Project Sheet

N-S Finland P1 stage 2

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Index

Key Information 3
Description 3
Project Description & Context 5
Project Investments 5
System Needs addressed by the project 5
Interconnection targets 5
Project Assessment 9
Transfer capacity increase (National Trends 2025) 9
CBA results 9
Central scenario: National Trends 9
Scenarios: Distributed Energy & Global Ambition 11
Non scenario-dependent indicator(s) 13
Sensitivity Study: Current Trends 13
Residual impact 14
Project Costs 14

ENTSOE

Key Information

Internal Project
AC transmission line
New

Under Construction

Description

This project is fifth 400 kV overhead line connecting North Finland to South Finland and required compensation investments. The project is to be built to increase the North-South transmission capacity thus enabling the integration of new renewable and conventional generation in northern Finland.

Project promoters

FINGRID

Countries

Finland

National development plan(s)

Kantaverkon kehittämissuunnitelma 2019-2030 (currently in Finnish, will be available in english later), Finland, 2019, codes: FG-NS-5P1 and FG-NS-PECOMP

Additional information on the project

"The project consist of 400 kV overhead line, series compensation of the line and substation extensions at the terminal substations.

Fingrid has published a national development plan in 2019. The investment plan presents a detailed look of the projects. The plan is available in Finnish:

https://www.fingrid.fi/globalassets/dokumentit/fi/kantaverkko/kantaverkon-kehittaminen/kantaverkon_kehittamissuunnitelma-2019-2030.pdf
"

Information on the Metsälinja -overhead line can be found here:
https://www.fingrid.fi/kantaverkko/suunnittelu-ja-rakentaminen/voimajohdot/metsalinja_rakentaminen/

Project sheet backlog

6 Nov. 2020 - Publication as part of the draft TYNDP 2020 package for consultation

Project Description & Context

Project Investments

Main investment(s): New single circuit 400 kV OHLs will be built from middle Finland to Oulujoki Area to increase the capacity between North and South Finland. Substations to connect wind farms in the region are also in consideration.

Type of element	Total route length (km)	From substation 1	To substation 2	Present status	Commissioning year	Progress of the investment	Explanation in case of delay or reclustering
AC transmission line	300	Pyhanselka (FI)	Petajavesi (FI)	Under Construction	2022	Investment on time	

Is the project in the reference grid?

Yes

System Needs addressed by the project

Project promoter(s) selected up to 4 system needs that are addressed by their project in a predefined list. Available needs ranged from reduction of price differentials between countries, improvement of system flexibility and stability, enabling cost-efficient connection of high volumes of RES, improvement of voltage stability...
As part of the TYNDP 2020, ENTSO-E released a study investigating cross-border system needs in the 2030 and 2040 horizons.

Need		How the project addresses each need (explanation provided by the project promoter(s))
	Infrastructure to reduce price differentials between EU and/or non-EU countries	
	Infrastructure designed to enable cost-efficient grid connection of high volumes of RES and/or reduce RES curtailment	
	Infrastructure to improve system flexibility and stability e.g. improve system or local ramp rate, improve transient stability or RoCoF to meet system Needs.	

Interconnection targets

In 2017, the Interconnection Target Expert Group proposed alternative indicators to the 15% interconnection criteria for every country and electrified island with a new methodology developed collaboratively between the European Commission, ENTSO-E, ENTSOG, industry, universities and other experts. The methodology is based on three indicators:
1. Price differential between EU countries, with an objective to reduce it below 2 EUR/MWh
2. Ratio between nominal transmission capacity and installed RES capacity, with a target of past 30%
3. Ratio between nominal transmission capacity and peak load, with a target of past 30%

The following maps show the ITEG methodology applied to the TYNDP 2030 scenarios, with the 2020 grid.

ENTSO-E

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Project Assessment

Transfer capacity increase (National Trends 2025)

	Border	A B	B A
Transfer capacity increase (in MW)	Internal (Finland)	1000	1000

CBA results

ENTSO-E has assessed the benefits delivered by each project in 2025 (scenario National Trends 2025) and in 2030 (three scenarios: National Trends, Distributed Energy and Global Ambition). Indicators B1 to B6 were computed by ENTSO-E, while promoters had the possibility to compute and submit so-called project-level benefits (B7 to B10). The benefits must be understood as benefits for Europe as a whole, not for the promoters of the project.
Results are presented per scenario.

This project was assessed with the internal redispatch methodology. Because this project was assessed with one tool only, there is no variation between min, max and average values.

Central scenario: National Trends

National Trends is the central policy scenario of the TYNDP2020, designed to reflect EU member state's National Energy and Climate Plans (NECP), in line with the requirement to meet current European 2030 energy strategy targets.

