Project Sheet

Greenconnector

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ENTSO-E

Key Information

Cross Border Project
DC transmission line
New

PCI number 2.14 (4th list, 31 Oct. 2019)
In Permitting

Description

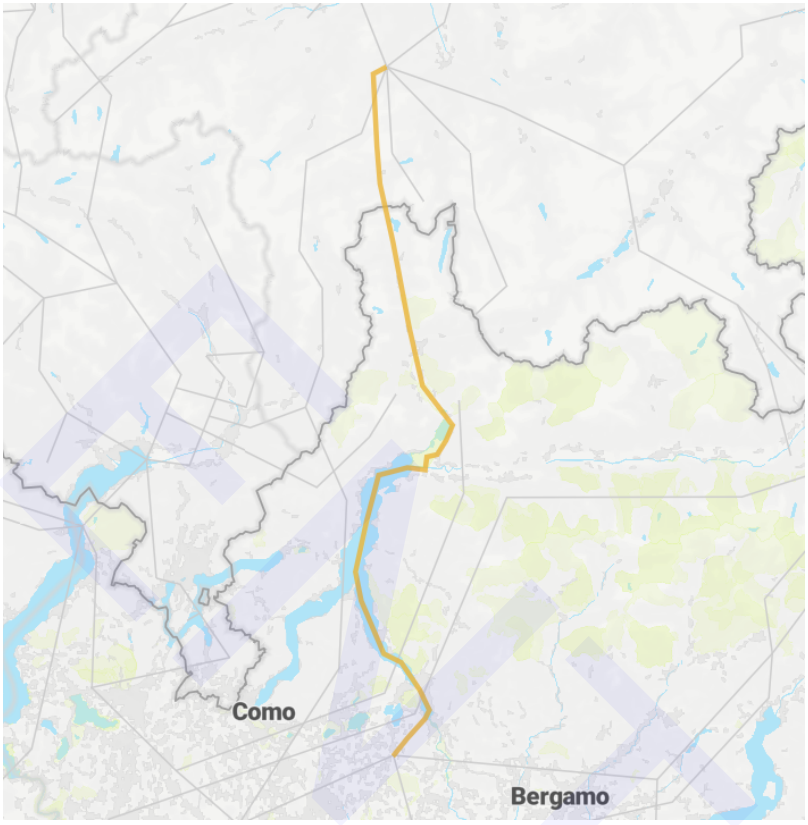
Greenconnector is an HVDC interconnector project between Italy and Switzerland for power transport using DC cables rather than overhead lines. The route length is about 165 km. The design power is 1000 MW (1200 MW in overload condition), while the DC voltage is +/- 400 kV DC. Two cables will be installed, working with a bipolar scheme. Great part of the cables route will exploit a section of an existing oil pipeline, no longer in service since January 1997. This pipeline crosses the Italian and Switzerland border at Splügenpass and is running close by the two end stations of the Greenconnector project (Bonaduz in Graubunden Canton and Verderio Inferiore, Lecco). The cables will be pulled inside the pipeline itself, reducing the amount of civil works required before and after cable laying and therefore limiting even temporary environmental impact. For about 47 km the cables will run across the Como lake. The selected technology and voltage level make it possible to build a very efficient interconnector with very low losses.

Project promoters

Worldenergy SA

Countries

Switzerland
Italy



National development plan(s)

Terna Piano di Sviluppo 2019, Italy, page 162,
https://download.terna.it/terna/0000/1188/36.PDF

Additional information on the project

Project website:
www.greenconnector.it

The Greenconnector project has been selected by the Renewables Grid Initiative "Good Practice of the Year" award jury as one of the favourite practices in the "Environmental Protection" category. As a relevant and applaudable practice, Greenconnector appears in the award brochure that has been presented at the award ceremony at the European Energy Infrastructure Forum in Copenhagen on June 1, 2017.

