

# Green Bond Investor Letter and Impact Report

**FINGRID**

February 2020



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# Green Bond Investor Letter and Impact Report

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*“Fingrid’s mission is to secure reliable electricity for our customers and the society. We shape the clean, market oriented power system of the future. As also sustainability is one of our core corporate values, it is natural for us to participate in the green bond market to finance our long term investments which have positive environmental effects”, says Jan Montell, CFO, Senior Vice President.*

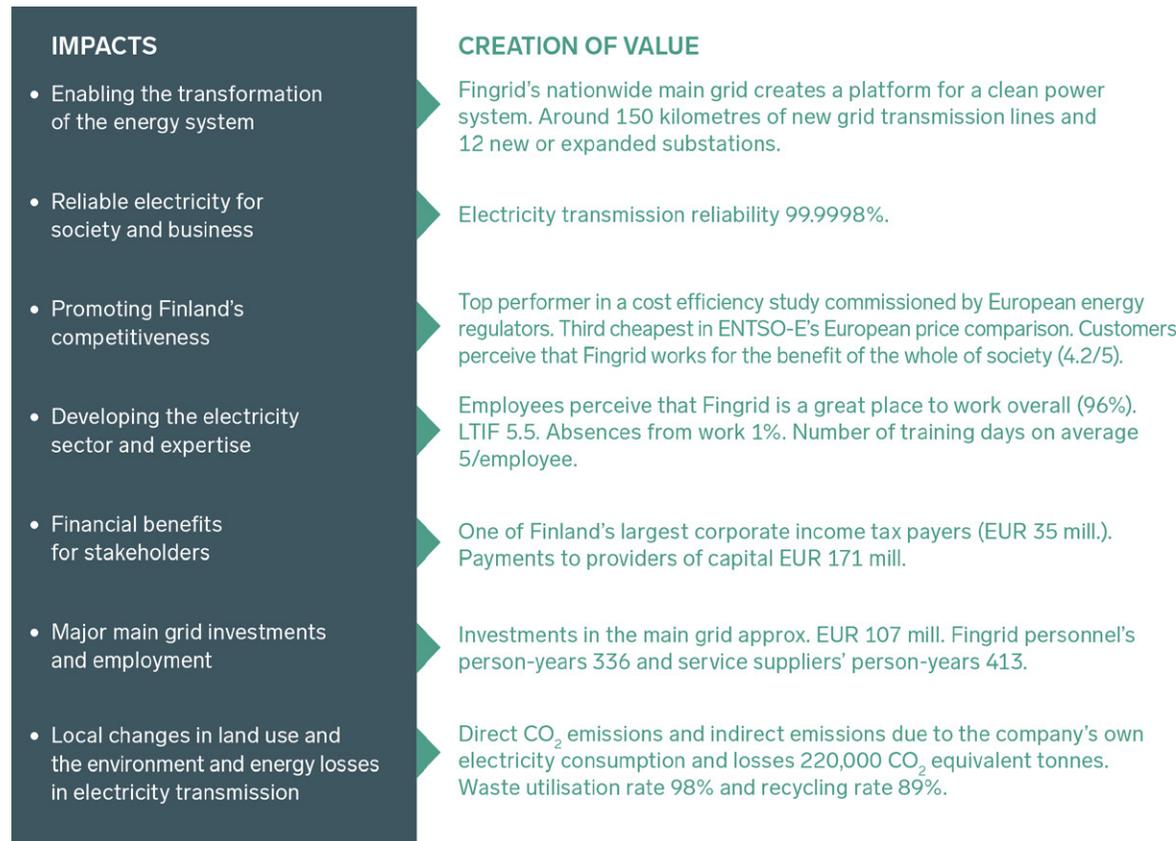


# Fingrid's business has significant positive impacts on society and the climate

The starting point for Fingrid's responsibility and sustainability work is our strategy where responsibility 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.

## Value created by Fingrid 2019



To ensure transparency and comparability, our reporting has complied with the international Global Reporting Initiative (GRI) framework since 2011. Fingrid's corporate responsibility reporting for 2019 was verified by a third party. Fingrid is also committed to the UN Global Compact initiative's principles on human rights, labour, the environment and anti-corruption, and the annual report stands for a Communication on Progress (COP) report. Corporate sustainability is further commented in our Annual Report.

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.

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

We maintain and develop an important electricity transmission infrastructure for the needs of customers and society. The extensive investments of our main grid development programme provide several hundred person-years of employment for

our 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 production structure of electricity resulting from the fight against climate change will cause changes in the electricity system. We enable the integration of new energy production into the main grid. We will also ensure the adequacy of system reserves in the future and prepare for a reduction in flexible production capacity while developing the electricity market for the needs of a carbon-neutral electricity system. We minimise the energy losses, which have a negative impact on the climate, in our electricity transmission.

Fingrid's Green Bond eligible investments pro-

mote above listed SGDs in practice when e.g. renewable power generation is connected to our substations and/or power transmission losses are reduced following a transmission line upgrade.

### **CO2 impacts now reported**

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

This is the first year Fingrid reports the estimated indirect impact of CO2-equivalent (CO2-eqv) avoided thanks to the Green Bond investments. The estimated indirect impacts of Fingrid's investments have been verified by an independent external party (Mitopro Oy) and their statement is included to this report on page 14.



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

Fingrid's 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 <https://www.fingrid.fi/en/pages/investors/financing/green-financing/> Green bonds are issued under the company's Euro Medium Term Note programme and are listed on the London Stock Exchange and the Irish Stock Exchange (Euronext Dublin) as the company's other bonds.



