Calibration Report T-4 CRM auction 2026-2027

Explanatory note

Version 2

1. Introduction

This explanatory note should be read in conjunction with the calibration report related to the Delivery Period 2026-27, submitted by Elia to the Minister of Energy, the CREG and the Directorate-General for Energy of the FPS Economy on 15 November 2021, and published on its website[1].

It has the objective of providing further information and insight into the parameters calculated for the upcoming auction, as well as highlighting the main input changes (methodological and assumptions) and related differences in results when comparing this calibration report with the report issued for the Y-4 CRM Auction for the Delivery Period 2025-2026.

2. Summary conclusions

For each CRM auction, a number of parameters have to be determined in preparation of the auction itself. We can roughly distinguish three groups of parameters:

- Parameters determining the **demand volume** to be fulfilled in the auction, such as the peak electrical demand, reserve needs, and average ENS at scarcity
- Parameters influencing the **supply volume** participating to the auction, such as the non-eligible volume, the cross-border contribution and the derating factors
- **Price parameters** linked to the auction, such as (intermediate) price caps, strike price, etc.

All of these parameters are a result of simulations and assessments, which are based on input hypotheses determined by the Minister in the "Reference Scenario". Given that these input parameters can and will evolve between auctions, it is to be expected that also the auction parameters will change from one auction to the next.

However, between the previous Y-4 auction and the upcoming Y-4 auction, a more fundamental change took place in the methodology of determining the auction parameters. In October 2020, ACER adopted a new methodology for the European Resource Adequacy Assessment, which also influences the methodology applied to determine the CRM auction parameters, and more in particular the parameters related to demand and supply volumes, as Elia fully implemented the changes required at the European level.

Climate database

All auction parameters are determined through probabilistic analyses, where a large set of "possible situations" is constructed and simulated to yield average parameters that are robust over this large set of potential situations. Next to the construction of different "outage patterns" of the transmission grid, the most important variables are the weather conditions, given that potential scarcity issues are heavily

[1] http://www.elia.be/-/media/project/elia/elia-site/users-group/ug/adequacy-working-group/2021/20211223_dy2026---y-4-auction---calibration-report_v3_without_annex_psp_with_erratum.pdf

determined by situations of (low) temperatures and reduced RES infeed in Belgium and neighboring countries.

Therefore, the methodological evolution that has the deepest impact on the auction parameters is the evolution of the climate database applied for the simulations. While for the previous calibration report, an historical climate database containing the 35 most recent available years was used, for the current calibration report a switch was made to a forward-looking climate database taking into account the effects of climate change. This switch was made following the adoption of the new ERAA methodology and upon general stakeholder request, and was implemented in cooperation with a renowned meteorological institute, Météo France.

The main difference between the new and the old climate database are the probability of occurrence, the severity and the duration of cold spells. With the new database taking into account climate change, cold spells have typically become significantly shorter on average. Translated to scarcity periods, we see that those have similarly become shorter, and much more concentrated around mostly the evening peak consumption (roughly between 17h and 19h), while previously we saw scarcity periods spanning nearly a full working day.

Demand volume parameters

This effect firstly impacts the **electrical consumption** that needs to be covered through the CRM. As this parameter reflects the average consumption in Belgium over all simulated scarcity hours, this value has increased with roughly 500 MW due to the scarcity periods being more concentrated around the evening peak load hours, leading to a higher average load when compared to taking the average over a full working day, with lower loads during day hours.

This demand volume is adjusted by adding the upward reserve needs and subtracting average Energy Not Served (ENS) during scarcity periods. The **reserve needs** (and therefore the demand volume as well) increased with 200 MW, both due to the assumed commissioning of a first batch of new offshore wind generation in the Princess Elisabeth zone, and the reduction of reserve capacity counted upon from abroad, given the assumption that all import capacity into Belgium will already be used by market parties in times of scarcity.

The Reliability Standard for Belgium is defined at 3 hours of loss of load on average. Obviously, the electricity consumption that is not covered at these times of scarcity (the “ENS”) therefore also should not be contracted in the CRM auction, and should be deducted from the demand volume. The **average ENS** decreased with ca. 200 MW, leading to an increase by 200 MW of the demand volume. This reduction is linked to the evolution in derating factors of energy-limited technologies, which we will come back to later.

All impacts combined, we notice an increase of about 900 MW in the total demand volume for the CRM auction compared to the T-4 auction for 2025-2026.

Supply volume parameters

On the supply side, the adjusted climate database also has an important impact. Existing and new capacities contribute to covering the demand volume according to their "derating factor". This factor adjusts the nominal capacity of all technologies depending on how they contribute at times of scarcity, by calculating their average simulated output over all scarcity periods.

Given that, as explained above, scarcity periods have become much shorter on average, the **contribution of energy-limited technologies** such as Demand Side Response, Batteries and Pumped Storage increases significantly. For example, a Demand Response Capacity of 100 MW that can be activated for 4 hours was counted for 36 MW in the previous auction, while in the upcoming auction it will count for 68 MW, nearly doubling its contribution. This results in the fact that for the same demand volume in the auction, less physically installed capacities need to be contracted to fulfil the need.

Finally, the last impacting change occurs on the level of the **cross-border contribution** (import) that Belgium can count upon at times of scarcity. This contribution has decreased with approximately 500 MW compared to previous calibration, while the distribution over Belgian borders has changed as well. These differences are mainly due to changing international scarcity patterns. As the cross-border contribution of a given country to Belgium's Security of Supply is mostly governed by the probability of simultaneous scarcity events between the concerned country and Belgium, due to an increased probability of such simultaneous scarcity events, the overall cross-border contribution went down.

Bottom-line impact on the need for new capacities

All in all, it is key to look at the combined effect of all these changes on the need for new capacity to be contracted through the CRM auctions. For this exercise, we make abstraction of the distribution between T-4 and T-1 auctions, and determine the combined need for new capacity between delivery years 2025-2026 and 2026-2027.

This comparison is depicted in the figure below. On the one hand, the demand volume (target volume, as defined in the Royal Decree) increased from 13 767 MW to 14 691 MW. On the other hand, the summed contribution of all existing and foreseen domestic capacities (RES, CHP, Storage & DSR[2] (incl. E-pact ambitions), thermal) and cross-border capacities increased from 10 593 MW to 11 483[3] MW[4]. Combined, this results in an expected need for new capacities to be contracted to have remained roughly stable between the two auction horizons.

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[2] For DSM shifting, an availability of 3h was considered.
[3] Note that this estimation takes into account art. 4bis for Seraing ST (170 MW of installed capacity), as well as the confidential feedback received from Engie during the public consultation (increase of capacity for St Ghislain from 350 to 386 MW and Coo extension, leading to a turbining capacity of 1161 MW). The figures and excel attached take into account those updates.
[4] Note that the derating factors from the CRM calibration reports have been used in order to generate the graph from Figure 1.

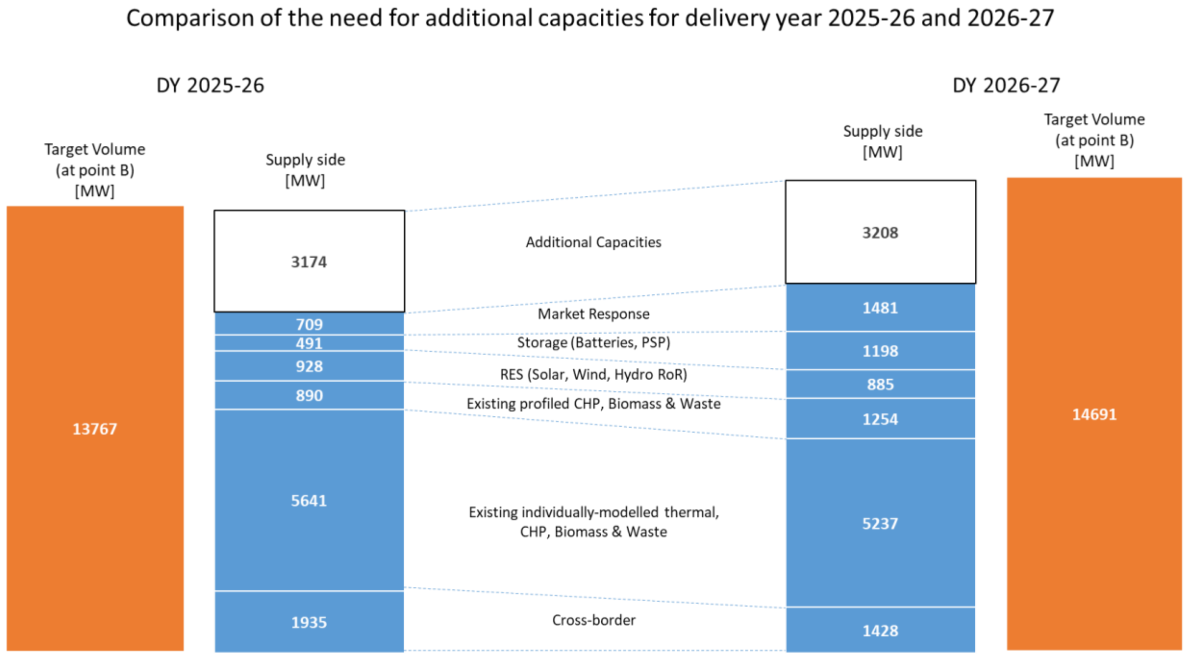

Figure 1: Remaining need for additional capacities for target years 2025-26 and 2026-27

Estimation of the T-4 demand and supply volumes

Going one step further, we can also estimate the auction volume and the contracted supply volumes for the upcoming T-4 auction. The final auction volume is determined by starting from the demand volume (consumption + reserve needs - average ENS), and subtracting the already contracted capacity in T-4 2025-26 through multi-year contracts, the reserved cross-border capacity, the 200h reservation and the non-eligible capacity. The table below gives an overview of these values for the target auction volume (the so-called 'point B'). Regarding the non-eligible capacity, a fork is given, as the final non-eligible volume can only be determined after the auction prequalification phase[5]. This exercise finally leads to an estimated T-4 auction demand volume between 7663 MW and 8072 MW. In comparison, last year's T-4 auction demand volume equaled 8365 MW.

