Preparation of the CRM Y-1 auction with Delivery Period 2025-26 and the CRM Y-4 auction with Delivery Period 2028-29:

Additional analysis regarding the obtained results.

Contents

0. Introduction

This explanatory note aims to provide further information regarding the results obtained in the context of the calibration report for the CRM Y-4 auction with Delivery Period 2028-29 and the CRM Y-1 auction with Delivery Period 2025-26. Additionally, a comparison with the values obtained in the previous calibration report, the CRM Y-4 auction with Delivery Period 2027-28, will be presented, providing insights to explain any evolutions. Some insights will also be provided regarding the evolutions between the 2 auctions related to Delivery Period 2025-26.

In order to ease the reading the following acronyms will be used:

- 2025-26/Y-1: refers to the Y-1 calibration report for the DP 2025-26;
- 2025-26/Y-4: refers to the Y-4 calibration report for the DP 2025-26;
- 2027-28/Y-4: refers to the Y-4 calibration report for the DP 2027-28;
- 2028-29/Y-4: refers to the Y-4 calibration report for the DP 2028-29.

This explanatory note consists of two main parts.

- Firstly, an analysis of the key changes concerning assumptions and input data between the reference scenarios of the auctions of the current calibration report and the previous calibration report is presented.
- Secondly, the results of the simulation of the reference scenario are analyzed, particularly in light of the developments presented in the first part, and compared to the results of the previous auction.

1. Changes in scenario assumptions between reference scenarios used in the calibration reports

For each CRM auction, a certain number of parameters must be established within the framework of the reference scenario selected by the Minister. The elaboration of the scenario is further explained in the main report. These data are updated annually and the latest available information is taken into account. The calculated parameters evolve with the changes in the reference scenario. The key elements are explained in this section in order to ease the understanding of the changes in the calculated parameters.

1.1. Data and assumptions applicable to Belgium

In the subsections below, assumptions and parameters related to Belgium are detailed, along with any potential changes.

Electricity consumption

The annual consumption selected in the reference scenario is:

- 2025-26/Y-1: 85.7 TWh;
- 2028-29/Y-4: 102.4 TWh.

The total annual consumption for the 2027-28 Delivery Period selected last year, by comparison, was 90.9 TWh. The change between the two Y-4 reference scenarios represents an average hourly difference of around 1.3 GW, although this difference is not evenly distributed throughout the year.

The increase in electricity consumption for the future can be explained amongst others by:

- increased electrification ambitions following the publication of the regional climate plans (for electro-mobility and heating in buildings). The trend is being confirmed by recent numbers on sales in EVs and heat pumps;
- increased industrial electrification of existing processes following the increased decarbonization targets and European plans (Fit For 55 and RePowerEU);
- new uses such as data centers, carbon capture or electrolysis;
- other measures and information that were introduced and that were accounted for when defining the reference scenario.

It should be noted that the increase in electricity consumption from newly electrified processes includes significant amounts of flexibility.

Impact on parameters:

- ➔ The load assumptions have a direct impact on the average load during scarcity. The type of load also impacts the energy not served and derating factors.
- ➔ Higher electrification in the system will also tend to lead to higher inframarginal rents for power plants, (more running hours).

Demand-side response

Regarding demand-side response (DSR), the methodology evolved in the framework of the latest AdeqFlex'23 study[1]. The DSR consists of 3 main categories and is summarized in Table 1.

- The DSR from existing usages, calculated based on the estimation by E-cube on historical volumes (presented during the Working Group Adequacy from 25/08[2]). In the reference scenario selected by the Minister, a volume of 1843 MW is considered.
- The DSR from industry electrification comes from industrial heat pumps, e-boilers, steel, CCS or datacenters. In the reference scenario selected by the Minister, a volume of respectively 436 MW and 1204 MW is considered for 2025-25/Y-1 and 2028-29/Y-4.
- The potential additional DSR from existing usages submitted to the economic optimization loop of each auction from the preselected capacity types. In this framework, 300MW of DSR 24h has been added for 2028-29/Y-4 in order to reach the reliability standard. This 300MW volume corresponds to the first step from the stepwise approach considered for the annualized costs of additional DSR.

In the framework of 2027-28/Y-4, published in November 2022, an historical volume was calculated based on the estimation by E-cube and an interpolation was performed in order to reach the 2030 target set in the 'Energy Pact'. It leads to a volume of 2,226 MW of DSR shedding. In 2025-26/Y-4, the DSR volume was equal to 1,565 MW.

CRM auction	DSR from existing usages [MW]	DSR from industry electrification [MW]	Additional DSR after economic loop [MW]	**Total DSR Shedding in the model [MW]**
2025-26/Y-1	1843	436	0	**2279**
2028-29/Y-4	1843	1204	300	**3347**
2025-26/Y-4	1565	NA	500	**2065**
2027-28/Y-4	2226	NA	0	**2226**

Table 1 : Overview of DSR volume in CRM auctions

Regarding the total amount of DSR capacity, it means that:

- the DSR volume is similar between 2025-26/Y-1 and 2027-28/Y-4;
- the DSR volume is assumed to be higher by around 200 MW in 2025-26/Y-1 compared to 2025-26/Y-4;
- the DSR volume is assumed to be higher by more than 1100 MW in 2028-29/Y-4 compared to 2027-28/Y-4.

Finally, it should also be noted that the methodology regarding end-user flexibility (mainly electric

[1] https://elia.group/ADEQFLEX-EN
[2] https://www.elia.be/en/users-group/adequacy-working-group/20230825-meeting

vehicles, heat pumps and residential batteries) significantly evolves as well as the amount of units considered in each category. This results in more flexibility available in the system compared to the previous CRM calibration report published in November 2022.

In general, a significant share of the electrification coming from both industry and end-users is considered flexible, resulting in higher volumes of flexibility.

Impact on parameters:

- ➔ The flexibility assumptions impact the average load during scarcity as it tends to flatten the load profiles.
- ➔ The higher the installed capacity of an energy-limited technology in a certain area, the lower the derating factor of that technology will be. Considering the higher assumed volume of both storage and DSR in 2028-29/Y-4 compared to 2027-28/Y-4, lower derating factors are expected for the energy-limited technologies.
- ➔ Higher shares of flexibility in the system will also tend to lead to higher inframarginal rents for powerplants. Among others, the more technologies dispatched after OCGTs in the merit order, the higher the expected yearly inframarginal rents obtained on the energy market for this technology. In such situations, there are more occurrences with electricity prices higher than the marginal cost of OCGTs.

Thermal capacities

The reference scenarios for 2025-26/Y-1 and for 2028-29/Y-4 incorporate the most up-to-date information regarding thermal capacities.

For 2025-26/Y-1:

- the scenario considers the nuclear extension projects for Tihange 3 and Doel 4;
- the addition of two new CCGTs, as a result of the Y-4 auction for 2025-26/Y-4[3];
- the capacity of Zandvliet Power is increased from 386 MW to 419 MW[4].

For 2028-29/Y-4:

- the addition of two new CCGTs, as a result of 2025-26/Y-4;
- the addition of OCGT capacity, as a result of 2027-28/Y-4[5];
- the capacity of Zandvliet Power is increased from 386 MW to 419 MW.

Impact on parameters:

➔ No major impact on the calculated parameters.

Renewables

Regarding assumptions related to renewable energies in Belgium, there is a notable increase in installed solar panel capacity between 2025-26/Y-1 and 2028-29/Y-4. Between 2025-26/Y-4 and 2025-26/Y-1, the installed capacity increases by more than 2 GW, which reflects the increased installation rate of the last years.

An increase in onshore wind energy is also considered in light of Belgium's latest ambitions. There is no change in the installed capacity of offshore wind energy for the assessed Delivery Periods.

Impact on parameters:

➔ In general, it is observed that the derating factors for renewable technologies decrease with the increase of those technologies. It should be however noted that the impact on derating factors is also correlated with the installed capacities of these technologies at European level. Given the substantial ambitions regarding solar and wind energy at European level (see Section 1.2), the derating factors for these technologies is affected.

