TeasiMed

TOWARDS AN EFFICIENT, ADEQUATE, SUSTAINABLE AND INTERCONNECTED MEDITERRANEAN POWER SYSTEM

Enhance coordination in the operation of the Electric Systems

March 2023

Med-TSO
MEDITERRANEAN TRANSMISSION SYSTEM OPERATORS

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TASK 4 *Optimized planning capacities and operation procedures*

Activity 4.1 *Enhance coordination in the operation of the Electric Systems*

Deliverables

4.1. A – Improvement of the coordination in Electric Systems operation

4.1. B – Guidelines for operational planning activity

4.1. C – DBMED Operation section – User guide (CESI)

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Acronyms

AC	Administrative Controller
CED	Data Center
DB	Database
DBMED	Med-TSO database object of current document
DBMS	Database management system
HW	Hardware
RDBMS	Relational Database Management System
SQL	Structured Query Language
SW	Software
TSO	Transmission System Operator

1 Executive Summary

The coordination in operating the Mediterranean Electric Systems is the key enabling factor for the integration of the Mediterranean Networks. Therefore, bigger efforts must be focused on enhancing coordination between the different neighbouring interconnected TSOs in the region.

The achievement of this objective depends on creating automations and systematic channels for exchanging information between the interconnected neighbouring countries in terms of operational / planning data, communication and information sharing procedures as well as real-time collaboration.

The work developed in this activity concerning the improvement of the coordination in the operation has reached a first conclusion aiming to focus on the following axes:

I. The tool:

Med-TSO wants DBMED (Mediterranean database) to become the backbone of data sharing in the Association. A specific section will be dedicated to data related to cooperation in operation, with the objective of making operational data available, traceable, and accessible by all the members.

II. The content:

data to be shared should cover a wide range in terms of granularity and times step from statistical/historical data to short term predicted behavior of the power system. The database will be accessible for all Med-TSO members and the use of its content will respect the internal regulation of the association related to the confidentiality of data.

- Real time Data to be shared up to date.

In order to provide a transparent/constructive view of what is happening in the power system, certain real time data should be shared on the actual data base in a section dedicated to that.

- Forecast data:

In addition to the data that already exist on the DBMED, some further forecast data need to be shared with different times frame (Week ahead or day ahead) such as the following data reported in the table below:

Week ahead	Day ahead
Hourly load	Hourly renewable production
Hourly generation	Emergency maintenance outages
Hourly spinning reserve	Hourly Net transfer capacities
Must run Unit information	International Interconnector transfer capability and availability

- Periodic reports that will provide a synthesis of the main aggregated data for the Med-TSO region.

III. Further steps: Development of critical activities to improve the management of interconnections such as:

  - Outage planning coordination (facilities that could impact interconnected countries)
  - Short-term Adequacy - up to Week-Ahead Adequacy
  - Coordination with regards to the calculation of the Net Transfer Capacities
  - Establishment of common rules about reporting disturbances
  - Coordination with regards to the management of energy exchanges

2 Introduction

The management and operation of an interconnected power system is a complex activity that requires a lot of collaboration from the neighbouring interconnected countries. Various parameters may interfere with the proper management of the power system and sharing them between the interconnected TSOs can be considered as minimum requisite for a secure and sustainable system management. Here in below, some of those factors are listed:

- The rate of the renewable energy production due to its intermittent nature,
- The level of overall production,
- Consumption
- Net Transfer Capacity on the interconnection lines,
- Unavailability of production and transmission network (forced and planned) that could affect the operation of neighbouring networks.
- The energy reserves (Power Margins)

In order to take advantage and make profitable the interconnection infrastructure, which represent huge investments, it is crucial to improve the coordination in operation. In order to reach this goal, it is important to define the guidelines to be followed and implemented to guarantee a coordinated and transparent operation.

The purpose of the next chapter is to describe more precisely the objectives and the methodology that should be used to determine the guidelines for this activity, aiming to enhance the coordination in operating the Mediterranean interconnected power systems.

The following chapter presents the geographical scope including a complete overview covering all Med-TSO perimeter, split between ENTSO-E member countries, where energy markets are already implemented with high transparency and non ENTSO-E members where such markets are not implemented yet, in the South and East of the Mediterranean Sea.

More globally, the present guidelines are strongly inspired by the methodology implemented by ENTSO-E in particular « ENTSO-E Transparency Platform [1]»

The coming chapters will detail the steps followed in the elaboration of this work, i.e. a survey with well-targeted questions, as well as an analysis of the results obtained from the responses of the members who answered the shared survey.

[1] https://transparency.entsoe.eu/

The document concludes with a global description of the steps to follow in order to enhance coordination in the operation of the electric power system highlighting the essential activities to be developed within this framework and the initiatives to be followed.

3 Improvement of the coordination in Electric Systems operation

3.1 Scope of enhancing coordination in the operation:

The coordination in the operation of the electric power systems is the key enabling factor for the integration of the Mediterranean Networks. Operation is a complex activity, where TSOs are fully engaged and perform their responsibility. Therefore, any coordination activity in this area requires a number of tasks to be enhanced in relation with the current status.

As it is specified in the TEASIMED Grant Contract, the main objective of the Task 4.1 is to enhance coordination in the operation of electric systems through a platform that should evolve to a more sophisticated information on quality/security of operation and linked with data bases to complement the operational planning process.

3.1.1 Geographical perimeter

The figure below shows the perimeter of Med-TSO members

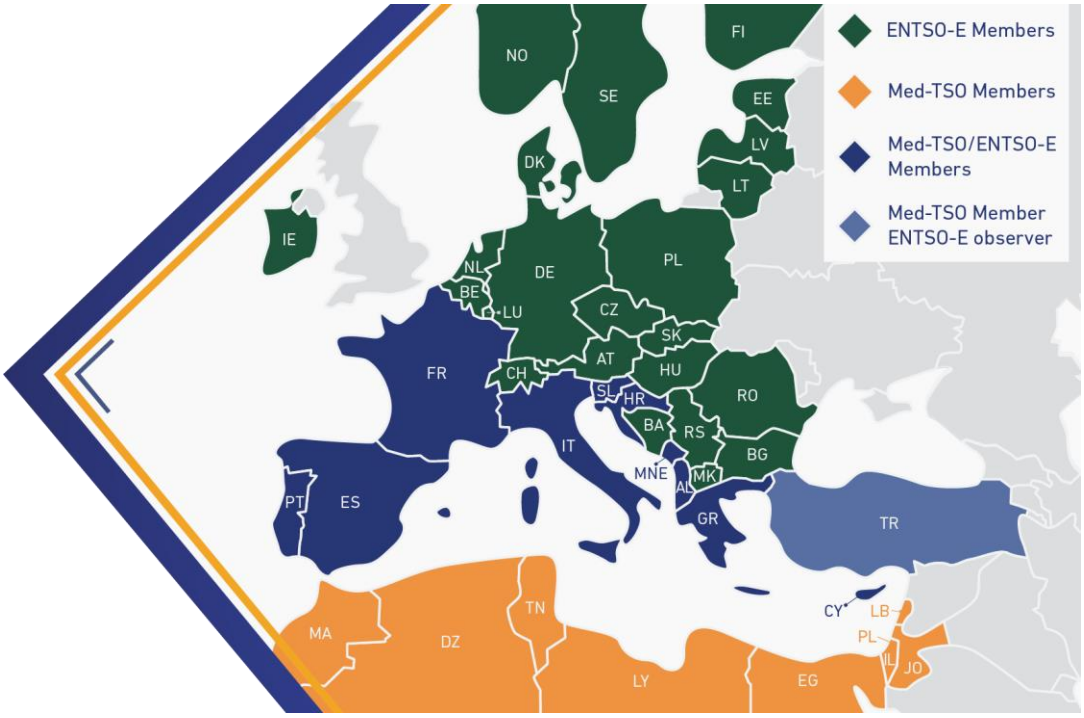


Figure 3-1 Med-TSO Perimeter

3.1.2 Methodology and survey description:

The work carried out to set guidelines for improving coordination in operations, resulted in a survey with well-targeted questions (included in the appendix 7.1) that focused on coordination in operation, to collect the current situation, the needs and expectations in terms of measures to improve the coordinated operation. The survey was divided into two parts as follows:

- Enhancing coordination in operation
- Sharing data

The diagrams below describe the structure of the survey:

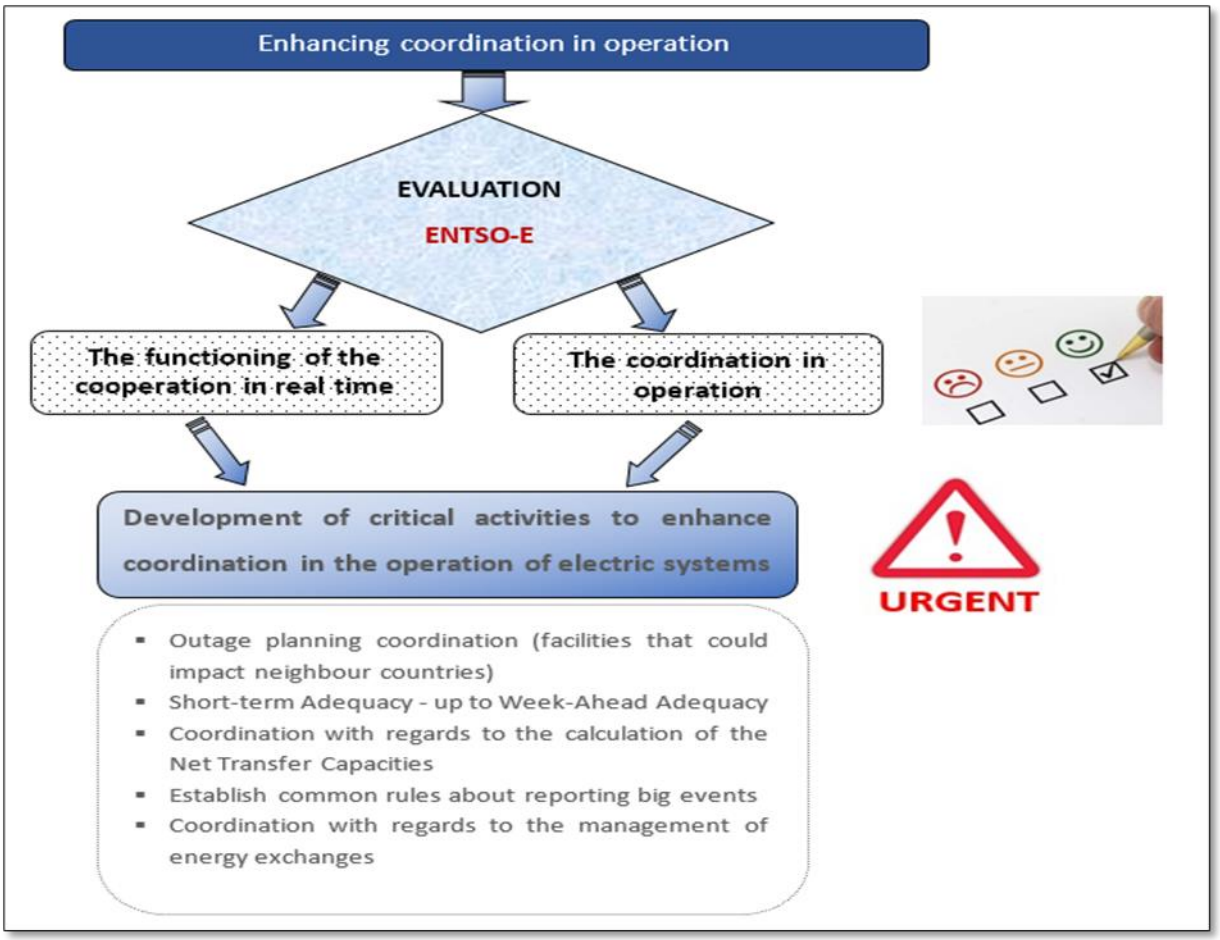


Figure 3-2 The structure of the survey first part

In this first part of the survey, the questions were aimed at evaluating the coordination in the operation between the countries already members of Med-TSO and identify:

- the practices that would have allowed for better coordination for certain interconnected countries compared to others (ENTSO-E member and others)
- critical activities considered urgent to be developed in order to enhance coordination in the operation of electric systems.

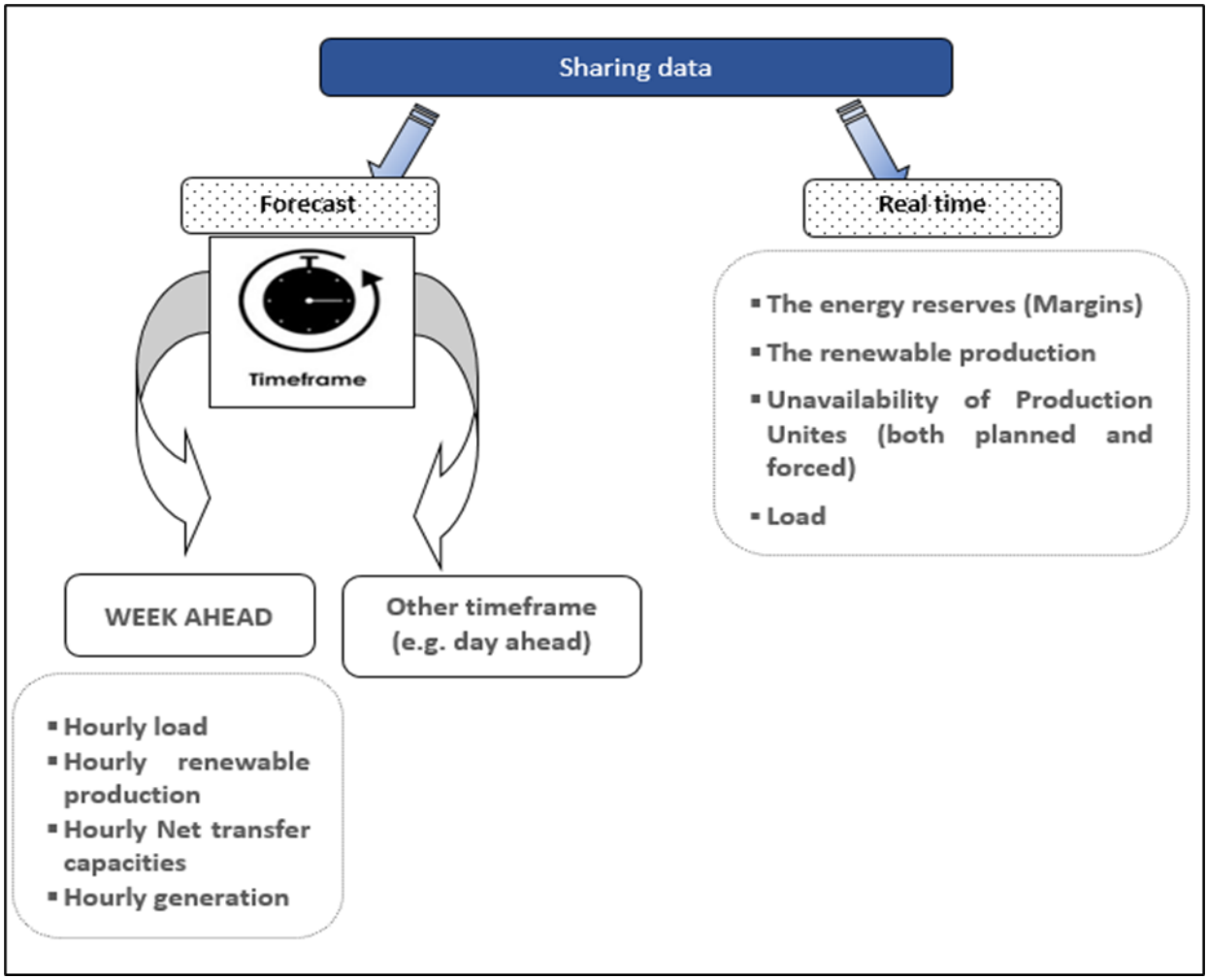


Figure 3-3 diagram describing the second part of the survey

The questions dedicated to the second part of the survey focused on data sharing, i.e., the data to be added to the current database in terms of forecast and real time data as well as the determination of the times frame (week ahead, day ahead).

