CIGRE C1 ISRAELI WEBINAR

SYSTEMS AND GRID PLANNING APPROACHES IN AGE OF RENEWABLE ENERGY & STORAGE GROWTH. THE EURO MEDITERRANEAN PERSPECTIVE

June 7, 2021

EXPERIENCE OF MED-TSO IN PLANNING STUDIES FOR ADDRESSING THE ENERGY TRANSITION IN THE MEDITERRANEAN

Emmanuel BUÉ – CIGRE Turkish National Committee

Med-TSO - Chairman of the TC Economic Studies & Scenarios

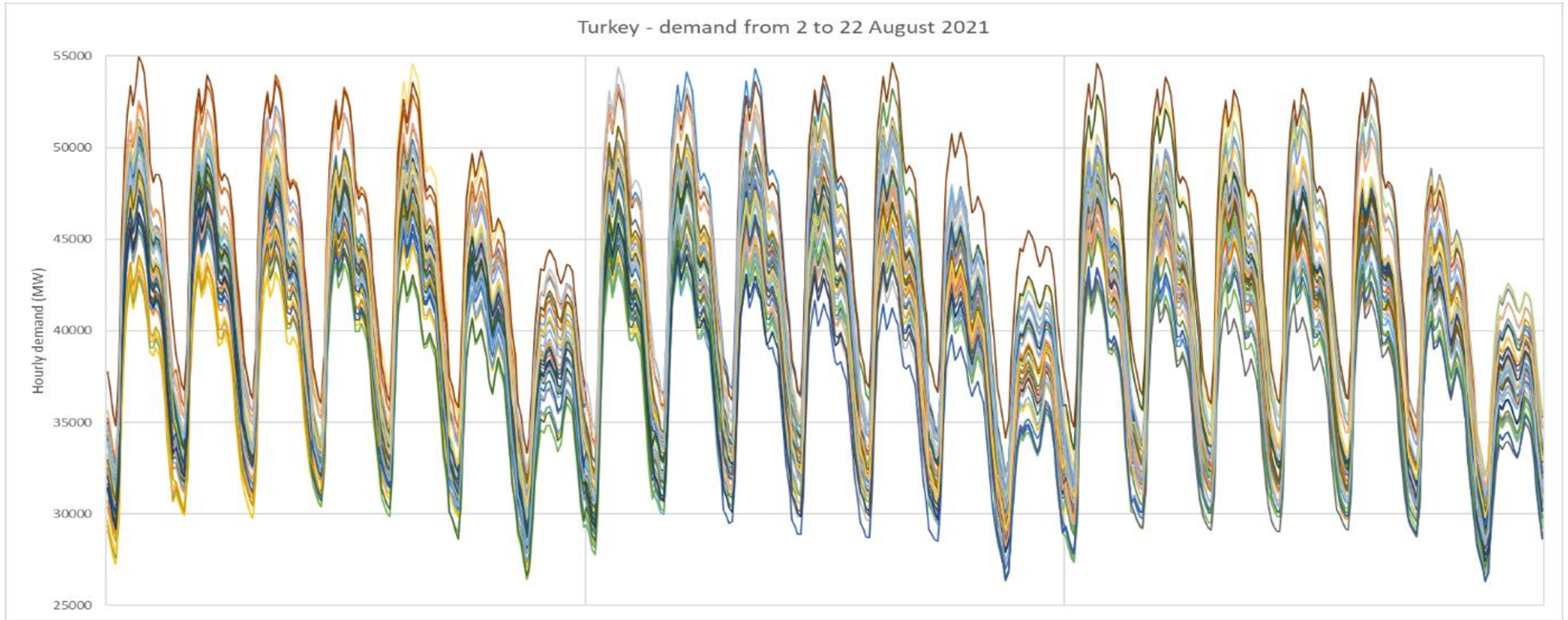
MEDITERRANEAN TRANSMISSION SYSTEM OPERATORS

Supported by
the European Union

Few words about Uncertainty and hazard

Main hazards affecting the Power System

- Temperature
- Wind speed
- Irradiation
- Water inflows
- Thermal availability



Ex. Electricity demand in Turkey in August 2021, assuming real weather conditions in the same period from 1982 to 2017

Hazard is the effect of different possible weather conditions or any other events on given structural conditions (number of air conditioning devices, installed PV capacity, thermal plant reliability, etc.)

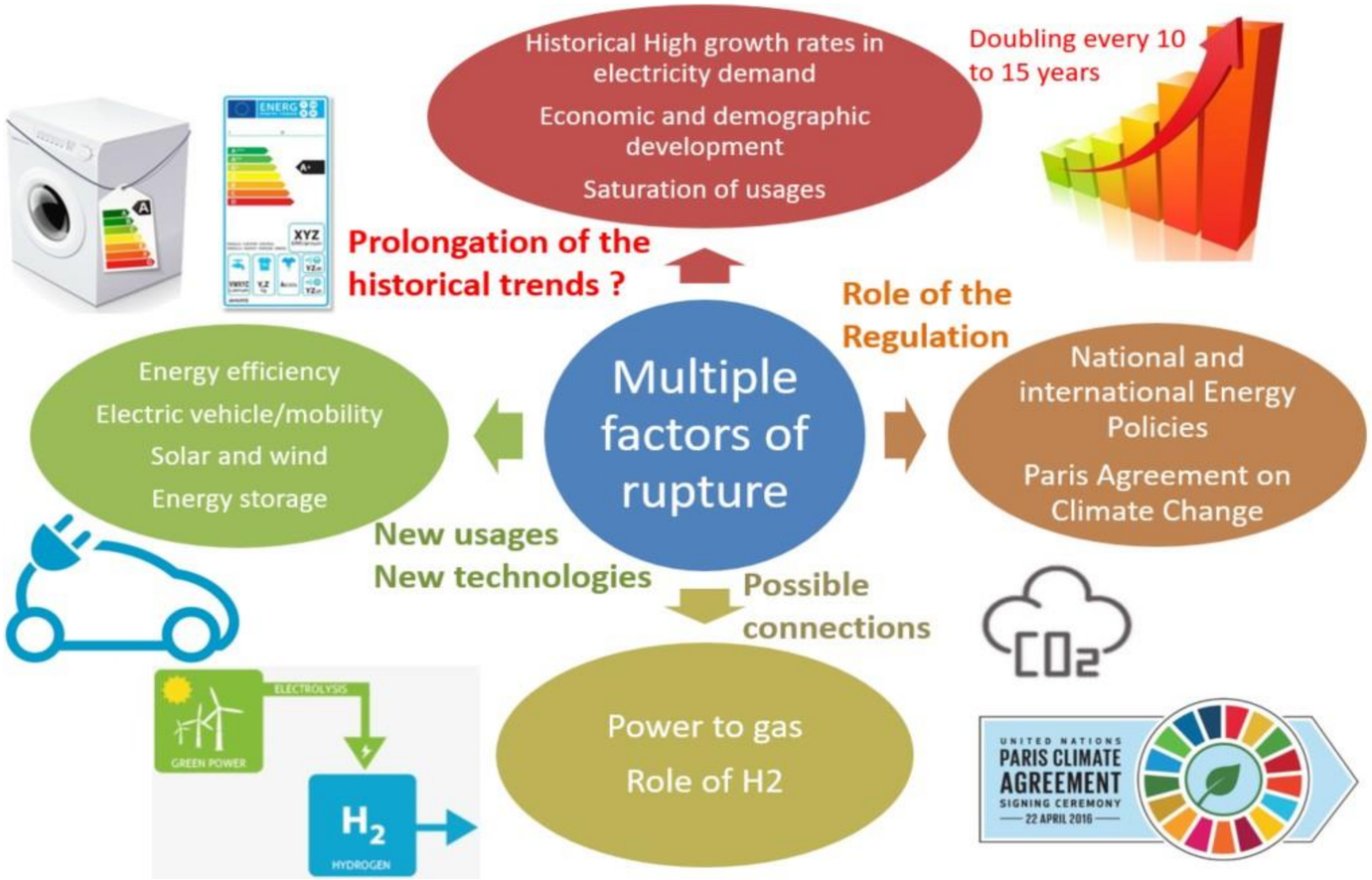
Excepting short-term (weather forecast doesn't provide any information)**, the hazard only depend on structural conditions.**