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[3] https://www.elia.be/en/grid-data/adequacy/crm-auction-results
[4] A repowering to 419 MW as of November 2024 is announced on REMIT
[5] https://www.elia.be/en/grid-data/adequacy/crm-auction-results

Storage

Regarding storage capacity, 4 categories are considered:

- Pumped-storage: an installed capacity of 1,305 MW (1161 MW in Coo 1-6 and 144 MW in Plate Taille 1-4) is considered for both auctions, taking into account the reservoir extension and the increased of the turbining capacity.
- Large-scale batteries: an installed capacity of 327 MW is considered for both reference scenarios, taking into account batteries already in service and batteries contracted in 2025-26/Y-4. For 2028-29/Y-4, an additional derated volume of 357 MWd[6] is considered from the results of the 2027-28/Y-4 auction.
- Small-scale batteries: 384 MW and 455 MW are respectively considered for 2025-26/Y-1 and 2028-29/Y-4.
- Vehicle-to-grid: 1% of the electric vehicles are optimized as V2H (vehicle-to-home) in 2028-29/Y-4.

Similarly to renewables, the storage capacity increases significantly between 2025-26/Y-1 and 2028-29/Y-4 with the installed capacity considered for 2027-28/Y-4 falling in between. In 2027-28/Y-4, the assumed total capacity of large-scale and small-scale batteries was equal to 839 MW.

Impact on parameters:

➔ The more storage capacity is present in the system, the more these capacities compete to contribute during scarcity moments, resulting in lower derating factors. This explains the lower storage derating factors calculated for 2028-29/Y-4 as opposed to 2025-26/Y-1. As presented in the part on Renewables, this effect is exacerbated with additional flexibility in the system at the European level.

[6] Considering derating factors from 2027-28/Y-4

1.2. Assumptions for Neighboring Countries

The assumptions for neighboring countries are based on data available in the "European Resource Adequacy Assessment 2022"[7]. This database has been updated and were proposed during the public consultation on the scenarios, sensitivities and data for the CRM parameter calculation for 2025-26/Y-1 and 2028-29/Y-4[8].

In order to have the latest available information for each country, an update of the data for France, Great Britain and Italy were communicated bilaterally to the CREG and the SPF before the determination of the reference scenario. This final update was selected by the Minister for the reference scenario.

All of this data is included in the Excel "Assumptions Workbook" attached to the calibration report, and a summary table is presented in Table 2 for 2025-26/Y-1 and in Table 3 for 2028-29/Y-4.

2025-2026	France	Germany	Netherlands	Great Britain	Spain	Italy	Poland	Denmark
Demand [TWh]	471	574	124	289	259	329	167	41
Onshore Wind [GW]	25	77	10	19	37	14	11	6
Offshore Wind [GW]	2	11	6	23	0	4	0.6	3
Solar [GW]	24	108	34	21	34	45	20	8
Coal [GW]	1.1	25.1	2.7	0.0	0.0	0.5	21	0.4
Nuclear [GW]	62.9	0.0	0.5	5.9	7.1	0.0	0.0	0.0

Table 2 : Assumptions for neighboring countries, incorporated in the reference scenario for 2025-26/Y-1

2028-2029	France	Germany	Netherlands	Great Britain	Spain	Italy	Poland	Denmark
Demand [TWh]	504	619	141	309	261	346	178	50
Onshore Wind [GW]	27	99	11	25	45	17	11	7
Offshore Wind [GW]	3	15	12	36	0	7	6	5
Solar [GW]	40	172	43	28	50	68	25	15
Coal [GW]	0.0	7	2.7	0.0	0.0	0.0	20	0.4
Nuclear [GW]	62.9	0.0	0.5	4.4	5.1	0.0	0.0	0.0

Table 3 : Assumptions for neighboring countries, incorporated in the reference scenario for 2028-29/Y-4

Compared to previous auction, a significant increase of the renewables capacity is observed between 2027-28/Y-4 and 2028-29/Y-4, mainly regarding the solar capacity (+ 20%) and wind onshore (+10%)[9]. This shift is depicted in Figure 1. The trend regarding future electrification is also confirmed. Regarding other parameters, the values remain in the range observed in previous CRM calibration reports.

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[7] ERAA 2022 | ERAA 2022 by ENTSO-E (entsoe.eu)
[8] https://www.elia.be/en/public-consultation/20230418_public-consultation-on-the-scenarios-sensitivities-and-data-for-the-crm
[9] Only considering the capacity in France, Germany, Netherlands, Great Britain, Spain, Italy and Poland, as provided in the assumptions workbook.

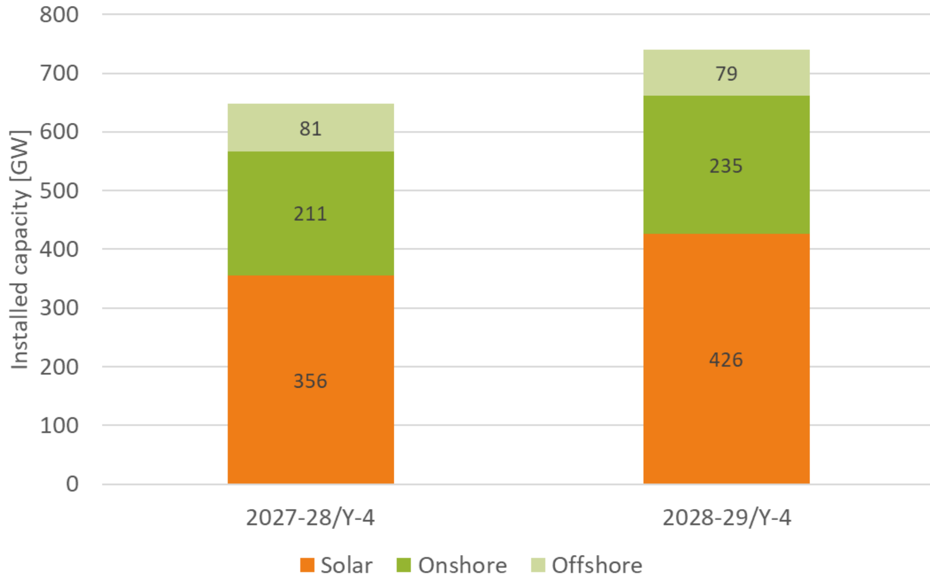

Figure 1 : Evolution of the renewable installed capacity between 2027-28/Y-4 and 2028-29/Y-4. Only considering the capacities in France, Germany, Netherlands, Great Britain, Spain, Italy and Poland, as provided in the assumptions workbook.

In order to compare 2027-28/Y-4 and 2028-29/Y-4, another important evolution regarding neighboring countries is related to the compliancy of each country to its reliability standard. In 2027-28/Y-4, only countries with a market-wide mechanism are assumed to respect their reliability standard (or 3h if unknown). For other countries, only an economic viability loop was applied on potential new capacities. However, this methodology did not ensure that these countries met their reliability standard in the simulations. In 2028-29/Y-4, all countries are assumed to respect their reliability standard (also those that do not have a market-wide CRM in place). This update leads to more installed capacity assumed in Germany, leading to a lower amount of simulated scarcity periods in the country. The scarcity periods in Belgium are therefore less correlated with the ones in Germany (see §2.5).

<u>Impact on parameters:</u>

- ➔ The increased share of renewables in the European system will impact the scarcity profiles and the derating factors.
- ➔ The methodology update impacts directly the installed capacity assumed in Germany, leading to lower amount of scarcity periods and less long-lasting scarcity periods for Germany, which directly impacts the derating factors in Belgium.
- ➔ As more capacity is installed in Germany in 2028-29/Y-4 compared to 2027-28/Y-4, less simultaneous scarcity situations between Germany and Belgium are expected, hence impact the maximum entry capacity distribution over the neighboring countries.

1.3. Price assumptions

The evolution of prices represents another significant change in assumptions, as shown in Table 4. The prices considered were historically high in the previous CRM calibration report. In the reference scenario for the CRM calibration reports of this year, however, prices have decreased. Note that 2027-28/Y-4 was expressed in €2020, while the CRM calibration reports of this year are expressed in €2022. To facilitate the comparison, all prices are converted in €2022.

