Project Sheet

HVDC corridor from Northern Germany to Western Germany

Project type	transmission
Project id	1034
Created by	Lea Dehaudt
Created on	Feb 11, 2021 5:06:59 PM

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Key Information

Internal Project
DC transmission line
New

Planned But Not Yet Permitting

Description

Project 1034 consists of two new HVDC cable from Heide/West to Polsum and from Wilhelmshaven to Uentrop. The HVDC have a transfer capacity of 2 GW each. The project is a grid expansion project for low-loss transmission of high power over long distances from Northern Germany to the Ruhr-Area. Northern Germany is characterized by a large number of regenerative onshore and offshore energy sources which exceed the demand of Northern German loads. The Ruhr-Area, however, is a high-production region with large conventional generation capacity that has to be substituted by renewable generation capacity due to the German coal phase-out.

Project promoters

AMPRION
TenneT DE

Countries

Germany

National development plan(s)

Netzentwicklungsplan Strom 2030, Version 2019, 2. Entwurf (Aktualisierung Januar), Germany, 2019, pp. 380-391;
https://www.netzentwicklungsplan.de/de/netzentwicklungsplaene/netzentwicklungsplan-2030-2019

Additional information on the project

Project sheet backlog

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

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

ENTSO-E

Project Description & Context

Project Investments

Main investment(s): HVDC line from Wilhelmshaven to Uentrop to integrate onshore and offshore wind energy in Northern Germany and transport it to the load centers in Western Germany

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	267	Wilhelmshaven	Uentrop	Planned But Not Yet Permitting	2030	New Investment	

Other investments

Description	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
HVDC line from Heide/ West to Polsum to integrate onshore and offshore wind energy in Northern Germany and transport it to the load centers in Western Germany	DC transmission line	407	Heide/ West	Polsum	Planned But Not Yet Permitting	2030	New Investment	

Is the project in the reference grid?

No

System Needs addressed by the project

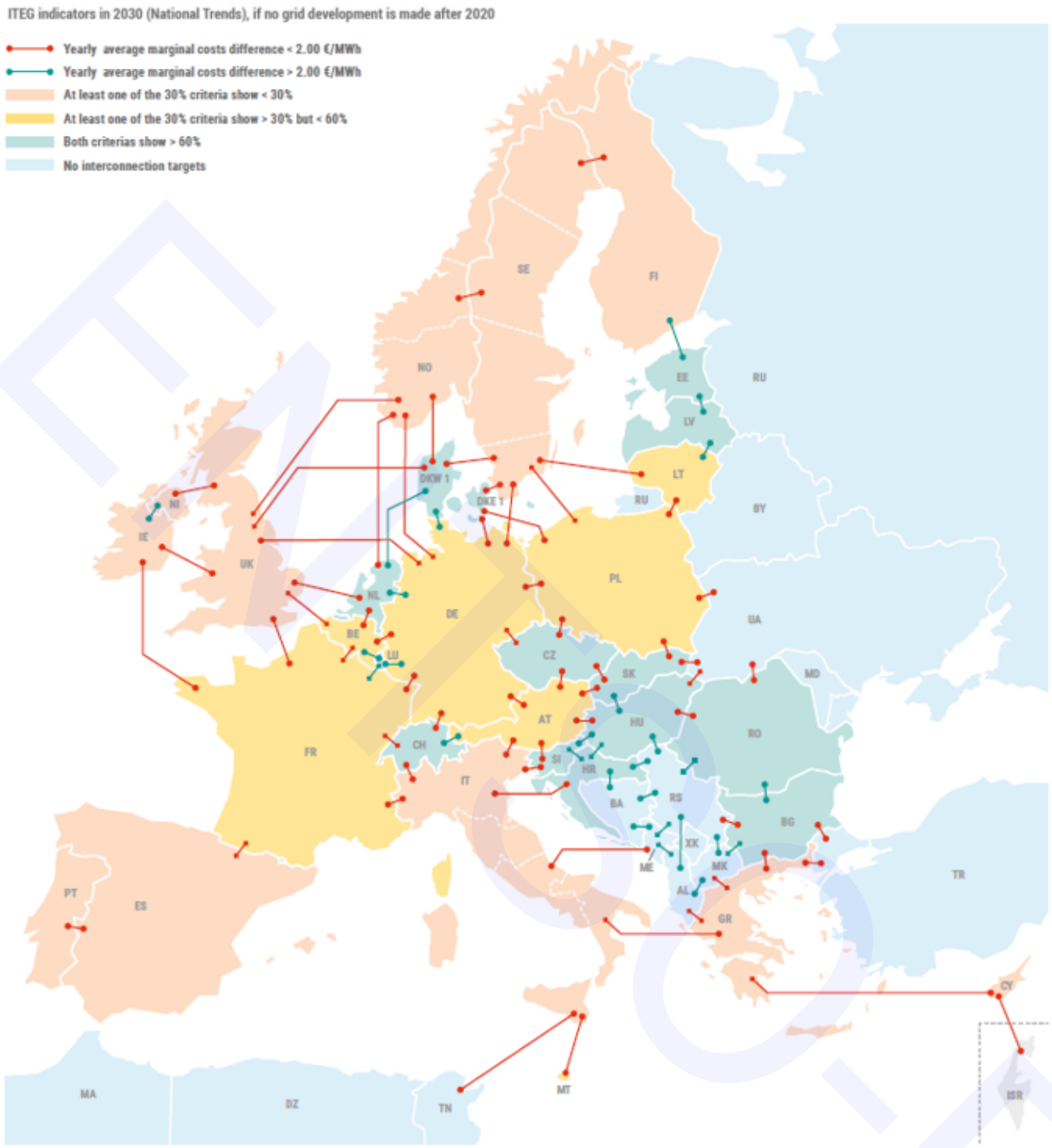
Project promoter(s) selected up to 4 system needs that are addressed by their project in a predefined list. Available needs ranged from reduction of price differentials between countries, improvement of system flexibility and stability, enabling cost-efficient connection of high volumes of RES, improvement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

