Winter Outlook 2022/2023

November 2022

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Med-TSO is co-funded
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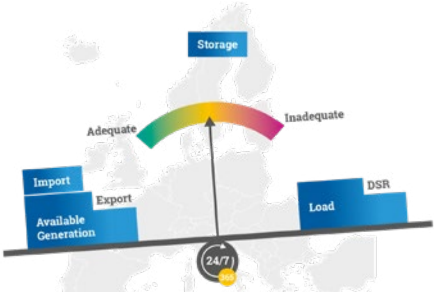
PURPOSE OF THE WINTER OUTLOOK 2022/2023

This Brochure presents the adequacy results among non-EU Med-TSO members during this winter (2022/2023). With this assessment, Med-TSO is aligning with the world-wide best practices and the latest development of the EU regulations[1].

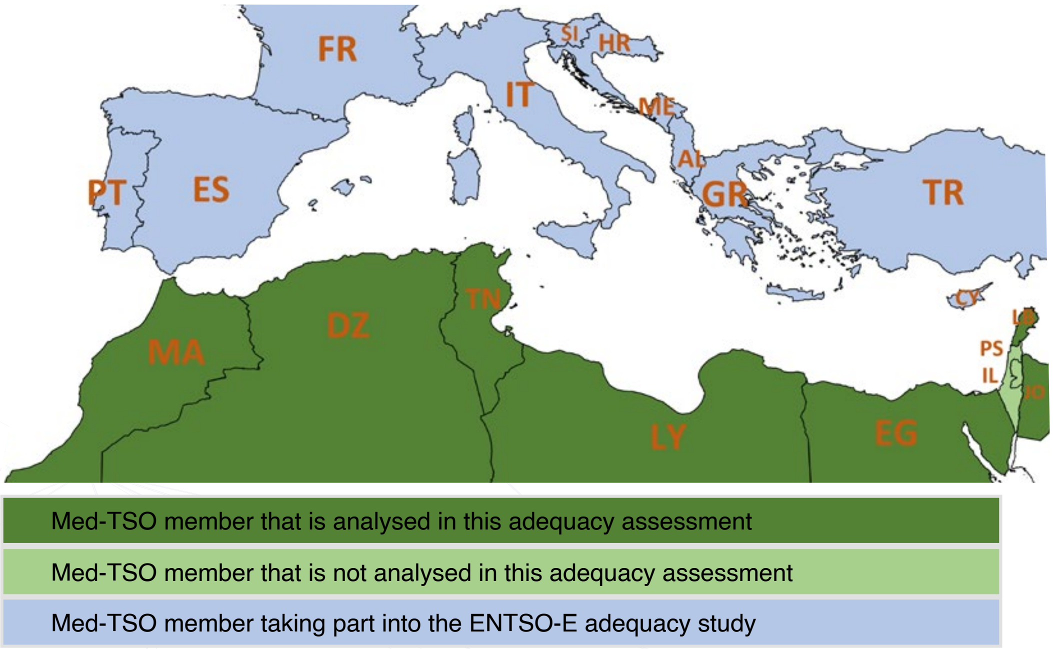
In general, these investigations check whether available resources are sufficient to cover required electricity demand while complying with transmission grid operational security limit.



These investigations consider the security of electricity supply to consumers through a detailed power system adequacy assessment, using probabilistic criteria. This approach is inevitable due to the stochastic nature of renewable energy systems (RES), their intermittency and the power system operation which raise the question of power system adequacy in the short, mid, and long run. Moreover, the integration of immense amounts of RES must be closely followed by the commissioning of devices that can provide adequate power system flexibility.

With all the changes in the electricity sector in countries around the Mediterranean Sea - from the energy markets development, integration of renewable energy sources and efforts to decarbonise energy systems - adequacy monitoring becomes more and more important.

The Winter Outlook 2022/2023 Report provides information about potential adequacy issues during the winter 2022/2023 in seven MED-TSO members: **Morocco, Algeria, Tunisia, Libya, Egypt, Jordan and Lebanon**:



Data for Israel and Palestine are not available at the moment.

