Project Sheet

Internal Belgian Backbone Center-East: HTLS upgrade Massenhoven-VanEyck-Gramme-Courcelles-Bruegel-Mercator

Project type	transmission
Project id	252
Created by	
Created on	Feb 12, 2021 9:45:26 AM

Index

Key Information 3
Description 3
Project Description & Context 5
Project Investments 5
System Needs addressed by the project 6
Interconnection targets 7
Project Assessment 11
Transfer capacity increase (National Trends 2025) 11
CBA results 11
Central scenario: National Trends 11
Scenarios: Distributed Energy & Global Ambition 14
Non scenario-dependent indicator(s) 15
Sensitivity Study: Current Trends 15
Residual impact 17
Project Costs 17

ENTSOE

Key Information

Internal Project
AC transmission line
Upgrade

Under Consideration

Description

This project structurally strenghtens the central & eastern part of the internal Belgian backbone. The current conductors on the 380kV ring Massenhoven-VanEyck-Gramme-Courcelles-Bruegel-Mercator-Massenhoven will be replaced by HTLS conductors. The implementation starts with the upgrade of the Massenhoven-VanEyck section by 2024 as this is the weakest link only having 1 conductor at the moment. It then follows a phased approach running up to 2035. Phasing is subject to optimalisation in function of outage constraints (operational secutiry) and the evolution of the production park.

Project motivation:

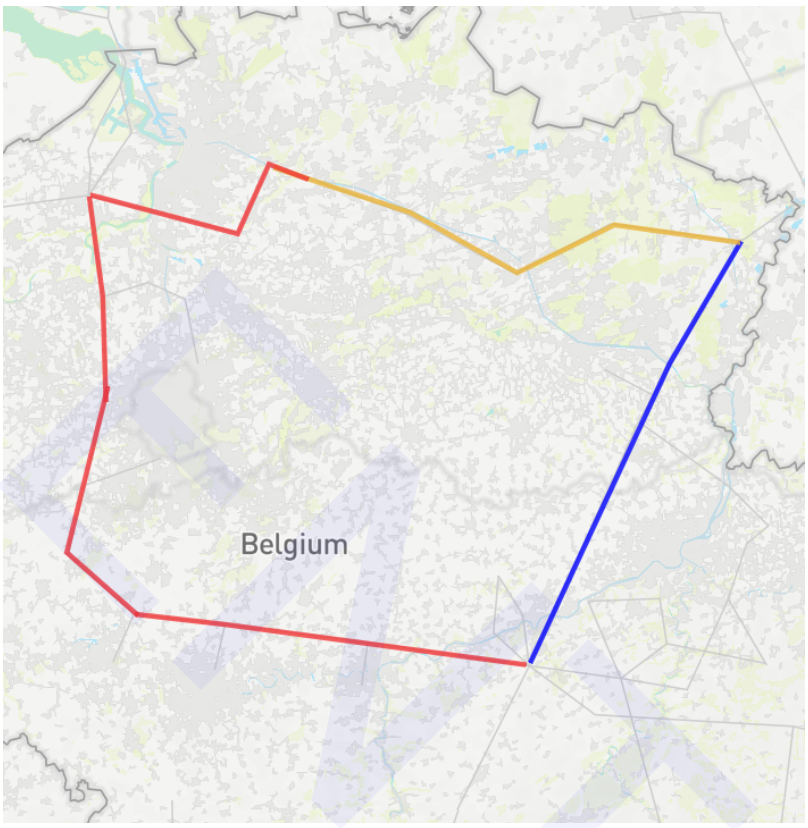
This upgrade will be key to sustain price convergence whilst the power flows become increasingly more volatile and international. Where in the past the location of generation and load centers was quite stable over time, this will be much less the case with the future energy mix characterized by RES geographically spread out over Europe. Depending on the climatic conditions, flows can come from the north, east, south or west, and even change several times per day as wind fronts and clouds move from one hour to the next. Upgrading the existing internal corridors also ensures the potential to integrate new large power plants domestically. RES integration implies higher flows in the meshed AC-grid and thus increases the need for internal transmission capacity. This project satisfies this need in a cost-efficient manner.This project contributes to adequacy, as both new grid hosting capacity is created & as it supports other projects intending to increase cross border transmission capacity, and in particular for Belgium considering the nuclear phaseout.