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): Greenconnector is an HVDC interconnector project between Italy and Switzerland for power transport using DC cables rather than overhead lines. The route length is about 165 km. The design power is 1000 MW (1200 MW in overload condition), while the DC voltage is +/- 400 kV DC. Two cables will be installed, working with a bipolar scheme. Great part of the cables route will exploit a section of an existing oil pipeline, no longer in service since January 1997. This pipeline crosses the Italian and Switzerland border at Spl genpass and is running close by the two end stations of the Greenconnector project (Bonaduz in Graubunden Canton and Verderio Inferiore, Lecco). The cables will be pulled inside the pipeline itself, reducing the amount of civil works required before and after cable laying and therefore limiting even temporary environmental impact. For about 47 km the cables will run across the Como lake.

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
DC transmission line	165	Verderio	Bonaduz	In Permitting	2024	Delayed	A different location of the Converter Station in Switzerland has been evaluated due to local opposition. A rerouting of the final part of the Interconnector has been evaluated as well.

Is the project in the reference grid?

No

System Needs addressed by the project

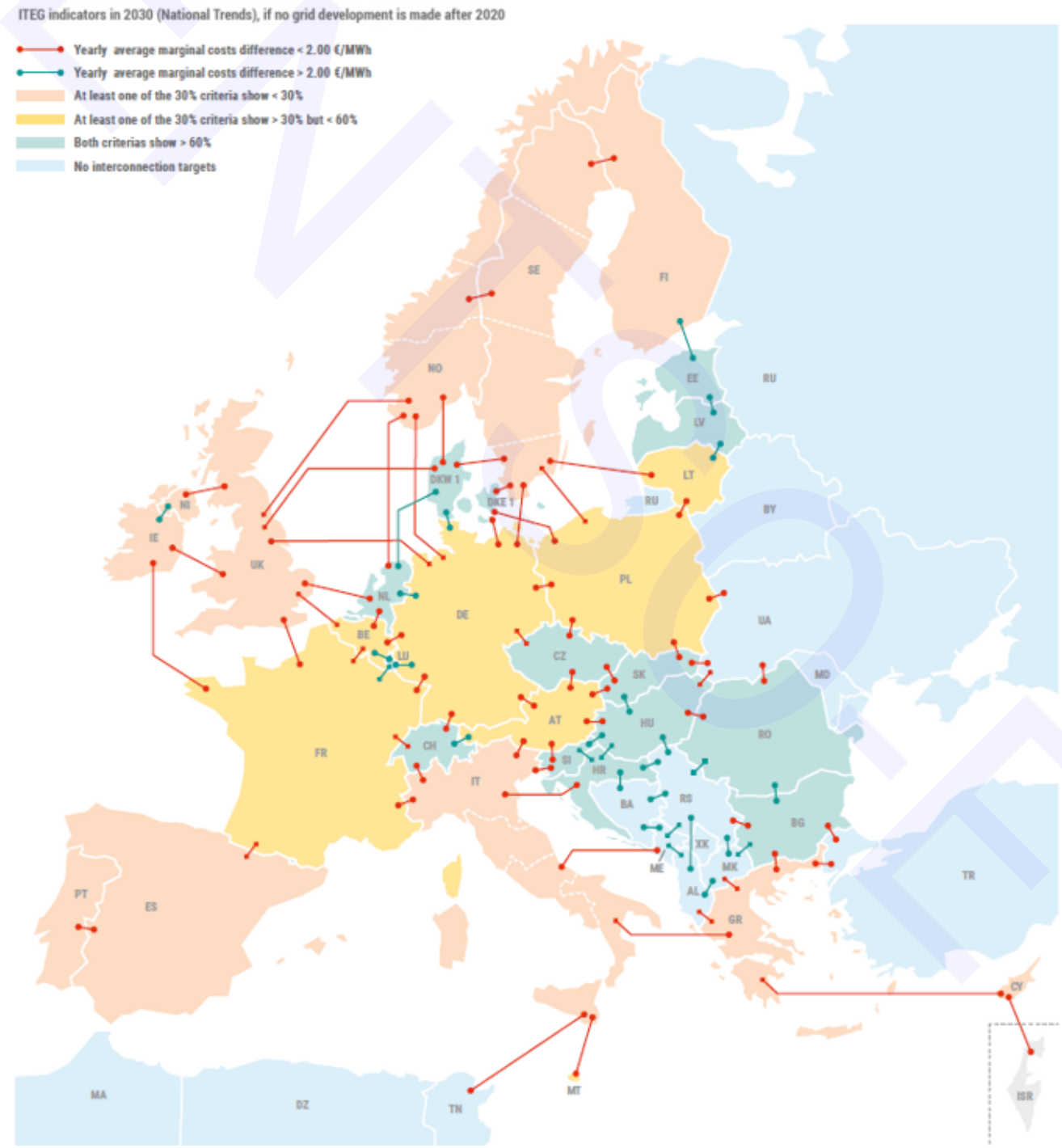
Project promoter(s) selected up to 4 system needs that are addressed by their project in a predefined list. Available needs ranged from reduction of price differentials between countries, improvement of system flexibility and stability, enabling cost-efficient connection of high volumes of RES, improvement 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.

