European Network of
Transmission System Operators
for Electricity

EUROPEAN RESOURCE ADEQUACY ASSESSMENT 2024

DATA COLLECTION GUIDELINES

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From: System Development Committee – Adequacy Team

ENTSO-E Mission Statement

Who we are

ENTSO-E, the European Network of Transmission System Operators for Electricity, is the association for the cooperation of the European transmission system operators (TSOs). The 40 member TSOs, representing 36 countries, are responsible for the secure and coordinated operation of Europe's electricity system, the largest interconnected electrical grid in the world. In addition to its core, historical role in technical cooperation, ENTSO-E is also the common voice of TSOs.

ENTSO-E brings together the unique expertise of TSOs for the benefit of European citizens by keeping the lights on, enabling the energy transition, and promoting the completion and optimal functioning of the internal electricity market, including via the fulfilment of the mandates given to ENTSO-E based on EU legislation.

Our mission

ENTSO-E and its members, as the European TSO community, fulfil a common mission: Ensuring the security of the inter-connected power system in all time frames at pan-European level and the optimal functioning and development of the European interconnected electricity markets, while enabling the integration of electricity generated from renewable energy sources and of emerging technologies.

Our vision

ENTSO-E plays a central role in enabling Europe to become the first climate-neutral continent by 2050 by creating a system that is secure, sustainable and affordable, and that integrates the expected amount of renewable energy, thereby offering an essential contribution to the European Green Deal. This endeavour requires sector integration and close cooperation among all actors.

Europe is moving towards a sustainable, digitalised, integrated and electrified energy system with a combination of centralised and distributed resources. ENTSO-E acts to ensure that this energy system keeps consumers at its centre and is operated and developed with climate objectives and social welfare in mind.

ENTSO-E is committed to use its unique expertise and system-wide view – supported by a responsibility to maintain the system's security – to deliver a comprehensive roadmap of how a climate-neutral Europe looks.

Our values

ENTSO-E acts in solidarity as a community of TSOs united by a shared responsibility.

As the professional association of independent and neutral regulated entities acting under a clear legal mandate, ENTSO-E serves the interests of society by optimising social welfare in its dimensions of safety, economy, environment, and performance.

ENTSO-E is committed to working with the highest technical rigour as well as developing sustainable and innovative responses to prepare for the future and overcoming the challenges of keeping the power system secure in a climate-neutral Europe. In all its activities, ENTSO-E acts with transparency and in a trustworthy dialogue with legislative and regulatory decision makers and stakeholders.

Our contributions

ENTSO-E supports the cooperation among its members at European and regional levels. Over the past decades, TSOs have undertaken initiatives to increase their cooperation in network planning, operation and market integration, thereby successfully contributing to meeting EU climate and energy targets.

To carry out its legally mandated tasks, ENTSO-E's key responsibilities include the following:

› Development and implementation of standards, network codes, platforms and tools to ensure secure system and market operation as well as integration of renewable energy;

› Assessment of the adequacy of the system in different timeframes;

› Coordination of the planning and development of infrastructures at the European level (Ten-Year Network Development Plans, TYNDPs);

› Coordination of research, development and innovation activities of TSOs;

› Development of platforms to enable the transparent sharing of data with market participants.

ENTSO-E supports its members in the implementation and monitoring of the agreed common rules.

ENTSO-E is the common voice of European TSOs and provides expert contributions and a constructive view to energy debates to support policymakers in making informed decisions.

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Introduction

The PEMMDB app is the application used to collect and validate TSOs data used in System Development Studies (legally mandated). The current release of the application targets information about the generating units in the european energy market.

Data is still collected as excel files whose sheets contain the raw data that is used to populate the fields in the Web Ontology Language (OWL) model.

This documentation is designed to provide guidelines for the European Resource Adequacy Assessment 2024 data collection. It is intended to be a public document describing the methodology.

General instructions

This data collection is intended to serve the needs of ERAA2024 for:

1. European Resource Adequacy Assessment (ERAA)
2. Economic Viability Assessment (EVA)

The data collection will request the TSOs to deliver data in line with the following target year dependent assumptions:

- 2026 – TSO Best Estimate
- 2028 – TSO Best Estimate (unless for EU countries, National Energy and Climate Plans (NECP) data is available)
- 2030 – NECP data
- 2035 – NECP data (or National Policies)

Below a short list of some sources that could be available for TSOs to generate a robust Best Estimate for target years 2026 and 2028:

- Grid access permits issued
- Grid planning requests received
- Awarded auctions
- Awarded public grants (national, European)
- Awarded capacity mechanisms
- Calendars on future auctions and agreed calendars for units decommissioning
- Coordination between neighbours to estimate cross border capacities and availability of new interconnectors

Overall structure of this data collection

The PEMMDB App allows many new features. A pragmatic approach has been chosen for its launch. It consists in collecting data through Excel files that the application is reading, converting into the right data structures, and validating through a set of predefined rules regarding formats, ranges of values, relationships among fields, etc.

Because of some technical constraints some sheets have been revisited. New files have also been created. StG Data & Models has always keep simplicity and ease of use in mind when doing so.

New templates have been pre-filled with PEMMDB data available from the latest data collection. These files can be downloaded from the PEMMDB App.

The TSOs are asked to update the file downloaded from the PEMMDB Application with the latest data available. The final version of PEMMDB excel files shall be uploaded in PEMMDB App and appropriately validated following the instructions included in the rejected files, if any.

The data collection files are the following:

– Main and Thermal: Contains all general information about the market node (e.g. reserve requirements, redispatch) and Thermal generation (e.g. unit-by-unit, must-run requirements, deratings)

– Renewables: Contains mainly information about Renewable plants (plant-by-plant, similar parameter to Thermal) including Wind, Solar, Hydro and other RES

– Electrolysers, Fuel cells, Batteries and DSR: Contains information about batteries, electrolysers, fuel cells and DSR

– Transfer Capacities: Contains information about countries Net Transfer Capacities and exchanges with non ENTSO-E countries

– Hydro Inflow: contains information about flows of water and associated power generated by hydro units

The new version of the Pan-European Climate Database (PECDv4) has been adopted. To account for climate change, projection data will be considered in the study.

In particular, the following climatic years, from the Shared Socioeconomic Pathway SSP2-4.5, have been sampled for the study:

– Climate model CMCC-CM2-SR5: years 2025-2036

– Climate model EC-Earth3: years 2025-2036

– Climate model MPI-ESM1-2-HR: years 2025-2036

For technical reasons, the following mapping has been adopted to refence the selected climatic years in PEMMDB App and Demand Forecasting Toolbox:

– Climate model CMCC-CM2-SR5: years 2025-2036

– Climate model EC-Earth3: years 2037-2048

– Climate model MPI-ESM1-2-HR: years 2049-2060

Market node structure

The naming convention for market nodes has been defined for harmonization reasons. The following rules apply:

1. Same number of symbols
2. Only capital letters and digits

This data collection, following the previous one, focuses on increasing the granularity of data. The geographical zonal split of capacities is being extended to other RES, and, where possible, plant-by-plant data being collected for renewable plants. Also, there is a focus on closing the gap between Market and Network models, as well as with the Transparency Platform.

