Med-TSO
MEDITERRANEAN TRANSMISSION SYSTEM OPERATORS

Deliverable 3.2.A

"Guidelines and Methodology for Periodic Adequacy report"

EC DGNEAR - GRANT CONTRACT: ENI/2018/397-494

"Med-TSO—Mediterranean Project II"

Task 3.2 "Risk preparedness: Winter Outlook or/and Summer Outlook"

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Med-TSO Winter and Summer Outlook

Executive Summary

The Periodic Adequacy report is the document that includes the vital information needed to determine the requirements of an area in energy facilities (including infrastructure) in order to meet the load demand under a safe margin of credibility, in a predefined time period. In this file, the basic guidelines are presented, followed by the main methodology principles used to produce the seasonal outlook of the Mediterranean countries, according to the Med-TSO context. The geographical perimeter examined covers all Med-TSO members. The seasonal adequacy assessment shall cover the winter and summer seasons under a probabilistic Monte Carlo approach. Depending on the power systems' under analysis, the assessment can be performed firstly considering the power systems on an isolated basis and then considering the same power systems including the interconnections. With this approach the benefits of the interconnections are quantified in terms of a favorable variation on the indicators of security of supply.

A number of possible scenarios for each variable, under various conditions are constructed to assess adequacy risks where at least hourly calculations are performed to ensure that all correlated variables are well combined in time and space, using a common data base and similar technical approach. The dispatch price is determined on a common fuel and CO_2 price assumptions while a case-by-case approach is considered when a large deviation from the actual conditions is encountered. The study takes into account network constraints as well as scheduled maintenance and other planned outages as indicated by the corresponding TSOs. The calculation of the NTC values is performed under the N-1 operational rule at least, and the results are given in the borders between the single-node zones considered.

The adequacy models are built with demand and supply data using the best estimates available at the assessment stage. Grid zones are represented as single nodes, which are coupled via interconnectors described by NTCs for each border based on the best estimated provided by TSOs. The data used to consider the variability of supply and demand include uncertainty as the assessments are made for a season ahead and therefore numerous Monte Carlo years are examined with correlated variables to account for potential risks. Standard probabilistic indicators are considered, while in some specific cases other indicators are used to help to identify and quantify risks.

The seasonal outlook study shall be deployed by using as much as possible software and database yet deployed for Med-TSO activities for the load forecasts and for the assessment of the variability of wind farm and photovoltaic plant production, assuming for its step-by-step implementation the relevance of adopting a gradual approach (in terms of perimeter and methodology), with the aim of laying the foundations in terms of organization, while simultaneously seeking practical efficiency.

1 Introduction

System adequacy is the possibility for a power system to meet demand and appropriate reserve margin at all times, thus guaranteeing the full security of supply. Under the framework of Med-TSO, the winter and summer outlook activity consists of analyzing the main risks to the system adequacy for each country of the whole Med-TSO area. This analysis looks at uncertainties, such as climatic conditions and outages, as well as other risks faced by the system including the evolution of load, load-management, and generation and cross border exchange capacities.

Historically, the moment with the highest load was usually used for this kind of analysis, taking into account generation maintenance and outages and renewable energy reliability. Therefore, under consideration of uncertainties of data acquisition, the probable most critical situation could be assessed. However, due to more recent trends in the energy generation mix, with increasing intermittent renewables and diminishing conventional fossil generation, the need of a more sophisticated assessment becomes necessary.

With the increase of renewables in the system, in the future, the most critical situations may occur at times other than peak demand, for instance when the load is low and the in-feed of renewables is high. In addition to the assessment of whether the generation meets the demand, downward regulation and the need for more flexibility in the system must be considered.

The Seasonal Outlook analysis should be firstly performed at country level, or sub-country level in case the presence of bottlenecks (also considering the outages of Generation) have an impact on adequacy. In a second phase the analysis should be performed at a regional level, examining how neighboring countries can contribute to the power balance of a power system under stress. In fact, performing this analysis in two phases, may help highlighting the benefits brought by the system integration from an Adequacy point of view. The objective of Guidelines and Methodology for Periodic Adequacy report, commonly designed by Working Group Economic Studies and Scenarios (WG ESS) members, is to set a harmonized Med-TSO adequacy methodology to perform regional simulations.

After this short introduction, the purpose of the next chapter is to describe more precisely the objectives and main principles of the Seasonal Outlook, addressing the period and area to be covered, a definition of indicators and also the risks to be studied, including an overview of the content and structure of the Report.

The following chapter introduces the organization set up among the members of Med-TSO for the realization of seasonal studies, proposing a general schedule and organization for the data collection and the report drafting and its gradual implementation. Since the Report shall include a full view of all Med-TSO perimeter (i.e. including countries covered by ENTSO-E Seasonal outlook), the guidelines should take into consideration this aspect for coordination among Med-TSO Members and with ENTSO-E. More globally, the present guidelines are strongly inspired for the aim of compatibility by the methodology to be implemented by ENTSO-E and described in the following document: "*Short-term and Seasonal Adequacy Assessments Methodology Proposal in accordance with Article 8 of the REGULATION (EU) 2019/941 of 5 June 2019 on risk-preparedness in the electricity sector and repealing Directive 2005/89/EC (version 8 July 2019)*" [1].

The chapter 4 is devoted to some technical aspects of the realization of the adequacy studies, covering the definition and format of data to be collected (load at reference point and load demand point, net generating capacity, planned and forced outages, system service reserves, exchanges capacity, etc.), margin calculation and severe condition assessment. The underlying assumptions shall be harmonized to fully benefit from the assessment of the entire interconnected system as a whole. Special attention will be paid to the definition of climatic conditions and their impact on system adequacy and risk assessment.

The chapters 5 proposes a list of indicators to quantify and interpret adequacy assessment results. A careful selection of indicators is important, as well as a clear explanation of their meaning to the audience.

The document concludes with a global description of the steps for implementation and publication of the seasonal studies, where the chapter 6 highlights the relevance of adopting a gradual approach (in terms of perimeter and methodology), with the aim of laying the foundations in terms of organization, while simultaneously seeking practical efficiency.

2 Scope of Seasonal Adequacy studies

The purpose of Seasonal Adequacy assessment is to assess if expected (or planned) availabilities of supply and transmission infrastructure are sufficient to ensure adequacy, and under which circumstances a risk may exist. Outcomes from pan-Euro Mediterranean adequacy assessment can be refined in regional and national studies, which can incorporate higher granularity and local sensitivities, while complying with the Methodology. Furthermore, when the assessments show they can pose a risk for adequacy, some generation and network planned outages can be rescheduled to mitigate the risk.

2.1 Geographical perimeter

Geographical perimeter covers all Med-TSO members and should consider the neighboring countries/regions that contribute to the adequacy issue. The minimum requirements for geographical granularity is the minimum size between country and bidding zones.

The map below shows Med-TSO member countries, and specifies those who are taking part to the ENTSO-E adequacy studies.

