Project Sheet

HVDC Ultranet Osterath to Philippsburg

Project type	transmission
Project id	254
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ENTSO-E

Key Information

Internal Project
DC transmission line
New

PCI number 2.9 (4th list, 31 Oct. 2019)
In Permitting

Description

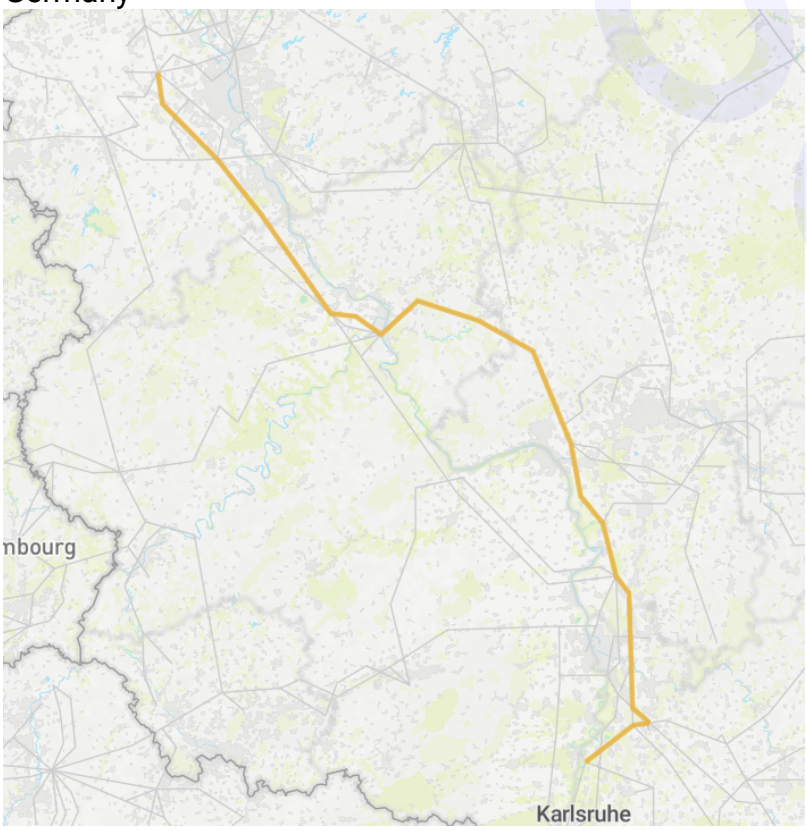
The Ultranet project consists of a 2 GW HVDC-connection from the Region of Osterath (Rhineland) to the Region of Philippsburg (Baden-Württemberg). It's a pilot project with DC circuits on the same pylons as AC lines and will therefore deliver profund knowledge.It represents a separate subsection for the large-scale transmission link from the North Sea coast to Baden-Württemberg (with P132).

Project promoters

AMPRION
TRANSNET-BW

Countries

Germany



National development plan(s)

NDP, Germany, Netzentwicklungsplan 2030 Version 2019, Project DC2, p. 363

Additional information on the project

German Grid Development plan (in German):
http://www.netzentwicklungsplan.de/content/der-netzentwicklungsplan-0

Project specific websites (in German):
https://www.amprion.net/Netzausbau/Aktuelle-Projekte/Ultranet/
and
https://www.transnetbw.de/de/ultranet/

The project is also part of the current PCI-List (in English):
http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:JOL_2016_019_R_0001&from=EN

Permitting status in the TYNDP reflects the fact, that the project is approved by the NRA and part of the German Law (so called Bundesbedarfsplangesetz) and therefore the realization is certain. In addition several procedural steps towards the permitting process have started.

http://www.gesetze-im-internet.de/bbplg/BBPlG.pdf
(Page 4, Project Nr. 2).

https://www.netzausbau.de/leitungsvorhaben/de.html?cms_map=2

Project sheet backlog

25 Jan. 2021 - Addition of results for indicator B10 for scenarios DE2030 and GA2030

20 Jan. 2021 - Addition of a note on the cross-border NTC increase of the project. Correction of the value of the internal NTC increase, used for the CBA.

