Master Plan of Mediterranean Interconnections

2025 edition

Acknowledgements

This report was prepared by Med-TSO Technical Committee Planning, chaired by Neveen Saleh, Egyptian Transmission System Operator, in the framework of the TEASIMED 2 project.

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This work would not have been possible without the support and cooperation of all TC Planning group members who reviewed the document. Special thanks to the Med-TSO Secretariat staff, particularly Ms. Naglaa Khattab, Mr. Ahmed El Shami, and Mr. Anas EL Hraiech, for their coordination efforts in producing this report.

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Abbreviations

AC	Alternative Current
CBA	Cost-Benefits Analysis
CCGT	Combine Cycle Gas Turbine
DBMED	Mediterranean Database
DC	Direct Current
EC	European Commission
EENS	Expected Energy Not Supplied
ENS	Energy Not Supplied
ENTSO-E	European Network of Transmission System Operations for Electricity
EU	European Union
GDP	Gross Domestic Product
GHGs	Greenhouse Gases
GWh	Gigawatt hour
HVAC	High-Voltage Alternating Current transmission
HVDC	High-Voltage Direct Current transmission
IN	Inertial scenario
kV	Kilovolt
LCC	Line-Commutated Current-sourced Converters
LOLE	Loss of Load Expectation
MA	Mediterranean Ambition scenario
MEDREG	Mediterranean Energy Regulators
Med-TSO	Association of the Mediterranean Transmission System Operators (TSOs)
MENAT	Middle East, North Africa, and Türkiye
MMP	Mediterranean Master Plan
NDP	National Development Plan
NTC	Net Transfer Capacity
OCGT	Open-Cycle Gas Turbine
PCI	Projects of Common Interest
PINT	Put IN one at a Time
PiTs	Point in Time
PMI	Projects of Mutual Interest
PR	Proactive scenario
PV	Photovoltaics
SEW	Socio-Economic Welfare
SoS	Security of Supply
TEASIMED	Towards an Efficient, Adequate, Sustainable and Interconnected MEDiterranean power system

TOOT	Take One Out a Time
TSO	Transmission System Operator
TYMNDP	Ten-Year Mediterranean Network Development Plan
UNFCCC	United Nations Framework Convention on Climate Change
VSC	Voltage Source Converters
VOLL	Value of Lost Load

1

Executive Summary

The present edition of the Master Plan of Mediterranean Interconnections is an update of the version issued by Med-TSO in 2022. **It represents the result of close collaboration among the 20 Transmission System Operators (TSOs) of Med-TSO**, who jointly assessed opportunities to enhance electrical integration across the Mediterranean region.

This updated Master Plan is one of the key deliverables of TEASIMED 2 (Towards an Efficient, Adequate, Sustainable and Interconnected MEDiterranean Power System 2), the fourth project co-funded by the European Commission to sustain regional energy development.

It includes an updated assessment of the eight interconnection projects included in the 2022 Master Plan, an expanded cluster including Jordan, Syria, now including Lebanon and an interconnection between Greece and Albania. **These projects are promoted by Mediterranean TSOs from 16 different countries and five different corridors, each characterised by shared geographical features and challenges.**

The projects are assessed with a 2030 time horizon in mind, based on an updated version of the long-term Inertial energy scenarios developed by Med-TSO members. These scenarios are aligned with those developed by ENTSO-E, the Association of European TSOs, in the framework of the 2024 Ten-Year Network Development Plan (TYNDP).

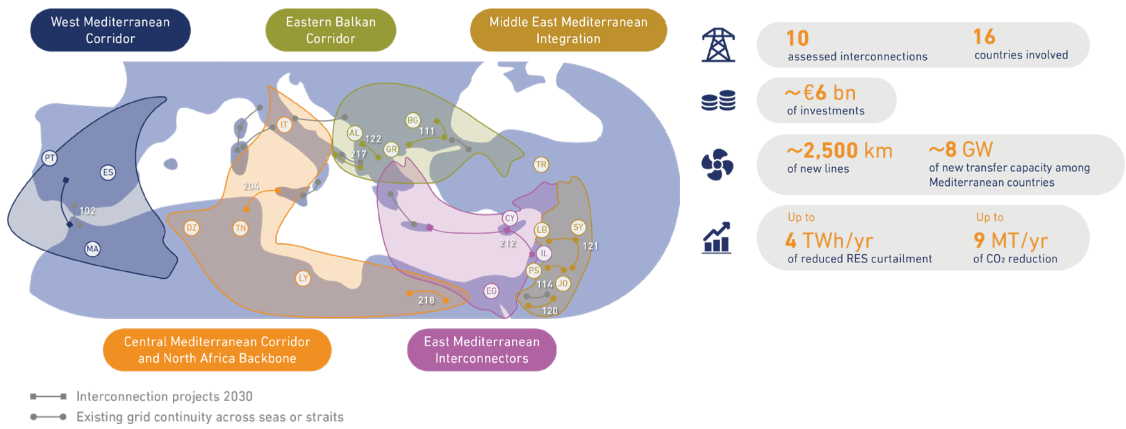


Figure 1. MMP 2025 main results

Within the framework of the Master Plan, TSOs were given the opportunity and the tools **to observe possible evolutions across the entire Mediterranean Power System, identify associated system needs, and assess the benefits of interconnection projects in addressing them.**

Looking at the results and the overall indicators resulting from the Master Plan, the following key considerations can be extracted:

• The implementation of the analysed interconnection projects would result in around 8 GW of additional transfer capacity and require up to €6 billion in investment. This would make **a significant contribution to the economic, social, and environmental development of the Mediterranean region.**

• The Master Plan provides valuable insights into **projects currently under development and future interconnections undergoing preliminary assessment.** Projects at various stages of development but mature enough to be in the reference grid for the year 2030, include the additional Morocco–Spain interconnection, the Albania–Greece connection, the Jordan–Palestine project, and the Great Sea Interconnector connecting Greece, Cyprus and Israel, which has secured €657 million of EU financing for the interconnection between Greece and Cyprus. Also included is the first interconnection between Italy and Tunisia, which has secured €307 million of EU financing.

• The development of new interconnection capacity enables a more efficient exploitation of complementarities among Mediterranean countries, **facilitating the integration of renewable generation and the global reduction of CO_2 emissions.**

• In some cases, interconnections directly contribute to **reducing the isolation of specific countries and regions**, drastically increasing their Security of Supply (SoS).

• The realisation of interconnections is a first step towards the **broader integration of the Mediterranean region**, which will require further developments to ensure the efficient operational use of the available transmission capacity.

2

Introduction and context of the updated Master Plan

This document presents the 2025 edition of the Mediterranean Master Plan, incorporating updated scenarios and latest developments in the Mediterranean countries' energy landscape. It is a key deliverable of the TEASIMED 2 Project, co-funded by the European Commission, to promote greater integration, sustainability and efficiency in the Mediterranean Power System. This update captures the revisions made in the regional energy scenarios, as outlined in the TEASIMED 2 Scenarios Report.