3.2 Results analysis

3.2.1 Enhancing coordination in operation

- Evaluation of the coordination in operation and the cooperation in real time

The analysis of the results is based on the classification of the answers by the criterion "ENTSO-E" and "Extra ENTSO-E" in order to be able to appreciate the coordination in operation of the countries that are already part of an entity whose exchange and collaboration modalities are consolidated.

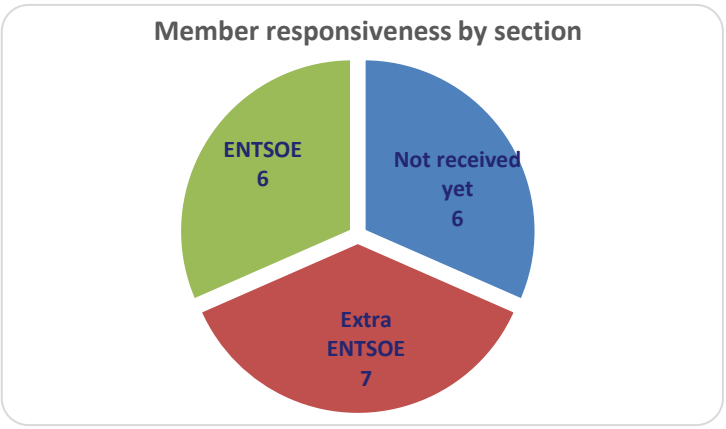


Figure 3-4 Member responsiveness to the survey by section

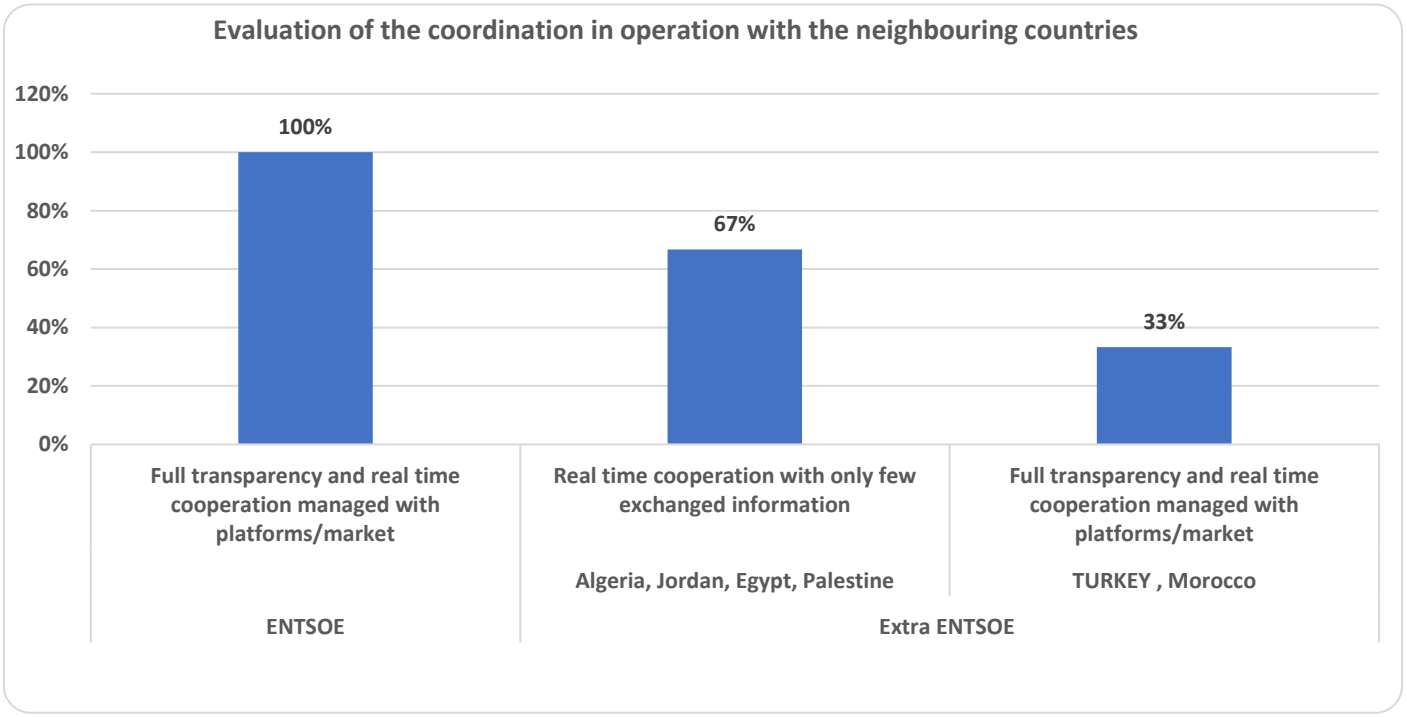
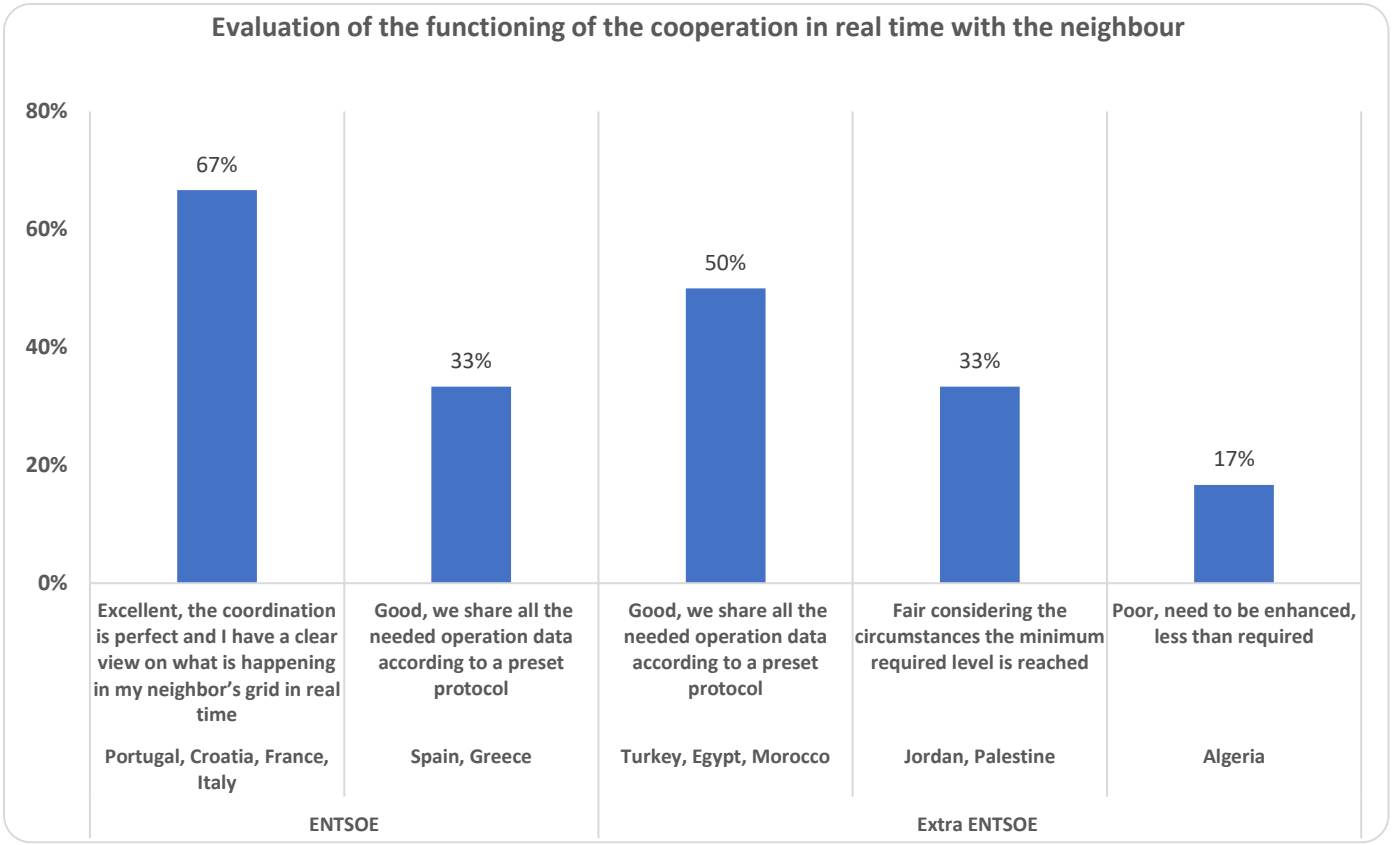


Figure 3-5 Evaluation of the coordination in operation with the neighbouring countries



From the collected answers represented in the graphs above:

- All the ENTSO-E members have answered "Full transparency "(100%);
- Except TEIAS and ONEE all the Extra – ENTSO-E members have responded "Real time cooperation" (67%).

We deduce that the collaboration method adopted by ENTSO-E "full transparency platform" allows to have a good coordination between the interconnected TSO's and improves enormously the real time operation of the interconnected electric system.

We should mention that TSOC is not interconnected to any other TSO but in case of, TSOC will follow EU rules.

- The ranking of the activities considered the most urgent to be developed is given in the chart below

In order to identify and determine the areas that should be developed to best improve coordination in operations, members were asked to rank in order of priority (from 01: low priority to 05: high priority) five key activities in operations, namely:

- Short-term Adequacy - up to Week-Ahead Adequacy.

- Outage planning coordination (facilities that could impact neighbour countries).
- Establish common rules about reporting big events.
- Coordination with regards to the calculation of the Net Transfer Capacities.
- Coordination with regards to the management of energy exchanges and energy exchanges.

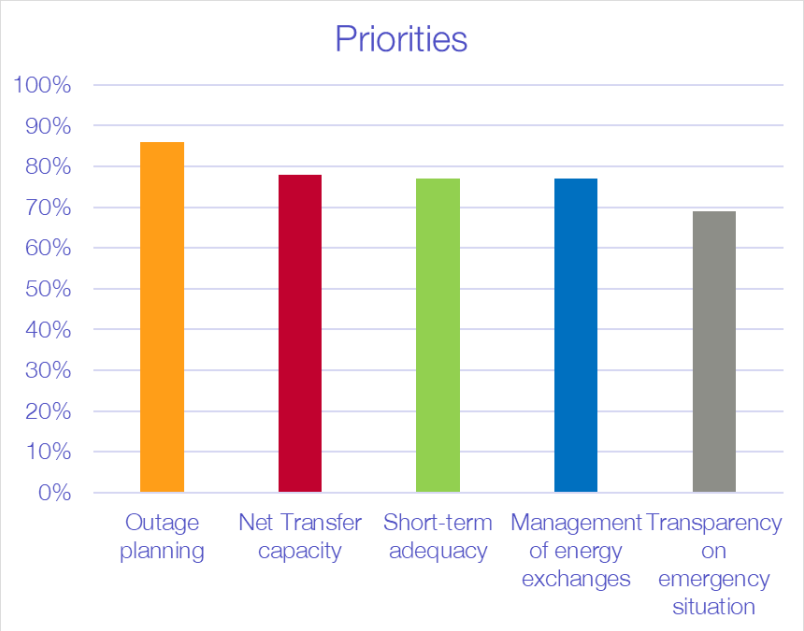


Figure 3-7 Priority activities to be developed to enhance the cooperation with the neighbors

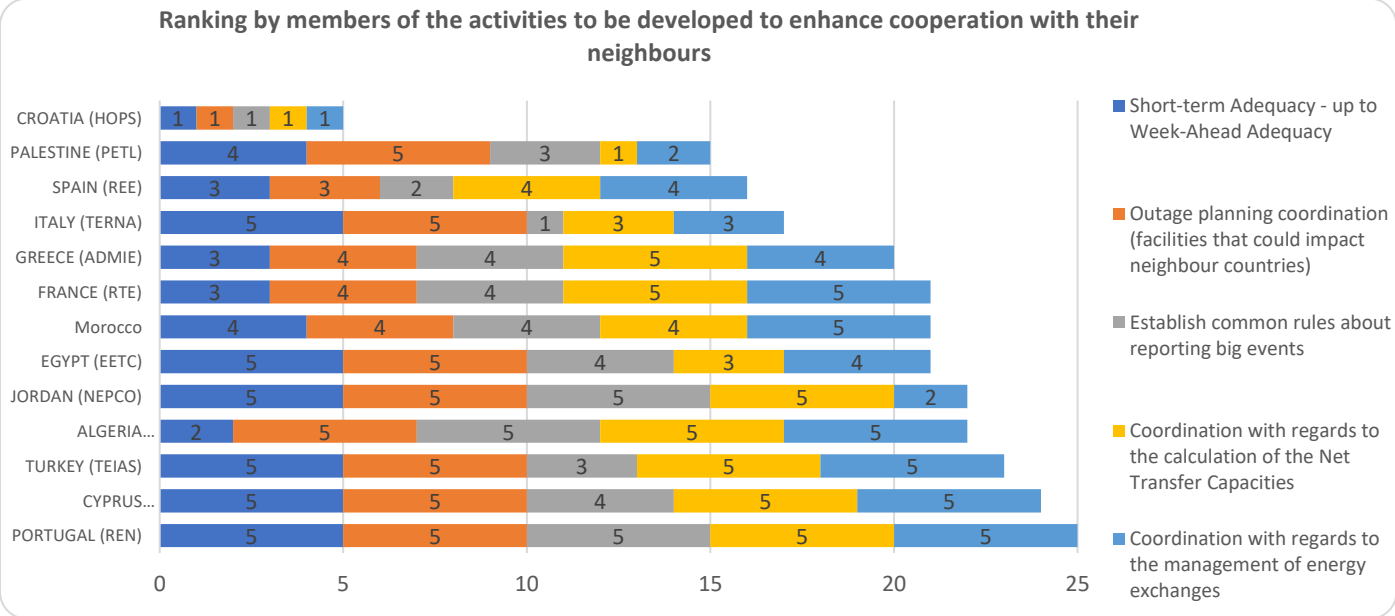


Figure 3-8 Ranking by members of the activities to be developed to enhance cooperation with their neighbours

n= number of TSO's that responded

$$\text{Rate of the activity (\%)} = \frac{\sum Ranking\ by\ members\ of\ the\ activity}{\text{The maximu ranking that could be obtained (n} * 5)}$$

The answers collected by this question inform us about the vision of the members on the most urgent activities to be developed. Indeed, the first graph clearly indicates that for the members who answered, the five activities proposed in the survey are equal in terms of importance, in fact the percentages were quite tight (variation from 69% to 86%). Regarding the second graph, it shows that the countries that have judged that most of the proposed activities were urgent to be developed, are mostly the non-ENTSO-E TSOs, with the exception of REN, whose answer is based on the relevancy of the topics (5 out of 5 for all topics), independently of all the topics already being developed in the framework of European rules and ENTSO-E.

3.2.2 Sharing Data:

The second part of the survey consists in identifying the expansion horizons of the existing database and in the perspective of creating a "transparency" section.
In this perspective, member countries have been asked to prioritize the data (forecast and real time) proposed to expand the actual data base.

- **Forecast data:**

The sharing of the forecast data for the proper functioning of the power system is one of the keys of success of the coordination in operation between the interconnected TSO's.
In this framework, members were asked to:

1. prioritize the following data to be shared week ahead:
    - Hourly load
    - Hourly renewable production (solar, wind, others)
    - Hourly Net Transfer Capacities
    - Hourly generation
2. Propose any other forecasts data that can be important to be shared week-ahead.
3. Forecast data to be shared with a different time frame (e.g., day ahead).

