Project Sheet

HVDC SuedLink Brunsbüttel/Wilster to Großgartach/Grafenrheinfeld

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Key Information

Internal Project
DC transmission line
New

In Permitting

Description

4 GW HVDC connection from Northern Germany (areas of Brunsbüttel/Wilster) to Bavaria / Baden-Württemberg (areas of Großgartach/Grafenrheinfeld). North Germany is characterised by a high amount of RES, the feed-in exceeds the local load and therefore there is a high demand for transfer to the load centres in southern parts of Germany. With the further installation of additional renewable energy, the relevance of this projects increases.

Project promoters

TRANSNET-BW
TenneT DE

Countries

Germany

National development plan(s)

NEP2030 v2019

Additional information on the project

German grid development plan:

http://www.netzentwicklungsplan.de/content/der-netzentwicklungsplan-0

Project specific web page (in German):

https://www.tennet.eu/de/unser-netz/onshore-projekte-deutschland/suedlink/

https://www.transnetbw.de/de/suedlink

3rd PCI-list:

https://ec.europa.eu/energy/sites/ener/files/documents/annex_to_pci_list_final_2017_en.pdf

4th PCI -list:

https://ec.europa.eu/energy/sites/ener/files/c_2019_7772_1_annex.pdf

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. 3 & 4).

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

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 DC-lines to integrate new wind generation from Northern Germany towards Southern Germany and Southern Europe 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	700	Brunsbüttel, Wilster	Großgartach, Grafenrheinfeld	In Permitting	2026	Delayed	Due to complex and long approval process

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

Need		How the project addresses each need (explanation provided by the project promoter(s))
	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.

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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 also has a cross-border impact of 600 MW on the borders Germany - Denmark/West and Germany – Norway.

	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	130 130 130	595 595 595	>	>	ENTSO-E assessment

B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	max average min	-1 -1 -1	93 93 93	>	<	ENTSO-E assessment
B1_RES Annual Socio-Economic Welfare increase resulting from RES integration	max average min	46 46 46	342 342 342	>	>	ENTSO-E assessment

Reduction of CO2 and GHG emissions

B4 Non-CO2 emissions (kg/year)

B4a Nitrogen oxides	average	870337	-3996049	n/a	n/a	ENTSO-E assessment
B4b Ammonia	average	-72197	-286378	n/a	n/a	ENTSO-E assessment
B4c Sulfur dioxide	average	2174508	-572245	n/a	n/a	ENTSO-E assessment
B4d Particular matter 5	average	26190	-443397	n/a	n/a	ENTSO-E assessment
B4e Particulate matter 10	average	17940	-297607	n/a	n/a	ENTSO-E assessment
B4f Non-methane volatile organic compounds	average	-20456	-75018	n/a	n/a	ENTSO-E assessment

B2a Annual CO2 variation from market simulation (ktonnes / year)	max average min	22 22 22	-3333 -3333 -3333	<	>	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	107 240 537	< < >	< < <	ENTSO-E assessment
B2b Annual CO2	average	-480	-62	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	18 37 80	2 4 10	n/a	n/a	ENTSO-E assessment

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)	max average min	1056 1056 1056	7919 7919 7919	>	>	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	-1087	-230	n/a	n/a	ENTSO-E assessment
B5_€ Variation of network losses monetised (M€ / year)	average	-41	1	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	66	97	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	3292	4830	

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	1007	658	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction average	112	75	ENTSO-E assessment
			ENTSO-E assessment

B1_RES Annual Socio-Economic Welfare increase resulting from RES integration	average	693	404	

Reduction of CO2 and GHG emissions

B2a Annual CO2 variation from market simulation (ktonnes / year)	average	-4000	-2678	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	28 188 544	67 174 412	ENTSO-E assessment

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)	average	10515	8725	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	295	94	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	14746	4703	

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.

Non scenario-dependent indicator(s)

B8.0 Stability (Transient, Voltage and Frequency Stability)	Transient stability	Voltage stability	Frequency stability	
HVDC Line C (New HVDC)	++	++	+ (between sync areas)	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	554	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	average	5	ENTSO-E assessment
B1_RES Annual Socio-Economic Welfare increase resulting from RES integration	average	198	ENTSO-E assessment

Reduction of CO2 and GHG emissions

B2a Annual CO2 variation from market simulation (ktonnes / year)	average	-165	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 12 27	ENTSO-E assessment

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)	average	4159	ENTSO-E assessment
B3a Connected RES (MW)	-		ENTSO-E assessment

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

CBA results have been determined in compliance with the draft 3rd CBA guideline and its respective Implementation Guideline for the TYNDP 2020 using a redisptach methodology based on a combination of Market and Network simulations. On top of these results, additional benefits may apply depending on the nature of the project.

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 C	In Permitting	121	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 an upper limit, since 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 C	In Permitting	157	Sensitivity regarding landscape - Other areas protected by 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 an upper limit, since 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
664. HVDC Line C	9560	+-20%	76.5
Total	9560		76.5

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

664 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.