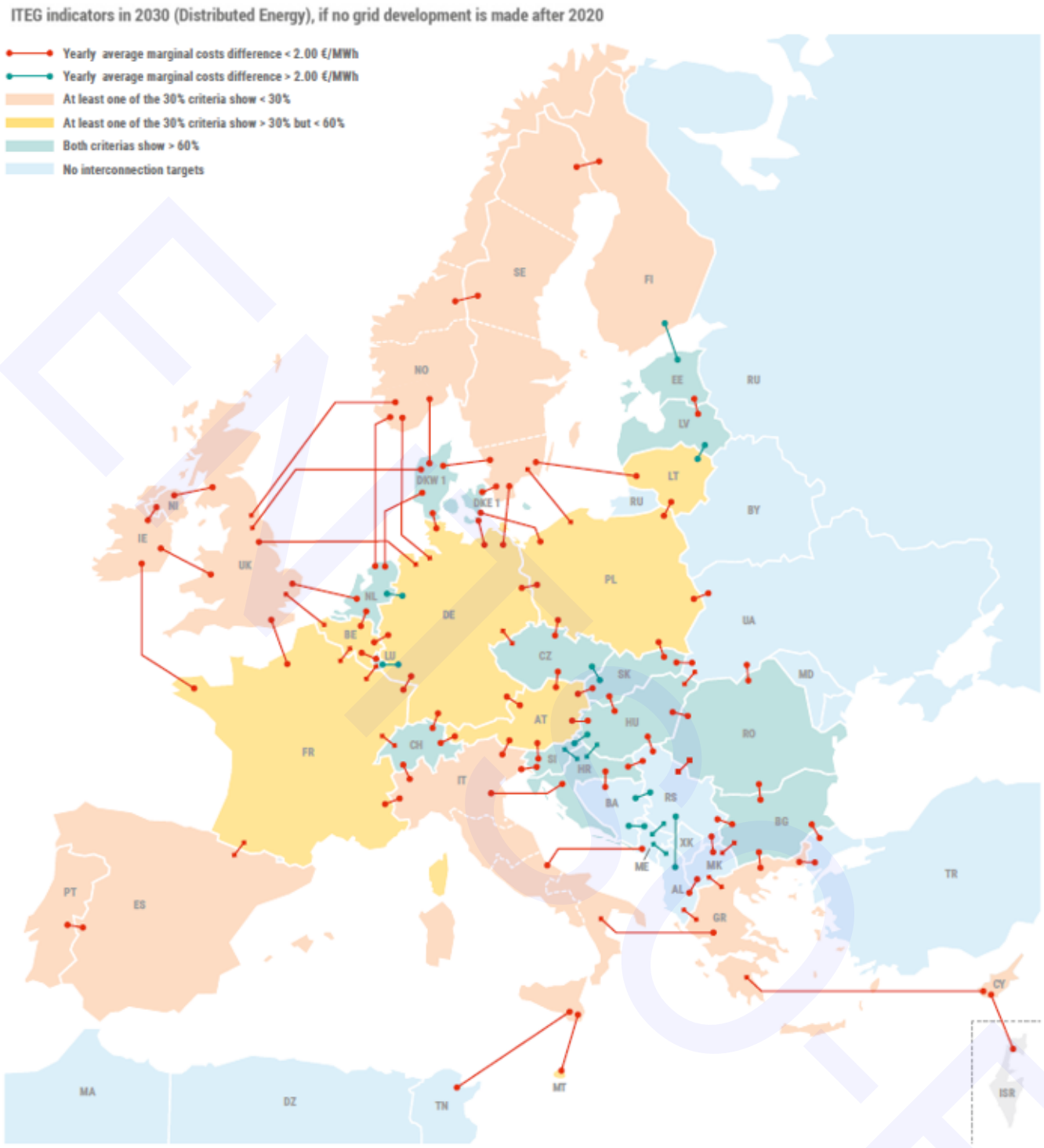
Need		How the project addresses each need (explanation provided by the project promoter(s))
	Infrastructure to improve system flexibility and stability e.g. improve system or local ramp rate, improve transient stability or RoCoF to meet system Needs.	Reducing the redispatch leading to more flexibility and increasing the stability of the system.
	Infrastructure to facilitate and accommodate future scenarios, cross-border flows or loop flows.	In critical grid situations, costly congestion management measures are taken to avoid overload of grid elements. The project will reduce the demand for re-dispatching, countertrading and curtailment of renewable energy producers by adding significant transmission capacity between the congested routes in the North-Western part of Germany
	Infrastructure designed to enable cost-efficient grid connection of high volumes of RES and/or reduce RES curtailment	integration of huge amounts of offshore and onshore wind.