Consumption + Reserve needs – ENS (point B)	**14691 MW**	
Already contracted capacity through multi-year contracts	-1641 MW	
Reserved cross-border capacity	-1428 MW	
200h reservation	-1264 MW	
Non-eligible capacity	-2286 MWd	-2695 MWd

[5] The lower value of the fork for the non-eligible capacity includes all capacities for which information was given to Elia that other subsidy streams exist; the upper value adds to this value also the capacities for which no information was given to Elia, and those that potentially could receive other subsidy streams.

T-4 auction demand volume (point B)	8072 MW	7663 MW

We can complete the exercise by giving some insights into what could be expected on the auction supply side. We can take two approaches for this exercise. First we'll assume that all capacities that are deemed existing in the system participate to the T-4 auction (through explicit offers or through an OPT-OUT IN). The table below shows the numbers for the estimated non-eligible capacity of 2286 MWd. Any delta on the non-eligible capacity will result in an equal, but opposed delta in the existing capacities, and will therefore not affect the estimated T-4 new capacities.

T-4 auction demand volume (point B)	8072 MW
Existing thermal capacities	5032 MWd
Existing hydro capacities (incl. pumped storage)	1010 MWd
Existing & foreseen storage & DSR (incl. E-pact ambitions)	1726 MWd
Estimated T-4 new capacities	304 MWd

However, a second approach could also be followed. If we take into account the experience from the first T-4 auction, we notice that not all existing capacities participated to the auction (via explicit offers or via an OPT-OUT IN). If we approach the exercise from the angle that similar capacities participate to the upcoming T-4 auction as to the previous T-4 auction, we get the numbers as shown in the table below. For this analysis, we assume similar volumes of non-eligible capacities as in the previous T-4 auction.

T-4 auction demand volume (point B)	8072 MW
Assume capacities that obtained a 1-year contract in previous T-4 auction also submit offer for the upcoming T-4 auction	2805 MWd
Assume capacities that performed an OPT-OUT IN in previous T-4 auction also perform an OPT-OUT IN for the upcoming T-4 auction	3806 MWd
Assume the above capacities similarly introduce their additional derated capacity thanks to the improved deratings for the upcoming T-4 auction	ca. 500 MWd
Estimated T-4 new capacities	961 MWd

We can therefore conclude that, depending on the behavior of the auction participants, in the upcoming T-4 auction there will be an estimated margin for new capacities to be contracted between 304 MWd and 961 MWd. It is to be noted that this remains an estimation, and that the final volume of new capacities contracted in the T-4 auction depends on several additional parameters in the auction that were not considered for this estimation, such as for example the auction price cap, non-proven capacities and OPT-OUT OUT volumes.

3. Methodology & input assumptions

3.1 Scenario and input data

The scenario used in the calibration reports is instructed by the Minister and set in a Ministerial Decree. For the first auction the scenario was decided by the Minister on 27/07/2020[6]. For the second auction the decision was taken on 14/09/21 by the Minister[7].

The scenario choice follows the process set in the Royal Decree where several steps are included such as a public consultation of stakeholders, a recommendation from Elia, a proposal from the CREG and the opinion of the FPS Economy. This process starts around March/April and ends with the decision by the Minister in September.

The public consultation aims to receive feedback from the stakeholders on the best estimate data that should be used to calculate the different calibration parameters and inputs that are required by the CREG to make its proposals. The consultation also aims to collect and argument the sensitivities that should be included as part of the reference scenario.

The auctions can be compared in terms of scenario data used. Some differences can be explained by the fact that the delivery year is not the same. Other changes are implied by updated forecasts or feedback received during the public consultation[8].

<u>The main changes for the thermal generation fleet between both auctions are:</u>

- The notified closure of Vilvoorde GT (255 MW);
- The notified closure of Seraing ST (170 MW);
- The new CHP unit in Borealis Kallo (32 MW);
- Capacity changes (Inovyn, Marcinelle, Ringvaart, Saint-Ghislain, Izegem) following stakeholder feedback received between both auctions. This amounts leads to a net increase of around 80 MW between the second and the first auction.

The changes related to thermal generation have very little impact on the calibration parameters as the scenario used for the calibration is made 'adequate' (this means that additional capacity will be added to the system to comply with the Belgian reliability standard).

<u>With respect to RES capacities:</u>

- An increase of 931 MW of installed wind capacities (both onshore and offshore);
- An increase of 600 MW of PV capacities;
- An increase of 6 MW of hydro Run of River;

6 2020-07-27-courrier-CRM-scenario.pdf (fgov.be)

7 LOI - WET (fgov.be)

8 Note that the capacity change for St-Ghislain as well as the updated installed capacity and reservoir size from Coo are part of the confidential answer sent by Engie during the public consultation process.

— An increase of 173 MW of biomass and waste capacities (this includes the expected closure of Rodenhuize and the commissioning of E-Wood. In addition, the trajectory was revised to take into account the final NECP of Belgium).

The changes related to RES generation can impact their derating factors as the more RES of a certain type, the lower its derating factor. Indeed, the contribution to adequacy per MW decreases with the amount of installed capacity.

For storage capacities:

— A reduction of 90 MW in pumped-storage. The assumptions regarding Coo capacity were updated for the second auction after the public consultation (confidential answer from Engie);
— A reduction of 243 MW of other storage (large scale, small scale and V2G) following the feedback also received by stakeholders in other public consultations.

The changes related to storage generation can impact their derating factors as the more energy-limited capacities (such as storage), the lower their derating factor. Indeed the contribution to adequacy per MW decreases with the amount of installed capacity.

The demand was increased between the first and the second auction:

— The first auction, the total normalized yearly demand amounted to 88.9 TWh;
— The second auction, the total normalized yearly demand amounted to 91.5 TWh;
— The difference can be explained by the fact that the second auction looks one year later than the first one but also by updated and improved economic projections taken into account. The load forecasts are updated on a yearly basis during summer, based on the latest economic projections (June 2021) of Plan Bureau[9]. The methodology developed by Climact[10] is used to derive the different sectorial growth rates regarding electricity consumption;
— The electricity consumption is also expected to increase due to electrification of heat and mobility combined with industries planning to electrify part of their processes.

[9] https://www.plan.be/publications/publication-2130-fr-perspectives_economiques_2021_2026_version_de_juin_2021

[10] https://www.elia.be/-/media/project/elia/elia-site/public-consultations/2020/20200603_total-electricity-demand-forecasting_en.pdf

The changes related to the demand assumptions have a direct impact on the calibration parameters as the average load during scarcity is linked to the assumptions on consumption taken into account. Indeed, the higher the demand, the higher the required capacity that has to be available in Belgium to meet the adequacy requirements.

<u>Economic loop adding capacity to meet the adequacy requirements:</u>

The scenario used in the CRM calibration report and used to derive the different parameters is made adequate (3 hours of Loss of Load on average) by using an economic loop consisting of several preselected capacity types.

— For the first auction, this finally resulted in the addition of 2300 MW of OCGT, 500 MW of CCGT and 500 MW of DSM shedding with a 4h availability in the simulation in order to comply with the Belgian reliability standard.
— For the second auction 1800 MW of CCGT (consistent with the results of the first auction),1000 MW of OCGT and 500 MW of DSM shedding with a 4h availability were added in order to comply with the Belgian reliability standard.

<u>Forced outage rates considered for thermal units:</u>

The forced outage rates applied for the thermal generation fleet were also recalculated for the new calibration report to take into account the 10 most recent historical years. This resulted in only marginal differences in these forces outage rates between the two calibration reports.

The changes related to the forced outage rates have a direct impact on the derating factors of the associated thermal units.

All input data can be found in annex to this note.

3.2 Applied Climate Database

Why a change in the climate database between both auctions?

A major change between both auction reports consists in the usage of a climate database compliant with the requirements of the ERAA methodology. The aspect of the climate database was also heavily debated prior to the ERAA methodology publication in order to better reflect the evolution of the climate and its impact on weather variables used in an adequacy assessment.

The ERAA methodology published in October 2020 has set forward 3 possible options to take the climate into account in adequacy assessments. Since the publication of the ERAA methodology, Elia has implemented a new approach in order to comply with this requirement for its Adequacy and Flexibility study that was published in June 2021. Indeed, it was not possible yet to use the newly adopted ERAA requirements for the first auction calibration report which was due one month after the publication of the

ERAA methodology. For the first calibration report covering the delivery period 2025-26, the full historical climate database as used by ENTSO-E and consisting of 35 climate years was used. Such database was also used by ENTSO-E for its MAF2020 study which was released after the first calibration report made by Elia.

The option (i) set in Article 4 (f) of the ERAA methodology was chosen by Elia to be used in future adequacy assessments as from 2021. It is also the option that ENTSO-E has chosen as the target method to be used in the future. Using a sub-selection of climate years was deemed not sufficiently robust, nor statistically the most appropriate approach. However, Elia does agree that effects of climate change should be duly taken into account and that climate experts are the best suited advisors on how to implement this. Elia has therefore worked with Météo France and RTE (where such methodology is already implemented for several years) in order to transpose the needed data in its simulations. The proposed methodology was publically consulted for the Adequacy and Flexibility study 2022-32 end of 2020 and several comments by stakeholders led to additional information on the climate database and its underlying methodology being published.

