Periodic Adequacy Report

MEDITERRANEAN PROJECT 2 (2018-2020)

January 2021

www.med-tso.com

Med-TSO is supported by the European Union.

PERIODIC ADEQUACY REPORT

System adequacy is the ability for a power system to meet demand consistently with an appropriate reserve margin, thus guaranteeing the full security of supply.

Starting with the second edition of the Mediterranean Project conducted by Med-TSO, the Association decided to pave the way for a rolling seasonal outlook as a new challenging and promising activity in order to assess system adequacy in an extended geographical perimeter covering all the members of Med-TSO.

The main principles applicable for carrying out this activity were established and published by Med-TSO at the beginning of 2020 in the report "Deliverable 3.2.A Guidelines and Methodology for Periodic Adequacy report[1]".

PURPOSE OF THE MEDITERRANEAN SEASONAL OUTLOOKS

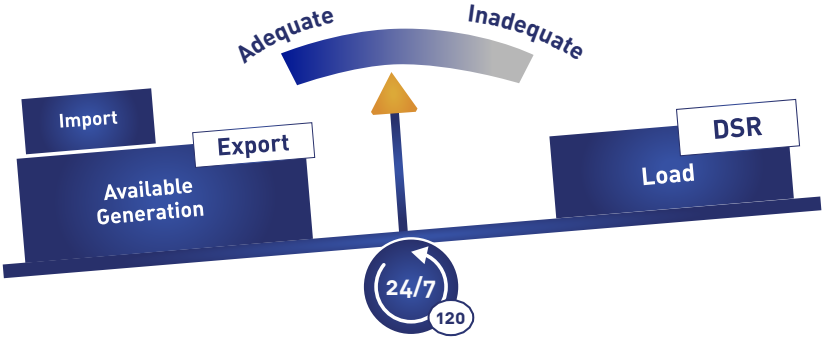
Mediterranean seasonal adequacy assessments intend to ensure risk awareness for all the involved TSOs and support system operation by answering the following questions:

- **Is the electrical system adequate through the summer/winter season?**
- **Is the system able to deal with extreme weather conditions or would its adequacy be threatened?**
- **What are the adequacy risks? When do these risks exist?**
- **What are the best means to mitigate these issues?**

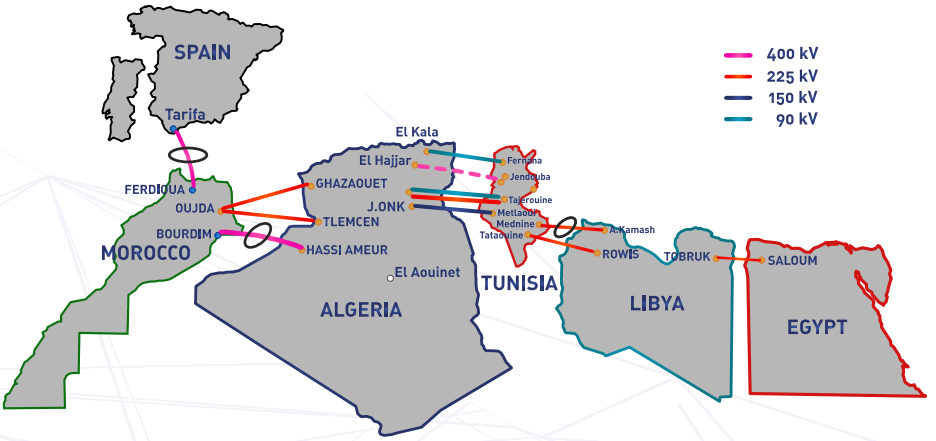
There is no doubt that, individually, every TSO is asking and answering these questions before every season. Historically, adequacy studies focus on the moment with the highest load in order to know whether one system is adequate enough to cope with load increase on the basis of who can do more and who can do less. However, due to the recent trends within the energy generation mix and with the remarkable increase of the shares of intermittent renewables, this rule may no longer be enough and analysis should be pushed further in order to cover all possible situations that may occur in a system.