This Mediterranean Master Plan is aligned with both global and regional climate objectives, building on the commitments set out in the Paris Agreement (2015) and subsequent EU initiatives, including the EU Green Deal (2019), the Fit-for-55 package (2021), and the REPower EU initiative. **These frameworks target achieving carbon neutrality by 2050 and accelerating the decarbonisation of the energy sector in response to geopolitical tensions and energy security concerns.**

This Master Plan is an update on the 2022 report while focusing on the 2030 targets. It also prioritises the most mature infrastructure projects, essential for advancing regional decarbonisation, integrating renewable energy sources, and enhancing cross-border interconnections. These projects aim to improve energy security, boost market efficiency, and reduce the environmental impact of electricity generation.

The TEASIMED 2 Master Plan will be complemented by a separate document: the Mediterranean Electricity Interconnections Perspectives (MEIP), which will focus on covering the projects scheduled for implementation by 2040 and beyond, as well as list the exploratory initiatives to enhance interconnectivity in the region's power systems.

Together, **these documents ensure a strategic, phased approach to regional energy development, balancing immediate priorities with long-term ambitions.**

This Master Plan is part of the broader efforts of Med-TSO, an association of 20 Transmission System Operators (TSOs) from 20 Mediterranean countries, established to foster regional cooperation and facilitate the creation of an integrated Mediterranean energy market. The plan is developed in alignment with ENTSO-E methodologies, ensuring coherence with wider European energy strategies while addressing the unique dynamics and challenges of the Mediterranean region.

3

Elaboration of the Master Plan

Med-TSO members follow a common process for coordinated planning. This involves preparing and assessing a development plan for interconnection projects between their transmission systems to support the energy transition in the Mediterranean area.

To ensure the energy transition is cost-effective and secure, the portfolio of interconnection projects is assessed against various possible energy futures. These futures reflect different trends in load and generation, based on carefully developed long-term scenarios.

These scenarios outline the path from the current situation to the target time horizon and provide a robust framework for grid development studies. Based on this, **the interconnection projects in the MMP are assessed using a techno-economic approach, which relies on results from market and network studies.**

To support this goal, the Methodology for the Long-term Network Development Plan includes the following key steps:

• Defining Mediterranean energy scenarios

• Identifying a list of future interconnection projects

• Creating regional-level reference models of the power system for market studies

• Analysing network behaviour through load flow calculations and identifying necessary investments to meet security standards

• Conducting a Cost-Benefit Analysis (CBA) for the proposed investments

This edition of the Master Plan of Interconnections is an update of the report published by Med-TSO in 2022. As such, it does not follow the full methodology described above, but focuses only on updating one of the Mediterranean scenarios and the results of the related CBA. Given the maturity level of the assessed projects, the network studies presented in the 2022 report have not been revised.

3.1 Projected evolution of Mediterranean Power Systems by 2030

The scenario-building process developed by Med-TSO serves as the foundation for assessing future energy needs. **It offers a quantitative basis for infrastructure assessment and network planning by defining a set of plausible futures against which system performance can be tested.** In practice, these scenarios are designed to capture the dynamic uncertainties of the energy transition.

The Med-TSO framework includes three long-term scenarios: Inertial, Proactive and Mediterranean Ambition, which represent different levels of interaction among national power systems, ultimately aiming at a more coordinated Mediterranean Power System. These 2040 scenarios outline possible pathways from the present to a range of future trends in energy demand, electricity generation, sector coupling, technological development, policy directions, and decarbonisation goals. They provide a solid foundation for grid development studies.

However, the level of uncertainty for the 2030 horizon is relatively low. As a result, Med-TSO has developed a single projection for the medium-term evolution of Mediterranean electrical systems. This projection is aligned with the NT+2030 scenario from the TYNDP2024 for European countries.

By 2030, electricity consumption across all Mediterranean countries (excluding electricity demand dedicated to renewable hydrogen production), is expected to reach approximately 2,470 TWh, marking a 20% increase from the reference year 2023. To meet this rising demand, particularly in the context of the energy transition, the development of renewable energy is set to accelerate, continuing the strong growth seen over the past two to three years, especially in solar and wind power. As a result, **the share of electricity consumption covered by Renewable Energy Sources (RES) is projected to exceed 50% by 2030, up from 32% in 2023.** Simultaneously, most of the highest CO_2 emitting thermal power plants are expected to be permanently decommissioned or have their output significantly reduced. This shift is anticipated to result in a 36% decrease in CO_2 emissions from electricity generation compared to 2023 levels across the Mediterranean region.

These elements are presented in detail in another key deliverable of the TEASIMED 2 project: the Med-TSO Scenario Report for the 2030 and 2040 horizons. **The report outlines how the evolution of power systems will influence the electricity exchanges between Mediterranean countries in 2030.**

The interconnection network linking Mediterranean countries enables electricity exchanges based on the complementarities between connected systems. These complementarities take various forms, for example, economics, where electricity flows from countries with lower production costs to those where generation is more expensive. They may also arise from supply-demand imbalances, allowing a country facing a temporary deficit to rely on available capacity from its interconnected neighbours. In addition, complementarity can result from the large-scale development of non-dispatchable renewable energy, where surplus generation at certain times of the day can be exported through interconnections.

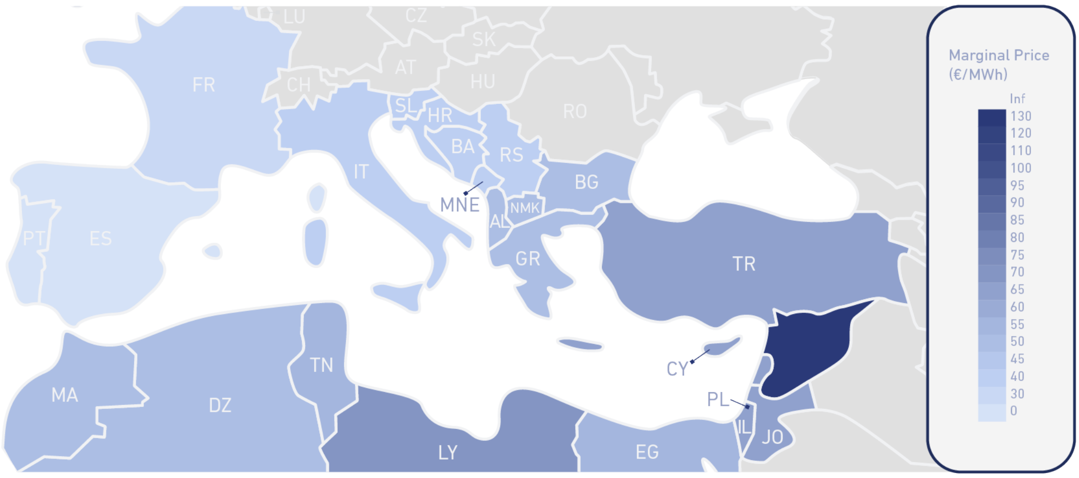


Figure 2. Marginal electricity price in the Mediterranean in 2030

On the map above, each country or bidding zone is coloured according to its annual average marginal electricity production cost, expressed in €/kWh. Spain, Portugal and France show the lowest average marginal prices among Mediterranean countries, thanks to their abundant decarbonised generation mix, including nuclear, hydroelectric, wind and solar power. **This cost advantage results in predominantly export-oriented electricity flows towards northern Italy on one side, and the western Maghreb — particularly Morocco and Algeria — on the other.**