The approach followed by Elia was clearly endorsed by the Belgian State as it was part of the notification to the European Commission, which led to a formal approval of the CRM.

What are those "200 climate years"?

The climate years used in the second calibration report are no longer historical climate years but are synthetic (simulated) climate years under a constant climate, with two main differences:

— the goal of synthetic representative climate years is to look further than today and to take a certain evolution of the climate into account;
— the goal of synthetic representative climate years under a "constant climate" is to obtain series of climate data which can be considered as equiprobable for a certain climate.

The meteorological parameters of this climate database are temporally consistent. They describe realistic, albeit fictitious, meteorological situations. The aim of such database is not to predict the exact weather for a given year but to provide a reliable set of data that can be used for probabilistic calculations such as resource adequacy assessments.

Cold waves can have an important impact on adequacy requirements. Therefore it is valuable to look at these consecutive days of low temperature in the new synthetic climate years of 2025 compared to the historical climate years used previously for Elia's adequacy studies. The figure below shows the distribution of cold waves in Belgium in the two climate databases. The cold waves are categorised based on their average temperature and their duration. The large majority (>80%) of the cold waves have an average temperature above -3°C in both databases. Regarding long cold waves, their number is significantly reduced in the synthetic 200 climate years of 2025 compared to the historical climate years.

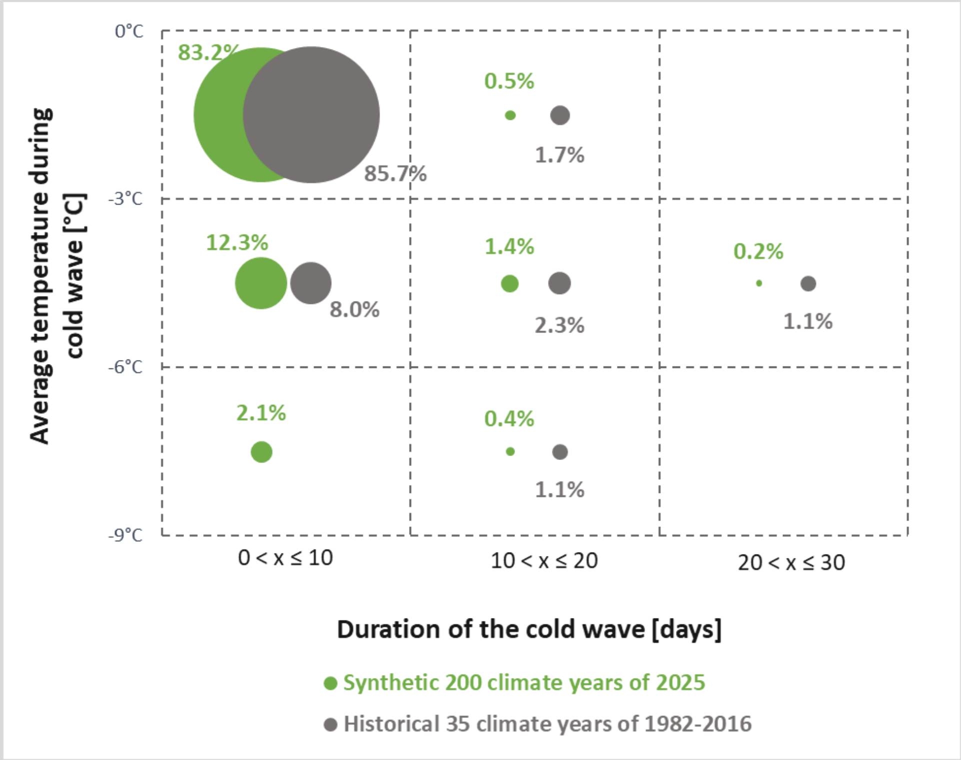

Figure 2: Comparison of the distribution of cold waves in Belgium in the different climate databases

Detailed information of the new climate database

The documents, prepared by MétéoFrance and RTE can be found on the Elia website and give a lot of details on the construction of the climate years[11]:

- A user guide from MeteoFrance "*Utiliser les simulations à climat constant*" which gives an comprehensive overview of the key aspects of the methodology of MeteoFrance;
- A technical document from MeteoFrance "*DSM-CS-ENR-SCenClim2014_T2m_V1-1*" which explains how the temperature is calibrated;
- A technical document from MeteoFrance "DSM-CS-DC-ENR_ScenClim2014_T2m_Stations-V1-1" which explains how the interpolation to constant climate 2025 is done;
- A presentation from MeteoFrance "*Simulations à climat constant : conception et utilisations*" covering the most important points related to the climatic database of MeteoFrance.
- A document from the French TSO RTE "*Representation of the effects of climate on the electrical system: modelling Wind and Solar Generation*" explaining how the climatic data are converted into energetic data.

[11] Consultation publique sur la méthodologie, les données de base et scénarios pour l'étude d'adéquation et d'estimation du besoin de flexibilité du système électrique belge pour la période 2022-2032. (elia.be)

How many Monte-Carlo years were simulated?

In order to obtain robust results for adequacy indicators, a large set of Monte-Carlo years needs to be simulated. Each Monte-Carlo year consists of a combination of a climate year and a random outage pattern for thermal units and HVDC links. As the climate database contains equiprobable years, every climate year needs to be simulated the same amount of times. The amount of Monte-Carlo years is therefore always a multiple of the amount of climate years in a given dataset.

As the simulations are not run on calendar years (in order to keep the winters together), the 35 climate calendar years were combined into 34 climate years (from September to August). Similarly 200 calendar climate years lead to 199 climate years (from September to August).

For the first auction, 680 Monte-Carlo years were simulated. Each Monte-Carlo year is simulated for the whole year. The simulation is done for 52 weeks, hence 8736 hours. For the second auction, 597 Monte-Carlo years were simulated.

4. Impact assessment on calibration parameters

4.1 Scarcity periods

The volume parameters determined in the calibration report generally reflect the average of the concerned indicator over all time periods (hours) in which a shortage of supply, or scarcity, occurs in the simulations. The nature of these scarcity periods (their typical length, frequency, days and hours of occurrence) can and will therefore have a major impact on the final value of the different parameters. We will therefore first take a closer look at some main characteristics of these scarcity periods, and how these evolved in comparison with the previous calibration report.

First, it is however very important to note that, while the number of simulated climate years and the scarcity periods has changed between the calibration reports, the average number of hours per year where scarcity occurs in Belgium remains constant and equal to the Belgian reliability standard, namely 3 hours.

Figure 3 depicts the histogram and the cumulative distribution of the duration of simulated scarcity periods for both calibration reports. It can be clearly seen that the change in climate database leads to shorter scarcity periods (as the cumulative distribution converges quicker). While the amount of scarcity periods of 1 hour is the same in both simulations, the amount of scarcity periods of more than 6 hours is very limited with the simulations performed for delivery year 2026-2027. This can be explained by the change in the climate database.

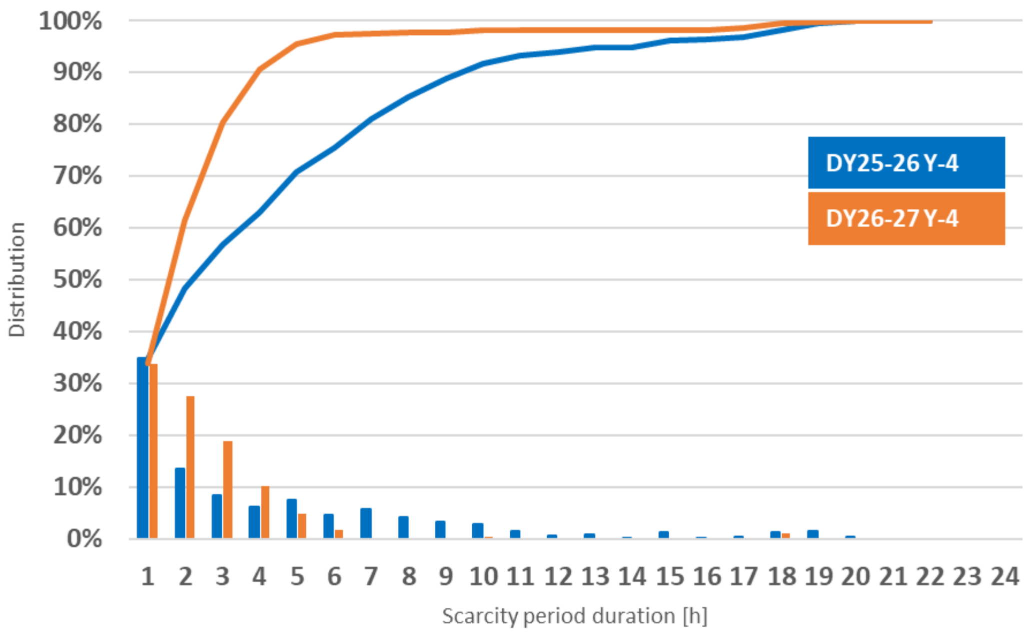

Figure 3: histogram and cumulative distribution of the duration of simulated scarcity periods for both calibration reports.

Similar conclusions could be drawn by looking at the typical number of consecutive days in which at least one hour of scarcity occurs. As can be derived from Figure 4, the probability of encountering scarcity periods spanning several consecutive days has reduced significantly. As mentioned earlier, this can be clearly linked to the climate conditions taken into account with diminishing probabilities of long-duration cold spells.

