Mediterranean Masterplan 2020

MEDITERRANEAN PROJECT 2 (2018-2020)

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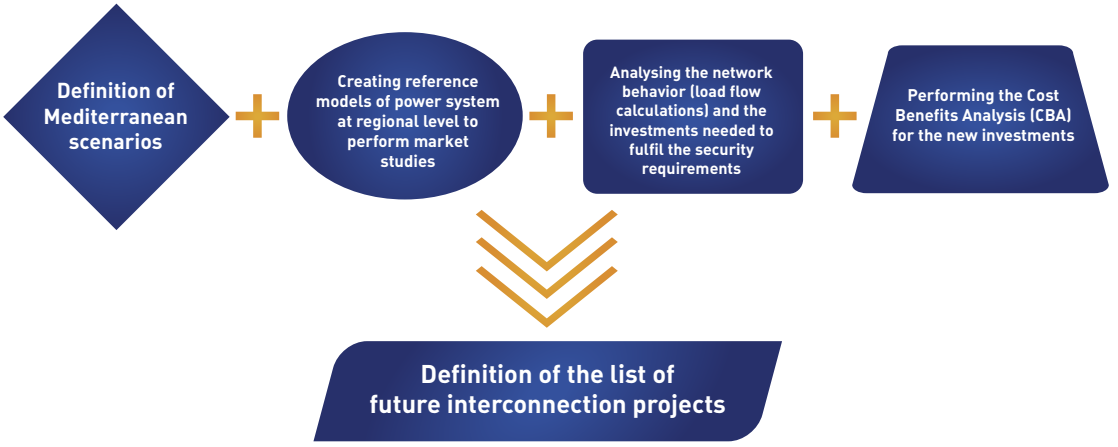
www.med-tso.com

Med-TSO is supported by the European Union.

INTRODUCTION

The **Mediterranean Master Plan 2020** is a bunch of several **new interconnection projects** among the Mediterranean countries, assessed, according to a shared methodology by Med-TSO members, to evaluate their benefits at a regional level. Indeed, the Plan focuses on projects with different degrees of maturity, but all proposed to **connect the Mediterranean area and reach the goal of the energy transition.** In fact, our studies are developed taking into consideration the Paris Agreement and within the framework of the Green Deal Communication issued by the European Commission in December 2019, which has given high momentum to accelerated initiatives at EU level for decarbonizing society at a whole at the year 2050.

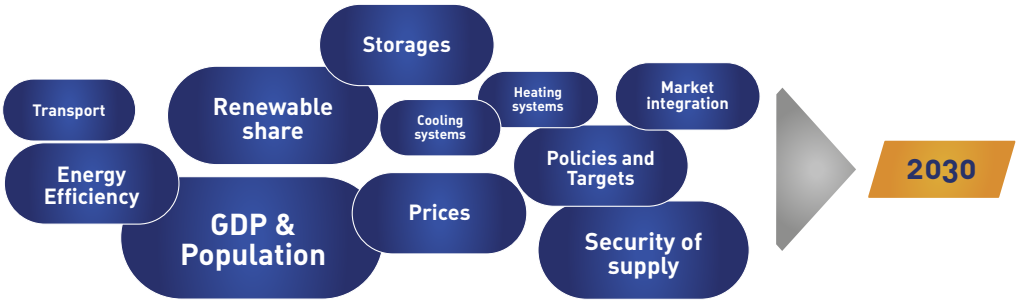
This Master Plan represents an attempt to raise together the challenges of diversification of the electrical mixes and increasing the overall flexibility of the systems by enhancing Market integration and assessing new interconnection projects, basing on the different Med-TSO countries National Development Plans. The list of 15 interconnection projects identified and promoted by the members (TSOs) has been studied and assessed in compliance with the requirements of the EU Regulation (EU) 347/2013[1], as a direct application of ENTSO-E[2] Cost-benefit analysis (CBA).
The Mediterranean Master Plan includes the assessment results of the selected interconnection projects, grouped under a geographical subdivision of the Mediterranean area, with respect to their commercial and technical feasibility in three identified energy scenarios.



The overall result is an evaluation of about 5.800 km of new interconnections (4.100 km of them in HVDC technology), for 18 GW of additional interconnection capacity and a total investment cost of about 12 billion USD (about 10 billion EUR).

