Project Sheet

Greece - Africa Power Interconnector (GAP Interconnector)

Project type	transmission
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Key Information

Cross Border Project
Offshore DC transmission cable
New

Under Consideration

Description

The project refers to the construction of a submarine DC transmission link of total capacity 2000MW (2x1000MW) interconnecting Egypt's North Mediterranean coast and Greece at the island of Crete. A new HVDC conversion station close to the existing thermal power plant of Atherinolakkos in South-East Crete will be the connection point to Greece. Crete interconnection with mainland Greece is already under way by the Greek TSO (IPTO) with the implementation works expected to be completed before 2030 (both AC and DC links). Moreover, the Southern Aegean Interconnector" transmission project will provide another transmission route of the transfer capacity through the Aegean sea. The connection point in Egypt will be at its Northern coast located South of Crete, where the bulk of Egypt's electrical load and HV transmission grid infrastructure is located. All the aforementioned installations (converter stations, substations etc) will be of closed type using GIS technology. The proposed Greece - Africa interconnection project will provide energy stability to the Eastern Mediterranean Sea area as intercontinental energy transfers will be facilitated and generation adequacy of the region will be increased.

Project promoters

Kykladika Meltemia SA

Countries

Egypt
Greece

National development plan(s)

Additional information on the project

Related projects

Southern Aegean Interconector - SAI (TYNDP project number 293)

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