The answers collected from the questions mentioned above are summarized in the following charts and tables:

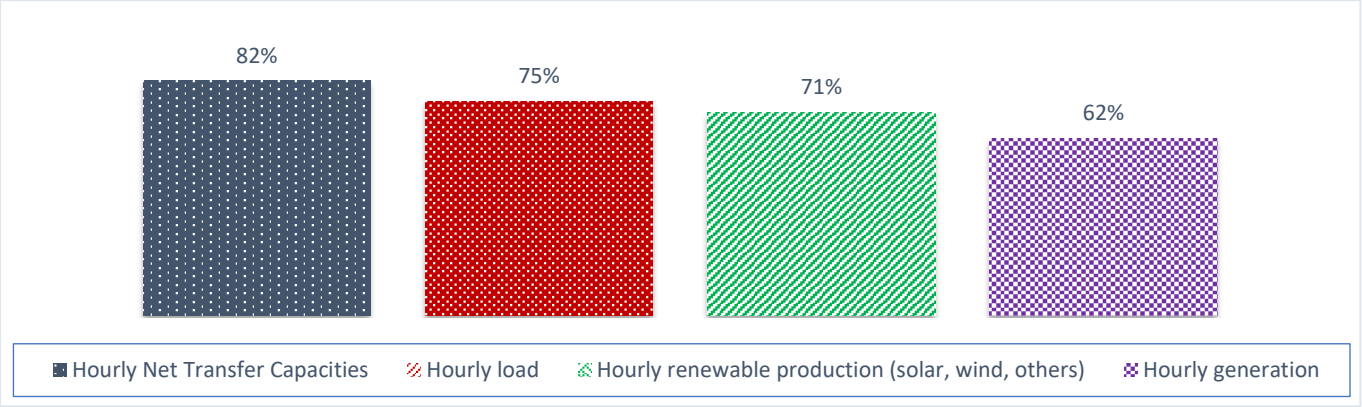


Figure 3-9 Rate of the priority that should be given by data (Forecast) to be shared week ahead

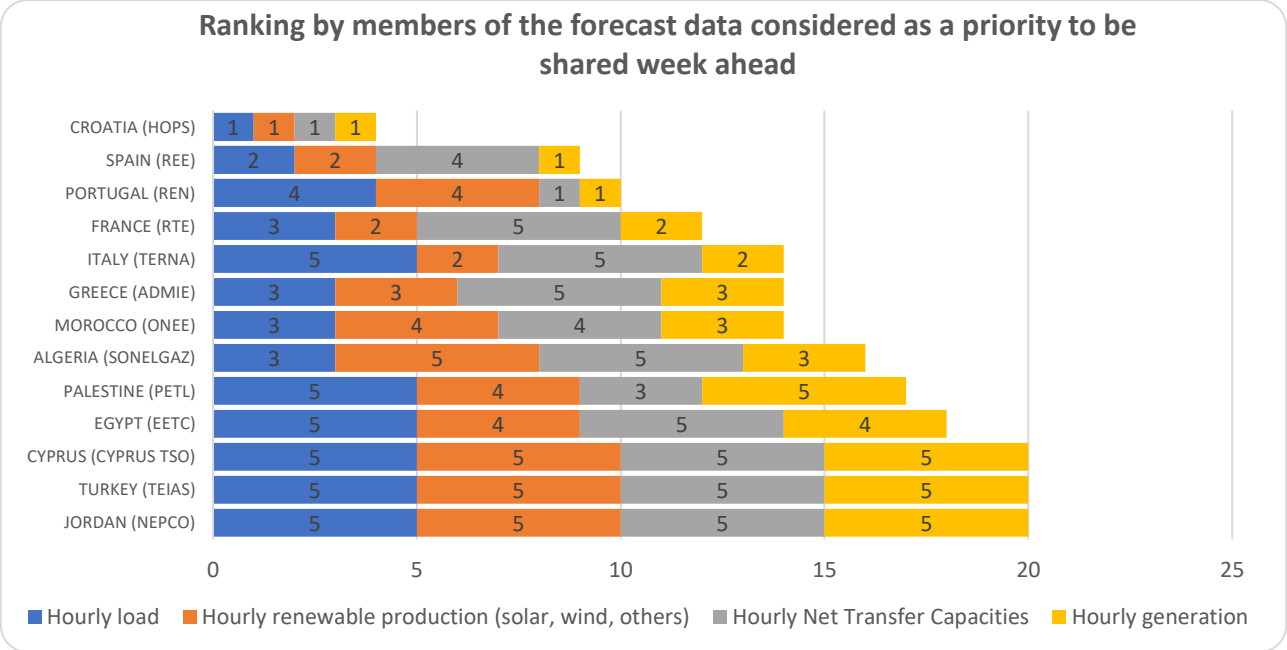


Figure 3-10 Ranking by members of the forecast data considered as a priority to be shared week ahead

$$\text{Rate of the activity (\%)} = \frac{\sum Ranking\ by\ members\ of\ the\ activity}{\text{The maximu ranking that could be obtained (n} * 5)}$$

n= number of TSO that responded

The main proposals collected for the other forecast data considered important to be shared week ahead in addition in addition to what has been proposed:

Table 3-1 the main proposals collected for forecast data to be shared week ahead

➢ Renewable production connected to the distribution grid;
➢ Hourly spinning reserve;
➢ International Interconnector transfer capability and availability;
➢ Must run Unit information;
➢ Real time outages in the grid that impact the net transfer and the interconnection.

Member's suggestions for other forecasts data to be shared with another timeframe (e.g., day-ahead) are giving in the table below:

Table 3-2 the main proposals collected for forecast data to be shared with another timeframe.

Forecast to be shared day ahead	Why?
Any outage with influence in the load flows of other system	In a market environment, the certainties of the referred variables increase substantially
RES production forecast in day-ahead and intraday timeframes	high intermittency of RES production
hourly renewable production	/
Generation, Load	Day-ahead is more important than week-ahead More accurate for all those variables
Important outages	/
Emergency maintenance outages	to take into consideration in operation plan
Hourly Net Transfer Capacities	/
International Interconnector transfer capability and availability	/
Must run Unit information	/

From the results previously synthesized, we can conclude that for the forecast data to be shared week ahead the priority is given in the first instance to:

- Hourly Net Transfer Capacities (NTC)

- Hourly load
- Hourly renewable production (solar, wind, others)

Then in a second step, it will be envisaged to share the forecast data concerning the hourly generation.

Nevertheless, proposals for other forecast data to be shared week ahead have been collected and the possibility of including them in the database as well as the modalities to do it, will be studied as well as for the suggestions made for the forecast data to be shared with a different time frame.

➢ **Real time data:**

In order to consider the possibility of sharing data up to date (close to real time), the members have been surveyed if they agree to share actual information about:

- Unavailability of Production Units (both planned and forced)
- Load
- Renewable Production
- Energy Reserves
- Other

The answers collected are represented in the chart below.

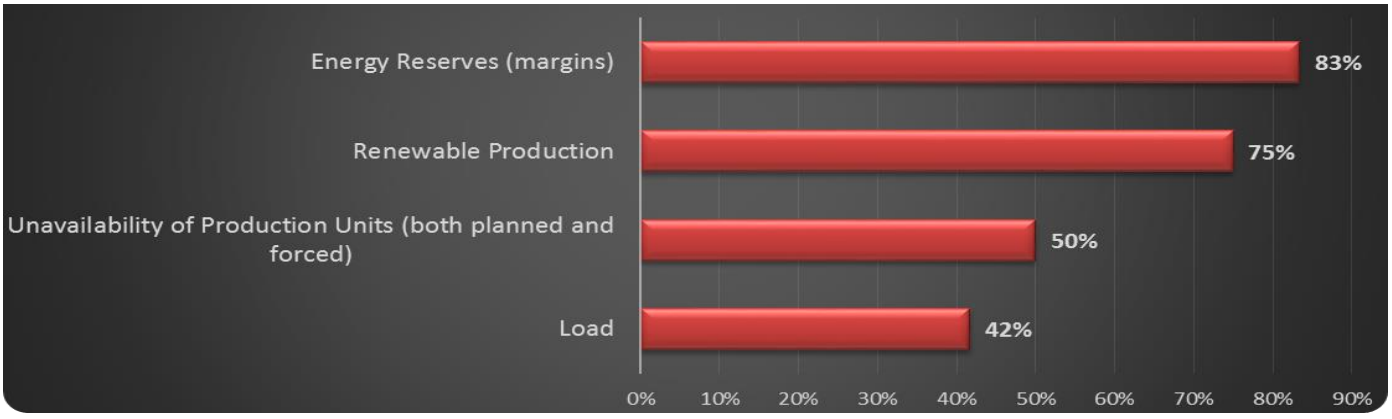


Figure 3-11 Evolution rate of the members for the data to be shared up to date (close to real time)

Table 3-3 the main answers collected in the comment's section.

PROPOSAL	COUNTRY
We do not see the necessity	REE
Data are Already available in Transparency Platform of ENTSO-E	IPTO
Transmission facilities unavailability	RTE
In the case of "load" and "renewable production", the answer is yes, but only in the "observability area"[2]	REN

From the responses received, we can conclude that members are more open to share real-time data about **Renewable Production (83%)** and **Renewable Production (75%)** but opinions remain mixed for Unavailability of Production **Units both planned and forced (50%)** and **load at (42%).**

Considering the comments made in the **"other"** section we can see that the position of TSO's is different even for ENTSO-E members.

3.3 Conclusion

The work developed in this activity in the framework of improving coordination in operations leads to the conclusion that the main guidelines to be plotted and followed are:

- **Development of the actual** DBMED (Mediterranean database) with a view of adding a section dedicated to the sharing of data related to cooperation in operation.
- Identify the **data useful for the effective improvement** of the coordination in the operation that should cover a wide range in terms of granularity and times step from statistical/historical data to short term;

According to the survey shared among the Med TSO members the data, we retain the following data:

[2] "Observability area" as defined in ENTSO-E's Operation Handbook Policy 3: "own grid + interconnectors + relevant neighboring grid, taking into account effect of loss of related grid elements". https://eepublicdownloads.entsoe.eu/clean-documents/pre2015/publications/entsoe/Operation_Handbook/Policy_3_Appendix_final.pdf

- **Forecast data**

Week ahead	Day ahead
Hourly load	Hourly renewable production
Hourly generation	Emergency maintenance outages
Hourly spinning reserve	Hourly Net transfer capacities
Must run Unit information	International Interconnector transfer capability and availability

- **Real time data**
  - Energy reserves (margins)
  - Renewable Production
- **Periodic reports**

☞ **Development of critical activities** to improve the management of interconnections**.**

The reflection to adopt is even if there is not Market for the moment regarding to all the Med TSO members, it is possible to start sharing data and having cooperation inspired by what happened in Europe.

4 Guidelines for operational planning activity

To enhance coordination in the operation of the Electric Systems, based on the outcome of the survey, the members were raising the needs to collect the following data:

1. Operational forecasts related to demand, thermal availability, renewable projections, reserve and NTC:

This set of data will help the operational planning departments of our TSOs to assess the adequacy of their system interconnected to their neighbours for the next weeks/months

2. Statistical results of operating the system for the last few days/weeks mainly for what concerns demand and Renewable generation:

   This set of data will help our TSO to have a visibility on what is happening with their neighbours and find a suitable explanations to phenomenon impacting their grids (peak, off-peak, increase/decrease of RES generation, particular patterns among the days of the week...)

In order to systematically exchange this important data, TF dealing with the activity 4.1 has prepared two separate templates to be emended into Med-TSO data sharing platform called DBMED.

In the following paragraphs, those templates will be presented.

4.1 Transparency Forecast (Template description TS)

The template offers to each TSO the possibility to provide the following information:

- The load forecast including the values corresponding to P05 and P95 percentile (Demand sheet).
- The availability of thermal power generation modules per production (Thermal Generation sheet)
- Must-Run for thermal power generation modules per production type (Thermal Generation sheet)
- P05 and P95 on wind and PV solar generation (Renewable Generation sheet)
- The available NTC with the neighbouring TSOs (NTC sheet)
- The tertiary reserve (Reserve Tertiary)

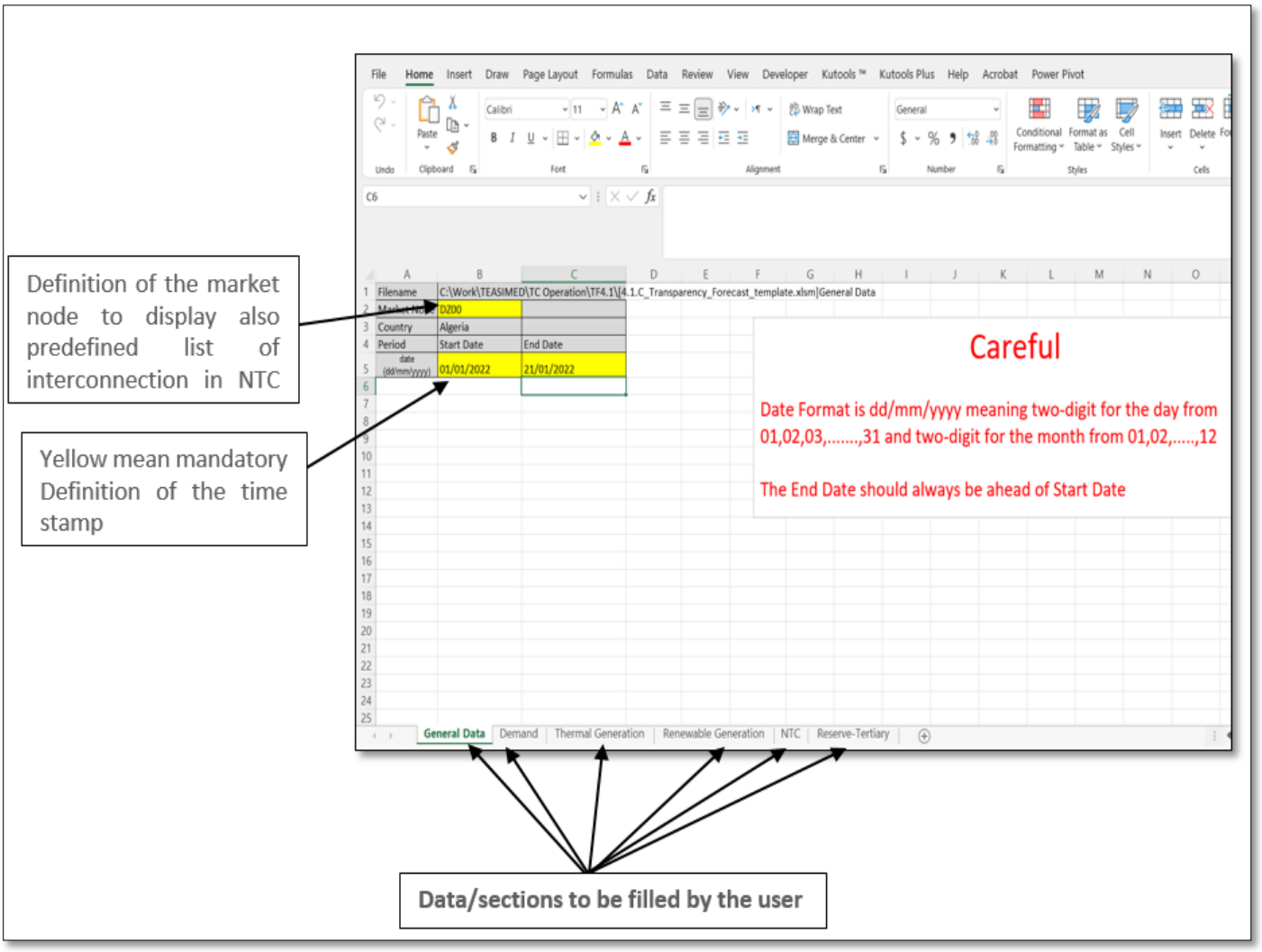


Figure 4-1 Overview of the Transparency forecast template

The template proposes to the user the possibility to provide in addition to the median value of the forecast (P50) extreme values P05 & P95 as an alignment with the xml used in regional coordination centres in Europe, the definition of these values is described in the figure below

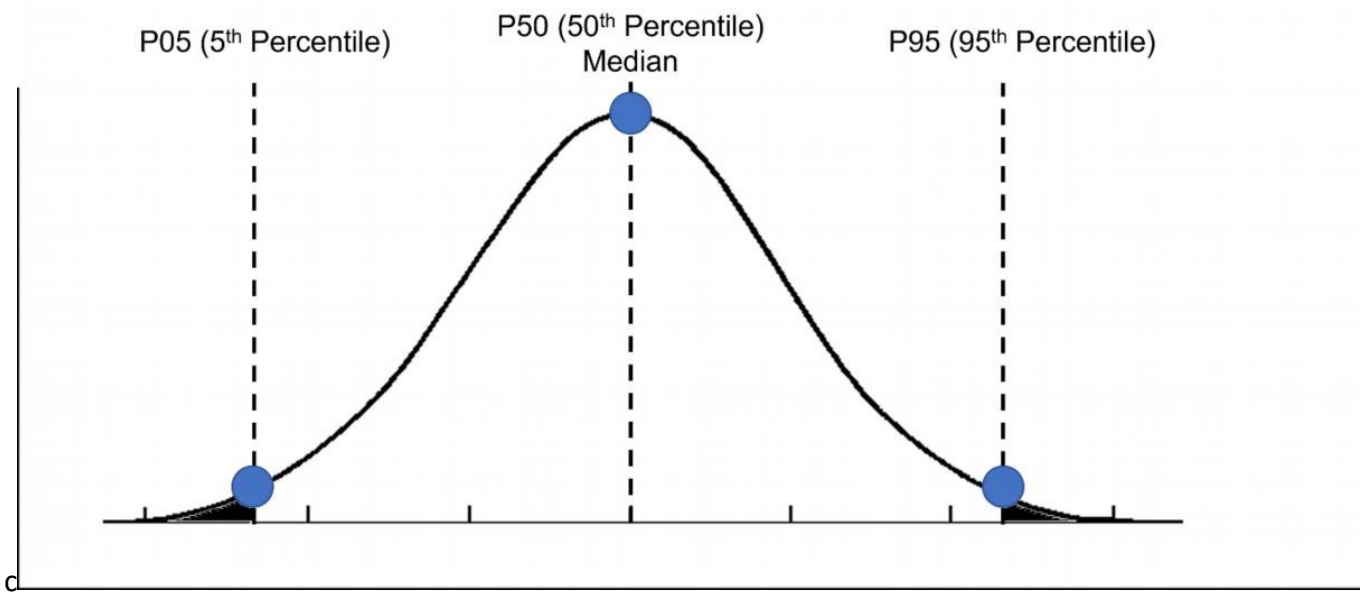


Figure 4-2 shows the percentile definition

4.2 Demand

For what concerns the demand, the template offers the possibility to provide the hourly forecast for the next period (weeks/months) by indicating for each hour the forecasted value (P50) together with the lower limit (P05) and the upper limit (P95).