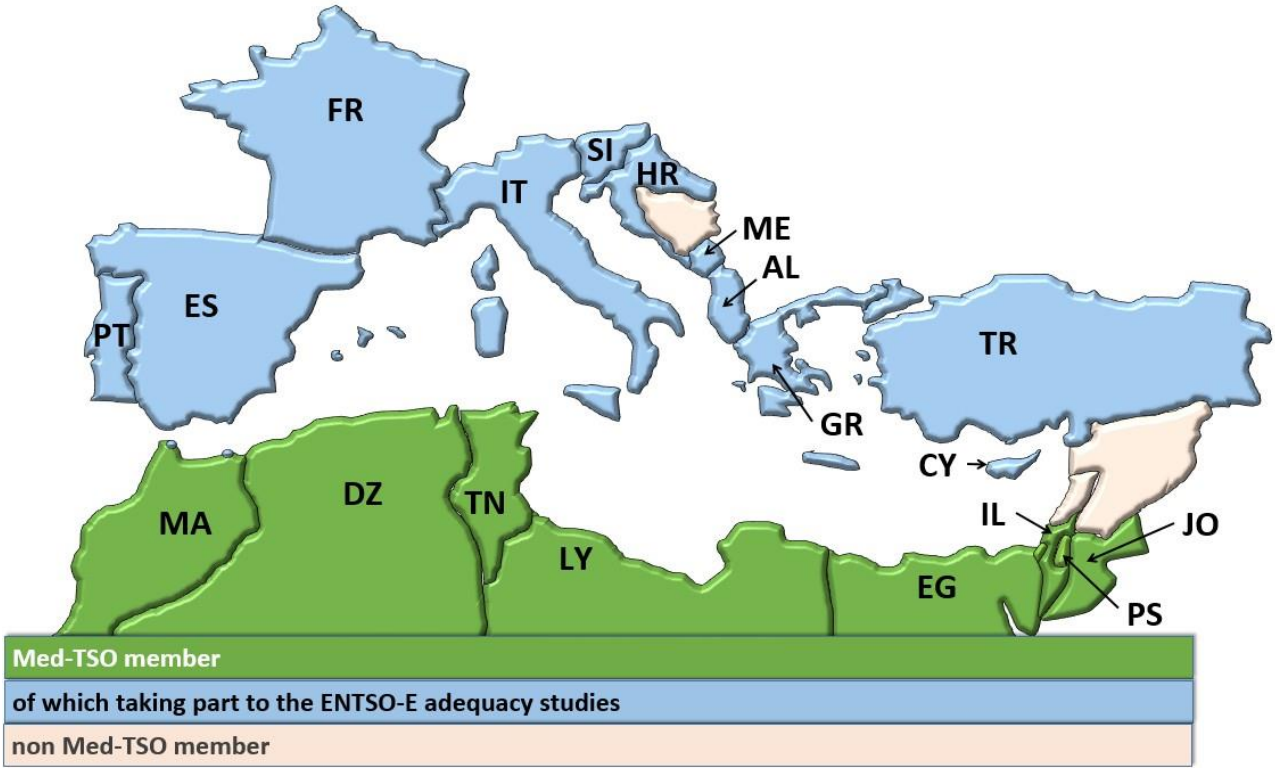

Figure 1: Med-TSO members

The seasonal outlook published by Med-TSO should include all member countries of the association. It is particularly relevant that the role of exchanges between interconnected countries is taken into account and illustrated in the studies. This implies, on one hand a common methodological approach, an on the other hand an access to the study assumptions for all the involved countries. For this reason, the implementation of seasonal studies and their publication by Med-TSO requires coordination with ENTSO-E for the countries whose study is regulated by *REGULATION (EU) 2019/941* [3].

2.2 Temporal Scope

Seasonal adequacy assessment covers at least winter and summer seasons a season as following:

- period between 1 December and 31 March in winter adequacy assessments, and
- period between 1 June and 30 September in summer adequacy assessments.

The above study periods shall be considered as minimum requirements to be respected all seasons. It corresponds to the experienced risk periods for the security of supply in the Mediterranean Region. Med-TSO does not exclude specific assessments in earlier or later weeks if there would be a potential risk.

2.3 Methodological approach

A probabilistic Monte Carlo with Unit Commitment Economic Dispatch (UCED) model shall be used, ensuring inter zonal and inter temporal correlation of model variables and considering specificities of assessed geographical perimeter. In particular, the methodology shall follow a Monte Carlo approach to reflect the variability of weather, as well as the randomness of supply and transmission outages.

The UCED model shall consider the inter zonal and inter temporal (e.g. between 2 successive time steps) correlation of variables and the characteristics of the geographical perimeter assessed. At least hourly resolution shall be implemented in the model.

Seasonal Adequacy assessment shall consist of following steps:

- Run of Monte Carlo probabilistic assessment with UCED model;
- Spatial analysis on seasonal basis to detect regions with adequacy risk;
- Temporal analysis on weekly basis to detect periods with adequacy risk;
- Focused analysis of adequacy in zones and weeks with high risks identified.

Depending on the countries under analysis, this assessment could include two successive phases, the first considering the countries alone (isolated areas) and then considering the same countries as interconnected. The advantage of this approach is to be able to quantify the benefit of the interconnections in terms of a favorable variation on the indicators of security of supply.

Taking interconnections into account requires modeling of neighboring countries, ideally with a complete representation of these countries offered by UCED models. However, for reasons of limited access to the assumptions, or simply for not unnecessarily complicating the model, simplified approaches can be envisaged. For example, the approach can be based on the analysis a typical behavior observed over a recent period of time, in order to form a set of boundary conditions data with non-modeled countries.

The implementation of the methodological approach described above requires access to a detailed set of data and a calculation process described in the following paragraph, which involves the use of complex tools. Chapter 6 proposes a number of criteria for addressing a phased implementation.

3 Adequacy calculation general approach

The objective of adequacy assessments is monitoring if available supply and transmission capacities are enough to cover demand under various conditions; and if not, to identify what, where and when the risks are.