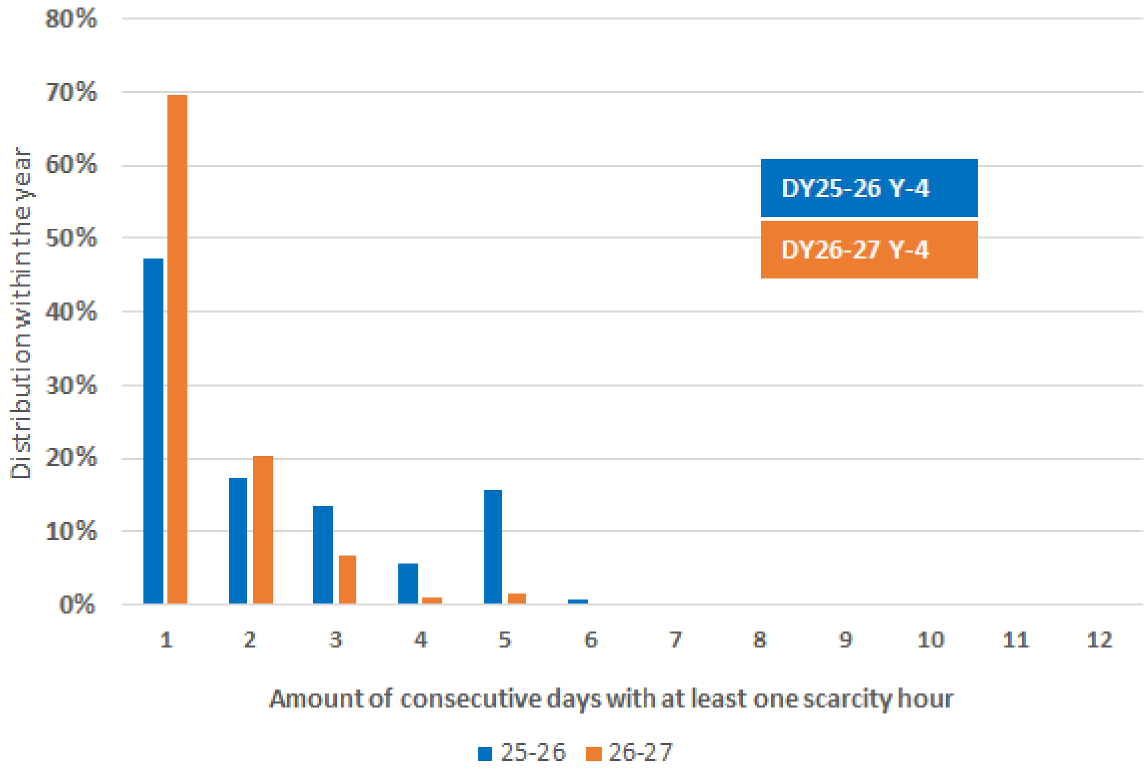

Figure 4: histogram of the number of consecutive days with at least one hour of scarcity for both calibration reports.

Additional insight can be given by looking at the hours of the day in which such scarcity events typically occur. Figure 5 shows a histogram of the hours of the day where scarcity occurs for both calibration reports. In line with the observations above, we notice that with the new climatic database, scarcity events are much more concentrated around the (evening) peak hours.

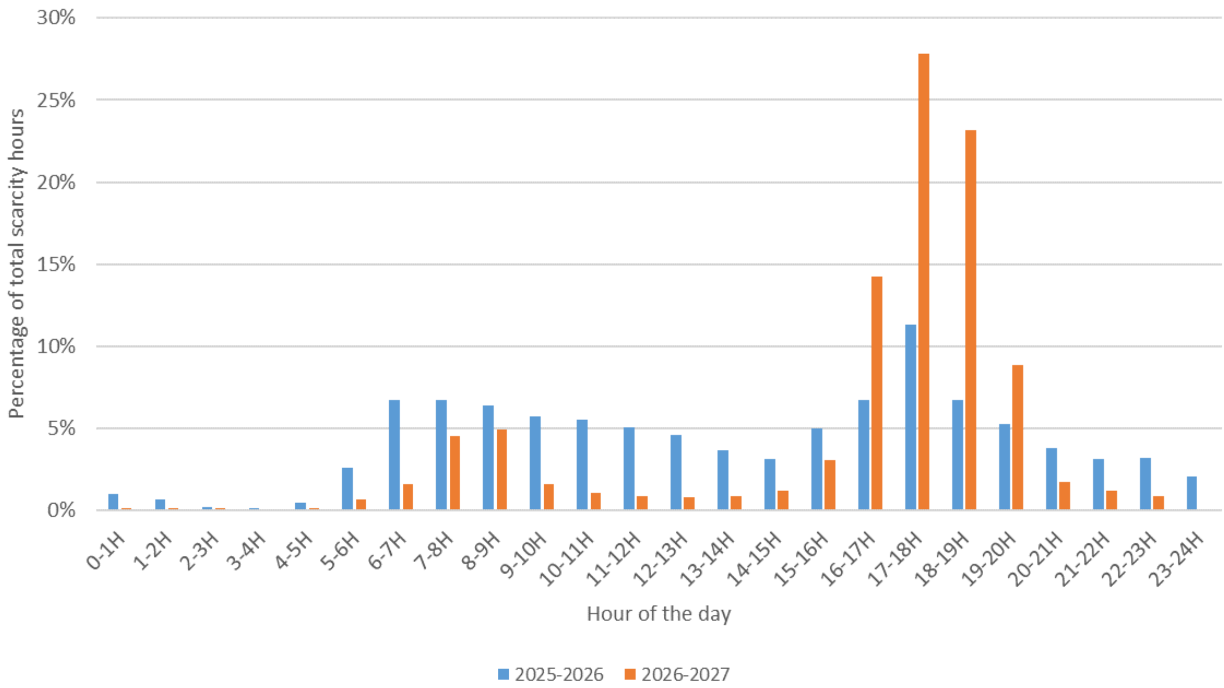

Figure 5: histogram of the hours of the day where scarcity occurs for both calibration reports.

4.2 Average load during scarcity periods

The first parameter included in the calibration report is the average load during simulated scarcity periods. It is calculated by taking the average consumption, corrected with out-of-market storage capacities, over all hours in which scarcity occurs. The table below summarizes the final value calculated for points A, B & C for both calibration reports.

Description	Royal Decree	T-4 auction 2025-26	T-4 auction 2026-27
Average load during simulated scarcity situation (point A)	Art. 11, §2, 1°	13 332 MW	13 939 MW
Average load during simulated scarcity situations (points B and C)		13 591 MW	14 089 MW

We note that for the current calibration report, and for points B and C, this average load is about 500 MW higher compared to previous calibration report. There are two reasons explaining such increase:

- First, it is due to a change in underlying assumptions: the electrical demand is expected to increase from 2025-26 to 2026-27 due to economic projections and an increased electrification of demand. Assuming that the increase of demand would be distributed evenly across all hours of the year, the increase of the total yearly demand can explain around 300 MW of the increase. Indeed (91.5 TWh – 88.9 TWh) / 8760 hours is roughly equal to 300 MW. However, as can be noticed in Figure 6, thanks to the out-of-market flexibility (V2G, residential batteries)[12] taken into account, the impact of the demand increase on the evening peak demand is relatively more limited and the average consumption is smoother during the day.

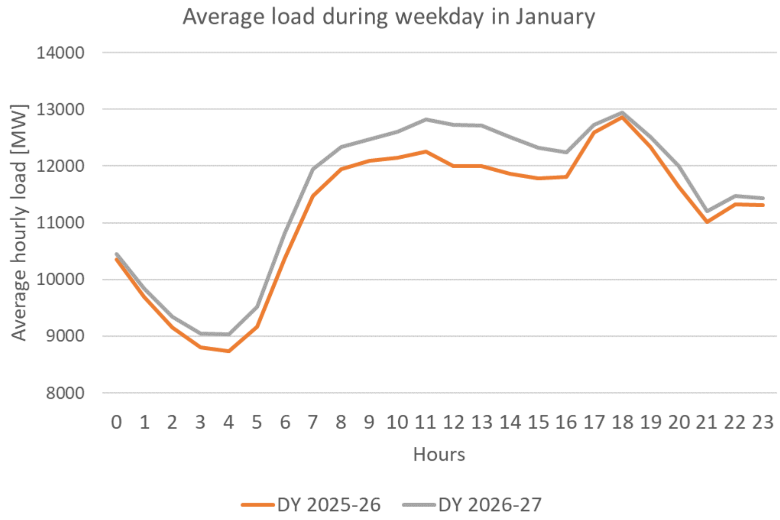

Figure 6: average load in MW during a typical weekday in January, corrected for out-of-market flexibility

- The second driver for this increased load is linked to the change in typical scarcity periods. As shown before, scarcity periods have become shorter and more concentrated around the hours in which the peak load occurs. A logical consequence is therefore that, when averaged over all scarcity hours, the average load during scarcity periods has increased.

Figure 7 shows the duration curve of the load at times of scarcity in Belgium. The general upward shift due to the increase of the underlying electrical demand can be noticed, as well as the disappearance of scarcity hours at times of lower load, outside of the peak load hours.

[12] Note that DSM shifting was considered “in-the-market” and therefore considered on the supply side.