The overview of the sheet dedicated to the demand forecast in the template is given below.

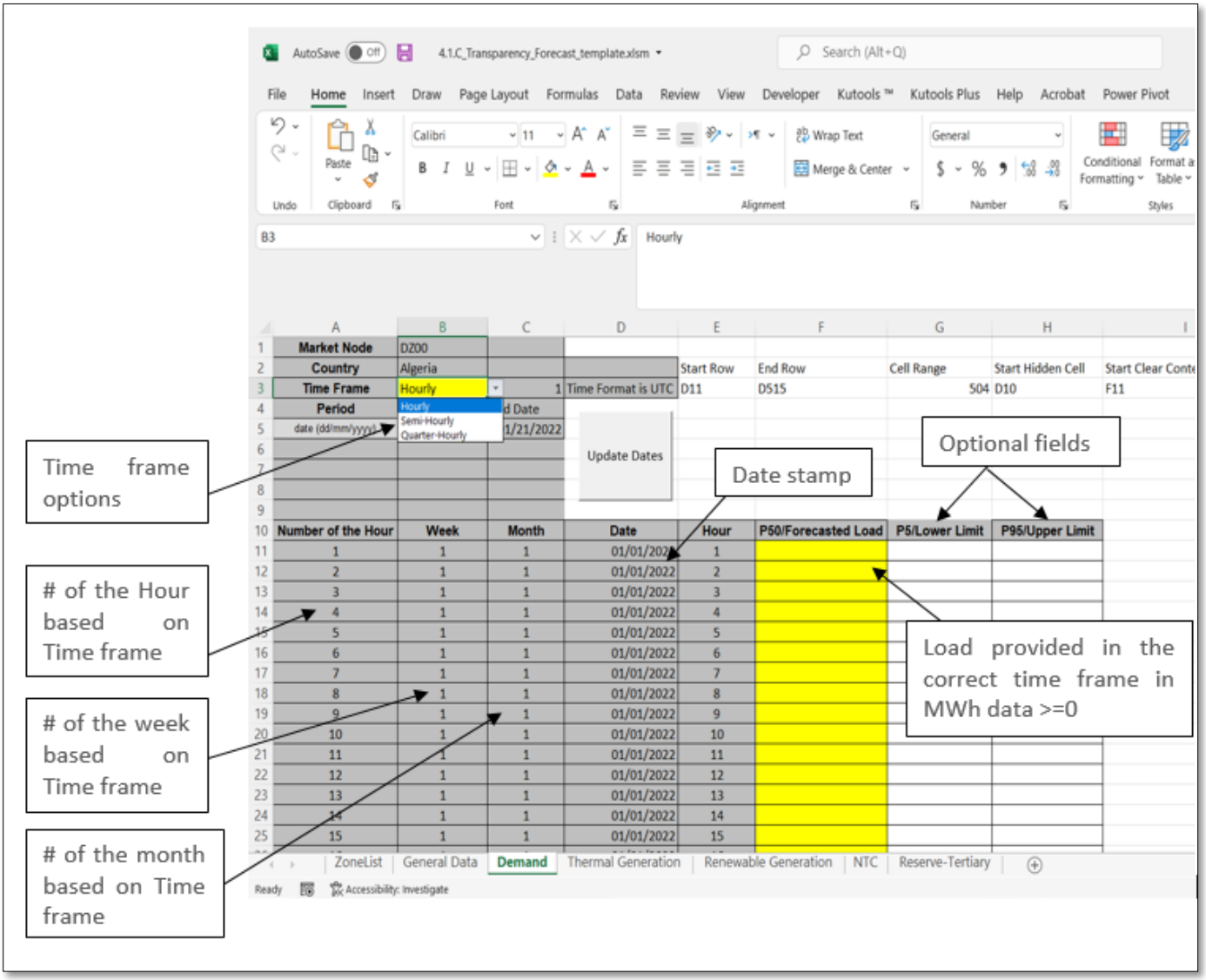


Figure 4-3 Overview of the demand forecast sheet in the template

4.3 Thermal Generation

4.3.1 Thermal Generation categories

For each type of thermal generation defined, TSOs should provide the hourly values of reliable available capacity. For the template of data collection, and knowing that all the Euro-Mediterranean TSOs members of Med-TSO are preparing the data for ENTSO, and in order to maximize harmonisation, it was decided to opt for the same classification as the one used by ENTSO-e. The main difference is that the data related to thermal would be differentiated from the Renewable (different sheets).

Table 4-1 Codification of the different Thermal generation types

Codification	Thermal Generation types
B02	Fossil Brown coal/lignite electrical power
B03	Coal-derived gas electrical power
B04	Gas electrical power
B05	Hard coal electrical power
B06	Oil electrical power
B07	Fossil Oil shale electrical power
B08	Fossil Peat electrical power
B09	Geothermal electrical power
B14	Nuclear electrical power
B20	Others Non-Renewable electrical power

The user may indicate whether any thermal unit has Must-Run values, it is possible to add this constraint for each type of generation defined above.

Hereinafter, an overview of the user interface of the thermal sheet is given.

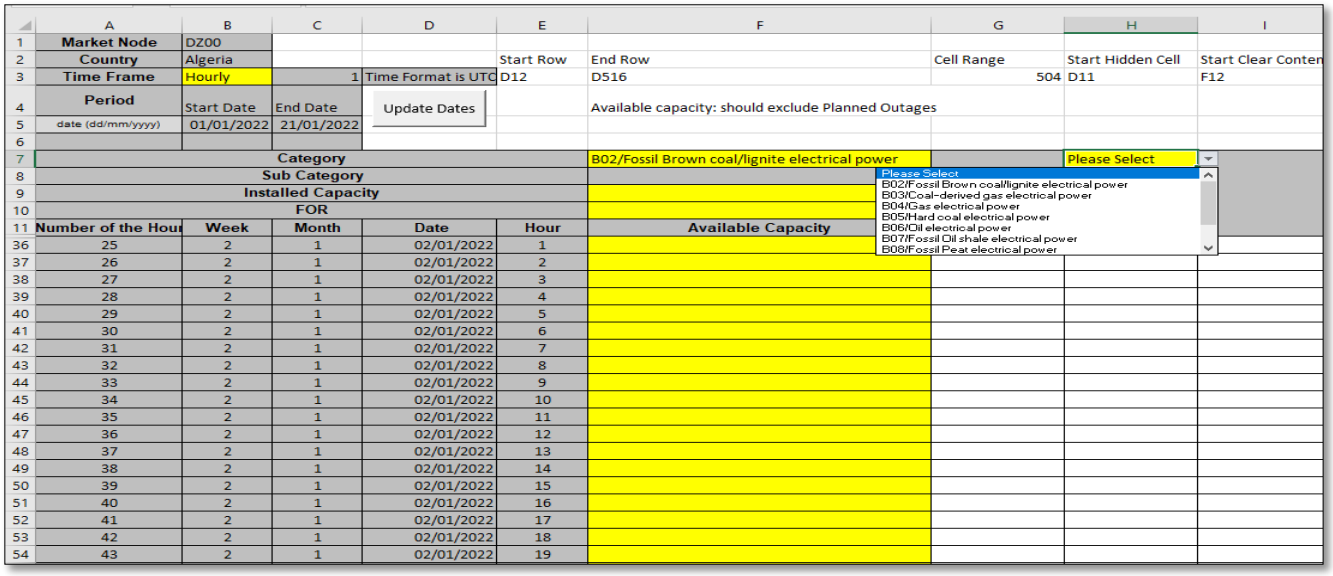


Figure 4-4 Overview of the thermal sheet in the template

In addition, a specification was added to the template offering to the members the possibility to add few sub-categories for the Gas and Oil units as given in the following table:

- **Gas subcategories**

Table 4-2 Different Gas generation subcategories

Gas subcategories
Gas conventional old 1
Gas conventional old 2
Gas CCGT old 1
Gas CCGT old 2
Gas CCGT present 1
Gas CCGT present 2
Gas CCGT new
Gas CCGT CCS
Gas OCGT old
Gas OCGT new
Gas biofuel

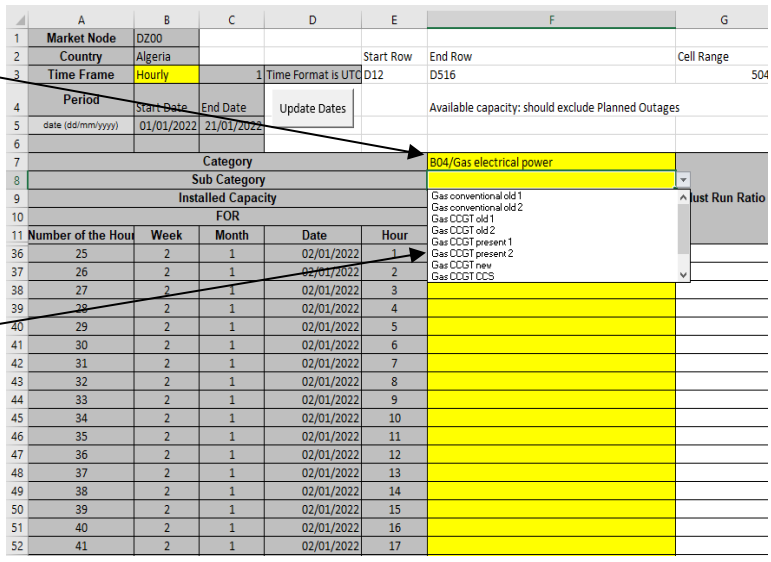


Figure 4-5 Overview of the Gas subcategory selection

- **Oil subcategories**

Table 4-3 Different Oil generation subcategories

Oil subcategories
Light oil -
Heavy oil old 1
Heavy oil old 2
Light oil biofuel
Heavy oil biofuel
Oil shale biofuel

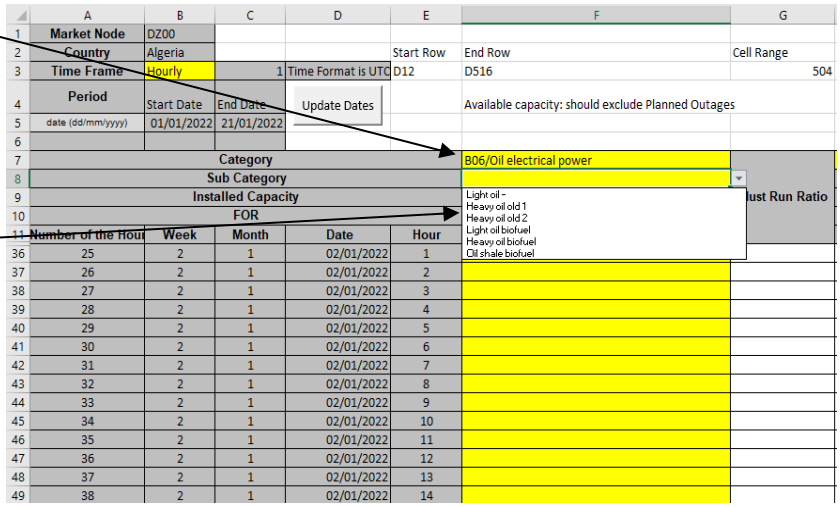


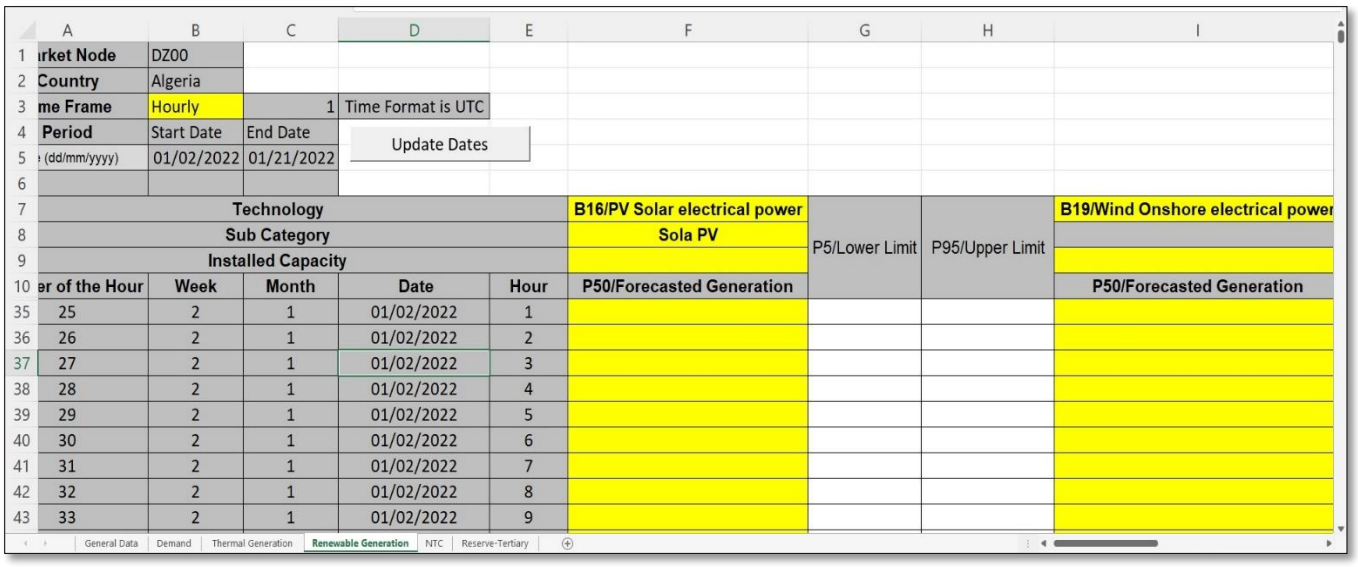
Figure 4-6 Overview of the Oil subcategory selection

A more details about the different of subcategories can be found in Appendix 7.2

4.4 Renewable Generation

In addition to thermal generation, the created template offers the possibility to include any forecast for generation from renewable P50 with a margin of error from P95 to P05 as upper and lower limits for the forecast.

Hereinafter, an overview of the user interface of the Renewable sheet is given.