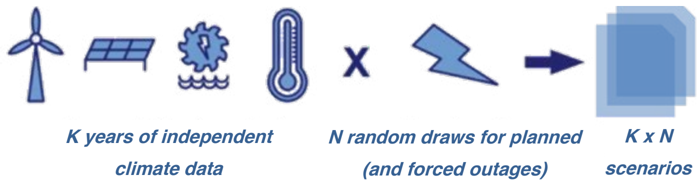
The analysed period includes all hours between the beginning of week 48 and the end of week 52 in 2022 (with exception of December 31st) and all hours between the begging of week 1 and end of week 13 in 2023.

1 https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019R0943&from=en

APPROACH AND METHODOLOGY USED IN WINTER OUTLOOK 2022/2023

As a general approach, a probabilistic Monte Carlo with Unit Commitment and Economic Dispatch (UCED) model has been used, ensuring inter-zonal and inter-temporal correlation of model variables and considering specificities of the assessed geographical perimeter. The hourly resolution has been implemented in the model and the Monte-Carlo approach has been used to reflect the variability of weather as well as the randomness of supply and transmission outages.

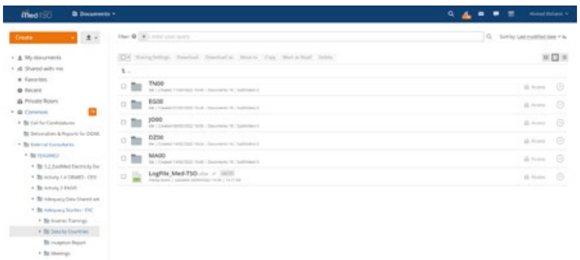
A number of Monte Carlo (MC) years are constructed to assess adequacy risks under various conditions for the analysed time-frame (see Figure below). For all those MC years, hourly calculations are performed for the whole geographical scope.



Collection of all relevant data and information necessary to model the power systems of Med-TSO has been realized with support from each TSO via forms specialized for collection of the data for different generation technologies, interconnections and demand. As an additional quality assurance, all provided data have been analysed and sanity checks were conducted.

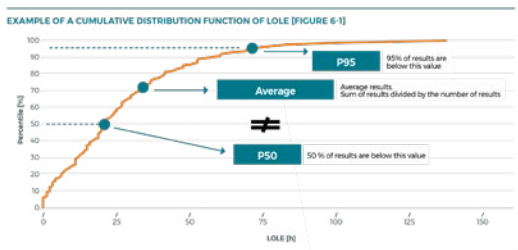
Input data for the Winter Outlook 2022/2023 have been collected in August/September 2022. For some countries (like Tunisia for example), the demand forecast is changed and updated but to ensure the coherence of the demand forecast evolution with the mid-term adequacy (2025 and 2027), demand has not been updated.

The analyses have been carried out with the **ANTARES simulator.**



Seasonal adequacy assessment is based on the following main indicators:

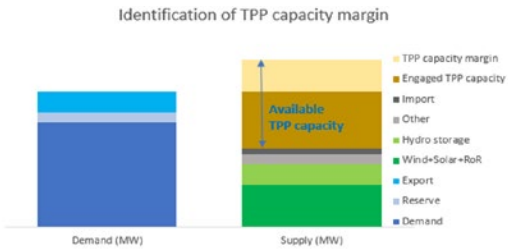
- **P95/P50 Loss of Load Duration or Energy Not Supplied (P95/P50 LOLD/ENS)**
  While LOLD in a given geographical zone for a given period is the number of hours during which the zone experiences ENS during a single Monte Carlo sample/simulation year, P95/P50 LOLD are LOLD in more or less severe operational conditions:
  - P95: LOLD/ENS that happens once in 20 years
  - P50: LOLD/ENS that happens once in 2 years



- **Loss of Load Expectation (LOLE) or Expected Energy Not Supplied (EENS)** in a given geographical zone for a given period is the expected number of hours per year when there is a lack of resources to cover the demand needs, within a sufficient transmission grid operational security limit or corresponding expected value of energy not to be supplied.

- **Dump Energy:** or RES curtailment, in a given geographical zone for a given period, is the energy generated in excess that cannot be balanced, for instance when the load is low and the in-feed from renewable is high.

◆ **The capacity Margin** for a given geographical zone for a given point in time is the difference between the available and engaged TPP capacity, as presented in the following diagram. These values point to the excess of capacity in the system.



