Med-TSO
MEDITERRANEAN TRANSMISSION SYSTEM OPERATORS

Masterplan of Mediterranean Interconnections

March 2023

www.med-tso.org

Med-TSO is co-funded by the European Union.

THE MEDITERRANEAN MASTERPLAN

This brochure presents the work carried out to finalize the 2022 edition of the Mediterranean Masterplan of Interconnections, the assessment of 19 interconnection projects proposed by Med-TSO Members and involving 16 Mediterranean countries.

Projects have been assessed considering three possible different long-term energy scenarios at the 2030 year-horizon (Inertial, Proactive & Mediterranean Ambition), developed by Med-TSO in coherence with those presented by ENTSO-E (the European Network of TSOs for electricity) in the framework of their 2022 Ten-Year Network Development Plan.

MEDITERRANEAN SCENARIOS

The Med-TSO 2030 Reference Scenarios explore possible future situations of load and generation in the Euro-Mediterranean Power System. The aim of these scenarios is to build the path from the present to several possible future settings (trends in load and generation) and deliver a robust framework for grid development studies.

Rationales for defining scenarios for the future of the Mediterranean Power System

To build a consistent storyline for future energy scenarios in the Mediterranean Region, a series of parameters, to be considered as main drivers of evolution, have been identified, as summarized below.

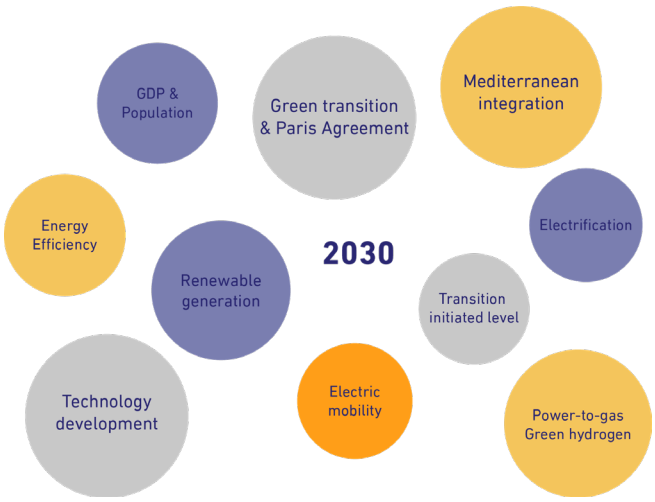

Figure 1. Overview of Med-TSO key scenario drivers

Three scenarios to address the evolution of the Mediterranean Power System in 2030

Based on different assumptions concerning the evolution of the key drivers, three different long-term scenarios have been developed, characterized by the main principles described in Table 1.

Drivers	Criteria	Inertial scenario	Proactive scenario	Mediterranean Ambition scenario
Macro-Economic Trends	GDP, population growth	+	+ +	+ +
Integration of energy policies	Energy transition	+	+ +	+ + +
	New demand	+	+	+ + +
Generation, RES development and GHG emission reduction	RES/GHG reduction target achieved	+ +	+ + + Distributed	+ + + Large scale

Drivers	Criteria	Inertial scenario	Proactive scenario	Mediterranean Ambition scenario
New demand - Efficiency	Electric mobility - energy efficiency	+	+ +	+ +

Table 1. Med-TSO scenarios' drivers and metrics.
2030 compared to today. + Low growth I ++ Moderate growth I +++ High growth

