Explanatory note for the Public consultation on the scenario's, sensitivities and data for the CRM parameter calculation for the Y-4 Auction with Delivery Period 2025-2026

May 2020

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Introduction

In order to support the public authorities in meeting their responsibility to ensure the security of supply for Belgium, Elia is provided with a number of tasks. In the framework of the Capacity Remuneration Mechanism ('CRM') these tasks are foreseen in the Electricity law (by its modification of April 22nd 2019) and in the proposed secondary legislation following this law. Recent instructions were in addition given by the authorities to prepare the first auction in this framework (see chapter 1).

As from the start, Elia, together with the FPS Economy and the CREG have set up an intensive stakeholder involvement process. This has greatly helped to improve the elaborated documents and this interaction will continue to take place in preparation of the first auction, foreseen by March 2021.

As will be further elaborated in the next section, the instruction received from the public authorities is to go further with the elaborated design and ensure that all necessary preparation is undertaken to organize the first auction.

A consecutive step towards the market parties is the organization of a public consultation on the data, scenario and sensitivities for the first volume and parameter report for the CRM for Delivery Period 2025-26, starting on 1 November 2025.

The scope of the public consultation includes the scenarios dataset presented on §2.1, the sensitivities menu on §2.2 and the parameters required by the proposed Royal Decree on §3. Regarding sensitivities, feedback from stakeholders on the proposed sensitivities are welcome just like other quantified sensitivities proposal in line with article 6, §2, 2° of the proposed Royal Decree.

This explanatory document is provided to give stakeholders more context and guidance on the submitted consultation document, which is a vast Excel-file with above mentioned data. It foresees also some additional qualitative information, which is not quantified in the Excel. Should there be any remark on this document, this can obviously be provided as part of the consultation contribution.

1. Legal and regulatory framework

The law of 22 April 2019, modifying the federal electricity law of 29 April 1999 foresees in its article 7undecies §2 that the Transmission System Operator (Elia) elaborates on a yearly basis and after public consultation, the reports providing the calculation for the necessary volume and a proposal of auction parameters on the basis of a methodology adopted by the King, on proposition of the TSO, made after public consultation and advice of the regulator.

Since the adoption of the law, the Electricity Regulation (2019/943) entered into force and is applicable as of January 1st 2020. This regulation implies some evolutions to this legal framework and has led to several alignment discussions within the Comité de Suivi, i.e. the working group presided by the FPS Economy and bringing together representatives of the cabinet of the Minister of Energy, the CREG and Elia.

These discussions have lead the CREG to propose a note on certain aspects for the above mentioned methodology to be adopted by the King on the one hand, and Elia proposed a methodology for other related aspects of the volume determination. Both have been provided to the FPS Economy after public consultation.

The FPS Economy combined both inputs, made some modifications and has put an integrated proposal for Royal Decree Methodology for the volume and parameter calculation of the CRM to public consultation. The consultation report, the advice from the FPS Economy and the modified final proposal of Royal Decree, as submitted towards the European Commission, is published on the FPS Economy's website[1] as of April 21st.

For more context and background, we refer to the advice of the FPS Economy and the other documents published on the above mentioned website.

Following the finalization of this proposal of Royal Decree, the FPS Economy received an instruction from the Minister of Energy to prepare, together with the Members of the Comité de Suivi, the necessary works for the first auction, and this in accordance with the secondary legislation as introduced towards the European Commission (i.e. in this case, the proposed Royal Decree of the FPS Economy). The Members of the Comité de Suivi were informed about this on April 20th. Elia commits to ensure the qualitative completion of its tasks as requested by the public authorities, eventhough the secondary legislation is not (yet) formally adopted. The concrete instruction that the FPS Economy received from the Minister of Energy and which has been shared with the Comité de Suivi is the following:

[1] https://economie.fgov.be/nl/themas/energie/bevoorradingszekerheid/capaciteitsremuneratiemechanis

Madame Mahieu,

La législation secondaire relative à la mise en œuvre de la loi CRM (hormis l'AR financement) ayant été introduite auprès de la DG Concurrence et en vue d'assurer la sécurité d'approvisionnement du pays en électricité dès 2025, la Ministre demande à la DG Energie de faire, en collaboration avec les membres du comité de suivi CRM, le nécessaire pour préparer la première enchère qui devra avoir lieu en 2021 et ce, en respectant la législation secondaire comme elle a été introduite, y compris les délais, les procédures et les méthodologies y décrits.

