



# **Risk of freezing rain disruption in Finland**

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(C3S) Symposium for the Energy Sector  
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Fingrid Plc.**

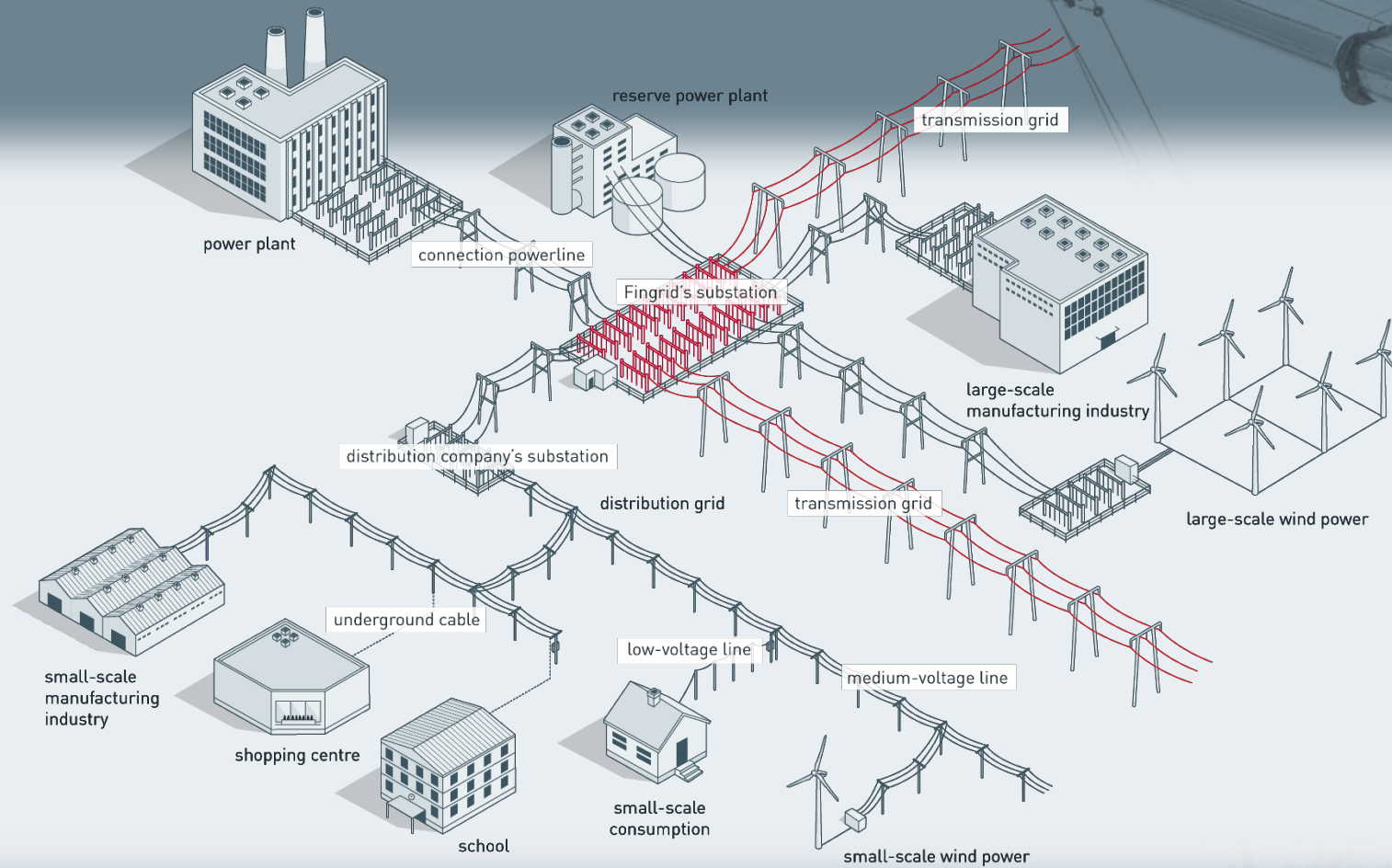
**FINGRID**

# Fingrid and Power System

Finland runs on electricity.  
Fingrid's most important task is to ensure that Finland obtains electricity without disturbances at all times.