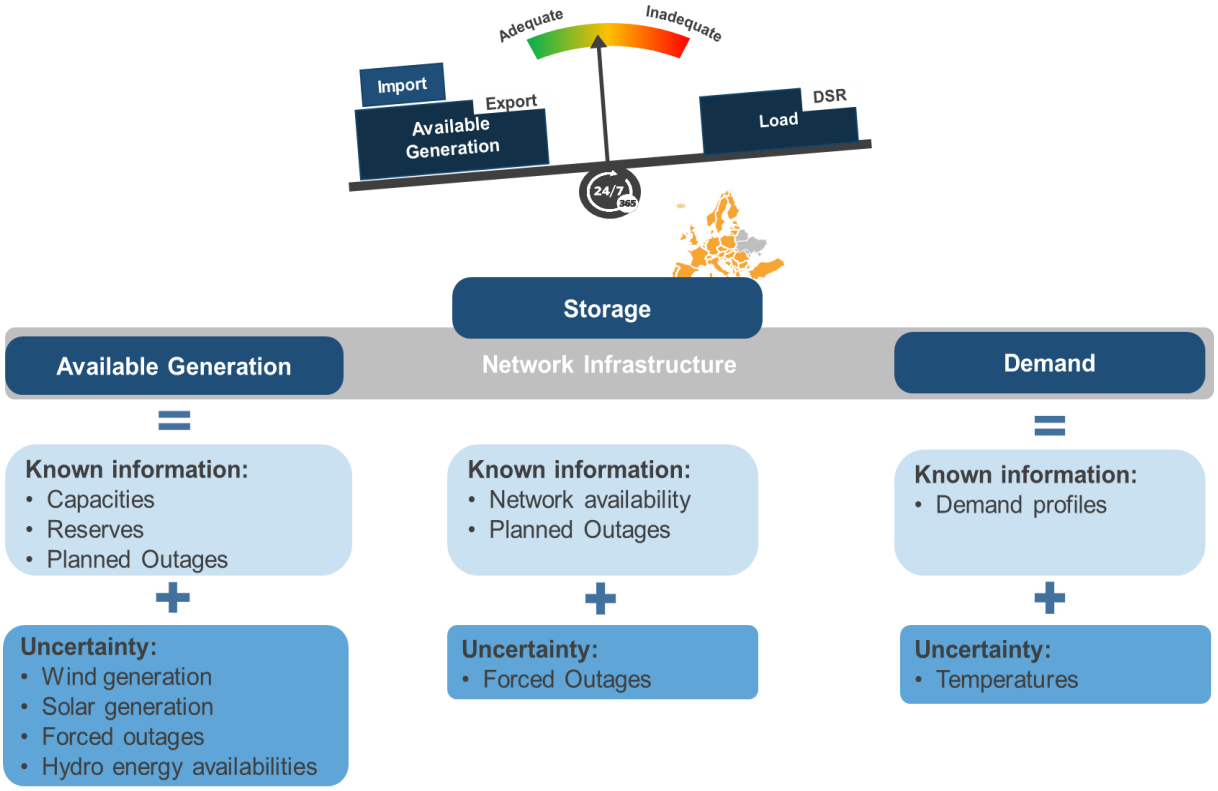

Figure 2: supply-demand data overview - *Source: ENTSO-E [2]*

A number of possible scenarios (or time-series) for each variable are constructed to assess adequacy risks under various conditions for the timeframe under analysis. For all those scenarios, at least hourly calculations are performed for the whole geographical perimeter.

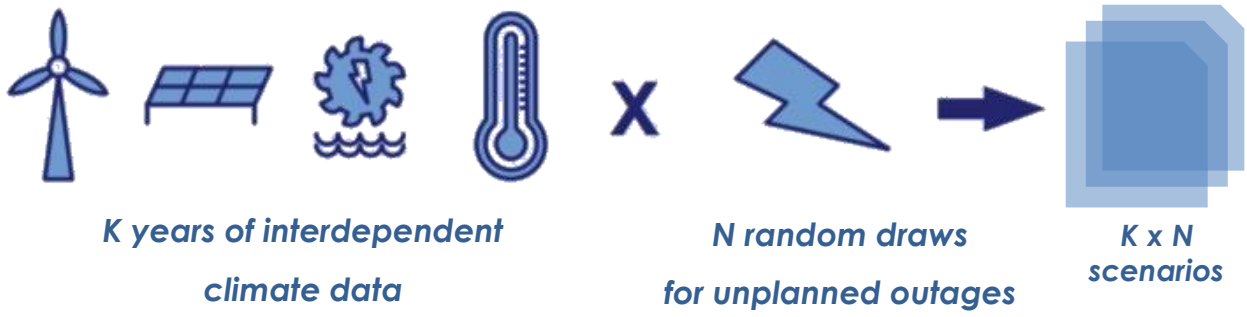

Figure 3: Monte-Carlo years building principle - *Source: ENTSO-E [2]*

The scenarios are constructed to ensure that all correlated variables (interdependent) are well combined in time and space. Correlation is ensured by the analysis of historical weather conditions (temperature, wind, irradiance, humidity, etc.) and variable input statistical data (e.g. demand). To ensure the highest quality of data used in assessments, a common database is used with data prepared under the same conditions and a similar technical approach.

The criteria for considering resources is whether or not they are market based. Consequently, any non-market resources, such as strategic reserves, shall be disregarded in the base case calculations. However, they be considered as a possible remedial action in the sensitivity study.

Dispatch price (which sets a merit order) is determined on common fuel and CO_2 prices assumptions, that are used as best estimate. These prices are based on future prices of CO_2 and fuels or, when such prices do not exist, on the latest available statistical information (e.g. nuclear fuel prices).

However, the preferential choice to determine common assumptions for the fuels and CO_2 prices should not lead to ignoring the contrasts that may exist in the Mediterranean region. Indeed, the choice of common assumptions could lead to a large deviation from the actual conditions encountered in certain regions, and induce an economic merit order of generation that is not representative. When these situations are identified, a case-by-case approach should be considered, emphasizing regional coherence (encompassing a set of close countries) and with choices that must necessarily be supported by recent factual evidence.

Supply and interconnector availability must consider scheduled maintenances and other known outages (mothballing, etc.). Conversely, unplanned outages of supply and interconnectors (HVDC and HVAC) are considered in a probabilistic manner, with the best expertise available by TSOs. It is relevant to note that, while modelling unplanned outages of supply units and HVDC interconnectors is rather straight forward, modelling HVAC interconnection unplanned outages is more complicated, because these interconnectors do not represent a physical cross border interconnector, but rather a physical capability to exchange energy between two systems.

The seasonal outlook is not a network study, but it must take into account network constraints that have an impact on the security of supply and the distribution of production between zones. Thus, each country, or each bidding zone, is considered as a copper plate without internal constraints; and the grids are taken into account in the borders between zones via the NTC values.

The calculation of the NTC values is performed taking into account the operational rules (at least N-1).

4 Building assumptions

Adequacy models are built using three major pillars: demand (including demand side response and system reserve requirements), supply (e.g. generation, storage units) and grid representation, which connect demand and supply in different zones. Additionally, climate data is used to address uncertainties of these three major pillars.

4.1 Demand

Demand data shall be based on the best estimates of demand available at the assessment moment. This data set shall especially reflect general electricity demand growth, which can be very dynamic among the Mediterranean countries, but also be very attentive to certain specific uses, particularly air conditioning,

which strongly affects consumption at the cutting edge of the summer period. A number of demand profiles are created in order to represent demand variability relative to weather conditions.

Demand for system reserves shall be defined based on the practice of system operations of each specific system.

Furthermore, available contribution of market-based demand side response, as well as additional demand during charging of storage units, shall be considered as individual elements responding to market signals. Demand-side response which provides system reserves shall be disregarded.

4.2 Supply

Supply data shall include best estimates of available supply resources considering planned and unplanned outages. Any supply resources shall be considered. Supply resources may be generation, storage and available exchanges with non-explicitly modelled neighboring countries. Hydro generation shall be modelled considering energy availability.

The supply modeling could take into account, if necessary, the loss in efficiency observed on thermal power plants when the ambient air temperature is high, noting that this phenomenon is generally concomitant with the increase in consumption (air conditioning) and therefore particularly affects the tensions on the supply-demand balance in the summer period.

Definition Explanation – Planned Outage

These outages are all outages known at the moment of the adequacy assessment. These include maintenances, mothballing, existing outages due to forced outages and any supply unavailability due to other reasons.

Definition Explanation – Unplanned Outage

These outages are not known in advance. Unplanned Outages may occur due to technical or human faults and are modelled as outages in addition to planned outages. In order to incorporate unplanned outages, a number of random drawings is taken, based on historical rates of forced outage of generation or transmission assets.

4.3 Grid

Zones are represented as copper plates (single nodes), which are coupled via modelled interconnectors. Interconnectors are described by NTCs for each border, which are based on the best estimates made by TSOs.