## Investments financed with Green Bonds

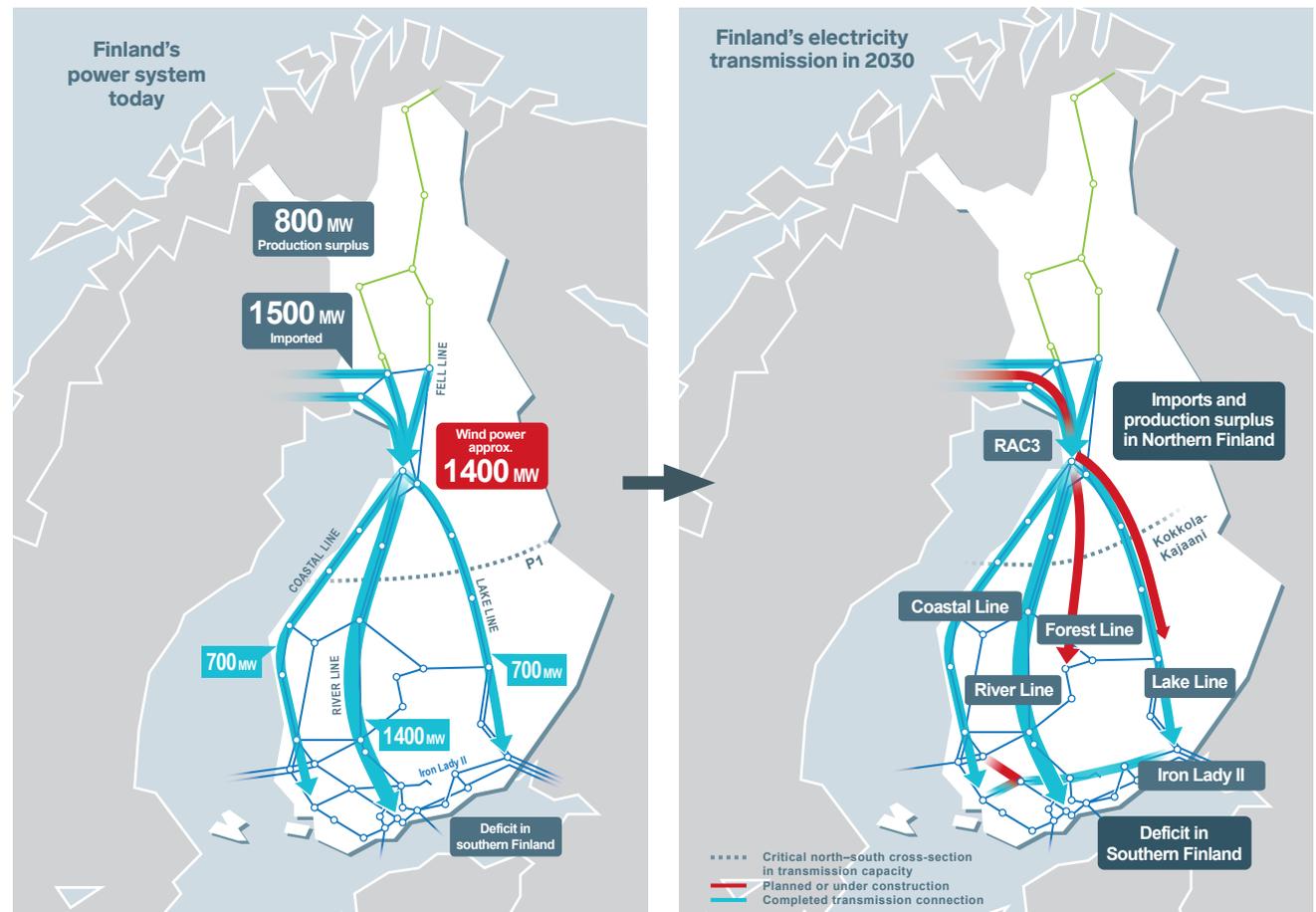
Under the Green Bonds Framework the company can finance investments which connect renewable energy, increase cross-border capacity, reduce electricity transmission losses and/or improve energy efficiency via smart grids.

These investments are facilitated by market developments in recent years as condensing power plants and even 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 last decade, and capacity growth of new on-shore wind power generation is expected to continue strong in the forthcoming years. In forthcoming years wind power is estimated to reach 6000-7000 MW by the end of 2024.

Regarding green bond eligible investments, Fingrid has invested heavily in order 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.



## 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 transaction raised broad international interest and expanded the company's debt investor base. The bond accounts for approximately 9 per cent of the company's total debt. 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.

Fingrid was awarded a certificate in recognition of creating the First Corporate Green Bond in Finland in May 2018 by the Climate Bonds Initiative. The Awards are in recognition of organisations, financial institutions and government bodies and individuals who have led the development of green finance and green bond markets in the past year and through their pioneering initiatives and issuance have provided positive examples of climate resilient and low carbon investment.



# Projects financed with the Green Bond proceeds

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. During 2019 the Committee approved no new projects. The pool of approved eligible projects will be reviewed during 2020 for new projects potentially to be financed with Green Bonds.

*“Eligible projects are expected to have long-term net positive environmental impacts.”*

## Estimated costs of eligible approved projects totalled EUR 154 million

Project	2013	2014	2015	2016	2017	2018	2019	2020	2021
Expansion of Keminmaa substation			2						
Reconductoring of Isohaara-Raassakka 110 kV transmission line		1	1						
New 220 kV substation Kuolajärvi		1	3	1					
New 110 kV substation Siikajoki			3	1					
Refurbishment and expansion of Taivalkoski substation			1	4					
Expansion of Tuovila substation		1	2	1					
Expansion of Pirttikoski substation and a new 400/220 kV transformer		1	6	1					
New Hikiä-Forssa 400 kV transmission line	3	11	14	5					
Renewal of Petäjäsoski 220 kV substation and a new 400/220 kV transformer		3	7	6	1				
New 400/110 kV transformer substation Isokangas			3	13	1				
New 400/110 kV transformer at Kristinestad substation				6	1				
New Vihtavuori-Koivisto 110 kV transmission line					3				
New 220/110 kV transformer at Seitenoikea substation				1	2				
New Lieto-Forssa 400 kV transmission line			2	10	10	1			
New Lempiälä-Vuoksi 400 kV transmission line					1	5	2		
New Hikiä-Orimattila 400 kV transmission line					3	10	9	1	
<b>Totals</b>									
Refinance MEUR 64	3	15	33	14					
New projects MEUR 90		3	12	37	21	16			
<b>Total MEUR 154</b>	<b>3</b>	<b>18</b>	<b>45</b>	<b>50</b>	<b>22</b>	<b>16</b>			

## Allocation of green bond proceeds to approved eligible projects

Project		2013	2014	2015	2016	2017	2018	2019	2020	2021
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 Hikiä-Forssa 400 kV transmission line	4	9	16	4					
New projects	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>5</b>	<b>13</b>	<b>35</b>	<b>31</b>	<b>4</b>	<b>11</b>			

*“All of the EUR 100 million of proceeds have been allocated to approved eligible project costs at the end of 2018.”*



*Siperian Jay lives in coniferous and mixed forest in most parts of Finland. Often accepts food handouts from humans and can be quite tame.*

The projects completed in 2015–2016 and with a cost of EUR 62 million in total were fully refinanced with the green bond proceeds. The new projects completed in 2017 were also fully financed with EUR 27 million of green bond proceeds. The remaining EUR 11 million was placed into company's liquidity reserves and was allocated to costs incurred during in 2018 arising from Hikiä-Orimattila (EUR 9 million) and Lempiälä-Vuoksi (EUR 2 million) transmission line projects. Green bond financing accounted for an estimated 60% for Hikiä-Orimattila's and 40% of Lempiälä- Vuoksi's total project costs of estimated EUR 18 million and EUR 7.5 million in total. Hikiä-Orimattila transmission line investment project was completed in December 2019 and Lempiälä-Vuoksi project in September 2019 – both in budget and well in schedule.