Raising this matter at Med-TSO level could provide an early warning when available resources are expected to fail to keep pace with demand growth. It will also help TSOs to address the weather condition scenarios in a common regional way.

An overview of the actual situation of the Mediterranean's existing interconnection compared to the status of the historical exchanges between the countries led to the identification of two main regions where the interest in performing seasonal outlooks is high as interconnections are already implemented and there is an unexploited potential of exchange between the countries.



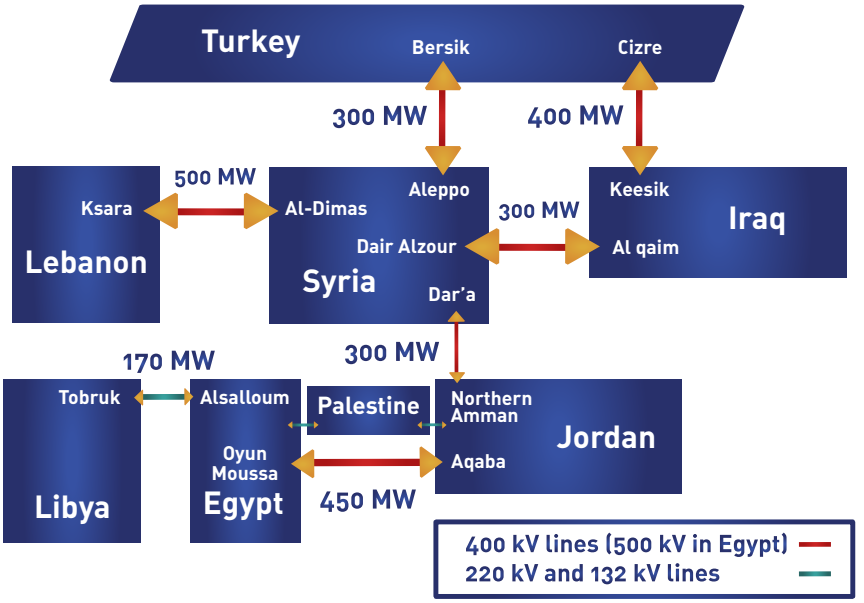
South-western Mediterranean area (Maghreb)



Starting in 2018, exchanges between Algeria, Tunisia and Libya were enhanced even if the balance is still low.

1.Med-TSO : Deliverable 3.2.A "Guidelines and Methodology for Periodic Adequacy report".

Eastern Mediterranean area



The statistical data collected in the framework of the actual Mediterranean project showed that many of the existing interconnection lines have been used to avoid load shedding in some countries where the load increases (mainly within the summer period) and over the years, some of the electricity exchange contracts are being activated.

SEASONAL OUTLOOK REQUIREMENTS

Adequacy models are built using three major pillars: **demand, supply and equivalent grid representation** connecting demand and supply in a pre-defined perimeter.

Electricity usage is changing and varies with the weather conditions, as changes that may occur in temperature and humidity affect the electricity demand for heating and cooling.

Med-TSO made an early decision to push cooperation with its historical partner ENTSO-E in order to make access to its demand forecast module called TRAPUNTA available for all Med-TSO members.

Med-TSO members have shown a strong interest in the tool: its ability to model the load increase associated with fast-growing economies, coupled with a reliable model for **weather dependency**. Although TRAPUNTA's use was globally positive, it also showed some specific difficulties related to the high growth of consumption in some of the Mediterranean countries where demand growth rate is expected to reach 4% per year. For this reason, it was important to consider a multi-year de-trending correction aimed to solve faced training and forecast issues related to the steep change in energy usage habits. Several new functions are also needed in order to provide a user-friendly environment for performing long-term and **seasonal outlook forecasts**.