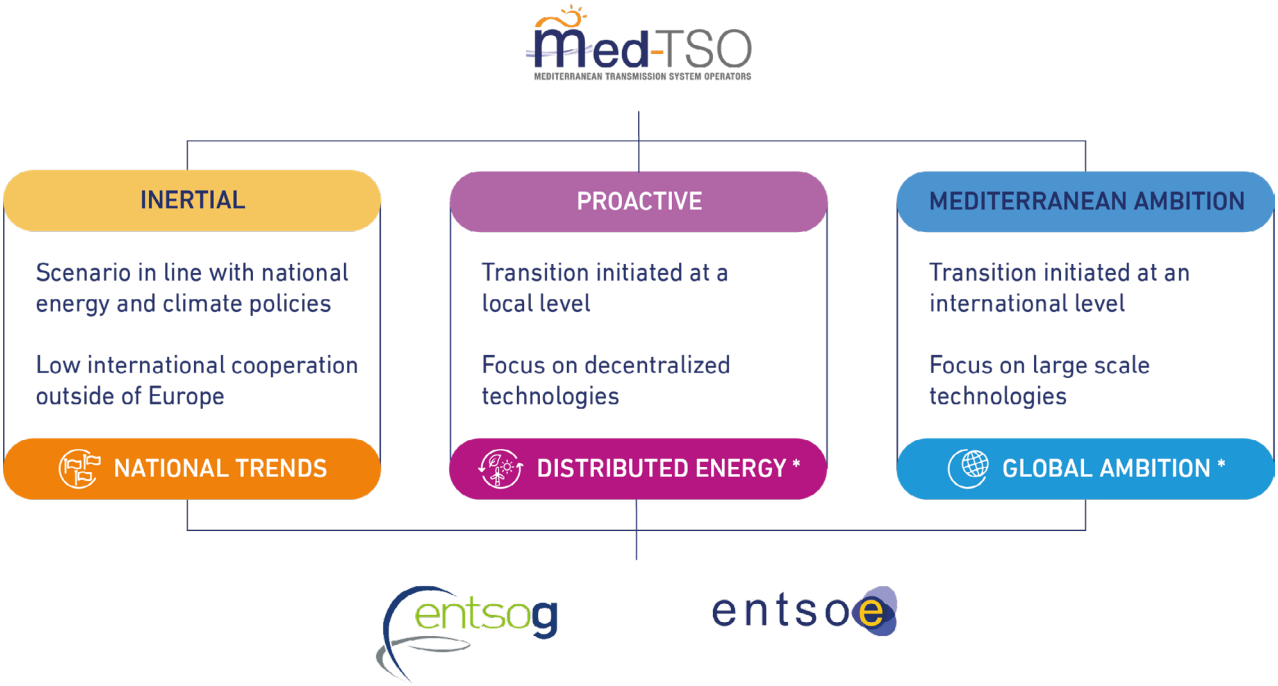

Figure 2. Adopted matching for Med-TSO and ENTSO-E TYNDP2022 scenarios
** At least a 55% reduction in 2030 in EU countries*

It is worth highlighting that these three long-term scenarios do not intend to forecast the future, and there is no assumption of probability associated with any of them. Moreover, the three identified extreme scenarios, characterized by contrasting trends, define an area of probability within which the future evolution should reasonably fall, thus supporting the robust assessment of costs and benefits associated with the proposed interconnection projects.

Relations with ENTSO-E

The perimeter of Med-TSO power system modelling includes both EU and non-EU Mediterranean countries. For the resulting Euro-Mediterranean Power System, it is therefore key to ensure consistency among data provided by ENTSO-E and Med-TSO.

THE TRANSMISSION PROJECTS

The Masterplan of Interconnections aims to identify, through the assessment of new interconnection projects, potential benefits at regional level, such as improved market efficiency, reduced cost of energy for end users, improved integration of renewable energy sources, enhanced security of supply and power grid stability. In this 2022 edition of the Masterplan, Med-TSO members proposed 19 interconnection projects to be assessed, involving 16 countries.

The total length of the new lines built exceeds 10,000 km, implying an investment of more than €16 billion. The analyses carried out have shown that the completion of these projects would result in almost 19 GW of additional exchange capacity between the Mediterranean countries, contributing to reducing the RES curtailment in the Region by up to 15 TWh/yr and saving the planet up to 24 Mt/yr of CO_2 emissions.