Few words about Uncertainty and hazard

Uncertainty affects the structure of the Power systems

- Economy, demography evolution
- Sectorial changes
- New uses
- Evolution of technologies
- Policy, regulation
- …

Uncertainty increases with the time



Ex. Illustration of uncertainty factors likely to affect the evolution of the Power System in the Mediterranean region in the coming decades

Few words about Uncertainty and hazard

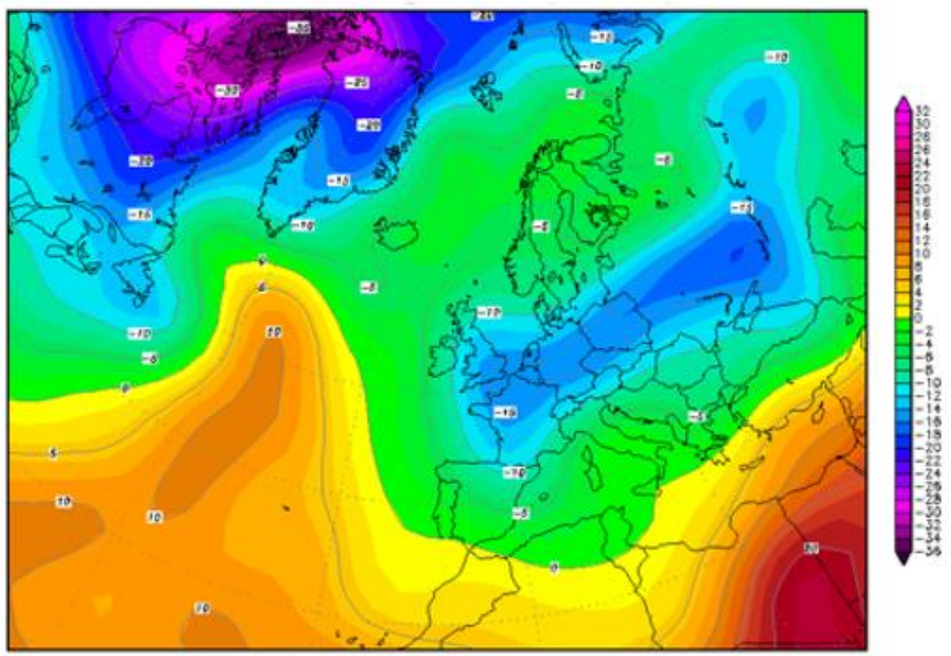
Uncertainty :

- Managed by building **several Scenarios** aimed at covering different possible futures
- To be used to propose uncertainty margin on result indicators
- Or to elaborate more robust investment strategies toward uncertainty

Hazard:

- For every scenario, hazard is fully addressed in **stochastic modelling**
- **Monte-Carlo approach**, inter-variables and inter-area control (correlations)
- Requires long-period database : Hourly time-series (PECD for Temp, wind, solar, hydro)

antaressimulator



climate scenarios, transformed in **load, wind and solar production**

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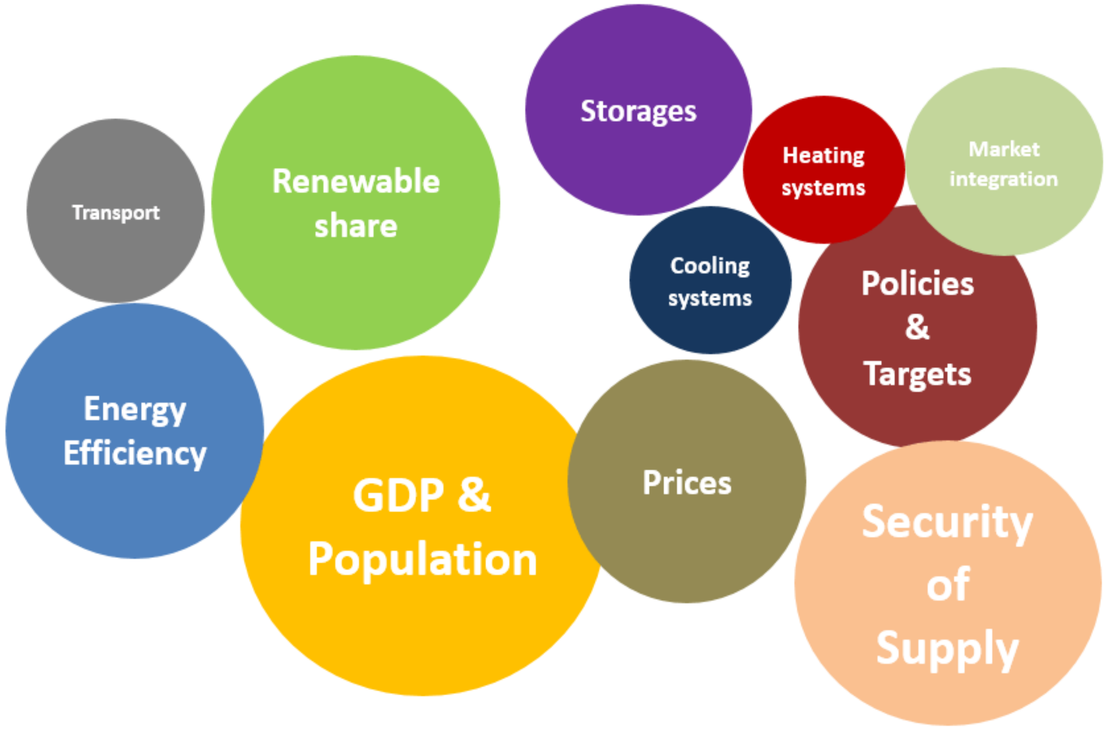
Scenarios development investigating the energy landscape in 2030

These Med-TSO 2030 Reference scenarios explore **possible future situations** of load and generation, interacting with the Mediterranean Power system.