Project sheet backlog

19 Jan. 2021 - Addition of results in third countries for indicator B2a_€

6 Jan. 2021 - Correction of results in third countries for indicator B2a

6 Nov. 2020 - Publication as part of the draft TYNDP 2020 package for consultation

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Project Description & Context

Project Investments

Main investment(s): 2 HVDC Subsea cables interconnecting the Northern coast of Egypt with the island of Crete at Atherinolakkos. At both connection points bipolar HVDC conversion stations will be constructed for the connection to the national HV grids.

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	450	Atherinolakkos (Crete)	Mersa Matruh	Under Consideration	2028	New Investment	

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.

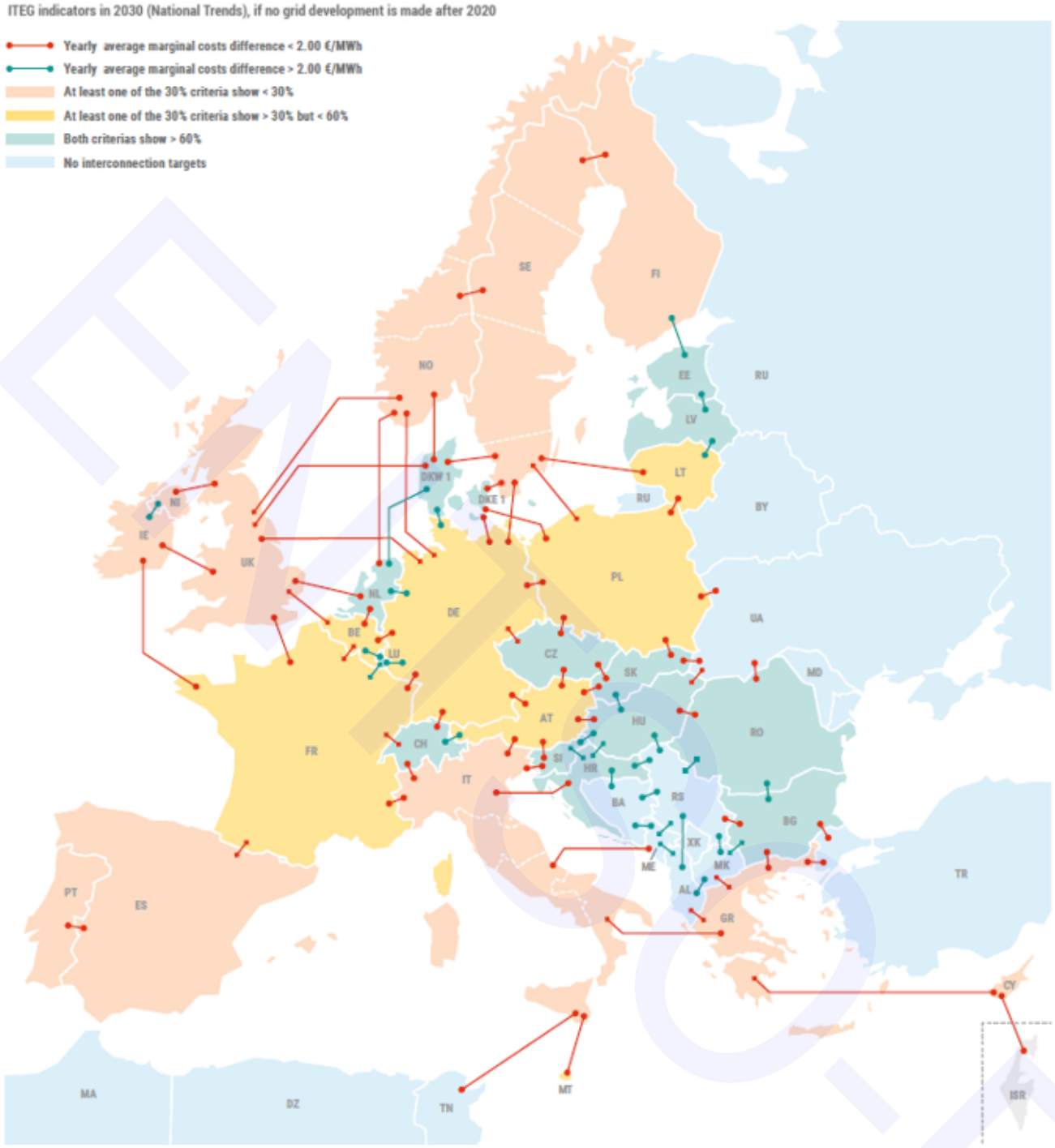
Need		How the project addresses each need (explanation provided by the project promoter(s))
	Infrastructure to facilitate and accommodate future scenarios, cross-border flows or loop flows.	The proposed Greece - Africa interconnection project will provide energy stability to the Eastern Mediterranean Region as intercontinental energy transfers will be facilitated and generation adequacy of the region will be increased. Various future scenarios will be made eligible for testing and analysis between EU and non EU cross border flows.
€	Infrastructure to reduce price differentials between EU and/or non-EU countries	Energy transactions between Greece and Egypt through GAP Interconnector (HVDC cable) will lead to reduced price differentials between EU (Greece) and non-EU countries (Egypt).
	Infrastructure designed to	Certainly the increased interconnection capacity between