Categories

Main and Thermal

The Main and Thermal file contains all general information about the market node (e.g. reserves requirements, redispatch) and Thermal generation (e.g. unit-by-unit, must-run requirements, deratings).

Supply Data

1. Thermal Dispatchable Generation Data Set (Thermal)
2. Must-run and derating Data Set of Thermal Dispatchable Generation (Must-run, Group Must-run, Derating, Group Derating and Inelastic)
3. Other Non-Renewables Generation Data Set (Thermal)
4. Maintenance information (Min-Max Unit Maintenance and Planned Outages)

General data and requirements of Market Node

1. Operational reserves dataset (Reserves Requirements)
2. Capacity expansion constraints per fuel type (Thermal Expansion Constraints)

Thermal

The Thermal sheet aims to collect more granular thermal capacities:

- The resolution of the thermal power plants representation is increased to generating unit level, with the ability to create the hierarchy of generating units under groups.
- The time horizon of the thermal data collected is not tied to a single year with this format. Instead, we collect the expected commissioning and decommissioning dates available for the plants/units available now and expected to be available in the future.
- Geographic location of plants, at least defining the PECD region, is now needed. This will be extremely important for any zonal modelling approach.
- Information regarding connectivity of plants in the Network Model, closing the gap between market and network models. As for the geographic location of plants, this will be extremely useful for any zonal modelling approach.
- Other Non-RES technologies are now collected in the Thermal sheet.

Thermal Categories

To ensure consistent treatment of thermal units in Europe, and to avoid deviations in simulations, thermal categories are pre-defined, with fixed technical and economic characteristics (available in PEMMDB Common Data). Thermal units should be assigned to one of the listed types, depending on:

- The fuel (e.g. gas, hard coal, lignite)
- The type (e.g. OCGT, CCGT)
- The age categories (e.g. old 1, old 2, new), which correspond to standard efficiencies. The age category is used to ensure a realistic efficiency is applied, collected commissioning dates are not used to determine efficiency.

CCS (Carbon Capture & Storage) is a sub-category which assumes the CO2 emission factor is reduced by 90% and the standard efficiency reduced by 10% compared to the parent category.

Gas CCGT present 1 and present 2 categories were included in the last data collections to tackle the high number of units in the CCGT new category. Present 2 category has the same common data values as the former CCGT new (with standard efficiency value of 58%). The updated CCGT new category has its standard efficiency increased to 60%. The present 1 category retained all the former CCGT new attributes but with a standard efficiency changed to 56%.

The list below explains how to deal with some other specific units:

- Biofuels: Biofuel units can be defined with the usage of the “Secondary fuel” attribute by selecting biofuel option and the “Secondary fuel usage ratio” attribute. The option to provide custom biofuel price for these units is handled now in the Thermal sheet and can be defined for each unit separately.

- Mixed Fuels (except biofuels): If a unit burns several fuels (one after the other or simultaneously), two of them can be defined, the mostly used as primary through the "PEMMDB Fuel & Type" attribute and a second one through the "Secondary fuel" attribute. In this case the "Secondary fuel usage ratio" attribute is mandatory. With a secondary fuel defined, it will be assumed that the two fuels are used simultaneously.

- Dispatchable CHPs should be assigned to the most commonly used fuel, bearing in mind the consequence on the merit-order.

- CCGT units: Steam and gas turbines of one CCGT block should be merged and represented in one row of the Thermal sheet. If the network representation contains more synchronous machines, the additional rdf:ID fields have to be provided also.

- Fully non-dispatchable units (should it result from a contract or technical constraints) should be included in the "Other non-RES" (if not renewable) data set or reported in Thermal sheet with attribute "Operational Status" set to "Inelastic Supply/Fixed Profile". If reported in Thermal sheet as "Inelastic Supply/Fixed Profile", a separate file will be required to report the timeseries for each specific unit with this status. For the moment, such sophistication is not strictly needed hence it is fine if such capacities are only reported in "Other non-RES" sheet.

- Units that are not mentioned in the list should be assigned to the closest fitting category, taking into account standard values, especially fuel costs and efficiencies.

Data collected in the Thermal sheet

The Common Data Sheet contains common thermal characteristics applied to each thermal generation unit. Other data must be collected in addition to this, indication on mandatory and optional fields can be found in the templates. Indication on default values is available in the specific Fields guidelines.

Must-run

For thermal generation it is important to indicate so called must-run obligations, which can have many causes (heat requirements, technical, economic/subsidies/taxes, environmental, etc.) and should not be confused with minimum stable generation.

Climatic years associated with must-runs can now be selected in these sheets.

Reasons that could induce must-run obligation include:

- Network constraints (overload management, voltage control)
- Specific policies (subsidies of lignite mines)
- Minimum number of units needed to provide system services
- Heat constraints

Reasons that, in most cases, should not induce must-run obligation include:

- Fully non-dispatchable units such as biomass, waste (if unit is fully non-dispatchable, it should be specified in either the sheet "Other Non-RES")
- Low flexibility. This can be represented by other parameters such as "Minimum stable generation" and "Ramp up/down rate"

Data collected in the Must-run sheet

This worksheet contains the hourly ratios of possible generating unit based must-run criteria to be modelled in the market simulations. The data provider should fill a separate column for each different hourly curve (8760 values). In case of constant curves, please provide only the first hourly value.

To reference the defined curve, the data provider should use matching curve IDs in this sheet and in the generation unit based "Must-run curve ID" column in the new Thermal sheet.

If the reference is not correct, when uploading the file to the PEMMDB App, the file will be rejected and specific error messages will be reported in the REJECTED file. After validating the file (uploading procedure in PEMMDB App) dropdown lists will be automatically generated for the "Must-run curve ID" column in the Thermal sheet.

During the validation phase, constant timeseries or part of timeseries will be saved as a single value (i.e. 01.01-1h: 0.2, 02.01-7h: 0.3, meaning that all hours between the two timestamps have a constant value of 0.2) this will lead to having empty cells in validated excel files for the constant period.

The sheet also includes validity start and end year cells, to specify an interval of years, where the hourly curve should be considered. The defined starting and end year is included in the validity interval. The same curve ID can be used more than once if the validity intervals are not overlapping, thus defining different hourly curves for different years.

The defined curves can be referenced by more generation units. In this case these units will still be modelled independently.

