110 kV line was replaced by 400 kV power line resulting in significant drop in electricity transmission losses








*"Thanks to the Green Bond projects an estimated 137 000 tCO<sub>2</sub> eqv. was avoided in 2023"*



## A summary of the estimated impacts<sup>1)</sup> to be achieved from the funded projects and related SGDs

Project	Renewable capacity <sup>2)</sup>					Transmission losses reduced
Applicable SGDs to all projects   	Cumulative until 12/2021	Cumulative until 12/2022	Cumulative until 12/2023	New renewable capacity estimated in next three years <sup>3)</sup>	Total estimated impact	12/2023
Reconductoring of Isohaara–Raassakka 110 kV transmission line	100 MW	100 MW	100 MW	0 MW	100 MW	approx. 60%
New 220 kV substation Kuolajärvi	50 MW	50 MW	50 MW	0 MW	50 MW	n/a
New 110 kV substation Siikajoki	250 MW	400 MW	350 MW	250 MW	600 MW	n/a
Refurbishment and expansion of Taivalkoski substation	200 MW	200 MW	200 MW	0 MW	200 MW	n/a
Expansion of Tuovila substation	100 MW	200 MW	300 MW	100 MW	400 MW	n/a
Expansion of Pirttikoski substation and a new 400/220 kV transformer	100 MW	200 MW	300 MW	0 MW	300 MW	n/a
New Hikiä–Forssa 400 kV transmission line	n/a	n/a	n/a	n/a	n/a	approx. 95%
New 400/110 kV transformer substation Isokangas	50 MW	50 MW	100 MW	200 MW	300 MW	n/a
New 400/110 kV transformer at Kristinestad substation <sup>4)</sup>	350 MW	550 MW	400 MW	150 MW	500 MW	n/a
New Hikiä–Orimattila 400 kV transmission line	n/a	n/a	n/a	n/a	n/a	approx. 80%
New Lempiälä–Vuoksi 400 kV transmission line	n/a	n/a	n/a	n/a	n/a	approx. 80%
<b>Total by these investments</b>	<b>1150 MW</b>	<b>1700 MW</b>	<b>1800 MW</b>	<b>650 MW</b>	2400 MW	n/a
<b>Total estimated tCO<sub>2</sub> eqv avoided p.a.</b>	<b>258 000</b>	<b>209 000</b>	<b>137 000</b>	<b>73 000</b>	<b>419 000</b>	<b>n/a</b>

1) Approximations, figures are rounded

2) Directly connected or through enhanced transmission capacity by these investments

3) Estimated upon completion 2026 in addition to impacts estimated until 12/2023

4) Kristinestad substation grid topology changed in 2023, two wind parks changed connection to Arkkukallio and three new wind parks connected to Kristinestad

The estimated tCO<sub>2</sub> eqv avoided p.a. for 2023 (2022) in the table above has been calculated as follows: total realized annual electricity generation of approximately 3,6 (3,5) GWh from wind farms enabled by the green bond investments in 2023 multiplied by CO<sub>2</sub> baseline of 38kg (60kg) CO<sub>2</sub>/MWh, which is the 2023 average of CO<sub>2</sub> emission coefficient (baseline) for electricity consumption in Finland estimated by Fingrid [fingrid.fi/en/electricity-market-information/real-time-co2-emissions-estimate](https://fingrid.fi/en/electricity-market-information/real-time-co2-emissions-estimate).

The decrease in the CO<sub>2</sub> baseline in 2023 reflects positive development towards Finland's climate goals. The decline is explained by the decrease in consumption of electricity, and changes in cross-border transmission reflecting Nordic import, export to Estonia, and cross-border transmission ending between Finland and Russia in May 2022. The decline in the CO<sub>2</sub> baseline multiple of

electricity produced in Finland was affected by increases in wind and nuclear power, with Olkiluoto 3 nuclear plant commissioned in 2023.

The estimated tCO<sub>2</sub> estimated in next three years p.a. is calculated as follows: tCO<sub>2</sub> avoided in 2023 plus estimated new renewable electricity generation capacity enabled by the green bond investments by 2026 multiplied by an estimated annual generation in MWh per annum per installed MW multiplied by CO<sub>2</sub> baseline of 38kg CO<sub>2</sub>/MWh. Estimated annual generation in MWh per annum per installed MW of around 3040 MWh p.a. is based on a weighted average of annual production estimates publicly available of recently commissioned new wind farms in Finland per MW. The CO<sub>2</sub> baseline applied is the same used for Fingrid's corporate responsibility reporting.





Fingrid has started to use the weighted yearly average in annual reporting 2023 onwards instead of the previously reported arithmetic yearly average. The weighted yearly averages have been calculated and added to the table post the change for the previous years. These averages have been calculated by weighting the momentary emission factor values by the momentary values of corresponding total electricity consumption or generation.



# Independent Practitioner's Assurance Report

## To the Management of Fingrid Oyj

### Scope

We have been engaged by Fingrid Oyj (hereafter Fingrid) to perform a 'limited assurance engagement,' as defined by International Standards on Assurance Engagements, hereafter referred to as the engagement, to report on avoided greenhouse gas emissions in (tCO<sub>2</sub>-eqv) presented in page 13 of Fingrid's Green Bond Investor Letter and Impact Report 2023 (the "Subject Matter") for the period 1.1.–31.12.2023.

### Criteria applied by Fingrid

In preparing the Subject Matter, Fingrid applied Fingrid's Green Bonds Framework and Fingrid's own internal reporting principles (the "Criteria"). As a result, the Subject Matter information may not be suitable for another purpose.

### Fingrid's responsibilities

Fingrid's management is responsible for selecting the Criteria, and for presenting the Subject Matter in accordance with that Criteria, in all material

respects. This responsibility includes establishing and maintaining internal controls, maintaining adequate records and making estimates that are relevant to the preparation of the subject matter, such that it is free from material misstatement, whether due to fraud or error.

### Ernst & Young's responsibilities

Our responsibility is to express a conclusion on the presentation of the Subject Matter based on the evidence we have obtained.

We conducted our engagement in accordance with the International Standard for Assurance Engagements Other Than Audits or Reviews of Historical Financial Information ('ISAE 3000'), and the terms of reference for this engagement as agreed with Fingrid on 22.08.2022. Those standards require that we plan and perform our engagement to express a conclusion on whether we are aware of any material modifications that need to be made to the Subject Matter in order for it to be in ac-

cordance with the Criteria, and to issue a report. The nature, timing, and extent of the procedures selected depend on our judgment, including an assessment of the risk of material misstatement, whether due to fraud or error.

We believe that the evidence obtained is sufficient and appropriate to provide a basis for our limited assurance conclusions.