The Mediterranean region is characterized by **wide contrasts** and complementarity in terms of load growth and of RES development.

- Contrasts in the dynamics of the evolution of electricity demand
- Contrast in national energy and environmental policies
- Contrasts in the way of organizing electricity exchanges between countries

Which **rationales for defining scenarios** for the future of the Mediterranean power system.



Three scenarios to address the Mediterranean power system in 2030

On the basis of the most essential parameters in the context of the Mediterranean electricity system, the definition of three different long-term scenarios, as following :

- **National Development scenario**
- **Green Development scenario**
- **Mediterranean Evolution scenario**

Drivers	Criteria	National Development	Green Development	Mediterranean Evolution
Macro-Economic Trends	GDP/Population	+	++	+++
New demand and energy efficiency	Energy efficiency	+	++	++
	New demand	+	++	+++
Generation, RES development and GHG emission reduction	RES/GHG reduction target achieved	++	+++	+++

Three scenarios to address the Mediterranean power system in 2030

The need for a set of common technical parameters and principles, to ensure the coherency on market studies:

- **Efficient day-ahead markets or mechanisms**
- **Similar fossil fuel prices across all Mediterranean countries**
- **An economic value for CO2 emissions common to all Mediterranean countries**

Scenario	National Development	Green Development	Mediterranean Evolution
CO2 price for UE-regulated countries	28 €/t CO2	53 €/t CO2	35 €/t CO2
CO2 price for non UE-regulated countries	28 €/t CO2	28 €/t CO2	35 €/t CO2

Power system modelling aims to represent **all the interconnected countries**

- ENTSO-E **TYNDP2020** for the European countries

Med-TSO 2030 Mediterranean Scenarios	ENTSO-E TYNDP2020 Scenarios
National Development	National Trends
Green Development	Distributed Energy
Mediterranean Evolution	Global Ambition

- Connection **with KSA** through Jordan and Egypt interconnections
- Reference Grid: **Exchange capacity table** (NTC) to be the assumption for the base case, and the starting point for the project assessment (TOOT or PINT).

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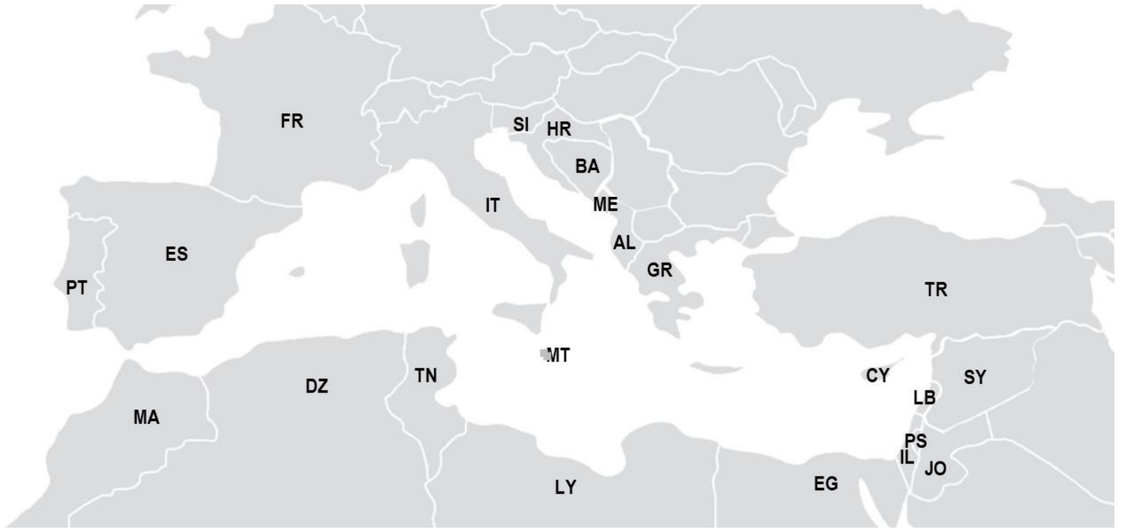
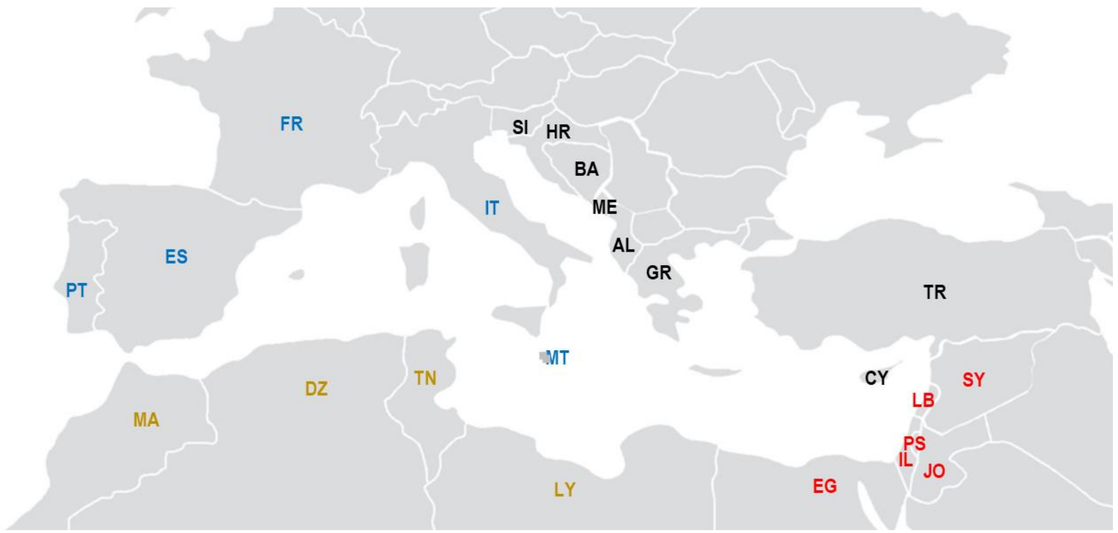
Electricity consumption evolution for 2030