			Comparison of the COP21 scenarios with NT2030 average result		
	NT2025	**NT2030**	**DE2030 is < or > than NT2030**	**GA2030 is < or > than NT2030**	

Increase in socio-economic welfare

B1 Annual Socio-Economic Welfare (SEW) increase (M € / year)	max average min	3 3 3	16 16 16	>	>	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	max average min	1 1 1	1 1 1	>	>	ENTSO-E assessment

B1_RES Annual Socio-Economic Welfare increase resulting from RES integration	max average min	0 0 0	0 0 0	>	>	ENTSO-E assessment

Reduction of CO2 and GHG emissions

B4 Non-CO2 emissions (kg/year)

B4a Nitrogen oxides	average	-5766	-22812	n/a	n/a	ENTSO-E assessment
B4b Ammonia	average	-536	-2658	n/a	n/a	ENTSO-E assessment
B4c Sulfur dioxide	average	-2146	-629	n/a	n/a	ENTSO-E assessment
B4d Particular matter 5	average	-399	-1829	n/a	n/a	ENTSO-E assessment
B4e Particulate matter 10	average	-254	-1160	n/a	n/a	ENTSO-E assessment
B4f Non-methane volatile organic compounds	average	-164	-797	n/a	n/a	ENTSO-E assessment

B2a Annual CO2 variation from market simulation (ktonnes / year)	max average min	26 26 26	24 24 24	>	>	ENTSO-E assessment
B2a_€ Annual Societal cost variation resulting from CO2 variation from market simulation monetised (M € / year)	CO2 price 60€/ ton 100€/ ton 189€/ ton	-1 -2 -4	-1 -2 -4	>> >> >>	>> >> >>	ENTSO-E assessment
B2b Annual CO2 variation due to network losses (ktonnes / year)	average	26	24	n/a	n/a	ENTSO-E assessment
B2b_€ Annual Societal cost	CO2 price 60€/ ton	-1 -2	-1 -2	n/a	n/a	ENTSO-E assessment

variation resulting from CO2 variation from network simulation monetised (M € / year)	100€/ ton 189€/ ton	-4	-4			

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)	max average min	174 174 174	953 953 953	>	>	ENTSO-E assessment
B3a Connected RES (MW)	-			n/a	n/a	ENTSO-E assessment

Impact on grid losses

B5 Variation of network losses (GWh / year)	average	-86	-6	n/a	n/a	ENTSO-E assessment
B5_€ Variation of network losses monetised (M€ / year)	average	-4	-3	n/a	n/a	ENTSO-E assessment

Security of supply

B6 Annual reduction in Energy Not Served (MWh / year)	max average min		N/A	n/a	n/a	ENTSO-E assessment
B6_€ Annual Socio-Economic Welfare increase resulting from reduction in Energy Not Served monetised (M€ / year)	average	n/a	N/A	>	n/a	ENTSO-E assessment

Scenarios: Distributed Energy & Global Ambition

DE and GA are two scenarios created in line with the COP21 targets to understand the impact on

infrastructure needs agains different pathways reducing EU-28 emissions to net-zero by 2050. For these two scenarios, projects were assessed with a subset of CBA parameters.

		DE2030	GA2030	
Increase in socio-economic welfare				
B1 Annual Socio-Economic Welfare (SEW) increase (M€ / year)	average	N/A	N/A	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	average	N/A	N/A	ENTSO-E assessment
B1_RES Annual Socio-Economic Welfare increase resulting from RES integration	average	N/A	N/A	ENTSO-E assessment
Reduction of CO2 and GHG emissions				
B2a Annual CO2 variation from market simulation (ktonnes / year)	average	N/A	N/A	ENTSO-E assessment
B2a_€ Annual Societal cost variation resulting from CO2 variation from market simulation monetised (M€ / year)	CO2 price 60€/ ton 100€/ ton 189€/ ton	N/A N/A N/A	N/A N/A N/A	ENTSO-E assessment
Integration of renewable energy sources				
B3 Annual avoided curtailment (RES integration) (GWh / year)	average	N/A	N/A	ENTSO-E assessment
B3a Connected RES (MW)	-			ENTSO-E assessment

Non scenario-dependent indicator(s)

B8.0 Stability (Transient, Voltage and Frequency Stability)	Transient stability	Voltage stability	Frequency stability	
Pyhanselka-Petajavesi (New AC line)	++	++	0	Qualitative assessment by ENTSO-E based on information on the project technology provided by the project promoter(s). This indicator is not dependent on scenarios or time horizons.

Sensitivity Study: Current Trends

'Current Trends' describes a future where the energy transition is slower than planned.

	CT2030	

Increase in socio-economic welfare

B1 Annual Socio-Economic Welfare (SEW) increase (M€ / year)	average	N/A	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	average	N/A	ENTSO-E assessment
B1_RES Annual Socio-Economic Welfare increase resulting from RES integration	average	N/A	ENTSO-E assessment

Reduction of CO2 and GHG emissions

B2a Annual CO2 variation from market simulation (ktonnes / year)	average	N/A	ENTSO-E assessment
B2a_€ Annual Societal cost variation resulting from	CO2 price 60€/ ton 100€/	N/A N/A N/A	ENTSO-E assessment

CO2 variation from market simulation monetised (M€ / year)	ton 189€/ ton		

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)	average	N/A	ENTSO-E assessment
B3a Connected RES (MW)	-		ENTSO-E assessment

Residual impact

Information on the residual impact of the project was provided by the project promoter(s).

Project Costs

The project costs were provided by the project promoter(s).

	CAPEX (Meuro)	Uncertainty range (%)	OPEX
742. Pyhanselka-Petajavesi	100	+-10 %	0.242
Total	100		0.242

Explanation provided by the project promoter on the CAPEX uncertainty range:

742