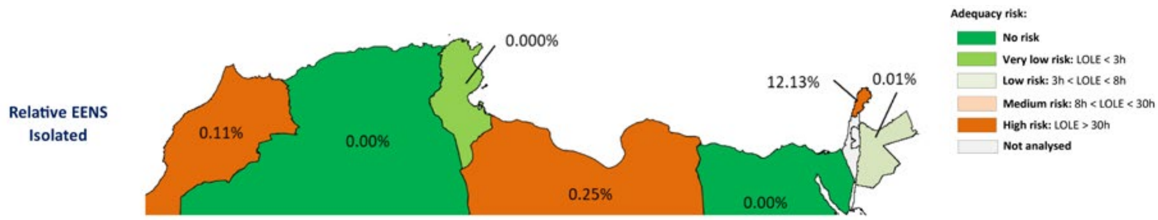
MAIN FINDINGS OF THE WINTER OUTLOOK 2022/2023

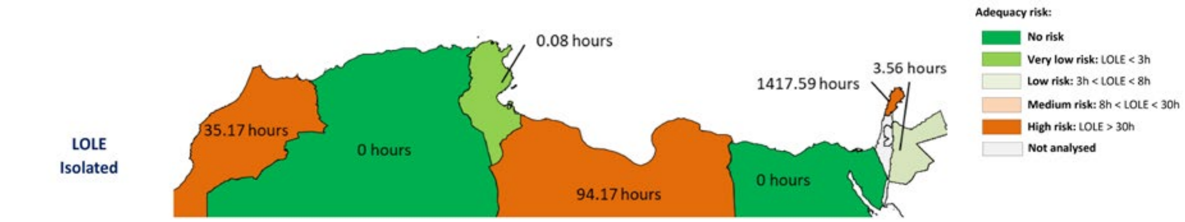
For probabilistic simulations, a total of 684 MC years have been constructed by combining climate-dependent variables (wind, solar and demand from 38 climatic years), available hydro time series and given/random outages:

- Climate years (each of 38 years from the period 1982- 2019) are selected one by one.
- Each climate year is associated with random outage samples, i.e. randomly assigned unplanned outage patterns for thermal units.

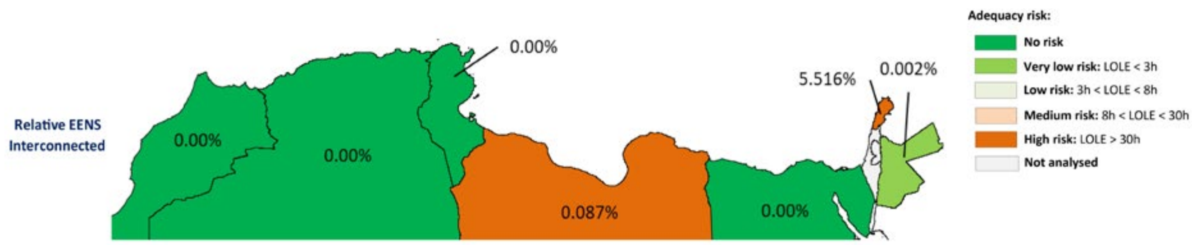
The adequacy situation is assessed using a two-step approach:

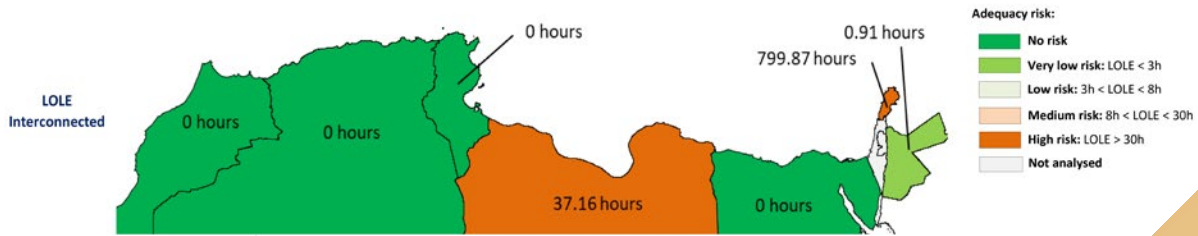
◆ In the first step, adequacy under isolated system operation is evaluated.





◆ In the second, adequacy under interconnected system operation is assessed to quantify the importance of Med-TSO interconnections.





