Project Sheet

Muhlbach - Eichstetten

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Key Information

Cross Border Project
AC transmission line
Upgrade

Planned But Not Yet Permitting

Description

Reinforcement of the existing 400kV OHL.

Deployment of a second 400kV circuit at existing double circuit OHL Muhlbach - Eichstetten, instead of the currently operated circuit Eichstetten - Vogelgrun (currently operated with 225kV). Some topological adjustments of the existing grid in the area might prove to be necessary. This also include a transformer in Sierentz substation to balance flows between 225kV and 400kV grid in the area.

Motivation for the project :

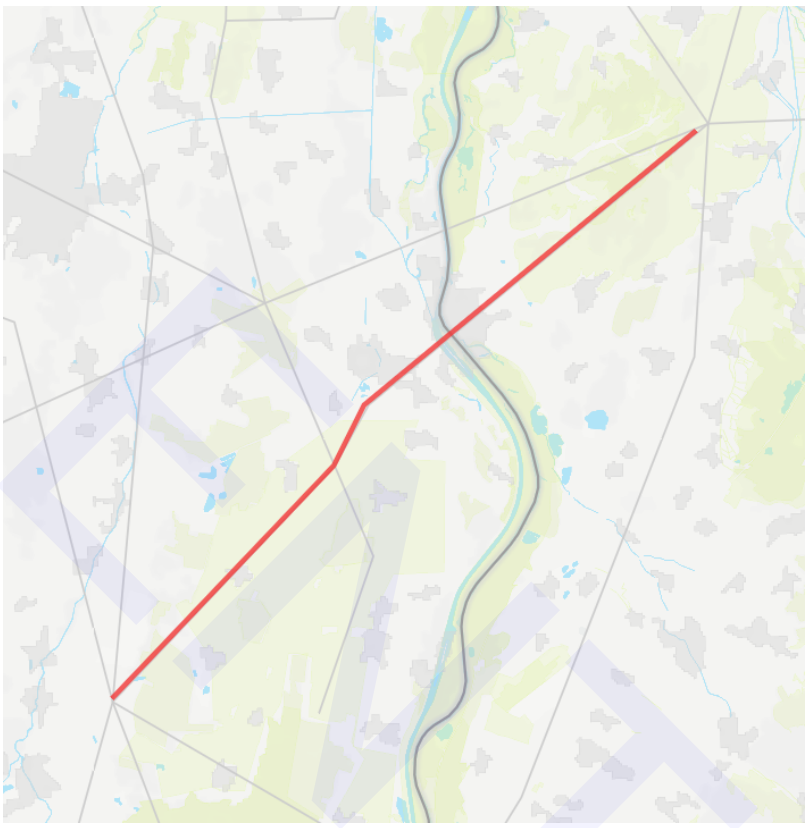
Germany and also the CCS-Region is characterised by a significant increase in RES generation. The grid has to be developed in order to support these new exchange possibilities, facilitating the access to the most economic energy mix, while minimising grid congestions. High flows in both directions West-East and North-South are expected. The project strengthens the European single market. This project increases the interconnector capacity between France and Germany and therefore also the security of supply.

Project promoters

RTE
TRANSNET-BW

Countries

Germany
France



National development plan(s)

NDP1; Netzentwicklungsplan 2030 Version 2019, Germany, Project n°176, p.458 ; NDP2, France, SDDR (Schéma Décennal de Développement du Réseau -Ten Year Network Development Scheme), 2019, project n°880, page 442, https://www.rte-france.com/fr/article/evolution-du-reseau-electrique-francais-l-horizon-2035

Additional information on the project

The project is part of the German National Grid Development Plan 2030, Version 2019, 2nd draft: http://www.netzentwicklungsplan.de/en/front

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): Deployment of a second 400kV circuit at existing double circuit OHL Muhlbach - Eichstetten, instead of the currently operated circuit Eichstetten - Vogelgrun (currently operated with 225kV). Some topological adjustments of the existing grid in the area might prove to be necessary. This also include a transformer in Sierentz substation to balance flows between 225kV and 400kV grid in the area.

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	32	Muhlbach	Eichstetten	Planned But Not Yet Permitting	2025	Investment on time	

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 reduce price differentials between EU and/or non-EU countries	Although this is not the main driver for this project, increase the interconnectivity between the German and French bidding zone give the possibility of higher market exchanges between these two bidding zones leading to a higher price convergence in more hours of the year.
⚖	Infrastructure to address system adequacy deficiencies and/or mitigate the risk of power failures.	France and Germany face decreasing figures of installed conventionals due to reduction or phaseout of nuclear and bad market conditions for other conventionals. The interconnector contributes to meet

Need		How the project addresses each need (explanation provided by the project promoter(s))
		adequacy not only in both countries but also in the entire CWE region.
	Infrastructure designed to enable cost-efficient grid connection of high volumes of RES and/or reduce RES curtailment	Rising figures of RES capacities especially in Germany lead to increasing RES-curtailment in the coming decades. This interconnector project allows a higher export in hours of high RES infeed particularly in Western Germany.
	Reduction of the loop flows occurrence in the borders between CZ-DE, DE-PL, DE-NL, BE-LU, FR-DE	Flows on 380kV OHL could be adjusted with both PSTs installed in Muhlbach substation rather than current 220kV interconnector.

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.