Fuel and CO_2 prices	2025-26/Y-1 [€2022/MWh]	2027-28/Y-4 [€2022/MWh]	2028-29/Y-4 [€2022/MWh]
Oil	39.5	78.0	34.8
Gas	37.3	51.9	27.0
Coal	16.4	12.5	10.9
	[€2022/tCO2]	[€2022/tCO2]	[€2022/tCO2]
CO_2	98.5	113.8	109.1

Table 4 : Price evolution between the last two calibration reports

Figure 2 illustrates the impact of the evolution of the prices considered on the marginal cost of units in the model, and indirectly on the associated merit order. Compared to the previous calibration report, marginal costs decrease, along with the cost gap between CCGTs and OCGTs.

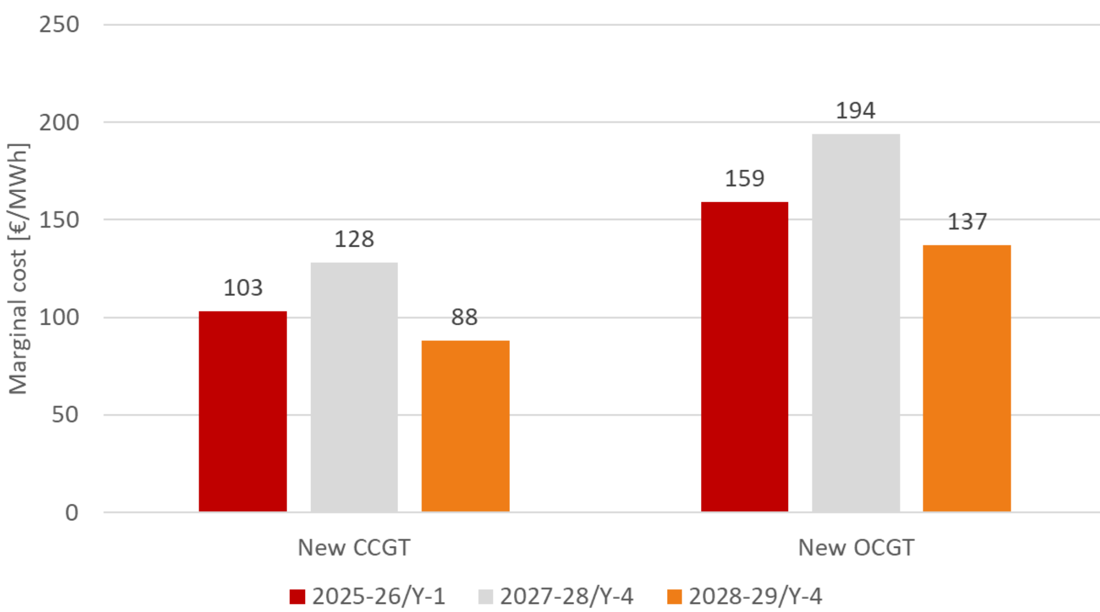

Figure 2 : Evolution of the marginal cost of CCGT and OCGT between the last two calibration reports

Impact on parameters

- ➔ Higher prices lead to higher marginal cost deltas between technologies and therefore the merit order will be stretched. This effect is expected to lead to higher inframarginal rents for technologies firstly dispatched in the merit order.
- ➔ High prices are not the only parameters to impact the revenues. Electrification and higher shares of flexibilities in the system will also tend to lead to higher revenues.

2. Impact on the calibration parameters

2.1. Analysis of scarcity periods

The volume parameters (average electricity consumption, average energy not served, and maximum available entry capacity for indirect foreign capacity participation) as well as the calculated derating factors in the calibration report reflect the average contribution of a specific technology/parameter over all periods in which a scarcity situation occurs in the simulations. The characteristics of these simulated scarcity periods (their length, frequency, and the hours at which they occur) have a significant impact on the final value of the indicators. Therefore, this paragraph provides details and characteristics of these scarcity periods as well as their evolution compared to the previous calibration report.

Distribution of scarcity hours per duration

Firstly, it is important to note that the average number of hours of scarcity per year is the same between the calibration reports. Indeed, this parameter remains constant (by design) and is equal to 3 hours, which corresponds to the reliability standard applicable in Belgium.

Figure 3 presents the histogram and cumulative distribution of simulated scarcity periods for the last two calibration reports.

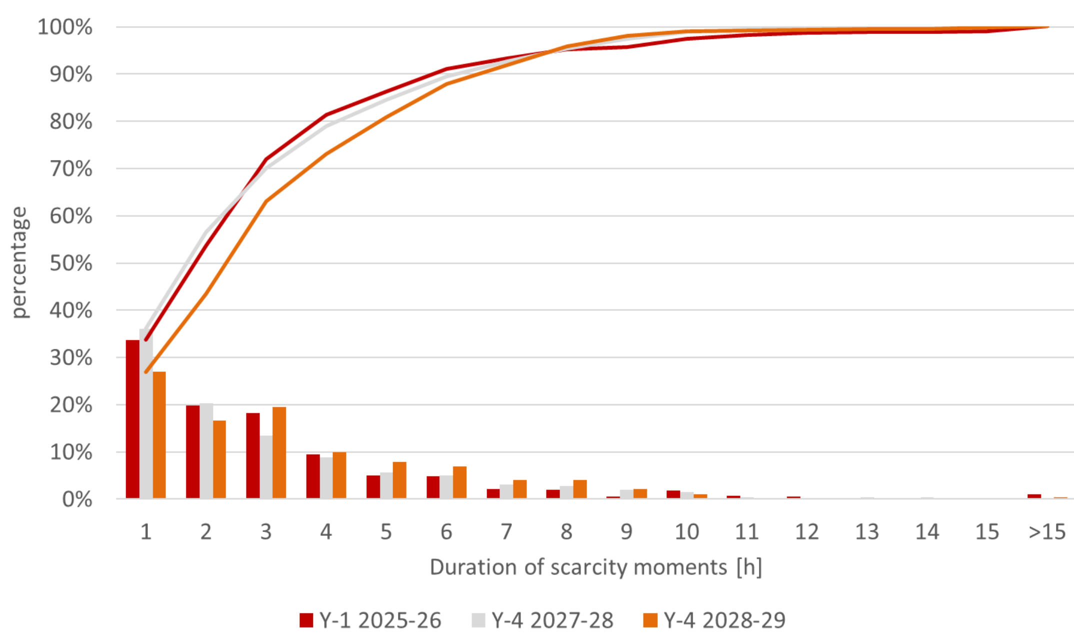

Figure 3: Histogram and cumulative distribution of the length of scarcity periods across the simulated scarcity periods in the last 3 calibration reports.

Changes between the 2028-29/Y-4 and 2027-28/Y-4

For 2028-29/Y-4, the histogram and cumulative distribution of simulated scarcity periods can be compared to the ones from 2027-28/Y-4. The amount of short scarcity periods (less than or equal to 2 hours) are lower. The cumulative distributions for these 2 auctions cross each other for scarcity situations of 8h (or less).

Changes between the 2025-26/Y-1 and 2028-29/Y-4

For 2025-26/Y-1, more short scarcity periods (lower or equal to 3h) are observed, meaning that technologies with a limited hours of availability would be able to contribute during a significant amount of scarcity periods. Compared to 2028-29/Y-4, there are fewer batteries and less flexibility from the industrial and residential sectors in 2025-26/Y-1. This will result in scarcity hours being more concentrated around specific times of the day, leading to shorter scarcity periods. Furthermore, more very long scarcity periods are also observed in 2025-26/Y-1 (10 hours or more). This can be attributed to the strong correlation between scarcity periods in Belgium and France, mainly driven by the low nuclear availability in France (see §1.2). Indeed, longer scarcity periods are the result of nuclear unavailabilities (which last for longer periods).