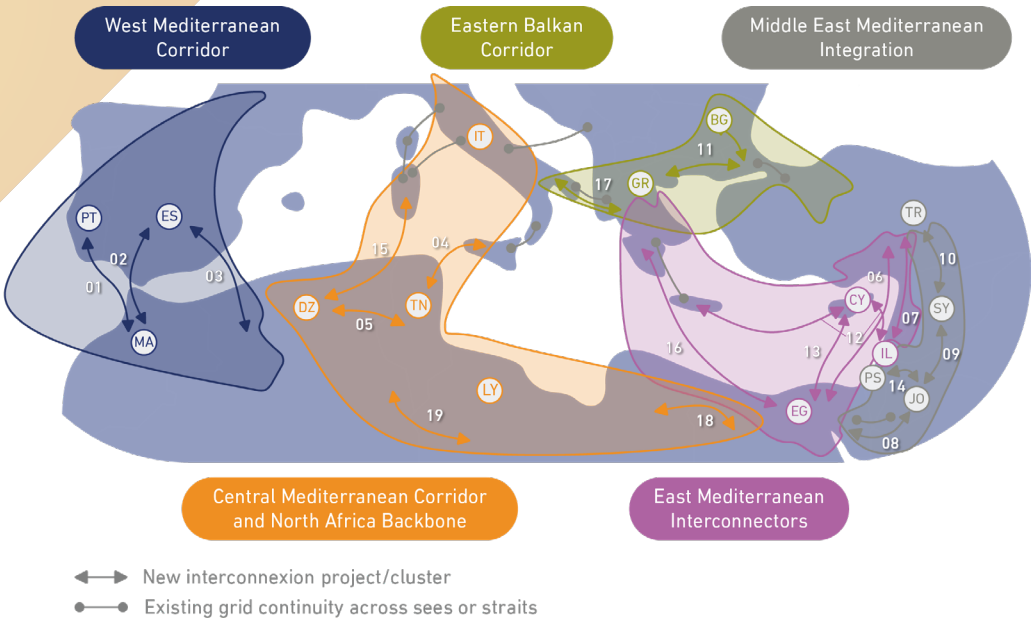

Figure 3. Project grouping mapping in the Mediterranean Area

According to their merits and their common geographical particularities and challenges, the projects have been grouped into 5 different corridors. Table 2 shows the various project merit indicators used in Med-TSO's cost-benefit analysis, while Table 3 gives a detailed overview of the potential benefits that could be achieved through the individual interconnection projects.

Category	Symbol	Detailed Project Merits – Legend
Welfare, Sustainability and Security of Supply		1.1. Reduce high price differentials between different market nodes/countries
		1.2. Positively contribute to the reduction of RES curtailment and CO_2 emission levels
		1.3. Contribute to solving adequacy and security of supply issues
Isolation		2.1. Fully or partially contribute to resolving the isolation of countries in terms of power system connectivity or to meeting specific interconnection targets
Operation – Flexibility		3.1. Introduce additional system restoration mechanisms
		3.2. Improve system flexibility and stability
		3.3. Increase system voltage stability
		3.4. Contribute to the integration of new RES generation capacity
Operation – Flows		4.1. Enable cross-border flows to overcome internal grid congestion
		4.2. Mitigate loop flows in bordering systems

Table 2. Project merit indicators for Med-TSO CBA

Projects Corridor/ Region	Projects composing the Corridor/Region	Nominal transfer capacity (MW)	Potential expected benefit from the cluster	Detailed benefits
West Mediterranean corridor	Project 1: Morocco – Portugal	+1000		1.1, 1.2, 2.1, 3.1, 3.2, 3.3, 3.4, 4.1, 4.2
	Project 2: Spain – Morocco	+600 / +650		1.1, 1.2, 2.1, 3.1, 3.4
	Project 3: Algeria – Spain	+1000		1.1, 1.2, 2.1, 3.1, 3.3, 3.4

Projects Corridor/ Region	Projects composing the Corridor/Region	Nominal transfer capacity (MW)	Potential expected benefit from the cluster	Detailed benefits
Central Mediterranean Corridor & North Africa Backbone	Project 4: Italy – Tunisia	+600		1.1, 1.2, 1.3, 3.2, 3.3, 3.4, 4.1
	Project 15: Algeria – Italy	+1000		1.1, 1.2, 3.2, 3.3
	Project 5: Algeria – Tunisia	+750		1.1, 1.2, 1.3, 2.1, 3.1, 3.2, 3.3, 3.4, 4.1, 4.2
	Project 19: Algeria – Libya	+1000	N/A	N/A
	Project 18: Egypt – Libya	+1000		1.1, 1.3, 2.1, 3.3, 3.4
East Mediterranean Interconnectors	Project 6: Egypt – Türkiye	+3000		1.1, 1.2, 3.1, 3.2, 3.3, 3.4, 4,1
	Project 7: Israel – Türkiye	+2000		1.1, 1.2, 3.1, 3.2, 3.3, 3.4
	Project 12: Greece – Cyprus – Israel	+1000 / +1000		1.1, 1.2, 1.3, 2.1, 3.1, 3.2, 3.3, 3.4, 4.1, 4.2
	Project 13: Cyprus – Egypt	+1000		1.1, 1.2, 1.3, 3.1, 3.2, 3.3, 3.4
	Project 16: Egypt – Greece	+2000		1.1, 1.2, 1.3, 3.3, 3.4
Eastern Balkan Corridor	Project 11: Bulgaria – Turkey – Greece	+1100 / -700 ± 600		1.1, 1.2, 2.1, 3.4
	Project 17: Italy – Greece	+500		1.1, 1.2, 3.2, 3.3, 3.4. 4.1
Middle East Mediterranean Integration	Project 9: Jordan – Syria	+1000		1.1, 1.2, 1.3, 2.1, 3.2, 3.3, 3.4, 4.1
	Project 10: Syria – Türkiye	+600		1.1, 1.3, 3.4
	Project 14: Jordan – Palestine	+200 / -0		1.1, 1.2, 1.3, 2.1, 3.1, 3.3, 3.4, 4.1
	Project 8: Egypt – Jordan	+550		1.1, 1.2, 1.3, 3.2, 3.3, 3.4, 4.1