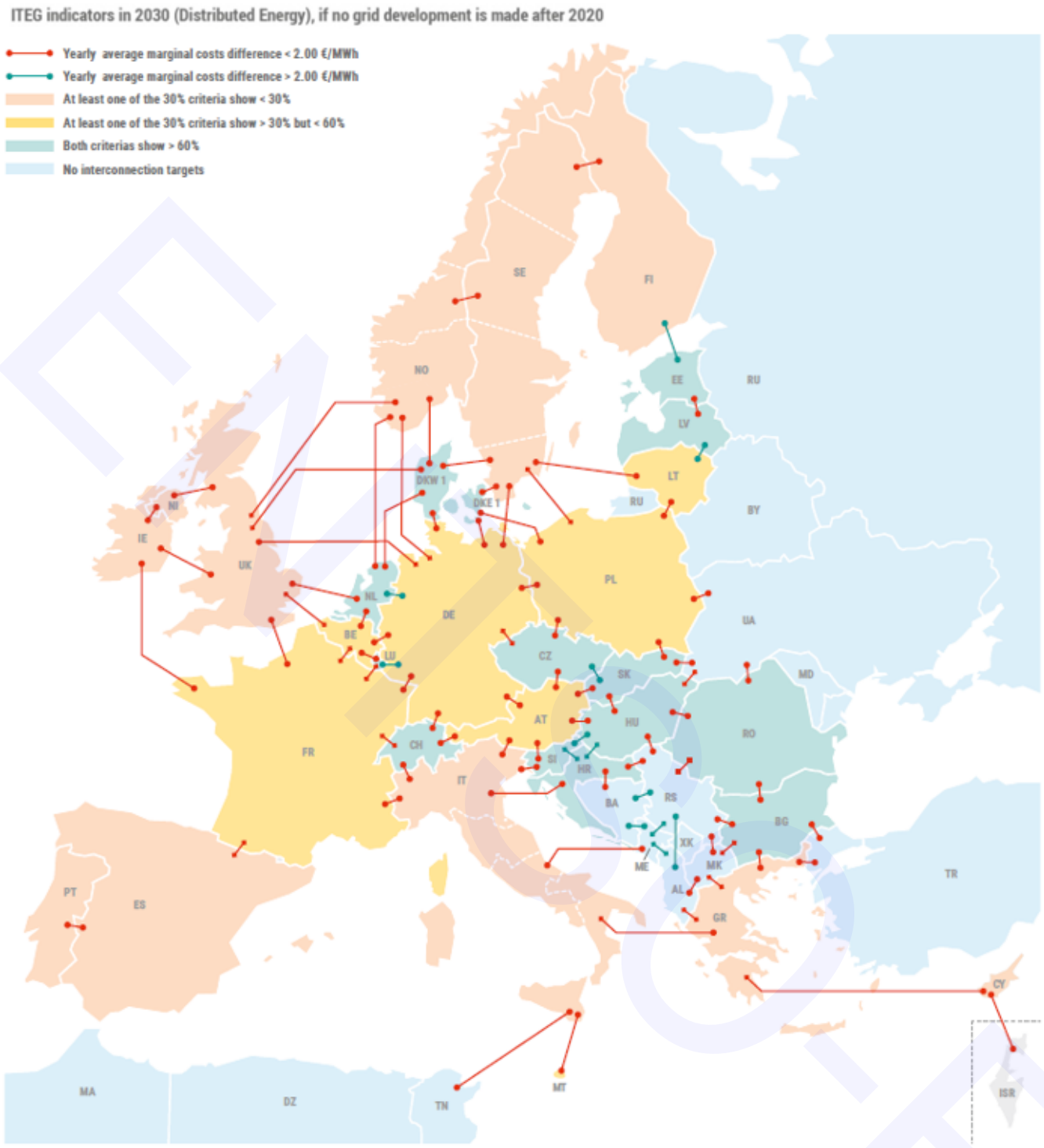
Need		How the project addresses each need (explanation provided by the project promoter(s))
	enable cost-efficient grid connection of high volumes of RES and/or reduce RES curtailment	Greece and Egypt provided via the development of GAP Interconnector shall lead to significant decrease of RES curtailments.
	Infrastructure to address system adequacy deficiencies and/or mitigate the risk of power failures.	The increased Interconnection capacity provided via the infrastructure of GAP Interconnector will enhance System Adequacy for both Power Systems (Greek - EU and Egyptian - Africa). Power failures will be mitigated in a more bulk interconnected grid.