### Our Independence and Quality Control

We have maintained our independence and confirm that we have met the requirements of the Code of Ethics for Professional Accountants issued by the International Ethics Standards Board for Accountants and have the required competencies and experience to conduct this assurance engagement.

EY also applies International Standard on Quality Management 1, Quality Management for Firms that Perform Audits or Reviews of Financial State-



ments, or Other Assurance or Related Services engagements, which requires that we design, implement and operate a system of quality management including policies or procedures regarding compliance with ethical requirements, professional standards and applicable legal and regulatory requirements.

### **Description of procedures performed**

Procedures performed in a limited assurance engagement vary in nature and timing from, and are less in extent than for a reasonable assurance engagement. Consequently, the level of assurance obtained in a limited assurance engagement is substantially lower than the assurance that would have been obtained had a reasonable assurance engagement been performed. Our procedures were designed to obtain a limited level of assurance on which to base our conclusion and do not provide all the evidence that would be required to provide a reasonable level of assurance.

Although we considered the effectiveness of management's internal controls when determining the nature and extent of our procedures, our as-

surance engagement was not designed to provide assurance on internal controls. Our procedures did not include testing controls or performing procedures relating to checking aggregation or calculation of data within IT systems.

A limited assurance engagement consists of making enquiries, primarily of persons responsible for preparing the Subject Matter and related information and applying analytical and other appropriate procedures.

Our procedures:

- EY interviewed Fingrid's data collection specialists to understand the Subject Matter
- Fingrid's systems and reporting principles were checked against the Criteria
- EY ensured the accuracy of the data by making recalculations and data consolidations
- EY obtained list of funded projects confirmed the consistency with the Green Bonds Framework
- By sample basis EY tested the completeness and validity of the data from Fingrid's original sources

We also performed such other procedures as we considered necessary in the circumstances.

### **Conclusion**

Based on our procedures and the evidence obtained, we are not aware of any material modifications that should be made to the Subject Matter for the period 1.1.–31.12.2023, in order for it to be in accordance with the Criteria.

### **Ernst & Young Oy**

Authorized Public Accountant Firm

Mikko Rytilahti

Authorized Public Accountant

Nathalie Clément

Leader of Climate Change and Sustainability Services

## Annex 1.

# Projects financed under the EUR 100 million green bond

---



REDUCING  
LOSSES



CONNECTING  
RENEWABLE POWER



CROSS-BORDER  
TRANSMISSION





# Reconductoring of Isohaara-Raasakka 110 kV power line

## Connecting renewable power and reducing losses

- Single conductors were changed to thicker double conductors
- Transmission losses reduced >60%.
- Higher transmission capacity made it possible to connect extra 100 MW new wind power with minimum connection costs.
- No new right of way was needed so the negative environmental impact was negligible.
- Project also included new lightning conductors which resulted to much higher reliability: Less failures caused by lightning or snow adhesion to lightning conductors.



TOTAL ESTIMATED IMPACT

**+100 MW**



TRANSMISSION LOSSES

**-60%**

ACTUALIZED

**2014–2015**

ALLOCATED COSTS

**€1,5M**

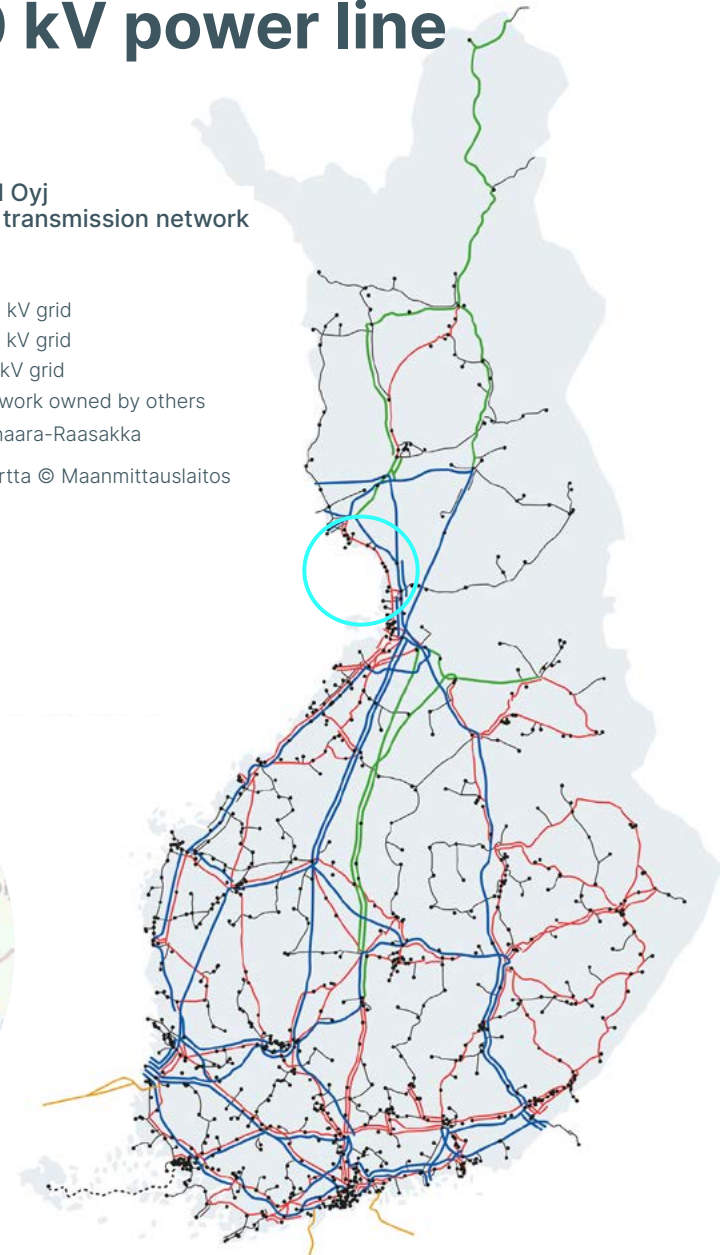


Fingrid Oyj  
power transmission network

1.1.2020

- 400 kV grid
- 220 kV grid
- 110 kV grid
- Network owned by others
- Isohaara-Raasakka

Pohjakartta © Maanmittauslaitos



# New 220 kV substation at Kuolajärvi

## Connecting renewable power

- Lapland is very sparsely populated (1,9 people/km<sup>2</sup>) and distance between existing grid connection points can be more than 100 km.
- Kuolajärvi substation was built in order to connect new wind power to Fingrid's 220 kV transmission line.
- Kuolavaara–Keulakkopää wind park consists of 17 turbines totaling 51 MW.

