Project Sheet

Southern Aegean Interconnector

Project type	transmission
Project id	293
Created by	
Created on	Feb 11, 2021 11:52:56 AM

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Key Information

Internal Project
Offshore DC transmission cable
New

Under Consideration

Description

The project refers to the construction of a submarine DC transmission link to connect the licensed RES plants, located on 23 small uninhabited islands at the South Aegean sea, with mainland Greece and the islands of Crete, Kos and the Dodecanese. The main link will be an HVDC link connecting the island of Levitha to both the metropolitan area of Athens and the island of Crete; the 400kV substation at Lavrion area will be the connection point in the Athens area and the substation of Atherinolakkos will be the connection point in Crete (located in the South-East coast). The capacity of each link will be 600 to 800MW both directions using HVDC (High Voltage Direct Current) XLPE insulated technology and both links will consist of two parallel cables in order to increase the reliability of each link. 3 conversion stations using HVDC VSC technology are foreseen in Lavrio, Levitha & Crete (Atherinolakkos). All the installations on the islands (converter stations, substations etc) will be of closed type using GIS technology. The project will provide 19TWh/year of wind energy, increasing the transfer capacity between mainland Greece and Crete-Kos islands.

Project promoters

Kykladika Meltemia SA

Countries

Egypt
Greece

National development plan(s)

Not in a NDP yet.

Additional information on the project

http://eunice-group.com/projects/aegean-project/

Related projects

Greece Africa Power Interconnector - GAP (TYNDP project number 1048)

The related projects improve the cross border inter-connectivity between the two countries (Greece-Egypt)

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 DC link (2 converter SS + 245 km DC subm. cable) to connect 582MW of offshore WF generation to the mainland (Area of Athens and Crete Island)

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
Offshore DC transmission cable	245	Lavrio	Levitha	Under Consideration	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
Interconnection of the Crete Island to the Greek Mainland via Levitha converter station.	Offshore DC transmission cable	250	Levitha	Atherinolakkos Crete	Under Consideration	2026	Investment on time	
Connection Wind Farms with AC Substations at Levitha and Syrna	Off-shore AC transmission cable	81	Levitha	Syrna	Under Consideration	2025	Investment on time	
AC Submarine cable to connect Kinaros substation to the AC side of Levitha	Off-shore AC transmission cable	14	Kinaros	Levitha	Under Consideration	2024	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
Substation								
HVAC Submarine cable to connect Kandeliousa OffsHore Wind Farm HV substation to Syrna HV Subsation	Off-shore AC transmission cable	34	Kandeliousa	Syrna	Under Consideration	2025	Investment on time	
HVAC Submarine cable connect Kandeliousa offshore Wind Farm HV substation to Pergousa HV Substation	Off-shore AC transmission cable	14	Kandeliousa	Pergousa	Under Consideration	2025	Investment on time	
HVAC Submarine cable connecting Levitha offshore Wind Farm HV substation to Dodecanese (Kos & Rhodes HV Substation)	Off-shore AC transmission cable	170	Levitha	Kos - Rhodes	Under Consideration	2026	New Investment	

Reason for investment clustering

The clustering explanation is that the whole project refers to the construction of one common submarine DC transmission link to connect the licensed RES plants at the South Aegean Sea to mainland Greece and the islands of Crete, Kos and the Dodecanese. The main link will be an HVDC link connecting the island of Levitha to both the metropolitan area of Athens and the island of Crete.

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 designed to enable cost-efficient grid connection of high volumes of RES and/or reduce RES curtailment	Currently non-interconnected islands face significant RES curtailments, as the conventional units available in each island do not meet the flexibility requirements in view of adapting to the RES generation profile. Such curtailments will be significantly reduced when the project is implemented. More the project will facilitate the cost efficient grid connection of the under development Wind Turbine Plants (approx. 600 MW installed power) with mainland Greece.
	Infrastructure designed to offer more supply options to isolated areas	The supply of currently non interconnected autonomous islands will be enhanced with via the development of Southern Aegean Interconnector.
	Infrastructure to address system adequacy deficiencies and/or mitigate the risk of power failures.	The increased RES (Wind Turbine) capacity penetration provided with the development of Southern Aegean Interconnector shall lead to significant enhancement of System Adequacy (LOLE & LOEE decrease).
	Infrastructure to improve system flexibility and stability e.g. improve system or local ramp rate, improve transient stability or RoCoF to meet system Needs.	