Table 3. 2022 MMP Projects benefits by merit indicator

MAIN OUTCOMES

Project assessment has been carried out considering only two scenarios (Inertial & Proactive) and using an innovative continuous load flow approach, as described in Figure 4. It relies on the analysis of a wider number of grid conditions, potentially enabling a more accurate and detailed identification of contingencies and network issues for further investigation.

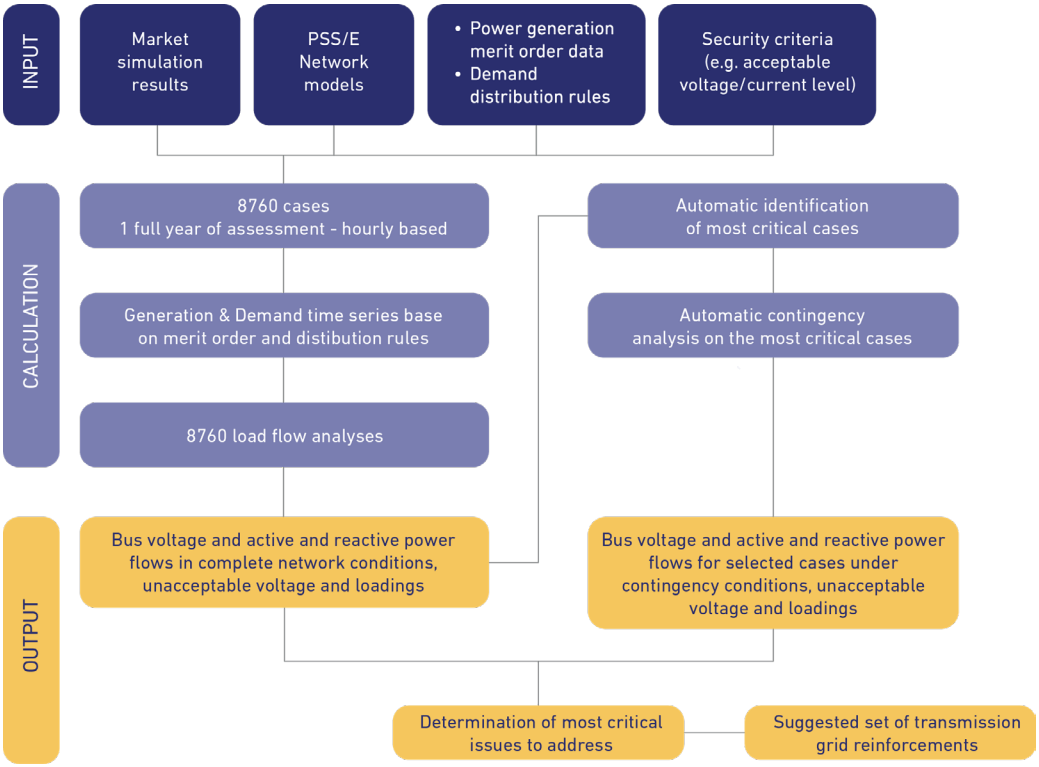

Figure 4. Network Analysis: Continuous load flow process

Read the full document in the website's reports section

Med-TSO
MEDITERRANEAN TRANSMISSION SYSTEM OPERATORS

Med-TSO is the Association of the Mediterranean Transmission System Operators (TSOs) for electricity, operating the High Voltage Transmission Networks of 20 Mediterranean Countries. It was established on 19 April 2012 in Rome as a technical platform that, using multilateral cooperation as a strategy of regional development, could facilitate the integration of the Mediterranean Power Systems and foster Security and Socio – economic Development in the Region.

Med-TSO members share the primary objective of promoting the creation of a Mediterranean energy market, ensuring its optimal functioning through the definition of common methodologies, rules and practices for optimizing the operation of the existing infrastructures and facilitating the development of new ones.

Med-TSO Legal Headquarters
Viale Egidio Galbani, 70 - 00156 Rome,Italy

Operational Headquarters
Via della Marcigliana, 911 - 00138 Rome, Italy

Telephone +39 06 8313 9431 - Email: info@med-tso.com

This publication was co-funded by the European Union. Its contents are the sole responsibility of Med-TSO and do not necessarily reflect the views of the European Union.