Consecutive days with scarcity

When observing the number of consecutive days with at least 1 hour of scarcity, as presented in Figure 4, it should be noted that most simulated scarcity periods occur only within a single day. This probability is similar between the Delivery Periods of the 3 auctions. Longer-lasting scarcity periods occur when wind production is low for an extended period or when nuclear availability (both in France and Belgium) is low. This observation will also impact the derating factors for energy-limited technologies, primarily because recharge periods must be available between scarcity periods for these technologies to contribute to adequacy.

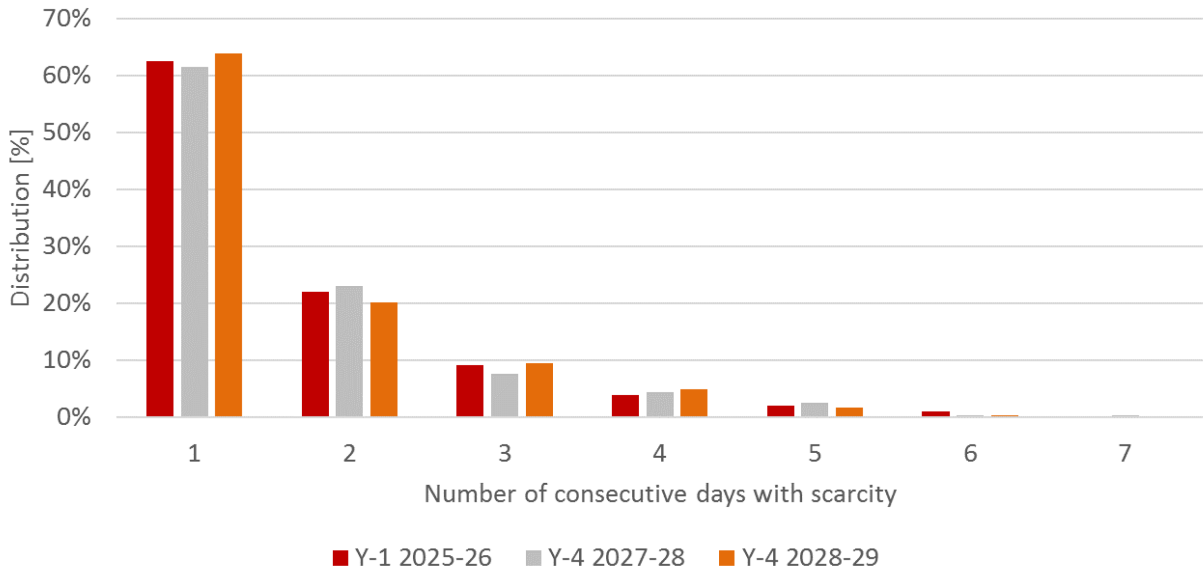

Figure 4: Distribution of consecutive days with at least 1 scarcity moment

Intra-daily distribution of scarcity hours

Figure 5 depicts the intra-daily distribution of simulated scarcity periods, in other words, the times of day during which the simulated scarcity situations occur.

<u>Changes between the 2025-26/Y-1 and 2028-29/Y-4</u>

Compared to the Y-4 auctions, the scarcity hours for 2025-26/Y-1 are more concentrated around specific times of the day, which are the morning and the evening peaks. This observation can be explained by the lower share of flexibility assumed for 2025-26.

<u>Changes between the 2028-29/Y-4 and 2027-28/Y-4</u>

To explain the difference between 2027-28/Y-4 and 2028-29/Y-4, it is important to know that compared to the previous calibration report, all the countries are now assumed to respect their reliability standard or 3h if unknown (see §1.2). In the previous calibration reports, this was only assumed for the countries with a market-wide capacity mechanism. Therefore, a stronger correlation of scarcity situations with Germany (not complying with its reliability standard), was observed in the previous calibration report (see §1.2), leading to longer scarcity periods around the peaks.

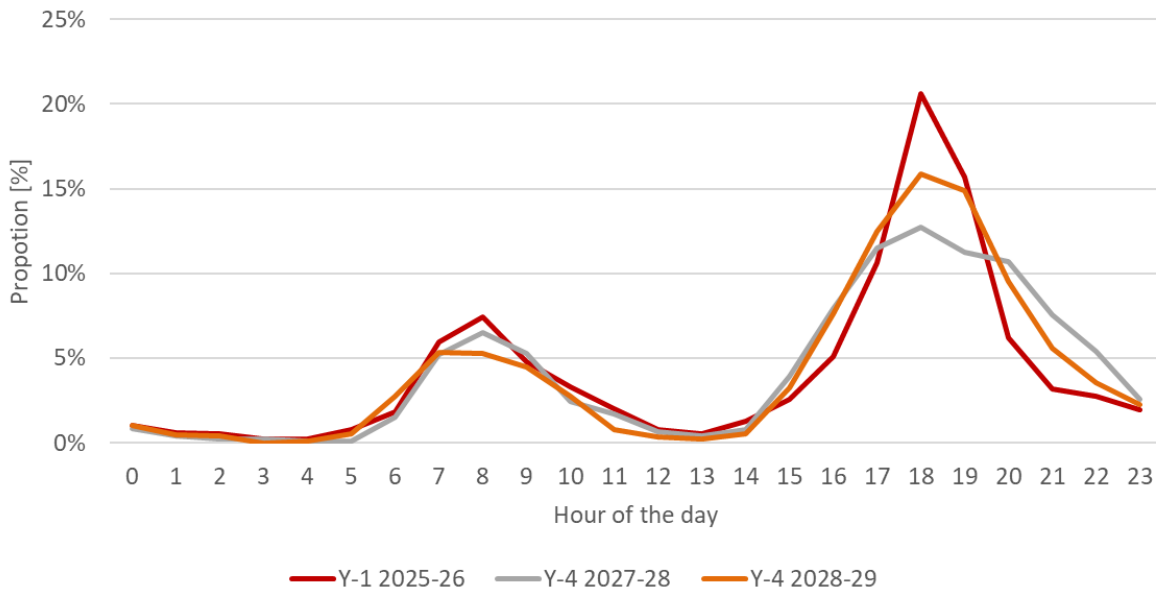

Figure 5: Intra-daily distribution of simulated scarcity periods between the last two calibration reports.

Monthly distribution of scarcity hours

Figure 6 presents the monthly distribution of observed scarcity periods during the winter. Most scarcity situations occur in January. One of the key factors explaining the differences between the various Delivery Periods is the availability profiles of the French nuclear power. Each auction employs a different profile:

- 2025-26/Y-1 uses the latest information available on REMIT;
- 2027-28/Y-4 used the profile of ERAA 2021;
- 2028-29/Y-4 uses the profile of ERAA 2022.

Given the significant correlation between scarcity periods and the availability of French nuclear, the profile can have a substantial impact on the monthly distribution of simulated scarcity periods. As the availability of French nuclear was assumed to be worst in February for 2025-26/Y-1 and 2028-29/Y-4, a higher amount of scarcity events is assumed to happen during this month.