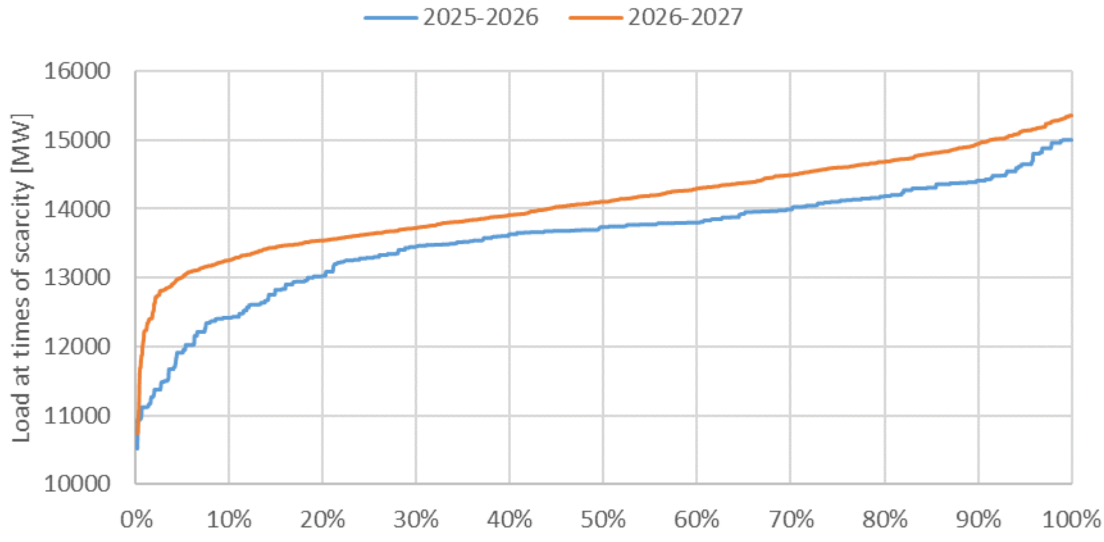

Figure 7: duration curve of the load at times of scarcity for both calibration reports.

Another way to illustrate this effect is to look at the correlation between the distribution of scarcity situations during the day and the average load in January (when most of the scarcity situations occur). Figure 8 below shows that those scarcity situations happen mainly during the evening peak hours when the electrical load reaches its maximum.

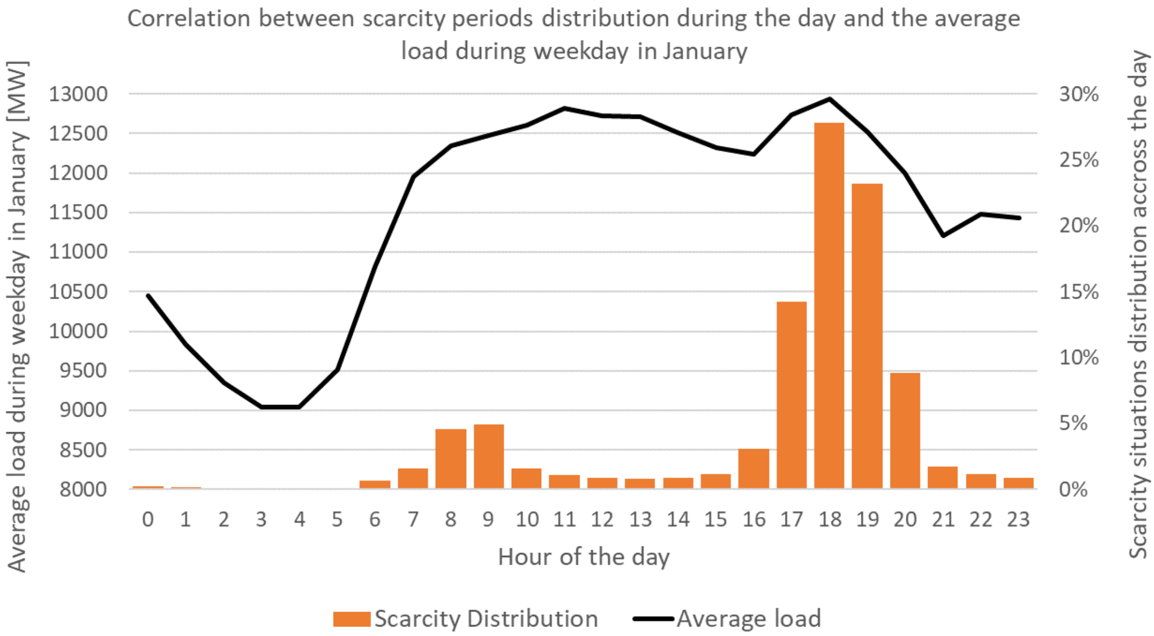

Figure 8: Correlation between scarcity periods and daily evening peak for delivery period 2026-2027.

4.3 Reserve needs

The reserve needs to be taken into account for the determination of the auction parameter reflect the sum of both Frequency Containment Reserve (FCR) needs and Frequency Restoration Reserve (FRR) needs. The FCR volume remained roughly constant over both delivery periods, amounting to ca. 80 MW.

With respect to FRR needs, an analysis was performed to determine the reserve needs, taking into account the anticipated offshore developments. This analysis resulted in an increased FRR need of ca. 100 MW for delivery period 2026-2027.

In addition, the part of the reserve needs that could be counted upon through a cross-border contribution was set to zero for the current calibration report. This is due to the assumption that scarcity periods will go hand in hand with a maximal utilization of the cross-border capacities, which leads to the impossibility of using balancing capacities located abroad for the purpose of the Belgian market in the balancing timeframe.

	CRM 2025-26	CRM 2026-27
FCR + FRR	1088 MW	1189 MW
XB contribution	-103 MW	0 MW*
Total reserve capacity	**985 MW**	**1189 MW**

Figure 9: Comparison of reserve needs between both auctions

This volume was also included in the reference scenario, as determined by Ministerial decision of 15 september 2021[13].

4.4 Average ENS during scarcity periods

A third parameter is the average ENS during scarcity periods. This reflects the energy that is intrinsically not served at scarcity, and therefore should be deduced from the demand to be contracted in the CRM auction. The table below summarizes the final value calculated for points A, B & C for both calibration reports.

Description	Royal Decree	T-4 auction 2025-26	T-4 auction 2026-27
Estimated Energy Not Served during simulated scarcity situations (point A)	Art. 11, §2, 3°	1522 MW	906 MW
Estimated Energy Not Served during simulated scarcity situations (points B and C)		809 MW	577 MW

We note that for the current calibration report, and for points B and C, the average ENS is about 200 MW lower compared to the previous calibration report. One might assume that, due to the average load during scarcity having increased, also the average ENS should increase. This however is not the case

[13] LOI - WET (fgov.be)

thanks to the significantly increased contribution of energy-limited sources during scarcity periods. This effect leads to the delta between demand and generation/storage/imports to reduces, leading to a lower average ENS during scarcity periods. This evolution was already remarked in the latest Adequacy & Flexibility report published, where the simulated ENS at times in scarcity was shown to have reduced compared to the previous Adequacy & Flexibility report.

In order to illustrate this effect, Figure 10 shows the relationship between ENS and load at times of scarcity. It can be clearly seen that for similar load levels, the simulated ENS has reduced thanks to the increased contribution of energy limited resources.

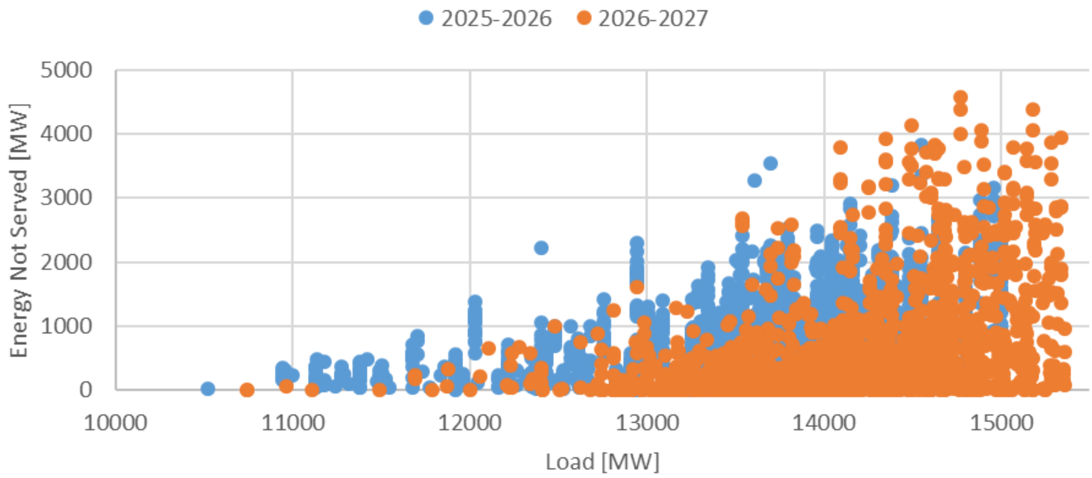

Figure 10: Energy Not Served versus Load during scarcity moments for both calibration reports.

When we look at the duration curves of the ENS, we note however that while the average ENS at times of scarcity has been reduced, the high range of ENS values has increased for 2026-2027. The table below shows that the maximum simulated ENS, as well as the P99 and P90 values significantly increased. While at most times energy-limited capacities can contribute more thanks to the shorter scarcity periods, there still are moments left when the scarcity periods are longer, reducing this contribution. This in combination with the increased base demand in 2026-2027, and the reduced cross-border contribution leads to higher ENS in the most severe scarcity periods.

