Project Sheet

Slovenia-Hungary/Croatia interconnection

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Key Information

Cross Border Project
AC transmission line
Mostly New

PCI number 3.9.1 (4th list, 31 Oct. 2019)
Under Construction

Description

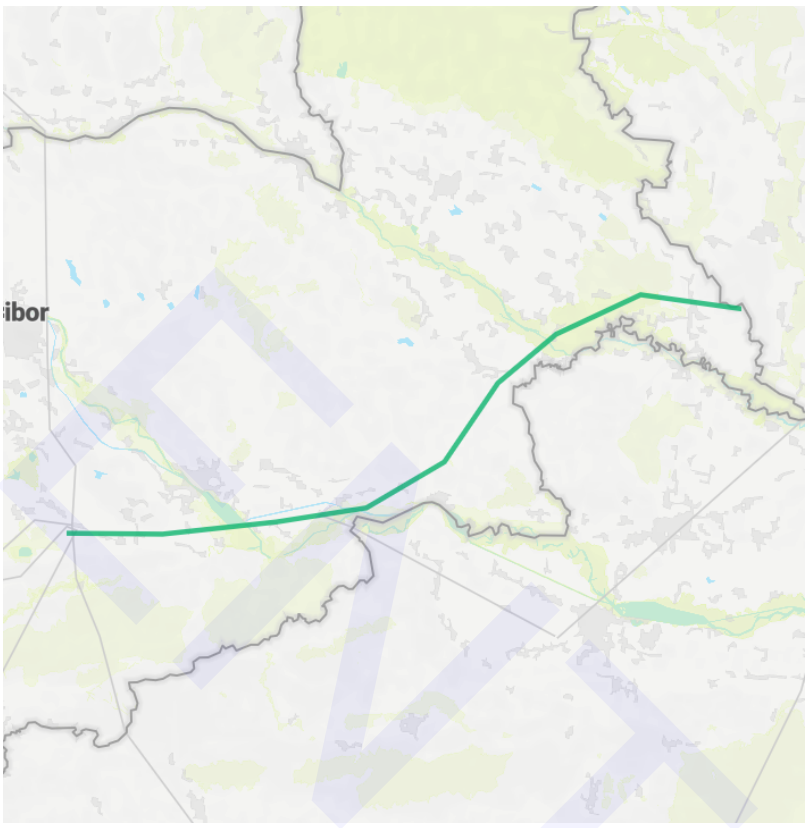
The project consists of a new 80km double circuit 400kV OHL in Slovenia (section Cirkovce-Pince) and a new 400 kV substation of Cirkovce(SI). The new double 400 kV overhead line will be connected to one circuit of the existing double circuit 400kV OHL Heviz(HU)-Zerjavinec(HR). By this two new cross-border lines will be established - Heviz(HU)-Cirkovce(SI) and Cirkovce (SI)-Zerjavinec (HR).

Project promoters

ELES
HOPS
MAVIR

Countries

Croatia
Hungary
Slovenia



National development plan(s)

A Magyar Villamosenergia-rendszer Hálózatfejlesztési Terve 2017., Hungary, 2017, Page 5 ;
https://www.eles.si/Portals/EN/Document/ELES
NDP 2019-2028.pdf?ver=2019-06-05-095251-500, Page 32, 6.2

Additional information on the project

Project website:
https://www.cirkovce-pince.eu/

4th PCI list:
https://ec.europa.eu/energy/sites/ener/files/c_2019_7772_1_annex.pdf

Clustering approach: Project represents an international connection and is considered as cluster of one investment.

Slovenian NDP:
https://www.eles.si/Portals/EN/Document/ELES
NDP 2019-2028.pdf?ver=2019-06-05-095251-500

Hungarian NDP:
https://www.mavir.hu/documents/10258/15454/HFT_2017.pdf

Related projects

Project is a prerequasite for all other investments (such as Projects 150 and 325).