1. DEFINITION OF MEDITERRANEAN SCENARIOS

The aim of Med-TSO's long-term scenarios is to build the path from the present to several possible futures (trends on load and generation), to provide a robust framework for the grid development studies. In this context, three long-term Med-TSO Scenarios have been built on a set of main macro-economic, policy-driven and energy-related indicators.



◆ **National Development Scenario:** based on a positive yet conservative option for long-term economic growth and decarbonisation in the Mediterranean region, accompanied by a moderate population growth. The extent of development of renewable energy generation corresponds to commitments already made plus already

1.Regulation on guidelines for trans-European energy infrastructure.
2.European Network of Transmission System Operators for Electricity.

approved national energy policies. Energy efficiency, as well as electrification of other sectors present a limited development;

◆ **Green Development Scenario:** describes a Mediterranean region that benefits from a good development of macroeconomic trends. Emphasis is placed on the development of RES, especially with the construction of large generation facilities, but also with the development of decentralized generation and the growing role of prosumers. Efforts to improve energy efficiency focus on the residential sector and industry, resulting in the emergence of new uses of electricity;

◆ **Mediterranean Evolution Scenario:** considers a regional approach to the energy transition. It is based on the expected strong population growth, especially in the South and East countries, accompanied by a dynamic economy based on a huge development of industrial sectors and services. The ambitions for the development of RES and the reduction of GHGs are increased and can rely on regional cooperation and enhanced interconnection between countries. New uses of electricity are developing significantly, while efforts are being made at the same time to improve energy efficiency.

2. CREATING REFERENCE MODELS OF POWER SYSTEM AT REGIONAL LEVEL TO PERFORM MARKET STUDIES

Starting from the collection of National grid model data and based on Med-TSO documentation on planning methodology, another fundamental step of the process is the building of the reference grid model of the interconnected Mediterranean system.

The 15 proposed projects are clustered in six blocks, according to common geographic and network characteristics. ¨ **West Mediterranean corridor** ¨ **Central Mediterranean corridor & North Africa Backbone** ¨ **East Mediterranean interconnectors** ¨ **South East Mediterranean hub** ¨ **Eastern Balkan corridor** ¨ **Mediterranean Middle East reinforcement.**

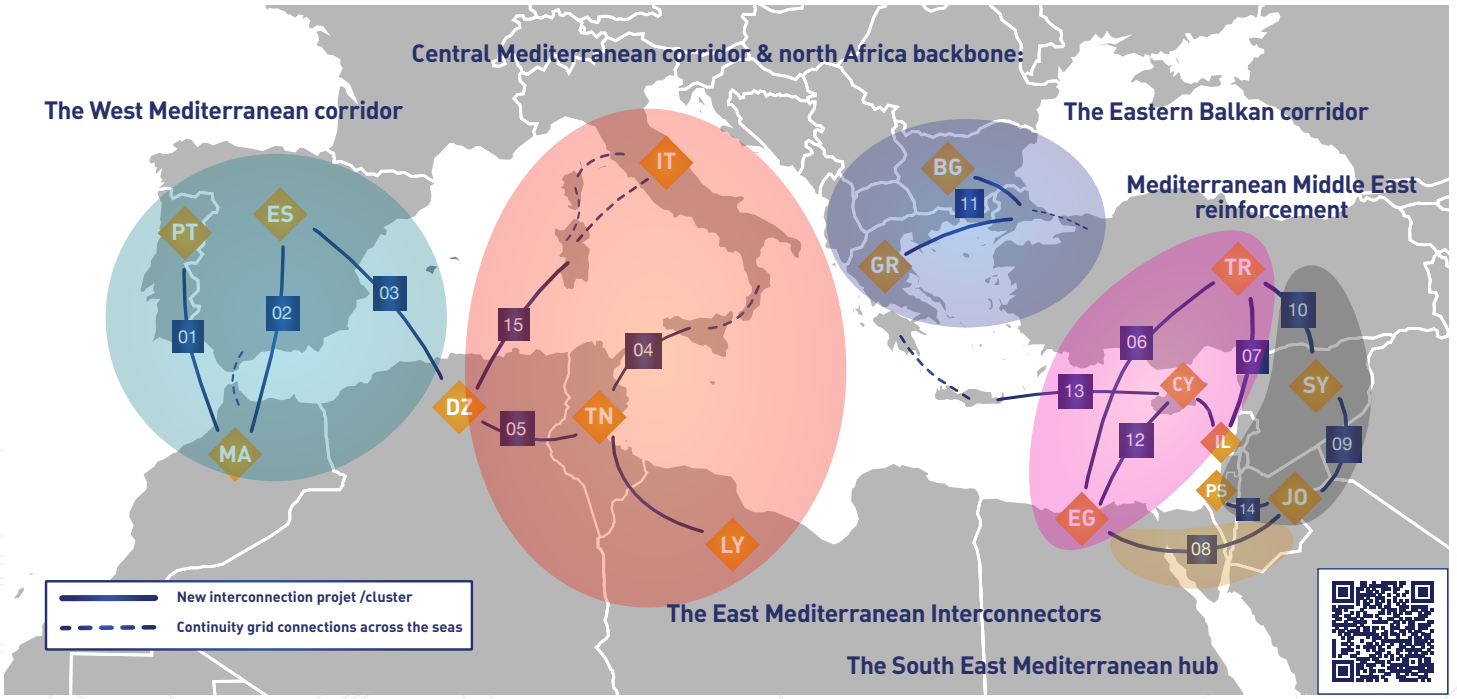
The purpose of Market Studies is to assess the benefits of the different investment clusters and the exchanges within the area. The implementation of Market model makes it possible to obtain a global and detailed vision of the Mediterranean power system behavior for each of the scenarios through a large number of indicators and physical quantities.