The provided ratios will be multiplied by the net generating capacity of the generating unit that is referencing the curve to get the generation that must be committed on this unit. The net generating capacities used for determining the amount of must-run shouldn't include any derating effect.

Group Must-run

For thermal generation it is important to indicate so called must-run obligations, which can have many causes (heat requirements, technical, economic/subsidies/taxes, environmental, etc.) and should not be confused with minimum stable generation.

Climatic years associated with must-runs can now be selected in these sheets.

Reasons that could induce must-run obligation include:

- Network constraints (overload management, voltage control)
- Specific policies (subsidies of lignite mines)
- Minimum number of units needed to provide system services
- Heat constraints

Reasons that, in most cases, should not induce must-run obligation include:

- Fully non-dispatchable units such as biomass, waste (if unit is fully non-dispatchable, it should be specified in either the sheet "Other Non-RES")
- Low flexibility. This can be represented by other parameters such as "Minimum stable generation" and "Ramp up/down rate"

Data collected in the Group Must-run sheet

This worksheet contains the hourly ratios of possible Group-based must-run criteria to be modelled in the market simulations as well as the number of units to allocate the group must-run obligation. The data provider should fill two separate columns for each different hourly curve of must run ratio (8760 values) and units to allocate must run as they go in pairs. In case of constant curves, please provide only the first hourly value.

To reference the defined curve, the data provider should use matching curve IDs if this sheet and in the "Group based must-run curve ID" column in the Thermal sheet.

If the reference is not correct, when uploading the file to the PEMMDB App, the file will be rejected and specific error messages will be reported in the REJECTED file. After validating the file (uploading procedure in PEMMDB App) dropdown lists will be automatically generated for the "Group based must-run curve ID" column in the Thermal sheet.

During the validation phase, constant timeseries or part of timeseries will be saved as a single value (i.e. 01.01-1h: 0.2, 02.01-7h: 0.3, meaning that all hours between the two timestamps have a constant value of 0.2) this will lead to having empty cells in validated excel files for the constant period.

The sheet also includes validity start and end year cells, to specify an interval of years, where the hourly curve should be considered. The defined starting and end year is included in the validity interval. The same curve ID can be used more than once if the validity intervals are not overlapping, thus defining different hourly curves for different years.

The sheet enables the definition of the “Number of units to be used to allocate Group must-run” attribute. If provided, only this amount of units need to run to provide the calculated must-run commitment from the group must-run criteria. The attribute enables to provide must-run with only a sub-set of the generators in the group regardless of any planned or forced outage event.

The defined curves can be referenced by more unit groups. In this case these groups will still be modelled independently, but the must-run ratio values will be the same for all of them.

The generating units defined under the same group, must have the same group based must-run curve ID and the must-run criteria will be met (if possible) with the available units (which are not on planned/unplanned outage).

The provided ratios will be multiplied by the sum of net generating capacities of the generating units defined under the group to get the generation that has to be committed on the units of the group. The net generating capacities used for determining the amount of must-run shouldn’t include any derating effect.

The allocation of this MW value has the following rules: when the “Must-run units” is defined (and has to be lower than the number of units in the group): then (as an additional constraint) this value act as a minimum number units that have to be committed to at least their technical minimum generation (PMin).

Inelastic

This worksheet contains the hourly ratios of possible generating unit based inelastic profile criteria to be modelled in the market simulations. The data provider should fill a separate column for each different hourly curve (8760 values). In case of constant curves, please provide only the first hourly value.

To reference the defined curve, the data provider should use matching curve IDs in this sheet and in the generation unit based “Inelastic curve ID” column in the new Thermal sheet.

During the validation phase, constant timeseries or part of timeseries will be saved as a single value (i.e. 01.01-1h: 0.2, 02.01-7h: 0.3, meaning that all hours between the two timestamps have a constant value of 0.2) this will lead to having empty cells in validated excel files for the constant period.

If the reference is not correct, when uploading the file to the PEMMDB App, the file will be rejected and specific error messages will be reported in the REJECTED file. After validating the file (uploading procedure in PEMMDB App) dropdown lists will be automatically generated for the “Inelastic curve ID” column in the Thermal sheet.

The sheet also includes validity start and end year cells, to specify an interval of years, where the hourly curve should be considered. The defined starting and end year is included in the validity interval. The same curve ID can be used more than once if the validity intervals are not overlapping, thus defining different hourly curves for different years.

The defined curves can be referenced by more generation units. In this case these units will still be modelled independently.

The provided ratios will be multiplied by the net generating capacity of the generating unit that is referencing the curve to get the generation inelasticity on this unit. The net generating capacities used for determining the amount of inelastic profile shouldn't include any derating effect.

Derating

Derating data reflects that the total installed capacity of a unit is not always available for market optimization. Potential causes include:

- Generators providing system service reserve. If you specify a value here, do not include this in the Reserve Requirements sheet.
- Generators whose output power is limited by e.g., transmission constraints, cooling constraints, others.
- Generators using inferior quality fuel.

The default derating value is 100%, which is equal to a reduction value of 0%. TSOs should provide hourly values possibly for the entire year. In case of constant curves, please provide only the first hourly value.

The modelling of derating introduced here is independent of the forced outage modelling method also called derating. The reduction of Net Generating Capacity (NGC) introduced with this parameter is independent of the forced outage and maintenance modelling in the studies: units can still be considered unavailable in the model because of maintenance and forced outage regardless of any defined derating.

Providing data sets related to derating follows the same logic as for must-run. The two specific sheets collect the derating curves related to unit groups and individual generating units.

Data collected in the Derating sheet

To model generation constraining effects, like fuel availability and quality, inner transmission constraints, heat/cold waves etc. time-dependent derating factors can be provided for each unit that was defined on the Thermal sheet.

The Derating worksheet contains the hourly ratio curves, which can be assigned to units. The data provider should fill a separate column for each different hourly curve (8760 values). In case of constant curves, please provide only the first hourly value.

To reference the defined curve, the data provider should use matching curve IDs in this sheet and in the generation unit based “Derating curve ID” column in the new Thermal sheet.

If the reference is not correct, when uploading the file to the PEMMDB App, the file will be rejected and specific error messages will be reported in the REJECTED file. After validating the file (uploading procedure in PEMMDB App) dropdown lists will be automatically generated for the "Derating curve ID" column in the Thermal sheet.

During the validation phase, constant timeseries or part of timeseries will be saved as a single value (i.e. 01.01-1h: 0.2, 02.01-7h: 0.3, meaning that all hours between the two timestamps have a constant value of 0.2) this will lead to having empty cells in validated excel files for the constant period.

The defined curves can be referenced by more generating units. In this case these units will still be modelled independently, but the derating ratio values will be the same for all of them.

The sheet also includes validity start and end year cells, to specify an interval of years, where the hourly curve should be considered. The defined starting and end year is included in the validity interval. The same curve ID can be used more than once if the validity intervals are not overlapping, thus defining different hourly curves for different years.