In the central part of the region, projections for 2030 indicate a relatively higher average

marginal price in Libya compared to its neighbouring countries. At the same time, the growth of renewable energy in southern Italy positions this area as a net exporter. Although electricity flows are generally oriented from north to south, such as from Italy to Tunisia, and from Algeria to Libya —reverse flows also occur. This highlights the bidirectional use of interconnections and the effective exploitation of complementarities between countries.

In the Southeastern Mediterranean, Egypt is projected to maintain a net export balance with all neighbouring countries by 2030. This is driven by the development of decarbonised energy sources (wind, solar, and nuclear) and a modern, highly efficient gas-fired power plant fleet. The interconnection with Saudi Arabia remains generally balanced over the year, reflecting strong complementarities between the two power systems, especially due to their offset in peak consumption periods.

In the northeast, Türkiye is projected to have a relatively high average marginal price by 2030. This is due to the expected continued growth in electricity demand and an aging thermal power plant fleet, despite significant progress in renewable energy development. As a result, electricity exchanges in the southern Balkans are expected to move predominantly from west (Greece and Bulgaria) to east (Türkiye) by 2030. A similar trend is anticipated further south, with projected flows from Greece to Cyprus and Israel, driven by regional economic optimisation of thermal generation and reduced curtailment of renewable energy in Cyprus.

In the Middle East, Syria is expected to continue facing a severe electricity deficit through 2030, necessitating maximum electricity imports from neighbouring countries, depending on the availability of electrical networks. In Lebanon, electricity exchanges, particularly with Jordan, could reach a more balanced state if the country secures access to natural gas to operate its CCGT (combined-cycle gas turbines) power plants. **By 2030, Jordan emerges as a key player in regional electricity exchanges, serving as a hub for connections with Syria and Lebanon to the north; Iraq, Saudi Arabia, and Egypt to the east and south; and Palestine via its link with the West Bank.**

3.2 Proposed investment clusters and their rationale

The Mediterranean electricity network spans a vast and diverse region, characterised by significant variability in generation mixes, weather conditions, renewable generation potential, and demand patterns.

To address the diverse system needs across regions, TSOs propose investment clusters and interconnection projects tailored to specific challenges. To facilitate the identification of these clusters, the system needs they address have been categorised into defined project benefit types, as shown in the following table.

Some project benefits can be directly quantified using the benefits typically considered in a Cost-Benefit Analysis. This is particularly true for benefits under the first macro-category, ‘Welfare, Sustainability and Security of Supply’, which includes factors such as economic welfare generated by the project, reduced curtailment of renewable energy sources (RES) and associated CO_2 emissions and lower levels of Energy Not Supplied (ENS). Other benefits, however, are assessed qualitatively and are represented using symbols and specific descriptions linked to each project.

Category	Detailed Project Benefits	Associated System Needs	Symbol
Welfare, Sustainability and Security of Supply (SoS)	• Reduce high price differentials between different market nodes/ countries. • Positively contribute to the reduction of RES curtailment and CO_2 emission levels. • Contribute to solving adequacy and security of supply issues.	By increasing the net transfer capacity between market zones, cross-border interconnections enable additional electricity flows from countries with lower production costs to those with higher production costs. This reduces price differentials between zones, thus creating value for the consumer and the whole system. As a result of the additional enabled flow, interconnections also contribute directly to reducing RES curtailment. Surplus renewable (and typically low-cost) electricity produced in a given zone can be exported to another, thereby reducing the overall emission factor of the generation mix. Furthermore, imported electricity from other countries serves as an additional resource during scarcity periods, ensuring the balance between supply and demand, and enhancing security of supply.	
Isolation	Fully or partially address the isolation of countries from the interconnected power system or contribute to achieving specific interconnection targets.	This benefit is particularly relevant for isolated systems (e.g. islands) and for those with a low level of connectivity. It may also apply to projects that support countries in achieving interconnection targets, such as those set by the Clean Energy Package of the European Commission.	

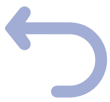
Category	Detailed Project Benefits	Associated System Needs	Symbol
Operation-Flexibility	• Introduce additional system restoration mechanisms. • Improve system flexibility and stability. • Increase system voltage stability. • Contribute to the integration of new RES generation capacity.	In the coming years flexibility needs are expected to evolve in both nature and volume, due to the increased penetration of weather-dependent generation (replacing conventional fossil fuel power) and power electronic-based devices. In this context, cross-border interconnections can play a key role in reducing and covering flexibility needs. Cross-border interconnections enable not only the exchange of energy, but also the provision of flexibility services between countries in the same interconnected power system. This helps reduce overall flexibility needs. In some cases, interconnections themselves can provide some flexibility services (e.g. through HVDC converter stations), thus contributing to system restoration and overall resilience. The flexibility enabled and provided by interconnections ultimately supports the integration of a greater share of RES into the power system.	
Operation-Flows	• Enable cross-border flows to overcome internal grid congestions. • Mitigate loop flows in bordering systems.	By enabling new exchanges or increasing existing transfer capacity between market zones, cross-border interconnections can be particularly effective for countries experiencing internal grid congestion or physical loop flows involving other market zones.	

Table 1. Project benefits categories and description.

The listed benefits have served as a basis for TSOs to propose cross-border interconnection projects for assessment within the framework of the TEASIMED 2 project.

3.3 Market studies approach and CBA methodology

Scenario building provides Med-TSO members with a common framework to quantitatively assess, on a pan-Mediterranean level, national assumptions regarding the evolution of load and generation fleets for Med-TSO 2030 scenario. **Given the weather-dependent nature of renewable energy sources and the varying operating conditions of load and generation, market studies are conducted using a probabilistic approach.** These studies focus on the impact of weather conditions, such as wind, temperature and insulation, using available weather databases.

Market simulations involve the economic optimisation of the total generation cost across the entire Euro-Mediterranean Power System, including commercial exchanges between bidding zones. The physical network is taken into account primarily to determine interconnection exchange capacities and, where relevant, minor internal constraints.