It may be possible to improve grid representation in the future, for example through a Flow Based representation where such market coupling is already operational. However, the essentially linear structure of the trans-border transmission grid on the southern and eastern shores of the Mediterranean supports a NTC-based approach.

Beyond its mainly linear structure, the interconnection grid plays a key role in many countries for the security of supply, which is enabled by the setting up of programmed electricity exchanges in the absence of market mechanisms. These organized exchanges between the national companies can also be induced by their economic interest.

In this context, the seasonal outlook performed by Med-TSO can also be carried out in two phases:

- Phase 1: result analysis under insulated country assumption;
- Phase 2: the countries are connected through NTC modelling.

The addition of phase 1 intends to firstly measure the security of supply indicators with an isolated country hypothesis (self-sufficient assessment). By previously undertaking phase 1, in phase 2 it will then be possible to assess the potential profit brought by the interconnections, by analyzing the evolution of the values of the same security of supply indicators from phase 1 to phase 2.

When appropriate, the existence of long-term electricity exchange contracts may be taken into account in a specific way.

4.4 Climate data

Various climate data are applied to consider variability of supply and demand. Wind, photovoltaic and concentrated solar power plant generation estimates, as well as hydro inflow into hydro power plants are part of these data. Furthermore, other climate data, such as temperature and solar irradiance, are used to determine demand variability, having a specific attention on air conditioning usage when impacting the security of supply.

Seasonal adequacy assessments are usually performed well ahead of season, therefore forecasts for this time horizon are limited and uncertainty is usually high. Therefore, a variability of weather patterns by means of numerous scenarios is considered, in order to account for potential risks. Correlation of all variables is guaranteed in time and space, ensuring reliable assessment results.

5 Indicators and results analysis

Indicators are measures to quantify and interpret adequacy assessment results. Careful selection of indicators is important, as well as a clear explanation of their meaning to the audience.

A range of indicators may be used for seasonal adequacy assessments. Each indicator may provide specific insight on adequacy assessment; therefore, a combination of indicators may be used. For example, there may be a risk of load shedding affecting a very small number of consumers, however it may be considered relevant by some if it is for a long period. Further on, we can also consider the opposite, i.e. there may be a risk of a very short supply scarcity, which affects many consumers and therefore the risk is considered very relevant.

Potential and well-known probabilistic indicators are described below. However, in some specific cases other indicators may be used, which would help to identify and quantify risks. The need of such indicators may be considered in each study, individually considering adequacy assessment results.

- **Loss of Load Expectation (LOLE)** in a given geographical zone for a given period is the expected number of hours when there is a lack of market-based resources to cover the demand needs, within sufficient transmission grid operational security limits. This indicator is very useful for overview of adequacy in long period and is commonly used in adequacy assessments as mid-term adequacy forecast.
- **Loss of Load Probability (LOLP)** in a given geographical zone for a given period, is the probability to have a lack of market-based resources to cover the demand needs, within sufficient transmission grid operational security limits. This indicator represents likelihood of adequacy issues in an analyzed period.
- **Expected Energy Not Served (EENS)** in a given geographical zone for a given period, is the expected value of energy not to be supplied due to lack of market-based resources, while complying with transmission grid operational security limits. This indicator describes the magnitude of adequacy issue expressed in energy for an analyzed season.

- **Relative EENS** is more suitable indicator to compare adequacy across geographical scope as it represents the percentage of annual demand which is expected to be not 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 of renewables is high. This indicator illustrates the capability of the system in terms of downward regulation and the potential need for additional flexibility.
- **Margin,** in a given geographical zone for a given point-in-time, is the difference between the available capacity and the demand. This indicator describes the expected adequacy margin over the studied period.

Result analysis

Result analysis (and presentation) is an integral part of adequacy assessment. This step of adequacy assessment employs indicators as a mean to present adequacy in the assessed geographical perimeter.

Seasonal adequacy assessment shall consist of three main steps: 1) firstly, seasonal spatial screening shall be performed. The purpose of this first step is to give general indication for the coming season among Med-TSO members; 2) secondly, temporal screening shall be performed to analyze when are the adequacy risks the highest; 3) thirdly, and if relevant, circumstances under which risks exist shall be investigated.

Spatial risks screening shall present a generic indicator for the coming season on the large geographical perimeter. This shall raise awareness of adequacy situation in each assessed geographical zone as well as raise awareness of neighboring zones. One of potential indicators can be relative EENS which is the ratio between EENS during the period and zone demand during the same period.

Temporal risks screening can be supported by a chart of LOLE or LOLP on Mediterranean level at weekly basis (Monday to Sunday). This would allow to detect which weeks are mostly at risk.

In addition to these indicators, which may reveal the existence of a risk on the security of supply, the use of other global indicators relating to the available margin may be used (for example the lowest available margin calculated for each week over the season). This type of indicator can be calculated under normal conditions in the statistical sense, but can also be assessed in rare situations, for example 5th percentile of supply margin for each zone in a given week. This would represent margin under severe conditions.

A dedicated analysis on risks in weeks with high risks shall be performed. This analysis shall focus on understanding the risk (magnitude, probability and any other related parameter) and identification of circumstances when risks are relevant. Any tailor-made analysis may be done for this purpose and will depend on case-by-case situation.

For the countries for which it is relevant, the analysis can be carried out firstly with a country-alone approach (not considering possible import), and then secondly taking into account the possibilities of exchanges, in order to measure the benefits provided by the interconnections. Benefits can be both in terms of the security of supply indicators and/or of the economic benefits.

6 Implementation and publication

The adequacy assessment process consists of the following key steps:

a. Data preparation

b. Adequacy modelling

c. Result analysis

d. Report drafting

e. Report validation

f. Result dissemination

General schedule

The results shall be disseminated before the start of the assessed period.

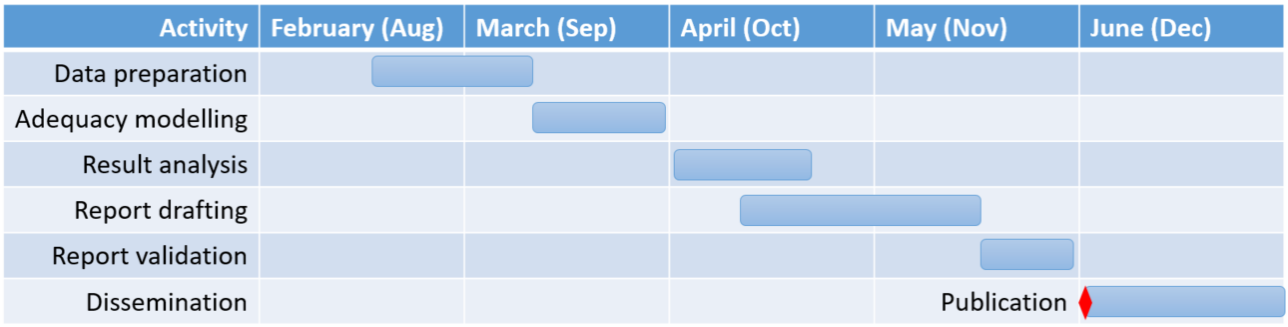

Figure 4: Summer (Winter) Outlook indicative timeline

Data collection organization

Data preparation, performed by individual TSOs, shall ensure that data used in probabilistic modelling is consistent across Med-TSO perimeter. The same interpretation and assumptions shall be used by different parties involved in data preparation. This is ensured by respecting common data collection guidelines and using a previously prepared common template.