5 Jan. 2021 - Addition of CBA results for the DE2030 scenario

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

Project Description & Context

Project Investments

Main investment(s): New HVDC-lines from Osterath to Philippsburg to integrate new wind generation especially from North Sea towards Central-South Germany for consumption and storage.

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	340	Osterath (DE)	Philippsburg (DE)	In Permitting	2024	Rescheduled	

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.

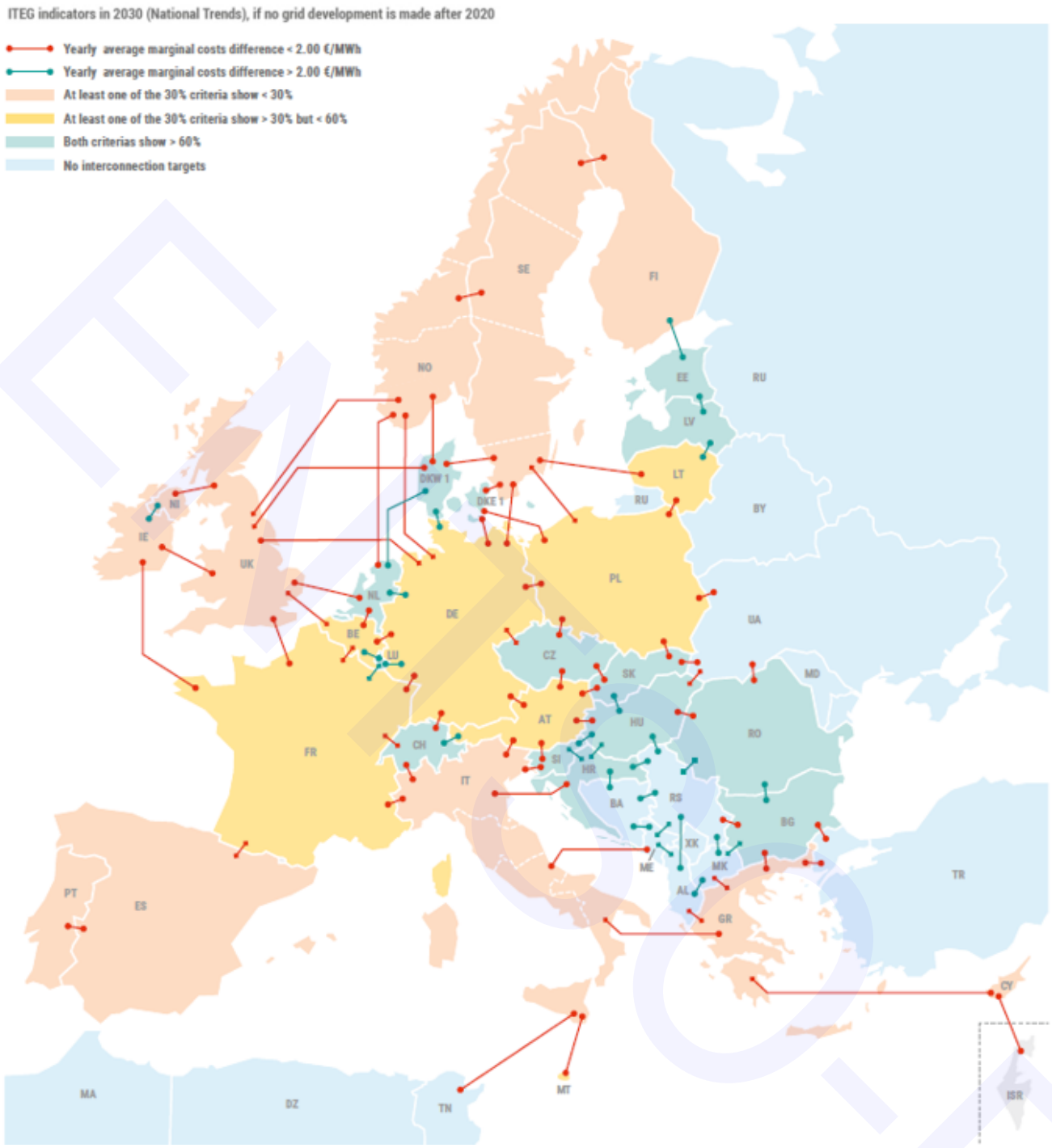
Need		How the project addresses each need (explanation provided by the project promoter(s))
	Infrastructure to facilitate and accommodate future scenarios, cross-border flows or loop flows.	In connection with P132, the planned HVDC connection transports the energy of regenerative Energy sources in northern Germany directly to the demand regions of southern Germany. It strengthens the common German market area through targeted energy transport.
	Reduction of the loop flows occurrence in the borders between CZ-DE, DE-PL, DE-NL, BE-LU, FR-DE	The project reduces loop flows to Germany's neighboring countries by reducing bottlenecks in northern Germany and providing a transport task from western Germany to southern Germany
	Infrastructure designed to enable cost-efficient grid connection of high volumes of RES and/or reduce RES curtailment	The project enables the integration of offshore wind and onshore wind energy in combination with P132 and prevents potential bottlenecks in northern Germany and southern Germany.

