Project Sheet

Central Balkan Corridor

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Key Information

Cross Border Project
AC transmission line
Mostly Upgrade

Planned But Not Yet Permitting

Description

This corridor will enable transmission of energy from east to west on the border between Bulgaria to Serbia and further to Montenegro and Bosnia and Herzegovina. It consists of several investments from SS Sofia West on the east to SS Pljevlja 2 and SS Visegrad on the west. In that way this corridor will be directly connected with project Transbalkan corridor (therefore, enabling the connection between Bulgarian energy market and Italian energy market), which represent a direct prerequisite for the proper development of the Central Balkan corridor. Among the numerous other benefits expected once this project is commissioned, the increase of NTCs on the borders between the involved countries (implying both the market integration and additional resources in securing the reliability of transmission systems' operation) can be seen as one of the most prominent.

Project promoters

EMS
ESO

Countries

Bosnia and Herzegovina
Bulgaria
Montenegro
Serbia

National development plan(s)

Plan razvoja prenosnog sistema Republike Srbije za period 2019 - 2028, page 157, (Serbian national TYNDP 2019-2028)

Additional information on the project

http://www.ems.rs/media/uploads/Plan_razvoja_prenosnog_sistema_R.pdf

Related projects

TYNDP 2020 - project 227

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): Second interconnection line on the border between Bulgaria and Serbia

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	123	SS Sofia West	SS Nis 2	Planned But Not Yet Permitting	2034	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 exsisting OHL 220 kV to 400 kV SS Nis 2 - SS Kruševac 1	AC transmission line	72	SS Nis 2	SS Krusevac 1	Planned But Not Yet Permitting	2034	Investment on time	
Upgrading SS 220/110 kV Krusevac 1 to 400 kV	Onshore substation		SS Krusevac 1	SS Krusevac 1	Planned But Not Yet Permitting	2034	Investment on time	
Upgrading of exsisting OHL 220 kV to 400 kV SS Krusevac 1 - SS Kraljevo 3	AC transmission line	48	SS Krusevac 1	SS Kraljevo 3	Planned But Not Yet Permitting	2034	Investment on time	
Uprading exsisting OHL 220 kV to 400 kV SS	AC transmission line	70	EMS	EMS	Planned But Not Yet	2034	New Investment	

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
Kraljevo 3 - SY Pozega					Permitting			
New 400 kV SY Pozega	Onshore substation		SS Pozega	SS Pozega	Planned But Not Yet Permitting	2034	New Investment	
New OHL SS Jagodina 4 - SY Drmno	AC transmission line	95	SS Jagodina 4	SY Drmno	Planned But Not Yet Permitting	2034	New Investment	
Upgrading 220 kV OHL SS Pozega - node Vardiste to 2x400 kV and conductoring second circuit on 400 kV OHL SS Bajina Basta - SS Pljevlja from node Vardiste to SS Pljevlja.	AC transmission line	135	SY Pozega	SS Pljevlja	Planned But Not Yet Permitting	2034	New Investment	
Upgrading 220 kV OHL SS Pozega - node Vardiste to 2x400 kV and conductoring second circuit on 400 kV OHL SS Bajina Basta - SS Visegrad from node Vardiste to SS Visegrad..	AC transmission line	65	SY Pozega	SS Visegrad	Planned But Not Yet Permitting	2034	New Investment	

Reason for investment clustering

These investments will form a new 400 kV corridor from Bulgaria, through Serbia to the border with the Bosnia and Herzegovina and Montenegro. New corridor will enable evacuation of energy from new RES in Bulgaria to the western part of Balkan region.

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 Central Balkan corridor, among other investments, also includes strengthening of the interconnections in the CSE region (that involves both EU and non-EU countries), enhancing the market integration in the area of interest and, hence, succeeding in reducing the price differentials.
	Infrastructure to address system adequacy deficiencies and/or mitigate the risk of power failures.	As the project envelops the replacement of severely ageing 220 kV infrastructure in Central Serbia with the new 400 kV lines and substations, it is expected to significantly improve the system reliability in this area, thus reducing the possibility of putting the security of supply at risk in some operational regimes.
	Infrastructure to improve system flexibility and stability e.g. improve system or local ramp rate, improve transient stability or RoCoF to meet system Needs.	Since the project of Central Balkan corridor offers the new interconnections between Serbia and several neighboring countries, it is most certainly envisaged as valuable improvement regarding the system flexibility, the full impact of which becoming apparent in the light of rapidly developing renewable energy sources in the CSE region.
	Infrastructure to facilitate and accommodate future scenarios, cross-border flows or loop flows.	As the relevant scenarios, taken into account in the scope of the analyses carried out in the scope of TYNDP 2020, consider the significant flows across the borders in the CSE region, the NTC increases, caused by this project, might prove to be crucial for the involved systems.