# Electric Power System





14 400 km  
of power lines

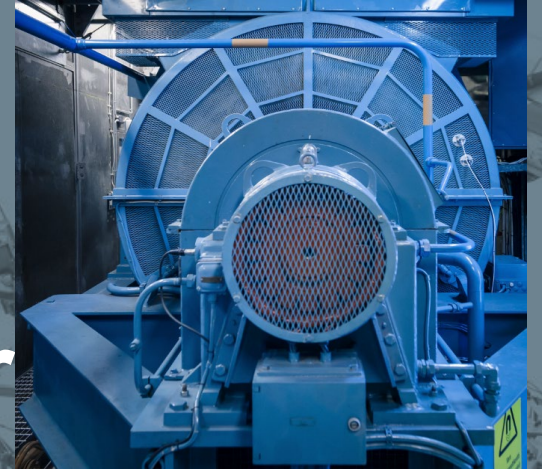
300 km  
of submarine cable



over 47 000  
towers



115 substations



10 reserve power  
plants  
> 935 MW reserve

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# Power Transmission Network

to which major power plants, factories and regional distribution networks are mainly linked.

Also connects Finland to international electricity markets.

Fingrid Oyj  
power transmission network  
1.1.2017

- 400 kV grid
- 220 kV grid
- 110 kV grid
- network owned by others

# **The risk of freezing rain disruption in Finland**

# Threats caused by weather

- The climate in Finland puts several severe stresses on the open air structures of power network.
- The mix of wind, snow, frost, water and ice in different amounts and strenghts must be anticipated in planning of the structures.
- Wind alone has not been documented to have caused severe breakdowns in main grid stucturess unless material defects or bad planning has contributed





# Ice, frost and snow

- Hoar frost is quite frequent trouble in wintertime on the conductors and lightning arrester ropes. The load can cause dangerously deep sags and even cut down of ropes or wires.
- Heavy snowloads cause wide disruptions and outages especially in distribution networks due to trees bending down on conductors (picture).
- Wind alone has not been documented to have caused severe breakdowns in main grid structures unless material defects or bad planning has contributed



# Freezing rain in Finland

- Freezing rain is considered a rare and potentially very destructive phenomenon to power networks and other critical infrastructures.
- The huge damages caused by freezing rain in Canada 1998, Germany 2005 (pic.), Slovenia 2011, Russia 2013 are noticed with great concern also in Finland.



# Why is freezing rain so serious threat ?

- The strenght of structures in transmission network is designed to withstand normal (weight and tension) and exceptional (storm, single conductor brakedown) stresses according to standards based on climatic and geographical circumstances.
- Combination of wind and ice accumulating on especially conductors cause eventually surpassing the strenght of structures and due to one collapse several others are bound to follow.



# Consequenses of ice storm

Freezing rain combined with strong winds makes an ice storm.

The ice storm affects the whole society with severity directly proportional to the accumulation of ice and strenght of winds.

In USA a index table is created to assess the consecuences of an ice storm the variables being ice accumulation and wind speed

## Sperry-Piltz Ice Accumulation Index.

<http://www.spia-index.com/>

The Sperry-Piltz Ice Accumulation Index, or "SPIA Index" – Revised September, 2009

ICE DAMAGE INDEX	RADIAL ICE AMOUNT (inches)	WIND (mph)	DAMAGE AND IMPACT DESCRIPTIONS
0	< 0.25	< 15	Minimal risk of damage to exposed utility systems; no alerts or advisories needed for crews, few outages.
1	0.10 – 0.25	15 - 25	Some isolated or localized utility interruptions are possible, typically lasting only a few hours. Roads and bridges may become slick and hazardous.
	0.25 – 0.50	> 15	
2	0.10 – 0.25	25 - 35	Scattered utility interruptions expected, typically lasting 12 to 24 hours. Roads and travel conditions may be extremely hazardous due to ice accumulation.
	0.25 – 0.50	15 - 25	
	0.50 – 0.75	< 15	
3	0.10 – 0.25	> = 35	Numerous utility interruptions with some damage to main feeder lines and equipment expected. Tree limb damage is excessive. Outages lasting 1 – 5 days.
	0.25 – 0.50	25 - 35	
	0.50 – 0.75	15 - 25	
	0.75 – 1.00	< 15	
4	0.25 – 0.50	> = 35	Prolonged & widespread utility interruptions with extensive damage to main distribution feeder lines & some high voltage transmission lines/structures. Outages lasting 5 – 10 days.
	0.50 – 0.75	25 - 35	
	0.75 – 1.00	15 - 25	
	1.00 – 1.50	< 15	
5	0.50 – 0.75	> = 35	Catastrophic damage to entire exposed utility systems, including both distribution and transmission networks. Outages could last several weeks in some areas. Shelters needed.
	0.75 – 1.00	> = 25	
	1.00 – 1.50	> = 15	
	> 1.50	Any	