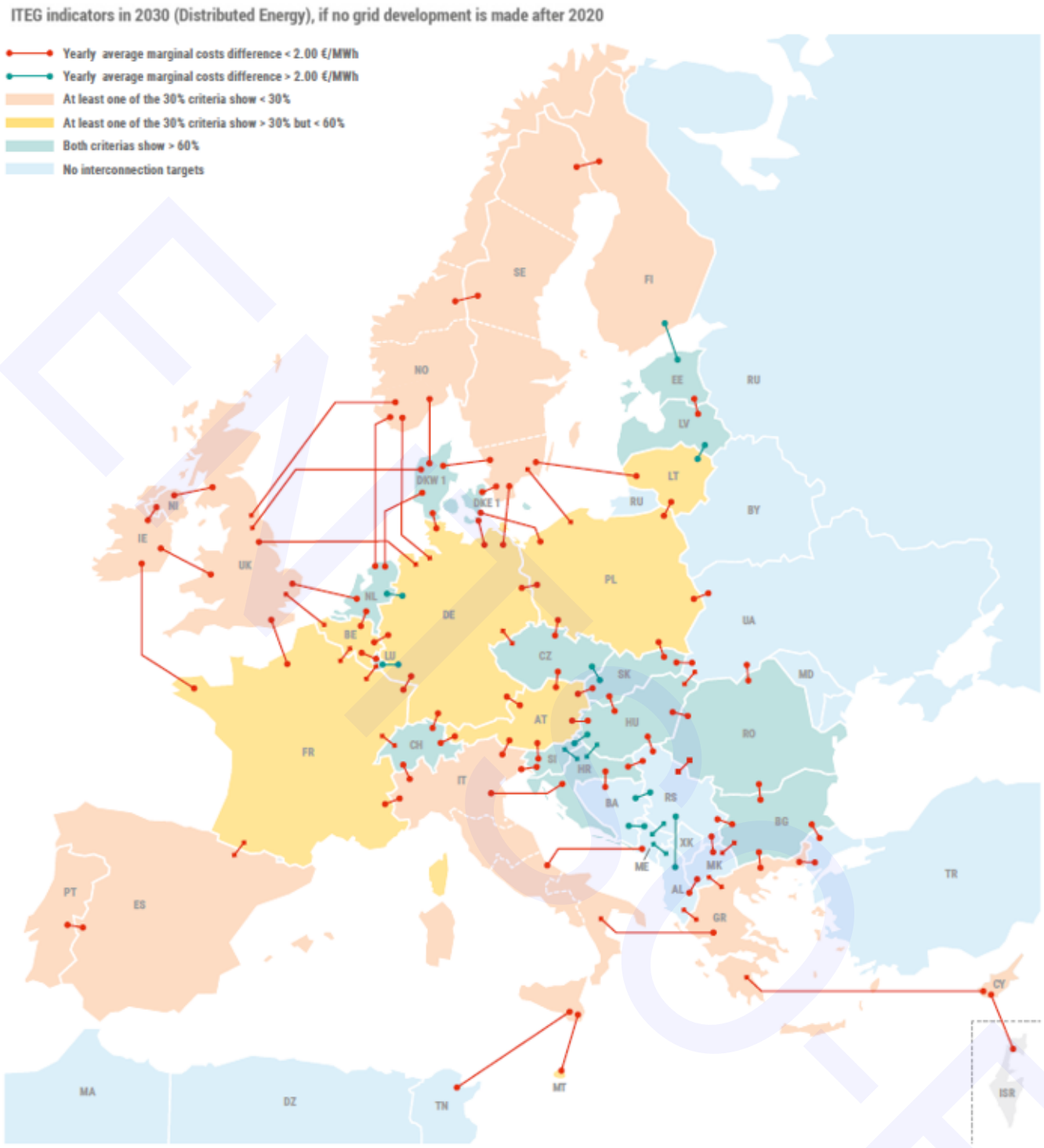
Need		How the project addresses each need (explanation provided by the project promoter(s))
	Infrastructure to improve system flexibility and stability e.g. improve system or local ramp rate, improve transient stability or RoCoF to meet system Needs.	The project contributes significantly to security of supply and grid stability through the widespread integration of renewable energies in northern (wind offshore and onshore) and southern Germany (wind onshore). In particular, the system flexibility is increased by the use of HVDC converter.