The project promoter did not select any need.

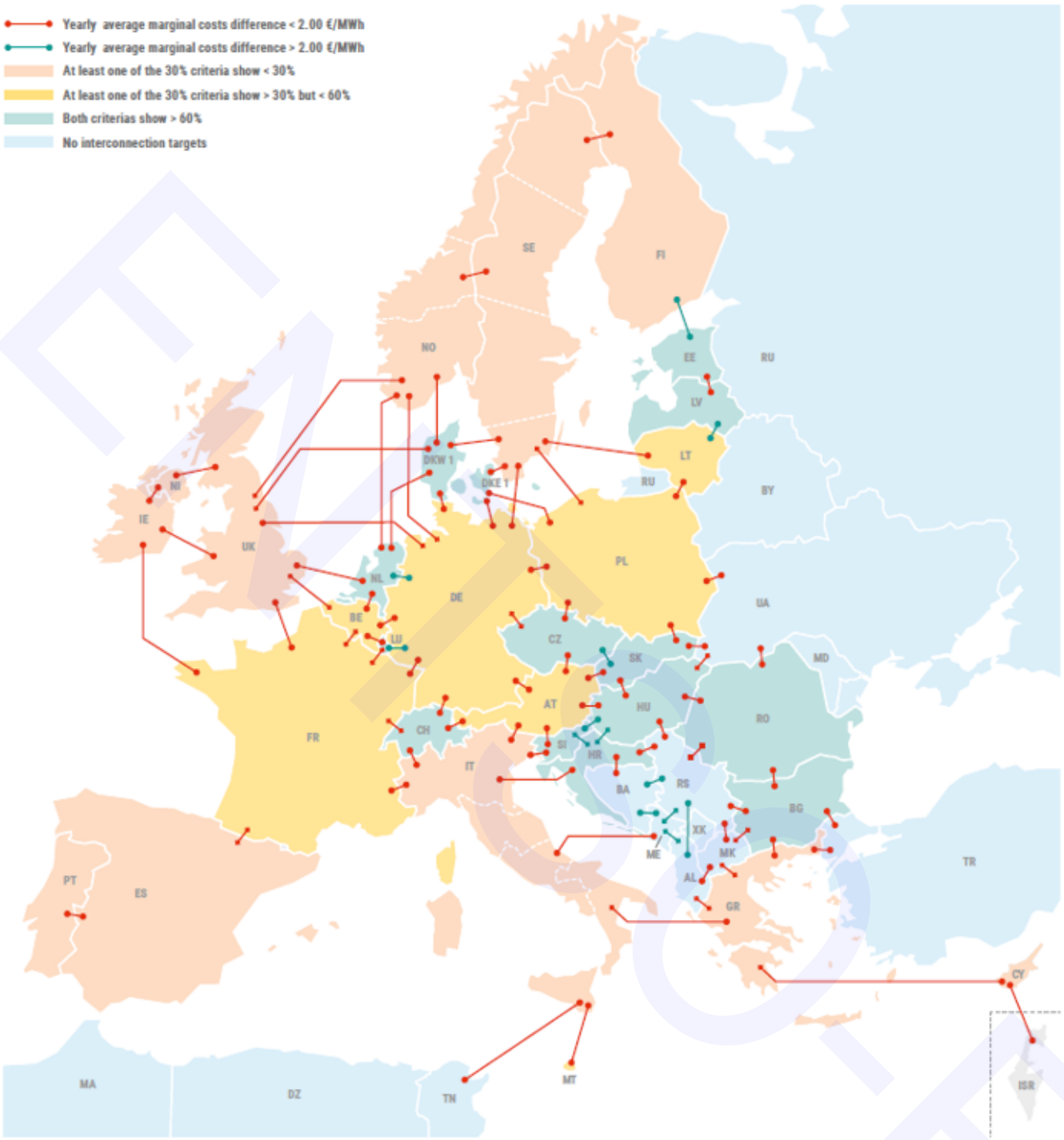
Interconnection targets

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%