(Categories of damage are based upon combinations of precipitation totals, temperatures and wind speeds/directions.)

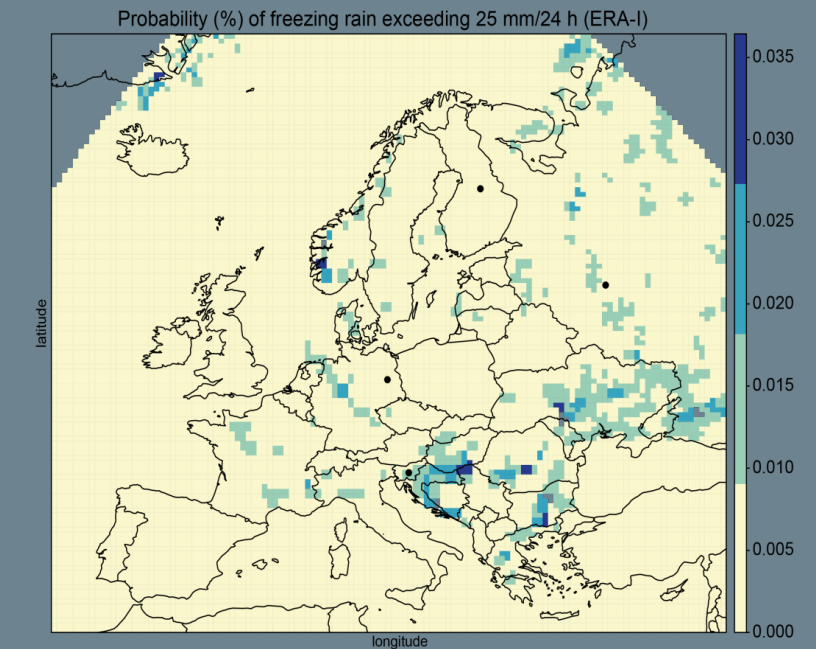
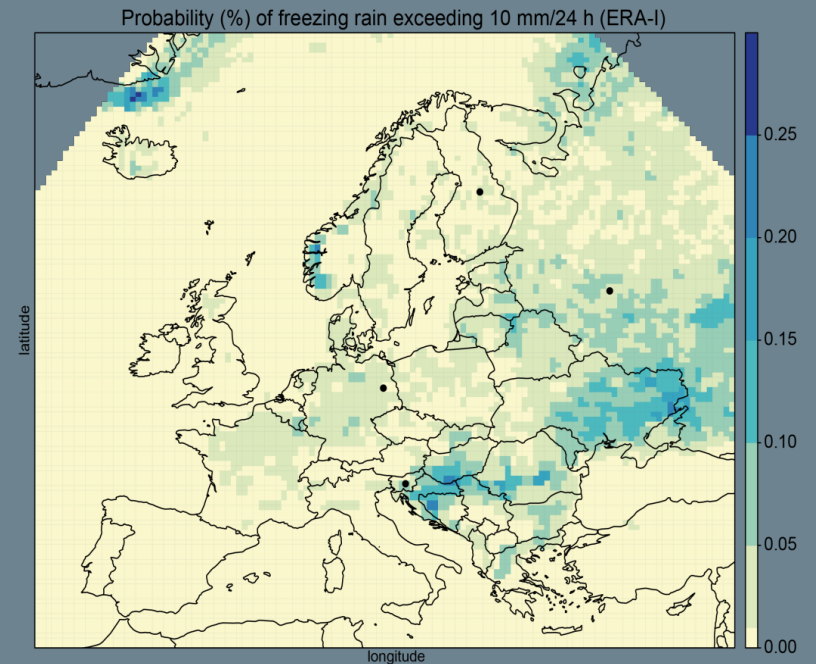
**CLIM4ENERGY**

**Case study using the indicator**

***Freezing Rain Impact Indicator***

# Freezing Rain Impact Indicator

The co-operation in developing Freezing Rain Impact Indicator with Finnish Meteorological Institute has brought Fingrid deeper understanding of freezing rain as a climatic phenomenon and also data of its occurrence and projections of the possible changes up to the middle of this century.