Interconnection targets

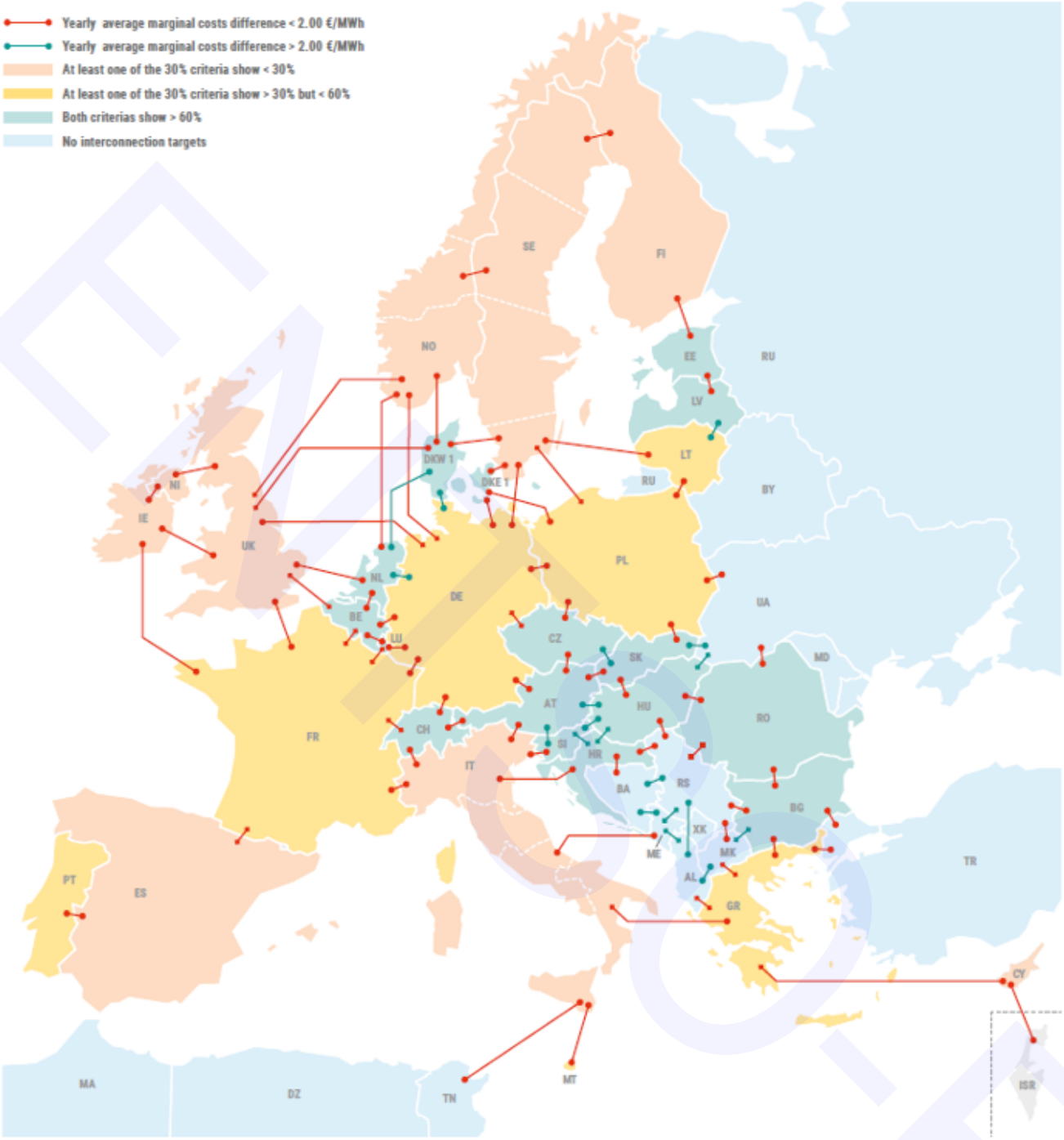
In 2017, the Interconnection Target Expert Group proposed alternative indicators to the 15% interconnection criteria for every country and electrified island with a new methodology developed collaboratively between the European Commission, ENTSO-E, ENTSOG, industry, universities and other experts. The 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 (National Trends), if no grid development is made after 2020
Yearly average marginal costs difference < 2.00 €/MWh
Yearly average marginal costs difference > 2.00 €/MWh
At least one of the 30% criteria show < 30%
At least one of the 30% criteria show > 30% but < 60%
Both criterias show > 60%
No interconnection targets
SE
FI
NO
EE
RU
LV
LT
DKW 1
DKE 1
RU
BY
NI
IE
UK
PL
NL
DE
UA
BE
LU
CZ
SK
MD
AT
HU
RO
FR
CH
SI
HR
IT
BA
RS
BG
XK
ME
MK
AL
TR
PT
ES
GR
CY
MA
DZ
TN
MT
ISR


ITEG indicators in 2030 (Distributed Energy), if no grid development is made after 2020
Yearly average marginal costs difference < 2.00 €/MWh
Yearly average marginal costs difference > 2.00 €/MWh
At least one of the 30% criteria show < 30%
At least one of the 30% criteria show > 30% but < 60%
Both criterias show > 60%
No interconnection targets
SE
FI
NO
EE
RU
LV
LT
DKW 1
DKE 1
RU
BY
NI
IE
UK
PL
NL
DE
UA
BE
LU
CZ
SK
MD
AT
HU
RO
FR
CH
SI
HR
IT
BA
RS
BG
XK
ME
MK
AL
TR
PT
ES
GR
CY
MA
DZ
TN
MT
ISR

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



Project Assessment

Transfer capacity increase (National Trends 2025)

The net transfer capacity increases considered by ENTSO-E to assess this project are indicated below. The project has also a cross-border impact of 600 MW on the borders Germany - Switzerland and Germany – the Netherlands.