The market simulator used is ANTARES, a sequential Monte-Carlo-based, multi-area simulator developed by RTE, the French TSO, designed to assess generation adequacy and economic efficiency across interconnected power systems.

The implementation of market models provides a comprehensive and detailed view of the Mediterranean Power System's behaviour, using a wide range of indicators and physical quantities at hourly resolution. The output data includes, but is not limited to, power and energy generation by plant type and by country, cross-border exchanges, marginal production prices, national energy balances, expected unsupplied energy, renewable energy curtailment and CO_2 emissions.

The Cost Benefit Analysis (CBA) methodology is designed to evaluate the benefits and costs of new interconnection projects, offering consistent data and indicators to support their assessment. The primary objective of the CBA methodology used in this Master Plan is to establish a common and uniform framework for evaluating these projects.

The following set of common indicators provides a comprehensive and robust foundation for project assessment across the Mediterranean region within the scope of the Mediterranean Project. **The multi-criteria approach highlights the key aspects, advantages and limitations of each project, offering sufficient information to support informed decision-making.** The indicators are summarised in the figure below and described in subsequent sections.

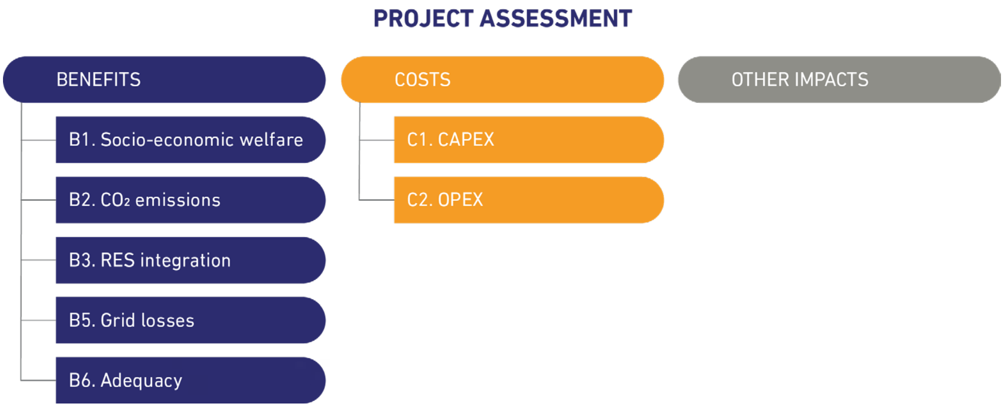


Figure 3. Cost-Benefit Assessment indicators

B1. Socio-economic welfare (SEW) or market integration reflects a project's ability to reduce congestion between bidding zones, thereby increasing transmission capacity and facilitating more efficient electricity trading across markets. SEW quantifies the annual cost savings achieved by the system due to the project, including fuel cost savings, monetised savings in the CO_2 emissions, and variations in the Expected Energy Not Supplied (EENS). It is important to note, however, that SEW does not account for changes in grid losses, which are evaluated separately through a different indicator.

B2. Variation in CO_2 emissions captures the change in CO_2 emissions in the power system resulting from the implementation of a new project. It is a consequence of the effects measured in B1 (Socio-economic welfare) and B3 (RES integration) as the project may enable the use of lower-carbon generation sources. Although the economic impact of CO_2 emission changes is already included in the SEW calculation, the CO_2 variation is presented as a standalone indicator due to its strategic importance for the Mediterranean region's decarbonisation goals.

B3. RES integration: Support for RES integration refers to the system's ability to connect new RES plants and enable both existing and future "green" generation, while minimising curtailments. Although this indicator is economically included in the calculation of SEW (since changes in RES integration affect energy from conventional sources and, in turn, system costs), RES integration remains a key objective in the Mediterranean region and is therefore presented separately.

B5. Variation in losses in the transmission grid is an indicator that reflects the change in energy losses in the transmission grid resulting from the new project, serving as a measure of energy efficiency. The monetisation of these losses is based on the hourly marginal electricity price, as determined in the market studies and further explained in the relevant section of the Network Studies chapter.

B6. Security of supply: The indicator of adequacy to meet demand assesses the project's impact on the power system's ability to supply sufficient electricity to meet demand over an extended period. It accounts for the variability of weather conditions that influence both electricity demand and renewable energy generation. Monetisation of B6 is based on the Value of Lost Load (VOLL) set at €3,000 MWh. In the SEW assessment, peak generation capacity is adjusted to ensure that the adequacy criterion — Loss of Load Expectation (LOLE) — remains below three hours per year in every Mediterranean country.

Sector coupling

The modelling link between electricity and hydrogen systems via electrolysers establishes sector coupling. Electrolysers use surplus electricity from RES and/or nuclear sources to produce low-carbon hydrogen. As a result, **the development of new interconnections can influence how electrolysers operate.** In a simplified two-country scenario, increasing electricity export capacity reduces RES curtailment in the exporting country and delivers carbon-free electricity to the importing country. **Depending on where the electrolysers are located, new interconnections may decrease or increase low-carbon hydrogen production.**

The calculation of the B1 indicator must account for these mechanisms to capture the full value of SEW. The detailed modelling and calculation method is described in Chapter 2.6.2 of the ENTSO-E document called *Implementation Guidelines for TYNDP 2022*, based on the third ENTSO-E Guidelines for Cost benefit Analysis of Grid Development projects.

CBA reporting

The calculation of B1, B2, B3 and B6 indicators is performed over 35 climatic years. For each project, the Mediterranean Master Plan presents the average, minimum and maximum values. **The geographical scope for these indicators extends beyond Mediterranean countries to include the entire interconnected Euro-Mediterranean electricity system.**

Indicator B5, which relates to grid losses, is calculated using data from the 1990 climatic year only, as it most closely reflects the annual exchanges on Mediterranean interconnections across the 35-year dataset.

4

The Master Plan of Interconnections

4.1 Presentation of the transmission projects

Interconnection projects have been proposed for updated assessment due to multiple drivers. Interconnectors offer various benefits, including improved market efficiency, lower costs for end users, greater integration of renewable energy, enhanced security of supply and increased power system stability.

In this edition of the Master Plan, Med-TSO members have proposed a total of ten interconnection projects for assessment.