ENTSOE

ENTSOE

ENTSOE

Project Assessment

Transfer capacity increase (National Trends 2025)

	Border	A B	B A
Transfer capacity increase (in MW)	Germany - France	300	300

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	10 8 7	32 30 29	>	>	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	max average min	4 2 0	14 12 11	>	>	ENTSO-E assessment
B1_RES Annual Socio-Economic	max average	4 3	12 12	<	<	ENTSO-E assessment

Welfare increase resulting from RES integration	min	3	11			

Reduction of CO2 and GHG emissions

B4 Non-CO2 emissions (kg/year)

B4a Nitrogen oxides	average	-278	-734	n/a	n/a	ENTSO-E assessment
B4b Ammonia	average	-9	-15	n/a	n/a	ENTSO-E assessment
B4c Sulfur dioxide	average	-328	-741	n/a	n/a	ENTSO-E assessment
B4d Particular matter 5	average	689	4769	n/a	n/a	ENTSO-E assessment
B4e Particulate matter 10	average	-14	-38	n/a	n/a	ENTSO-E assessment
B4f Non-methane volatile organic compounds	average	702	4823	n/a	n/a	ENTSO-E assessment

B2a Annual CO2 variation from market simulation (ktonnes / year)		max average min	-17 -85 -160	-383 -436 -497	< 	< 	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	3 7 14	14 31 70	< < >	< < >	ENTSO-E assessment
B2b Annual CO2 variation due to network losses (ktonnes / year)		average	51	48	n/a	n/a	ENTSO-E assessment
B2b_€ Annual Societal cost variation resulting from	CO2 price	60€/ ton 100€/	-2 -4 -9	-2 -3 -8	n/a	n/a	ENTSO-E assessment

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

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)	max average min	87 72 56	339 311 285	<	<	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	110	209	n/a	n/a	ENTSO-E assessment
B5_€ Variation of network losses monetised (M€ / year)	average	4	4	n/a	n/a	ENTSO-E assessment

Security of supply

B6 Annual reduction in Energy Not Served (MWh / year)	max average min		675	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	6.75	>	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	62	38	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	average	32	17	ENTSO-E assessment
B1_RES Annual Socio-Economic Welfare increase resulting from RES integration	average	8	11	ENTSO-E assessment
Reduction of CO2 and GHG emissions				
B2a Annual CO2 variation from market simulation (ktonnes / year)	average	-609	-479	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 29 83	12 31 74	ENTSO-E assessment
Integration of renewable energy sources				
B3 Annual avoided curtailment (RES integration) (GWh / year)	average	167	244	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	
Muhlbach Eichstetten (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	13	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	5	ENTSO-E assessment

Reduction of CO2 and GHG emissions

B2a Annual CO2 variation from market simulation (ktonnes / year)	average	-154	ENTSO-E assessment
B2a_€ Annual Societal cost variation resulting from CO2 variation from market	CO2 price 60€/ton 100€/ton 189€/	5 11 25	ENTSO-E assessment

simulation monetised (M€ / year)	ton		

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)	average	92	ENTSO-E assessment
B3a Connected RES (MW)	-		ENTSO-E assessment

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

The German-French border belongs to a very densely meshed region (CWE region: Belgium, Netherlands, Germany, France) where exchange capacities between countries are highly dependent on each other.

Delta NTC calculation performed within the framework of this TYNDP show several interactions between the reinforcement projects of the German-French border –projects 228 and 244 – and also with other boundaries. Thus:

• in the direction France to Germany, the main critical branches are Vigy-Ensdorf-Uchtelfangen lines. The implementation of Dynamic line ratings (DLR) on these lines as a first step and of project 244 as a longer term step will directly increase the exchange capacity. The project 228 will first have a more indirect effect by alleviating the flows on the main critical branches. After the commissioning of several internal reinforcements and PSTs in Germany and the implementation of the DLR on Vigy-Ensdorf-Uchtelfangen lines, which are all scheduled within the same timeframe, the project 228 will achieve its full potential. Indeed it will have a more direct impact on exchange capacity as Mulhbach-Eichstetten will become more often the critical branch.

• in the direction Germany to France, the congestions are more widespread between the French, German, Belgium and Netherlands borders. Thus, to reach their full potential, project 228 and 244 need to alleviate congestions in the West corridor of the CWE region. The implementation of dynamic line ratings, the use of controllable devices such as PSTs, as well as other TYNDP projects scheduled within the same timeframe, will allow to capture the full potential of these projects to increase exchange capacity.

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

Note based on CBA Guideline 3.0: Given that the actual route of the project might not be defined due to the low degree of maturity of its investment(s), an environmental assessment is not yet

available.

Additional information by the project promoter(s)

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Residual social impact

Investment	Investment status	Distance (km)	Type of sensitivity

Note based on CBA Guideline 3.0: Given that the actual route of the project might not be defined yet because of the low degree of maturity of its investment(s), a residual social impact assessment is not yet available.

Additional information by the project promoter(s)

Note based on CBA Guideline 3.0: Given that the actual route of the project might not be defined due to the low degree of maturity of its investment(s), a residual social assessment is not yet available

Project Costs

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

	CAPEX (Meuro)	Uncertainty range (%)	OPEX
1231. Muhlbach Eichstetten	67	10%	0.7
Total	67		0.7

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

1231 Uncertainty range is needed due to uncertainties in material costs and permitting issues and unknown final routing in case of projects in early planning status.