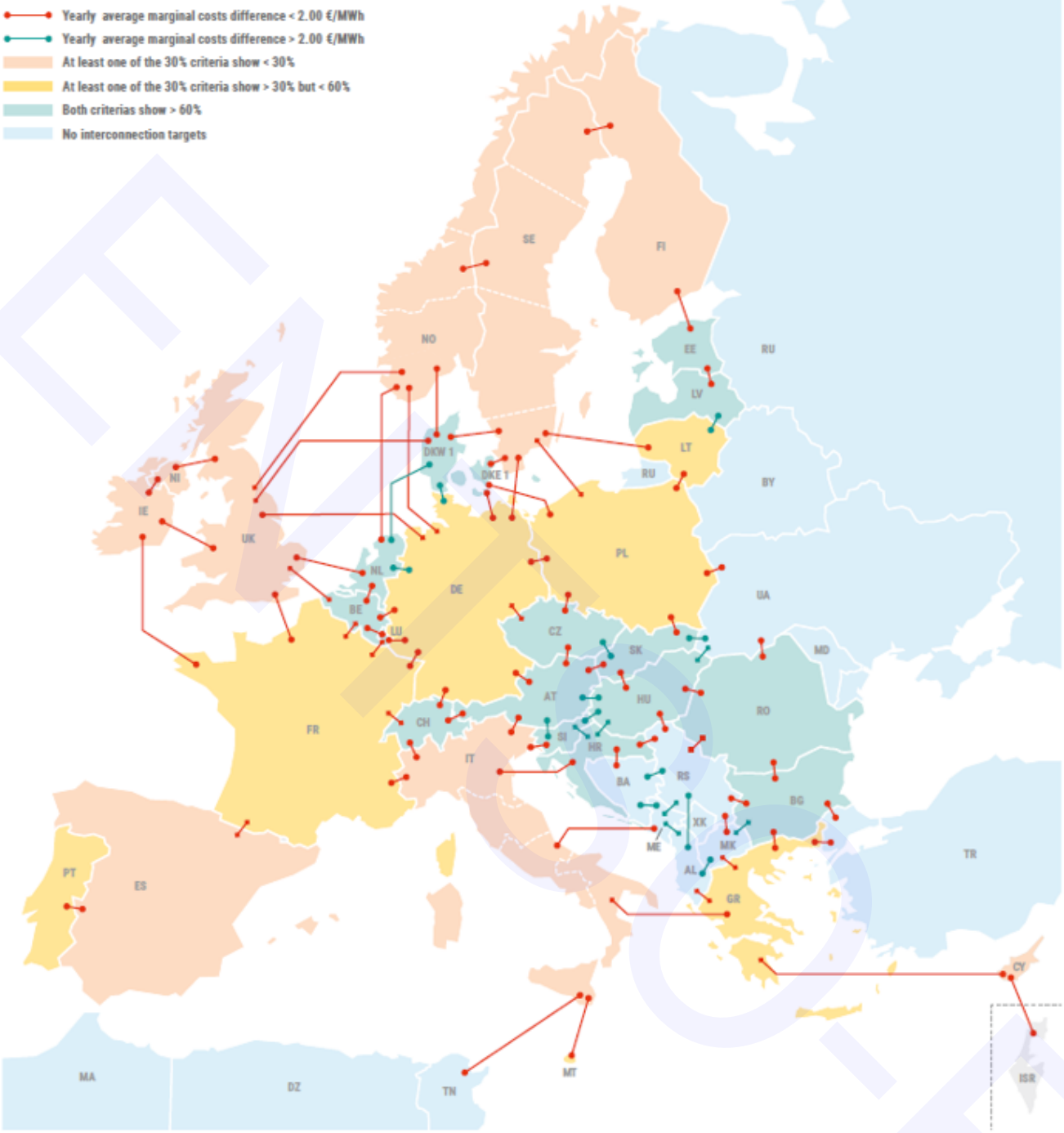
The following maps show the ITEG methodology applied to the TYNDP 2030 scenarios, with the 2020 grid.