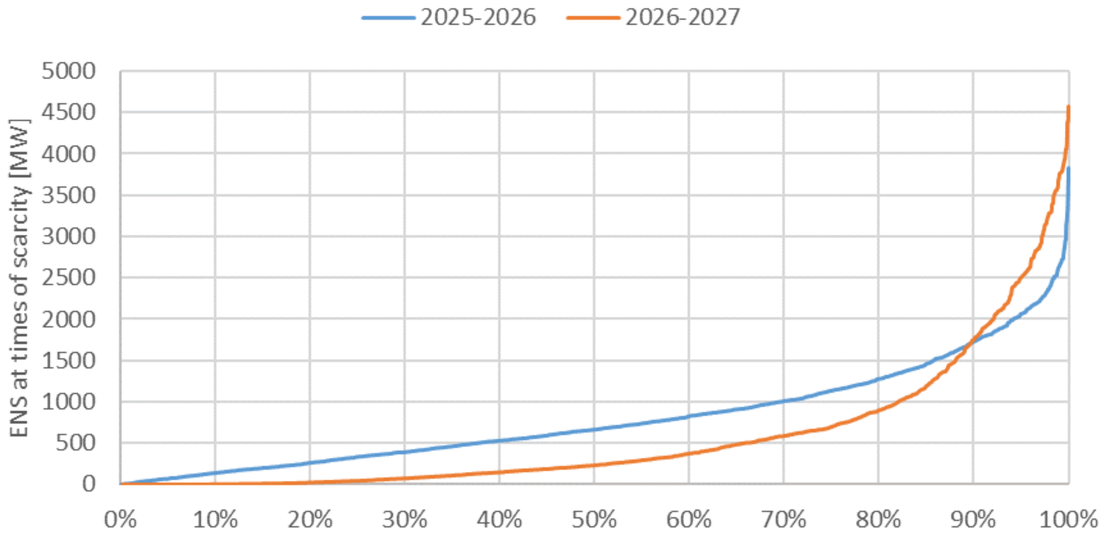

Figure 11: duration curve of the ENS at times of scarcity for both calibration reports.

	2025-2026	2026-2027
Maximum	3834	4577
P99	2647	3767
P90	1733	1761
Average	809	577

4.5 Illustration of a scarcity period

In order to further illustrate the effect of changing scarcity patterns on the resulting load and ENS to be covered in the CRM auction, we below show a typical week with a scarcity event for both time periods. The combined effects explained above can be clearly seen in this illustration.

Y-4 auction for DY 2025-26

A typical week is presented on Figure 12. A weekday in January is shown with limited RES infeed, particularly during two days with almost no wind generation. During those two days, long scarcity periods are observed with a high amount of energy not served. As the scarcity situations generally occur during low RES infeed, it is expected that the contribution of renewables is reduced, which explains the low derating factors observed for weather dependent technologies.

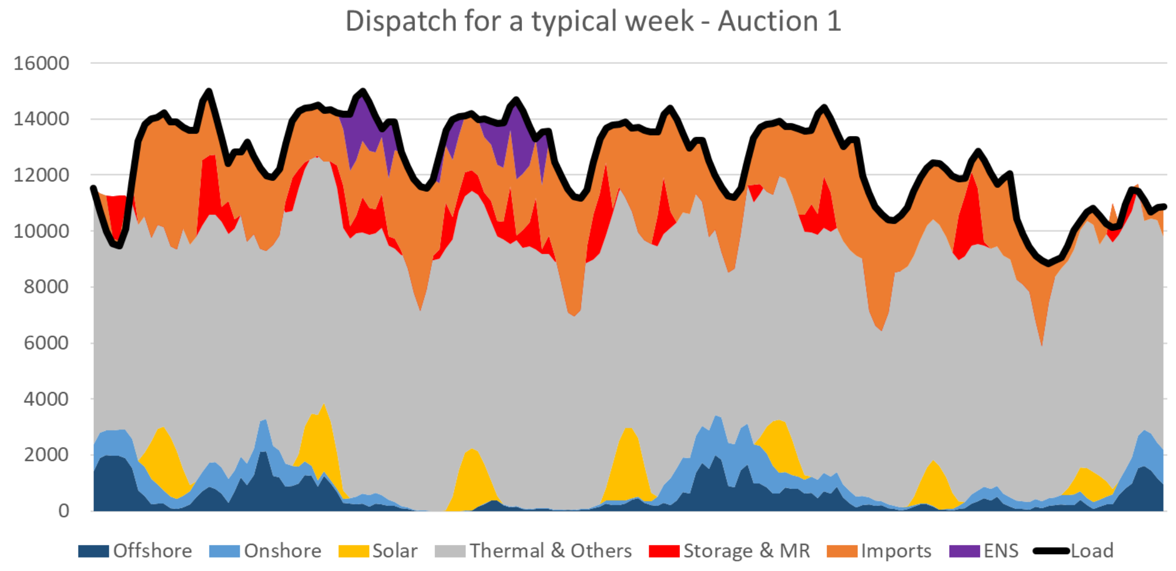

Figure 12: Illustration of the demand and the generation mix of a typical week with scarcity events for the T-4 auction for delivery period 2025-2026.

Regarding storage and market response in the market, Figure 13 shows the correlation between the dispatch of batteries/market response and the scarcity situations. In particular, for the third day of the week, scarcity is observed during almost the entire day. The batteries are therefore optimized during the day to reduce ENS and market response is dispatched according to the category availability. There however is insufficient available energy to recharge the batteries. Their contribution during scarcity is therefore strongly reduced, leading to the low derating factors observed in the first auction. Regarding market response, the scarcity situations are too long in order for them to fully contribute during those moements.

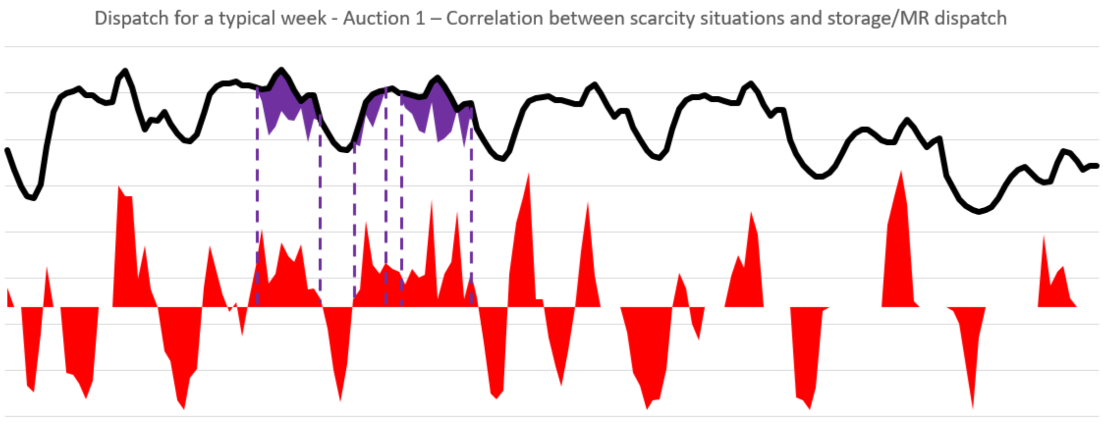

Figure 13: Dispatch of storage and market response in relation to scarcity situations for the T-4 auction for delivery period 2025-2026.

Y-4 auction for DY 2026-27

Figure 14 shows a similar typical week for delivery period 2026-2027, simulated using the new climate database. It is immediately clear that scarcity periods are much more concentrated around the evening peaks of day 3, 4 and 8. This results in an increased average demand during scarcity events, as explained earlier.

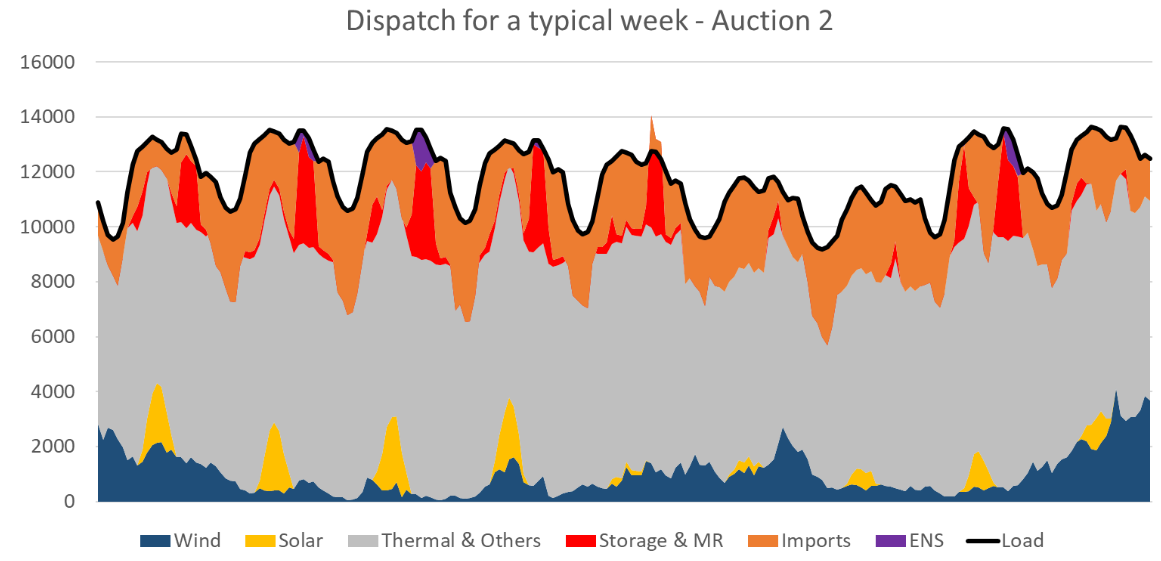

Figure 14: Illustration of the demand and the generation mix of a typical week with scarcity events for the T-4 auction for delivery period 2026-2027.

Figure 15 shows the impact of the shorter scarcity periods on the utilization of storage and market response in the system. The contribution of these technologies is clearly significantly larger, which is reflected in their increased derating factors for the upcoming Y-4 auction. As a side-effect, the reduction of the average ENS volume can also be observed.