Concentrating some of the Med-TSO effort on the renewable generation profiles was a must since the portion of renewables is already high within the Mediterranean countries (one third of the installed capacity) and with the fast-growing share of new wind and solar installations. In the framework of its close cooperation with ENTSO-E, Med-TSO succeeded in extending the perimeter covered by the Pan European Climate Database (PECD) to integrate all Med-TSO members and datasets have been prepared for all of the southern members of the association. Interested members furnished a detailed geographical distribution of their covered territories based on the availability of the grid and the potential of their wind and solar resources. Many other aspects were considered as the planned or existing projects alongside the future technological evolution of the wind turbines and PV panels.

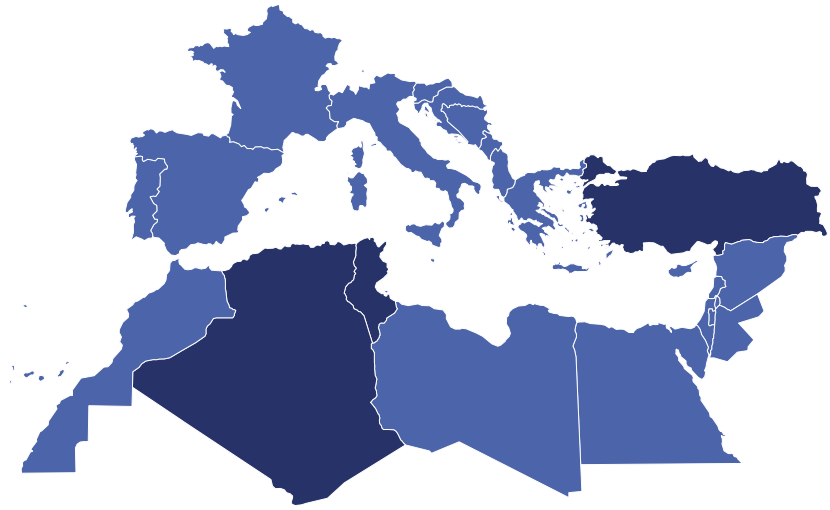
SUMMER OUTLOOK 2020 – ROLLING THE EXERCISE ON A PRESELECTED AREA

The implementation of adequacy studies and their publication by Med-TSO is a very ambitious goal given the challenges - not only in technical terms but also in accessing data and transparency requirements added to other practical terms related to the availability of the contributing members. This is why a gradual approach (in terms of perimeter and methodology) was adopted, with the aim of laying the foundations of organization, while simultaneously seeking practical efficiency. The first phase of the gradual approach could be implemented by a Pilot (or test) Zone.

The test zone includes both Algeria (SONELGAZ) and Tunisia (STEG) and the objective was to roll the load forecast activity and compare results to the already addressed forecasts for the year 2020.

Although not included in the test zone, it was of interest to complete the TRAPUNTA experiment with the case of Turkey (TEİAŞ). In fact, the consumption of this country has characteristics that make the demand modeling particularly complex: dynamic annual growth, although irregular in recent years, high climate sensitivity, both in winter with electric heating and in summer with a massive development of air conditioning.

SEASONAL OUTLOOK IMPLEMENTATION ZONE



For Tunisia and Algeria, the forecasted year is 2020 when it is 2021 for Turkey.

Input data description

Data inputs used for the model fitting phase are:

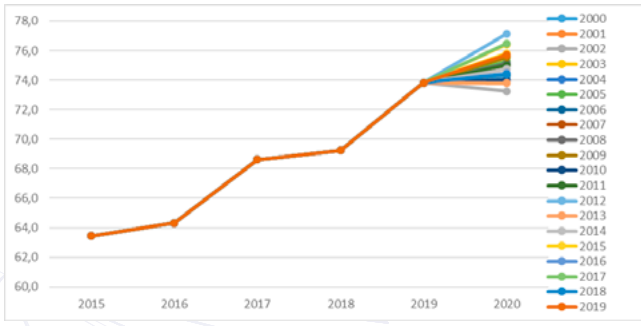
- **Model parameters** – a set of parameters that determine, for example, the basis function number used in the SVD (Singular Value Decomposition) of time series, number of (virtual) cities considered, number of day groupings considered (holidays/ special days), regression order, p-value (threshold for elimination of regressors) among others.
- **Pan-European Climate Data Base (PECD)** consists of time series for N climate years on temperature, irradiance, humidity, wind speed among others. From this database, the demand forecasting methodology principally relies on historical load, humidity, wind speed, irradiance and temperature time series that are used to establish a link between the load and the remaining variables.
- **Holiday/special days** are days that are characterized by different electrical load behaviors, related to the load pattern deviations experienced during holiday days or special days (Ramadan, national and religious holidays). Currently, the software allows users to cluster special days into several groupings that are separately treated during the forecasting process.