***“Green Bond proceeds were allocated across eleven eligible projects.”***

## 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 line is going to be 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 losses
New Lempiälä - Vuoksi 400 kv transmission line	Old 110 kV line is going to be replaced by 400 kV power line resulting in significant drop in losses

## A summary of the estimated impacts to be achieved from the funded projects

Project	New renewable capacity**			Transmission losses reduced
	12/2019	Estimated in next years***	Total estimated impact	12/2019
<b>Applicable SGDs to all projects</b>   				
Reconductoring of Isohaara-Raassakka 110 kV transmission line	+ 100 MW	n/a	+ 100 MW	approx. 60%
New 220 kV substation Kuolajärvi	+ 50 MW	n/a	+ 50 MW	n/a
New 110 kV substation Siikajoki	+ 200 MW	+ 250 MW	+ 450 MW	n/a
Refurbishment and expansion of Taivalkoski substation	+ 100 MW	+ 100 MW	+ 200 MW	n/a
Expansion of Tuovila substation	+ 50 MW	+ 150 MW	+ 200 MW	n/a
Expansion of Pirttikoski substation and a new 400/220 kV transformer	+ 100 MW	n/a	+ 100 MW	n/a
New Hikiä-Forssa 400 kV transmission line	n/a	n/a	n/a	approx. 95%
New 400/110 kV transformer substation Isokangas	+ 50 MW	+ 250 MW	+ 300 MW	n/a
New 400/110 kV transformer at Kristinestad substation	+ 150 MW	+ 250 MW	+ 400 MW	n/a
New Hikiä-Orimattila 400 kV transmission line	n/a	n/a	n/a	approx. 80%
New Lempiälä-Vuoksi 400 kV transmission line	n/a	n/a	n/a	approx. 80%
<b>Total by these investments****</b>	<b>+ 750 MW</b>	<b>+ 1 000 MW</b>	<b>+ 1750 MW</b>	<b>n/a</b>
<b>Total estimated tCO<sub>2</sub> eqv avoided p.a.</b>	<b>330 000</b>	<b>540 000</b>	<b>870 000</b>	<b>n/a</b>

\* Approximations

\*\* Directly connected or through enhanced transmission capacity by these investments

\*\*\* Estimated upon completion 2022 in addition to impacts estimated until 12/2019

\*\*\*\* Reported capacity in 12/2019 is now presented more accurately than previous years i.e. 750 MW is the sum of accurate capacity figures instead (of the sum) of rounded figures presented previously. Another change is more accurate calculation of the impact of Kuolajärvi and Pirttikoski substations, which both were initially needed to connect windpower in their catchment area. Previously the capacity was reported to both investments in full, but is now split between these two in order to calculate achieved impact more accurately

*“Estimated impact from Green Bond projects include around 750 MW of new renewable capacity\*\* by end of 2019”*

The estimated indirect tCO<sub>2</sub> eqv avoided p.a. for 2019 in the table above has been calculated as follows: total realized annual electricity generation of approximately 2 TWh from wind farms enabled by the green bond investments in 2019 multiplied by CO<sub>2</sub> baseline of 158kg CO<sub>2</sub>/MWh, which is the five year moving average CO<sub>2</sub> baseline for electricity generation in Finland in 2019 published by Motiva, (<https://www.motiva.fi/en/motiva>).

The estimated tCO<sub>2</sub> in next three years p.a. is calculated as follows: tCO<sub>2</sub> avoided in 2019 plus estimated new renewable electricity generation capacity enabled by the green bond investments by 2022 multiplied by an estimated annual generation in MWh per annum per installed MW multiplied by CO<sub>2</sub> baseline of 158kg CO<sub>2</sub>/MWh. Estimated annual generation in MWh per annum per installed MW of around 3400 MWh p.a. is based on a weighted average of annual production of recently commissioned new wind farms in Finland per MW. The CO<sub>2</sub> baseline applied is the same, which is used for Fingrid’ corporate sustainability reporting.

# Health, Safety and Environment

When building and maintaining the main grid, we take landowners and other stakeholders into account, and we reduce environmental impacts at all stages of the grid's life cycle in accordance with Fingrid's land-use and environmental policy.

Key aspects include a thorough environmental impact assessment (EIA) and preparedness for environmental risks. The Finnish Association for Impact Assessment (FAIA) has twice rewarded Fingrid's environmental impact assessment work with its EIA award; the award annually rewards assessments that have significantly developed the assessment procedure.

We commit our contractors and suppliers to operating practices with the help of contractual terms, training and auditing. Fingrid's Supplier Code of Conduct covers issues such as business practices, human rights, labour rights, occupational safety and the environment. It is applied to procurements worth at least EUR 30,000 and they are linked to material, equipment, ICT etc. purchase agreements. Fulfilment of the requirements is monitored on a risk basis. Acknowledgement of the Code is a condition for being included in supplier registers used in recurring substation and power line procurements. In addition, contractual partners

are subject to separate contract conditions related to the use of subcontractors and workforce, and to occupational safety and environmental matters.

In 2019, we verified compliance with sustainability requirements through dozens of risk-based audits. Following a competitive tendering process, expert, outsourced workforce, including from abroad, were employed on the grid's work and maintenance sites in various parts of Finland. Nine work sites, including Lempiälä–Vuoksi, were audited to verify compliance with contractor obligations, occupational safety and environmental management. Special attention was paid to risk assessments, safety plans for specific work phases and the use of chemical safety data sheets already during induction. In addition, key foreign subcontractors were audited by a third party, focusing especially on employment matters and wages. In international goods sourcing, third-party supplier audits were carried out at 20 production plants in a total of nine countries, and three follow-up audits were carried out in order to rectify any observed deficiencies. The audits covered both Fingrid's direct contractual partners and their suppliers, including key material suppliers in projects Hikiä-Orimattila and Lempiälä-Vuoksi.



*Fingrid has audited work sites through a risk-based approach to verify compliance with contractor obligations, occupational safety and environmental management.*

# Independent Limited Assurance Report

## To the Management of Fingrid Oyj

### Scope and Objectives

The Management of Fingrid Oyj (“Fingrid”) commissioned us to perform a limited third-party assurance engagement over Selected Information presented in the Fingrid Green Bond Investor Letter and Impact Report (“the Report”) for the period of 1st January to 31st December 2019. The assurance engagement was conducted in accordance with the International Standard on Assurance Engagements (ISAE) 3000 revised – ‘Assurance Engagements other than Audits and Reviews of Historical Financial Information’

### Selected Information

The scope and boundary of our work is restricted to the assurance over the avoided greenhouse gas emissions in tonnes of carbon dioxide equivalents, tCO<sub>2</sub>-eqv (“Selected information”) from the Green Bond projects described in page 12 of the Report.

### Responsibilities

Fingrid is responsible for the collection, calculation, and presentation of the Selected information according to the reporting criteria. The Manage-

ment of Fingrid has approved the Selected information disclosed in the Report. Our responsibility as assurance providers is to express an independent conclusion on the Selected information subject to the limited assurance engagement. To assess the Selected information, which includes an assessment of the risk of material misstatement in the Report, we have used Fingrid’s Green Bond Framework and internal impact reporting instructions for estimating the avoidance of greenhouse gas emissions from the Green Bond projects (“the Criteria”).

### Assurance Provider’s Independence and Competence

We have conducted our assessment as independent and impartial from the reporting organisation. We were not committed to any assignments for Fingrid that would conflict with our independence, nor were we involved in the preparation of the Report. Our team consists of competent and experienced sustainability reporting experts, who have the necessary skills to perform an assurance process.

### Basis of Our Opinion

Assurance providers are obliged to plan and perform the assurance process so as to ensure that they collect adequate evidence for the necessary conclusions to be drawn. The procedures selected depend on the assurance provider’s judgement, including their assessment of the risk of material misstatement adhering to the Reporting criteria.

Our opinion is based on the following procedures performed:

- Interviews with Fingrid’s specialists responsible for data collection and reporting of the Selected information.
- Review of systems, internal reporting instructions and procedures to generate, collect and report the Selected information for the Report.
- Assessment of calculations and data consolidation procedures and internal controls to ensure the accuracy of the Selected information.
- Testing the accuracy and completeness of the Selected information from original documents and systems on a sample basis.