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)	Internal (Greece)	582	582

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	47 45 43	71 62 54	<	<	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	max average min	14 11 9	38 31 26	<	<	ENTSO-E assessment
B1_RES Annual Socio-Economic	max average	50 48	50 48	<	>	ENTSO-E assessment

Welfare increase resulting from RES integration	min	46	45			

Reduction of CO2 and GHG emissions

B4 Non-CO2 emissions (kg/year)

B4a Nitrogen oxides	average	-252	-752	n/a	n/a	ENTSO-E assessment
B4b Ammonia	average	19	32	n/a	n/a	ENTSO-E assessment
B4c Sulfur dioxide	average	36	-545	n/a	n/a	ENTSO-E assessment
B4d Particular matter 5	average	22	-73	n/a	n/a	ENTSO-E assessment
B4e Particulate matter 10	average	12	-16	n/a	n/a	ENTSO-E assessment
B4f Non-methane volatile organic compounds	average	63	24	n/a	n/a	ENTSO-E assessment

B2a Annual CO2 variation from market simulation (ktonnes / year)		max average min	-404 -482 -597	-925 -1091 -1346	>	>	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	18 37 80	35 79 176	< < <	< < <	ENTSO-E assessment
B2b Annual CO2 variation due to network losses (ktonnes / year)		average	13	33	n/a	n/a	ENTSO-E assessment
B2b_€ Annual Societal cost variation resulting from	CO2 price	60€/ ton 100€/	0 -1 -2	-1 -2 -5	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	1003 993 990	1292 1268 1234	<	<	ENTSO-E assessment
B3a Connected RES (MW)	-	582	582	n/a	n/a	ENTSO-E assessment

Impact on grid losses

B5 Variation of network losses (GWh / year)	average	23	40	n/a	n/a	ENTSO-E assessment
B5_€ Variation of network losses monetised (M€ / year)	average	1	2	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	62	53	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	average	26	28	ENTSO-E assessment
B1_RES Annual Socio-Economic Welfare increase resulting from RES integration	average	43	50	ENTSO-E assessment

Reduction of CO2 and GHG emissions

B2a Annual CO2 variation from market simulation (ktonnes / year)	average	-481	-810	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 23 65	20 53 125	ENTSO-E assessment

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)	average	866	1153	ENTSO-E assessment
B3a Connected RES (MW)	-		582	ENTSO-E assessment

Non scenario-dependent indicator(s)

B8.0 Stability (Transient, Voltage and Frequency Stability)	Transient stability	Voltage stability	Frequency stability	
Southern Aegean Interconnector (New HVDC)	++	++	+ (between sync areas)	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.
Southern Aegean Interconnector (New HVDC)	++	++	+ (between sync areas)	
Southern Aegean Interconnector (New AC line)	++	++	0	
Southern Aegean Interconnector (New AC line)	++	++	0	
Southern Aegean Interconnector (New AC line)	++	++	0	
Southern Aegean Interconnector (New AC line)	++	++	0	
Southern Aegean Interconnector (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	56	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	average	12	ENTSO-E assessment
B1_RES Annual Socio-	average	54	ENTSO-E assessment

Economic Welfare increase resulting from RES integration		

Reduction of CO2 and GHG emissions

B2a Annual CO2 variation from market simulation (ktonnes / year)	average	-434	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	14 31 70	ENTSO-E assessment

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)	average	1012	ENTSO-E assessment
B3a Connected RES (MW)	-	582	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

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
1431. Southern Aegean Interconnector	600	5%	40
1432. Southern Aegean Interconnector	600	5%	40
1433. Southern Aegean Interconnector	150	5%	7
1434. Southern Aegean Interconnector	30	5%	1
1435. Southern Aegean Interconnector	80	5%	6
1436. Southern Aegean Interconnector	40	5%	2
1704. Southern Aegean Interconnector	330	5%	10
Total	1830		106

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

1431	Much less than 10% (explanation: Commercially mature technology and equipment leading to reduced expenditures)
1432	Much less than 10% (explanation: Commercially mature technology and equipment leading to reduced expenditures)
1433	Much less than 10% (explanation: Commercially mature technology and equipment leading to reduced expenditures)
1434	Much less than 10% (explanation: Commercially mature technology and equipment leading to reduced expenditures)
1435	Much less than 10% (explanation: Commercially mature technology and equipment leading to reduced expenditures)
1436	Much less than 10% (explanation: Commercially mature technology and equipment leading to reduced expenditures)
1704	