Project Sheet

TuNur

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Key Information

Cross Border Project
Offshore DC transmission cable
New

Under Consideration

Description

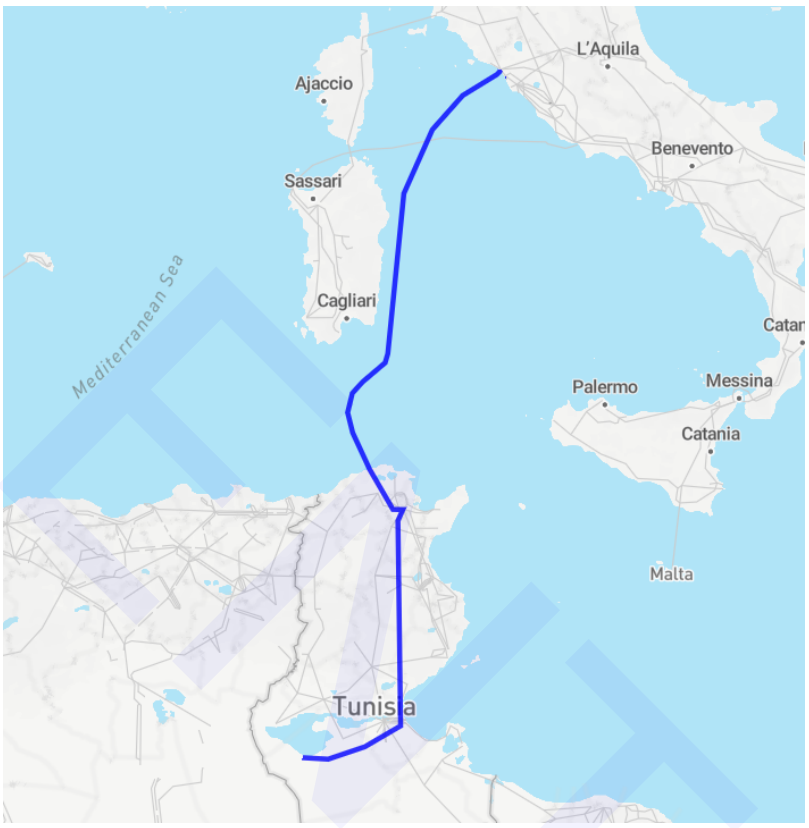
TuNur aims at connecting to the European electricity network a Concentrated Solar Power (CSP) plant with storage and an overall capacity in excess of 2000 MW to be located in Rejim Maatoug, Kebili, Tunisia. The connection point to ENTSO-E's network is located in Montalto di Castro, North of Rome, Italy. The transmission project will consist in a +/- 500 kV DC overhead line in Tunisia spanning from the power plant to the shoring point, submarine cables from the Tunisian Northern coast to Montalto di Castro, VSC HVDC converter stations at both terminal points, and short 400 kV AC cables from the HVDC converter in Montalto to Terna's 400 kV station. No sea electrode is foreseen.

Project promoters

TuNur Ltd

Countries

Italy
Tunisia



National development plan(s)

The project is mentioned in the Italian "Piano di Sviluppo", Terna S.P.A. E Gruppo Terna of 2019 at page 167. There is no project number allocated to the project. The development plan can be found at:
https://download.terna.it/terna/0000/1188/36.PDF

Additional information on the project

https://www.tunur.tn/project/export-projects/

On July 31, 2017 TuNur Limited filed its request for authorization with the Tunisian Ministry of Energy, Mines and Renewable Energy for a solar export project with a total of up to 4.5 GW to be realized in 3 tranches. A newly established solar complex in the Sahara Desert in Southwest Tunisia, near Réjim Maâtoug (Kébili Governorate) would supply the growing European market for carbon-free electricity, and stimulate much needed economic development in the interior region of the country. The project includes programs for local development and Tunisian industrial participation in the supply chain. Part of the production will be available for local and national consumption, at the option of the Tunisian government. The project is part of the solution to Europe's increasingly urgent challenges in the energy sector: meeting the Paris Climate Agreement emissions reduction targets, replacing obsolete fossil fuel and nuclear power plants, reducing reliance on imported fossil fuels, and meeting the expected surge in electricity demand from electric vehicles.

Multiple HVDC submarine cables systems are under development, which will allow the transport of power to Europe with low losses. The primary cable system will link Tunisia to central Italy, with a shoring point in Montalto, North of Rome. This cable system has been under development for several years and was included in ENTSO-E's TYNDP 2018. Additional cables are under study

specifically to link Tunisia directly to the South of France, and also to Malta.

Project sheet backlog

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): TuNur DC consists in a +/- 500 kV DC overhead line in Tunisia from the CSP plant to the shoring point, submarine cables from the Tunisian Northern coast to Montalto di Castro in Italy and VSC HVDC converter stations at both terminal points.

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	1270	Rejim Maatoug (TN) VSC HVDC - 400 kV AC +/- 500 kV DC – 2x 1GW	Montalto di Castro (IT) VSC HVDC - 400 kV AC +/- 500 kV DC – 2x 1GW	Under Consideration	2026	Delayed	The Tunisian regulatory framework has been settled only recently and this delayed the overall permitting process.

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
400 kV AC underground cables from the HVDC converter in Montalto to Terna's 400 kV station in Montalto. CAPEX includes 2 circuit breaker bays within	AC transmission line	2	Montalto di Castro (IT) VSC HVDC - 400 kV AC +/- 500 kV DC – 2x 1GW	Montalto di Castro (IT) Terna station 400 kV AC	Under Consideration	2026	Delayed	The Tunisian regulatory framework has been settled only recently and this delayed the overall permitting process.

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
Terna's station.								