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.


ITEG indicators in 2030 (National Trends), if no grid development is made after 2020
Yearly average marginal costs difference < 2.00 €/MWh
Yearly average marginal costs difference > 2.00 €/MWh
At least one of the 30% criteria show < 30%
At least one of the 30% criteria show > 30% but < 60%
Both criterias show > 60%
No interconnection targets
SE
FI
NO
EE
RU
LV
LT
DKW 1
DKE 1
RU
BY
NI
IE
UK
PL
NL
DE
UA
BE
LU
CZ
SK
MD
AT
HU
RO
FR
CH
SI
HR
IT
BA
RS
BG
XK
ME
MK
AL
TR
PT
ES
GR
CY
MA
DZ
TN
MT
ISR


ITEG indicators in 2030 (Distributed Energy), if no grid development is made after 2020
Yearly average marginal costs difference < 2.00 €/MWh
Yearly average marginal costs difference > 2.00 €/MWh
At least one of the 30% criteria show < 30%
At least one of the 30% criteria show > 30% but < 60%
Both criterias show > 60%
No interconnection targets
SE
FI
NO
EE
RU
LV
LT
DKW 1
DKE 1
RU
BY
NI
IE
UK
PL
NL
DE
UA
BE
LU
CZ
SK
MD
AT
HU
RO
FR
CH
SI
HR
IT
BA
RS
BG
XK
ME
MK
AL
TR
PT
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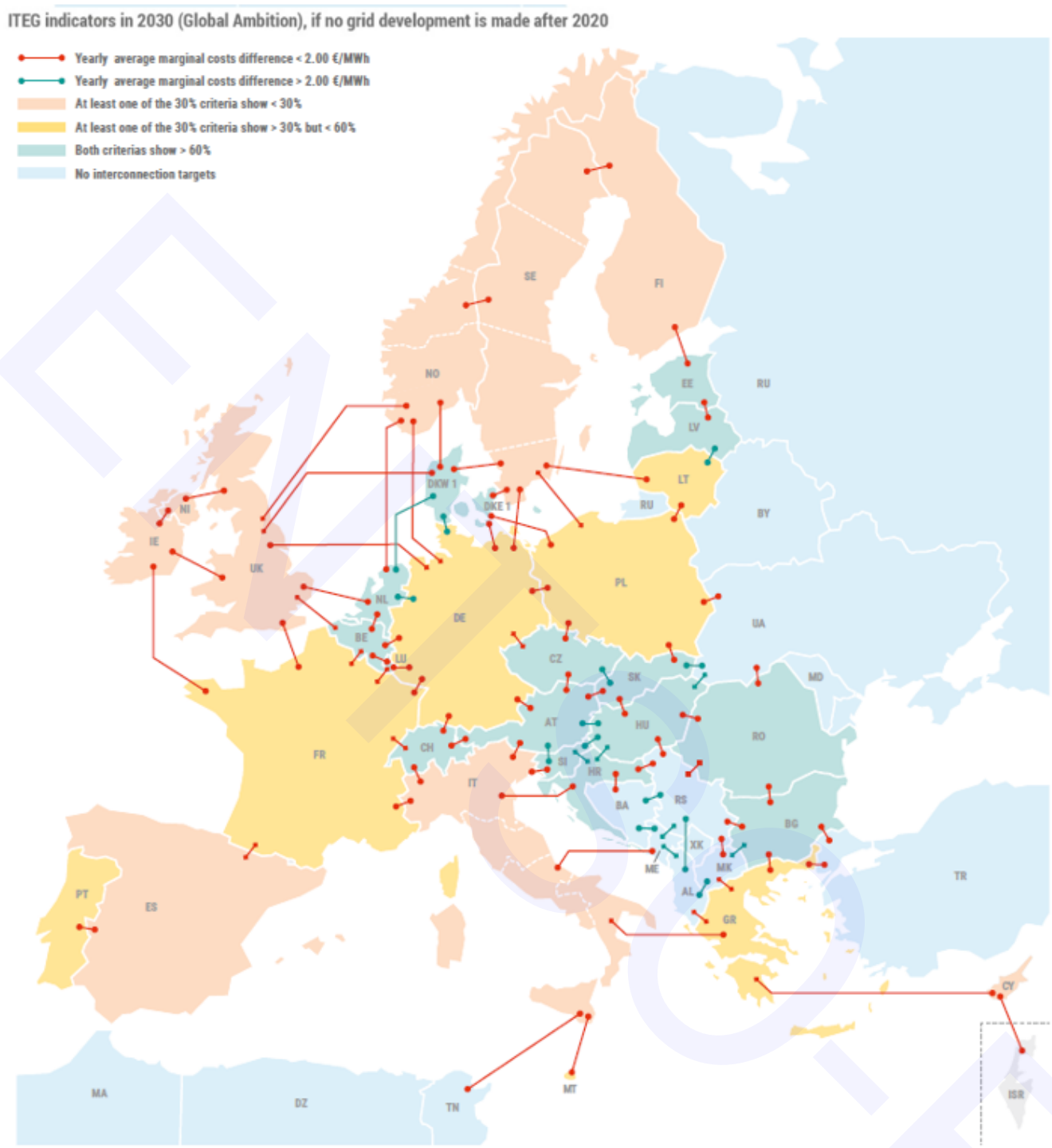
GR
CY
MA
DZ
TN
MT
ISR


ITEG indicators in 2030 (Global Ambition), if no grid development is made after 2020
Yearly average marginal costs difference < 2.00 €/MWh
Yearly average marginal costs difference > 2.00 €/MWh
At least one of the 30% criteria show < 30%
At least one of the 30% criteria show > 30% but < 60%
Both criterias show > 60%
No interconnection targets
SE
FI
NO
EE
RU
LV
LT
RU
BY
DKW 1
DKE 1
NI
IE
UK
PL
UA
NL
DE
BE
LU
CZ
SK
MD
AT
HU
RO
CH
FR
SI
HR
IT
BA
RS
BG
XK
ME
MK
AL
TR
PT
ES
GR
CY
MA
DZ
TN
MT
ISR

Project Assessment

Transfer capacity increase (National Trends 2025)

	Border	A B	B A
Transfer capacity increase (in MW)	Greece - Egypt	2000	2000

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	73 73 73	154 147 140	<	<	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	max average min	-203 -203 -203	-247 -282 -312	>	<	ENTSO-E assessment
B1_RES Annual Socio-Economic	max average	1 1	3 1	>	>	ENTSO-E assessment

Welfare increase resulting from RES integration	min	1	0			

This project involves countries outside of the ENTSO-E area.