- **Electricity consumption evolution for 2030 remains dynamic, mainly driven by economic and demographic growth : +25% to +33 % in 12 years**

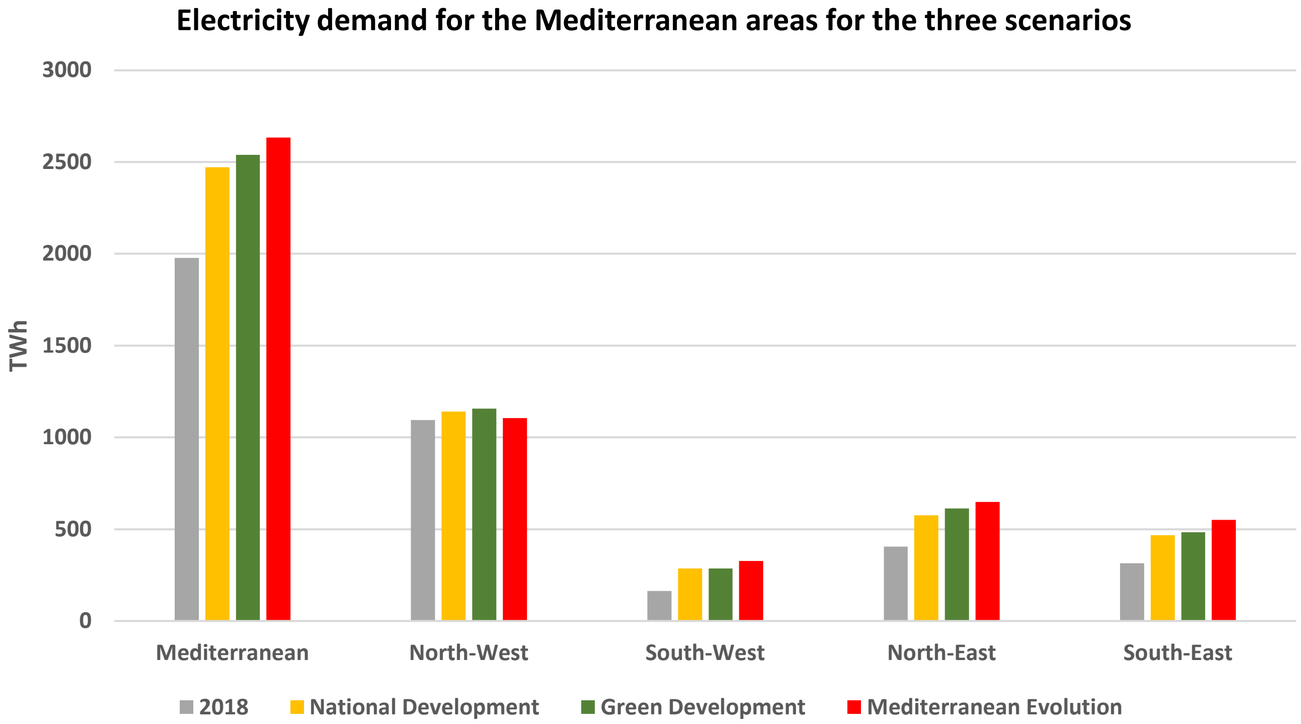
	2018	2030		
	Mediterranean countries	National Development	Green Development	Mediterranean Evolution
Electricity Demand (TWh)	**1980**	**2470**	**2540**	**2630**
Demand increase (12 years)	-	*+ 25%*	*+ 28%*	*+ 33%*
Compound annual growth rate (CAGR)	-	*+ 1.9%*	*+ 2.1%*	*+ 2.4%*

Electricity consumption evolution for 2030



South-West		North-West		South-East		North-East	
MA	Morocco	IT	Italy	EG	Egypt	TR	Turkey
DZ	Algeria	MT	Malta	JO	Jordan	CY	Cyprus
TN	Tunisia	FR	France	PS	Palestine	GR	Greece
LY	Libya	ES	Spain	IL	Israel	AL	Albania
		PT	Portugal	SY	Syria	ME	Montenegro
				LB	Lebanon	BA	Bosnia and Herzegovina
						HR	Croatia
						SI	Slovenia

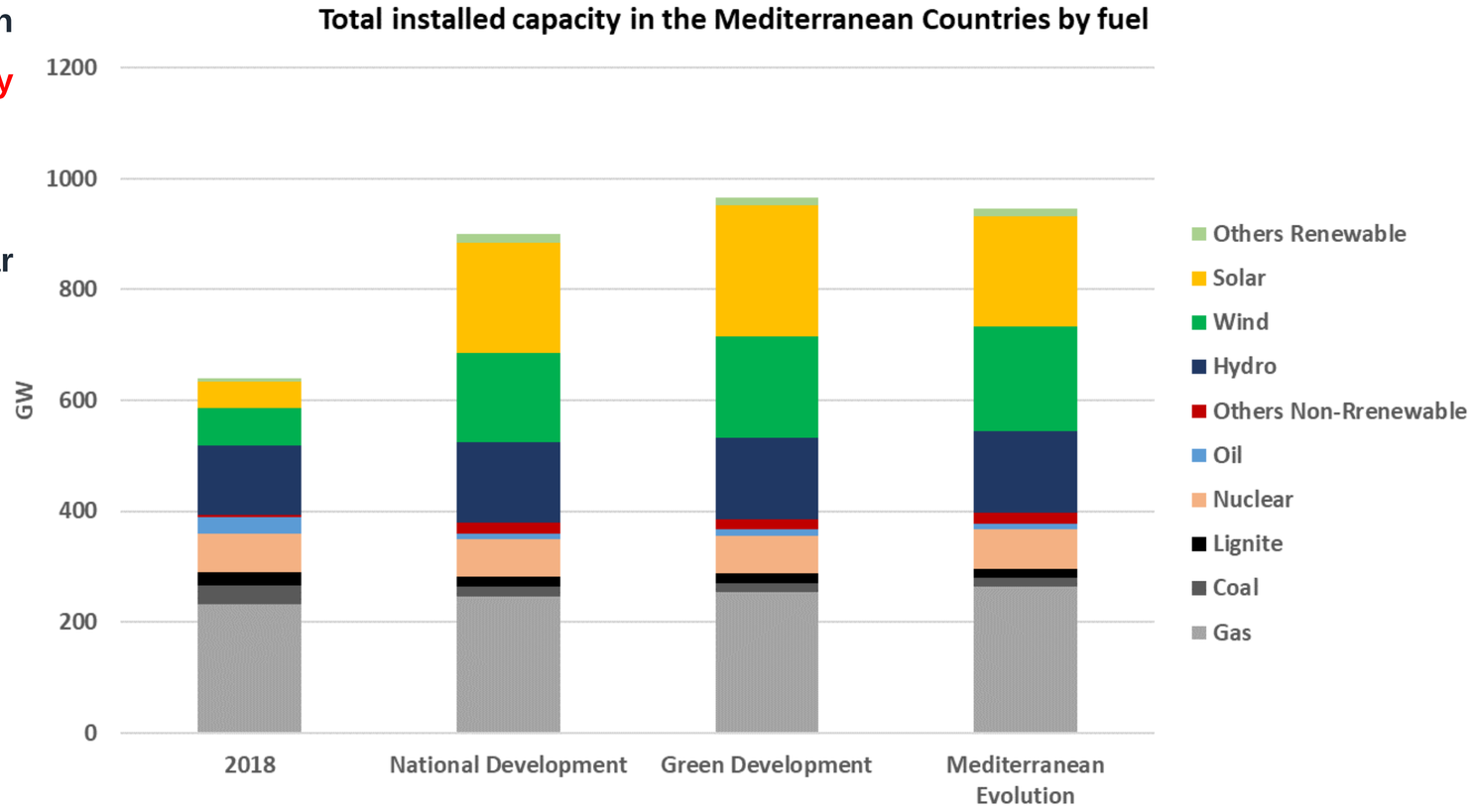
- **Electricity consumption evolution for 2030 remains dynamic, mainly driven by economic and demographic growth : +25% to +33 % in 12 years**