### Fingrid Oyj power transmission network

1.1.2020

- 400 kV grid
- 220 kV grid
- 110 kV grid
- Network owned by others
- Kuolajärvi



TOTAL ESTIMATED IMPACT

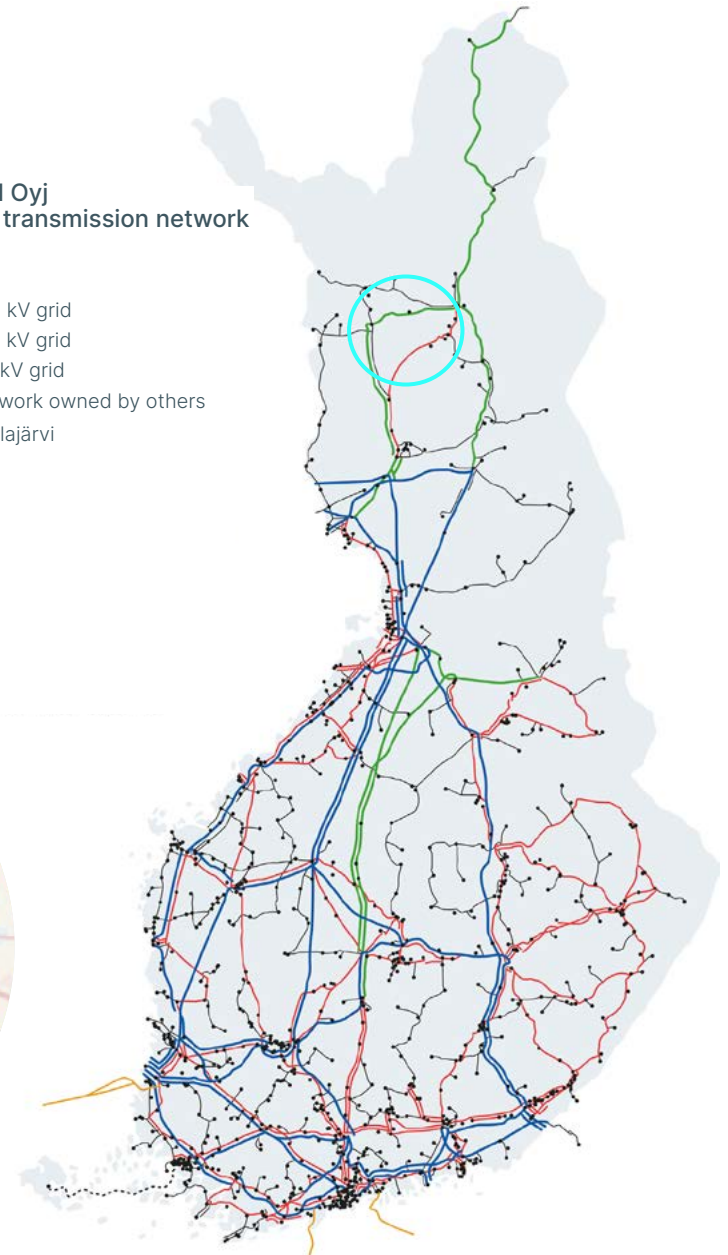
**+50 MW**

ACTUALIZED

**2014–2015**

ALLOCATED COSTS

**€5,0M**





# New 110 kV substation at Siikajoki

## Connecting renewable power

- Ostrobothnian coast is excellent for wind power.
- A new substation was built in order to offer a connection point for wind power.
- 350 MW of wind power has already been connected to the substation and many new projects for further 250 MW are expected in next few years. New connections to Siikajoki substation require also other main grid reinforcement investments.

### Fingrid Oyj power transmission network

1.1.2020

- 400 kV grid
- 220 kV grid
- 110 kV grid
- Network owned by others
- Siikajoki



TOTAL ESTIMATED IMPACT

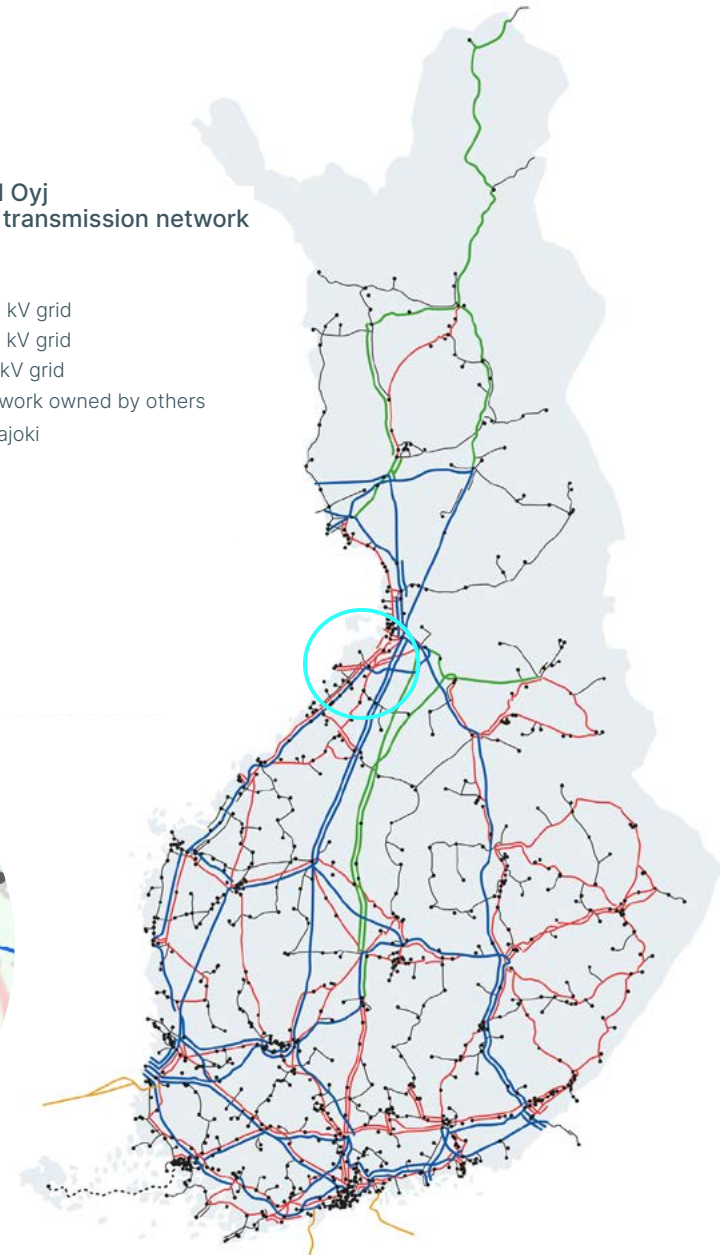
**+600 MW**

ACTUALIZED

**2015–2016**

ALLOCATED COSTS

**€4,4M**



# Refurbishment and expansion of Taivalkoski substation Connecting renewable power

## Connecting renewable power

- More than 130 MW of hydro power is connected to Taivalkoski Substation.
- An old substation was renewed for better reliability and higher transmission capacity.
- Substation was expanded and 200 MW new wind power was connected to the substation and more is expected in the future. New wind power connections require also other main grid reinforcement investments.