### Conclusion

Based on the work described in this report, nothing has come to our attention that causes us to believe that the Selected information disclosed in the Report has not been prepared, in all material respects, in accordance with the Criteria.

Helsinki, Finland, 31st January 2020

Mitopro Oy

Mikael Niskala  
Independent Sustainability Expert

Tomi Pajunen  
Independent Sustainability Expert

## Annex 1.

# Projects financed under the EUR 100 million green bond

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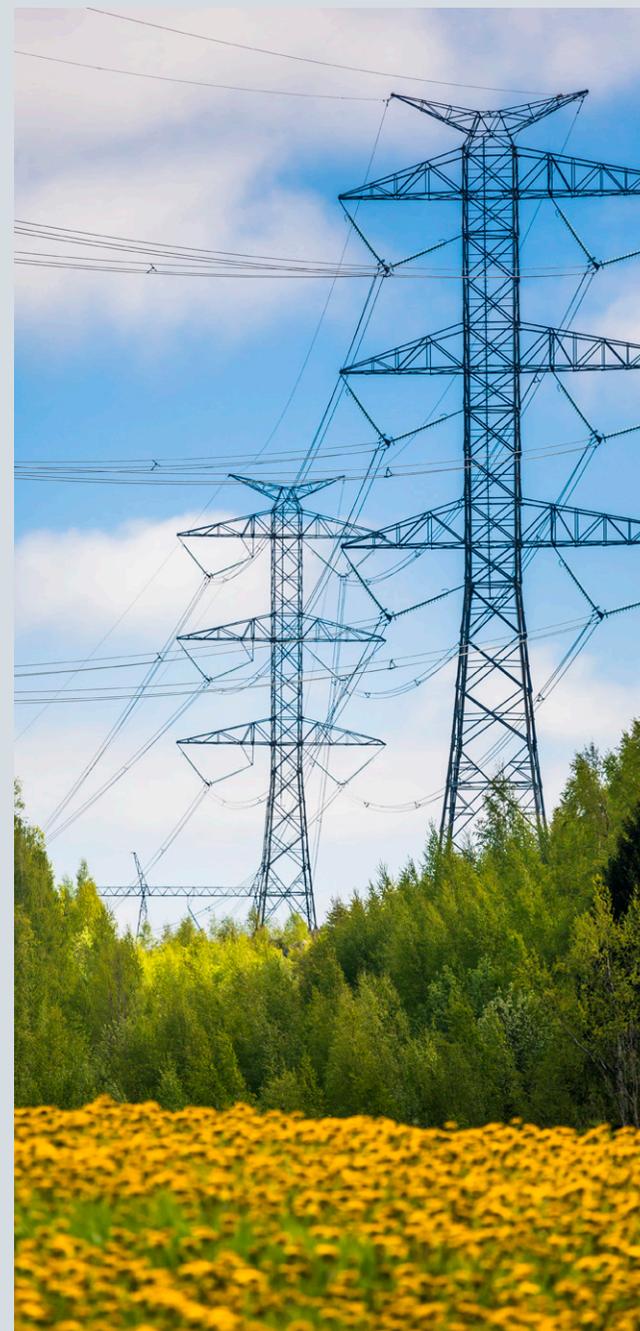
REDUCING LOSSES



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**

ALLOCATED COSTS

**1,5 M€**



TRANSMISSION LOSSES

**-60%**

ACTUALIZED

**2014–2015**

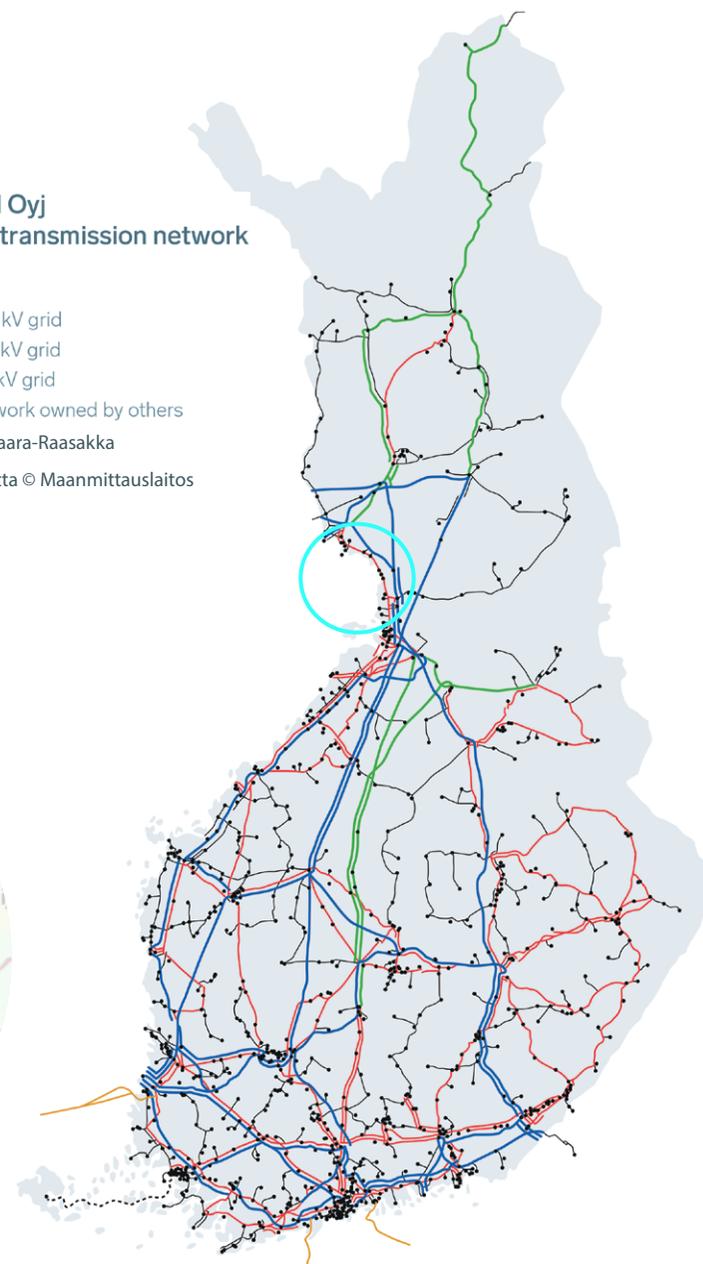


Fingrid Oyj  
power transmission network

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**

ALLOCATED COSTS

**5,0 M€**

ACTUALIZED

**2014–2015**

# 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.
- 200 MW of wind power has already been connected to the substation and many new projects are expected in next few years.