Project promoters

ELIA

Countries

Belgium



National development plan(s)

NDP1, Belgium, 2020-2030, §4.1.3

Additional information on the project

More information about the projects can be found following these links:

- HTLS-upgrade Massenhoven-Van Eyck:
https://www.elia.be/en/infrastructure-and-projects/infrastructure-projects/massenhoven-van-eyck

- National Development Plan:
https://www.elia.be/-/media/project/elia/elia-site/infra-and-projects/investment-plans/federal-development-plan-2020-2030/nl/20190516_federaal-ontwikkelingsplan_nl.pdf?la=en

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): Installation of a second circuit (in HTLS) and upgrade of existing circuit to HTLS

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	90	Massenhoven (BE)	Van Eyck (BE)	In Permitting	2024	Investment on time	

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 this double-circuit axis to HTLS conductors. Note that recently installed conductors along this axis anticipated the future HTLS upgrade, they don't have to be further upgraded.	AC transmission line	90	Van Eyck	Gramme	Under Consideration	2029	Investment on time	
Upgrade of this double-circuit axis to HTLS conductors	AC transmission line	60	Gramme	Courcelles	Planned But Not Yet Permitting	2033	Investment on time	

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 this double-circuit axis to HTLS conductors	AC transmission line	47	Bruegel	Courcelles	Planned But Not Yet Permitting	2035	Investment on time	
Upgrade of this double-circuit axis to HTLS conductors	AC transmission line	16	Mercator	Bruegel	Planned But Not Yet Permitting	2025	Investment on time	
Upgrade of this double-circuit axis to HTLS conductors	AC transmission line	36	Mercator	Massenhoven	Planned But Not Yet Permitting	2030	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	The upgrade of the backbone ring will unlock the full potential of future cross border capacity investments allowing higher market exchanges between bidding zones and 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.	This project contributes to adequacy, as both new grid hosting capacity is created and as it supports other projects intending to increase cross border transmission capacity, and in particular for Belgium considering the nuclear phase out.

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.	This project contributes to resolving internal congestions, considering expected increased market exchanges which induce higher flows.
	Infrastructure designed to enable cost-efficient grid connection of high volumes of RES and/or reduce RES curtailment	RES integration implies higher flows in the meshed AC-grid and thus increases the need for internal transmission capacity. This project satisfies this need in a cost-efficient manner.

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)	Internal (Belgium)	1500	1500

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.

Because its planned commissioning date is in 2035 or later, this project has only been assessed in the 2030 scenarios and based on a subset of CBA indicators.

This project was assessed with the internal redispatch methodology. Because this project was assessed with one tool only, 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	0 0 0	22 22 22	< 	< 	ENTSO-E assessment
B1_CO2 Annual Socio-Economic	max average	0 0	4 4	><	><	ENTSO-E assessment

Welfare increase resulting from CO2 emissions reduction	min	0	4			
B1_RES Annual Socio-Economic Welfare increase resulting from RES integration	max average min	0 0 0	11 11 11	<	<	ENTSO-E assessment

Reduction of CO2 and GHG emissions

B4 Non-CO2 emissions (kg/year)

B4a Nitrogen oxides	average	-997	-997	n/a	n/a	ENTSO-E assessment
B4b Ammonia	average	-116	-116	n/a	n/a	ENTSO-E assessment
B4c Sulfur dioxide	average	-27	-27	n/a	n/a	ENTSO-E assessment
B4d Particular matter 5	average	-80	-80	n/a	n/a	ENTSO-E assessment
B4e Particulate matter 10	average	-51	-51	n/a	n/a	ENTSO-E assessment
B4f Non-methane volatile organic compounds	average	-35	-35	n/a	n/a	ENTSO-E assessment

B2a Annual CO2 variation from market simulation (ktonnes / year)	max average min	0 0 0	-137 -137 -137	>	<	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	0 0 0	4 10 22	< < <	< > >	ENTSO-E assessment
B2b Annual CO2 variation due to network losses	average	0	0	n/a	n/a	ENTSO-E assessment

(ktonnes / year)						
B2b_€ Annual Societal cost variation resulting from CO2 variation from network simulation monetised (M € / year)	CO2 price	60€/ ton 100€/ ton 189€/ ton	0 0 0	0 0 0	n/a	n/a	ENTSO-E assessment

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)	max average min	0 0 0	281 281 281	<	<	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	0	0	n/a	n/a	ENTSO-E assessment
B5_€ Variation of network losses monetised (M€ / year)	average	0	0	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