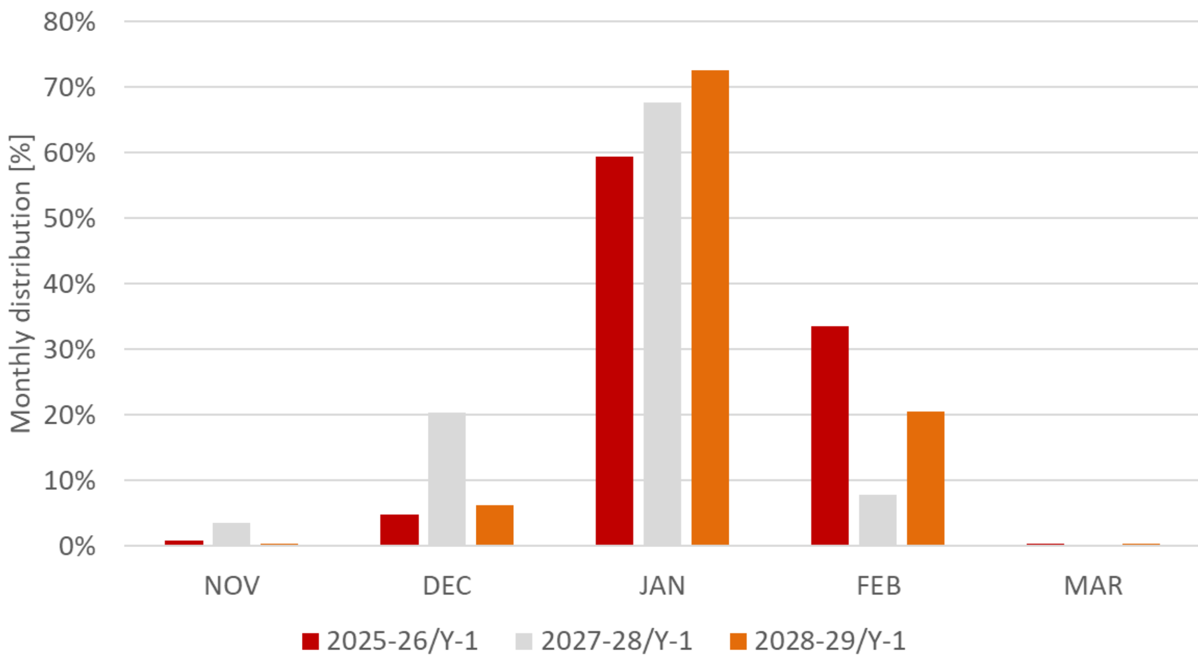

Figure 6: Monthly distribution of simulated scarcity periods during winter

2.2. Derating factors for energy-limited technologies

Derating factors for energy-limited technologies (batteries, demand side management, pumped storage, etc.) are correlated with the profiles of simulated scarcity periods. The shorter the simulated scarcity periods, the higher the derating factors will be. This is because the contribution of these technologies is linked to their ability to provide energy for a certain number of consecutive scarcity hours. Regarding storage technologies (batteries and pumped storage), it should be noted that the reservoir must be filled first so that the technology can contribute during the simulated scarcity periods, meaning that surplus energy must also be available between two simulated scarcity periods. The charge/discharge or pump/turbine efficiency will then determine which technology is used first to achieve an optimal solution.

To understand the impact of shorter simulated scarcity periods on the derating factors of energy-limited technologies, a relevant indicator is the distribution of simulated scarcity periods weighted by event duration, as depicted in Figure 7.

Considering an SLA with an associated availability duration of 3 hours as an example. This SLA will be able to provide energy for all scarcity periods of 1, 2, and 3 hours. However, this SLA can only partially contribute to longer events.

Figure 7 considers the total number of simulated scarcity hours, providing a more precise indicator of the impact on derating factors. While there may be more 1-hour scarcity periods than 2-hour scarcity periods, the fact that the latter have a duration of two hours means that the total number of hours in 2-hour scarcity periods is higher than in 1-hour scarcity periods.

It should be noted that this cumulative distribution does not consider certain aspects, such as:

- The fact that the availability duration of an SLA is determined on a daily basis in the model, which means that a 2-hour SLA can contribute to a 1-hour scarcity period in the morning and another 1-hour scarcity period in the evening. This graph was constructed solely based on the distribution of simulated scarcity period lengths without considering the daily constraints of SLAs.
- The fact that the penetration of energy-limited technologies in the market has an impact on the overall contribution of energy-limited technologies. Indeed, the more these technologies are present in the system, the lower their derating factor will be. This effect was explained during the Task Force CRM Meeting on January 8, 2021[10]. This impact is only partially taken into account as the scarcity periods are impacted by the energy mix and the amount of flexibility in Belgium and neighboring countries.

[10] https://www.elia.be/en/users-group/crm-implementation/20210108-tf-crm-21

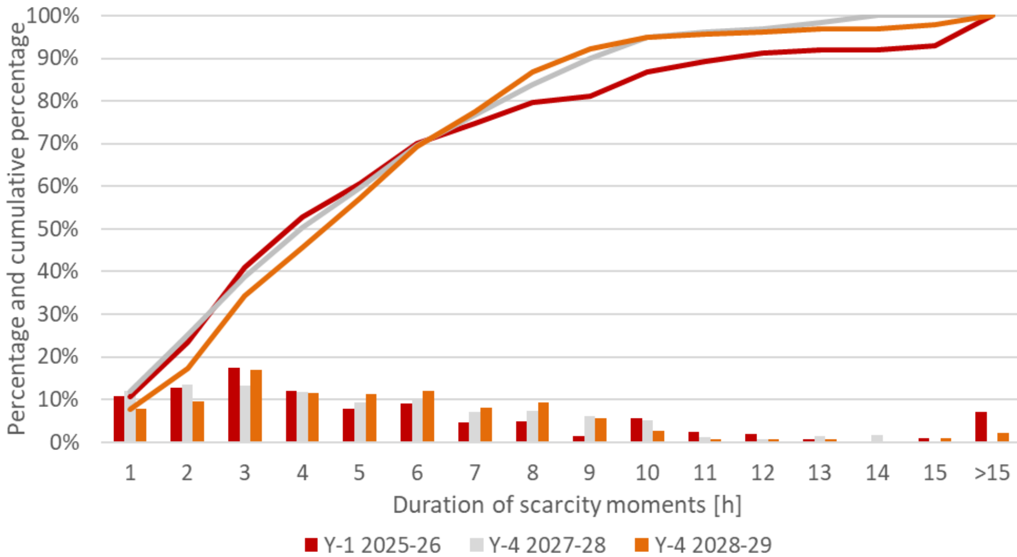

Figure 7: Cumulative and normal distribution of scarcity moments according to their duration and weighted by their duration.

<u>Changes between the 2025-26/Y-1 and 2028-29/Y-4</u>

The cumulative distribution shown in Figure 7 provides an indication of the derating factors for energy-limited technologies.

- ➔ It shows that derating factors are expected to be better in 2025-26/Y-1 than in 2028-29/Y-4 for energy-limited technologies with a low or medium availability duration (<= 6h). This is linked to the lower renewables and storage in the system.
- ➔ Derating factors for technologies with long availability duration (> 6h) are expected to be lower in 2025-26/Y-1 compared to 2028-29/Y-4, due to the impact of the few long scarcity events that can be explained with the nuclear availability in France. Indeed, longer scarcity periods can happen if nuclear availability is limited for a long period.

<u>Changes between the 2027-28/Y-4 and 2028-29/Y-4</u>

Figure 7 also shows that derating factors for energy-limited technologies are expected to be lower in 2028-29/Y-4 compared to 2027-28/Y-4 as there is more electrification, renewables and flexibility in the system.

Comparison of derating factors between auctions for Delivery Period 2025-26

Figure 8 provides a comparison between 2025-26/Y-4, performed 3 years ago, and 2025-26/Y-1, performed this year. It should be noted that a lot of changes happen during those auctions, among others the war in Ukraine leading to a significant increase of fuel prices, the covid-19 crisis which impacted the electricity demand, the Fit for 55 and REPowerEU packages at European level, leading to an acceleration of electrification, flexibility and renewables, the extension of two nuclear units in Belgium and the continuous methodology improvements (climate database, modelization of flexibility, …).

Derating factors for energy-limited technologies are higher in 2025-26/Y-1 as the amount of long scarcity events decreases significantly, mainly due to the evolution of the climate database. This effect also leads to lower derating factors for solar as less scarcity periods happen during the day.