Il convient notamment d'inviter les membres du comité de suivi CRM à commencer dans les plus brefs délais les travaux décrits dans les articles 4 et 5 de l' « avant-projet d'arrêté royal fixant la méthode de calcul du volume de capacité nécessaire et des paramètres nécessaires pour l'organisation des enchères dans le cadre du mécanisme de rémunération de capacité », y compris les consultations publiques, en vue d'un choix de un ou plusieurs scenario(s), des données et hypothèses à partir desquels ils sont établis et de paramètres intermédiaires avant le 30 juin de cette année.

The FPS Economy consequently organized further meetings and requested Elia to prepare the necessary alignment with the FPS Economy and the CREG, as stipulated in article 4 of the proposed Royal Decree.

This alignment has been duly performed via teleconference meetings on April 24th and 30th, with intermediate written feedback. The CREG has decided to participate as observer in both meetings and requested an additional concertation, bilaterally with Elia, on May 4th. This concertation has taken place, with the FPS Economy as observer. These interactions have led to several modifications of the consultation documents.

The proposed Royal Decree (art. 6 §1) stipulates that the public consultation should last for a period of one month. It will thus last from 05/05/2020 until 05/06/2020 (18h).

After the consultation period, Elia will elaborate a consultation report, including recommendations, as stipulated in article 6, §3 of the proposed Royal Decree. This will be submitted to the Minister, the FPS Economy and CREG. Afterwards, it is foreseen that the CREG makes a proposal for scenario, taking this consultation report and the stakeholder feedback into account. Consequently, the FPS Economy makes an advice on this proposal (art.4, §6) and ultimately, it is up to the Minister of Energy to make a decision by June 30th (art.4 §7). This decision concerns the scenario and the intermediate values of gross CONE and the X-factor, for which a separate public consultation will be organized by the CREG in accordance with art. 5 of the proposed Royal Decree.

Given the short timings, and as foreseen in art. 26 of the proposed Royal Decree, a slight modification to the planning has been agreed in the Comité de Suivi (with CREG as observer). This implies that the Minister's above mentioned decision will not be taken before June 30th, but before July 21st. This timing foresees two weeks for the CREG to elaborate their proposal (by June 30th) and two weeks for the FPS Economy to provide their advice (by July 14th).

2. Scenario and sensitivities

This chapter describes the data and assumptions related to the scenarios and sensitivities that have to be submitted to public consultation according to article 6 of the proposed Royal Decree. The overall process should lead to the Minister to select a reference scenario that will be used to determine the required data to be calculated by Elia in its report, as mentioned in article 7, §2.

This chapter contains two main parts: the main data and assumptions regarding the scenario (Article 6, §2, 1°) and the sensitivities that could be integrated in the reference scenario (Article 6, §2, 2°).

Proposed Royal Decree Reference	
Art. 6. § 2. Les sujets suivants au moins sont soumis à une consultation publique: 1° la mise à jour des données et des hypothèses du scénario ou des scénarios, ainsi que des sensibilités éventuellement sélectionnées, telles que visées à l'article 4, § 3 ; 2° la pertinence des sensibilités visées à l'article 4, §4, en ce compris les données et hypothèses à partir desquelles elles ont été établies ; (…)	**Art. 6.** § 2. Ten minste de volgende onderwerpen worden openbaar geraadpleegd: 1° de actualisatie van de gegevens en hypothesen van het scenario of de scenario's en de eventueel geselecteerde gevoeligheden zoals bedoeld in artikel 4, §3; 2° de relevantie van de gevoeligheden bedoeld in artikel 4, § 4, inclusief de gegevens en hypothesen waaruit ze zijn opgebouwd; **(…)**

Note that the methodology related to the model and simulation will be in line with the latest Mid-Term Adequacy Forecast (MAF 2019) performed at ENTSO-E level and in line with article 12, §2 of the proposed Royal Decree.