Data preparation shall consider the most recent available information, assuming the partial or full lack of information may lead to reducing the accuracy of the results, or even to not including a country within the scope of the study.

Data collection should take into account, where appropriate, confidentiality constraints related to the commercial or sensitive nature of certain data. In this case, the level of aggregation of data will be adapted to ensure sufficient confidentiality from a statistical point of view.

The necessary data for the modeling of neighboring countries will be collected preferentially from these countries. Otherwise, the experts will try to reconstruct a simplified model, for example by exploiting data observed in the recent past.

Report drafting organization

Drafting of the report is the process of compiling a document to present the findings of the adequacy assessment.

The report shall be exhaustive, informative, and strive to be reader-friendly. It can consist of a high-level summary and dedicated technical appendices, thus being able to address different target audiences.

However, some of the collected data may be confidential or sensitive in some countries, for example concerning the maintenance program for thermal power plants or the implementation of electricity

exchange contracts. In such cases, the report should ensure the confidentiality of this information, preferably through statistical aggregations.

Ultimately, the draft report will be submitted for approval to the decision-making bodies of Med-TSO (Executive Board and / or General Assembly), validating both the content of the report and its model of dissemination.

7 Med-TSO Seasonal outlook deployment

The implementation of these studies and their publication by Med-TSO is a very ambitious goal given the challenges they imply, not only in technical terms, but also in accessing data, transparency requirements, and also practical terms related to the availability of the contributing members.

This is why a gradual approach (in terms of perimeter and methodology) will be adopted, with the aim of laying the foundations in terms of organization, while simultaneously seeking practical efficiency.

The first phase of the gradual approach could be implemented by a Pilot (or test) Zone.

In addition to the geographical scope, the gradual approach may concern the level of complexity of data collection and modeling, without excluding initially a deterministic approach applied to a weekly time step and a simplified consideration of the possibilities of imports to satisfy the supply-demand balance.

Finally, the gradual approach should allow for a pragmatic approach to the issue of transparency and the possible confidentiality of certain data, both for carrying out the study and for the mode of dissemination of the report.

In addition, the implementation of the seasonal study is expected to benefit from synergies with other Med-TSO activities, Activity 3.1: *Development of a set of mid- and long-term scenarios and Market models* and Activity 5.2: *Report on the key performance indicators of the regional electricity system*.

Synergies with activity 3.1 essentially involve the use of certain tools and databases:

- TRAPUNTA for the load forecasts (structuring of the activity over an annual cycle, including the population of the climate database).
- ANTARES (UECD software) for the standardization, if possible, of data collection formats, the deployment of tools for helping model implementation, and the automation of the export of study results.
- PECD for the assessment of the variability of wind and photovoltaic production.

Then, the gradual deployment of the seasonal outlook will deal with the different modeling possibilities of the bordering countries, examining the possibilities of coordination or even of data sharing.

Finally, the analysis of the results and their restitution will be able to relate to more or less complex indicators, in connection with the depth of study. From this point of view, a peak margin indicator could be a first step consistent with a deterministic approach.

References

[1] "*Short-term and Seasonal Adequacy Assessments Methodology Proposal in accordance with Article 8 of the REGULATION (EU) 2019/941 of 5 June 2019 on risk-preparedness in the electricity sector and repealing Directive 2005/89/EC (version 8 July 2019)*" - https://consultations.entsoe.eu/system-development/risk-preparedness-short-term-and-seasonal-adequacy/

[2] ENTSO-E "*Short-term and Seasonal Adequacy Assessments Methodology – Explanatory note (supplements the Methodology document for information and clarification purposes)*" - https://consultations.entsoe.eu/system-development/risk-preparedness-short-term-and-seasonal-adequacy/

[3] *REGULATION (EU) 2019/941 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 5 June 2019 on risk-preparedness in the electricity sector and repealing Directive 2005/89/EC (Text with EEA relevance)* - https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2019.158.01.0001.01.ENG

Appendix

Feedback from a survey of Med-TSO members regarding their **national practice on seasonal study** and their view about the **benefit expected from performing seasonal outlook in the Med-TSO framework.**

Important: this survey was carried out in November 2018. It constitutes a snapshot at a given moment, without prejudging the subsequent evolutions.

Notice:

System Adequacy is the ability of the power system to meet demand at all times and thus guarantee security of supply. TSOs perform Adequacy Studies for their Systems in different time horizons (seasonal, mid-term, long-term) with the aim to adequately assess possible risks.

The objective of this document is to collect and share information between Med-TSO ESS members about adequacy issues, with the aim to select a set of information that could be collected by ESS WG and to develop the guidelines that should be followed to elaborate the "Periodic Adequacy Report".

For this aim the survey should be completed by all ESS members not only to reflect the existing situation and current practices in each national power system in terms of availability of relevant information, but also to investigate if it will be possible to provide the different types of data and information required for a Study to be performed within Med-TSO Mediterranean Project II.

Date of completion:

TSO	Country	Date
TSOC	**CY**	16/11/2018
SONELGAZ	**DZ**	27/11/2018
REE	**ES**	05/11/2018
RTE	**FR**	08/11/2018
IPTO	**GR**	13/11/2018
HOPS	**HR**	08/11/2018
TERNA	**IT**	19/11/2018
NEPCO	**JO**	
GECOL	**LY**	
ONEE	**MA**	25/11/2018
PETL	**PS**	
REN	**PT**	20/11/2018
ELES	**SL**	
STEG	**TN**	22/11/2018
TEIAS	**TR**	15/11/2018

Question A1:

Do you have any legal obligation to perform seasonal outlooks in your power system? (Yes/No) only national or also in a regional context (Arab Union of Electricity, ENTSO-E, COMELEC or other)? If "Yes" please explain below.		
CY	YES	TSOC has the obligation to perform seasonal outlooks of the Cyprus Power System for the purposes of System Development Committee and System Operating Committee of ENTSO E. The purpose is to use the national seasonal outlook to extract regional analysis.
DZ	YES	In order to prepare the summer and winter transition perspectives (two binding situations), studies are required in the Grid Code, they relate to the adequacy analysis and operational studies of the national production system and of the transport of electricity. These studies will be used to prepare at national level the required electricity generation capacities as well as the necessary transmission equipment and thus identify the implementation priorities among the current equipment program. There is no obligation at the regional level.
ES	YES	Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a Guideline on Electricity Transmission System Operation, article 106 establishes the legal obligation to contribute to ENTSOE Seasonal Outlooks and to perform adequacy analysis twice a year at least. Besides, Spanish legislation (Operating Procedure 2.2) also establishes the legal obligation of REE to perform adequacy studies on a monthly basis, covering for each study the next rolling year, including forecasts for generation and security analyses.
FR	YES	Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a Guideline on Electricity Transmission System Operation, article 106 establishes the legal obligation to contribute to ENTSOE Seasonal Outlooks and to perform adequacy analysis twice a year at least. Besides, French legislation (Contrat de Service Public, application of L.121-46 Energy code) also establishes the obligation of RTE to perform adequacy studies on a seasonal basis, covering for each study the next rolling season, summer and winter, and to contribute to studies performed under ENTSO-E framework.
GR	YES	Only in the context of seasonal outlooks published through the respective ENTSO-E reports. See explanation in question 2.
HR	YES	As a member of ENTSO-E, winter and summer outlook
IT	YES	ENTSO-E's seasonal outlooks are one of the association's legal mandates under Article 8 of EC Regulation no. 714/2009. TSOs shall contribute to these outlooks according to art.106(1) of the Commission Regulation (EU) 2017/1485 (SOGL).
JO		
LY		
MA	YES	Each year ONEE holds its "Conseil d'Administation" chaired by the prime minister. For that purpose and in order to prepare its budget for the following five years, ONEE performs adequacy analysis at national level. There is no obligation at regional level.
PS		
PT	YES	Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a Guideline on Electricity Transmission System Operation, article 106 establishes the legal obligation to contribute to ENTSOE Seasonal Outlooks and to perform adequacy analysis twice a year at least. Concerning Portuguese legislation (Decree-Law 215-B of 2012), contributions from TSO are only required to prepare mid-long term adequacy reports to be published annually by Portuguese General Directorate for Energy and Geology.
SL		
TN	NO	No legal obligation is required.
TR	NO	