In the case of a theoretical isolated scenario, adequacy risks are observed in some countries such as Lebanon, Libya and Morocco, although they could be considered as small or marginal in case of Jordan. Only in case of Lebanon and Libya, adequacy risk is very high under isolated system operating mode. Interconnections and energy exchanges with neighbouring countries reduce adequacy risks to zero or close to zero in Morocco and Jordan, but, ***in Lebanon and Libya, even in this more relaxed operating mode, adequacy risks are at unacceptable level.***

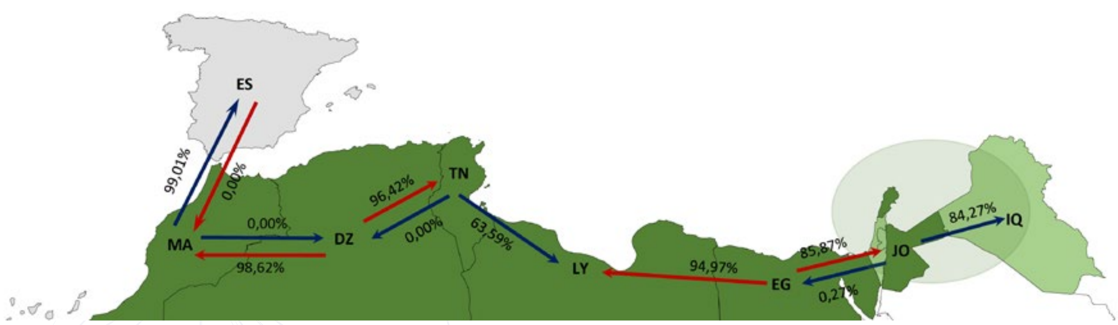
In the following tables ENS and LOLD seasonal results are given for all analysed countries.

Country	Interconnected	Isolated
DZ	EENS: 0 MWh	EENS: 0 MWh
	50TH percentile ENS: 0 MWh	50TH percentile ENS: 0 MWh
	95th percentile ENS: 0 MWh	95th percentile ENS: 0 MWh
	LOLE: 0 hours	LOLE: 0 hours
	50TH percentile LOLD: 0 hours	50TH percentile LOLD: 0 hours
	95th percentile LOLD: 0 hours	95th percentile LOLD: 0 hours
EG	EENS: 0 MWh	EENS: 0 MWh
	50TH percentile ENS: 0 MWh	50TH percentile ENS: 0 MWh
	95th percentile ENS: 0 MWh	95th percentile ENS: 0 MWh
	LOLE: 0 hours	LOLE: 0 hours
	50TH percentile LOLD: 0 hours	50TH percentile LOLD: 0 hours
	95th percentile LOLD: 0 hours	95th percentile LOLD: 0 hours
JO	EENS: 166 MWh	EENS: 671 MWh
	50TH percentile ENS: 0 MWh	50TH percentile ENS: 70 MWh
	95th percentile ENS: 991 MWh	95th percentile ENS: 3583 MWh
	LOLE: 0,91 hours	LOLE: 3.56 hours
	50TH percentile LOLD: 0 hours	50TH percentile LOLD: 1 hours
	95th percentile LOLD: 5,85 hours	95th percentile LOLD: 16.9 hours
LB	EENS: 435627 MWh	EENS: 950417 MWh
	50TH percentile ENS: 423221 MWh	50TH percentile ENS: 932105 MWh
	95th percentile ENS: 770645 MWh	95th percentile ENS: 1384332 MWh

Country	Interconnected	Isolated
LB	LOLE: 799,87 hours	LOLE: 1417.59 hours
	50TH percentile LOLD: 795 hours hours	50TH percentile LOLD: 1415 hours hours
	95th percentile LOLD: 1188 hours hours	95th percentile LOLD: 1770 hours hours
LY	EENS: 14579 MWh	EENS: 41282 MWh
	50TH percentile ENS: 8298 MWh	50TH percentile ENS: 31021 MWh
	95th percentile ENS: 52630 MWh	95th percentile ENS: 123822 MWh
	LOLE: 37,16 hours	LOLE: 94.17 hours
	50TH percentile LOLD: 28 hours hours	50TH percentile LOLD: 80 hours hours
	95th percentile LOLD: 113 hours hours	95th percentile LOLD: 227 hours hours
MA	EENS: 0 MWh	EENS: 17414 MWh
	50TH percentile ENS: 0 MWh	50TH percentile ENS: 3272 MWh
	95th percentile ENS: 0 MWh	95th percentile ENS: 80904 MWh
	LOLE: 0 hours	LOLE: 35.17 hours
	50TH percentile LOLD: 0 hours	50TH percentile LOLD: 11 hours
	95th percentile LOLD: 0 hours	95th percentile LOLD: 154 hours
TN	EENS: 0 MWh	EENS: 10 MWh
	50TH percentile ENS: 0 MWh	50TH percentile ENS: 0 MWh
	95th percentile ENS: 0 MWh	95th percentile ENS: 0 MWh
	LOLE: 0 hours	LOLE: 0.08 hours
	50TH percentile LOLD: 0 hours	50TH percentile LOLD: 0 hours
	95th percentile LOLD: 0 hours	95th percentile LOLD: 0 hours