The results of this analysis show that:

◆ Electricity consumption evolution for 2030 remains dynamic and expected to increase by 25 to 33% by 2030 for the entire Mediterranean region mainly driven by economic and demographic growth in the southern shore. This excess consumption is fully satisfied by the increase in production from renewable sources.

◆ For all Mediterranean countries, the reduction in CO2 emissions from electricity generation is expected between 16 and 20% by 2030 for the three scenarios compared to 2018, which represents a decrease of about 100 million tons per year.

All the results of the analysis and the datasets are available for consultation on the digital masterplan website, reachable in the following QR code.*



3. ANALYZING THE NETWORK BEHAVIOR (LOAD FLOW CALCULATIONS) AND THE INVESTMENTS NEEDED TO FULFIL THE SECURITY REQUIREMENTS

Load flow calculations are performed to verify the consistency of the interconnection clusters with possible network constraints. This analysis includes the consideration of planned reinforcements of current network in accordance with the year horizon 2030, and additional reinforcements evaluated to allow system functioning foreseen from Market studies.
Due to time and resources limitations, AC load flow analysis is performed for a selection of significant Points In Time (i.e. relevant snapshots of the system conditions), for the three different scenarios, to verify possible network constraints. In total 126 Points-in-Time are examined, in all of them both total line lengths and overall cost for the interconnections are the same.

KPI*	Scenario 1	Scenario 2	Scenario 3
N° of countries involved	16	16	16
N° Projects	15	15	15
N° Point in Times	41	48	37
Overall interconnection lenght (km)	5538	553	553
Overall reinforcements lenght (km)	2440	268	260
Aggregated investment costs (M€)	10,640	10,640	10,640
Aggregated reinforcements costs (M€)	710	810	760
%reinforcement cost over total investment	6.7	7.6	7.1
Total losses (GWh)	3,942.0	3,754.4	3,736.3
Total losses (M€)	232.3	221.2	214