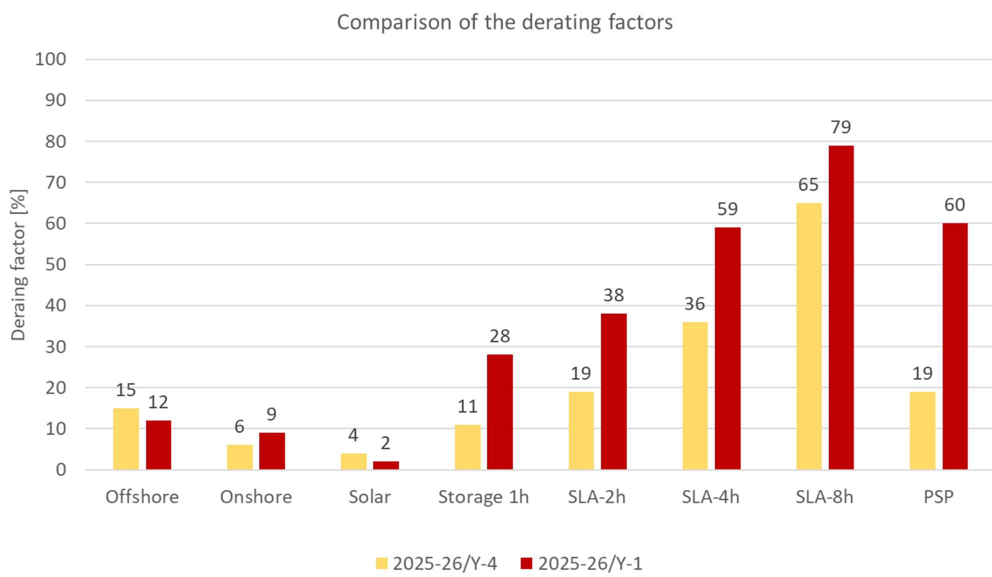

Figure 8 : Comparison of the derating factors for 2025-26/Y-4 and 2025-26/Y-1 for a selection of technologies[11]

[11] For PSP in 2025-26/Y-4, it refers to the value published by the TSO in the CRM calibration report. The Ministerial Decree provided updated values for energy-limited technologies with daily schedule : https://www.ejustice.just.fgov.be/cgi_loi/change_lg.pl?language=fr&la=F&cn=2021043002&table_name=loi

Comparison of derating factors between last two Y-4 auctions

Figure 9 presents the difference in derating factors between 2027-28/Y-4 and 2028-29/Y-4 for a selection of technologies. In general, it can be noted that the derating factors remain in the same range of results although the values in 2028-29/Y-4 are slightly lower.

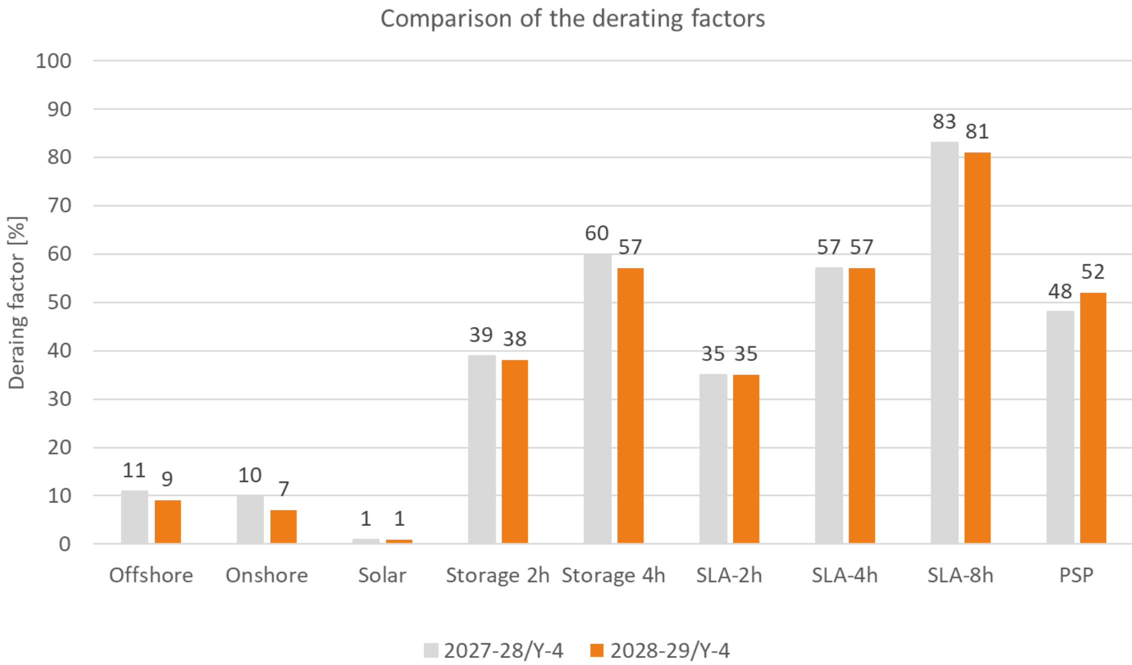

Figure 9 : Comparison of the derating factors for 2027-28/Y-4 and 2028-29/Y-4 for a selection of technologies

Comparison of derating factors at European level

Figure 10 presents a comparison of derating factors for energy-limited technologies from 2025-26/Y-1 and 2028-29/Y-4 and reports from other countries with a capacity mechanism. Data for Great-Britain comes from National Grid ESO's '2022 Electricity Capacity Report'[12], data for Italy comes from Terna's 'Rapporto adeguatezza 2023'[13] and data for Ireland from SEM-O's '2027/2028 T-4 Capacity Auction: Initial Auction Information Pack'[14] and '2026/2027 T-4 Capacity Auction: Initial Auction Information Pack'[15].

It can be noted that the values from the Belgian's CRM are in line with the values published in other capacity mechanism across Europe. Derating factors for energy-limited technologies in Belgian's CRM are even on the top side of the range.

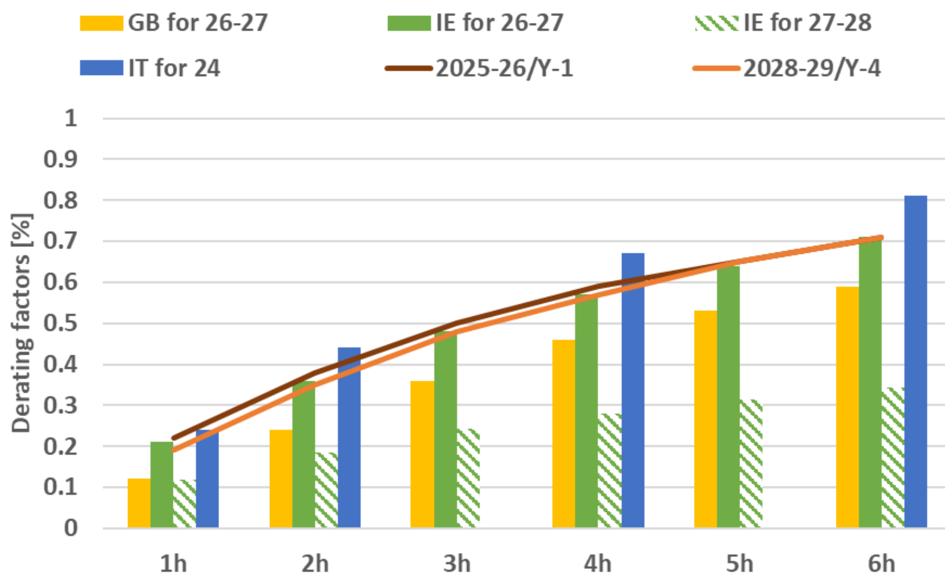

Figure 10: Comparison of derating factors with capacity mechanism in other countries

12 https://www.emrdeliverybody.com/Capacity%20Markets%20Document%20Library/Electricity%20Capacity%20Report%202022.pdf
13 https://download.terna.it/terna/Terna_Rapporto_Adeguatezza_Italia_2022_8db050a8496bbb3.pdf
14 https://www.sem-o.com/documents/general-publications/IAIP2728T-4.pdf
15 https://www.sem-o.com/documents/general-publications/Initial-Auction-Information-Pack_IAIP2627T-4.pdf

2.3. Average electricity consumption during simulated scarcity situations

The calculation encompasses both electricity consumption and a predefined flexibility volume, as established in the reference scenario. In the event that the modeling of either electricity consumption or flexibility undergoes changes, their impact on the average electricity consumption during simulated scarcity situations should be correctly taken into account.

For 2027-28/Y-4, the average electricity consumption during scarcity situations was calculated by taking the average electricity consumption from the reference scenario, decreased by the "out-of-market" flexible capacity considered in the reference scenario (part of small-scale batteries and part of vehicle-to-grid).