	Border	A B	B A
Transfer capacity increase (in MW)	Internal (Germany)	2000	2000

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 is assessed with the internal redispatch methodology. Because this project was assessed with only one tool for the NT scenario, 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	57 57 57	130 130 130	>	>	ENTSO-E assessment

B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	max average min	-9 -9 -9	-16 -16 -16	<	<	ENTSO-E assessment
B1_RES Annual Socio-Economic Welfare increase resulting from RES integration	max average min	4 4 4	19 19 19	>	>	ENTSO-E assessment

Reduction of CO2 and GHG emissions

B4 Non-CO2 emissions (kg/year)

B4a Nitrogen oxides	average	1066512	1973704	n/a	n/a	ENTSO-E assessment
B4b Ammonia	average	-39434	-80104	n/a	n/a	ENTSO-E assessment
B4c Sulfur dioxide	average	1694067	3547520	n/a	n/a	ENTSO-E assessment
B4d Particular matter 5	average	79562	117275	n/a	n/a	ENTSO-E assessment
B4e Particulate matter 10	average	53264	77194	n/a	n/a	ENTSO-E assessment
B4f Non-methane volatile organic compounds	average	-13266	-24596	n/a	n/a	ENTSO-E assessment

B2a Annual CO2 variation from market simulation (ktonnes / year)	max average min	302 302 302	575 575 575	>	>	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	-11 -23 -50	-18 -41 -93	> > <	< > <	ENTSO-E assessment
B2b Annual CO2	average	18	230	n/a	n/a	ENTSO-E

variation due to network losses (ktonnes / year)						assessment
B2b_€ Annual Societal cost variation resulting from CO2 variation from network simulation monetised (M € / year)	CO2 price 60€/ ton 100€/ ton 189€/ ton	-1 -1 -3	-7 -17 -37	n/a	n/a	ENTSO-E assessment

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)	max average min	93 93 93	444 444 444	<	>	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	19	391	n/a	n/a	ENTSO-E assessment
B5_€ Variation of network losses monetised (M€ / year)	average	1	16	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€ /	average	n/a	N/A	>	n/a	ENTSO-E assessment

year)					

B10 Reduction of Necessary Reserve for Redispatch Power Plants	NT2025	NT2030	
In Meuro/year	19	1	This indicator was submitted by the promoter(s). ENTSO-E confirms the consistency of the proposed indicator with the CBA Guideline 3.0. About the computation of this indicator by the project promoter(s)
In MW	950	41	

This indicator was computed based on NT2025 and NT2030, in a study performed by 50Hertz, Amprion, TenneT DE, TransnetBW in 2020. The promoter(s) stated that the submitted value was computed in accordance with the CBA Guideline and explained it as follows:

As the assessment described in this document in each step follows the guidance given in the 3rd CBA Guideline the compliance with it is given. Furthermore, as demanded within the Implementation Guideline for Redispatch Assessment, the German TSOs participated within the 'Sanity check for minimum modelling requirements' coordinated by ENTSO-E. The quality of the study carried out using the IAEW Redispatch tool has therefore been ensured.

The promoter(s) certified that the values submitted and assessed in the study relate to countries located within the ENTSO-E perimeter only.

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	179	161	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction average	-20	-27	ENTSO-E assessment
			ENTSO-E assessment

B1_RES Annual Socio-Economic Welfare increase resulting from RES integration	average	27	23	

Reduction of CO2 and GHG emissions

B2a Annual CO2 variation from market simulation (ktonnes / year)	average	729	963	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	-5 -34 -99	-24 -63 -148	ENTSO-E assessment

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)	average	405	503	ENTSO-E assessment
B3a Connected RES (MW)	-			ENTSO-E assessment

Security of supply

B10 Reduction of Necessary Reserve for Redispatch Power Plants	**DE2030**	**GA2030**	
In Meuro/year	161	0.5	This indicator was submitted by the promoter(s). ENTSO-E confirms the consistency of the proposed indicator with the CBA Guideline 3.0. About the computation of this indicator by the project promoter(s)
In MW	8038	13.5	

This indicator was computed based on DE2030 and GA2030, in a study performed by 50Hertz, Amprion, TenneT DE, TransnetBW in 2020. The promoter(s) stated that the submitted value was

computed in accordance with the CBA Guideline and explained it as follows:

As the assessment described in this document in each step follows the guidance given in the 3rd CBA Guideline the compliance with it is given. Furthermore, as demanded within the Implementation Guideline for Redispatch Assessment, the German TSOs participated within the 'Sanity check for minimum modelling requirements' coordinated by ENTSO-E. The quality of the study carried out using the IAEW Redispatch tool has therefore been ensured.