	A	B	C	D	E	F	G	H	I
1	rket Node	DZ00							
2	Country	Algeria							
3	me Frame	Hourly	1	Time Format is UTC					
4	Period	Start Date	End Date	Update Dates					
5	(dd/mm/yyyy)	01/02/2022	01/21/2022						
6									
7	Technology					B16/PV Solar electrical power	P5/Lower Limit	P95/Upper Limit	B19/Wind Onshore electrical power
8	Sub Category					Sola PV			
9	Installed Capacity								
10	er of the Hour	Week	Month	Date	Hour	P50/Forecasted Generation			P50/Forecasted Generation
35	25	2	1	01/02/2022	1				
36	26	2	1	01/02/2022	2				
37	27	2	1	01/02/2022	3				
38	28	2	1	01/02/2022	4				
39	29	2	1	01/02/2022	5				
40	30	2	1	01/02/2022	6				
41	31	2	1	01/02/2022	7				
42	32	2	1	01/02/2022	8				
43	33	2	1	01/02/2022	9				

General Data | Demand | Thermal Generation | Renewable Generation | NTC | Reserve-Tertiary

Figure 4-7 Overview of the Renewable sheet in the template

The categories of renewable production are defined in the table below:

Table 4-4 Renewable generation types

Codification	Renewable Generation types
B16	PV Solar electrical power
B17	Waste electrical power
B18	Wind Offshore electrical power
B19	Wind Onshore electrical power
B01	Biomass electrical power
B15	Others Renewable electrical power
B10	Hydro pump storage electrical power
B11	Hydro Run-of-river and poundage electrical power
B12	Hydro Water Reservoir electrical power
B13	Marine electrical power

In addition, a specification was added to the template offering to the members the possibility to define sub-categories for solar generation as given in the following table:

Table 4-5 Solar generation Subcategories

Solar subcategories
Solar PV
Solar (Thermal)

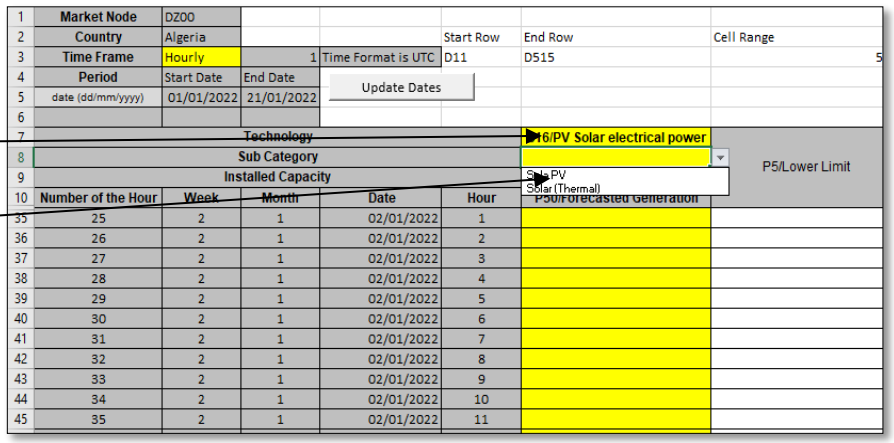


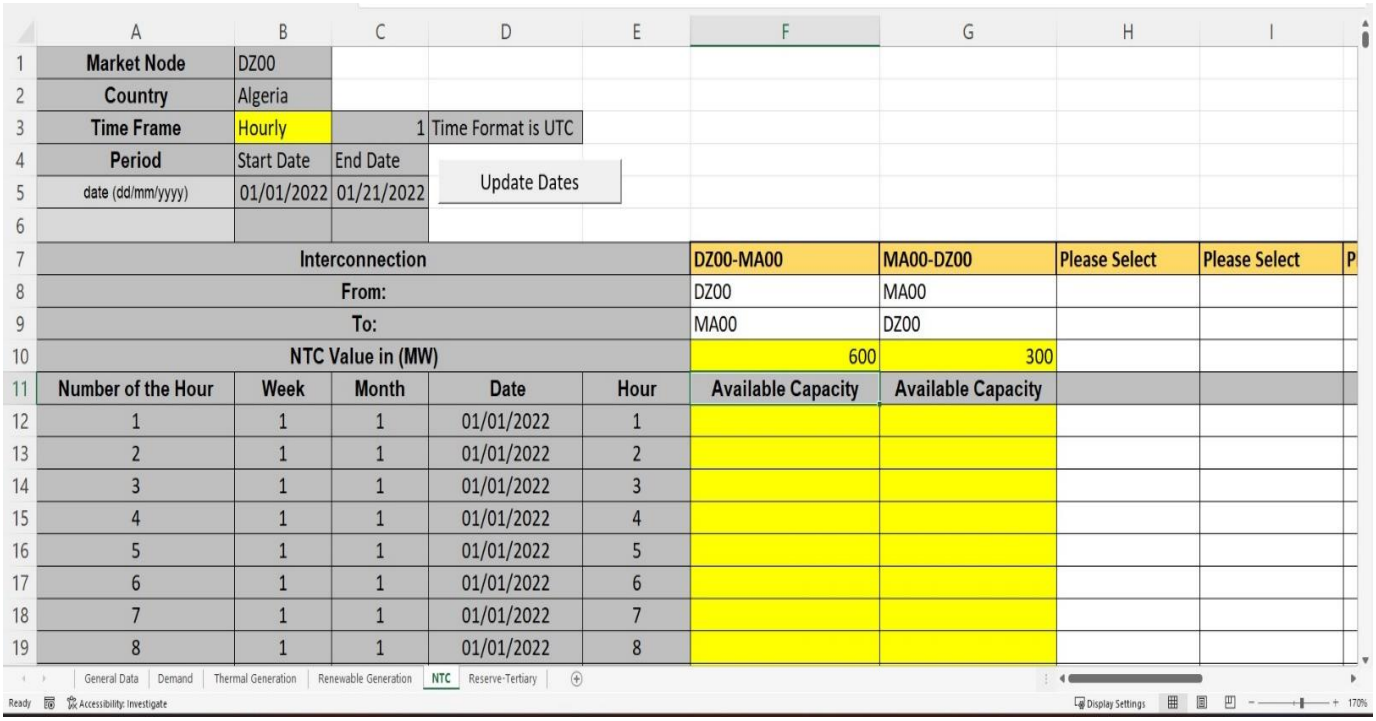
Figure 4-8 Overview of the solar subcategories on the template

4.5 Net Transfer Capacity

For the Net Transfer Capacity (NTC) sheet, the template offers the possibility to provide bilateral exchanges between countries keeping in mind that exchange should be lower than or equal to the given NTC values.

To define NTC the user needs to provide either TS or one single value for the available capacity in both directions of the exchange.

Hereinafter, an overview of the user interface of the NTC sheet is given.



	A	B	C	D	E	F	G	H	I
1	Market Node	DZ00							
2	Country	Algeria							
3	Time Frame	Hourly	1	Time Format is UTC					
4	Period	Start Date	End Date						
5	date (dd/mm/yyyy)	01/01/2022	01/21/2022	Update Dates					
6									
7	Interconnection					DZ00-MA00	MA00-DZ00	Please Select	Please Select
8	From:					DZ00	MA00		
9	To:					MA00	DZ00		
10	NTC Value in (MW)					600	300		
11	Number of the Hour	Week	Month	Date	Hour	Available Capacity	Available Capacity		
12	1	1	1	01/01/2022	1				
13	2	1	1	01/01/2022	2				
14	3	1	1	01/01/2022	3				
15	4	1	1	01/01/2022	4				
16	5	1	1	01/01/2022	5				
17	6	1	1	01/01/2022	6				
18	7	1	1	01/01/2022	7				
19	8	1	1	01/01/2022	8				

General Data | Demand | Thermal Generation | Renewable Generation | NTC | Reserve-Tertiary

Ready | Accessibility: Investigate | Display Settings | 170%

Figure 4-9 Overview of the NTC sheet in the template

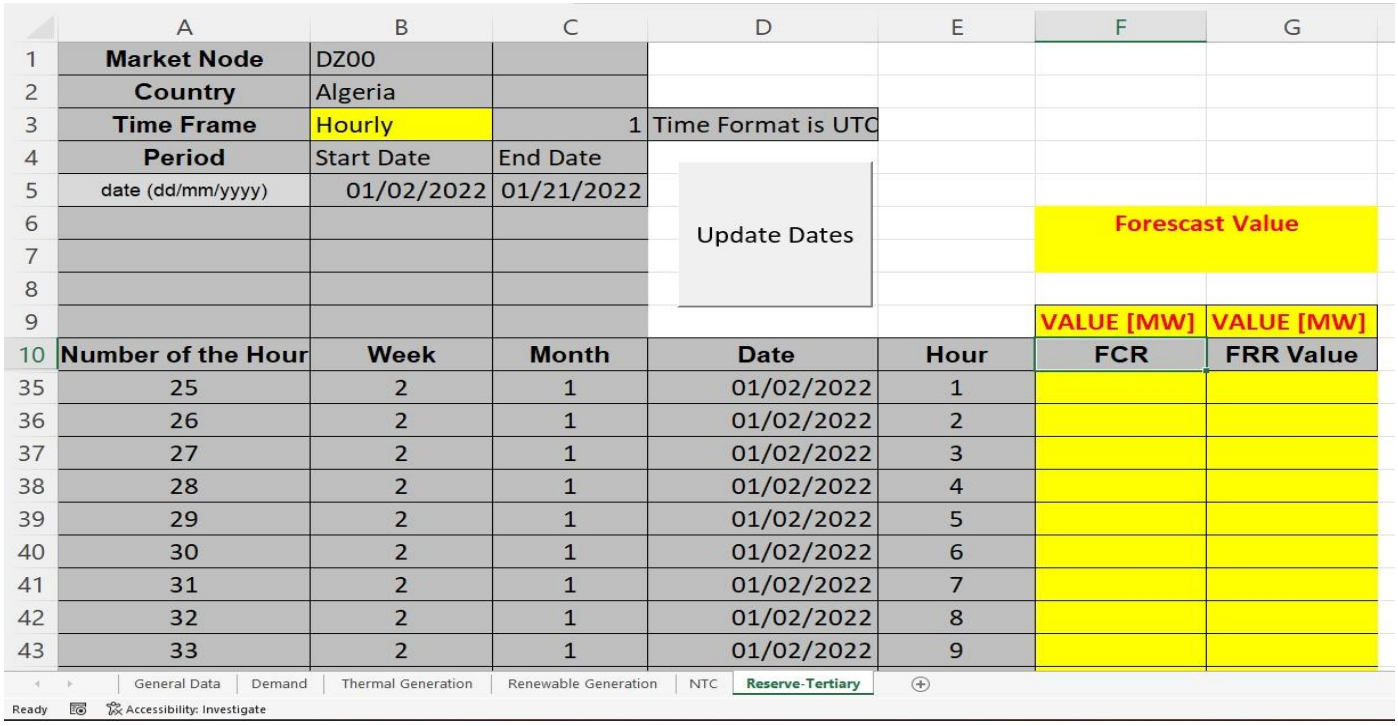
4.6 Reserve-Tertiary

For the Reserve sheet, the TSO should identify in the template two values

1. The Frequency containment reserve (FCR)
2. The Frequency Restoration Reserve (FRR)

FCR means operating reserves necessary for constant containment of frequency deviations (fluctuations) from nominal value in order to constantly maintain the power balance in the whole synchronously interconnected system. FRR means the active power reserves available to restore system frequency to the nominal frequency and, for a synchronous area consisting of more than one Load-Frequency Control area, to restore power balance to the scheduled value.

Hereinafter, an overview of the user interface of the Reserve-Tertiary sheet is given.



	A	B	C	D	E	F	G
1	**Market Node**	DZ00					
2	**Country**	Algeria					
3	**Time Frame**	Hourly	1	Time Format is UTC			
4	**Period**	Start Date	End Date				
5	date (dd/mm/yyyy)	01/02/2022	01/21/2022	Update Dates		**Forecast Value**	
6							
7							
8							
9						**VALUE [MW]**	**VALUE [MW]**
10	**Number of the Hour**	**Week**	**Month**	**Date**	**Hour**	**FCR**	**FRR Value**
35	25	2	1	01/02/2022	1		
36	26	2	1	01/02/2022	2		
37	27	2	1	01/02/2022	3		
38	28	2	1	01/02/2022	4		
39	29	2	1	01/02/2022	5		
40	30	2	1	01/02/2022	6		
41	31	2	1	01/02/2022	7		
42	32	2	1	01/02/2022	8		
43	33	2	1	01/02/2022	9		

Figure 4-10 Overview of the reserve tertiary sheet in the template

5 Transparency Results of Operation (Template description TS)

This template is created to provide the historical / result of operation for the following:

- The Load;
- Renewable generation

5.1 Demand

The template offers the possibility to provide the actual hourly result of operation for demand of a past period, Hereinafter, an overview of the user interface of the Demand operation sheet is given.

	A	B	C	D	E	F
1	**Market Node**	DZ00				
2	**Country**	Algeria				
3	**Time Frame**	Hourly	1	Time Format is UTC		
4	**Period**	Start Date	End Date			
5	date (dd/mm/yyyy)	01/01/2022	01/21/2022	Update Dates		
6						
7						
8						
9						
10	**Number of the Hour**	**Week**	**Month**	**Date**	**Hour**	**Result of Operation (Load)**
11	1	1	1	01/01/2022	1	
12	2	1	1	01/01/2022	2	
13	3	1	1	01/01/2022	3	
14	4	1	1	01/01/2022	4	
15	5	1	1	01/01/2022	5	
16	6	1	1	01/01/2022	6	
17	7	1	1	01/01/2022	7	
18	8	1	1	01/01/2022	8	
19	9	1	1	01/01/2022	9	

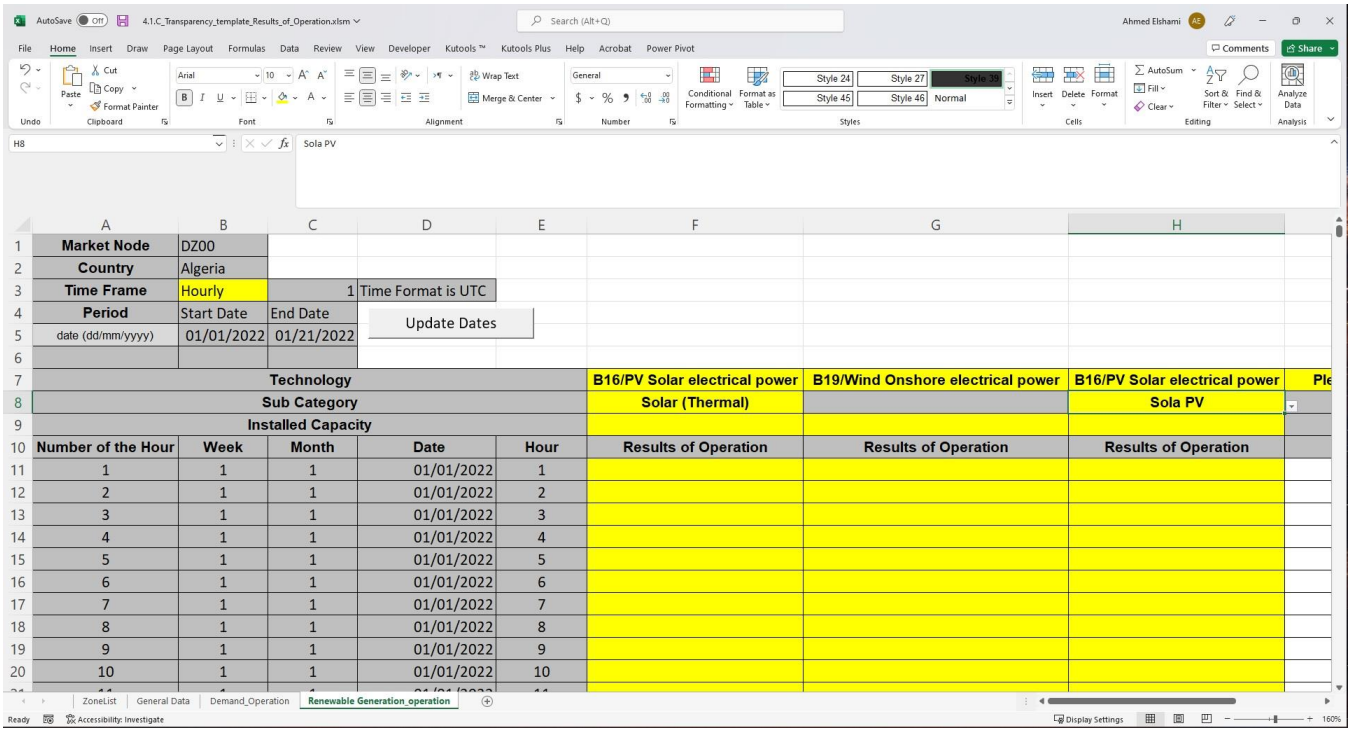
ZoneList | General Data | Demand_Operation | Renewable Generation_operation

Figure 5-1 Overview of the demand result of operation sheet in the template

5.2 Renewable

The template offers the possibility to include any result of operation for generation from renewable, while having the same categories of renewable as defined in Table 4-4 & Table 4-5

Hereinafter, an overview of the user interface of the Renewable result of operation sheet is given.