ITEG indicators in 2030 (Distributed Energy), if no grid development is made after 2020



ITEG indicators in 2030 (Global Ambition), if no grid development is made after 2020



Project Assessment

Transfer capacity increase (National Trends 2025)

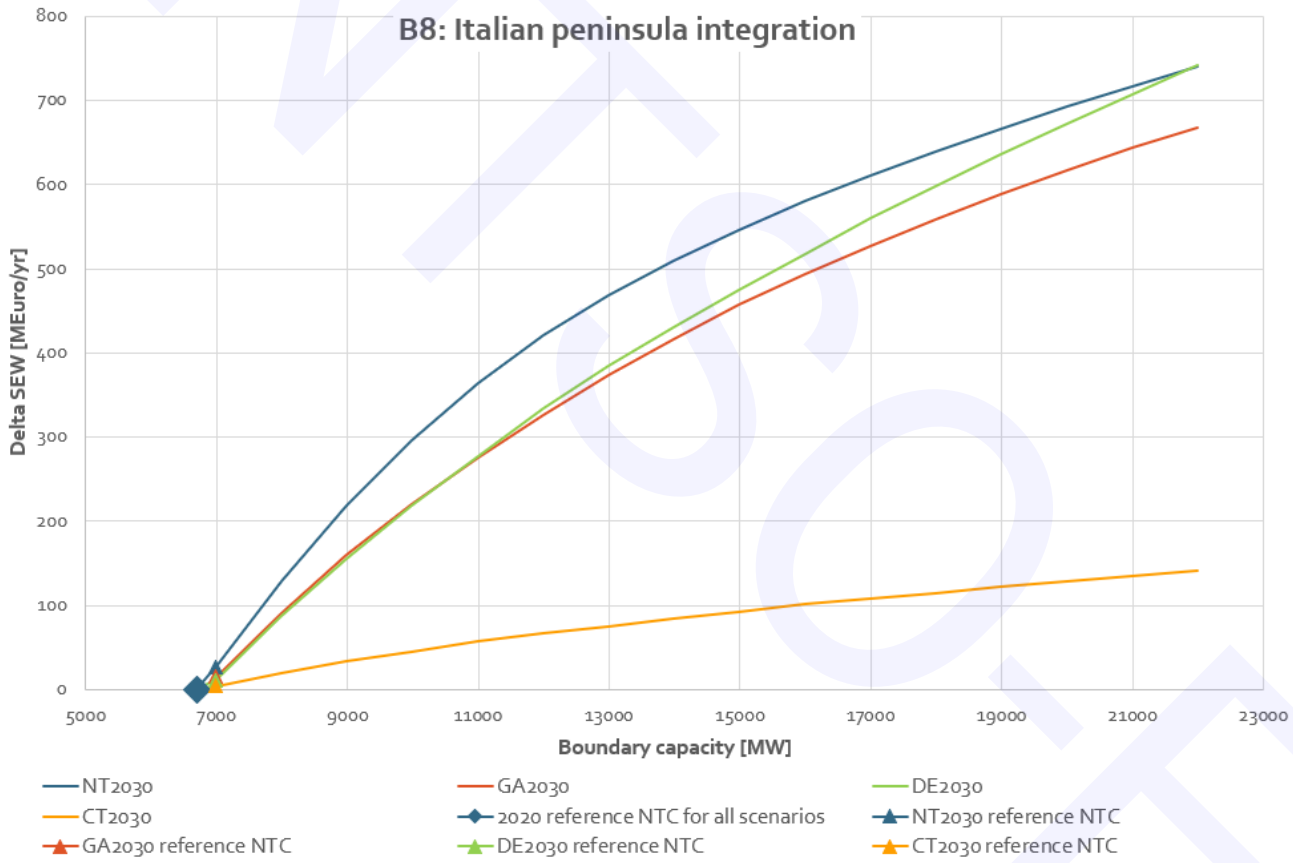
	Border	A B	B A
Transfer capacity increase (in MW)	Switzerland - Italy	1000	1000