Fingrid Oyj  
power transmission network

1.1.2020

- 400 kV grid
- 220 kV grid
- 110 kV grid
- Network owned by others
- Taivalkoski



TOTAL ESTIMATED IMPACT

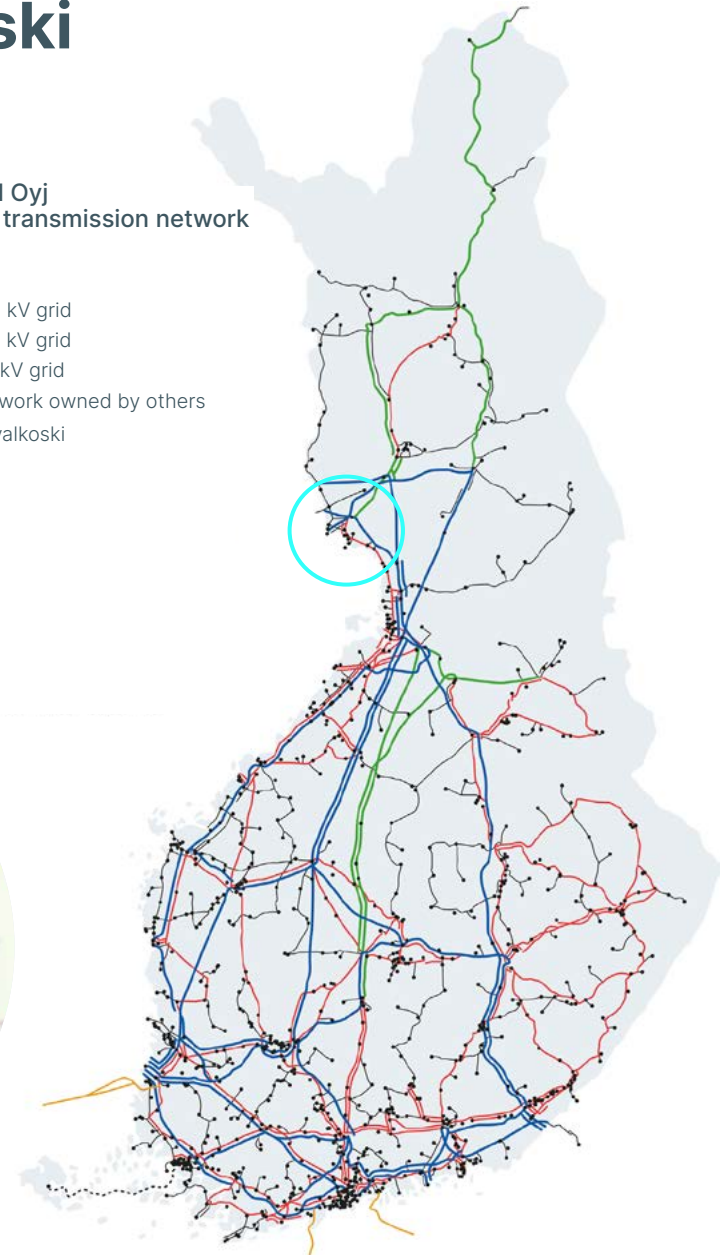
**+200 MW**

ACTUALIZED

**2015–2016**

ALLOCATED COSTS

**€5,0M**





# Expansion of Tuovila substation

## Connecting renewable power

- New 400 kV transmission connection was built on the western coast. Tuovila substation ties the power lines together and offers a strong connection point for new wind power
- Geographic distribution of power generation requires new transmission capacity from Northern to Southern Finland:
  - » Renewables are replacing fossil fuel power plants in Finland.
  - » Several power plants have been closed down in Southern Finland.
  - » More and more power is coming from wind parks in Northern Finland and from Sweden
- Ostrobothnian coast is excellent for wind power but the grid was too weak for new power generation:
  - » New 400 kV power line offers enough capacity and new connection point for wind power.