Development of generation capacity that responds to multiple challenges

- Mediterranean region is seeing increased production capacity to face the **challenges of security of supply and decarbonization of generation**.

- But the most remarkable is the development of solar and wind capacity in **all Mediterranean countries**.



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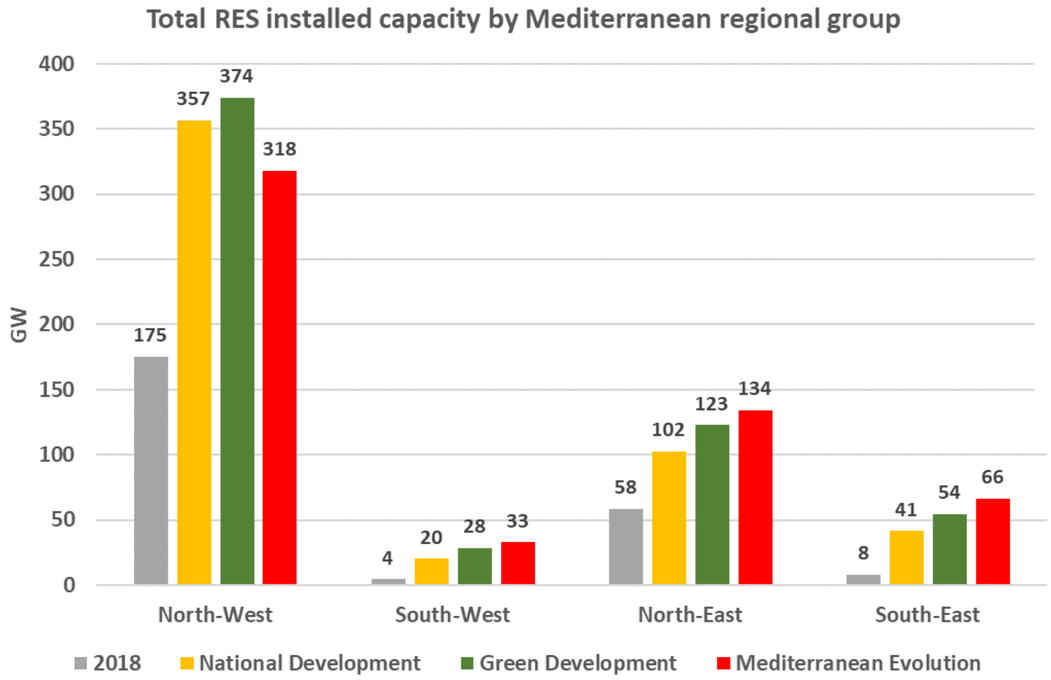
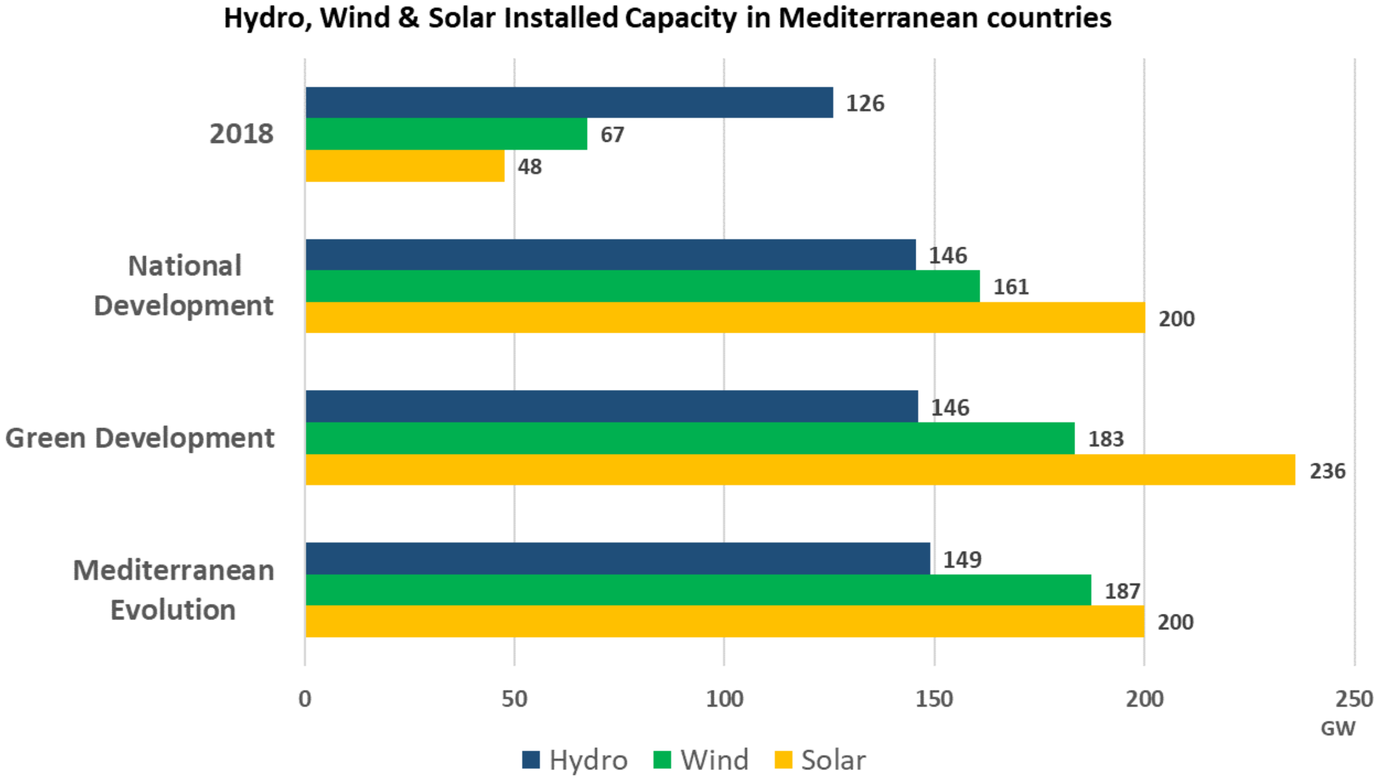