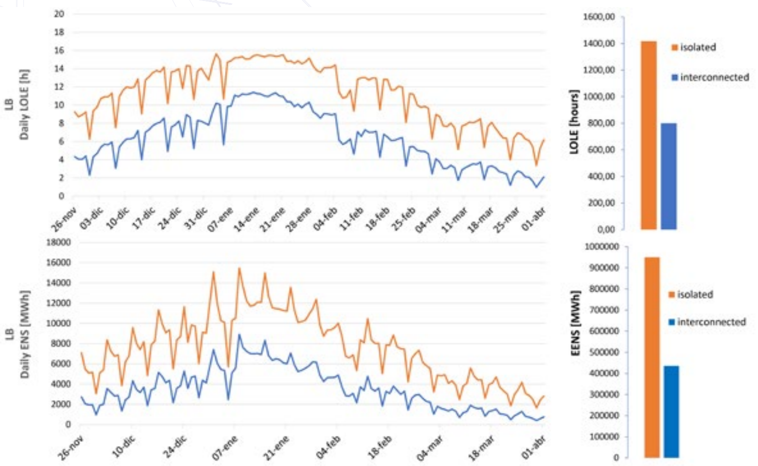
Interconnections improves the adequacy situation in some of the countries ***but present the inevitable support to adequacy in Lebanon and Libya.***

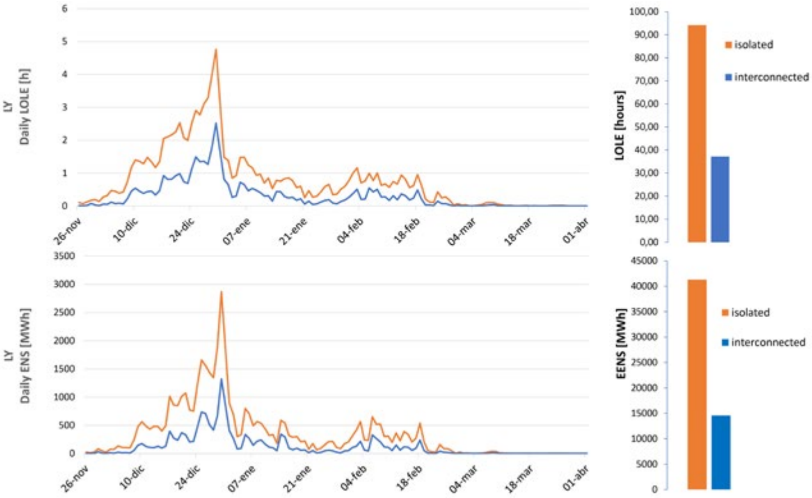
Exchange directions and transfer capacity utilization during 18 weeks of the 2022/23 winter season (average of all MC years) are presented on the following Figure.



CONCLUSIONS

The conclusion is that during this winter no adequacy issues are expected in Algeria, Egypt, Tunisia and Morocco, but some marginal adequacy issues might occur in Jordan. On the other hand, severe adequacy issues are expected to appear in Lebanon and Libya.





During entire winter period 2022/2023 there is the highest probability that generation (+import) will not be sufficient to cover Lebanon's electricity demand. The main reason for that is a lack of generation capacities in Lebanon's generation mix and low level of cross border capacities. Similar situation appears in Libya, where the situation is the worst in period November-December. After 1st January adequacy risk in Libya decreases, due to commissioning of new thermal capacities.

Read the full document

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.

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