### Fingrid Oyj power transmission network

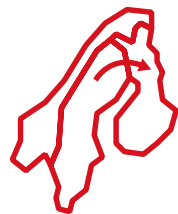
1.1.2020

- 400 kV grid
- 220 kV grid
- 110 kV grid
- Network owned by others
- Tuovila



TOTAL ESTIMATED IMPACT

**+300 MW**



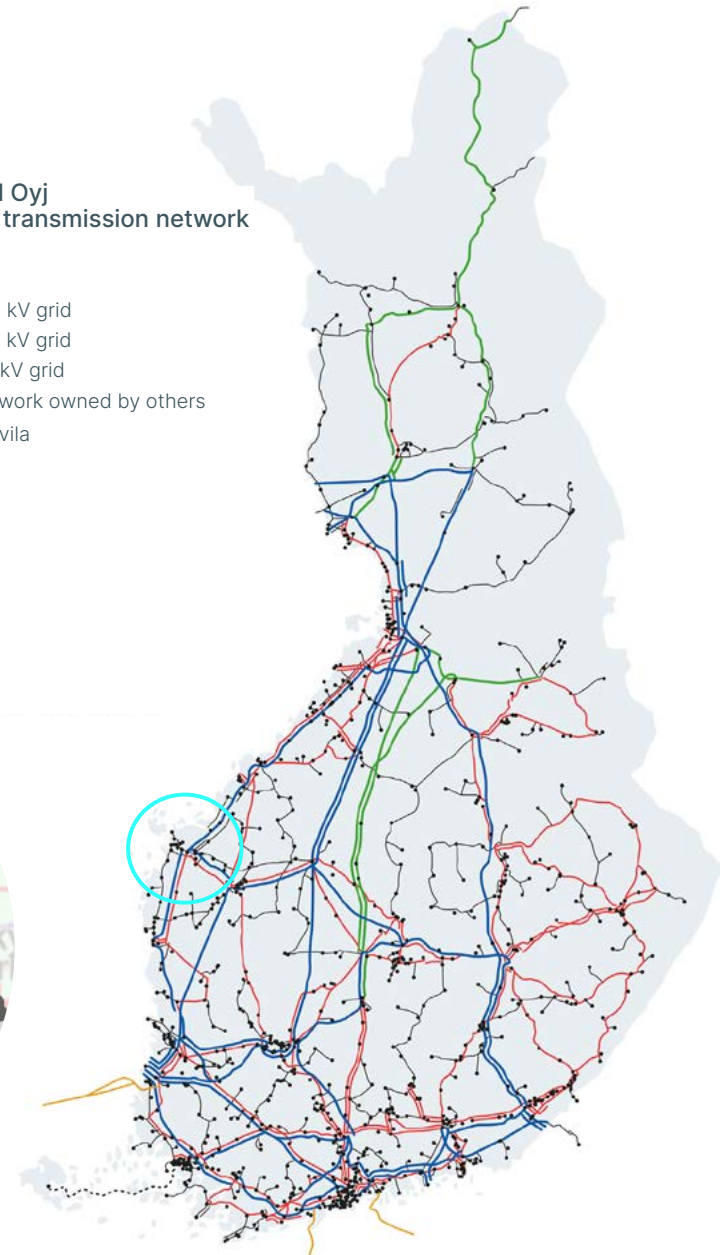
TRANSMISSION  
CAPACITY

COMMISSIONED

**2015–2016**

ALLOCATED COSTS

**€4,9M**



# Expansion of Pirttikoski substation and a new 400/220 kV transformer

## Connecting renewable power

- One third of Finnish hydro power is situated in Lapland. On top of 1000 MW of hydro there is also more than 300 MW of wind power and there are numerous wind power projects being built and planned.
- Power grid in Lapland is connected to rest of Finnish power system in Pirttikoski and Petäjäskoski 400/220 kV transformer substations.
- Transmission capacity and reliability in Pirttikoski were insufficient:
  - » A second transformer was added and 400 kV substation was expanded and modified to more reliable.
- New transformer capacity makes it possible to connect new wind power and eliminates the need to limit power in outage situations.



TOTAL ESTIMATED IMPACT

**+300 MW**

COMMISSIONED

**2014–2016**

ALLOCATED COSTS

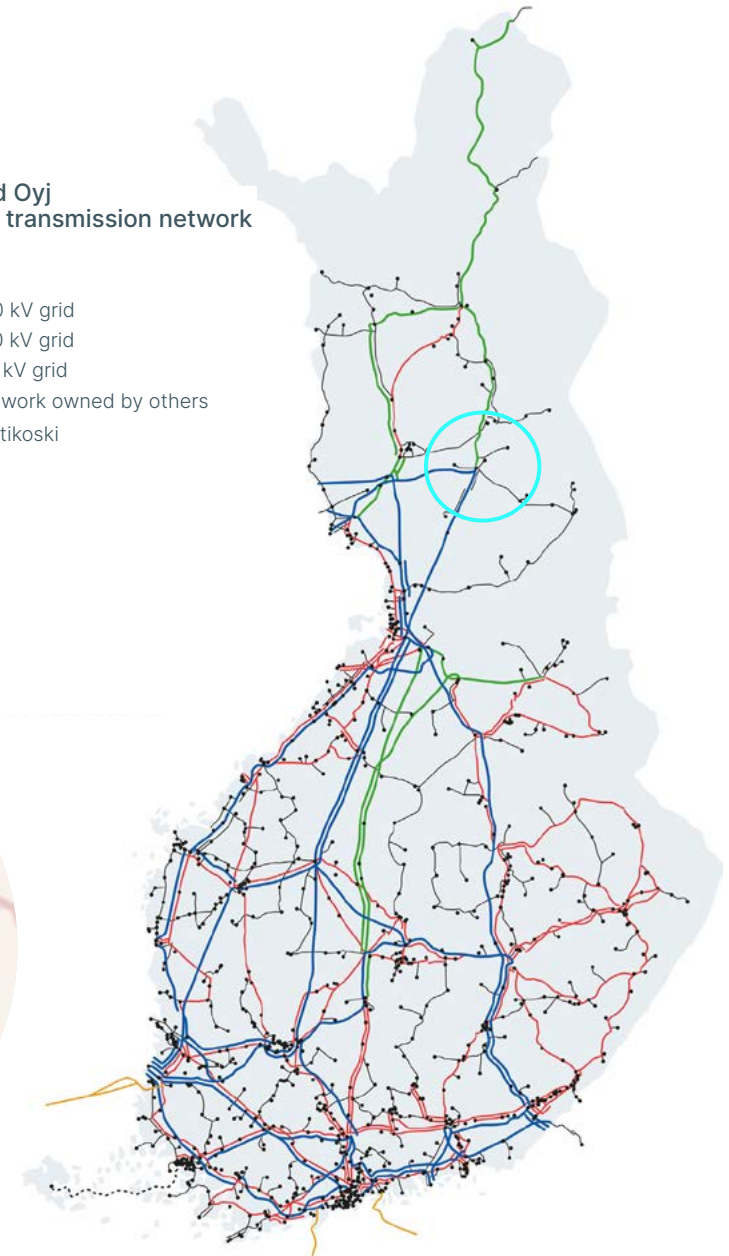
**€8,5M**



Fingrid Oyj  
power transmission network

1.1.2020

- 400 kV grid
- 220 kV grid
- 110 kV grid
- Network owned by others
- Pirttikoski

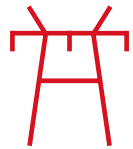




# New Hikiä-Forssa 400 kV transmission line

## Reducing losses

- Oldest 110 kV power line in Finland is being replaced with a new one.
- New power line was built on existing right of way. In Riihimäki city area a new route was used in order to free up land for city development.
- New power line has 95% lower transmission losses and more than 700% higher transmission capacity.
  - » New power line carries more and thicker conductors and losses sink when transmission voltage is upgraded to 400 kV.