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)	Montenegro - Serbia	500	500
Transfer capacity increase (in MW)	Bosnia Herzegovina - Serbia	500	500
Transfer capacity increase (in MW)	Bulgaria - Serbia	730	186

Boundary capacity diagram

Network boundary the projects helps mitigate

Eastern Balkan

Boundary capacity diagram

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 1 0	6 4 1	>	>	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	max average min	2 0 -1	2 0 -3	>	<	ENTSO-E assessment
B1_RES Annual Socio-Economic Welfare increase resulting from RES integration	max average min	1 0 0	0 0 0	>	>	ENTSO-E assessment

Reduction of CO2 and GHG emissions

B4 Non-CO2 emissions (kg/year)

B4a Nitrogen oxides	average	61	24	n/a	n/a	ENTSO-E assessment
B4b Ammonia	average	-3	-8	n/a	n/a	ENTSO-E assessment
B4c Sulfur dioxide	average	106	59	n/a	n/a	ENTSO-E assessment
B4d Particular matter 5	average	-4	132	n/a	n/a	ENTSO-E assessment
B4e Particulate matter 10	average	2	0	n/a	n/a	ENTSO-E assessment
B4f Non-methane volatile organic compounds	average	-9	126	n/a	n/a	ENTSO-E assessment

B2a Annual CO2 variation from market simulation (ktonnes / year)		max average min	26 -17 -80	109 15 -71	< 	< 	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	0 -1 -2	> > >	< > >	ENTSO-E assessment
B2b Annual CO2 variation due to network losses (ktonnes / year)		average	-27	-40	n/a	n/a	ENTSO-E assessment
B2b_€ Annual Societal cost variation resulting from CO2 variation from network simulation monetised (M € / year)	CO2 price	60€/ ton 100€/ ton 189€/ ton	1 2 4	1 3 6	n/a	n/a	ENTSO-E assessment

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)		max average min	12 3 0	7 3 0	> 	> 	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	-40	-35	n/a	n/a	ENTSO-E assessment
B5_€ Variation of network losses monetised (M€ /		average	-2	-2	n/a	n/a	ENTSO-E assessment

year)					

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	14	6	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	average	10	0	ENTSO-E assessment
B1_RES Annual Socio-Economic Welfare increase resulting from RES integration	average	7	4	ENTSO-E assessment

Reduction of CO2 and GHG emissions

B2a Annual CO2 variation from market	average	-196	9	ENTSO-E assessment

simulation (ktonnes / year)				
B2a_€ Annual Societal cost variation resulting from CO2 variation from market simulation monetised (M€ / year)	CO2 price	60€/ ton 100€/ ton 189€/ ton	1 9 27	0 -1 -1	ENTSO-E assessment

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)	average	128	99	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	
Sofia West (BG) - Nis 2 (RS) 2nd (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.
New OHL SS Jagodina 4 - SY Drmno (New AC line)	++	++	0	
OHL SS Pozega - SS Pljevlja (New AC line)	++	++	0	
OHL SS Pozega - SS Visegrad (New AC line)	++	++	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	0	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	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	27	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
OHL SS Pozega - SS Visegrad	Planned But Not Yet Permitting	15.7	Other nature protection areas under national law

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

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
1520. Sofia West (BG) - Nis 2 (RS) 2nd	56	5%	0.5
1522. Upgrade of exsisting OHL 220 kV to 400 kV SS Nis 2 - SS Kruševac 1	17	5%	0.2
1523. Upgrading SS 220/110 kV Krusevac 1 to 400 kV	6.5	5%	0.08
1524. Upgrading of exsisting OHL 220 kV to 400 kV SS Krusevac 1 - SS Kraljevo 3	11.5	5%	0.1
1525. Uprading exsisting OHL 220 kV to 400 kV SS Kraljevo 3 - SY Pozega	32	5%	0.5
1698. New 400 kV SY Pozega	2		0.1
1699. New OHL SS Jagodina 4 - SY Drmno	26		0.1
1700. OHL SS Pozega - SS Pljevlja	18	5%	0.05
1701. OHL SS Pozega - SS Visegrad	13	5%	0.05
Total	182		1.6800000000000002

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

1520 Uncertainty of prices of necessary materials. Difference between the estimated capex

	cost for the investment and the standard costs of investments is caused by fact that the ACER report considers only 14 EU member countries, in which the unit price for this type of project is higher than price for corresponding projects in Serbia.
1522	Uncertainty of prices of necessary materials. Difference between the estimated capex cost for the investment and the standard costs of investments is caused by fact that the ACER report considers only 14 EU member countries, in which the unit price for this type of project is higher than price for corresponding projects in Serbia.
1523	Uncertainty of prices of necessary materials. Difference between the estimated capex cost for the investment and the standard costs of investments is caused by fact that the ACER report considers only 14 EU member countries, in which the unit price for this type of project is higher than price for corresponding projects in Serbia.
1524	Uncertainty of prices of necessary materials. Difference between the estimated capex cost for the investment and the standard costs of investments is caused by fact that the ACER report considers only 14 EU member countries, in which the unit price for this type of project is higher than price for corresponding projects in Serbia.
1525	Uncertainty of prices of necessary materials. Difference between the estimated capex cost for the investment and the standard costs of investments is caused by fact that the ACER report considers only 14 EU member countries, in which the unit price for this type of project is higher than price for corresponding projects in Serbia.
1698	
1699	
1700	
1701	