TOTAL ESTIMATED IMPACT

**+450 MW**

ALLOCATED COSTS

**4,4 M€**

ACTUALIZED

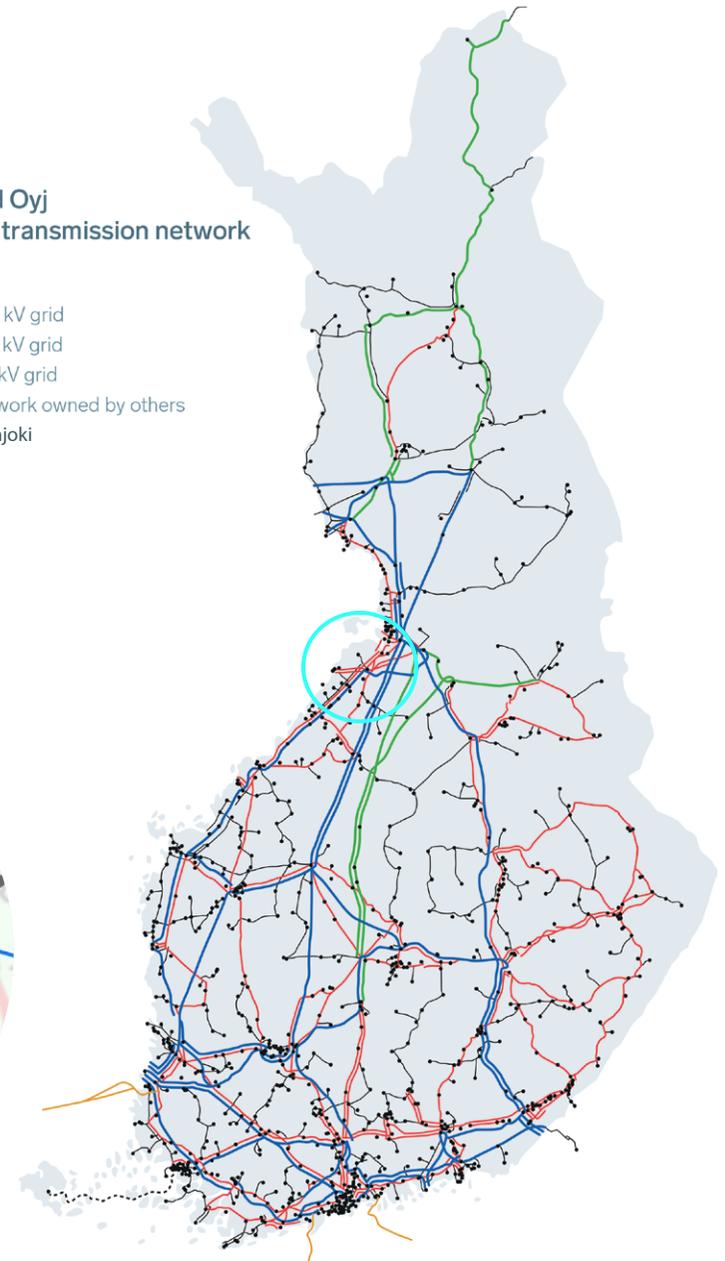
**2015–2016**



### Fingrid Oyj power transmission network

1.1.2020

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



# Refurbishment and expansion of Taivalkoski substation

## 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 100 MW new wind power was connected to the substation and more is expected in next few years.



TOTAL ESTIMATED IMPACT

**+200 MW**

ALLOCATED COSTS

**5,0 M€**

ACTUALIZED

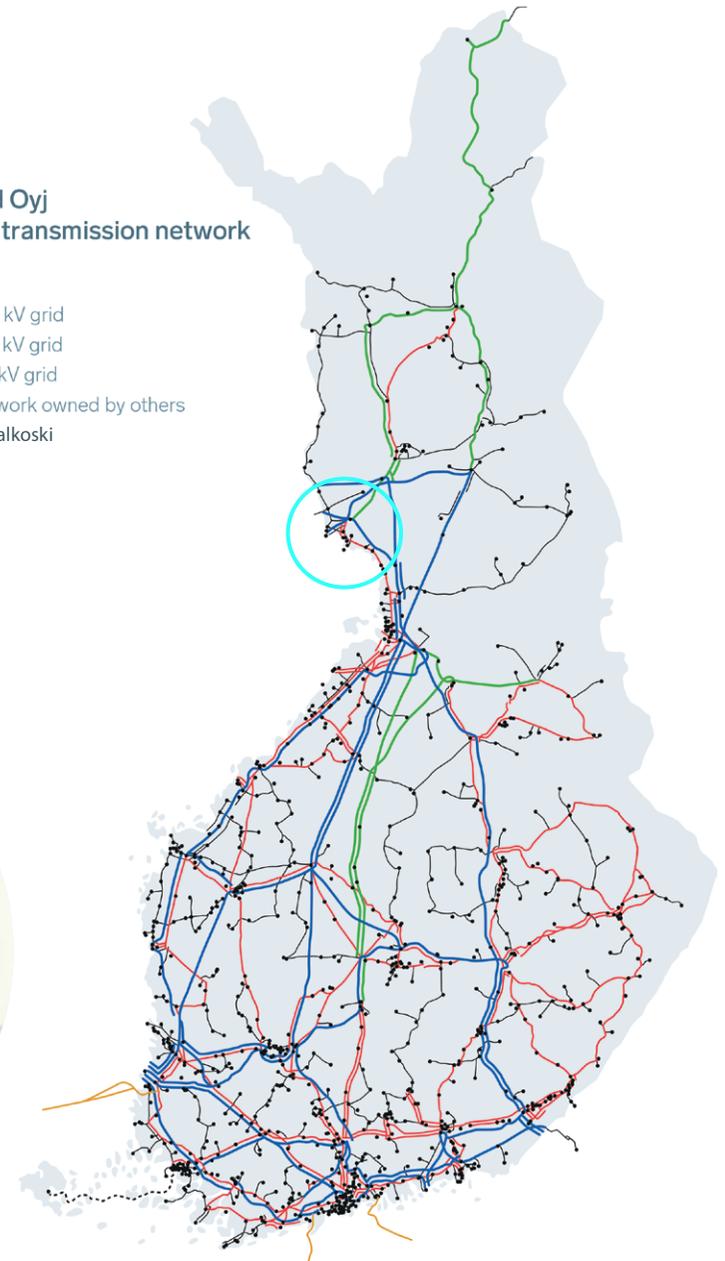
**2015–2016**



Fingrid Oyj power transmission network

1.1.2020

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



# Expansion of Tuovila substation

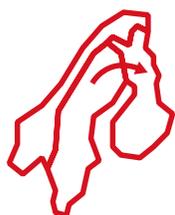
## Connecting renewable power

- 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

**+200 MW**

TRANSMISSION CAPACITY

ALLOCATED COSTS

**4,9 M€**

ACTUALIZED

**2015–2016**

# 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 100 MW of wind power and there are numerous wind power projects being 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