The effective net generating capacity of a unit with defined derating curve is its original net generating capacity multiplied by the derating ratio value of the given hour in the simulation.

Group Derating

Derating data reflects that the total installed capacity of a unit is not always available for market optimization. Potential causes include:

- Generators providing system service reserve. If you specify a value here, do not include this in the Reserve Requirements sheet.
- Generators whose output power is limited by e.g., transmission constraints, cooling constraints, others.
- Generators using inferior quality fuel.

The default derating value is 100%, which is equal to a reduction value of 0%. TSOs should provide hourly values possibly for the entire year. In case of constant curves, please provide only the first hourly value.

The modelling of derating introduced here is independent of the forced outage modelling method also called derating. The reduction of Net Generating Capacity (NGC) introduced with this parameter is independent of the forced outage and maintenance modelling in the studies: units can still be considered unavailable in the model because of maintenance and forced outage regardless of any defined derating.

Providing data sets related to derating follows the same logic as for must-run. The two specific sheets collect the derating curves related to unit groups and individual generating units.

Data collected in the Group Derating sheet

To model generation constraining effects, like fuel availability and quality, inner transmission constraints, heat/cold waves etc. time-dependent derating factors can be provided for each unit group that was defined on the Thermal sheet.

The Group Derating worksheet contains the hourly ratio curves, which can be assigned to unit groups. The data provider should fill a separate column for each different hourly curve (8760 values). In case of constant curves, please provide only the first hourly value.

To reference the defined curve, the data provider should use matching curve IDs in this sheet and in the generation unit based "Group-based derating curve ID" column in the new Thermal sheet.

If the reference is not correct, when uploading the file to the PEMMDB App, the file will be rejected and specific error messages will be reported in the REJECTED file. After validating the file (uploading procedure in PEMMDB App) dropdown lists will be automatically generated for the "Group-based derating curve ID" column in the Thermal sheet.

During the validation phase, constant timeseries or part of timeseries will be saved as a single value (i.e. 01.01-1h: 0.2, 02.01-7h: 0.3, meaning that all hours between the two timestamps have a constant value of 0.2) this will lead to having empty cells in validated excel files for the constant period.

The defined curves can be referenced by more unit groups. In this case these groups will still be modelled independently, but the derating ratio values will be the same for all of them.

The sheet also includes validity start and end year cells, to specify an interval of years, where the hourly curve should be considered. The defined starting and end year is included in the validity interval. The same curve ID can be used more than once if the validity intervals are not overlapping, thus defining different hourly curves for different years.

The effective net generating capacity of a group of units with defined group derating curve is the sum of the original net generating capacity of the units in the group multiplied by the derating ratio value of the given hour in the simulation. If some of the units in the group are unavailable (maintenance or forced outage), the remaining units only suffer the reduction that would remain if the original reduction would have been allocated to the outage unit(s).

[Example: If one of two units (each 1'000 MW) in a derating group is on forced outage in the hour where summed max. output is 0.8, the outage comes on top and the output in the derated group is only 0.5, equalling 1'000 MW].

Min-Max Unit Maintenance

This worksheet contains the weekly maximum and minimum number of units on maintenance for each defined group (defined with a group name in the Thermal sheet). The group name should be specified in the "Curve ID" row.

The sheet also includes validity start and end year cells, to specify an interval of years, where the weekly curve should be considered. The defined starting and end year is included in the validity interval. The same group name can be associated with different columns in case the validity years are not overlapping. It can be used to reflect an evolution of the weekly curve.

Maximum and minimum curves go in pairs for each group.

Planned Outages

This worksheet contains the exact dates of planned outages – it can serve both short term and more long-term studies. For each generating unit to be considered, represented the generating unit name from the Thermal sheet, several planned outage windows can be specified. The format of the date should be dd/mm/yyyy in a text cell format.

For each planned outage, the ratio of capacity on outage can be provided. A ratio of 1 mean that all the capacity is on maintenance. If the cell is left empty, it will be a ratio of 1 will assumed.

“Reason planned outage” can be selected for further explanation.

It is possible to set entire maintenance profiles by reporting each individual outage using as many rows as necessary. It is also possible to report outages of some units only, meaning a partial maintenance profile of the generation fleet.

Planned outage refers to the scheduled maintenance that power plants need to undergo periodically.

The planned outage for each power plant can be scheduled in 3 ways:

1. Maintenance schedule in Planned Outage sheet
2. Exclusion period for maintenance optimisation in Thermal sheet
3. If no data is provided in Thermal and Planned Outages, planned outages will be entirely optimised centrally

In the Thermal sheet there are two optional parameters called:

- Maintenance optimization exclusion period – start year
- Maintenance optimization exclusion period – end year

This information is used to exclude certain thermal units from endogenous maintenance calculations. Maintenance will not be calculated through an optimization process for that thermal unit from year “Maintenance optimization exclusion period – start year” until “Maintenance optimization exclusion period – end year”, both inclusive. It is expected that a maintenance profile is provided in the Planned Outages sheet for the period in which the thermal unit is excluded from endogenous maintenance calculations.

If no maintenance profile is provided in the Planned Outages sheet for the period in which the thermal unit is excluded from endogenous maintenance calculations, such unit will not be assigned with any maintenance profile within that period. The maintenance schedule in the Planned Outages sheet has the highest hierarchy and such profiles will be taken into account for the corresponding target years, regardless if the target years are included or not in the "Maintenance optimization exclusion period".

Thermal Expansion Constraints

This table represents the maximum quantity of capacity that could be built in each future year for each fuel/technology type, given the unique set of constraints associated with each region (PECD zone) and with the development of each fuel/technology type. These constraints should be provided only when legally binding or with very strong policy backing.

A source/reference for the constraint must be provided.

Reserves Requirements

Reserve data will be gathered for each market zone. In this worksheet, the operational reserves requirements should be provided while avoiding risk of double-counting.

In the Reserve Requirements sheet you are asked to provide information related to reserve requirements and information useful to decide how to model it.

Note: the aggregated FCR and FRR thermal requirement submitted by TSO LACs as additional to the unit-by-unit derating (already provided in Thermal sheet), will be accounted in ERAA through a central approach defined by the ERAA MST team. This proposal will be based on derating the capacity of the units of each fuel type proportionally to the fuel type share of the total installed thermal capacity. The derating will not affect any must-run requirements.

To reduce the risk of further iteration linked to the need of clarification on how to model reserve requirements, we also ask a recommendation of how reserves requirements should be modelled in case of simulation of Day Ahead market. This clarification is particularly important for hydro dominated country:

- Additional load – this option could be preferred in case there are concern related to the availability of Reserves due to energy constraints (e.g. if reserve is provided mainly by hydro and you want to be sure to ’keep enough water in the reservoir’).