Boundary capacity diagram

Network boundary the projects helps mitigate

Italian Peninsula integration

Boundary capacity diagram



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.

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	27 24 17	78 74 69	<	<	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	max average min	1 -6 -9	23 2 -18	>	<	ENTSO-E assessment
B1_RES Annual Socio-Economic Welfare increase resulting from RES integration	max average min	4 1 0	1 0 0	>	>	ENTSO-E assessment

Reduction of CO2 and GHG emissions

B4 Non-CO2 emissions (kg/year)

B4a Nitrogen oxides	average	866	580	n/a	n/a	ENTSO-E assessment
B4b Ammonia	average	-58	-67	n/a	n/a	ENTSO-E assessment
B4c Sulfur dioxide	average	1609	1656	n/a	n/a	ENTSO-E assessment
B4d Particular matter 5	average	892	15570	n/a	n/a	ENTSO-E assessment
B4e Particulate		39	48	n/a	n/a	ENTSO-E

matter 10	average					assessment
B4f Non-methane volatile organic compounds	average	810	15512	n/a	n/a	ENTSO-E assessment
B2a Annual CO2 variation from market simulation (ktonnes / year)	max average min	408 258 -58	657 -67 -824	< 	>>>>	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	-10 -20 -43	2 5 11	<<<<<<>>>>>><	<<<<<<<<<<<<	ENTSO-E assessment
B2b Annual CO2 variation due to network losses (ktonnes / year)	average	359	312	n/a	n/a	ENTSO-E assessment
B2b_€ Annual Societal cost variation resulting from CO2 variation from network simulation monetised (M € / year)	CO2 price 60€/ ton 100€/ ton 189€/ ton	-13 -28 -60	-10 -22 -50	n/a	n/a	ENTSO-E assessment

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)	max average min	84 22 0	32 8 0	>>>>>>>

B5 Variation of network losses (GWh / year)	average	625	648	n/a	n/a	ENTSO-E assessment
B5_€ Variation of network losses monetised (M€ / year)	average	28	21	n/a	n/a	ENTSO-E assessment

Security of supply

B6 Annual reduction in Energy Not Served (MWh / year)	max average min		0	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	0	>	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	34	51	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	average	5	-21	ENTSO-E assessment
B1_RES Annual Socio-Economic Welfare increase resulting	average	5	4	ENTSO-E assessment

from RES integration			

Reduction of CO2 and GHG emissions

B2a Annual CO2 variation from market simulation (ktonnes / year)	average	-92	613	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 4 13	-15 -40 -94	ENTSO-E assessment

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)	average	91	83	ENTSO-E assessment
B3a Connected RES (MW)	-			ENTSO-E assessment

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	9		ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	average	-4		ENTSO-E assessment

B1_RES Annual Socio-Economic Welfare increase resulting from RES integration	average	3	ENTSO-E assessment

Reduction of CO2 and GHG emissions

B2a Annual CO2 variation from market simulation (ktonnes / year)	average	138	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	-4 -10 -22	ENTSO-E assessment

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)	average	53	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
1014. Greenconnector	660	-10 / +15 %	2
Total	660		2

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

1014 The higher upper threshold of the uncertainty range reflects the possibility of a less competitive market for power cables and converter stations, due to the high number of

planned HVDC and underground/submarine cable projects.

ENTSO-E