Main forecast results

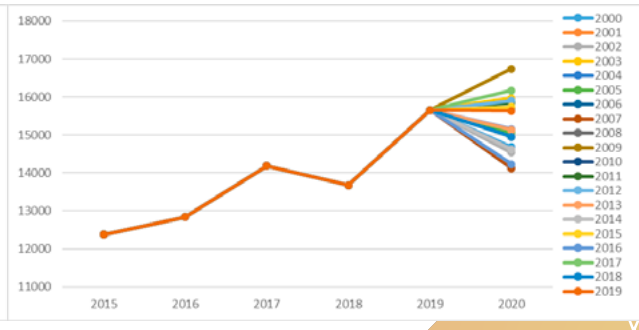
The main results obtained for the forecast related to the year 2020 with reference to 20 climatic years from 2000 to 2019 will be presented with a focus on the maximum and minimum load, their day and hour of appearance, and the predicted energy consumption.

The following tables and graphs will summarize those aspects for Algeria, Tunisia and Turkey.

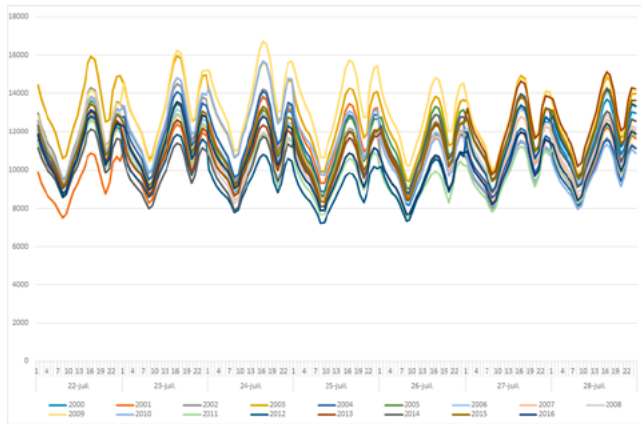
ALGERIA:



DZ – Energy (TWh) among 20 possible futures for 2020

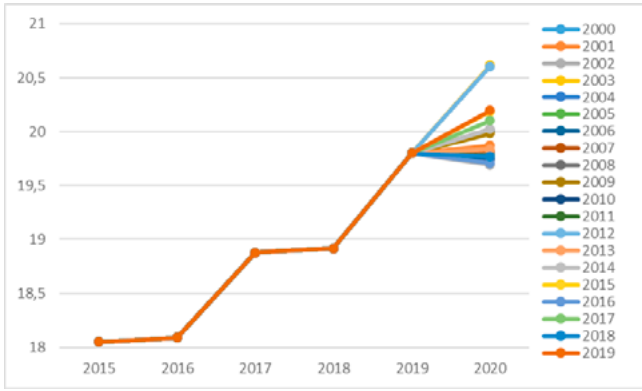


DZ – Peak load (MW) among 20 possible futures for 2020

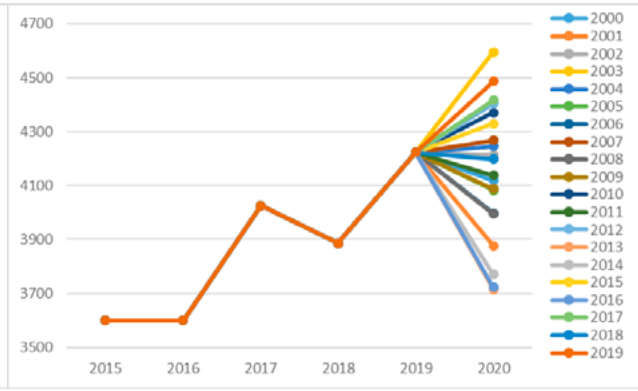


DZ - Predicted load curve shape during a week in summer

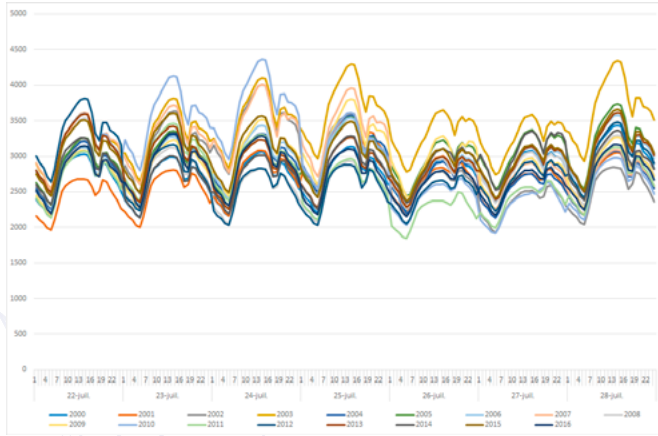
TUNISIA:



TN – Energy (TWh) among 20 possible futures for 2020

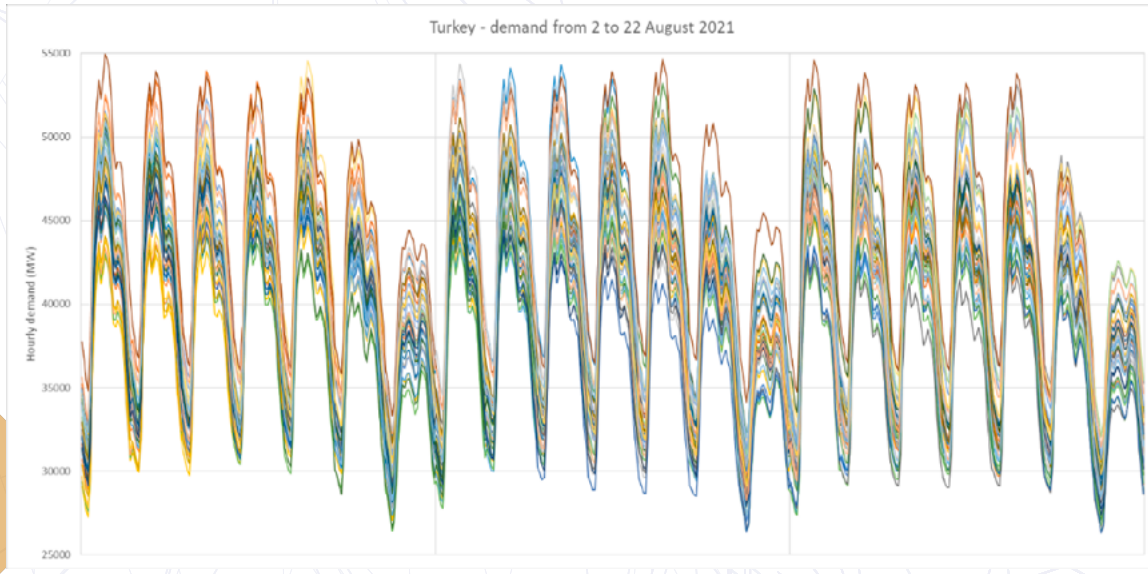


TN – Peak load (MW) among 20 possible futures for 2020

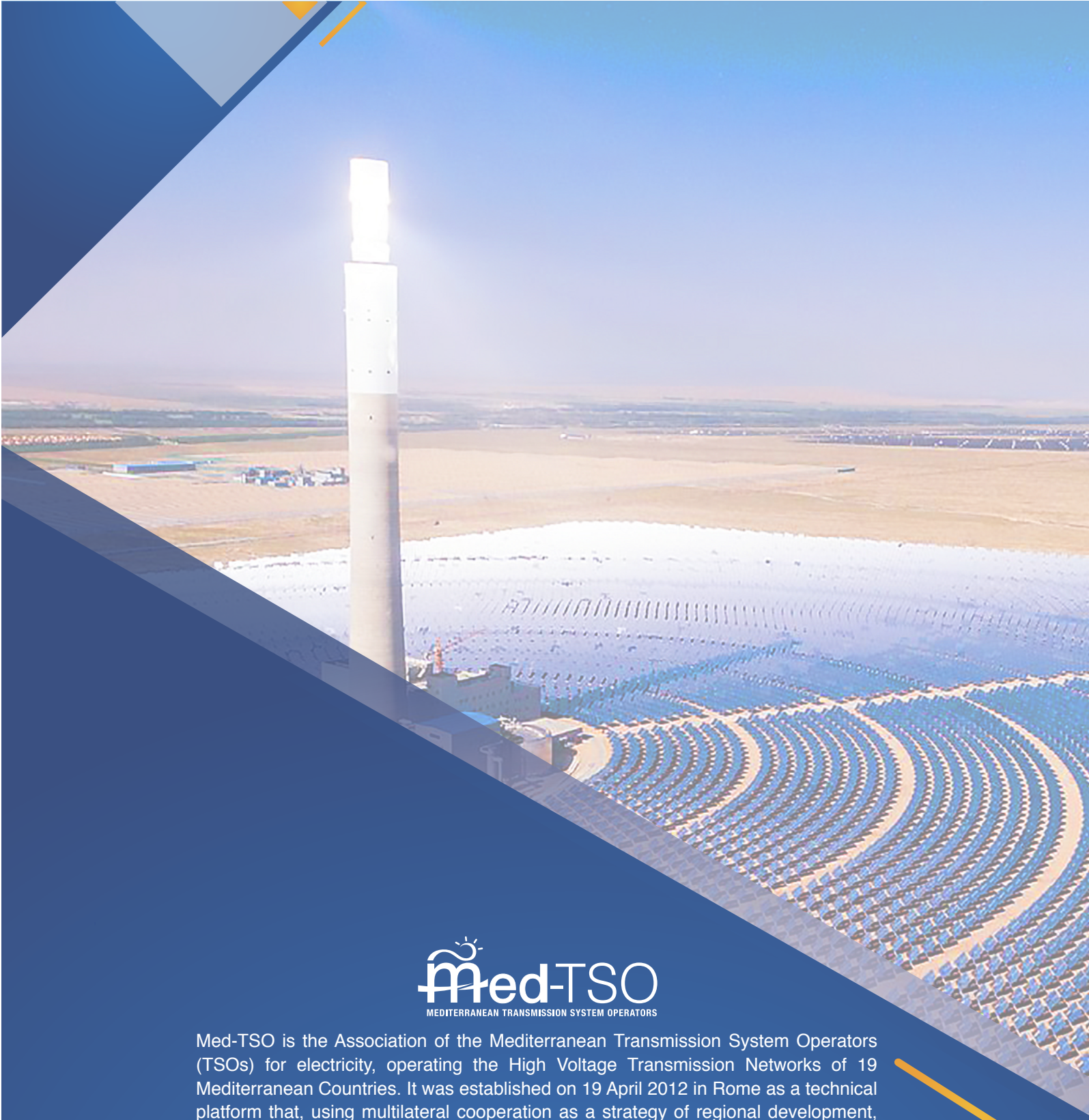


TN – Predicted load curve shape during a week in summer

TURKEY:



TR - Predicted load curve shape during a month in summer 2021



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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