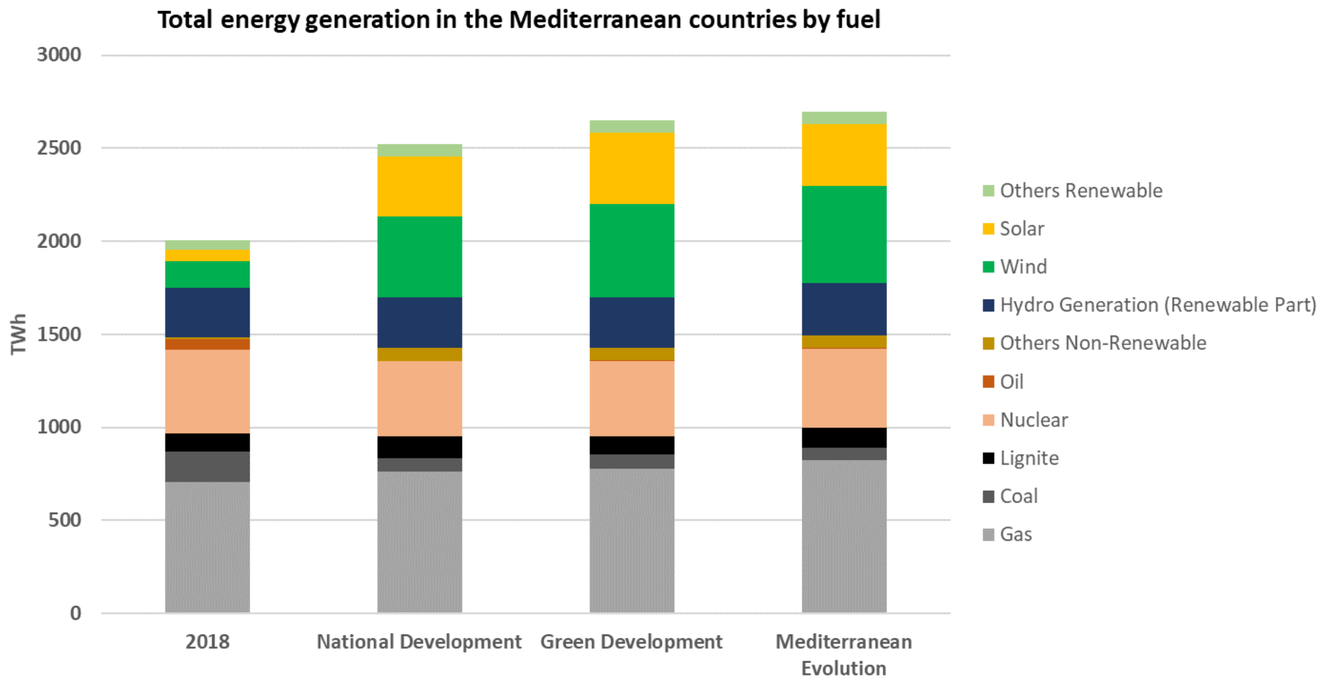
- **WIND : x 3 in 12 years**
- **SOLAR x 4-5 in 12 years**

… Mediterranean has two new kings

New RES to meet the increase in electricity demand

- While electricity consumption is expected to increase by 25 to 33% by 2030 for the entire Mediterranean region, this additional consumption is fully satisfied by the increase in production from renewable sources.

- For the Green Development scenario, nearly half (47.5%) of consumption is covered by renewable generation



	2018	2030		
	Mediterranean countries	National Development	Green Development	Mediterranean Evolution
Consumption covered by RES	26.3%	44%	47.5%	45%
From which Wind generation	*7.2%*	*17.7%*	*19.7%*	*19.7%*
From which Solar generation	*3.2%*	*13%*	*15.2%*	*12.8%*
*From which Hydro generation**	*13.3%*	*11%*	*10.7%*	*10.6%*

**renewable part*

Market Studies – main outputs, what can be assessed ?