	A	B	C	D	E	F	G	H
1	Market Node	DZ00						
2	Country	Algeria						
3	Time Frame	Hourly	1	Time Format is UTC				
4	Period	Start Date	End Date	Update Dates				
5	date (dd/mm/yyyy)	01/01/2022	01/21/2022					
6								
7	Technology					B16/PV Solar electrical power	B19/Wind Onshore electrical power	B16/PV Solar electrical power
8	Sub Category					Solar (Thermal)		Sola PV
9	Installed Capacity							
10	Number of the Hour	Week	Month	Date	Hour	Results of Operation	Results of Operation	Results of Operation
11	1	1	1	01/01/2022	1			
12	2	1	1	01/01/2022	2			
13	3	1	1	01/01/2022	3			
14	4	1	1	01/01/2022	4			
15	5	1	1	01/01/2022	5			
16	6	1	1	01/01/2022	6			
17	7	1	1	01/01/2022	7			
18	8	1	1	01/01/2022	8			
19	9	1	1	01/01/2022	9			
20	10	1	1	01/01/2022	10			

Figure 5-2 Overview of the Renewable result of operation sheet in the template

6 The Platform: DBMED Operation section

6.1 Introduction

DBMED a web-based platform developed by Med-TSO that allows to collect information from different sources into a single user interface.

In the new configuration of DBMED, it was decided to allocate a dedicated space to collect all kind of data discussed in chapter 2 of this report together with statistical data that the association is collecting every year.

In this chapter we will discuss how the user upload his collected data to this dedicated space called **Oration section in DBMED**.

6.1.1 Get Access to the Operation Section

It is possible to get access to the Operation Section from the button located in the top-left corner in the main page of DBMED.

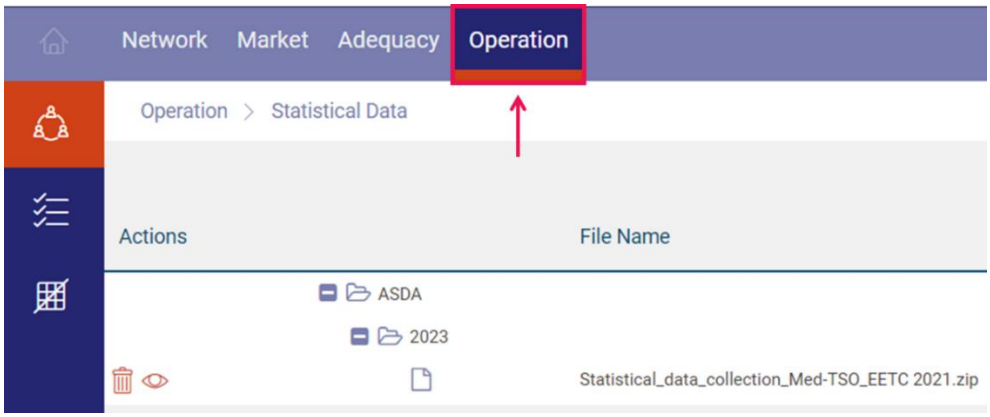


Figure 6-1 Operation section: Tab Button to get access to the main page

6.1.2 Data Organization

The Operation Section is allowing the collection of three kind of Data:

1. **Statistical Data**, collection of the statistical data
2. **Operation Result**, collection of the operation results
3. **Short-term Forecast**, collection of the forecast.

Each level groups information according to the TSO and the year (**TSO-Year Node**), as represented in the following tree-view representation:

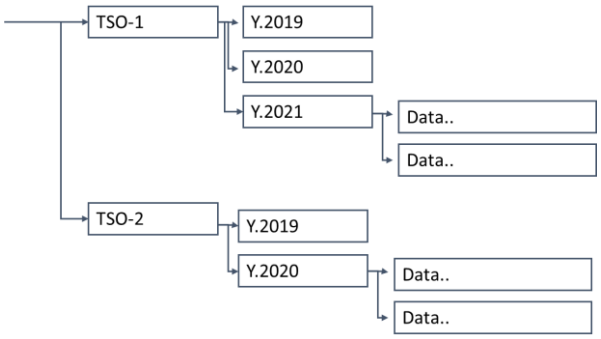


Figure 6-2 Tree-View Hierarchy

Each level has its own purpose and should be used accordingly to what is described in the next paragraphs.

6.1.3 Page Design

The Operation Section design is quite straightforward, every level has the same design and functions are not changing with levels.

The User can:

- Navigate through the levels thanks the three buttons in the **Level Switch** placed on the left of the main page
- Manage the data through the **Main Function Bar**

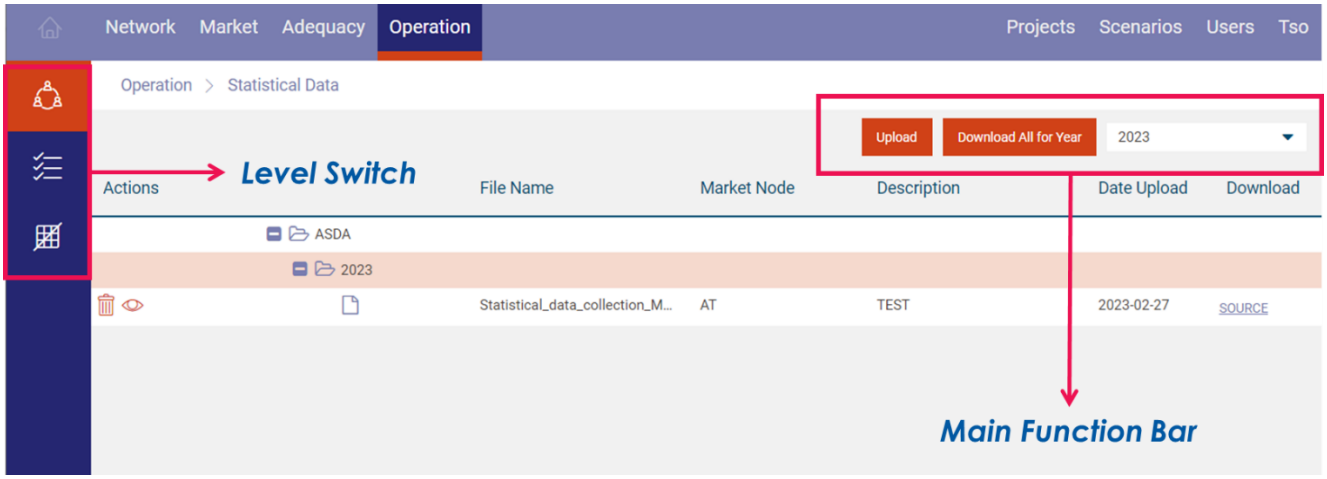


Figure 6-3 Main Page, navigation, and global functions

6.1.4 Main Function

As mentioned above each level has the same design, and the same functions too, these **global functions** are shared through the levels (see Figure 6-4).

The supported global functions are:

- **Upload,** to upload of data, data may vary accordingly to the selected Level,
- **Download**, to download the information that are stored in DBMED. To download the data the User is required to select the year to be downloaded.

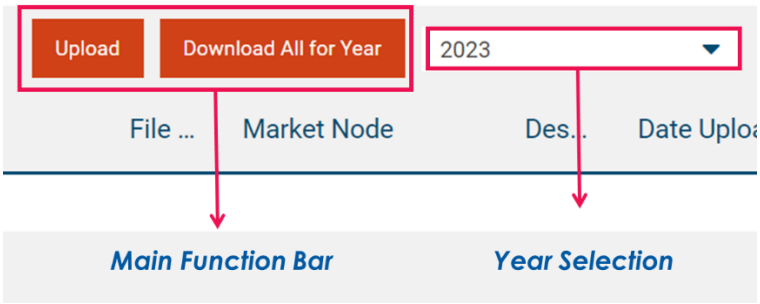


Figure 6-4 Global Functions (common to all Levels)

6.1.5 Understanding Roles

For each of the levels available in the Operation Section, the User can upload, download, view information and check data consistency. Worth it to mention that some of these functions are restricted only to a very specific type of users as explained in the “Application Architecture” manual.

For the Operation Section the following rules must be considered accordingly to the different user types listed below:

- **The Administrative Controller**, which basically can do everything across the application:
  - it can upload data at each level of the Operation Section,
  - it can download all the data available for all types
  - It can delete files
- **The TSO Administrator** can download all the data available in the Operation Section but has limited control for uploading data: in fact, it can upload only the data belonging to his own TSO
- **The Viewer** can only views information, whereas the upload, the download and the delete functions are blocked.

6.2 Statistical Data

The **statistical data Level** is accessible through the dedicated button. Once the User get access to this level the following actions are available:

- **Upload,** the User can upload information related to the statistical data about production and installed capacities of each TSO.
- **Download All (by Year)**, the User can download all the information related to the level, for each available TSO and the selected year.

6.2.1 Upload Of Data

By clicking on the **Upload Button** (in the top-right corner of the main page) the **upload form** (see Figure 6-5) will be displayed. Thanks to this popup the Users can insert:

- Type of information (this value is automatically displayed according to the Level, the statistical data)
- Year
- Market Node
- Description (Optional)

When the upload process is started, by clicking the **Run Button**, the data will be saved into DBMED.

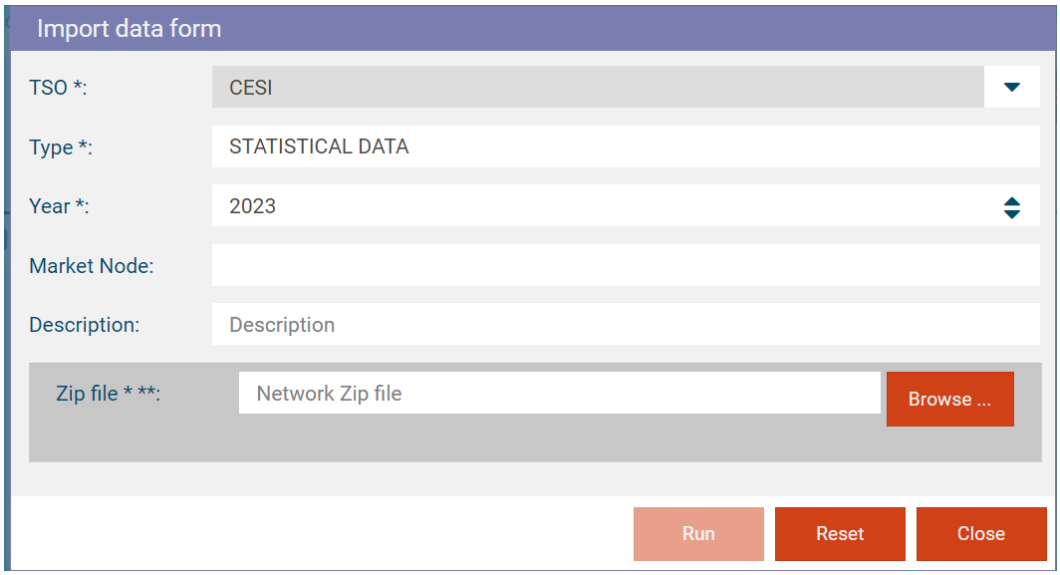


Figure 6-5 Statistical Data - Upload Panel

- Input Data Template

The file to be uploaded at this level it's an Excel File with different sheets covering the following topics:

- **Balance**, main balance recap for the Market Node (TWh)
- **Installed Capacity** with technology breakdown (MW)
- **Generation**, about yearly energy productions for each technology (TWh)
- **Demand**, about the yearly consumptions (TWh)
- **Exchange**, about the cross-border energy exchange with the other Market Node (TWh)
- **Lines,** about lines length in the Market Node (km)
- **Transformers,** about the Transformers installed capacity (MVA)
- **Key Performance Indicators,** about the main KPIs related to the Energy Not Supplied, Losses, Frequency Deviation Index, and others network availability and performance indicators.

6.2.2 Single Tree-View Node Actions

With regards of the single tree-view node, when a specific row **TSO-Year node** is selected, two action buttons show, the **Delete** and the **Query and Output** commands:

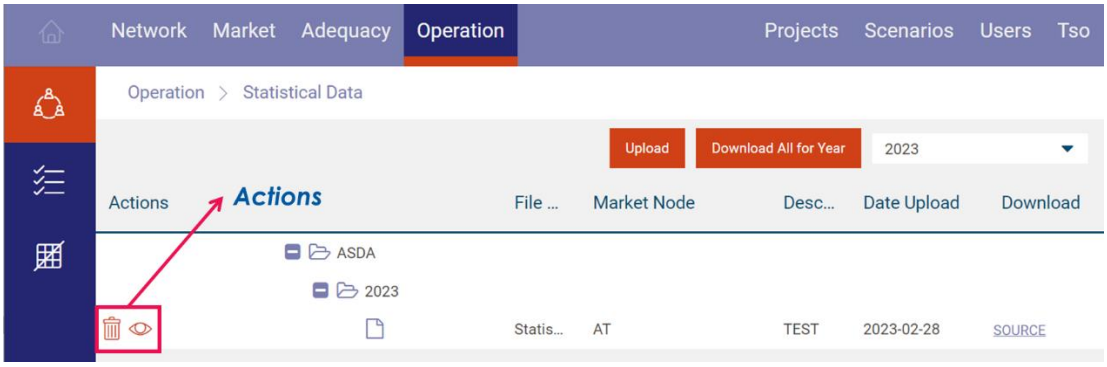


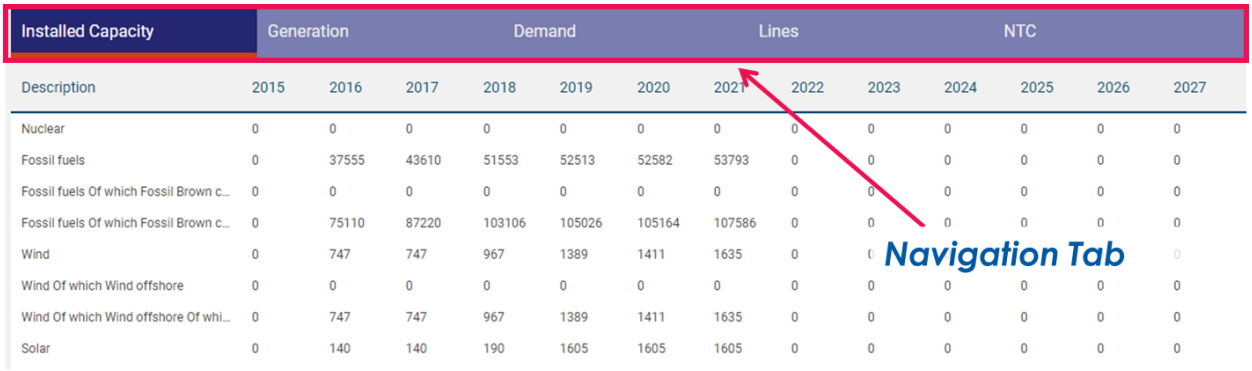
Figure 6-6 Single Tree-View Node Actions

Table 6-1 Commands available at each TSO-Year node

Command Icon	Description
	**Output and Query**, represents the command to open the summary table to navigate through the data (see paragraph 6.2.3)
	**Delete Node**, to delete a TSO-Year node

6.2.3 Output, Statistical Data Recap

By using the command "**Output & Query**" (the eye-shaped icon) the User can access the main table with all the statistical data present in the DBMED represented in tabular form. Data topics can be browsed using the dedicated **navigation tab** (Figure 6-8).