- Reduction of turbining capacity – if the constraint is more represented more accurately by generating capacity than by water availability (also in order to reduce the impact on marginal price of DA) it is better you impose a constraint to hydro generating output.

Frequency Containment Reserves (FCR)

FCR comprises of operational reserves which are activated to contain system frequency after an incident inside a pre-defined band. FCR are based on the automated, decentralised response of the governor controls on individual generators with a full activation time of 10-30 seconds. Please divide FCR’s requirements in:

- FCR that need to be made available by thermal. From a modelling perspective, this information would allow to constrain unit commitment to ensure (together with information provided in the “FCR capacity ratio” column of the Thermal sheet) that these requirements will be respected. Please provide as free text if some thermal units cannot provide FCR

- FCR that will be procured by Hydro

- FCR available from Demand (reduction of demand possible thanks to specific contract to cope with system imbalances; while DSR would work on the DA & ID, here only interruptible contract activated to contain system frequency should be considered). In case of systems imbalance this part of demand will be curtailed.

Frequency Restoration Reserves (FRR)

FRR comprises of operational reserves used to restore system frequency to its nominal value and, where applicable, the power balance to the scheduled value. FRR consists of manually-instructed services (manual FRR) as well as automatically instructed services (automatic FRR). The latter are based on the centralised control of specific generating units or loads. To model FRR requirements in adequacy assessment, or in future balancing market, you are asked to specify:

- FRR that will be procured by thermal (unit commitment of thermal units able to provide FRR considers this requirements); This will be modelled in using different methods: either as ‘additional load’ by imposing in the unit commitment the respect of this constraints for the units able to provide FRR. Please indicate in "Thermal" sheet if some unit cannot provide FRR

- FRR that will be procured by Hydro

Planned Outages

This worksheet contains the exact dates of planned outages – it can serve both short term and more long-term studies. For each generating unit to be considered, represented the generating unit name from the Thermal sheet, several planned outage windows can be specified. The format of the date should be dd/mm/yyyy in a text cell format.

For each planned outage, the ratio of capacity on outage can be provided. A ratio of 1 mean that all the capacity is on maintenance. If the cell is left empty, it will be a ratio of 1 will assumed.

“Reason planned outage” can be selected for further explanation.

It is possible to set entire maintenance profiles by reporting each individual outage using as many rows as necessary. It is also possible to report outages of some units only, meaning a partial maintenance profile of the generation fleet.

Planned outage refers to the scheduled maintenance that power plants need to undergo periodically.

The planned outage for each power plant can be scheduled in 3 ways:

1. Maintenance schedule in Planned Outage sheet
2. Exclusion period for maintenance optimisation in Thermal sheet

3. If no data is provided in Thermal and Planned Outages, planned outages will be entirely optimised centrally

In the Thermal sheet there are two optional parameters called:

- Maintenance optimization exclusion period – start year
- Maintenance optimization exclusion period – end year

This information is used to exclude certain thermal units from endogenous maintenance calculations. Maintenance will not be calculated through an optimization process for that thermal unit from year “Maintenance optimization exclusion period – start year” until “Maintenance optimization exclusion period – end year”, both inclusive. It is expected that a maintenance profile is provided in the Planned Outages sheet for the period in which the thermal unit is excluded from endogenous maintenance calculations.

If no maintenance profile is provided in the Planned Outages sheet for the period in which the thermal unit is excluded from endogenous maintenance calculations, such unit will not be assigned with any maintenance profile within that period. The maintenance schedule in the Planned Outages sheet has the highest hierarchy and such profiles will be taken into account for the corresponding target years, regardless if the target years are included or not in the "Maintenance optimization exclusion period".

Renewables

Renewables and hydro data should be provided Plant-by-Plant and not unit-by-unit.

The most important points are:

- **Rooftop PV values will not be considered by the DFT and have to be provided in the PEMMDB as installed capacity.**
- For all plants (except Wind and Solar types) reported in the Renewables sheet, a Curve ID must be defined and a curve (= timeseries) provided in the Other RES hourly sheet. Different plants can be linked to the same timeseries, which is handled by providing the respective Curve ID for each plant.
- The geographic location of plants, is mandatory on a PECD zone level. This is crucial for the correct link between PECD capacity factors and installed capacity.
- Hydro reservoirs are collected as separate objects in the Hydro Reservoirs sheet. The link between reservoirs and plants is done by providing the reservoir name the plant is connected

to in the hydro sheet. In the model, all head and all tail reservoir capacity will be aggregated per technology. cascaded are not being modelled.

Renewables

Renewables and hydro data should be provided Plant-by-Plant and not unit-by-unit. For future volumes, if no details are available, data can be provided aggregated at PECD zone level.

The most important points are:

- For all units (except Wind and Solar types) reported in the Renewables sheet, a Curve ID must be defined and a timeseries provided in the Other RES hourly sheet. Many units can use the same timeseries, so there is no need for unique curves – this will limit the efforts needed by Correspondents to provide the output profile of renewable plants.
- Geographic location of plants, at least defining the PECD region, is now needed. This will be extremely important for any zonal modelling approach.
- Hydro reservoirs are now collected as separate objects in the Hydro Reservoirs sheet. The link between reservoir and plants is done by using the reservoir name in the Hydro sheet.

The Renewables sheet aims to collect more granular renewable capacities:

- The resolution of the renewable power plants representation is increased to generating unit level, with the ability to create the hierarchy of generating units under groups.
- The time horizon of the renewables data collected is not tied to a single year with this format. Instead, we collect the expected commissioning and decommissioning dates available for the plants/units available now and expected to be available in the future. This means that a scenario (e.g. in TYNDP) with different time horizons will only have one Renewables data sheet that covers all study years for that scenario.
- Geographic location of plants, at least defining the PECD region, is now needed. This will be extremely important for any zonal modelling approach.
- Information regarding connectivity of plants in the Network Model, closing the gap between market and network models. As for the geographic location of plants, this will be extremely useful for any zonal modelling approach.
- Not defined or splitting not known RES technologies are collected in the Renewables sheet.

Indication on mandatory and optional fields can be found in the templates. Indication on default values is available in the Fields guidelines.

Other RES hourly

The Other-RES hourly worksheet contains the hourly ratio curves, which can be assigned to individual units. The data provider should fill a separate column for each different hourly curve (8760 values). In case of constant curves, please provide only the first hourly value.

To reference the defined curve, the data provider should use matching curve IDs in this sheet and in the generation unit based “Curve ID” column in the Renewables sheet.

If the reference is not correct, when uploading the file to the PEMMDB App, the file will be rejected and specific error messages will be reported in the REJECTED file. After validating the file (uploading procedure in PEMMDB App) dropdown lists will be automatically generated for the “Curve ID” column in the Renewables sheet.