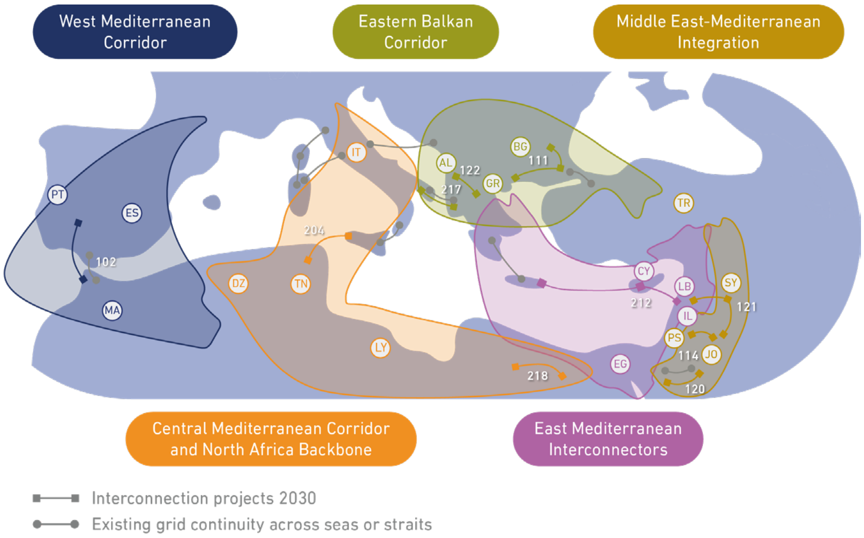


Figure 4. Corridors and regions to cluster assessed projects

Projects have been grouped into five corridors or regions (project clusters) to better reflect shared drivers and needs, as well as common geographical and network characteristics.

Projects Corridor/ Region	Projects comprising the Corridor/Region	Nominal transfer capacity (MW)	Potential expected benefit form the cluster	Detailed benefits
West Mediterranean Corridor	Project 102: Spain - Morocco	±600/650		1.1, 1.2, 2.1, 3.1, 3.4
Central Mediterranean Corridor & North Africa Backbone	Project 204: Italy - Tunisia	+600		1.1, 1.2, 1.3, 3.2, 3.3, 3.4, 4.1
	Project 218: Egypt - Libya	+760		1.1, 1.3, 2.1, 3.3, 3.4
East Mediterranean Interconnectors	Project 212: Greece - Cyprus - Israel	+1000/+1000		1.1, 1.2, 1.3, 2.1, 3.1, 3.2, 3.3, 3.4, 4.1

Eastern Balkan Corridor	Project 111: Bulgaria - Türkiye - Greece	+ 1100/- 700 ± 600		1.1, 1.2, 2.1, 3.4
	Project 217: Italy - Greece	+1000		1.1, 1.2, 3.2, 3.3, 3.4. 4.1
	Project 122: Albania - Greece	+200		1.1, 1.2, 1.3, 3.1, 3.2, 3.3, 3.4
Middle East Mediterranean Integration	Project 121: Jordan - Syria - Lebanon	+800/+800/ -300		1.1, 1.2, 1.3, 2.1, 3.2, 3.3, 3.4, 4.1
	Project 114: Jordan - Palestine	+200/-0		1.1, 1.2, 1.3, 2.1, 3.1, 3.3, 3.4, 4.1
	Project 120: Egypt - Jordan	+550		1.1, 1.2, 1.3, 3.2, 3.3, 3.4, 4.1

Table 2: List of projects and main figures

Category	Symbol	Detailed Project Benefits – Legend
1.Welfare, Sustainability and SoS		**1.1)** Reduce significant price differences between market nodes/ countries **1.2)** Help lower RES curtailment and reduce CO_2 emissions **1.3)** Support the resolution of adequacy and security of supply challenges
2. Isolation		**2.1)** Fully or partially address the isolation of countries in the power system or help meet specific interconnection targets
3. Operation Flexibility		**3.1)** Introduce additional system restoration mechanisms **3.2)** Improve system flexibility and stability **3.3)** Increase system voltage stability **3.4)** Help integrate the new RES generation capacity
4. Operation Flows		**4.1)** Enable cross-border flows to overcome internal grid congestion **4.2)** Mitigate loop flows in bordering systems

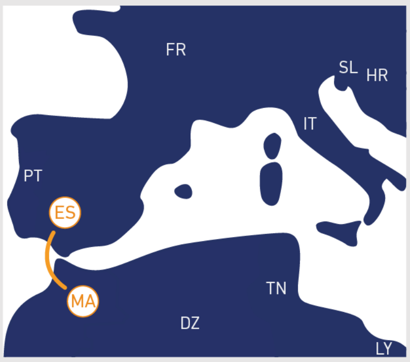
Table 3. Legend of project benefits

4.2 The West Mediterranean Corridor

The West Mediterranean corridor includes the assessments of one project involving Morocco and Spain by 2030 horizon. This project builds on the existing integration between the Iberian electricity market and the Maghreb region. As a result, its expected benefits are well aligned, showing a clear positive contribution in terms of:

1. **Reducing the electricity price differential** between the Iberian market and Maghreb countries by leveraging the lower prices observed in Spain
2. **Increasing renewable energy integration** — particularly by avoiding curtailment in Spain and channelling the surplus to Maghreb countries, thereby reducing gas-based generations in Morocco
3. **Contributing to the achievement of specific interconnection targets**, particularly those quantitatively defined for European countries
4. **Enhancing operational flexibility** through the technical features of the implemented technologies, especially VSC-HVDC systems, which offer capabilities such as black-start and voltage control.

Project n°102: Spain – Morocco (ES-MA)



PROJECT INFO

- **± 650/-600 MW**
- **52 km**
- **400 kV**
- **HVAC**

KEY INDICATORS

- **SEW:** Up to €200 M/y
- **RES integration:** Up to 1450 GWh/y
- **CO_2 reduction:** Up to 1,2 Mton/y
- **Project investment:** €235 M

REINFORCEMENTS

PROJECT BENEFITS

Figure 5. Project n°102: Spain - Morocco (ES-MA)

This project involves the construction of a new interconnection between Morocco (Ben Harchane) and Spain (Puerto de la Cruz). It will add a third link, based on HVAC technology, to the two existing interconnections, increasing the NTC by 650 MW from Spain to Morocco and 600 MW in the opposite direction. **The total length of the interconnection line is**

approximately 52 km, including a 37 km subsea cable.

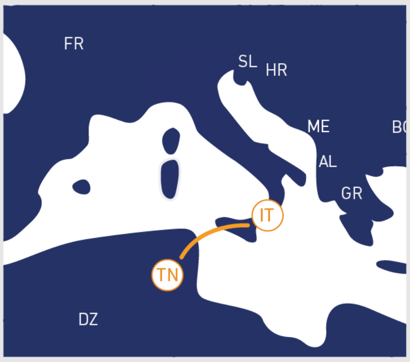
Promoted by ONEE and REE, the project is included in the latest editions of both the Moroccan and Spanish National Development Plans. It is considered mature due to its relatively short length and the fact that the two power systems have been synchronised since 1997, when the first interconnection became operational.

4.3 Central Mediterranean Corridor & North Africa Backbone

This group includes two interconnection projects at strengthening the interconnections among Maghreb countries and linking them to the Italian network. Italy has a high share of renewables in its energy mix, along with thermal power overcapacity. **Demand in Tunisia is expected to double over the next decade, while the Italian TSO anticipates demand saturation, and is seeking new markets to optimise renewables power flows to and from its islands, Sicily and Sardinia.**

New interconnections also bring greater flexibility, enabling an increased share of renewable energy on both shores of the Mediterranean Sea. As a result, this cluster is expected to reduce the overall volume of curtailed renewable energy. Additionally, STEG anticipates that the project will reduce the need for continuous investment in new Conventional power generation units while providing access to reliable electricity at a lower cost.