Description	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Nuclear	0	0	0	0	0	0	0	0	0	0	0	0	0
Fossil fuels	0	37555	43610	51553	52513	52582	53793	0	0	0	0	0	0
Fossil fuels Of which Fossil Brown c...	0	0	0	0	0	0	0	0	0	0	0	0	0
Fossil fuels Of which Fossil Brown c...	0	75110	87220	103106	105026	105164	107586	0	0	0	0	0	0
Wind	0	747	747	967	1389	1411	1635	0	0	0	0	0	0
Wind Of which Wind offshore	0	0	0	0	0	0	0	0	0	0	0	0	0
Wind Of which Wind offshore Of whi...	0	747	747	967	1389	1411	1635	0	0	0	0	0	0
Solar	0	140	140	190	1605	1605	1605	0	0	0	0	0	0

Figure 6-7 Statistical Data Table Navigation Tab

6.2.4 Download of Data

Data can be downloaded by the User thanks to the **Download Button** located in the upper right corner of the main page. This command allows the User to download the original file for each TSO, visible in the tree-view representation, for the selected year.

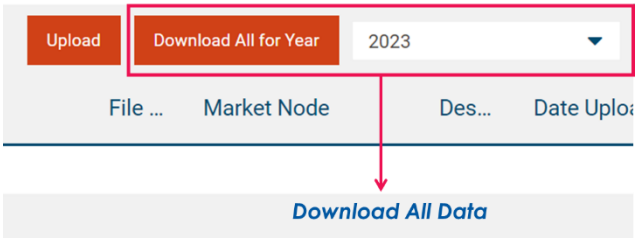


Figure 6-8 Download All (by Year) function

6.2.5 Source Command

At each Tree-View node level it also available the **Source** command, this command allows the User to download the original uploaded file for a given TSO-Year node.

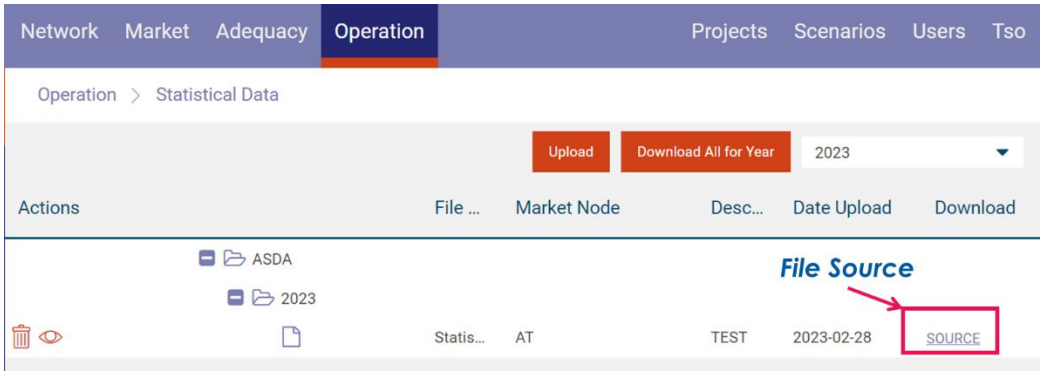


Figure 6-9 Source file command, to download the original data-source

6.3 Operation Results

The **Operation Results Level** is accessible through the dedicated button. Once the User get access to this level the following actions are possible:

- **Upload,** the User can upload information related to the statistical data related to demand profiles and renewable production.
- **Download All** (**by Year)**, the User can download all the information related to the level, for each available TSO and for the selected year.

6.3.1 Upload Of Data

By clicking on the **Upload Button** (in the top-right corner of the main page) the **upload form** (see Figure 6-10) will be displayed. Into the popup the User must indicate:

- Type of information (this value is automatically displayed according to the Level, the statistical data)
- Year
- Market Node
- Description (Optional)

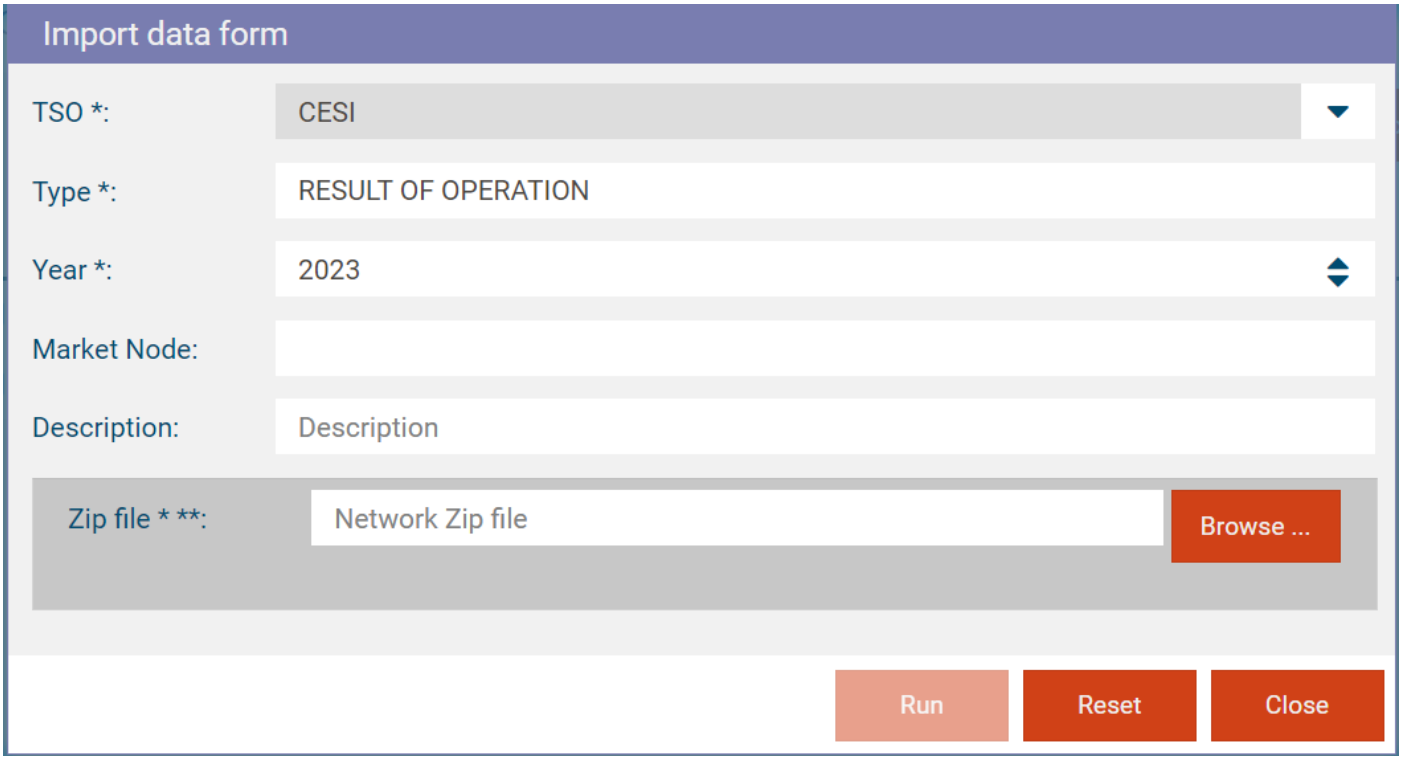


Figure 6-10 Operation Results - Upload Panel

6.3.2 Input Data Template

The file to be uploaded at this level it's an Excel File with different sheets which cover the following main topics:

- **General Data**, general information and time span data refers to.
- **Demand,** demand hourly profile
- **Renewable Generation**, hourly production related to renewable production.

6.3.3 Single Tree-View Node Actions

With regards of the single tree-view node, when a specific row TSO-Year is selected, the User can access to one action button only, the **Delete** command.

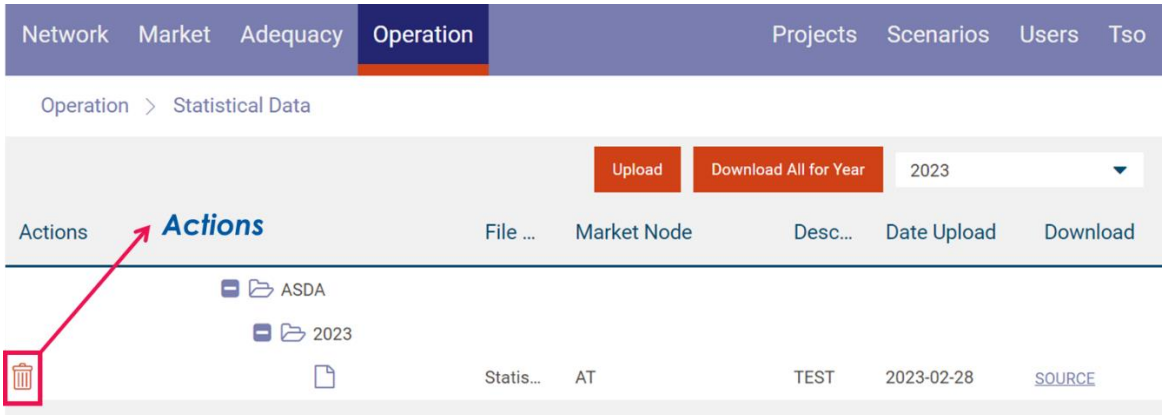


Figure 6-11 Single Tree-View Node Actions

Table 6-2 Commands available at each node TSO-Year

Command Icon	Description
	**Delete Node**, to delete a TSO-Year node

6.3.4 Download of Data

Data can be downloaded by the User via the **Download Button** located in the upper right corner of the main page. This command allows the User to download the original file for each TSO, visible in the tree-view representation, for the specific selected year.

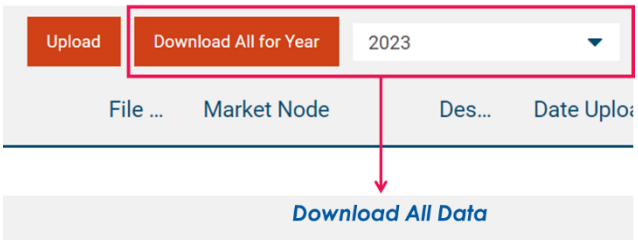


Figure 6-12 Download All (by Year) function

6.3.5 Source Command

At each Tree-View node level it also available the **Source** command, this command allows the User to download the original uploaded file.

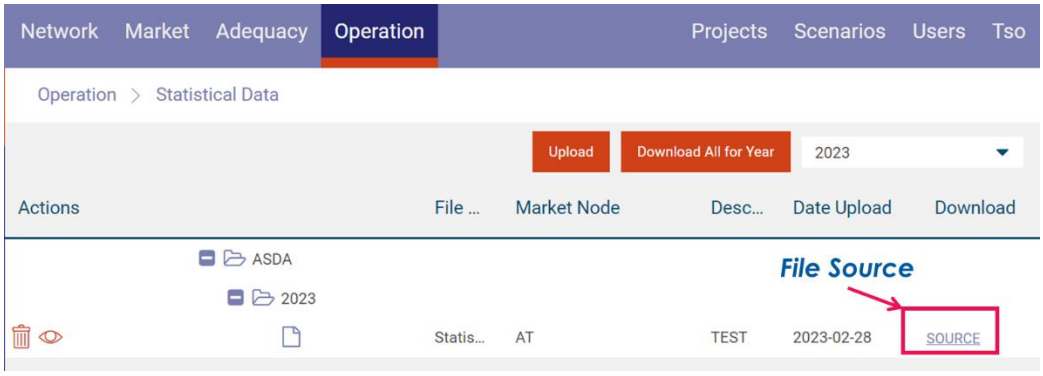


Figure 6-13 Source file command, to download the original data-source

6.4 Forecast Data

The **Forecast Data Level** is accessible through the dedicated button. Once the User get access to this level the following actions are possible:

- **Upload,** User can upload information related to the forcasted data related to demand profiles, renewable production, thermal generation, NTC profiles and Tertiary reserve data.
- **Download All by Year**, to download all the information related to this level, for each available TSO and for the selected year.

6.4.1 Upload Of Data

By clicking on the **Upload Button** (in the top-right corner of the main page) the **upload form** (see Figure 6-14) will be displayed. Via this popup User must indicate:

- Type of information, in this case two options are available:
  - Forecast Excel-like file format
  - Forecast XML-like file format
- Year
- Market Node
- Description (Optional)

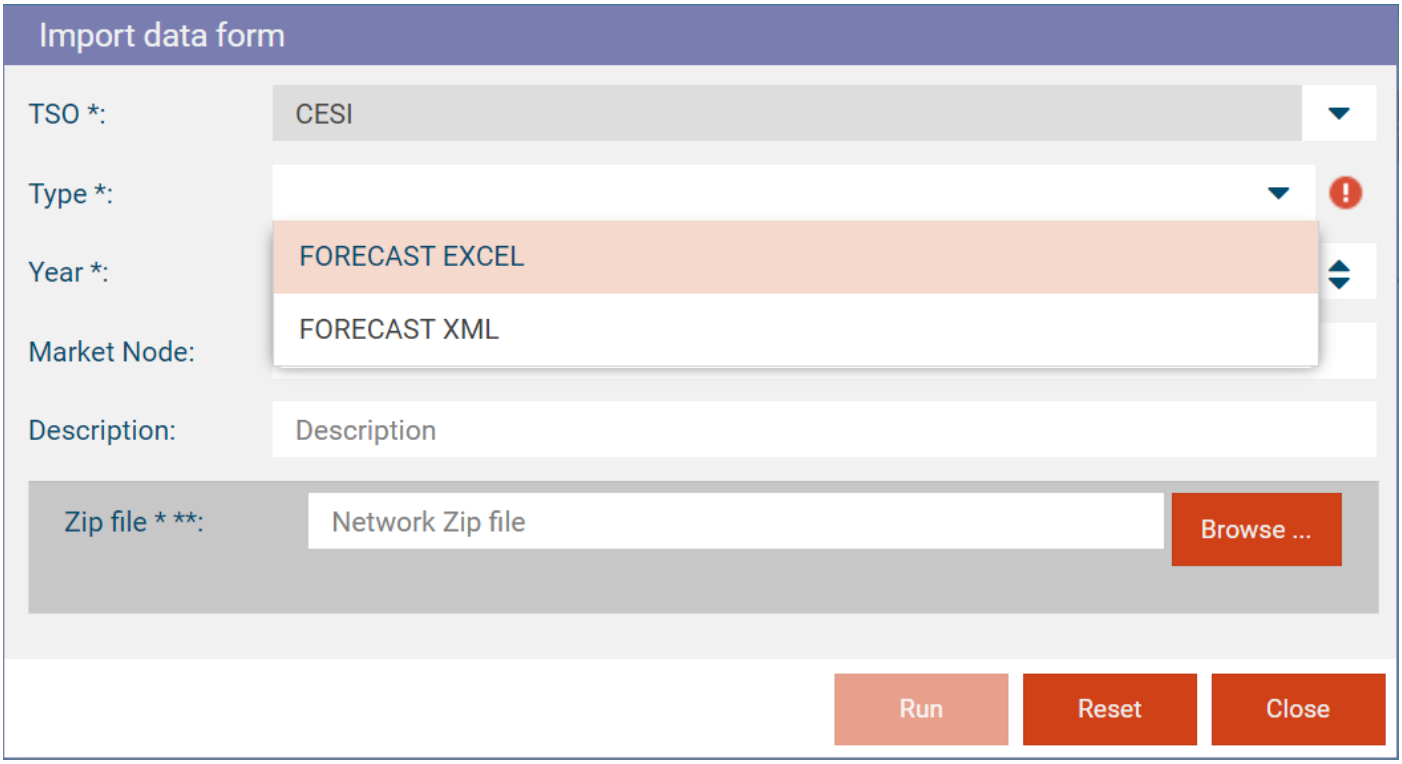


Figure 6-14 Operation Results - Upload Panel

6.4.2 Input Data Template

The file to be uploaded at this level it's an Excel File with different sheets which cover the following main topics:

- **General Data**, general information and time span data refers to.
- **Demand,** demand hourly profile
- **Renewable Generation**, hourly production related to renewable production.
- **Thermal Generation,** hourly production related to thermal production.
- **NTC**, hourly net transfer capacity profiles.
- **Tertiary Reserve,** tertiary reserve demand profiles.