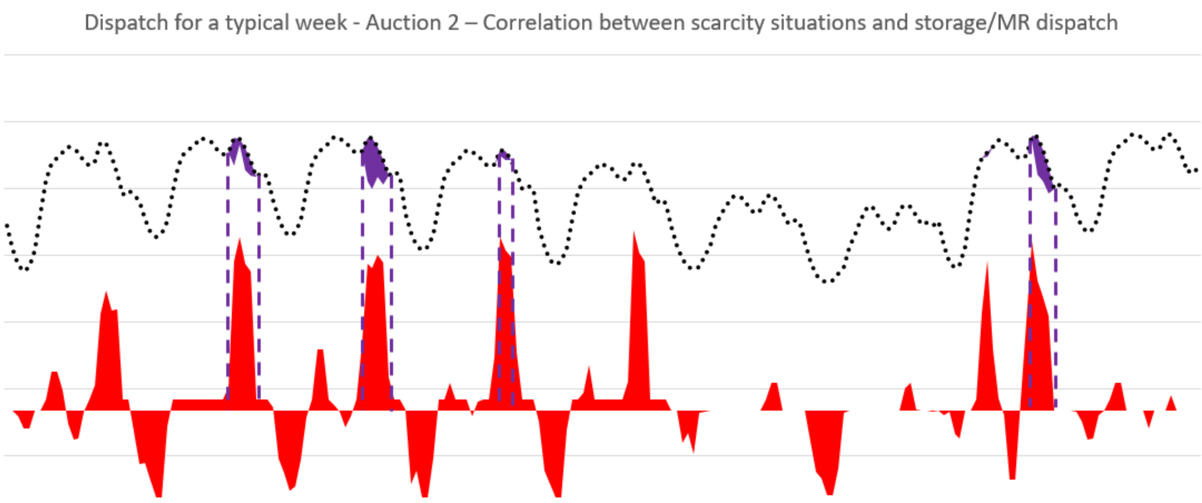

Figure 15: Dispatch of storage and market response in relation to scarcity situations for the T-4 auction for delivery period 2026-2027.

4.6 Non-eligible capacity

The non-eligible capacity estimation for each auction is divided in three parts:

— The renewable energy sources, which are assumed to already receive subsidies. It consists in solar PV, wind onshore and wind offshore;
— The “large” individually-modelled thermal capacity (CHP, Biomass and Waste), which are also assumed to already receive subsidies. However, for this category, an additional categorization is performed based on the available information from units receiving subsidies provided by the authorities;
— The “small” profile-modelled thermal capacity (CHP, Biomass and Waste), which are either assumed to already receive subsidies or to not reach the 1 MW derated threshold to participate in the auction.

Table 1 presents the differences between the two first Y-4 auctions.

Category	**Y-4 auction DY 2025-26[14] [MW]**	**Y-4 auction DY 2026-27 [MW]**
Renewables	883	828
“large” individually-modelled thermal capacity (CHP, Biomass and Waste)	1313	204
“small” profile-modelled thermal capacity (CHP, Biomass and Waste)	831	1254

Table 1: Comparison of non-eligible capacity assumptions between Y-4 auction for Delivery Periods 2025-26 and 2026-27.

Renewables

Regarding renewable energy sources, the evolution of the contribution of renewables to the non-eligible volume can be explained by two parameters: the installed capacity and the derating factors (see Table 2).

On the one hand, we observe an increase of the installed capacity for all technologies due to the fact that we are looking at a delivery period being one year later.

On the other hand, the derating factors for all technologies have been impacted by the new climate database. For wind onshore and offshore, the impact is quite limited. We observe a redistribution of the derating factors between both technologies, with the total contribution of wind increasing from the first to the second delivery period. Regarding solar, the impact of the new climate database and in particular of the updated scarcity patterns, which are typically shorter and mainly occurring during the evening peak, is higher. The contribution of solar capacities to scarcity situations is significantly reduced, leading to a derating factor of only 1% for Delivery Period 2026-27.

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[14] The volumes presented in the table reflect the Ministerial Decree, after discussion in order to improve the methodology to determine the non-eligible volume. In the CRM calibration report for delivery year 2025-26, only the renewables (883 MW) and the part of ““small” profile-modelled thermal capacity (CHP, Biomass and Waste) (205 MW) assumed to be below the 1 MW derated criteria were considered. The updated methodology then integrated the capacities that already received subsidies from “small” profile-modelled thermal capacity (CHP, Biomass and Waste) and the “large” individually-modelled thermal capacity (CHP, Biomass and Waste) that receive subsidies based on the information provided by the authorities. This leads to the total non-eligible volume of 3026 MW from the Ministrial Decree.

Technology	Installed Capacity [MW]	Derating Factor [%]	Derated Capacity [MWd]
Solar	8000	4	320
Wind Onshore	3747	6	225
Wind Offshore	2253	15	338
TOTAL FOR Y-4 AUCTION 2025-26			**883**

Technology	Installed Capacity [MW]	Derating Factor [%]	Derated Capacity [MWd]
Solar	8600	1	86
Wind Onshore	3978	9	358
Wind Offshore	2953	13	384
TOTAL FOR Y-4 AUCTION 2026-27			**828**

Table 2: Comparison of renewables contribution to the non-eligible volume between auctions

The total contribution of renewables is slightly reduced in the Y-4 auction for delivery period 2026-27, mainly due to the lower contribution of solar capacities.

"Small" profile-modelled thermal capacity (CHP, Biomass and Waste)

Regarding "small" profile-modelled thermal capacity (CHP, Biomass and Waste), the difference between the 2 auctions is mainly explained by the evolution in installed capacity for profiled biomass and thermal non-renewable generation. The derating factors between both auctions remains more or less the same.

This increase is in line with the evolution of the numbers provided in the Adequacy and Flexibility study: the assumptions for the Y-4 auction for Delivery Period 2025-26 are in line with the 2019 AdeqFlex study, while the assumptions for the Y-4 aucion for Delivery Period 2026-27 are in line with the 2021 AdeqFlex study.

The increase is the highest for biomass technologies, which can be explained by the fact that:

- more historical capacity was reported for small-scale biomass;
- the total volume of biomass installed capacity (sum of individually-modelled and profiled) is based on the NECP target. Due to the removal of "Les Awirs" and "Rodenhuize" (which are individually-modelled units), the profiled part was increased in order to remain compliant with this NECP target**.**

The total contribution of "small" profile-modelled thermal capacity increases in the Y-4 auction for delivery period 2026-27, mainly due to the increased installed capacity.

“Large” individually-modelled thermal capacity (CHP, Biomass and Waste)

Regarding the “large” individually-modelled thermal capacity (CHP, Biomass and Waste), the difference between the 2 auctions is explained by the evolution in terms of installed capacity and by the information received on units that already receive subsidies. The evolution of derating factors has a limited impact.

Delivery year 2025-26

Technology	Installed Capacity [MW]	Derating Factor [%]	Derated Capacity [MWd]
Individually modelled capacities	1908	62 (if < 25 MW) 93 (if > 25 MW)	1689
Already received subsidies	1459	“	1313

Delivery year 2026-27

Technology	Installed Capacity [MW]	Derating Factor [%]	Derated Capacity [MWd]
Individually modelled capacities	1363	65 (if < 25 MW) 93 (if > 25 MW)	1187
Already received subsidies	226	“	204
Already received subsidies OR unknown/maybe	723	“	613

Table 3: Comparison of non-eligibility for large individually-modelled capacities between auctions

Between the 2 auctions, some updates have been performed regarding the units considered. Zandvliet (386 MW) and Rodenhuize (205 MW) have been removed from this category and Borealis Kallo (32 MW) and e-wood (22 MW) have been added. In addition, some minor capacity updates have been made. This leads to a significantly lower volume considered as starting point for the non-eligible volume assessment (which is partially compensated by a switch to the “small” profile-modelled category).

The second CRM calibration report considers the capacities that confirmed to have already received subsidies (204 MWd) as non-eligible. If we additionally consider the capacities for which there is an uncertainty or unknown information on the receival of subsidies, the derated volume increases to 613 MWd. Summarized, this means that the final non-eligible volume associated to this category should be comprised between 204 MWd and 613 MWd.

The total contribution of “large” individually-modelled thermal capacity (CHP, Biomass and Waste) decreases in the Y-4 auction for delivery period 2026-27, mainly due to the decreased installed capacity (Rodenhuize, Zandvliet) included this category and the updated information regarding units that already receive subsidies.

4.7 Cross-border contribution at times of scarcity

The evolution of the cross-border contribution is also mainly explained by the impact of the new climate database on the scarcity situations. In simulations conducted using the historical climate database, scarcity in Belgium was heavily correlated to the energy available (and import needs) in France. This led to simultaneous scarcity between Belgium and France in nearly 100% of the scarcity situations, with also Germany having a shortage in 20% of the Belgian scarcity situations.

When applying the new climate database, scarcity situations mostly occur at peak moments, as explained before. During those moments, energy is scarce in the whole CORE region, resulting in energy not served being observed in multiple countries at the same moment (Figure 16). In most of the Belgian scarcity situations, simultaneous scarcity occurs in at least 3 of the 4 of our neigbouring countries. As countries in scarcity will not export energy to other countries, the average cross-border contribution of Belgium's neighboring countries has decreased compared to the first auction.