For 2025-26/Y-1 and 2028-29/Y-4, several improvements were applied in the modelling of the electricity consumption and flexibility, as introduced in the framework of AdeqFlex’23 (see §1.1). The calculation of the average electricity consumption during simulated scarcity hours had to be adapted consequently. Table 5 aims to present the different categories of consumption flexibility and how it was considered in the calculation.

- DSR from existing usages is calculated based on the estimation by E-cube on historical volumes, where bids on the day-ahead market above a certain threshold are considered as DSR. The flexibility from these sources is not considered as a reduction in the average electricity consumption during scarcity but is expected to offer into the CRM.
- End-user flexibility (mainly from electric vehicles, heat pumps and residential batteries is removed from the average consumption during scarcity.
- DSR volumes from newly electrified industry or new usages (industrial heat pumps, e-boilers, steel, CCS or datacenters) also represent a significant share of DSR volume in the reference scenario. For flexibility from newly electrified processes, two categories are considered:
    - DSR volumes reacting to low prices are removed from the average consumption during scarcity;
    - DSR volumes reacting to high prices:
        - for 2025-26/Y-1 are treated similarly as DSR from existing usages. It means that this volume is expected to be contracted in CRM auction for adequacy purpose;
        - for 2028-29/Y-4, 50% are treated similarly as DSR from existing usages and 50% are removed from the average consumption during scarcity.

  The equivalent share of DSR from newly electrified industry or new usages removed from the average electricity consumption during simulated scarcity situations is provided in Table 5. This results in respectively 79% and 81% of DSR from newly electrified industry or new usages being removed from the average electricity consumption during simulated scarcity in 2025-26/Y-1 and 2028-29/Y-4.

		2025-26/Y-1	2028-29/Y-4
DSR from existing industry (E-Cube)		Not removed from the average electricity consumption during scarcity	Not removed from the average electricity consumption during scarcity
End-user flexibility	Electric vehicles	Removed from the average electricity consumption during scarcity	Removed from the average electricity consumption during scarcity
	Heating		
	Residential batteries		
DSR from additional electrification in industry	Electrolysers	79% removed from the average electricity consumption during scarcity	81% removed from the average electricity consumption during scarcity
	E-boilers		
	Data centres		
	Indust. HP		
	Steel		
	CCS		

Table 5: Consideration of flexibility in the calibration reports

Figure 11 compares the average electricity consumption during simulated scarcity situations (point B) between the different auctions in the last two calibration reports.

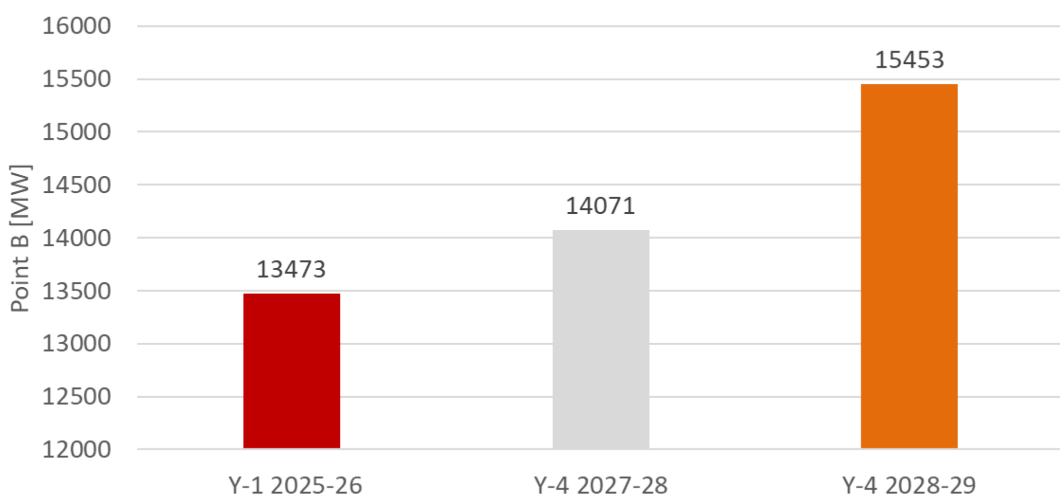

Figure 11 : Average electricity consumption during simulated scarcity situations

These differences can be explained as follows:

- The average consumption during scarcity is dependent on a variety of factors of which the annual consumption plays a major role. The annual consumption for 2025-26/Y-1 is 85.7 TWh compared to 102.4 TWh for 2028-29/Y-4. This represents an average hourly difference of 1.9 GW, although this difference is not evenly distributed throughout the year. The total annual consumption assumed for 2027-28/Y-4, by comparison, was 90.9 TWh resulting in an average consumption during scarcity that falls between those calculated for the 2025-26 and 2028-29 Delivery Periods.
- The higher numbers of electric vehicles and heat pumps in 2028-29/Y-4 compared to 2025-26/Y-1 will also affect the average electricity consumption during scarcity. The increased presence of electric vehicles will tend to increase the evening peak, and the increased number of heat pumps will tend to create additional seasonality in the consumption profile due to higher heat demand in winter.
- As mentioned above, flexibility considered unlikely to participate to 2025-26/Y-1 or 2028-29/Y-4 respectively is considered in the average electricity consumption. The higher amount of flexibility considered in 2028-29/Y-4 will mitigate the increase of the higher average load during scarcity.
- Finally, as presented in Figure 5, the scarcity periods in 2025-26/Y-1 are more concentrated around the evening peak. This will tend to increase the average electricity consumption during scarcity periods because its value will be more dependent on the contribution of the evening peak demand. This effect is most present for the 2025-26 Delivery Period. This observation can also be concluded based on Figure 12. The delta between the highest load during scarcity and the lowest load during scarcity is larger for 2027-28/Y-4 as more scarcity hours are encountered outside of the peak hours.

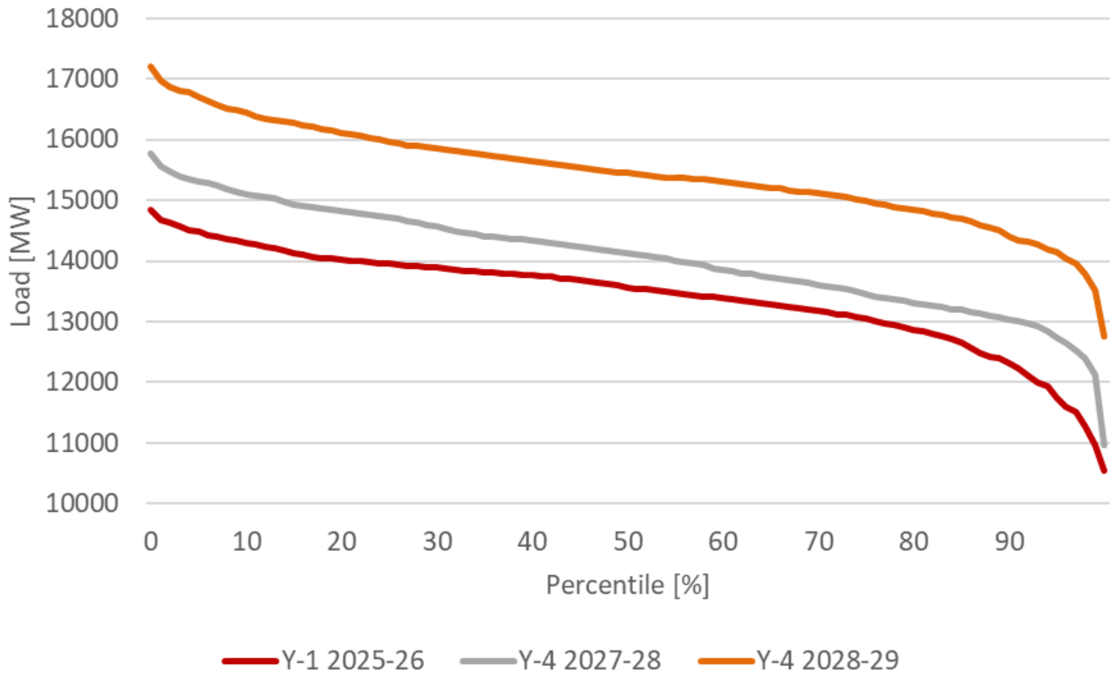

Figure 12: Comparison of the distribution of the load during scarcity periods

2.4. Expected energy not served during simulated scarcity situations

Another parameter used to determine the target volume is the expected Energy Not Served (ENS) during simulated scarcity situations. This parameter is determined by averaging the unserved energy over all hours in which a scarcity situation is observed. In the context of the calibration report for 2027-28/Y-4, this volume for point B was 453 MW. The values for 2025-26/Y-1 and 2028-29/Y-4, respectively 478 MW and 443 MW, and the distribution (see Figure 13) are similar to the value of last year.