6.4.3 Single Tree-View Node Actions

With regards of the single tree-view node, when a specific row TSO-Year is selected, the User can access to only one action button, the **Delete** command.

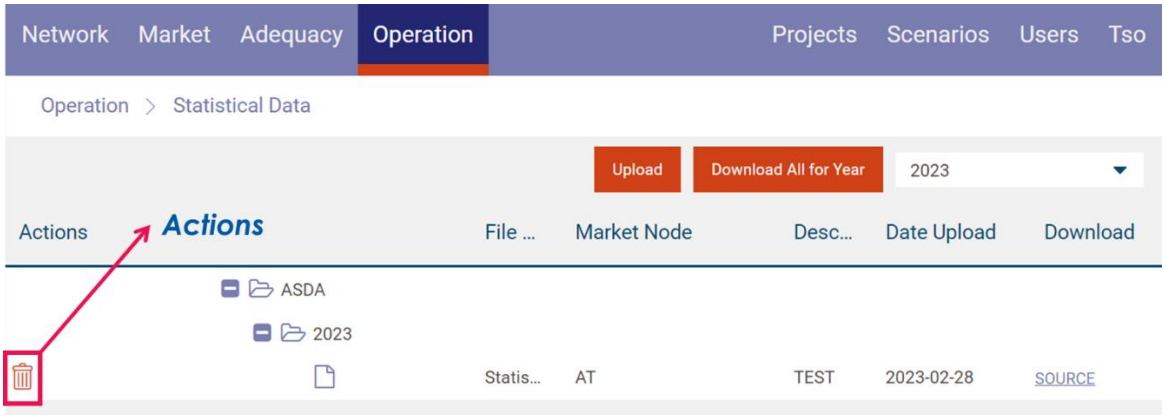


Figure 6-15 Single Tree-View Node Actions

Table 6-3 Commands available at each node TSO-Year

Command Icon	Description
	**Delete Node**, to delete a TSO-Year node

6.4.4 Download of Data

Data can be downloaded by the User via to the **Download Button** located in the upper right corner of the main page. This command allows the User to download the original file for each TSO, visible in the tree-view representation, for the specific selected year.

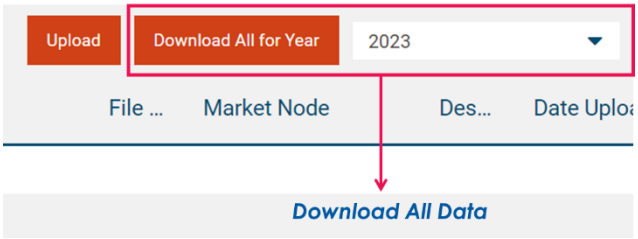


Figure 6-16 Download All (by Year) function

6.4.5 Source Command

At each Tre-View node level it also available the **Source** command, this command allows the User to download the original uploaded file.

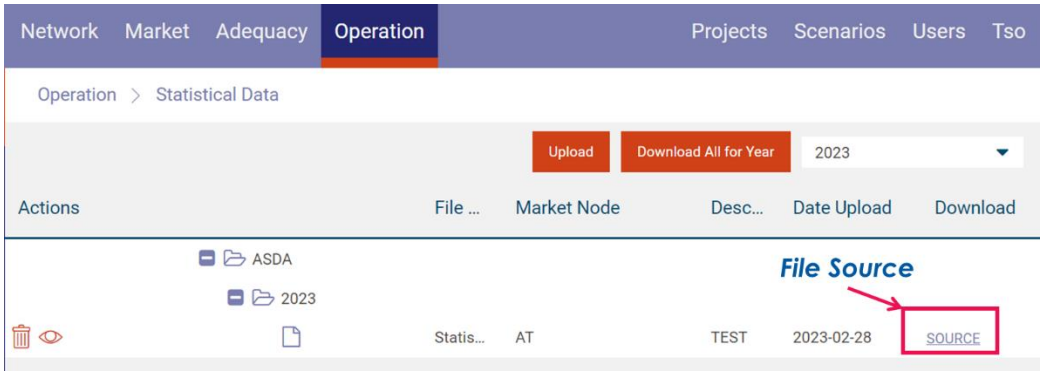


Figure 6-17 Source file command, to download the original data-source

7 Appendix

7.1 Med-TSO Survey Description

Feedback from a survey of Med-TSO members regarding their evaluation of coordination in operation with the Neighbours and their view about the activities that should be developed to enhance this coordination and all the data that should be shared jointly.

Date of completion

Date	Country (TSO)
09/04/2021 10:05	PORTUGAL (REN)
09/04/2021 11:47	CROATIA (HOPS)
15/04/2021 11:28	SPAIN (REE)
19/04/2021 14:37	ALGERIA (SONELGAZ)
19/04/2021 18:36	JORDAN (NEPCO)
26/04/2021 06:41	FRANCE (RTE)
27/04/2021 08:30	PALESTINE (PETL)
28/04/2021 09:09	TURKEY (TEIAS)
29/04/2021 03:38	EGYPT (EETC)
29/04/2021 06:35	GREECE (ADMIE)
03/05/2021 13:47	ITALY (TERNA)
05/05/2021 07:28	CYPRUS (CYPRUS TSO)
11/05/2021 10:00	MOROCCO (ONEE)

Question A1:

How would you evaluate the coordination in operation with your neighbouring countries?	
PORTUGAL (REN)	Full transparency and real time cooperation managed with platforms/market
CROATIA (HOPS)	Full transparency and real time cooperation managed with platforms/market
SPAIN (REE)	Full transparency and real time cooperation managed with platforms/market
ALGERIA (SONELGAZ)	Real time cooperation with only few exchanged information
JORDAN (NEPCO)	Real time cooperation with only few exchanged information

FRANCE (RTE)	Full transparency and real time cooperation managed with platforms/market
PALESTINE (PETL)	Real time cooperation with only few exchanged information
TURKEY (TEIAS)	Full transparency and real time cooperation managed with platforms/market
EGYPT (EETC)	Real time cooperation with only few exchanged information
GREECE (ADMIE)	Full transparency and real time cooperation managed with platforms/market
ITALY (TERNA)	Full transparency and real time cooperation managed with platforms/market
CYPRUS (CYPRUS TSO)	Cyprus is isolated
MOROCCO (ONEE)	Full transparency and real time cooperation managed with platforms/market

Question A2:

How would you evaluate the functioning of the cooperation IN REAL TIME with your neighbour?	
PORTUGAL (REN)	Excellent, the coordination is perfect, and I have a clear view on what is happening in my neighbour's grid in real time
CROATIA (HOPS)	Excellent, the coordination is perfect, and I have a clear view on what is happening in my neighbour's grid in real time
SPAIN (REE)	Good, we share all the needed operation data according to a present protocol
ALGERIA (SONELGAZ)	Poor, need to be enhanced, less than required
JORDAN (NEPCO)	Fair considering the circumstances the minimum required level is reached
FRANCE (RTE)	Excellent, the coordination is perfect, and I have a clear view on what is happening in my neighbour's grid in real time
PALESTINE (PETL)	Fair considering the circumstances the minimum required level is reached
TURKEY (TEIAS)	Good, we share all the needed operation data according to a present protocol
EGYPT (EETC)	Good, we share all the needed operation data according to a present protocol
GREECE (ADMIE)	Good, we share all the needed operation data according to a present protocol
ITALY (TERNA)	Excellent, the coordination is perfect, and I have a clear view on what is happening in my neighbour's grid in real time

CYPRUS (CYPRUS TSO)	When Cyprus gets connected, we will follow EU rules
MOROCCO (ONEE)	Good, we share all the needed operation data according to a present protocol

Question A3:

	Which activity is more urgent to develop & enhance the cooperation with your neighbours? (please rank each activity to be developed from 1: Low Priority to 5: High Priority				
	[Short-term Adequacy - up to Week-Ahead Adequacy]	Outage planning coordination (facilities that could impact neighbour countries)	Establish common rules about reporting big events	Coordination with regards to the calculation of the Net Transfer Capacities	Coordination with regards to the management of energy exchanges and energy exchanges]
PORTUGAL (REN)	5	5	5	5	5
CROATIA (HOPS)	1	1	1	1	1
SPAIN (REE)	3	3	2	4	4
ALGERIA (SONELGAZ)	2	5	5	5	5
JORDAN (NEPCO)	5	5	5	5	2
FRANCE (RTE)	3	4	4	5	5
PALESTINE (PETL)	4	5	3	1	2
TURKEY (TEIAS)	5	5	3	5	5
EGYPT (EETC)	5	5	4	3	4
GREECE (ADMIE)	3	4	4	5	4
ITALY (TERNA)	5	5	1	3	3
CYPRUS (CYPRUS TSO)	5	5	4	5	5
MOROCCO (ONEE)	4	4	4	4	5

Question A4:

You want to develop more? Please do it here.

PORTUGAL (REN)	All the above topics are very relevant but, in the case of Portugal, are already developed in the framework of European rules and ENTSO-E.
CROATIA (HOPS)	All activities mentioned above has already been implemented. Croatian Transmission System Operator Ltd. (HOPS) is the sole transmission system operator in the Republic of Croatia and the owner of the entire Croatian transmission network. HOPS is solely responsible for the Croatian Load-Frequency Control (LFC) area, scheduling area, and monitoring area that cover the entire country. Croatian LFC area is a part of the Continental Europe synchronous area. Together with Slovenian (ELES) and Bosnian and Herzegovinian transmission system operators (Nezavisni operator sistema u BiH - NOSBiH) HOPS form LFC Block Slovenia-Croatia-BiH (LFC block SHB).
SPAIN (REE)	Driven by Market, security limitations already developed
FRANCE (RTE)	Answered as if it would not yet be implemented in my country

Question B1:

	Looking ahead, it is considered important to share the week ahead forecast (better if with confidence interval). According to you, which priority should be given to each of the following type of data? from 1: Low Priority to 5: High Priority			
	Hourly load	Hourly renewable production (solar, wind, others)	Hourly Net Transfer Capacities	Hourly generation
PORTUGAL (REN)	4	4	1	1
CROATIA (HOPS)	1	1	1	1
SPAIN (REE)	2	2	4	1
ALGERIA (SONELGAZ)	3	5	5	3
JORDAN (NEPCO)	5	5	5	5
FRANCE (RTE)	3	2	5	2
PALESTINE (PETL)	5	4	3	5
TURKEY (TEIAS)	5	5	5	5
EGYPT (EETC)	5	4	5	4
GREECE (ADMIE)	3	3	5	3
ITALY (TERNA)	5	2	5	2
CYPRUS (CYPRUS TSO)	5	5	5	5
MOROCCO (ONEE)	3	4	4	3

Question B2:

	Which other forecasts will be important to share week-ahead with your neighbours? Why?
PORTUGAL (REN)	Important outages. The other data it is very difficult to forecast in a Market environment (Portugal is part of the Iberian Market).
CROATIA (HOPS)	All forecasts mentioned in previous question are shared on weekly basis with all TSO-s in ENTSO-E cooperation.
SPAIN (REE)	none
ALGERIA (SONELGAZ)	Renewable production connected to the distribution grid
JORDAN (NEPCO)	Hourly spinning reserve
FRANCE (RTE)	outage planning of the main facilities having an impact on the flows close to the borders
PALESTINE (PETL)	schedule outages, to taking it into consideration in operation plan
TURKEY (TEIAS)	None
EGYPT (EETC)	I think hourly load, hourly generation, hourly net transfer capacity and hourly renewable production is enough to share with neighbours
GREECE (ADMIE)	Hourly Net Transfer Capacities
ITALY (TERNA)	Maintenance plans and availability of generation plants
CYPRUS (CYPRUS TSO)	International Interconnector transfer capability and availability. 2) Must run Unit information.
MOROCCO (ONEE)	Real time outages in the grid that impact the net transfer and the interconnexion

Question B3:

	Which other forecasts will be important to share with another timeframe (e.g., day-ahead)? Why?
PORTUGAL (REN)	In a market environment, the certainties of the referred variables increase substantially, so it is in this horizon that these forecast data should be shared. Additionally, any outage with influence in the load flows of other system should also be shared.
CROATIA (HOPS)	Due to high intermittency of RES production, it would be important to share RES production forecast in day-ahead and intraday timeframes.
SPAIN (REE)	none
ALGERIA (SONELGAZ)	hourly renewable production Generation, Load important outages
JORDAN (NEPCO)	No others
FRANCE (RTE)	Day-ahead is more important than week-ahead, also because of more accurate for all those variables (load, generation)
PALESTINE (PETL)	emergency maintenance outages, to taking it into consideration in operation plan
TURKEY (TEIAS)	None
EGYPT (EETC)	It's important to share basic forecasts day ahead, month ahead, year ahead
GREECE (ADMIE)	Hourly Net Transfer Capacities
ITALY (TERNA)	Grid and main load/generation plants contingencies
CYPRUS (CYPRUS TSO)	1) International Interconnector transfer capability and availability. 2) Must run Unit information.
MOROCCO (ONEE)	RS

Question B4:

	Do you agree to share up to date (close to real time) actual information about:
PORTUGAL (REN)	Unavailability of Production Units (both planned and forced), Load, Renewable Production, In the case of "load" and "renewable production", the answer is yes, but only in the "observability area".
CROATIA (HOPS)	Unavailability of Production Units (both planned and forced), Load, Renewable Production, Energy Reserves
SPAIN (REE)	Energy Reserves, we do not see the necessity
ALGERIA (SONELGAZ)	Load, Renewable Production, Energy Reserves
JORDAN (NEPCO)	Load, Renewable Production, Energy Reserves
FRANCE (RTE)	Unavailability of Production Units (both planned and forced), Load, Renewable Production, Energy Reserves, transmission facilities unavailability
PALESTINE (PETL)	Load
TURKEY (TEIAS)	Unavailability of Production Units (both planned and forced), Load, Renewable Production, Energy Reserves
EGYPT (EETC)	Load, Renewable Production, Energy Reserves
GREECE (ADMIE)	Unavailability of Production Units (both planned and forced), Load, Renewable Production, Energy Reserves, Data are Already available in Transparency Platform of ENTSO-e
ITALY (TERNA)	Unavailability of Production Units (both planned and forced), Load, Energy Reserves
CYPRUS (CYPRUS TSO)	Load, Renewable Production, Energy Reserves
MOROCCO (ONEE)	AT the present stage we can not

7.2 Thermal Generation categories & subcategories

The table below show the standard thermal characteristics & different types of thermal categories & subcategories.

Table 7-1 Common Data used

Category #	Fuel	Type	Efficiency range in NCV terms %	Standard efficiency in NCV terms %
1	Nuclear	-	30% - 35%	33%
2	Hard coal	old 1	30% - 37%	35%
3	Hard coal	old 2	38% - 43%	40%
4	Hard coal	new	44% - 46%	46%
5	Hard coal	CCS	30% - 40%	38%
6	Lignite	old 1	30% - 37%	35%
7	Lignite	old 2	38% - 43%	40%
8	Lignite	new	44% - 46%	46%
9	Lignite	CCS	30% - 40%	38%
10	Gas	conventional old 1	25% - 38%	36%
11	Gas	conventional old 2	39% - 42%	41%
12	Gas	CCGT old 1	33% - 44%	40%
13	Gas	CCGT old 2	45% - 52%	48%
14	Gas	CCGT present 1	53% - 60%	56%
15	Gas	CCGT present 2	53% - 60%	58%
16	Gas	CCGT new	53% - 60%	60%
17	Gas	CCGT CCS	43% - 52%	51%
18	Gas	OCGT old	35% - 38%	35%
19	Gas	OCGT new	39% - 44%	42%
20	Light oil	-	32% - 38%	35%
21	Heavy oil	old 1	25% - 37%	35%
22	Heavy oil	old 2	38% - 43%	40%
23	Oil shale	old	28% - 33%	29%
24	Oil shale	new	34% - 39%	39%
25	Fuel cell	Hydrogen	34% - 60%	60%

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