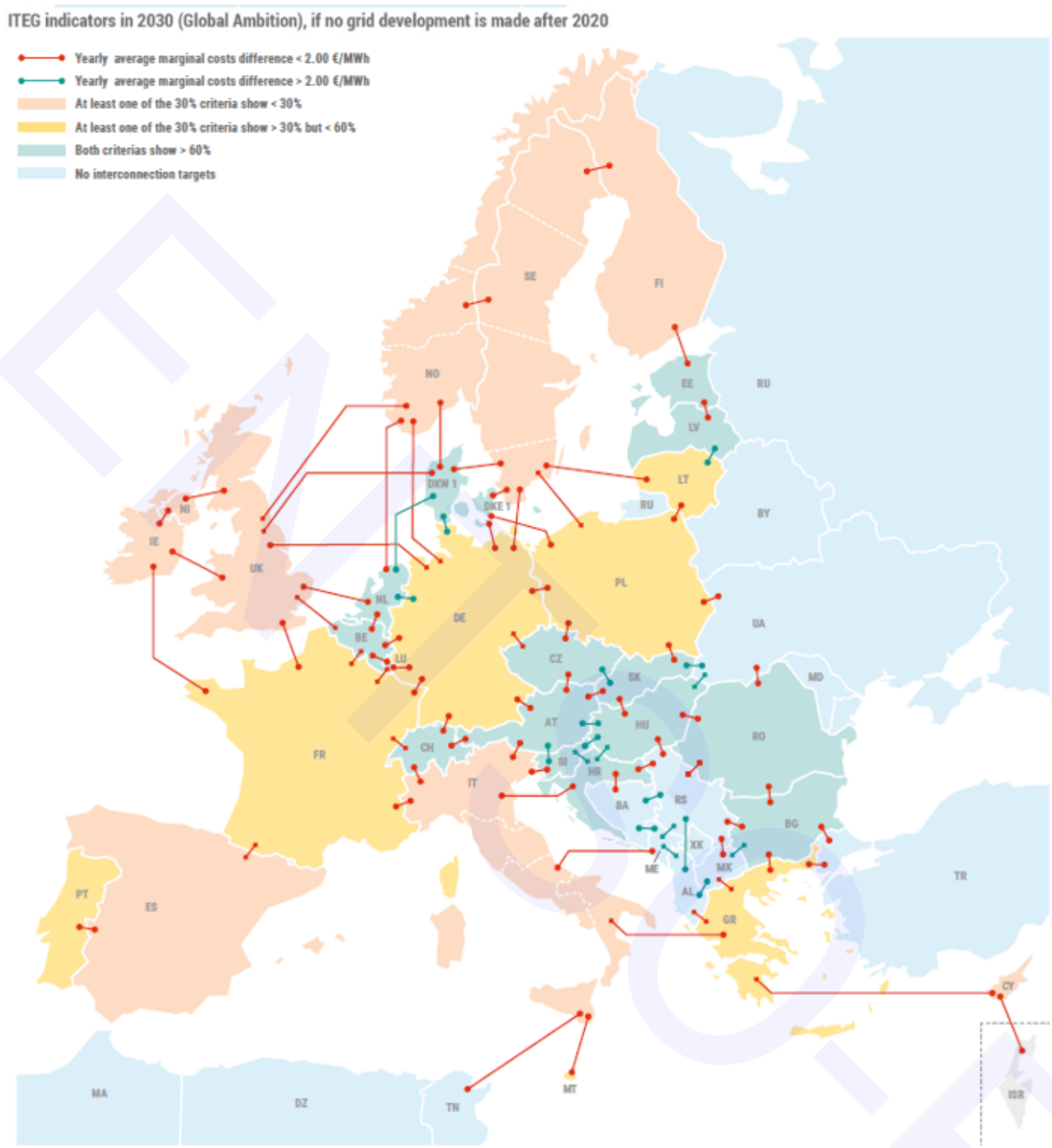
Interconnection targets

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
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
RU
BY
DKW 1
DKE 1
NI
IE
UK
PL
UA
NL
DE
BE
LU
CZ
SK
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AL
TR
PT
ES
GR
CY
MA
DZ
TN
MT
ISR

Project Assessment

Transfer capacity increase (National Trends 2025)

	Border	A B	B A
Transfer capacity increase (in MW)	Internal (Germany)	4000	4000

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	55 55 55	275 275 275	>	>	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2	max average min	11 11 11	60 60 60	>	<	ENTSO-E assessment

emissions reduction						
B1_RES Annual Socio-Economic Welfare increase resulting from RES integration	max average min	31 31 31	188 188 188	<	>	ENTSO-E assessment

Reduction of CO2 and GHG emissions

B4 Non-CO2 emissions (kg/year)

B4a Nitrogen oxides	average	926374	-3908614	n/a	n/a	ENTSO-E assessment
B4b Ammonia	average	20028	-114618	n/a	n/a	ENTSO-E assessment
B4c Sulfur dioxide	average	1532767	-4205656	n/a	n/a	ENTSO-E assessment
B4d Particular matter 5	average	11812	-243283	n/a	n/a	ENTSO-E assessment
B4e Particulate matter 10	average	7598	-159127	n/a	n/a	ENTSO-E assessment
B4f Non-methane volatile organic compounds	average	9594	-35654	n/a	n/a	ENTSO-E assessment

B2a Annual CO2 variation from market simulation (ktonnes / year)	max average min	-407 -407 -407	-2160 -2160 -2160	<	>	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	15 31 68	69 156 348	< < <	< < <	ENTSO-E assessment
B2b Annual CO2 variation due to network losses (ktonnes / year)	average	-295	-65	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	11 23 49	2 5 11	n/a	n/a	ENTSO-E assessment

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)	max average min	707 707 707	4343 4343 4343	>	>	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	-609	-129	n/a	n/a	ENTSO-E assessment
B5_€ Variation of network losses monetised (M€ / year)	average	-26	-4	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

B10 Reduction of Necessary Reserve for Redispatch Power Plants	NT2025	NT2030	
In Meuro/year	5	13	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	234	637	

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	613	408	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	average	68	44	ENTSO-E assessment
B1_RES Annual Socio-Economic Welfare increase resulting	average	66	266	ENTSO-E assessment

from RES integration			

Reduction of CO2 and GHG emissions

B2a Annual CO2 variation from market simulation (ktonnes / year)	average	-2417	-1577	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	17 114 329	39 103 243	ENTSO-E assessment

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)	average	6602	5744	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	232	34	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	11623	1694	

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	303	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	average	13	ENTSO-E assessment
B1_RES Annual Socio-Economic Welfare increase resulting from RES integration	average	118	ENTSO-E assessment

Reduction of CO2 and GHG emissions

B2a Annual CO2 variation from market simulation (ktonnes / year)	average	-446	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	14 32 72	ENTSO-E assessment

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)	average	2481	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
1692. HVDC from Wilhelmshaven to Uentrop	1735	10	13.9
1693. HVDC from Heide/West to Polsum	2646	10	21.2
Total	4381		35.1

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

1692 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.

1693