Reason for investment clustering

To connect to Terna's grid, the main investment (DC cable) requires a short AC cable. The AC cable has no standalone purpose without the main 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 reduce price differentials between EU and/or non-EU countries	The TuNur project will contribute to improving market integration and reducing price differentials between EU and non-EU countries by providing an additional 2000 MW of low cost and low carbon available capacity, through a new connection between a non-EU (Tunisia) and EU (Italy).
	Infrastructure to address system adequacy deficiencies and/or mitigate the risk of power failures.	TuNur will provide dispatchable low-carbon power, thereby mitigating the risk of power failure, and will contribute to system adequacy deficiencies by increasing transmission capacity. This power source will improve security of supply by reducing Loss of Load durations across EU networks, making a significant contribution to system stability
	Infrastructure to improve system flexibility and stability e.g. improve system or local ramp rate, improve transient stability or RoCoF to meet system Needs.	The TuNur project will significantly contribute to system flexibility through direct access to a new source of renewable energy. TuNur will also contribute to system stability by improving transient stability and helping to meet RoCoF system needs. TuNur will provide flexible power with black-start capacity.
	Infrastructure and/or market design to provide balancing	TuNur consists in infrastructure that will contribute to balancing flexibility by providing the European network

Need		How the project addresses each need (explanation provided by the project promoter(s))
	flexibility (e.g. international pooling / sharing of reserves, coordinated development of reserve capacity)	with a new source of low-carbon dispatchable power. Additionally, the TuNur project will deliver a 2000 MW power reserve through a new HVDC interconnection between Tunisia and Italy.

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)	Italy - Tunisia	2000	2000

Boundary capacity diagram

Network boundary the projects helps mitigate

Italy – North Africa

Boundary capacity diagram

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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	585 576 570	574 550 525	>	>	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	max average min	115 112 109	138 133 127	>	>	ENTSO-E assessment
B1_RES Annual Socio-Economic Welfare increase resulting from RES integration	max average min	628 577 531	423 423 423	>	>	ENTSO-E assessment

Reduction of CO2 and GHG emissions

B4 Non-CO2 emissions (kg/year)

B4a Nitrogen oxides	average	-239018	-226292	n/a	n/a	ENTSO-E assessment
B4b Ammonia	average	-18496	-18498	n/a	n/a	ENTSO-E assessment
B4c Sulfur dioxide	average	-172262	-148286	n/a	n/a	ENTSO-E assessment
B4d Particular matter 5	average	-136026	-191272	n/a	n/a	ENTSO-E assessment
B4e Particulate matter 10	average	-12783	-12675	n/a	n/a	ENTSO-E assessment
B4f Non-methane volatile organic compounds	average	-126702	-182050	n/a	n/a	ENTSO-E assessment

B2a Annual CO2 variation from market simulation (ktonnes / year)	max average min	-4759 -4861 -4997	-4532 -4736 -4939	>	>	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	180 374 807	152 341 762	< < <	< < <	ENTSO-E assessment
B2b Annual CO2 variation due to network losses (ktonnes / year)	average	112	101	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	-4 -9 -19	-3 -7 -16	n/a	n/a	ENTSO-E assessment

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)	max average min	11490 11432 11324	10793 10793 10793	<	>	ENTSO-E assessment
B3a Connected RES (MW)	-	4000	4000	n/a	n/a	ENTSO-E assessment

Impact on grid losses

B5 Variation of network losses (GWh / year)	average	713	610	n/a	n/a	ENTSO-E assessment
B5_€ Variation of network losses monetised (M€ /	average	12	8	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	617	579	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	average	198	156	ENTSO-E assessment
B1_RES Annual Socio-Economic Welfare increase resulting from RES integration	average	535	525	ENTSO-E assessment

Reduction of CO2 and GHG emissions

B2a Annual CO2 variation from market	average	-3734	-4448	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	26 175 508	111 289 685	ENTSO-E assessment

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)	average	10484	11191	ENTSO-E assessment
B3a Connected RES (MW)	-	4000	4000	ENTSO-E assessment

Non scenario-dependent indicator(s)

B8.0 Stability (Transient, Voltage and Frequency Stability)	Transient stability	Voltage stability	Frequency stability	
TuNur DC (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.
TuNur AC (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

		ENTSO-E assessment

B1 Annual Socio-Economic Welfare (SEW) increase (M€ / year)	average	614	
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	average	122	ENTSO-E assessment
B1_RES Annual Socio-Economic Welfare increase resulting from RES integration	average	644	ENTSO-E assessment

Reduction of CO2 and GHG emissions

B2a Annual CO2 variation from market simulation (ktonnes / year)	average	-4369	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	140 315 703	ENTSO-E assessment

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)	average	11567	ENTSO-E assessment
B3a Connected RES (MW)	-	4000	ENTSO-E assessment

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

Regarding B6 – Security of Supply

Italian power system has been identified as no-adequacy issue system during the 2030 NT Scenario SoS check. This means that the system already reached the adequacy standards in the

base case (without a project), therefore the project cannot have contribution in this sense.

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
TuNur DC	Under Consideration	1	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.

Additional information by the project promoter(s)

For TuNur DC, the detailed route around the Sidi Barrack Dam will be optimized in order to increase the buffer distance and minimize any impact.

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
1378. TuNur DC	2680	8%	41
1430. TuNur AC	16	8% of the overall project cost as exact length is not yet confirmed, it being understood that the impact of the short AC cable on the overall project will be negligible.	0.04
Total	2696		41.04

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

1378	Project cost has been evaluated with a nominal uncertainty of 5% but 8% has been assumed due to possible minor variation in the path.
1430	The overall project cost has been evaluated with a nominal uncertainty of 5% but an

uncertainty of 8% has been assumed due to possible minor variations in the path

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