B1 SEW (Meuro/ year) in third country/ies	max average min	40 40 40	78 75 72	>	<	ENTSO-E assessment
B1_RES (Meuro/ year) in third country/ies	max average min	0 0 0	0 0 0	<	<	ENTSO-E assessment
B1_CO2 (Meuro/ year) in third country/ies	max average min	154 154 154	196 196 196	>	>	ENTSO-E assessment

Reduction of CO2 and GHG emissions

B4 Non-CO2 emissions (kg/year)

B4a Nitrogen oxides	average	N/A	9433	n/a	n/a	ENTSO-E assessment
B4b Ammonia	average	N/A	-270	n/a	n/a	ENTSO-E assessment
B4c Sulfur dioxide	average	N/A	11808	n/a	n/a	ENTSO-E assessment
B4d Particular matter 5	average	N/A	-34007	n/a	n/a	ENTSO-E assessment
B4e Particulate matter 10	average	N/A	595	n/a	n/a	ENTSO-E assessment
B4f Non-methane volatile organic compounds	average	N/A	-35034	n/a	n/a	ENTSO-E assessment
B2a Annual CO2 variation from market simulation (ktonnes / year)	max average min	8821 8821 8821	11141 10066 8823	<	<	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	-326 -679 -1464	-322 -725 -1621	> > >	> > >	ENTSO-E assessment
B2b Annual CO2 variation due to network losses (ktonnes / year)		average	0	0	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	0 0 0	0 0 0	n/a	n/a	ENTSO-E assessment

This project involves countries outside of the ENTSO-E area.

B2a (ktonnes/year) in third country/ies		average	-6680	-7007	>	>	ENTSO-E assessment
B2a_€ (M€/ year) in third country/ies	CO2 price	60€/ ton 100€/ ton 189€/ ton	247 514 1109	224 504 1128	n/a	n/a	ENTSO-E assessment

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)		max average min	17 17 17	81 28 0	>	>	ENTSO-E assessment
B3a Connected RES (MW)	-				n/a	n/a	ENTSO-E assessment

This project involves countries outside of the ENTSO-E area.

B3 (GWh / year) in third countries	max average min	0 0 0	0 0 0	<	<	ENTSO-E assessment

Impact on grid losses

B5 Variation of network losses (GWh / year)	average	N/A	0	n/a	n/a	ENTSO-E assessment
B5_€ Variation of network losses monetised (M€ / year)	average	N/A	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	105	101	ENTSO-E assessment

B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	average	-264	-326	ENTSO-E assessment
B1_RES Annual Socio-Economic Welfare increase resulting from RES integration	average	35	18	ENTSO-E assessment

This project involves countries outside of the ENTSO-E area.

B1 SEW (Meuro/year) in third country/ies	average	79	65	ENTSO-E assessment
B1_RES (Meuro/year) in third country/ies	average	0	0	ENTSO-E assessment
B1_CO2 (Meuro/year) in third country/ies	average	272	218	ENTSO-E assessment

Reduction of CO2 and GHG emissions

B2a Annual CO2 variation from market simulation (ktonnes / year)		average	4989	9303	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	-35 -234 -678	-233 -605 -1433	ENTSO-E assessment

This project involves countries outside of the ENTSO-E area.

B2a (ktonnes/year) in third country/ies		average	-5131	-6226	ENTSO-E assessment
B2a_€ (M€/ year) in third country/ies	CO2 price	60€/ ton 100€/	36 241 698	156 405 959	ENTSO-E assessment

	ton 189€/ ton			

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)	average	613	412	ENTSO-E assessment
B3a Connected RES (MW)	-			ENTSO-E assessment

This project involves countries outside of the ENTSO-E area.

B3 (GWh / year) in third countries	average	0	0	ENTSO-E assessment

Non scenario-dependent indicator(s)

B8.0 Stability (Transient, Voltage and Frequency Stability)	Transient stability	Voltage stability	Frequency stability	
Greece Africa Power 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.

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
			ENTSO-E assessment

B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	average	-157	
B1_RES Annual Socio-Economic Welfare increase resulting from RES integration	average	1	ENTSO-E assessment

This project involves countries outside of the ENTSO-E area.

B1 SEW (Meuro/year) in third country/ies	average	45	ENTSO-E assessment
B1_RES (Meuro/year) in third country/ies	average	0	ENTSO-E assessment
B1_CO2 (Meuro/year) in third country/ies	average	186	ENTSO-E assessment

Reduction of CO2 and GHG emissions

B2a Annual CO2 variation from market simulation (ktonnes / year)	average	5618	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	-180 -404 -904	ENTSO-E assessment

This project involves countries outside of the ENTSO-E area.

B2a (ktonnes/year) in third country/ies	average	-6647	ENTSO-E assessment
B2a_€ (M€/ year) in third country/ies	CO2 price 60€/ ton 100€/	213 479 1070	ENTSO-E assessment

ton 189€/ ton		

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)	average	10	ENTSO-E assessment
B3a Connected RES (MW)	-		ENTSO-E assessment

This project involves countries outside of the ENTSO-E area.

B3 (GWh / year) in third countries	average	0	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
1709. Greece Africa Power Interconnector	1700	5%	25
Total	1700		25

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

1709

ENTSO-E