Project Sheet

Reinforcements Ring NL phase I

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Key Information

Internal Project
AC transmission line
Upgrade

In Permitting

Description

Upgrade of existing 380kV circuits in the Dutch main ring from 2,5 kA to 4 kA.

Project promoters

TENNET-NL

Countries

Netherlands

National development plan(s)

Samenvatting KCD 2017, The Netherlands,
https://www.tennet.eu/fileadmin/user_upload/Company/Publications/Technical_Publications/Dutch/TenneT_KCD2017_samenvatting.pdf

Additional information on the project

All investements in this project are related to the upgrade of the main 380 kV ring structure in the Netherlands.

https://www.tennet.eu/nl/ons-hoogspanningsnet/onshore-projecten-nederland/beter-benutten-bestaande-380kv/

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): Upgrade of existing 380kV circuits between Diemen, Lelystad and Ens from 2* 2,5 kA to 2* 4kA circuits by replacing the conductors with HTLS conductors

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	75	Diemen	Ens	Under Construction	2022	Rescheduled	

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
Upgrade of existing 380kV circuits between Ens and Zwolle from 2* 2,5 kA to 2* 4kA circuits by replacing the conductors with HTLS conductors	AC transmission line	32	Ens	Zwolle	In Permitting	2024	Rescheduled	
Upgrade of existing 380kV circuits between Krimpen and Geertruidenberg from 2* 2,5 kA to 2* 4kA circuits by replacing the	AC transmission line	35	Krimpen	Geertruidenberg	In Permitting	2023	Rescheduled	

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
conductors with HTLS conductors								
Upgrade of existing 380kV circuits between Eindhoven and Maasbracht from 2* 2,5 kA to 2* 4kA circuits by replacing the conductors with HTLS conductors	AC transmission line	50	Eindhoven	Maasbracht	In Permitting	2025	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 reduce price differentials between EU and/or non-EU countries	Upgrade of the internal grid via this project will help facilitated increase of cross-border exchange capacity between different bidding zones reducing thus the price differentials
	Infrastructure to facilitate and accommodate future scenarios, cross-border flows or loop flows.	The upgrade of the internal grid will solve congestions due to new power flow patterns for which the grid was not designed for.
	Infrastructure designed to enable cost-efficient grid connection of high volumes of RES and/or reduce RES curtailment	Connection of high volumes of RES in the future will create high flows for which the grid was not designed for. Upgrading the grid via this project will help transport power from the generation sites to

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

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)

	Border	A B	B A
Transfer capacity increase (in MW)	Germany - Netherlands	600	600

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	2 1 1	14 9 7	<	<	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	max average min	0 0 -3	7 5 3	<	>	ENTSO-E assessment
B1_RES Annual Socio-Economic	max average	1 0	7 6	<	<	ENTSO-E assessment

Welfare increase resulting from RES integration	min	0	5			

Reduction of CO2 and GHG emissions

B4 Non-CO2 emissions (kg/year)

B4a Nitrogen oxides	average	-26	-44	n/a	n/a	ENTSO-E assessment
B4b Ammonia	average	-1	7	n/a	n/a	ENTSO-E assessment
B4c Sulfur dioxide	average	-61	19	n/a	n/a	ENTSO-E assessment
B4d Particular matter 5	average	-28	660	n/a	n/a	ENTSO-E assessment
B4e Particulate matter 10	average	1	2	n/a	n/a	ENTSO-E assessment
B4f Non-methane volatile organic compounds	average	-30	671	n/a	n/a	ENTSO-E assessment

B2a Annual CO2 variation from market simulation (ktonnes / year)		max average min	142 20 -17	-109 -162 -249	>	<	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 -3	5 12 26	< < <	>>>	ENTSO-E assessment
B2b Annual CO2 variation due to network losses (ktonnes / year)		average	4	8	n/a	n/a	ENTSO-E assessment
B2b_€ Annual Societal cost variation resulting from	CO2 price	60€/ ton 100€/	0 0 -1	0 -1 -1	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	13 7 0	175 152 126	<	<	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	9	34	n/a	n/a	ENTSO-E assessment
B5_€ Variation of network losses monetised (M€ / year)	average	0	1	n/a	n/a	ENTSO-E assessment

Security of supply

B6 Annual reduction in Energy Not Served (MWh / year)	max average min		7	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	0.07	>	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	3	8	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	average	4	9	ENTSO-E assessment
B1_RES Annual Socio-Economic Welfare increase resulting from RES integration	average	1	2	ENTSO-E assessment

Reduction of CO2 and GHG emissions

B2a Annual CO2 variation from market simulation (ktonnes / year)	average	-83	-243	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 11	6 16 37	ENTSO-E assessment

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)	average	27	43	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	
Diemen-Lelystad-Ens (AC line high temperature conductor/ conductor replacement (e.g., duplex to triplex))	-	-	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.
Ens-Zwolle (AC line high temperature conductor/ conductor replacement (e.g., duplex to triplex))	-	-	0	
Krimpen-Geertruidenberg (AC line high temperature conductor/conductor replacement (e.g., duplex to triplex))	-	-	0	
Eindhoven-Maasbracht (AC line high temperature conductor/conductor replacement (e.g., duplex to triplex))	-	-	0	

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	3	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	average	0	ENTSO-E assessment
B1_RES Annual Socio-Economic Welfare increase resulting	average	1	ENTSO-E assessment

from RES integration		

Reduction of CO2 and GHG emissions

B2a Annual CO2 variation from market simulation (ktonnes / year) average	16	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 -1 -3	ENTSO-E assessment

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year) average	16	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
1488. Diemen-Lelystad-Ens	105	+/- 10%	1
1490. Ens-Zwolle	41	+/- 10%	0.4
1539. Krimpen-Geertruidenberg	41	+/- 10%	0.4
1540. Eindhoven-Maasbracht	50	+/- 10%	0.5
Total	237		2.3

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

1488

1490

1539

1540

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