TRANSMISSION LOSSES

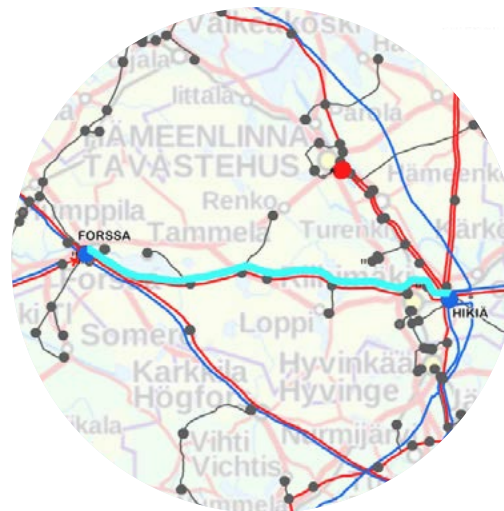
**-95%**

ACTUALIZED

**2013–2016**

ALLOCATED COSTS

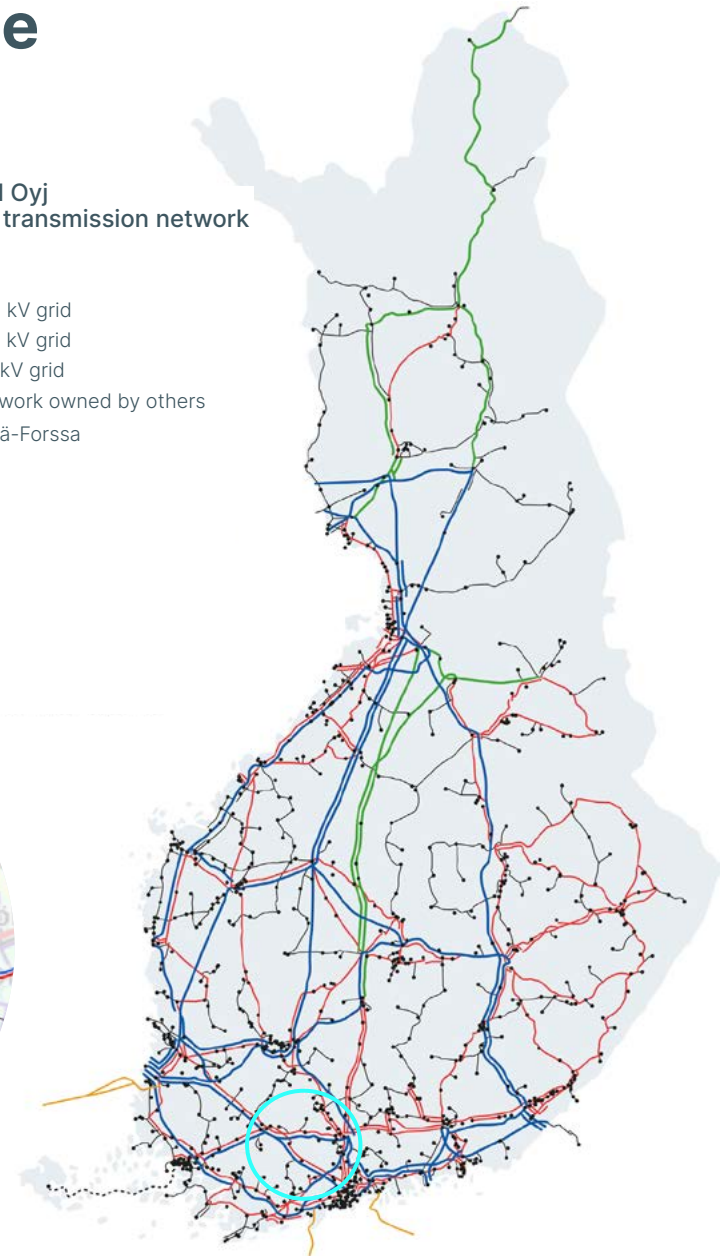
**€32,7M**



Fingrid Oyj  
power transmission network

1.1.2020

- 400 kV grid
- 220 kV grid
- 110 kV grid
- Network owned by others
- Hikiä-Forssa



# New 400/100 kV transformer substation Isokangas

## Connecting renewable power

- There are several hydro power plants in Iijoki river. Total power is 200 MW.
- New wind power is being built and planned in Iijoki region and SeaLapland coast.
- Transmission capacity had run out after several capacity increases in existing hydro power plant.
- A new 400/110 kV transformer station was built in order to increase reliability and transmission capacity for existing hydro power and make it possible to connect new wind power to the network.
- New transformer station also reduces losses by several megawatts.