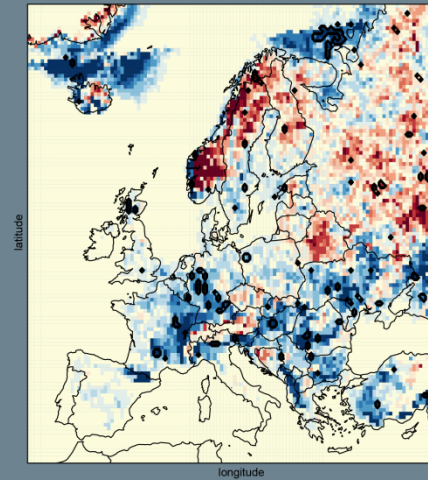


# The use of Freezing Rain Impact Indicator

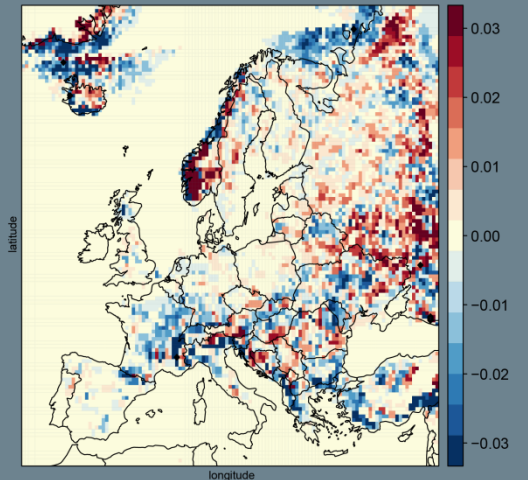
The projections provided in this project show clearly that the increase of possibility of freezing rain in Finland up to 2050 is slight.

The change do not imply upgrading the standards of designing power network structures or involve other preventive measures such as providing anti-icing methods or techniques excess to what already are available.

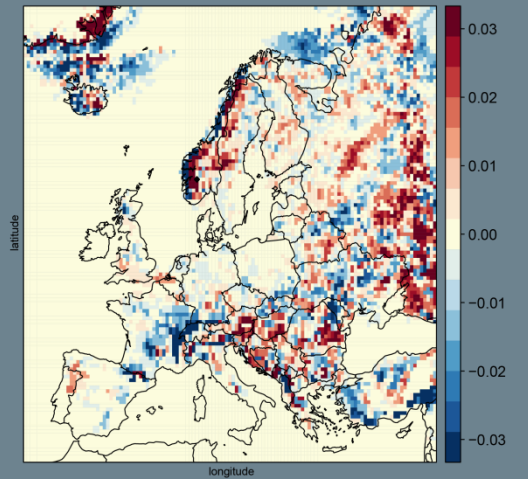
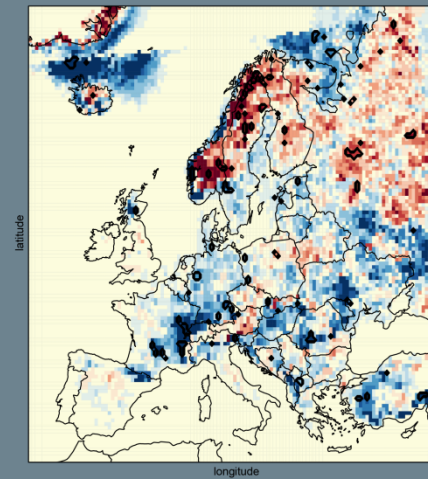
RCP4.5



FZRA>25 mm/24 h



RCP8.5



# Thank you!

## **Fingrid Oyj**

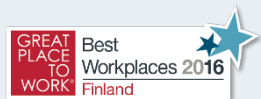
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