The promoter(s) certified that the values submitted and assessed in the study relate to countries located within the ENTSO-E perimeter only.

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	204	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	average	-32	ENTSO-E assessment
B1_RES Annual Socio-Economic Welfare increase resulting from RES integration	average	5	ENTSO-E assessment

Reduction of CO2 and GHG emissions

B2a Annual CO2 variation from market simulation (ktonnes / year)	average	1169	ENTSO-E assessment
B2a_€ Annual Societal cost variation resulting from CO2 variation from market simulation monetised (M€ /	CO2 price 60€/ ton 100€/ ton 189€/ ton	-37 -84 -188	ENTSO-E assessment

year)		

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year) average	101	ENTSO-E assessment
B3a Connected RES (MW) -		ENTSO-E assessment

Comments on the CBA results by the project promoter(s)

Comment on CO2 Reduction (B2a): According to the results of the redispatch calculations the project leads to an increase in CO2 emissions. This effect occurs due to the assumptions concerning the reference grid. As mentioned in the project description this project has a close connection to project 132 which is basically the extension to Northern Germany. By assessing the project without the northern part, which is not part of the reference grid, it will mainly transport conventional energy from the Rhineland leading to an increase of CO2 emissions. In case the Northern extension (P132) is factored into the assessment a huge amount of the transported energy will consist of renewable energy (e.g. from offshore and onshore wind) and the CO2 emissions will decrease.

Comment on Impact on grid losses (B5): According to the results of the redispatch calculations the project leads to an increase in grid losses. The project facilitates new power flows in the German grid, in order to shift more energy to the HVDC link and transport it further to the south. As far as the project P132 is not included to the reference grid, these new flows lead to a higher utilization of the AC grid especially in Western Germany which results in the higher amount of grid losses.

Residual impact

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

Residual environmental impact

Investment	Investment status	Distance (km)	Type of sensitivity
HVDC Line A South - Ultranet	In Permitting	12.6	Habitats Directive (92/43/EEC)
		16.7	Birds Directive (2009/147/EC)
		209	Other nature protection areas under national law

Additional information by the project promoter(s)

Due to the current planning stage in which the final routing is not fully known yet, the results must be seen as a result of the preliminary planning. During the planning process the avoidance

of passing through such societal or environmentally sensitive areas is the main issue.

Residual social impact

Investment	Investment status	Distance (km)	Type of sensitivity
HVDC Line A South - Ultranet	In Permitting	4.5	Sensitivity regarding population density - Land that is close to densely populated areas
		15.4	Sensitivity regarding landscape - World Heritage
		183.3	Sensitivity regarding landscape - Land within national parks and areas of outstanding natural beauty
		49.5	Sensitivity regarding landscape - Land with cultural significance

Additional information by the project promoter(s)

Due to the current planning stage in which the final routing is not fully known yet, the results must be seen as a result of the preliminary planning. During the planning process the avoidance of passing through such societal or environmentally sensitive areas is the main issue.

Project Costs

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

	CAPEX (Meuro)	Uncertainty range (%)	OPEX
660. HVDC Line A South - Ultranet	1250	10%	10
Total	1250		10

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

660 These CAPEX are provided as considered within “investment measures“ according to sec. 23 of the German Incentive Regulation Ordinance (Anreizregulierungsverordnung, ARegV). Future variations, also potentially beyond the 20% threshold indicated above at which BnetzA requires the submission of a change-request for the respective investment measure, are possible due to, inter alia, low maturity, new technologies, cable/OHL ratio, tendering results and other unforeseen circumstances.