TOTAL ESTIMATED IMPACT

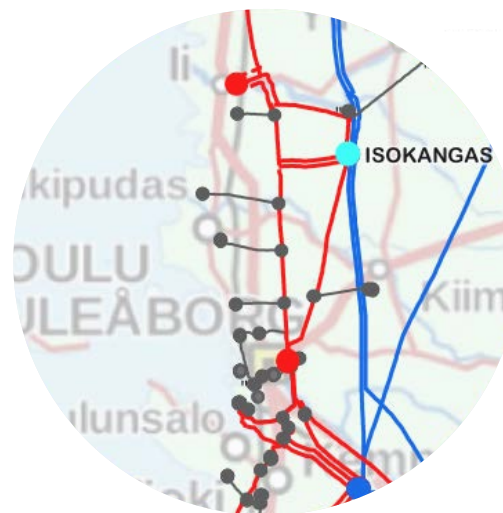
**+350 MW**

ACTUALIZED

**2015–2016**

ALLOCATED COSTS

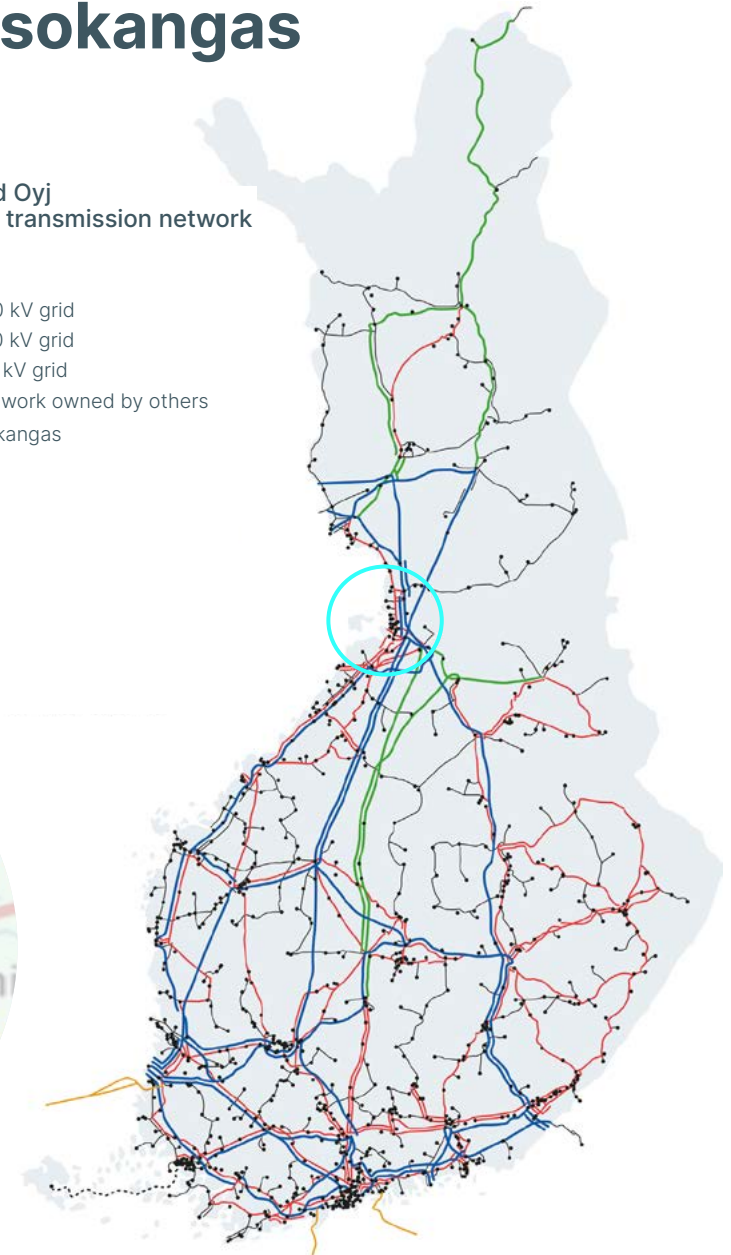
**€16,9M**



Fingrid Oyj  
power transmission network

1.1.2020

- 400 kV grid
- 220 kV grid
- 110 kV grid
- Network owned by others
- Isokangas





# New 400/110 kV transformer at Kristinestad substation

## Connecting renewable power

- Kristinestad substation was built in 2014 in the center of one of the best wind power areas in Finland:
  - » Kristinestad substation replaced an old substation that was situated 6 km from the new substation next to oil and coal fired condensing power plants. These power plants have now been demolished.
- A second 400/110 kV transformer was added to Kristinestad in 2017.
- Connection capacity for wind power increased 300 MW totaling 500–600 MW:
  - » The transformer also made it possible to change the use of surrounding 110 kV network. New wind power can now be connected to grid without the need of building new power lines.

### Fingrid Oyj power transmission network

1.1.2020

- 400 kV grid
- 220 kV grid
- 110 kV grid
- Network owned by others
- Kristinestad



TOTAL ESTIMATED IMPACT

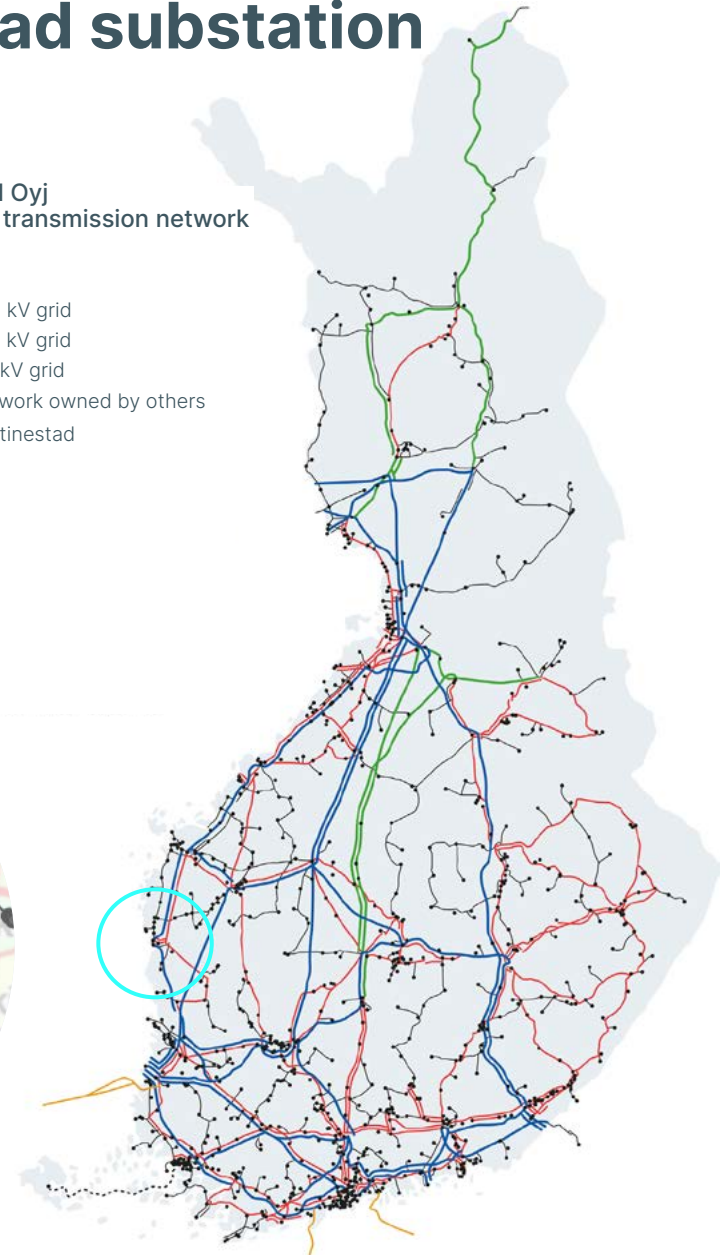
**+500 MW**

ACTUALIZED

**2016–2017**

ALLOCATED COSTS

**€8,0M**



# New Hikiä-Orimattila 400 kV transmission line

## Reducing losses

- Oldest 110 kV power line in Finland was replaced with a new one.
- New power line has 80% lower transmission losses and almost 500% higher transmission capacity:
  - » Power line structure makes it possible to upgrade voltage from 110 to 400 kV → Even higher capacity and lower losses.
- The new transmission line will provide (replacement) transmission capacity to a region where a coal fired combined heat and power plant is being closed and replaced with bio district heating plant, which has no electricity production.