**+100 MW**

ALLOCATED COSTS

**8,5 M€**

ACTUALIZED

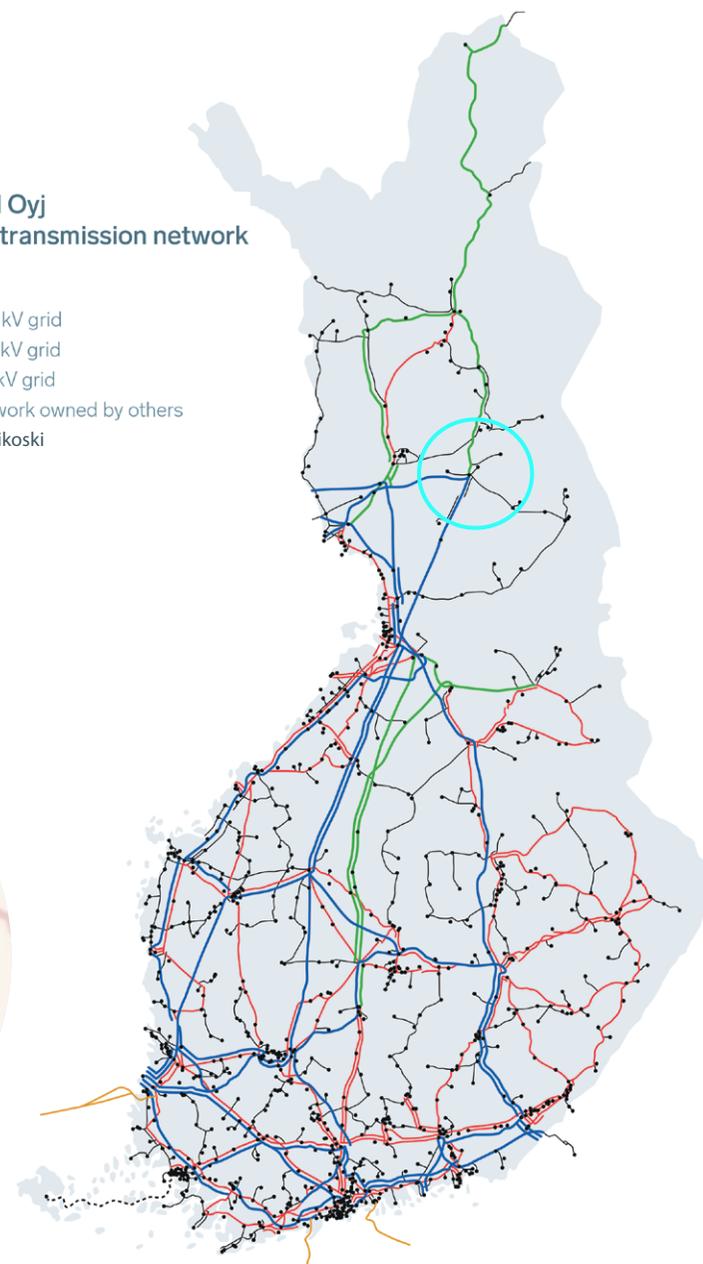
**2014–2016**



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.