Security of Supply

- Loss of Load Expectation (h)
- Unsupplied Energy (EENS)
- Adequacy margin

Economic Results

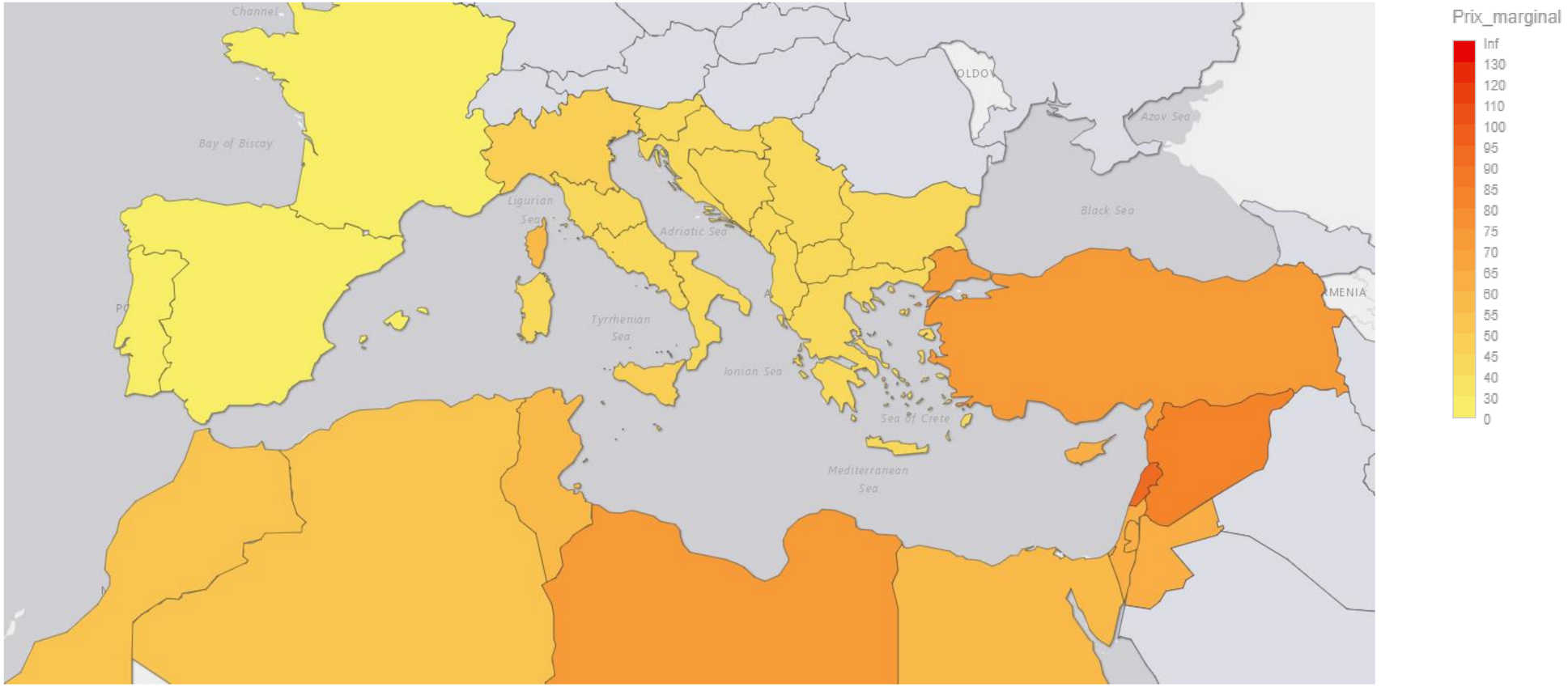
- Generation cost
- System cost (EENS, Spillage)
- Marginal price
- Use of generation capacity
- Exchanges (or flows) between areas
- Congestions

Environmental indicators

- CO2 emissions
- Renewable generation
- Renewable spillage (curtailment)
- Fuel use

Contrasts in Mediterranean that create opportunities for electricity exchange

The **average marginal price (€/MWh)** results from the competitiveness of the national generation fleets and the supply-demand balance.



Marginal price in the Mediterranean for the scenario National development

- **Same trends in the three scenarios / before adding new interconnection projects**

The Mediterranean Master Plan at a glance

PROJECT N°2: SPAIN - MOROCCO (ES-MA):

This project consists of a new interconnection between Morocco and Spain. In addition to the two-existing links, the project consists of a third link, based on HVAC technology, which will increase the NTC between both countries by 600 MW or 650 MW (Morocco – Spain and Spain – Morocco respectively). The total length of the interconnection line is estimated at around 60km, corresponding to a 30km subsea cable and a 30km overhead line. This project is promoted by ONEE and REE.
The overall investment cost is expected to be 223M€, 33% of which represent investment for internal reinforcements in Morocco.

Project Description Table

Description	*Substation (from)*	*Substation (to)*	*GTC contribution (MW)*	*Total Route length (km)*	*Present status*	*Expected commissioning date*	*Evolution*
New interconnection between Spain and Morocco	Béni Harchane - Morocco	Puerto de la Cruz - Spain	700	60	Long-term project	2026	

The Mediterranean Master Plan at a glance

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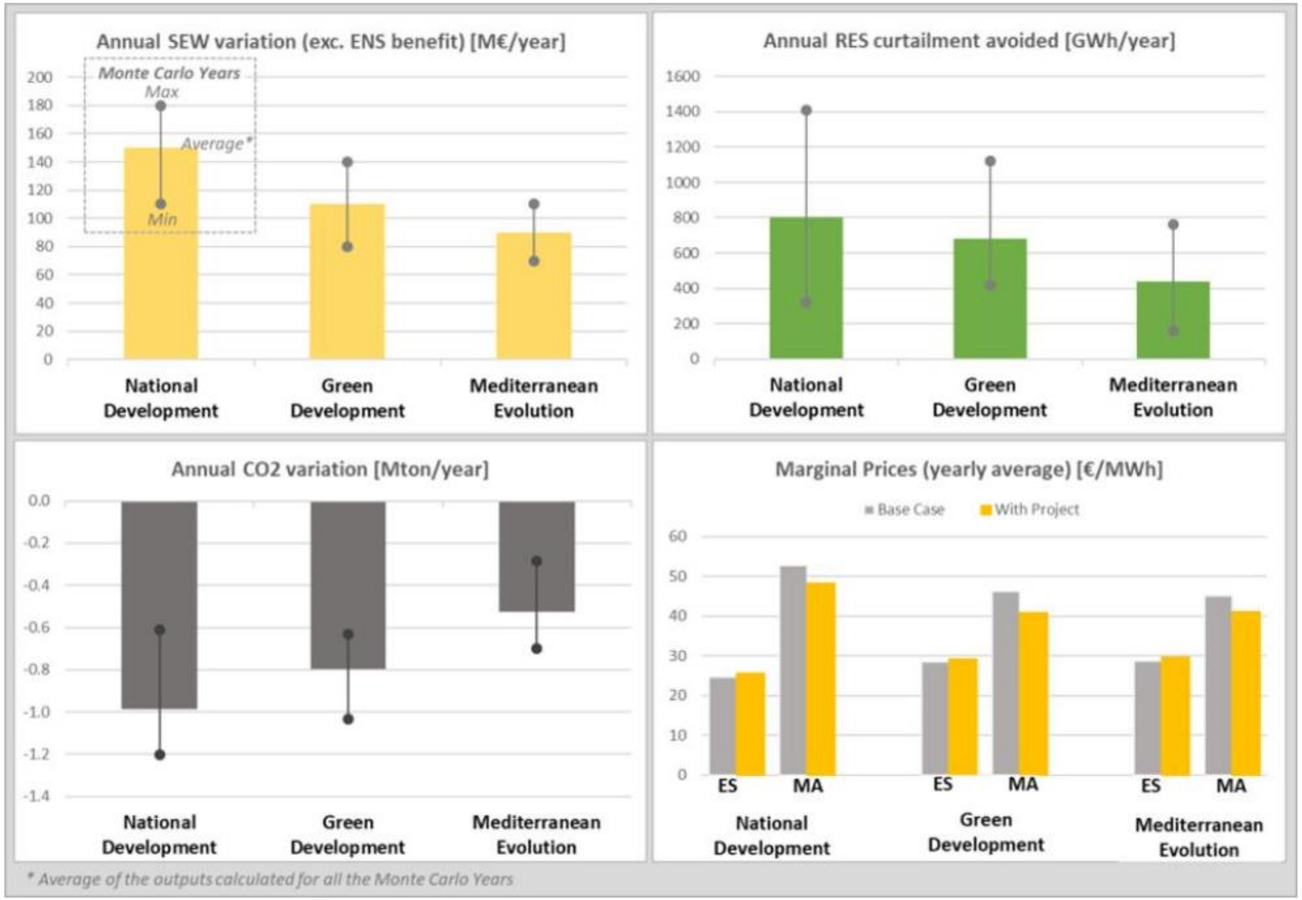
Description	*Substat (from)*
New interconnection between Spain and Morocco	Béni Harchar - Moroc