During the validation phase, constant timeseries or part of timeseries will be saved as a single value (i.e. 01.01-1h: 0.2, 02.01-7h: 0.3, meaning that all hours between the two timestamps have a constant value of 0.2) this will lead to having empty cells in validated excel files for the constant period.

The defined curves can be referenced by more generating units.

The sheet also includes validity start and end year cells, to specify an interval of years, where the hourly curve should be considered. The defined starting and end year is included in the validity interval. The same curve ID can be used more than once if the validity intervals are not overlapping, thus defining different hourly curves for different years.

The effective net output of a unit with defined hourly curve is its original net generating capacity multiplied by the ratio value of the given hour in the simulation.

Hydro

The Hydro sheet aims to collect more granular hydro capacities. The resolution of the hydro power plants representation is increased to generating unit level, with the ability to create the hierarchy of generating units under groups (river cascades).

Indication on mandatory and optional fields can be found in the templates. Indication on default values is available in the Fields guidelines.

Hydro Reservoirs

The Hydro reservoir sheet aims to collect more granular reservoir capacity data. Hydro reservoir units listed in the Hydro reservoir sheet shall be properly referenced in the “Head reservoir name” and “Tail reservoir name” columns in the Hydro sheet.

If the reference is not correct, when uploading the file to the PEMMDB App, the file will be rejected and specific error messages will be reported in the REJECTED file. After validating the file (uploading procedure in PEMMDB App) dropdown lists will be automatically generated for the "Head reservoir name" and "Tail reservoir name" columns in the Hydro sheet.

Offshore/Onshore Technology Evolution

These sheets show the evolution of different onshore and offshore technologies over the coming years for each PECD zone. The values are ratios and the sum of values for each year should be equal to 1.

These sheets are pre-filled with assumed values. These can be retained or updated.

Ratios refer to the mix of capacity increment over that year. More precisely, it is a mix over the previous year (i.e. 2021 capacity mix is valid for all wind additions from 1 January 2020 until 31 December 2020).

Example Ratio (provided by TSOs):

TECH\YEAR	2020	2021	2022
EXISTING	1	0	0
A	0	1	0
B	0	0	1

Example capacities:

TECH\YEAR	2020	2021	2022
TOTAL CAPACITY (PROVIDED BY TSOS)	10	11	11
EXISTING (COMPUTED BY US)	10	10	10
A (COMPUTED BY US)	0	1	1
B (COMPUTED BY US)	0	0	0

Using these capacities of individual technologies PECD files are created – a single file for onshore wind and a single file for offshore.

Electrolysers, Fuel cells, Batteries and Demand Side Response

All relevant info of Electrolysers, Fuel Cells, Batteries and DSR units are collected in this file.

Electrolysers

Electrolysers and Power-to-heat units are collected in the Electrolysers sheet.

Electrolysers

Demand for hydrogen is assumed to be equal to the installed capacity of electrolysers, i.e. it is a flat demand band. The hydrogen demand can be fulfilled either by operating electrolysers, or by steam-methane reforming. If the electricity price is below a certain threshold, electrolysers are covering the hydrogen demand. If the electricity price exceeds the threshold, steam-methane reforming processes are covering the hydrogen demand, implying no additional electricity demand. The threshold price is defined based on the price of hydrogen in the respective target year, which will be obtained from scenario building team, and the efficiency of electrolysers.

Power-to-heat

Power-to-heat (P2H) is considered as any industrial process which uses electricity to generate heat (e.g. district heat pumps). They have been introduced in the modelling of ERAA 2024 as for several countries across Europe these processes are or will become a significant part of power consumption in their electricity mix. In order to account for these units, a simplified data collection has been added to the PEMMDB.

Power-to-heat are modelled as price-responsive buyers with dynamic demand: they are consumer units which buy electricity when the price of the electricity is below a threshold activation price and they can buy up to a certain capacity (derived from the heat profile at a certain hour in the system). Both the activation price and the heat profile should be provided by the TSOs who wish to have power-to-heat units modelled in their systems.

If a unit is P2H, the following steps needs to be followed:

- In the "Electrolyser or Power-to-heat?" select Power-to-heat
- In the "Activation price (if power-to-heat)" column add the threshold activation price

In the Electrolysers Derating sheet you can define a derating curve for the power-to-heat unit (based on the heat profile of the unit) to be referenced in the “Derating curve ID” column of the Electrolysers sheet.

H2 Storage

Quantity of stored hydrogen connected to fuel cell units. Fuel cells can be supplied by either stored hydrogen or directly by an electrolyser.

Must-run

For Electrolyser and Fuel Cells it is important to indicate so called must-run obligations, which can have many causes (heat requirements, technical, economic/subsidies/taxes, environmental, etc.) and should not be confused with minimum stable generation.

Climatic years associated with must-runs can now be selected in these sheets.

Reasons that could induce must-run obligation include:

- Network constraints (overload management, voltage control)
- Minimum number of units needed to provide system services

Reasons that, in most cases, should not induce must-run obligation include:

- Fully non-dispatchable units
- Low flexibility. This can be represented by other parameters such as "Minimum stable generation" and "Ramp up/down rate"

Data collected in the Must-run sheet

This worksheets contain the hourly ratios of possible generating unit based must-run criteria to be modelled in the market simulations. The data provider should fill a separate column for each different hourly curve (8760 values). In case of constant curves, please provide only the first hourly value.

To reference the defined curve, the data provider should use matching curve IDs in this sheet and in the generation unit based "Must-run curve ID" column in the Electrolysers and Fuel Cells sheets.

If the reference is not correct, when uploading the file to the PEMMDB App, the file will be rejected and specific error messages will be reported in the REJECTED file. After validating the file (uploading procedure in PEMMDB App) dropdown lists will be automatically generated for the "Must-run curve ID" column in the Electrolysers and Fuel Cells sheet.

During the validation phase, constant timeseries or part of timeseries will be saved as a single value (i.e. 01.01-1h: 0.2, 02.01-7h: 0.3, meaning that all hours between the two timestamps have a constant value of 0.2) this will lead to having empty cells in validated excel files for the constant period.

The sheet also includes validity start and end year cells, to specify an interval of years, where the hourly curve should be considered. The defined starting and end year is included in the validity interval. The same curve ID can be used more than once if the validity intervals are not overlapping, thus defining different hourly curves for different years.

The defined curves can be referenced by more generation units. In this case these units will still be modelled independently.

The provided ratios will be multiplied by the net generating capacity of the generating unit that is referencing the curve to get the generation that must be committed on this unit. The net generating capacities used for determining the amount of must-run shouldn't include any derating effect.