Project n°204: Italy – Tunisia (IT-TN)



PROJECT INFO

- **± 600 MW**
- **226 km**
- **± 500 kV**
- **HVDC - VSC**

KEY INDICATORS

- **SEW:** Up to €120 M/y
- **RES integration:** Up to 470 GWh/y
- **CO_2 reduction:** Up to 0,9 Mton/y
- **Project investment:** €850 M*

REINFORCEMENTS

Already included in national plans

PROJECT BENEFITS

* The project is still in the awarding phase following the tender process. The outcome of the contracts awarding phase will allow the promoters to update the project investment cost, if needed.

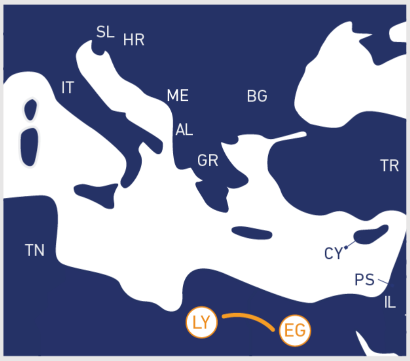
Figure 6. Project n°204: Italy – Tunisia (IT-TN)

The Italy-Tunisia interconnection will be the first link between the two countries and the first in the central corridor connecting the North and South banks of the Mediterranean. This project has been strongly promoted and prioritised by TERNA and STEG, with the support of both the Italian and Tunisian governments. It has also been endorsed by the European Commission, which has recognised it as both a Project of Common Interest (PCI) and a Project of Mutual Interest (PMI) since 2017. Highlighting its strategic importance, the European Commission announced in December 2022 that the project had secured €307.6 million in funding from the "Connecting Europe Facility" (CEF). **The interconnection is considered highly strategic for both countries, as it will optimise renewable energy flows, enhance grid operations, and help meet security and adequacy standards.**

By 2024, the project had received full authorisation in both Italy and Tunisia, and construction is currently underway. **Due to its advanced stage, the Italy-Tunisia interconnection has already been integrated to the reference grid for the 2030 base case of Med-TSO studies.** Since 2015, it has been analysed using the TOOT methodology in all editions of the Mediterranean Master Plan.

The project will link northeastern Tunisia with Sicily via a 500 kV HVDC submarine interconnection using VSC technology, with a rated power of 600 MW. The cable will extend from Mlaabi (Tunisia) to Partanna (Sicily, Italy), where two converter stations will be constructed. The total length of interconnections is 226 km, including 200 km of submarine cable reaching a maximum depth of approximately 800 metres. Further details can be found on the official project website[1] and in the latest Italian National Development Plan.[2]

Project n°218: Egypt – Libya



PROJECT INFO

- **± 760 MW**
- **170 km**
- **500 kV**
- **HVAC**

KEY INDICATORS

- **SEW:** Up to €130 M/y
- **RES integration:** Up to 70 GWh/y
- **CO_2 reduction:** Up to 0,7 Mton/y
- **Project investment:** €128 M

REINFORCEMENTS

Already included in national plans

PROJECT BENEFITS

Figure 7. Project n°218: Egypt – Libya

1 https://elmedproject.com/

2 https://www.terna.it/en/electric-system/efficient-territorial-planning/national-electricity-transmission-grid-development-plan. Information available in the Previous Development Plan Progression section.

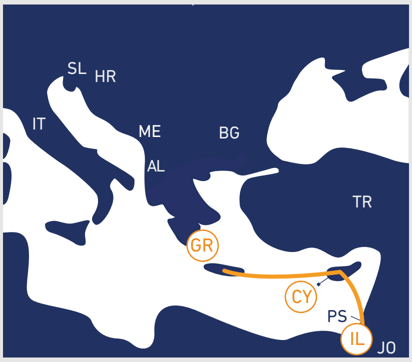
Libya and Egypt have been electrically interconnected since May 1998 via a 170 km 220 kV, double circuit AC overhead transmission line (OHTL). The line connects the Al Saloum (Egypt) substation to the Tobruk (Libya) substation with an exchange capacity of approximately 240 MW.

This current project involves the construction of a new 500 kV double-circuit OHTL along the same route between Tobruk and Saloum with a total length of about 170km. **This upgrade could theoretically increase the interconnection capacity from the existing 240 MW to up to 1,000 MW.**

4.4 The East Mediterranean Interconnectors

This group includes one interconnection project linking countries on both shores of the Eastern Mediterranean, thereby establishing new electricity corridors in the region. **The project aims to deliver mutual benefits by leveraging the complementary energy profiles and price differences of the countries involved.** Specifically, it connects the power system of Cyprus to Israel and, in turn, to the Greek system.

Project n°212: Greece – Cyprus – Israel



PROJECT INFO

- **± 1000/±1000 MW***
- **1208 km**
- **500 kV**
- **HVDC - VSC**

KEY INDICATORS

- **SEW:** Up to €195 M/y
- **RES integration:** Up to 281 GWh/y
- **CO_2 reduction:** Up to 0,7 Mton/y
- **Project investment:** €3039 M

REINFORCEMENTS

Line upgrade in Greece

PROJECT BENEFITS

*Actual transfer from/to Cyprus limited to 500 MW for operational security limits.

Figure 8. Project n°212: Greece – Cyprus – Israel

Greece is well interconnected with Italy, Türkiye and its Balkan neighbouring countries through seven interconnections: 1 DC link with Italy and 6 AC interconnections: one with Türkiye, one with Bulgaria, two with North Macedonia and two with Albania.

Although a member of the EU, Cyprus remains fully isolated, with no electricity or gas interconnections. Due to its autonomous power system, the penetration of renewable energy sources (RES) on the island is currently limited. **Achieving higher levels of RES integration, in line with the EU's ambitious targets, could significantly impact the island's security of supply.**

The project involves two new interconnections: one between Greece (Crete) and Cyprus, and another between Cyprus and Israel. Both links will be implemented using HVDC submarine cables with a combined length of approximately 1,200 km (nearly 314 km between Cyprus and Israel, and 894 km between Cyprus and Crete). The HVDC system based on VSC technology will have a transmission capacity of 1,000 MW and support bidirectional power flow. However, due to operational security reasons, imports to and exports from the Cyprus power system will initially be limited to around 500 MW. These limitations may be revised over time, depending on technological advancements and the integration of new reserve-capable resources into the Cyprus system.