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): New double circuit 400kV overhead line in Slovenia (section Cirkovce-Pince) and a new 400 kV substation Cirkovce (SI). The new OHL will be connected to one circuit of the existing double circuit 400kV OHL Heviz(HU)-Zerjavinec(HR), creating two new cross-border lines: Heviz(HU)-Cirkovce(SI) and Cirkovce (SI)-Zerjavinec (HR).

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	80	Cirkovce (SI)	Heviz (HU) \ Zerjavinec (HR)	Under Construction	2021	Investment on time	

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	Project 320 will establish the first cross-border connection between Slovenia and Hungary, by which a new border and new transmission capacity with up to 1200 MW in both directions will be established. Project will increase market integration in the region, facilitate access to Eastern electricity markets and decrease price differentials in the region.
	Infrastructure to address system adequacy deficiencies and/or mitigate the risk of	Project 320 will increase system flexibility and stability, improve operational reliability and by this improve security of supply. This is expected also in cases of extraordinary grid events (blackouts, extreme weather events, outages of

Need		How the project addresses each need (explanation provided by the project promoter(s))
	power failures.	major generation units or other unforeseen events) where the Project will assure important new and reliable transmission capacity to overcome such problems. Furthermore, project is also essential for successful completion of smart grid project SINCRO.GRID, which will, jointly with project 320 regionally assure regional voltage regulation and regional voltage stability and thus system stability.
	Infrastructure to facilitate and accommodate future scenarios, cross-border flows or loop flows.	In future scenarios production from RES sources will increase greatly, having also an influence on the power flows. Project will significantly increase transmission capacities and assure a higher level of security of supply, by which a positive effect on accomodation of power flows from new RES generation will be possible and in essence an increase of the amount of new RES integration. By realization of Project 320, also smart grid project SINCRO.GRID (PCI 10.3) will be completed, by which the level of regional system stability will be raised, having a direct effect on increased integration of additional RES generation in this region.
	Infrastructure and/or market design to provide balancing flexibility (e.g. international pooling / sharing of reserves, coordinated development of reserve capacity)	With the project the first connection between Slovenia and Hungary will be established. By this reserve sharing will be possible, this demontrasted also in scope of project FutureFlow.

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)	Hungary - Slovenia	1200	1200
Transfer capacity increase (in MW)	Slovenia - Croatia	0	150

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

Socio-Economic Welfare increase resulting from RES integration	average min	0 0	2 0	<	<	assessment

Reduction of CO2 and GHG emissions

B4 Non-CO2 emissions (kg/year)

B4a Nitrogen oxides	average	43	-282	n/a	n/a	ENTSO-E assessment
B4b Ammonia	average	-6	2	n/a	n/a	ENTSO-E assessment
B4c Sulfur dioxide	average	167	-343	n/a	n/a	ENTSO-E assessment
B4d Particular matter 5	average	-57	2730	n/a	n/a	ENTSO-E assessment
B4e Particulate matter 10	average	-6	-12	n/a	n/a	ENTSO-E assessment
B4f Non-methane volatile organic compounds	average	-53	2752	n/a	n/a	ENTSO-E assessment

B2a Annual CO2 variation from market simulation (ktonnes / year)	max average min	40 10 -11	-60 -95 -163	>	>	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 -1 -2	3 7 15	< < <	< < <	ENTSO-E assessment
B2b Annual CO2 variation due to network losses (ktonnes / year)	average	2	-23	n/a	n/a	ENTSO-E assessment
B2b_€ Annual Societal cost variation	CO2 price 60€/ ton	0 0	1 2	n/a	n/a	ENTSO-E assessment

resulting from CO2 variation from network simulation monetised (M € / year)	100€/ ton 189€/ ton	0	4			

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)	max average min	28 9 0	171 57 11	<	<	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	3	-3	n/a	n/a	ENTSO-E assessment
B5_€ Variation of network losses monetised (M€ / year)	average	0	-2	n/a	n/a	ENTSO-E assessment