Ineslastic

This worksheet contains the hourly ratios of possible generating unit based inelastic profile criteria to be modelled in the market simulations for Electrolysers and Fuel cells. The data provider should fill a separate column for each different hourly curve (8760 values). In case of constant curves, please provide only the first hourly value.

To reference the defined curve, the data provider should use matching curve IDs in this sheet and in the generation unit based “Inelastic curve ID” column in the Electrolysers and Fuel Cells sheets.

If the reference is not correct, when uploading the file to the PEMMDB App, the file will be rejected and specific error messages will be reported in the REJECTED file. After validating the file (uploading procedure in PEMMDB App) dropdown lists will be automatically generated for the “Inelastic curve ID” column in the Electrolysers and Fuel Cells sheet.

The sheet also includes validity start and end year cells, to specify an interval of years, where the hourly curve should be considered. The defined starting and end year is included in the validity interval. The same curve ID can be used more than once if the validity intervals are not overlapping, thus defining different hourly curves for different years.

The defined curves can be referenced by more generation units. In this case these units will still be modelled independently.

The provided ratios will be multiplied by the net generating capacity of the generating unit that is referencing the curve to get the generation inelasticity on this unit. The net generating capacities used for determining the amount of inelastic profile shouldn’t include any derating effect.

Derating

Derating sheets are provided for Electrolysers, Fuel Cells and Demand Side Response (DSR). Derating data reflects that the total installed capacity of a unit is not always available for market optimization. Potential causes include:

- Generators whose output power is limited by e.g., transmission constraints, cooling constraints, others.
- Generators using inferior quality fuel.

The default derating value is 100%, which is equal to a reduction value of 0%. TSOs should provide hourly values possibly for the entire year. In case of constant curves, please provide only the first hourly value.

The modelling of derating introduced here is independent of the forced outage modelling method also called derating. The reduction of Net Generating Capacity (NGC) introduced with this parameter is independent of the forced outage and maintenance modelling in the studies: units can still be considered unavailable in the model because of maintenance and forced outage regardless of any defined derating.

Providing data sets related to derating follows the same logic as for must-run. The two specific sheets collect the derating curves related to unit groups and individual generating units.

Batteries

Market participating battery storage capacities should be provided in the Batteries sheet. Market participating batteries will be explicitly modelled. Non-market participating batteries capacities are collected in the PEMMDB Demand input file and are used as input for the Demand Forecasting Toolbox (DFT) for demand profile calculation. Non-market participating batteries capacities should NOT be included in the Batteries sheet.

For the zonal splitting, it is expected an approximation of the split of the capacities reported for all technologies. As it doesn't differentiate between technologies, an approximation is enough. This is now a yearly attribute, and values have been copied to all years based on single value previously provided by TSO. The sum of the ratios must be equal to 1.0 for each year.

Demand Side Response

Demand Side Response (DSR) should now be provided through this unique worksheet, containing the capacity evolution, the activation price (EUR/MWh), the maximum number of hours to be used per day (if there are some constraints).

Please note that DSR refers to the capacity of demand reduction available on the market (user NOT willing to pay more than activation price). This demand reduction should be price-responsive, and will be used in the market models when price rises above the value denoted in the activation price. The activation price should be defined based on a forecast of future prices, rather than current prices.

TSOs have the option to give an hourly profile of availability (DSR Derating), since for example some demand might not be available for reduction at night-time. Profiles should assume that 1 January is a Monday. If the value does not change, and the same amount of DSR is expected to be available, TSOs do not need to provide a derating profile. If a DSR Derating curve is provided the Curve ID should be properly referenced in the "Derating curve ID" column of the DSR sheet.

TSOs should note that the available demand response is additive across each unit. Also, since the demand side response represents negative demand bidding into the market, it represents demand already included in the forecasted demand profile.

The DSR Sheet now accommodates information regarding DSR in Redispatch phase!

If a DSR unit is only available either in Redispatch or Day-Ahead phase, TSO should indicate a price of -1 for the unavailable phase.

DSR Expansion Constraints

On top of the national DSR Potentials that are taken from CONE studies, TSOs have the ability to provide expansion constraints for DSR in this sheet. However, CONE studies will always have first priority over TSO-submitted constraints, therefore this sheet will not be taken into account if a CONE study exists for the Member State.

Fuel Cells

Fuel Cells are now collected in a dedicated sheet.

Hourly ratios of possible generating unit based must-run, derating and inelastic profiles should be provided in the dedicated sheets (Fuel Cells Derating, Fuel Cells Inelastic and Fuel Cells Must-run) and be properly referenced in Fuel Cells sheet through the “Derating curve ID”, “Inelastic curve ID” and “Must-run curve ID” columns.

NTCs and Exchanges

Net Transfer capacities (NTC) and Exchanges with non-explicitly modelled areas/countries are now collected in the same file.

Transfer Links

The Transfer Links sheet aims to collect technical specifications of the concerned interconnections. Indication of the type of transfer link shall be reported in the “Transfer Type” column (i.e. NTC, Exchange).

To reference the profiles defined in the NTCs and Exchanges sheets, the data provider should use matching curve IDs in the “NTC curve ID” and “Exchange flow curve ID” columns of the Transfer Links sheet and in the “Curve ID” data point of the NTCs and Exchanges sheets.

If the reference is not correct, when uploading the file to the PEMMDB App, the file will be rejected and specific error messages will be reported in the REJECTED file. After validating the file (uploading procedure in PEMMDB App) dropdown lists will be automatically generated for the “NTC curve ID” and “Exchange flow curve ID” columns of the Transfer Links sheet.

In case of static NTCs profiles, the static NTC value should be provided in the “Static limit NTC” column of the Transfer Links sheet and no curve should be provided in the NTCs sheet.

Net Transfer Capacities

TSOs will be asked to fill in the template with their best estimate/ best forecast (neither conservative nor optimistic) consulting lists of projects as well as the NTC values that were used in previous data collections.

To reference the profiles defined in the NTCs sheet, the data provider should use matching curve IDs in the “NTC curve ID” column of the Transfer Links sheet and in the “Curve ID” data point of the NTCs sheet.

If the reference is not correct, when uploading the file to the PEMMDB App, the file will be rejected and specific error messages will be reported in the REJECTED file. After validating the file (uploading procedure in PEMMDB App) dropdown lists will be automatically generated for the “NTC curve ID” column of the Transfer Links sheet.

During the validation phase, constant timeseries or part of timeseries will be saved as a single value (i.e. 01.01-1h: 0.2, 02.01-7h: 0.3, meaning that all hours between the two timestamps have a constant value of 0.2) this will lead to having empty cells in validated excel files for the constant period.

Additional constraints will possibly be imposed by TSOs in the Transfer Limits and Limits sheets.

Exchanges

The Exchanges sheet aims to collect hourly profiles for every market node with connections to non ENTSO-E countries.