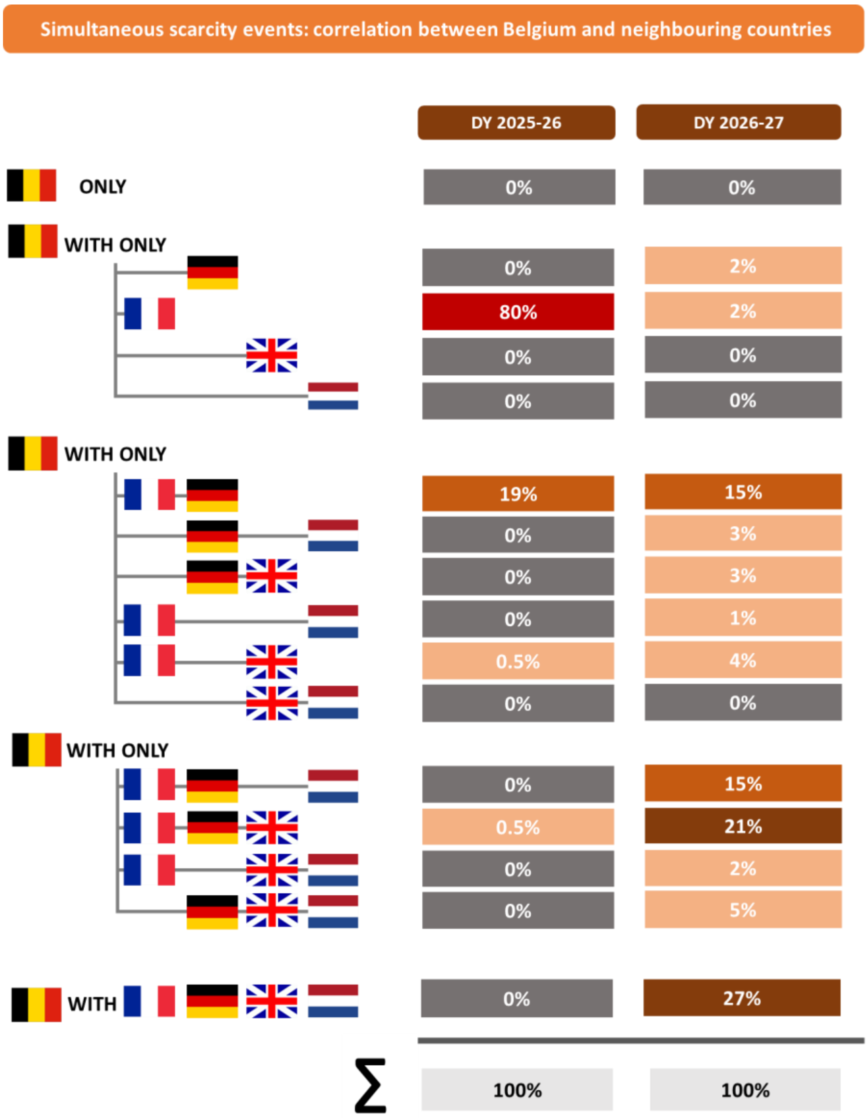

Figure 16: Comparison of simultaneous scarcity events between the Delivery Periods 2025-26 and 2026-27

4.8 Derating factors of energy-limited technologies

Shorter scarcity periods lead to higher derating factors for energy-limited technologies (batteries, DSR, pumped-storage…). Indeed, for those technologies, the derating factor depends on their capability to cover several consecutive hours of scarcity. For storage technologies, the reservoir first needs to be filled before it can deliver the needed energy during scarcity periods.

In order to understand the impact of shorter scarcity periods on the derating factors of energy limited technologies, one should focus on the distribution of scarcity events weighted by their duration. Let's assume an SLA (Service Level Agreement) that can only cope with a 3 hour scarcity duration. It will be able to cover scarcity periods of 1, 2 and 3 hours length. The scarcity lengths depicted earlier when assessing the scarcity length distribution (in Figure 3) do not take into account the total amount of hours with scarcity. While there are more scarcity periods with a duration of 1 hour than with a duration of 2 hours, the fact that the latter have a 2-hour length results in the total amount of hours in 2-hour scarcity periods being higher than in 1-hour scarcity periods. Stated otherwise, to evaluate the impact that the scarcity length has on derating factors of energy-limited technologies, one should also consider the total amount of scarcity hours.

Figure 17 depicts the distribution of scarcity events by their length where their proportion in terms of total amount of hours is taken into account. This is what matters when calculating derating factors as the derating factors are calculated by the contribution of energy-limited technologies over the total amount of scarcity hours.

The cumulative distribution of this graph gives a first indication of the derating factor of energy-limited technologies with the respective reservoir size (in hours). This is however only an indication as:

— The energy limit of SLAs is given over a day in the simulations, hence an SLA of 2 hours can cover both a scarcity period of 1-hour in the morning and one in the evening;
— On the contrary, the graph was constructed by only looking at consecutive hours. An SLA of 1 hour will only be able to contribute to one scarcity hour per day. Hence if there is one hour in the morning and one hour in the evening, it will only be able to cope with one of them;
— The total penetration of energy-limited technologies impacts the contribution of each energy-limited capacity. The more energy-limited technologies in the system, the lower their deratings. This was illustrated and explained after the publication of the calibration report of the auction 2025-26 upon stakeholders' request[15].

[15]https://www.elia.be/-/media/project/elia/elia-site/users-group/ug/crm/2020/20210111_tfcrm21_slides_en.pdf

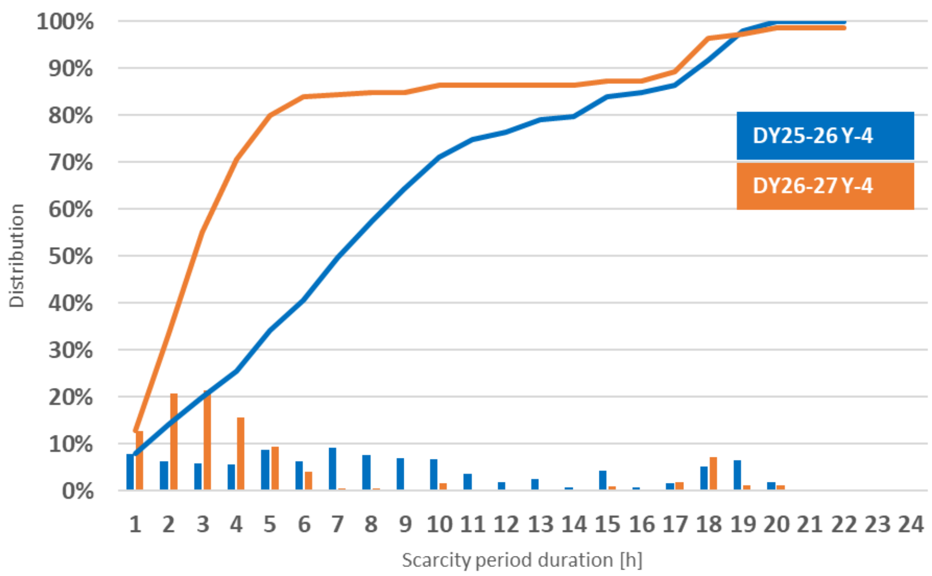

Figure 17: histogram and cumulative distribution of scarcity period duration weighted by their number of hours for both calibration reports.

5. Annex

5.1 Erratum of the calibration report

Erratum	Oorsprong van de fout	Impact
De capaciteiten voor de balancing reserves verschillen tussen de Engelse en de Nederlands/Franse versie van de executive summary.	In de Engelse versie van de executive summary werd de waarde van het vorige netbeheerdersverslag niet aangepast.	Geen impact, gezien de de correcte waarde in de Franse/Nederlandse versie van het verslag staat, alsook in de ministeriële beslissing hieromtrent. De balancing reserves maken inderdaad deel uit van de ministeriele beslissing, waar de juiste waarden gebruikt zijn: 75MW (FCR-capacities) + 1104 MW (aFFR + mFRR).
In tabel 4 (p.37) wordt een vaste O&M kost van 20 EUR/kW vermeld voor semi baseload technologieën, waar dit 25 EUR/kW moet zijn.	De waarde in het vorige netbeheerdersverslag, zijnde 20 EUR/kW, werd foutievelijk niet aangepast.	Geen impact, gezien de correcte vaste O&M kost van 25 EUR/kW is gebruikt in de simulaties.
In tabel 8 (p. 56) en tabel 13 wordt een foutieve waarde voor de variabele O&M kost vermeld.	De waarde in het vorige netbeheerdersverslag werd foutievelijk niet aangepast.	Geen impact, gezien de correcte waardes zijn gebruikt in de simulaties, zijnde 2 EUR/MWh voor CCGT (geen interval) en 11 EUR/MWh voor OCGT (geen interval), in lijn met Elia's Adequacy & Flexibility studie voor 2022 – 2032, gepubliceerd in juni 2021.
De inframarginale rentes voor onshore wind bevatten 2 outliers, zijnde in 2029 en 2030.	Bij het handmatig ingeven van deze waarden werd er foutievelijk een "0" weggelaten. De correcte waarden zijn 107 EUR/MW (in plaats van 174) en 103 EUR/MW (in plaats van 13).	Geen impact, gezien onshore windenergie niet bepalend is voor de Net-CONE berekening.
Wat betreft de inkomsten voor de net-CONE bepaling wordt verwezen naar foutieve scenario's uit Elia's Adequacy & Flexibility studie voor 2022 - 2032.	Het netbeheerdersverslag verwijst foutievelijk naar de scenario's uit vorige Adequacy & Flexibility studie, zoals het geval was in de vorige versie van het netbeerdersverslag.	Geen impact, gezien de correcte scenario's zijn gebruikt in het netbeheerdersverslag: • Scenario CENTRAL/EU-BASE, Efficient gas; • Scenario CENTRAL/EU-SAFE, Efficient gas; • Scenario CENTRAL/EU-BASE, Peakers; • Scenario CENTRAL/EU-SAFE, Peakers.

5.2 Detailed per-border comparison of the cross-border contribution

Description	Royal Decree	T-4 auction 2025-26	T-4 auction 2026-27
Max Entry Capacity for Cross-border participation France	Art. 14	4 MW	196 MW
Max Entry Capacity for Cross-border participation Netherlands		599 MW	646 MW
Max Entry Capacity for Cross-border participation Germany		461 MW	125 MW
Max Entry Capacity for Cross-border participation Great-Britain		871 MW	461 MW

5.3 Excel files consolidating the assumptions taken