The project has entered the construction phase and has secured EU co-financing. Specifically, the first segment (Greece–Cyprus) is a key component of the revised (2024) Cyprus NECP for achieving the country's 2030 RES penetration targets. **This segment has obtained €657 million in EU funding. Given its advanced status, this project is considered sufficiently mature to be included in the reference grid for the year 2030.**

The main driver for this project is to end the energy isolation of Cyprus. **Interconnecting the Cyprus power is expected to enable the integration of a high share of RES and support significant RES development on the island.** This will lead to a reduction of CO_2 emissions and provide substantial economic and environmental benefits for all participating countries. **Additionally, the project will establish a new electricity transfer route linking Israel, Cyprus, Crete and Greece**, generating mutual benefits by leveraging the complementary energy profiles and price differences among these countries.

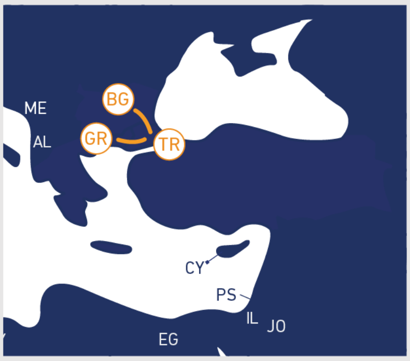
4.5 The Eastern Balkan Corridor

This corridor includes three interconnection projects: "Bulgaria–Türkiye–Greece", "Italy–Greece" and "Greece–Albania". The first project aims to increase the existing NTC between Türkiye and Continental Europe Synchronous Area (CESA), to which Türkiye is already synchronously connected. **It will increase the NTC between Türkiye and Greece by approximately 600 MW, and between Türkiye and Bulgaria by about 700-1,100 MW.** The second project seeks to enhance the existing NTC between Italy and Greece by an additional 1000 MW. It involves an HVDC submarine cable linking the Galatina substation (Italy) to the Arachthos substation (Greece). The third project focuses on increasing the NTC between Greece and Albania by about 200 MW.

The increased interconnection capacity between Türkiye and CESA through the Bulgaria–Türkiye–Greece project will facilitate the transfer of significant renewable energy from the Balkan region to Türkiye. This is expected to reduce thermal generation and lower CO_2 emissions in Türkiye.

The Italy–Greece project will effectively triple the interconnection capacity between the two countries, enhancing system reliability and operational security.

Project n°111: Bulgaria – Türkiye – Greece (BG-TR-GR)



PROJECT INFO

- **+ 1100/-700 MW ± 600 MV**
- **310 km**
- **400 kV**
- **HVAC**

KEY INDICATORS

- **SEW:** Up to €280 M/y
- **RES integration:** Up to 200 GWh/y
- **CO_2 reduction:** Up to 1,6 Mton/y
- **Project investment:** €152 M

REINFORCEMENTS

Already included in national plans

PROJECT BENEFITS

*It is not a triparty project

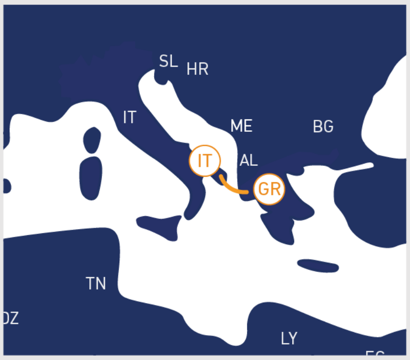
Figure 9. Project n°111: Bulgaria – Türkiye – Greece (BG-TR-GR)

In 2010, the Turkish power system was synchronised with the Continental Europe Synchronous Area (CESA), with Greece and Bulgaria forming the transmission corridor between CESA and Türkiye. Currently, there is one interconnection between Greece and Bulgaria, one between Greece and Türkiye and two between Bulgaria and Türkiye. The existing NTC is limited to 650 MW from CESA to Türkiye and 500 MW in the opposite direction. **However, the construction of a second interconnection between Greece and Bulgaria, along with the ongoing reinforcement of the 400 KV grid in South-East Bulgaria is expected to increase the NTC to 1,350 MW towards Türkiye and 1250 MW in the opposite direction.**

Greece is currently well interconnected with 1 DC and 6 AC interconnections. In addition to links with Türkiye and Bulgaria, Greece is connected to the power systems of North Macedonia, Albania and Italy. The Turkish grid, apart from its interconnections with Greece and Bulgaria, is also connected to the grids of Syria, Iraq, Iran and Georgia.

The current project involves the development of two new interconnections: one between Greece and Türkiye, and another between Bulgaria and Türkiye. Both will be implemented as AC overhead lines. Promoted by IPTO, TEIAS and ESO, the project aims to increase the interconnection capacity between Türkiye and the CESA by approximately 1,000 MW.

Project n°217: Italy – Greece



PROJECT INFO

- **± 1000 MW**
- **293 km**
- **500 kV**
- **HVDC - VSC**

KEY INDICATORS

- **SEW:** Up to €130 M/y
- **RES integration:** Up to 880 GWh/y
- **CO_2 reduction:** Up to 0,9 Mton/y
- **Project investment:** €1900 M*

REINFORCEMENTS

Already included in national plans

PROJECT BENEFITS

* This CAPEX figure is currently under discussion and could be revised due to the preliminary phase of the project.

Figure 10. Project n°217: Italy–Greece

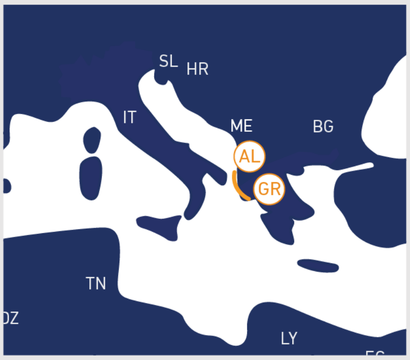
Southern Italy is characterised by a highly saturated grid, driven by increasing energy flows. This is due to both the high level of renewable energy generation and the continued operation of conventional generation units, which are essential for maintaining system stability. **To meet policy objectives, ensure the safe operation of the network, and improve market and service efficiency**, particularly by unlocking new resources through the coupling of the Services Market, **it will be essential in the coming years to expand transmission capacity in the South** through new interconnections with neighbouring countries.

In this context, the existing HVDC connection between Italy and Greece interconnection (GR. ITA. 1), based on LCC technology with a capacity of 500 MW, has played a key role in the safe management of southern Italy since its commissioning in 2001. **It enables power exchange with Eastern Europe (exports)** and supports the Southern region by providing demand coverage and reserve margins (imports).

The Italy-Greece interconnection project (also known as GR.ITA.2) involves the construction of a new HVDC link between the two countries, implemented via submarine cables. The project aims to **increase the interconnection capacity between Italy and Greece by an additional 1,000 MW.** It consists of a new HVDC VSC interconnection in a bipolar configuration, spanning a total length of 293 km, including 240 km of submarine cable. The link will connect the Galatina substation in Italy to the new Thesprotia substation in Greece. With a rated capacity of 1,000

MW, this project will **raise the total transmission capacity on the Italy-Greece border to 1,500 MW.** Further information is available in the latest editions of both the Italian[3] and Greek National Development Plans.