The PEMMDB database does not contain data regarding the generation portfolio, demand and other parameters necessary to model the countries of the non ENTSO-E region, hence it is not possible to model the exchanges with these countries in the standard way (e.g. explicitly). For this reason, the exchanges are not an output of the simulation driven by the market, but are input to the model in the form of annual hourly data series.

Therefore, hourly timeseries of the estimated overall power (MW) that would be exchanged with all the countries outside the ENTSO-E region under regular market conditions from an economic standpoint (market competition) must be provided. The value is positive if the flow is a net import (i.e. the ENTSO-E member country imports from the non-ENTSO-E neighbour) and negative if it is a net export. The sum of the 8760 values represents the expected overall net amount of energy annually exchanged with countries outside the ENTSO-E region.

To reference the profiles defined in the NTCs sheet, the data provider should use matching curve IDs in the “Exchanges curve ID” column of the Transfer Links sheet and in the “Curve ID” data point of the Exchanges sheets.

If the reference is not correct, when uploading the file to the PEMMDB App, the file will be rejected and specific error messages will be reported in the REJECTED file. After validating the file (uploading procedure in PEMMDB App) dropdown lists will be automatically generated for the “Exchanges curve ID” column of the Transfer Links sheet.

How to build the hourly data series

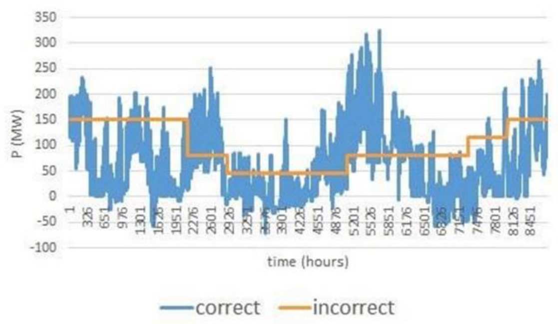
If the required exchanges are related to the border, which is in operation at present, the hourly time series should be built based on the real operation, using information about the real commercial flows on that border as a base. It is important to account, to the possible extent, for the dependency of commercial exchanges/flows on fluctuation caused by the alternation of seasons (winter/summer), changing of the load within a day (peak/off-peak), and switching-off of related systems/equipment for the reasons of outages/regular annual maintenance or others.

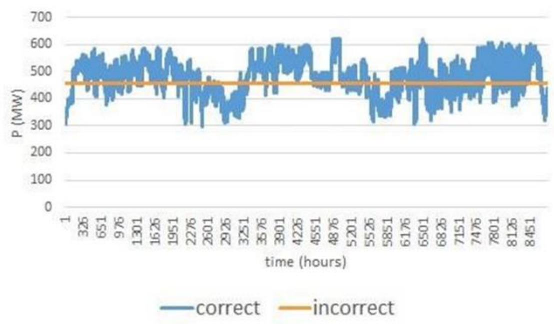
For simplicity, the typical behaviour of the real exchanges should be kept even if future interconnection development project which might influence on these exchanges, is expected to be realised within the time frame considered.

Some countries interconnected via non ENTSO-E countries (e.g., Slovakia-Hungary Romania via Ukraine; Estonia-Latvia via Russia) may affect each other's exchanges. If they do, TSOs of these countries should cooperate during the process of building these hourly timeseries to keep the correlation between these exchanges (e.g., build the exchanges on the base of the real exchanges from the same commonly agreed year).

If the required exchanges are related to a border which does not exist on the present, it is not possible to build the exchanges based on the real operation, and it is up to the TSO to build the exchanges profile based on his/her best estimate. However, it is important to keep in mind that the profile should not gain the shape of a line with the constant power in all year long, unless such exchanges are really expected. This may be the case for DC connections, but not for AC connections connecting two meshed systems, where constant exchanges are not likely to occur. TSOs having their own market simulation tool may build the exchanges by their internal market simulation. In this case, similar data sets should be used for both market assessments and adequacy modelling.

Simulated exchanges should be similar to real exchanges.





Transfer Limits

The Transfer Limits sheet aims to collect specificities of the country level limits to power exports and imports.

In case of static limits, the static value of the limit should be reported in the "Static limit capacity" column of the Transfer Limits sheet and no hourly values should be provided in the Limits sheet.

In case of dynamic limits, hourly values should be provided in the Limits sheet under a curve ID properly referenced in the "Exchange limit curve ID" column of the Transfer Limits sheet.

Limits

The Limits sheet aims to collect hourly profiles of country level limits to power exports and imports.

To reference the profiles defined in the Limits sheet, the data provider should use matching curve IDs in the "Exchange limit curve ID" column of the Transfer Limits sheet and in the "Curve ID" data point of the Limits sheet.

If the reference is not correct, when uploading the file to the PEMMDB App, the file will be rejected and specific error messages will be reported in the REJECTED file. After validating the file (uploading procedure in PEMMDB App) dropdown lists will be automatically generated for the “Exchange limit curve ID” column of the Transfer Limits sheet.

During the validation phase, constant timeseries or part of timeseries will be saved as a single value (i.e. 01.01-1h: 0.2, 02.01-7h: 0.3, meaning that all hours between the two timestamps have a constant value of 0.2) this will lead to having empty cells in validated excel files for the constant period.

An example on limitations can be found bellow:

Let’s suppose we have country A connected to B and C via NTC connections e.g. A-B =1000MW and A-C = 1000MW.

The theoretical MAX total simultaneous export/import can be 1000MW + 1000MW = 2000MW. However, it might not be possible to have the two NTC links at full export simultaneously so the ‘Gross Export limitation’ B◊A + C◊A can be less, let’s say 1800MW. This is the maximum simultaneous Export that B/C are able to provide simultaneously and together to A. Furthermore, there might be a second limitation on how much A can actually import B + C◊A, which could still be less than the ‘Gross import limit’ since country A cannot manage import levels higher than ‘Net import limit’. The latter is typically related to the minimum amount of inertia that country A needs to maintain i.e., minimum number of units running (spinning) in their system for the system to be operationally stable & running within operational safe levels.

Demand

Demand data will NOT be validated through PEMMDB app for the European Resource Adequacy Assessment 2024 data collection. They will be for future data collections, starting from SO2024.

Yet, there are a few key elements to remember about the functioning of the Demand Forecasting Toolbox (DFT):

1. Losses are not automatically calculated by DFT and MUST be included in total demand (row 80 of the Annual Demand sheet of the DFT PEMMDB input file).
2. The modelling of heat pumps (HP) and electric vehicles (EV) in the DFT only aims at influencing the shape of the time series. In other words, no matter the volume of HP and EV, curves are rescaled to meet total demand (row 80).
3. Rooftop PV values must be consistent with PEMMDB values.
4. PECD4.1 climate input data must be used to forecast the demand time series, even if the DFT is not used.