Question A2:

If there is no legal obligation, do you anyway perform any seasonal outlook? (Yes/No/Other) Only national or also in a regional context (Arab Union of Electricity, ENTSO-E, COMELEC or other)? Please provide more explaination below.		
CY	-	-
DZ	N/A	There is no obligation at the regional level.
ES	N/A	-
FR	N/A	-
GR	YES	At the moment, IPTO estimates regarding adequacy levels in the context of seasonal outlooks are only published through the respective ENTSO-E reports. However, with the approval of the Risk Preparedness in the Electricity Sector and repealing Directive 2005/89/EC (which is expected soon), national seasonal outlooks will be obligatory. IPTO in cooperation with the Regulator is planning the necessary steps in order to conform with this obligation.
HR	NO	
IT	-	-
JO		
LY		
MA	N/A	-
PS		
PT	N/A	-
SL		
TN	YES	Not applicable in regional context…
TR	NO	-

Question A3:

What is the purpose of your seasonal outlook?	
CY	For ENTSO E records. Since Cyprus is still isolated no interconnection issues arise.
DZ	As explained above, the objective of these analyzes is to assess the adequacy of the electricity generation and transmission system, in order to guarantee the continuity and the safety of its operation and thus to provide the necessary measures.
ES	The purpose of ENTSOE Seasonal Outlook is to analyse potential risks to system adequacy for the whole ENTSO-E area, which covers 36 countries including Turkey. Analyses are performed twice a year to have a good view regarding the summer and winter, the seasons in which weather conditions can be extreme and strain the system. Besides, the local adequacy studies for the next rolling year get the forecast of the use of energy resources and assess the the adequacy margin in the mid-term.
FR	The purpose of RTE seasonal Outlook is to analyse and to make public the potential risk to system adequacy in France considering the whole ENTSO-E area. Studies are performed both for winter and summer, in standart weather condition but also in severe conditions. For the winter season, severe conditions consider a cold wave because its massive effect on the load increase in France. For the summer period, the purpose is to examine adequacy in of-peak situation and during heat waves.
GR	The purpose will be to assess System Adequacy and possible risks in different time horizons and thus determine adequate mitigation measures in order to guarantee security of Supply.
HR	Assessment of power system adequacy (according to ENTSO-E methodology).
IT	To identify possible issues related to the adequacy of the system in the following 6 months. In particular, it is a key driver for the power plants'maintenance plans coordination process and it also allows TSOs to define in advance remedial actions to be activated in case identified risks will materialize.
JO	
LY	
MA	As explained, the purpose is to prepare ONEE budget (fuel, investments, financial statement etc…) to be validated by its "Conseil d'Administation"
PS	
PT	The purpose of ENTSOE Seasonal Outlook is to analyze potential risks to system adequacy for the whole ENTSO-E area, which covers 36 countries including Turkey. Analyses are performed twice a year to have a good view regarding the summer and winter, the seasons in which weather conditions can be extreme and strain the system.
SL	
TN	The purpose of our seasonal outlook is to determine energy requirements and subsequently set the fuel budget. And to set the maintenance schedule of the means of production. Also to predict the constraints that can affect the safety of electrical systems in extreme conditions.
TR	To see adequacy

Question A4:

What benefits do you expect to receive from Med-TSO seasonal outlook?	
CY	Medium term Capacity allocation from interconnected countries so that to perform generation/maintenance planning.
DZ	Med-TSO seasonal outlook will be performed at a more large scale taking into account detailed particularities of neighboring systems. Outcomes would be more accurate and more useful in regional context, showing the seasonal complementarity between the Mediterranean regions.
ES	To study in more detail complementarities with non-ENTSOE power systems in order to reduce potential risks.
FR	In general, benefit expected from a multi-countries adequacy analysis is to ensure methodological coherency and coordonated data collection and process in order to better appreciate the benefit of electricity exchanges to adequacy. The benefit expected from Med-TSO seasonal outlook is to study in more detail possible complementarities with non-ENTSO-E countries.
GR	To be informed on: • Adequacy of neighboring Systems connected to the Greek System and possible risks related to that, with the aim to determine additional measures in order to guarantee security of Supply of both interconnected Systems • Identify existing and future complementarities
HR	Better view of current power system adequacy conditions on southern/east borders of ENTSO-E, and MED-TSO regional impact
IT	To have a more global overview of the possible adequacy issues taking into account also the present interconnection between EU area and south mediterranea area.
JO	
LY	
MA	Med-TSO seasonal outlook will be performed at a more large scale taking into account detailed particularities of neighboring systems. Outcomes would be more accurate.
PS	
PT	To study in more detail the complementarities with non-ENTSOE power systems in order to reduce potential risks. To adequacy of neighboring Systems connected to the Iberian Peninsula and possible risks related to that, with the aim to determine additional measures in order to guarantee security of Supply of both interconnected Systems with more and more meshed grids.
SL	
TN	- to benefit from other TSO's experience in dealing with extreme situations - to show the seasonal complementarity between the Mediterranean regions.
TR	Observing the general state of the system

Question A5:

Which period of the year is analyzed in your seasonal outlook? (Winter, summer, both, other?)				
	WINTER	**SUMMER**	**BOTH**	**OTHER**
CY			Both (winter and summer) are analysed as requested by ENTSOE	
DZ			X	
ES			X	Local studies cover also the whole rolling year for each month
FR			X	
GR			ENTSO-E seasonal outlooks are published twice a year and cover the next semester. National seasonal outlooks will do the same	
HR			X	
IT			Both seasons described in two different reports.	
JO				
LY				
MA			X	
PS				
PT			X ENTSO-E seasonal outlooks are published twice a year and cover the next semester.	
SL				
TN		X Peak load		X Spring off-peak load
TR			X	

Question A6:

Which period of the year do you believe that should be analyzed in Med-TSO seasonal outlook? (Winter, summer, both, other?)				
	WINTER	**SUMMER**	**BOTH**	**OTHER**
CY			Both (winter and summer) should be analysed for the needs of adequacy studies.	
DZ			X	
ES		X – more likely to reach simultaneous peak demand in Mediterranean region		
FR		X		
GR			Summer and possibly winter peaks should be analysed for the Med-TSO area	
HR			X	
IT			The most critical period for adequacy is currently the summer. Anyway, for the future, could be of interest to study the winter period in order to evaluate, especially for the Nord zone, possible contribution of future interconnections to national contingencies.	
JO				
LY				
MA			X	
PS				
PT			X	
SL				
TN	X	X		X Spring off-peak load
TR			X	

Question A7:

7. Which risks do you analyze (or expect to analyze if you do not perform any seasonal outlook)?					
	Peak conditions	**Valley conditions**	**Upward adequacy**	**Downward adequacy (excess of generation)**	**Extreme conditions**
CY	X		X	X	X
DZ	X	X	X	X	X
ES	X	X	X	X	X
FR	X	X	X	X	X
GR	X	X	X	X	X
HR	X	X	X	X	X
IT	X	X	X	X	X
JO					
LY					
MA	X	X	X	X	X
PS					
PT	X	X	X	X	X
SL					
TN	X in summer	X in spring			
TR	X				

Question A8:

Which risks you believe should be analyzed in Med-TSO seasonal outlook?	
CY	Same as ENTSOE analysis.
DZ	- Peak conditions (for upward adequacy); - Valley conditions (for downward adequacy); - Extreme conditions (for both downward adequacy and upward adequacy) - RES integration: Upward adequacy and downward adequacy, mainly with the increasing of RES integration in power system.
ES	The same ones as with ENTSOE analyses.
FR	Heat Wave effect on summer adequacy Specific situation that could affect thermal generation (for example, lack of gaz supply)
GR	• Peak conditions (for upward adequacy) • Valley conditions (for downward adequacy) • Extreme conditions (for both downward adequacy and upward adequacy)
HR	All risks mentioned in 7.
IT	Lack of supply in south mediterranean area should be covered by an increase of exchange with european countries that in same period, due to the extreme climate conditions, could be in a condition of low marginal reserve
JO	
LY	
MA	-
PS	
PT	All the above (in both Summer and Winter periods)
SL	
TN	Upward adequacy and Downward adequacy (excess of generation) are important mainly with the increasing amount of renewables in insulated systems
TR	Peak condition should be analyzed in Med-TSO seasonal outlook.

Question A9:

Which period of the year do you understand as summer? And as winter?		
	WINTER	**SUMMER**
CY		Months between May – end of September (5 months)
DZ	October-March	May-September
ES	December-March	June-September
FR	November to March	June to September
GR	November to April	May to October
HR	December-March	June-September
IT	From week 48 to week 13	From week 22 to week 39
JO		
LY		
MA	March-September	October-February
PS		
PT	December-March (as for ENTSO-E seasonal outlooks)	June-September (as for ENTSO-E seasonal outlooks)
SL		
TN	November to February	July to September
TR	December	July

Question A10:

How many months do you consider for each period? 6 months for summer and 6 months for winter? Other?	
CY	Summer: May – September (5 months) Winter: December – March (4 months)
DZ	6 months for summer and 6 months for winter
ES	4 months are considered both for Summer Outlook and for Winter Outlook.
FR	5 months for winter 4 months for summer
GR	6 months for each period
HR	4 –months (according to ENTSO-E methodology)
IT	5-6 months per seasons.
JO	
LY	
MA	6 months for summer and 6 months for winter
PS	
PT	4 months for winter and 4 months for summer (according to ENTSO-E seasonal outlooks)
SL	
TN	4 months for winter and 3 months for summer
TR	May be 4 months

Question A11:

Which period of the week is considered as weekend in your power system?	
CY	Working days: Monday – Friday Weekend: Saturday and Sunday
DZ	Friday and Saturday.
ES	Saturday and Sunday Public holidays in summer for downward adequacy (i.e. 15th August)
FR	Saturday and Sunday Public holidays in summer for downward adequacy (i.e. 15th August°
GR	Saturday and Sunday
HR	Saturday and Sunday
IT	Saturday and Sunday
JO	
LY	
MA	Saturday and Sunday.
PS	
PT	Saturday and Sunday. Also to account for public holidays depending on the year.
SL	
TN	Saturday and Sunday is considered as weekend
TR	Saturday and Sunday is considered as weekend in our system.

Question B1 (part 1):

GENERATION AND LOAD DATA For the period specified in Section A / Question 10 (in principle 6 months) can you provide the following data for the following technologies: (Yes/No)?				
	Nuclear Power			
	Net generating capacity	**Weekly forced outage rate (Normal and severe conditions)**	**Weekly Maintenance & Overhauls (planned outages)**	**Weekly Non-usable capacity***
CY	NO	NO	NO	NO
DZ	N/A	N/A	N/A	N/A
ES	YES	YES	YES	YES
FR	YES	YES	YES	YES
GR	N/A	N/A	N/A	N/A
HR	NO	NO	NO	NO
IT	YES	YES	YES	YES
JO				
LY				
MA	N/A	N/A	N/A	N/A
PS				
PT	N/A	N/A	N/A	N/A
SL				
TN	N/A	N/A	N/A	N/A
TR	YES	YES	YES	YES
	Fossil Fuels (Lignite, Hard Coal, Gas, Oil, Oil Shale, Fossil Peat)			
	Net generating capacity	**Weekly forced outage rate (Normal and severe conditions)**	**Weekly Maintenance & Overhauls (planned outages)**	**Weekly Non-usable capacity***
CY	YES	YES	YES	YES
DZ	YES	YES	YES	YES
ES	YES	YES	YES	YES
FR	YES	YES	YES	YES
GR	YES	YES	YES	YES
HR	YES	YES	YES	YES
IT	YES	YES	YES	YES
JO				
LY				
MA	YES	YES	YES	YES
PS				
PT	YES	YES	YES	YES
SL				
TN	YES	NO	YES	YES
TR	YES	YES	YES	YES
	Renewable Energy Sources (other than hydro) (onshore /offshore wind, Solar (PV), Biomass, other RES (e.g. tidal, wave, geothermal, RES waste, CSP)			
	Net generating capacity	**Weekly forced outage rate (Normal and severe conditions)**	**Weekly Maintenance & Overhauls (planned outages)**	**Weekly Non-usable capacity***
CY	YES	YES	YES	YES
DZ	YES	YES	YES	YES
ES	YES	Both outages and maintenances are included in the expected non-usable capacity	Both outages and maintenances are included in the expected non-usable capacity	YES
FR	YES	YES	YES	YES
GR	YES	YES	YES	YES
HR	YES	YES	NO	NO
IT	YES	YES	YES	YES
JO				
LY				
MA	YES	YES	YES	YES
PS				
PT	YES	YES	YES	YES
SL				
TN	YES	NO	YES	YES
TR	YES	YES	YES	YES

Question B1 (part 2):

	Hydro Run of River and Reservoir			
	Net generating capacity	**Weekly forced outage rate (Normal and severe conditions)**	**Weekly Maintenance & Overhauls (planned outages)**	**Weekly Non-usable capacity***
CY	NO	NO	NO	NO
DZ	N/A	N/A	N/A	N/A
ES	YES	YES	YES	YES
FR	YES	YES	YES	YES
GR	YES	YES	YES	YES
HR	YES	YES	YES	YES
IT	YES	YES	YES	YES
JO				
LY				
MA	YES	YES	YES	YES
PS				
PT	YES	YES	YES	YES
SL				
TN	NO	NO	NO	NO
TR	YES	YES	YES	YES