ACTUALIZED

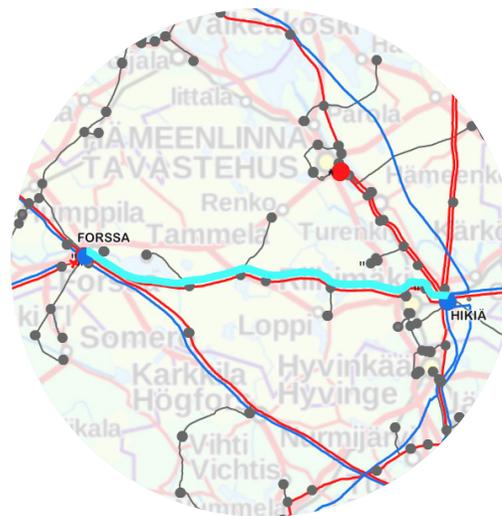
**2013–2016**

ALLOCATED COSTS

**32,7 M€**

TRANSMISSION LOSSES

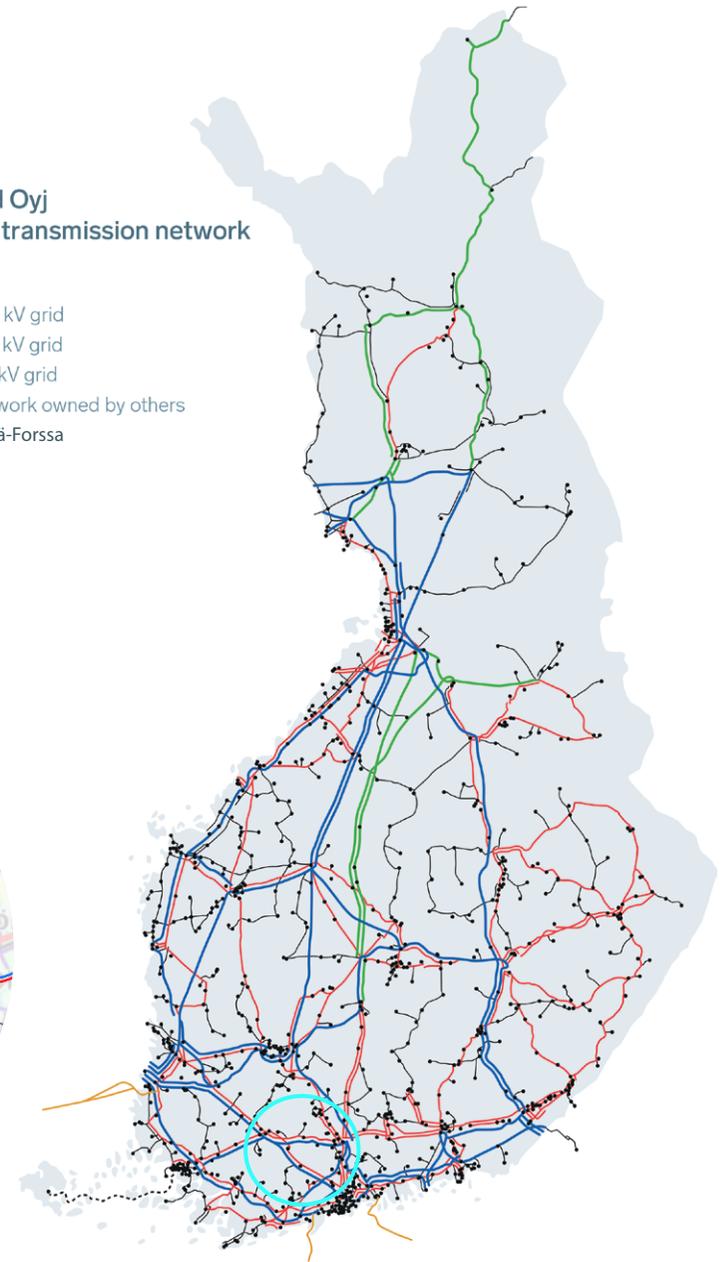
**-95%**



### 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

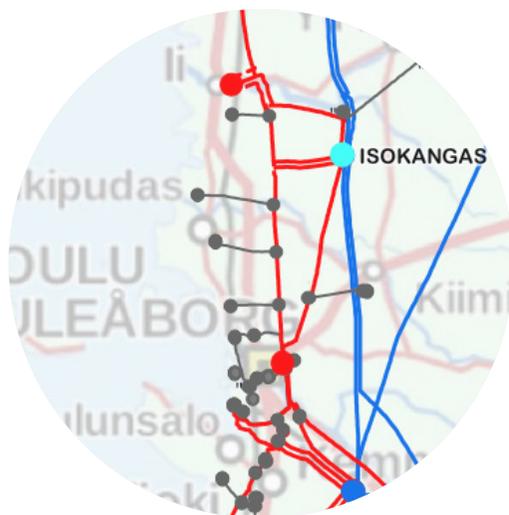
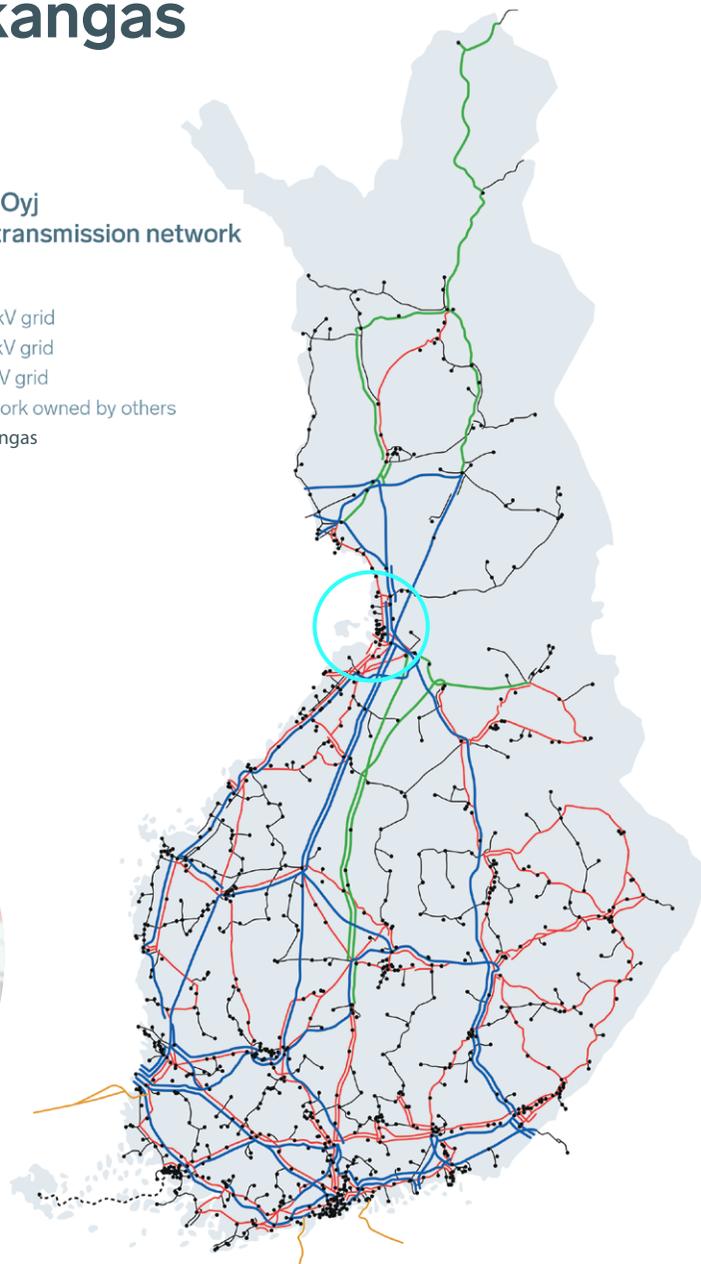
## Connecting renewable power

- There are several hydro power plant in Iijoki river. Total power is 200 MW.
- New wind power is being built and planned in Iijoki region and Sea-Lapland 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.

### Fingrid Oyj power transmission network

1.1.2020

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



TOTAL ESTIMATED IMPACT

**+300 MW**

ALLOCATED COSTS

**16,9 M€**

ACTUALIZED

**2015–2016**

# New 400/110 kV transformer at Kristinestad substation

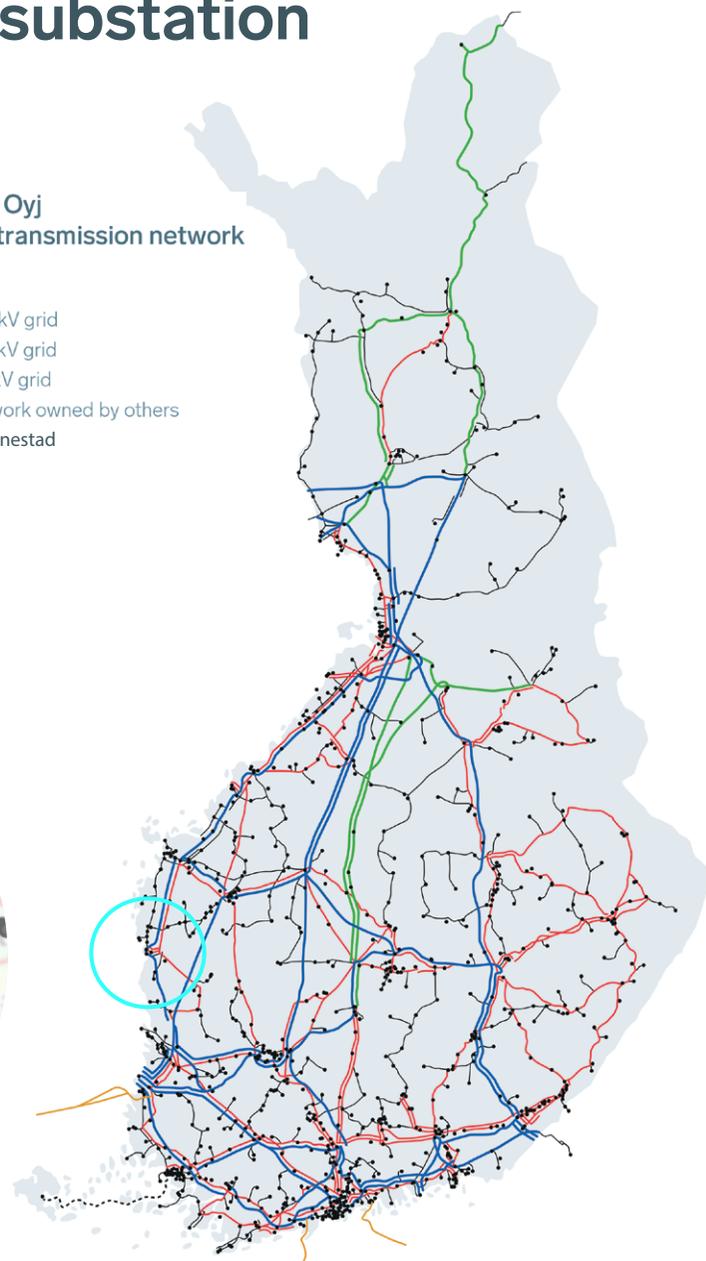
## Connecting renewable power

- 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 closed.
- 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

**+400 MW**

ALLOCATED COSTS

**8,0 M€**

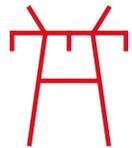
ACTUALIZED

**2016–2017**

# New Hikiä-Orimattila 400 kV transmission line

## Reducing losses

- Oldest 110 kV power line in Finland is being 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.