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	10	15	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	average	6	6	ENTSO-E assessment
B1_RES Annual Socio-Economic Welfare increase resulting from RES integration	average	8	9	ENTSO-E assessment
Reduction of CO2 and GHG emissions				
B2a Annual CO2 variation from market simulation (ktonnes / year)	average	-121	-175	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 6 16	4 11 27	ENTSO-E assessment
Integration of renewable energy sources				
B3 Annual avoided curtailment (RES integration) (GWh / year)	average	152	209	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	
Van Eyck - Gramme: HTLS upgrade (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.
Massenhoven - Van Eyck: HTLS upgrade (AC line high temperature conductor/ conductor replacement (e.g., duplex to triplex))	-	-	0	
Gramme - Courcelles: HTLS upgrade (AC line high temperature conductor/ conductor replacement (e.g., duplex to triplex))	-	-	0	
Bruegel - Courcelles: HTLS upgrade (AC line high temperature conductor/ conductor replacement (e.g., duplex to triplex))	-	-	0	
Mercator - Bruegel: HTLS upgrade (AC line high temperature conductor/ conductor replacement (e.g., duplex to triplex))	-	-	0	
Mercator - Massenhoven: HTLS upgrade (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	1	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	1	ENTSO-E assessment

Reduction of CO2 and GHG emissions

B2a Annual CO2 variation from market simulation (ktonnes / year)	average	-175	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	6 13 28	ENTSO-E assessment

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)	average	20	ENTSO-E assessment
B3a Connected RES (MW)	-		ENTSO-E assessment

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

The reinforcement of the high voltage backbone with HTLS conductors will enable integration of future XB interconnections as well as respect of the Clean Energy Package requirement for a RAM of minimally 70%. The project also increases the grid hosting capacity which is a.o.

important in the framework of security of supply.

The calculated benefits are considered a lower bound of the full value to be captured, since the redispatch simulations do not yet take into account the realization of additional interconnection capacity, nor potential future additional on/offshore RES.

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
Massenhoven - Van Eyck: HTLS upgrade	In Permitting	23	Habitats Directive (92/43/EEC)
		23	Birds Directive (2009/147/EC)
Mercator - Bruegel: HTLS upgrade	Planned But Not Yet Permitting	1.5	Habitats Directive (92/43/EEC)
		1.5	Birds Directive (2009/147/EC)

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.

Residual social impact

Investment	Investment status	Distance (km)	Type of sensitivity
Massenhoven - Van Eyck: HTLS upgrade	In Permitting	32	Sensitivity regarding population density - Land that is close to densely populated areas
Mercator - Bruegel: HTLS upgrade	Planned But Not Yet Permitting	15	Sensitivity regarding population density - Land that is close to densely populated areas

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.

Project Costs

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

	CAPEX (Meuro)	Uncertainty range (%)	OPEX
1050. Van Eyck - Gramme: HTLS upgrade	140	25%	0.4

	CAPEX (Meuro)	Uncertainty range (%)	OPEX
1456. Massenhoven - Van Eyck: HTLS upgrade	120	25%	0.4
1515. Gramme - Courcelles: HTLS upgrade	150	25%	0.3
1516. Bruegel - Courcelles: HTLS upgrade	110	25%	0.2
1517. Mercator - Bruegel: HTLS upgrade	80	25%	0.1
1676. Mercator - Massenhoven: HTLS upgrade	70	25	0.2
Total	670		1.6

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

1050	Considering project status, significant uncertainties exist regarding CAPEX estimations. These uncertainties are estimated based on both historic experience for similar projects and on present uncertainties regarding choice of final grid solution and related material/ resources costs.
1456	Considering project status, significant uncertainties exist regarding CAPEX estimations. These uncertainties are estimated based on both historic experience for similar projects and on present uncertainties regarding choice of final grid solution and related material/ resources costs.
1515	Considering project status, significant uncertainties exist regarding CAPEX estimations. These uncertainties are estimated based on both historic experience for similar projects and on present uncertainties regarding choice of final grid solution and related material/ resources costs.
1516	Considering project status, significant uncertainties exist regarding CAPEX estimations. These uncertainties are estimated based on both historic experience for similar projects and on present uncertainties regarding choice of final grid solution and related material/ resources costs.
1517	Considering project status, significant uncertainties exist regarding CAPEX estimations. These uncertainties are estimated based on both historic experience for similar projects and on present uncertainties regarding choice of final grid solution and related material/ resources costs.
1676	Considering project status, significant uncertainties exist regarding CAPEX estimations. These uncertainties are estimated based on both historic experience for similar projects and on present uncertainties regarding choice of final grid solution and related material/ resources costs.