CBA Indicators

Project 2 yields a positive impact in the expected values of all the analysed quantitative CBA indicators, except for the expected Energy Not Supplied, on which the impact is null since the expected ENS is already null in the base case. Specifically, the project drives consistent increases in the Social-Economic Welfare and RES Curtailment and a consistent decrease in the CO2 emissions across the 3 simulated scenarios.



The Mediterranean Master Plan at a glance

For having a complete understanding of the Project,
we invite you to **download the complete Project Sheet**

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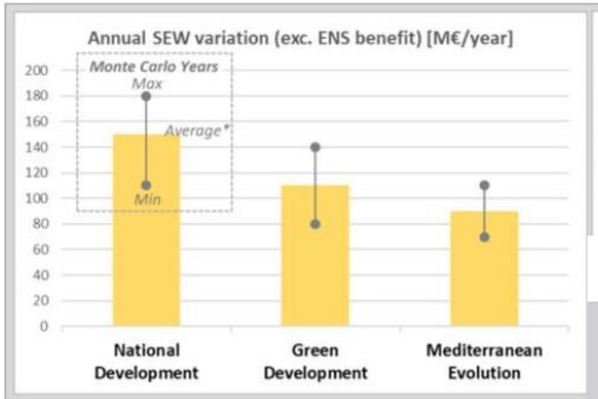
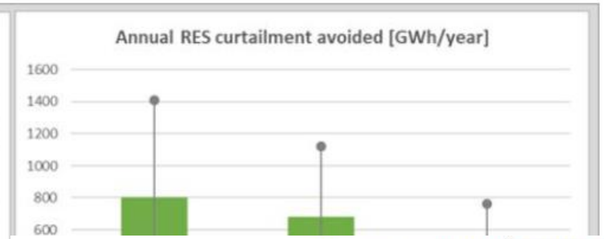
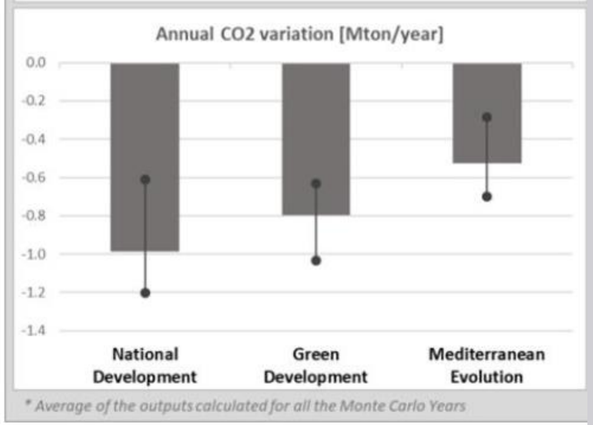
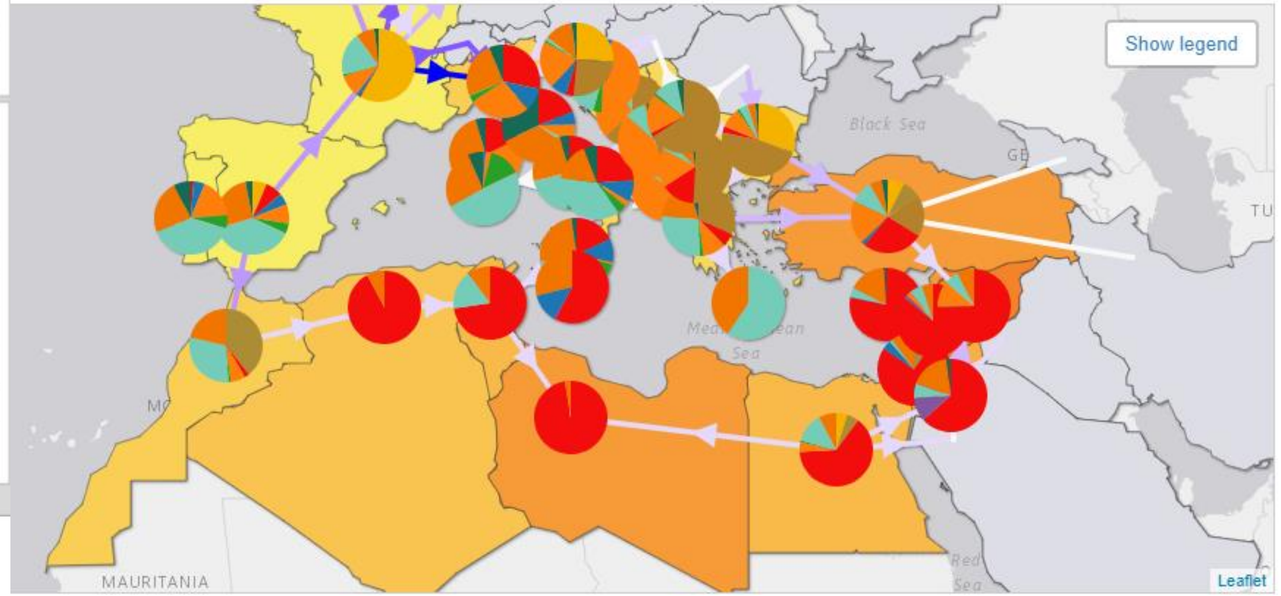






** Average of the outputs calculated for all the Monte Carlo Years*

Choose a Scenario: National Development



➢ https://med-tso.com/masterplan/

THANK YOU!

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