Project n°122: Albania – Greece



PROJECT INFO

- **± 200 MW**
- **170 km**
- **400 kV**
- **HVAC**

KEY INDICATORS

- **SEW:** Up to €30 M/y
- **RES integration:** Up to 80 GWh/y
- **CO_2 reduction:** Up to 0,05 Mton/y
- **Project investment:** €68 M

REINFORCEMENTS

Already included in national plans

PROJECT BENEFITS

Figure 11. Project n°122: Albania–Greece

In December 2022, IPTO and OST decided to implement the new 400 kV overhead line (OHL) between Greece and Albania, with a completion horizon of 2030. The new single-circuit 400 kV OHL will connect a new Thesprotia substation in Western Greece (linked to the Arachthos substation) with the Fier substation in Albania. It will have a nominal transmission capacity of 2,000 MVA and an estimated total length of approximately 170 km, of which 45 km will be in Greek territory and 125 km in Albanian territory. **The new OHL is expected to increase the transmission capacity between the two countries by at least 200 MW in both directions.** The project will support higher penetration of RES in the two systems, enhance market convergence and contribute to the EU's climate-neutrality goals. The interconnection is estimated to be commissioned by 2031.

The project has been included in the ENTSO-E Ten-Year Network Development Plan (TYNDP 2024) under the code TR 1183[4] with the Investment ID and name: 1988 – New Single-Circuit OHL 400 kV Thesprotia (GR) – Fier (AL).

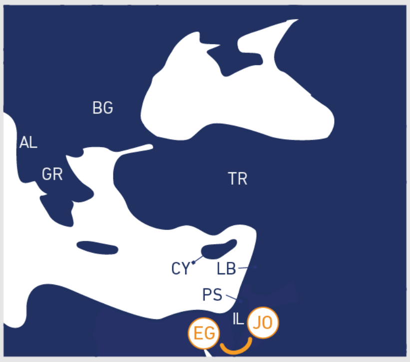
3 https://www.terna.it/en/electric-system/efficient-territorial-planning/national-electricity-transmission-grid-development-plan. Information available in the Previous Development Plan Progression section.

4 TR 1183 – New interconnection line 400 kV Greece – Albania https://tyndp2024.entsoe.eu/projects-map/Transmission/1183

4.6 Middle East-Mediterranean integration

This cluster includes two interconnection projects involving new OHLs aimed at strengthening connections between Eastern Mediterranean countries, and further increasing the existing NTC among them.

Project n°120: Egypt – Jordan (EG-JO)



PROJECT INFO

- **± 550 MW**
- **43 km (13 undersea cables)**
- **400 kV**
- **HVAC**

KEY INDICATORS

- **SEW:** Up to €65 M/y
- **RES integration:** Up to 80 GWh/y
- **CO_2 reduction:** Up to 0,3 Mton/y
- **Project investment:** €67 M

REINFORCEMENTS

New lines in Jordan

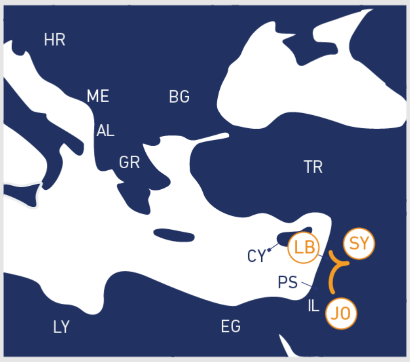
PROJECT BENEFITS

Figure 12. Project n°120: Egypt – Jordan (EG-JO)

Jordan and Egypt have been electrically interconnected since 1998 via a 13 km 400 kV, AC submarine cable (3 cores + 1 spare) laid at a depth of 850 metres across Taba in the Gulf of Aqaba. This interconnection has an exchange capability of 550 MW. Project 120 involves the construction of a second 13 km 400 kV AC submarine cable between the two countries. This new link is expected to **double the current transfer capacity to 1,100 MW, helping to mitigate potential overloads along the existing interconnection path.**

The Egyptian grid is currently interconnected with the grids of Libya, Jordan and Sudan. A new HVDC interconnection between Egypt and Saudi Arabia is under development, with a new NTC of 3,000 MW expected to be in place by 2030. This interconnection is part of a border 400 kV regional grid plan, aimed at linking the GCC Interconnection Authority Grid (connecting the six GCC countries at 400 kV) with the power systems of Jordan and Egypt. **The goal is to enhance system reliability, improve quality of supply and support the creation of an integrated electricity market across the Arab region.** In addition to Egypt, Jordan is also interconnected with Palestine, Syria and Iraq.

Project n°121: Jordan – Syria – Lebanon (JO-SY-LB)



PROJECT INFO

- **± 800 MW, ± 800 MW, - 300**
- **upgrade of existing grid**

KEY INDICATORS

- **SEW:** Up to €610 M/y
- **RES integration:** Up to 120 GWh/y
- **CO_2 reduction:** Up to 2,3 Mton/y
- **Project investment:** Negligible

REINFORCEMENTS

Already included in national plans

PROJECT BENEFITS

Figure 13. Project n°121: Jordan–Syria – Lebanon (JO-SY-LB)

The interconnection between Jordan, Syria and Lebanon was implemented between January 2001 and December 2005, covering a total distance of approximately 400 km. In Jordan, the interconnection consists of a single circuit 400 kV line from the Amman North 400/132 kV substation to the Syrian border, continuing into Syria to the Deir Ali 400/230 kV substation, with a length of approximately 144 km. From Deir Ali to Dimas (both in Syria), the link continues as a single circuit 400 kV line about 42 km long. In Lebanon, the interconnection includes a double circuit 400 kV line from the Ksara 400/220 kV substation to the Syrian border, then a single-circuit line connecting to the Dimas substation in Syria. The total length of this segment is approximately 42 km.

The designated transmission capacity of this interconnection is 800 MW. However, it is currently out of operation.

Project n°114: Jordan – Palestine (JO-PS)

PROJECT INFO

- **200 MW (from JO to PL)**
- **40 km**
- **132 kV**
- **HVAC**

KEY INDICATORS

- **SEW:** Up to €40 M/y
- **RES integration:** Up to 100 GWh/y
- **CO_2 reduction:** Up to 0,03 Mton/y
- **Project investment:** €10 M

REINFORCEMENTS

Already included in national plans

PROJECT BENEFITS

Figure 14. Project n°114 : Jordan–Palestine (JO-PS)

The project involves the construction of a new AC 132 kV overhead line interconnection between Jordan and Palestine. It is expected to **increase the transfer capacity between the two systems by approximately 100 MW, with the aim of supplying electricity to Palestine on an isolated-grid basis.**

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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.