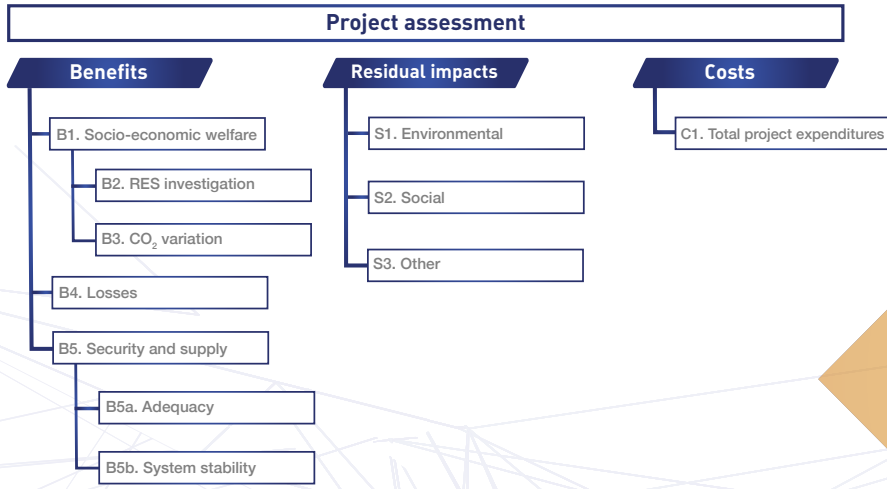
*** The aggregated investment costs are indicative as they average different technological solutions for the same project.**

Table 1. Reports the main achievements for the 15 assessed projects, including also the necessary reinforcements (overall line length, costs and their percentage compared to the total investment) and additional losses (energy and its monetization).

4. PERFORMING THE COST BENEFITS ANALYSIS (CBA) FOR THE NEW INVESTMENTS

As a final step, a Cost Benefit Analysis (CBA) is developed to evaluate the benefits and costs of new interconnection projects from a Mediterranean perspective, providing important input for the assessment of the interconnection projects considered in the Mediterranean Region. The methodology is based on the best practices promoted by ACER and applied by ENTSO-e at European Level with appropriate adaptations to the Mediterranean context. Its main objective is to provide a common and uniform basis for the assessment of these projects.

The cost-benefit impact assessment criteria adopted reflect each project's added value for society. Hence, economic and social viability are displayed in terms of increased capacity for exchange of energy and balancing services between market areas (market integration), sustainability (RES integration, CO2 emissions variation) and security of supply (secure system operation).
This set of common indicators resumed in the chart below, forming a complete and solid basis for project assessment across the Mediterranean area.



5. DEFINITION OF THE LIST OF FUTURE INTERCONNECTION PROJECTS

At the end of the process, the merits of the assessed projects are clustered into three categories (Market; Dispatching, Adequacy and Security of Supply; Operation): In this way it is shown where each interconnection projectwith its expected benefits, can contribute mostly to the needs of the Mediterranean electricity system.

Category	Project Merits	Symbol	Projects groups	Projects composing the group	Additional BTC (WW)	Potential Expected benefit from the cluster
Market	Reduce high price differentials between different market nodes and/or countries		West Mediterranean corridor	Project 1: Morocco – Portugal	+1000	
Dispatch, Adequacy and Security of Supply	Positively contribute to the integration of renewables			Project 2: Spain – Morocco	900	
	Contribute to solving adequacy and security of supply issues			Project 3: Algeria – Spain	+1000	
	Fully or partially contribute to resolving the isolation of countries in terms of power system connectivity or to meeting specific interconnection targets		Central Mediterranean corridor & North Africa Backbone	Project 4: Italy - Tunisia	+600	
	Introduce additional System Restoration mechanisms			Project 15: Algeria – Italy	+1000	
	Improve system flexibility and stability			Project 5: Algeria – Tunisia - Libya	+750/+1 250	
	Increase system voltage stability		East Mediterranean interconnectors	Project 6: Egypt – Turkey	3000	
	Enable cross-border flows to overcome internal grid congestions			Project 7: Israel – Turkey	2000	
	Mitigate loop flows in bordering systems			Project 12: Greece – Cyprus – Israel	1000 / 1000	
	Contribute to the flexibility of the power systems through the control of power flows			Project 13: Cyprus - Egypt in addition to Project 12.	1000	
			South East Mediterranean hub	Project 8: Egypt – Jordan	550	
			Eastern Balkan corridor	Project 11: Bulgaria – Turkey – Greece	500 /500	
			Mediterranean Middle East reinforcement	Project 9: Jordan – Syria	800	
				Project 10: Syria – Turkey	600	
				Project 14: Jordan – Palestine	100	

The implementation of the Master Plan is a rolling activity for Med-TSO, updated every two years, in tight connection with the Ten-Year Network Development Plan (TYNDP) carried out at European level by ENTSO-E.

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 19 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.

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