Security of supply

B6 Annual reduction in Energy Not Served (MWh / year)	max average min		39	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	>	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	4	1	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	average	0	-2	ENTSO-E assessment
B1_RES Annual Socio-Economic Welfare increase resulting from RES integration	average	1	0	ENTSO-E assessment
Reduction of CO2 and GHG emissions				
B2a Annual CO2 variation from market simulation (ktonnes / year)	average	-4	47	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 1	-1 -3 -7	ENTSO-E assessment
Integration of renewable energy sources				
B3 Annual avoided curtailment (RES integration) (GWh / year)	average	12	10	ENTSO-E assessment
B3a Connected RES (MW)	-			ENTSO-E assessment

Benefits submitted by promoters based on scenarios other than the TYNDP2020 scenarios

	2025	2030	
B7 System Flexibility – Balancing Energy Exchange	+	+	Qualitative assessment by ENTSO-E, based on the study and values provided by the project 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)

This indicator was computed based on / , in a study performed by Energy Institute Hrvoje Pozar; Ele in 2018. The promoter(s) stated that the submitted value was computed in accordance with the CBA Guideline and explained it as follows:

The attached study (Cost Benefit Analysis of project Slovenia-Hungary/Croatia) was performed specifically for project 320 and on the basis of project FutureFlow findings and models. The study builds on very detailed models, developed in FutureFlow project and not available in ENTSO-E models. Assesment was performed with full models for balancing energy markets as foreseen in CBA 3.0.As an additional benefit, this benefit was submitted and accepted in the 4th PCI list process.

In addition to the scenario, the following assumptions were made to compute this indicator:

To perform the necessary assessments, detailed data on all generators, their regulators and responses must be modeled. This was performed in scope of the project FutureFlow, which findings are used in the Study for project 320.

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)

	2021	2035		
B9 Avoidance of the Renewal/ Replacement Costs of Infrastructure (Meuro)	5,5	35,9		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)

This indicator was computed in a study performed by Energy Institute Hrvoje Pozar in 2018. The promoter(s) stated that the submitted value was computed in accordance with the CBA Guideline and explained it as follows:

The attached study (Cost Benefit Analysis of project Slovenia-Hungary/Croatia) was performed specifically for project 320 and in line with the CBA methodology (in 2018). As an additional

benefit, the study detected a project level benefit, which is now B9 and was submitted and accepted in the 4th PCI list process. The study clearly shows which is the infrastructure, whos replacement cost are avoided with the realization of project 320.
The promoter(s) certified that the values submitted and assessed in the study relate to countries located within the ENTSO-E perimeter only.

B8.0 Stability (Transient, Voltage and Frequency Stability)	**Transient stability**	**Voltage stability**	**Frequency stability**	
Double 400 kV OHL Cirkovce(SI)-Heviz(HU)/ Zerjavinec(HR) (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	2	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	average	-1	ENTSO-E assessment
B1_RES Annual Socio-Economic Welfare increase resulting from RES integration	average	0	ENTSO-E assessment

Reduction of CO2 and GHG emissions

B2a Annual CO2 variation from market simulation (ktonnes / year)	average	22	ENTSO-E assessment
B2a_€ Annual		-1	ENTSO-E assessment

Societal cost variation resulting from CO2 variation from market simulation monetised (M€ / year)	CO2 price 60€/ ton 100€/ ton 189€/ ton	-2 -4	

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)	average	1	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).

Residual environmental impact

Investment	Investment status	Distance (km)	Type of sensitivity
Double 400 kV OHL Cirkovce(SI)-Heviz(HU)/Zerjavinec(HR)	Under Construction	28	Other nature protection areas under national law

Residual social impact

Investment	Investment status	Distance (km)	Type of sensitivity
Double 400 kV OHL Cirkovce(SI)-Heviz(HU)/ Zerjavinec(HR)	Under Construction	37	Sensitivity regarding landscape - Other areas protected by national law

Project Costs

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

	CAPEX (Meuro)	Uncertainty range (%)	OPEX
1558. Double 400 kV OHL Cirkovce(SI)-Heviz(HU)/ Zerjavinec(HR)	132.5	+/- 5%	0.12
Total	132.5		0.12

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

1558

ENTSO-E