	Hydro pumping			
	Net generating capacity	**Weekly forced outage rate (Normal and severe conditions)**	**Weekly Maintenance & Overhauls (planned outages)**	**Weekly Non-usable capacity***
CY	NO	NO	NO	NO
DZ	N/A	N/A	N/A	N/A
ES	YES	YES	YES	YES
FR	YES	YES	YES	YES
GR	YES	YES	YES	YES
HR	YES	YES	YES	YES
IT	YES	YES	YES	YES
JO				
LY				
MA	YES	YES	YES	YES
PS				
PT	YES	YES	YES	YES
SL				
TN	N/A	N/A	N/A	N/A
TR	NO	NO	NO	NO

	Other non-RES (e.g. CHP non-renewable, waste non-renewable)			
	Net generating capacity	**Weekly forced outage rate (Normal and severe conditions)**	**Weekly Maintenance & Overhauls (planned outages)**	**Weekly Non-usable capacity***
CY	YES	YES	YES	YES
DZ	N/A	N/A	N/A	N/A
ES	YES	Both outages and maintenances are included in the expected non-usable capacity	Both outages and maintenances are included in the expected non-usable capacity	YES
FR	YES	YES	YES	YES
GR	YES	YES	YES	YES
HR	YES	YES	YES	YES
IT	YES	YES	YES	YES
JO				
LY				
MA				
PS				
PT	YES	YES	YES	YES
SL				
TN	NO	NO	NO	NO
TR	YES	YES	YES	YES

Question B1 (part 3):

	Weekly peak load or Demand at reference point in time ?	Comments
CY	NO	
DZ	YES	
ES	Demand forecasts can be provided but not linked to technologies.	
FR	YES Peak: Wednesday 7pm for winter and summer, in normal weather conditions and severe conditions. Off-peak: Sunday 5am and 11 am	All the thermal data mentioned are provided by Transparency Platform first, then controlled and updated by RTE for France if relevant.
GR	YES	
HR	YES	(ONLY FOR WIND GENERATION)
IT	YES	
JO		
LY		
MA	YES	
PS		
PT	YES (as for ENTSO-E seasonal outolooks) Peak: Wednesday 7pm for winter and summer, in normal weather conditions and severe conditions. Off-peak: Sunday 5am and 11 am	
SL		
TN	YES (to be confirmed)	
TR	YES	

Question B1 (part 4):

GENERATION AND LOAD DATA For the period specified in Section A / Question 10 (in principle 6 months) can you provide the following data: (Yes/No)?			
		YES	NO
CY	Average daily (24h) temperature (degrees Celsius) – on a weekly basis	X	
	Weekly Load reduction / demand side response available at reference point in time		X
DZ	Average daily (24h) temperature (degrees Celsius) – on a weekly basis		X
	Weekly Load reduction / demand side response available at reference point in time		X
ES	Average daily (24h) temperature (degrees Celsius) – on a weekly basis	X	
	Weekly Load reduction / demand side response available at reference point in time	X	
FR	Average daily (24h) temperature (degrees Celsius) – on a weekly basis	YES Initially coming from PECD, adjusted by RTE	
	Weekly Load reduction / demand side response available at reference point in time	YES	
GR	Average daily (24h) temperature (degrees Celsius) – on a weekly basis	YES	
	Weekly Load reduction / demand side response available at reference point in time	YES	
HR	Average daily (24h) temperature (degrees Celsius) – on a weekly basis	YES	
	Weekly Load reduction / demand side response available at reference point in time	YES	
IT	Average daily (24h) temperature (degrees Celsius) – on a weekly basis	YES	
	Weekly Load reduction / demand side response available at reference point in time	YES	
JO	Average daily (24h) temperature (degrees Celsius) – on a weekly basis		
	Weekly Load reduction / demand side response available at reference point in time		
LY	Average daily (24h) temperature (degrees Celsius) – on a weekly basis		
	Weekly Load reduction / demand side response available at reference point in time		
MA	Average daily (24h) temperature (degrees Celsius) – on a weekly basis		X
	Weekly Load reduction / demand side response available at reference point in time		X
PS	Average daily (24h) temperature (degrees Celsius) – on a weekly basis		
	Weekly Load reduction / demand side response available at reference point in time		
PT	Average daily (24h) temperature (degrees Celsius) – on a weekly basis	YES (according to ENTSO-E's PECD)	
	Weekly Load reduction / demand side response available at reference point in time	YES (although currently not available in Portugal as market measure)	
SL	Average daily (24h) temperature (degrees Celsius) – on a weekly basis		
	Weekly Load reduction / demand side response available at reference point in time		
TN	Average daily (24h) temperature (degrees Celsius) – on a weekly basis	X	
	Weekly Load reduction / demand side response available at reference point in time		X
TR	Average daily (24h) temperature (degrees Celsius) – on a weekly basis		X
	Weekly Load reduction / demand side response available at reference point in time	X	

Question B2:

INFORMATIONS FOR INTERCONNECTIONS **For the period specified in Section A / Question 10 (in principle 6 months) can you provide a weekly Simultaneous importable and exportable capacity at synchronous peak and daytime minimum demand (Yes/No)?** **If "No" please explain below.**		
CY	NO	Cyprus is currently an isolated Power System with no electrical Interconnections with other Systems.
DZ	NO	Until now, in the absence of a regional electricity market, exchange capacity with neighbouring countries is fixed only in short time (real time), intraday or the day before through involuntary exchanges (mutual help) or a prior programming.
ES	YES	
FR	YES	Comment: RTE provides exchange capacities for each boundary
GR	YES	
HR	YES	
IT	YES	
JO		
LY		
MA	YES	
PS		
PT	YES	
SL		
TN	NO	Until now, the importable and exportable capacity at synchronous peak and daytime minimum demand is fixed only in short time (real time): in intraday or in the day of exchange.
TR	YES	

Question B3:

FOR OFF PEAK DATES RELATED TO SUNDAY OF EACH WEEK DOWNWARD REGULATION CAPABILITIES **For the period specified in Section A / Question 10 (in principle 6 months) can you provide the following data: (Yes/No)?**					
	Weekly Minimum Demand (overnight valley minimum)	**Weekly Must Run Generation** (excluding wind/run of river) and **Run of river generation** (Must Run)	**Weekly Downward balancing reserves** (FCR, FRR)	**Weekly Pumping Storage Capacity available** (Power)	**Weekly Highest expected onshore and offshore wind generation running**
CY	YES	YES	YES	NO	YES
DZ	YES	YES	YES	N/A	N/A
ES	YES	YES	YES	YES	YES
FR	YES	YES	YES	YES	NO RTE provide a load factor for RES generation in normal conditions, and one specific load factor for wind generation in case of cold wave in winter
GR	YES	YES	YES	YES	YES
HR	YES	YES	YES	YES	YES
IT	YES	YES	YES	YES	YES
JO					
LY					
MA	YES	YES			
PS					
PT	YES	YES	YES	YES	YES
SL					
TN	YES	YES	NO	N/A	YES
TR	YES	YES	NO	NO	YES

End of the document

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