TRANSMISSION LOSSES

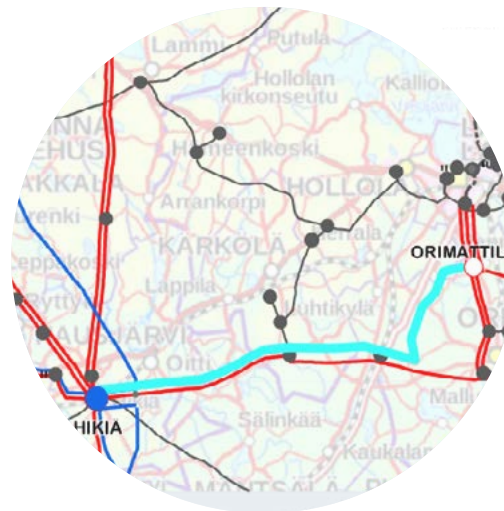
**-80%**

ACTUALIZED

**2017–2019**

ALLOCATED COSTS

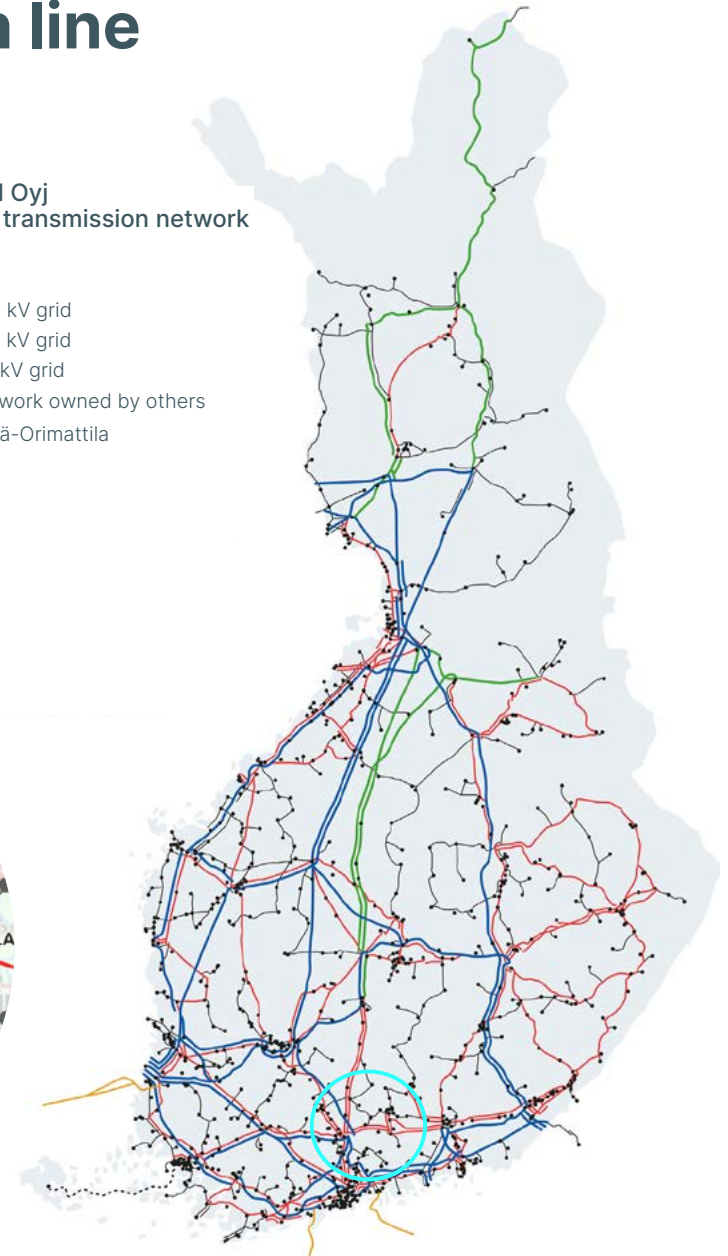
**€11,2M**



Fingrid Oyj  
power transmission network

1.1.2020

- 400 kV grid
- 220 kV grid
- 110 kV grid
- Network owned by others
- Hikiä-Orimattila





# New Lempiälä–Vuoksi 400 kV transmission line

## Reducing losses

- Old 110 kV wooden power line was replaced by a new structure on existing right of way.
- New power line is built with 400 kV towers and conductors but is used in 110 kV voltage level.
- New power line has **80% lower transmission losses** and more than **400% higher transmission capacity**
- New power line can be taken into 400 kV use later if more transmission capacity is needed. This upgrade would lower the losses yet another 90% (total drop almost 99%).



TRANSMISSION LOSSES

**-80%**

ACTUALIZED

**2018–2019**

ALLOCATED COSTS

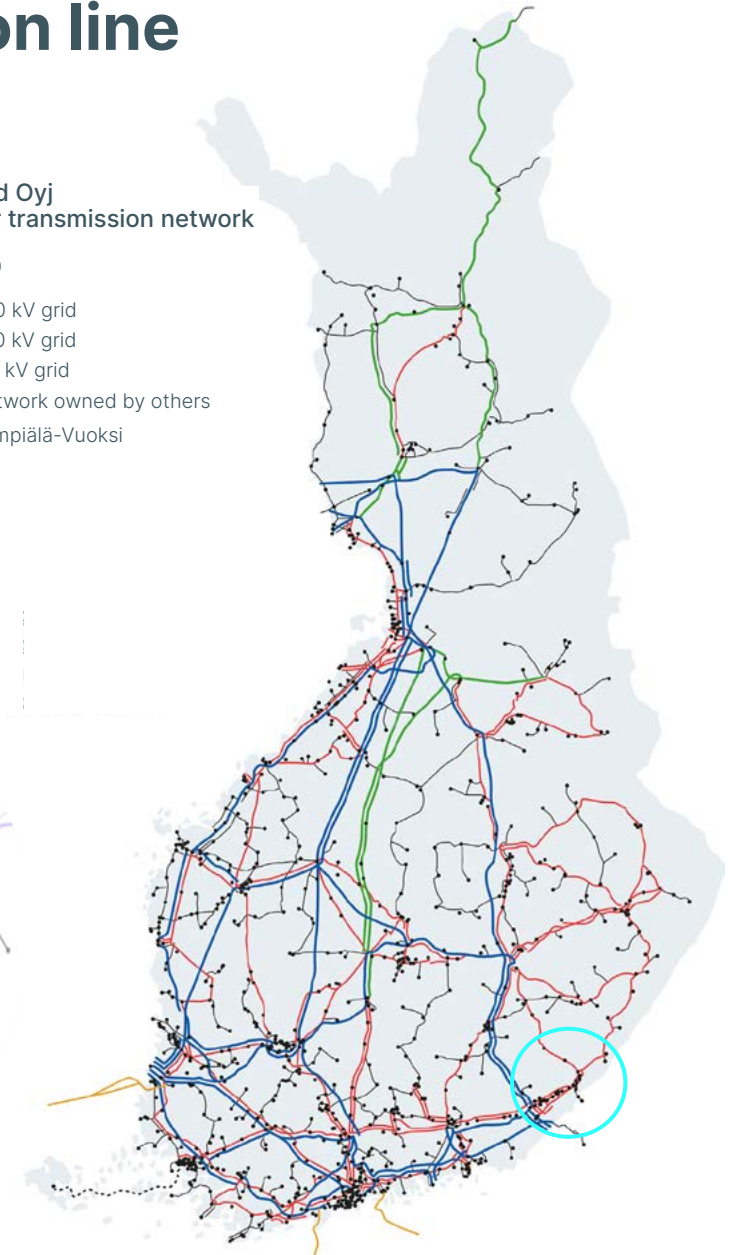
**€2,0M**



Fingrid Oyj  
power transmission network

1.1.2020

- 400 kV grid
- 220 kV grid
- 110 kV grid
- Network owned by others
- Lempiälä–Vuoksi





An aerial photograph showing a multi-lane highway winding through a vast, dense forest. In the foreground, several high-voltage power lines with lattice towers stretch across the frame. The sun is low in the sky, creating a bright glow and long shadows across the landscape. The forest is a mix of green and yellow, suggesting early autumn. In the distance, a body of water is visible on the horizon.

# FINGRID

**Fingrid Oyj**  
Läkkisepäntie 21  
FI-00620 Helsinki  
P.O.Box 530  
FI-00101 Helsinki, Finland  
Tel. +358 30 395 5000  
Fax. +358 30 395 5196