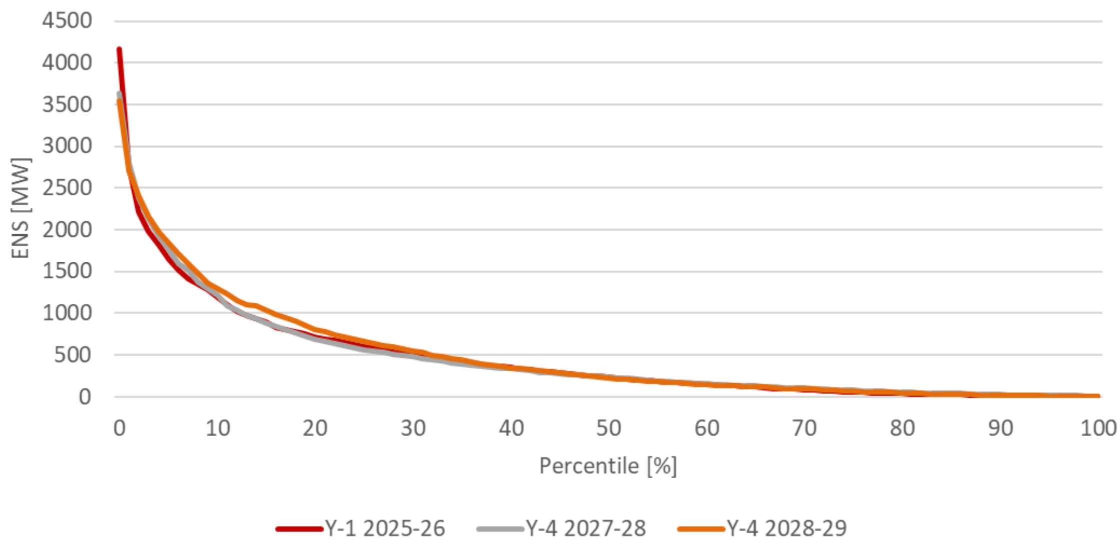

Figure 13: Comparison of Energy Not Served (ENS) distribution

2.5. Maximum Available Entry Capacity for Indirect Foreign Capacity Participation

The maximum available entry capacity for indirect foreign capacity participation also changed between the calibration reports, as shown in Table 6.

This total capacity remains relatively stable between the two Y-4 auctions. The differences between countries can be explained by the fact that Germany is now ensured to comply with its reliability standard following the updated methodology developed in AdeqFlex'23, and the effects of electrification in neighboring countries (see §1.2).

The maximum entry capacity available for indirect foreign capacity participation is twice as high for the Y-1 auction compared to the other two Y-4 auctions. This difference is due to the lower occurrence of scarcity periods in the Netherlands, Germany, and Great Britain, resulting in more cross-border capacity being available during scarcity situations in Belgium. Conversely, France contributes nothing to this increased capacity. Specifically, during the 2025-26 Delivery Period, Belgian scarcity periods are closely linked to scarcity periods in France, primarily due to periods of low nuclear availability in France (see Figure 14).

	2025-26/Y-1 Volume [MW]	2027-28/Y-4 Volume [MW]	2028-29/Y-4 Volume [MW]
France	0	119	10
Netherlands	976	260	497
Germany	284	2	132
Great Britain	709	553	379
TOTAL	**1969**	**934**	**1018**

Table 6 : Comparison of the Maximum Available Entry Capacity for Indirect Foreign Capacity Participation during scarcity situations between the last two calibration reports

This volume is closely related to the assumptions made for the control areas directly electrically connected to the Belgian control area, as mentioned earlier (§1.2).

The analysis of simultaneous simulated scarcity periods (Figure 14) highlights the differences in correlation of simulated scarcity periods in Belgium with other countries and its effect on the cross-border contribution of those countries.

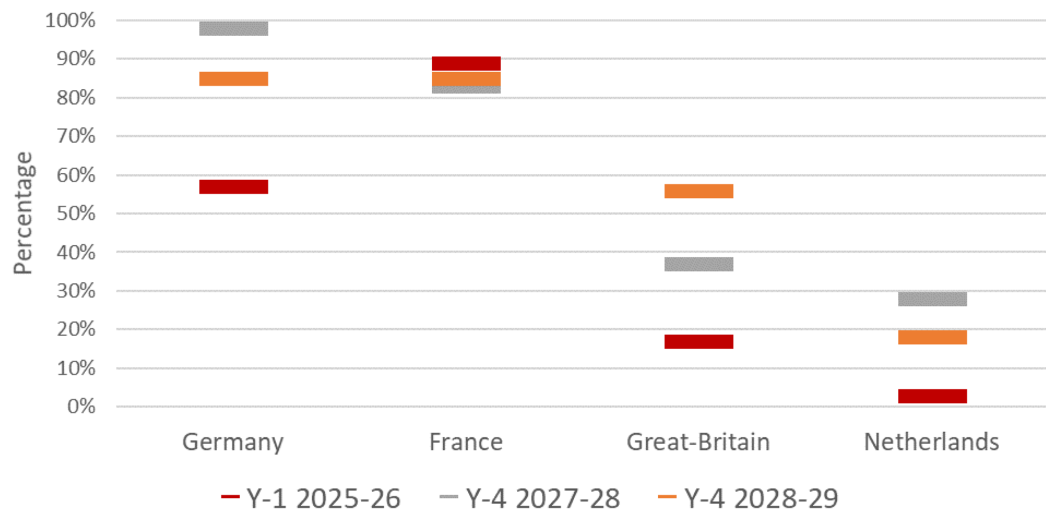

Figure 14: Comparison of the correlation of scarcity moments between Belgium and neighboring countries

<u>Evolution for France</u>

For France, the contribution has decreased compared to 2027-28/Y-4. This is linked to the higher nuclear unavailability compared to previous report and the lower simultaneous scarcity situations

<u>Evolution for Germany</u>

In the case of Germany, there is a significant increase in contribution for both 2025-26/Y-1 and 2028-29/Y-4. In 2028-29/Y-4, all countries were adjusted to meet their reliability criteria, even if they don't have a capacity remuneration mechanism in place. This aligns with the methodology followed in AdeqFlex'23. Prior to the calibration process, Germany did not meet its reliability criteria due to its electrification ambitions, which entail higher electricity consumption, as well as the anticipated acceleration of the coal phase-out. In the calibration report for 2027-28/Y-4, only an economic viability assessment on potential new capacities was performed. Germany therefore did not meet its reliability criteria which resulted in a high level of correlation in scarcity periods between Belgium and Germany. Consequently, Germany's cross-border contribution was lower. For 2025-26/Y-1, Germany had a margin, leading to a lower level of correlation with Belgium and a higher cross-border contribution for Germany.

<u>Evolution for the Netherlands</u>

The increase observed in 2025-26/Y-1 and 2028-29/Y-4 for the Netherlands is also significant. This increase is mainly due to the correlation with Germany and the expected developments in the Dutch energy mix. As simultaneous scarcity situations between Belgium and Germany decrease in occurrence, more capacity from the Netherlands is available for Belgium in case of scarcity situations in Belgium.

Evolution for Great Britain

Finally, a decreasing trend across Delivery Periods in the contribution from Great Britain is observed. This is due to the increasing electricity demand in the country reducing its export capacity.