ACTUALIZED

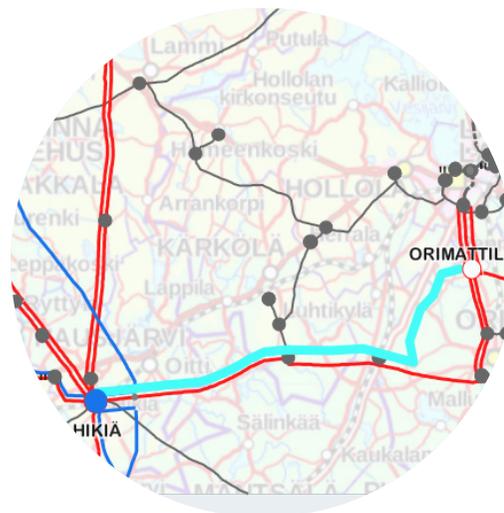
**2017–2019**

ALLOCATED COSTS

**11,2 M€**

TRANSMISSION LOSSES

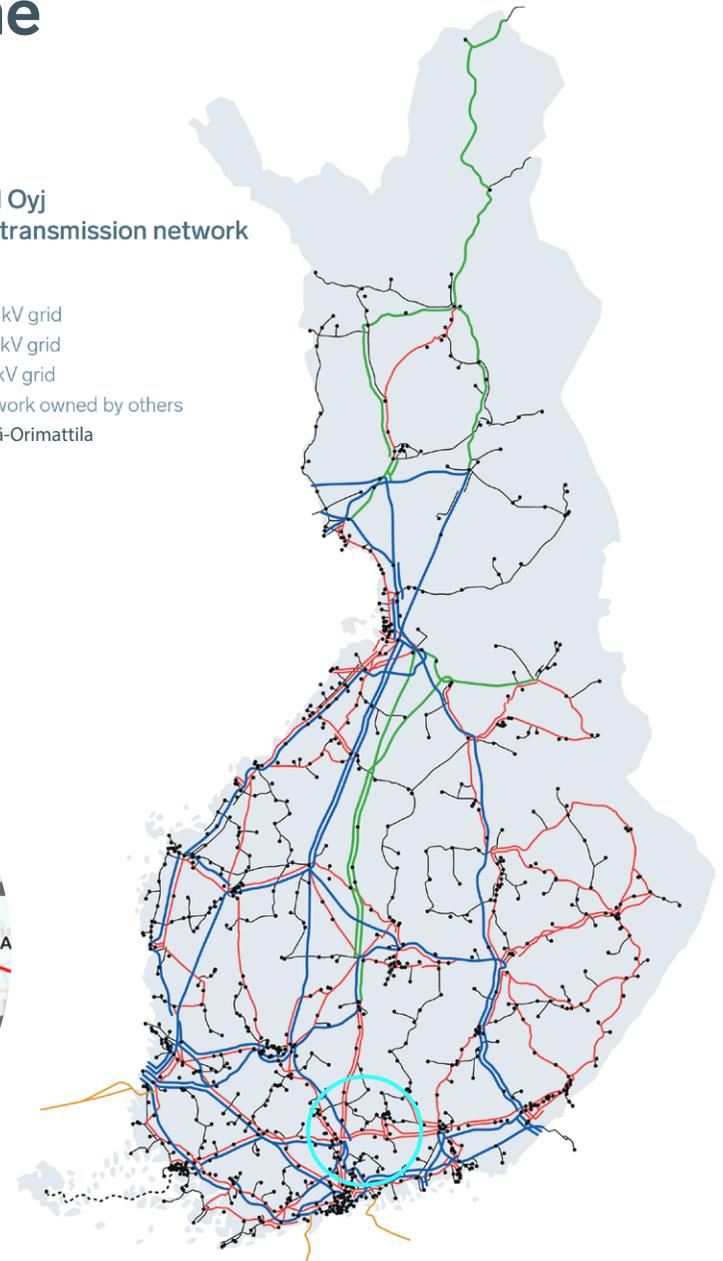
**-80%**



### Fingrid Oyj power transmission network

1.1.2020

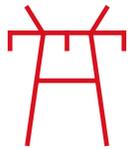
- 400 kV grid
- 220 kV grid
- 110 kV grid
- Network owned by others
- Hikiä-Orimattila



# New Lempiälä – Vuoksi 400 kV transmission line

## Reducing losses

- Old 110 kV wooden power line is being 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%).



ACTUALIZED

2018–2019

ALLOCATED COSTS

2,0 M€

TRANSMISSION LOSSES

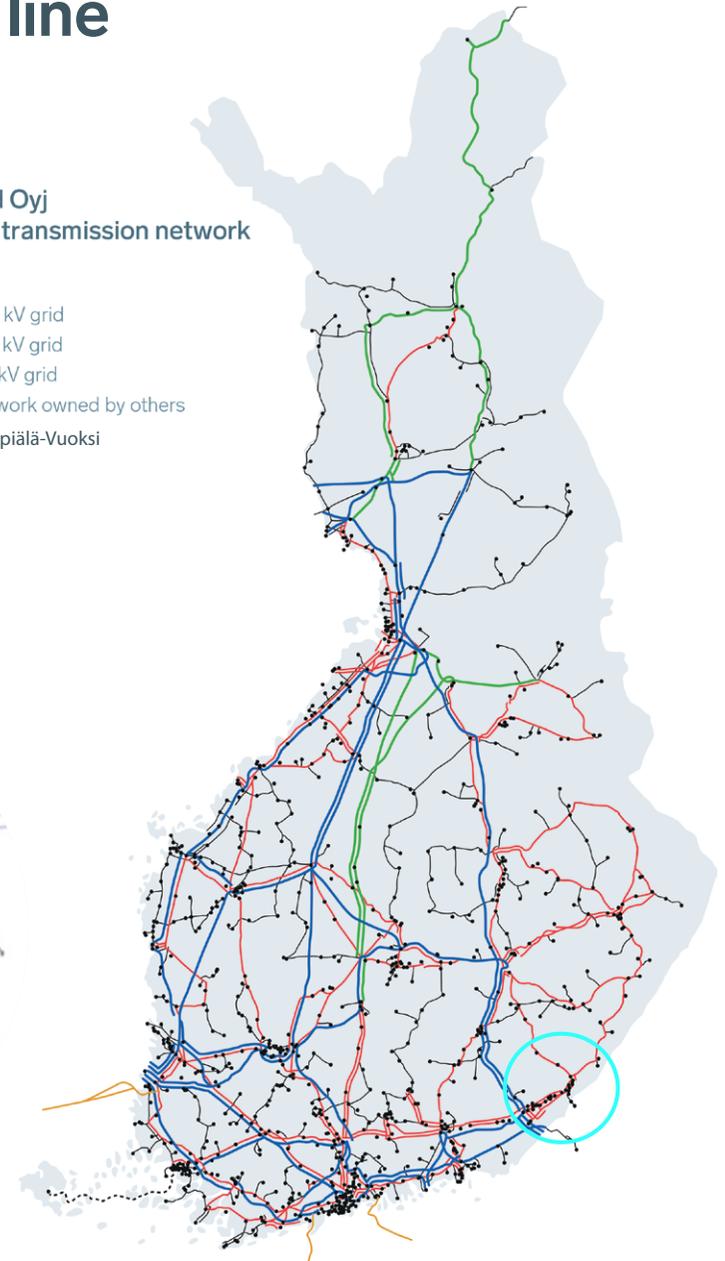
-80%



## Fingrid Oyj power transmission network

1.1.2020

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





# 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