2.1 Data and assumptions for the scenario

This section presents all the data and assumptions included in the scenario. These data come from the Mid-term Adequacy Forecast 2019 from ENTSO-E[2], which is the most recent European adequacy assessment and which has been updated based on the most recent available information. The sources of the updates are mentioned in each sub-section. The associated data are presented in the Excel file provided, 1° Data and assumptions for the scenario.

Proposed Royal Decree Reference	
Art. 4.	**Art. 4.**
§ 2. Un ou plusieurs scénarios et sensibilités sont sélectionnés à partir de l'évaluation européenne la plus récente visée à l'article 23 du Règlement (UE) 2019/943 ou de l'évaluation nationale visée à l'article 24 du Règlement (UE) 2019/943. Cette sélection comprend au moins le scénario de référence central européen visé à l'article 23, § 1er, 5, b) du Règlement (UE) 2019/943. Si lesdites évaluations ne sont pas encore disponibles, une sélection est effectuée à partir d'autres études disponibles.	§ 2. Uit de meest recente Europese beoordeling bedoeld in artikel 23 van Verordening (EU) 2019/943 of de nationale beoordeling bedoeld in artikel 24 van Verordening (EU) 2019/943, worden één of meerdere scenario's en gevoeligheden geselecteerd. Deze selectie omvat minstens het Europese centrale referentiescenario bedoeld in artikel 23, § 1, 5, b) van Verordening (EU) 2019/943. Indien deze beoordelingen nog niet beschikbaar zijn, wordt een selectie gemaakt uit andere beschikbare studies.
§ 3. Les données et hypothèses à partir desquelles lesdits scénarios et sensibilités ont été établis, sont mises à jour sur la base des informations pertinentes les plus récentes.	§ 3. De gegevens en hypothesen waaruit deze scenario's en gevoeligheden zijn opgebouwd worden geactualiseerd op basis van de meest recente relevante informatie.

2.1.1 Generation & Storage

First, the Belgian generation and storage capacities are presented. This sub-section also includes the forced outage rate based on historical data. The data comes from the 2019 Mid-Term Adequacy Forecast performed at ENTSO-E level, in line with article 4, §2 of the proposed Royal Decree, and have been updated according to the most recent available information sources. Table 1 presents the main update implemented in the CRM calibration.

[2] https://www.entsoe.eu/outlooks/midterm/

Data	Value in MAF 2019	Updated Value	Sources
Doel 2 availability	out of market	in the market until 1st December 2025	Belgian Law
Onshore wind	3430 MW	3747 MW	Final NECP (WAM)
Offshore wind	2271 MW	2253 MW	Final NECP (WAM)
Solar	7587 MW	8000 MW	Final NECP (WAM)
New CCGT	+ 2,5 GW of new CCGT	no new CCGT	Proposed Royal Decree, Article 7, §1
Awirs 4	in the market	out of market	Info from producer
Monsanto Lillo WKK	out of market	in the market	Info from producer
Vilvoorde GT	out of market	in the market	Info from producer
Ixelles-Volta TJ	out of market	in the market	Info from producer
Forced outage rate	MAF 2019 dataset	Excel file section 1.5	Detailed Belgian analysis based on ENTSO-E Transparency Platform, Elia internal database. Same as used for other Elia adequacy studies

Table 1: Update on generation & storage data

2.1.1.1 Generation & Storage summary

A summary of the generation and storage installed capacity for the 2025-2026 delivery period is presented in the Excel file (section 1.1). Figure 1 presents graphically the installed capacities for each technology and already includes market response data presented in §2.1.2.2.

Regarding individually modelled non-renewable thermal generation, the numbers have been taken from the Mid-Term Adequacy Forecast (MAF 2019). However, some modifications have been implemented, in line with article 4, §3 of the Royal Decree. The installed capacities from MAF 2019 are also taken into account in Figure 1 in order to present graphically the proposed updates.

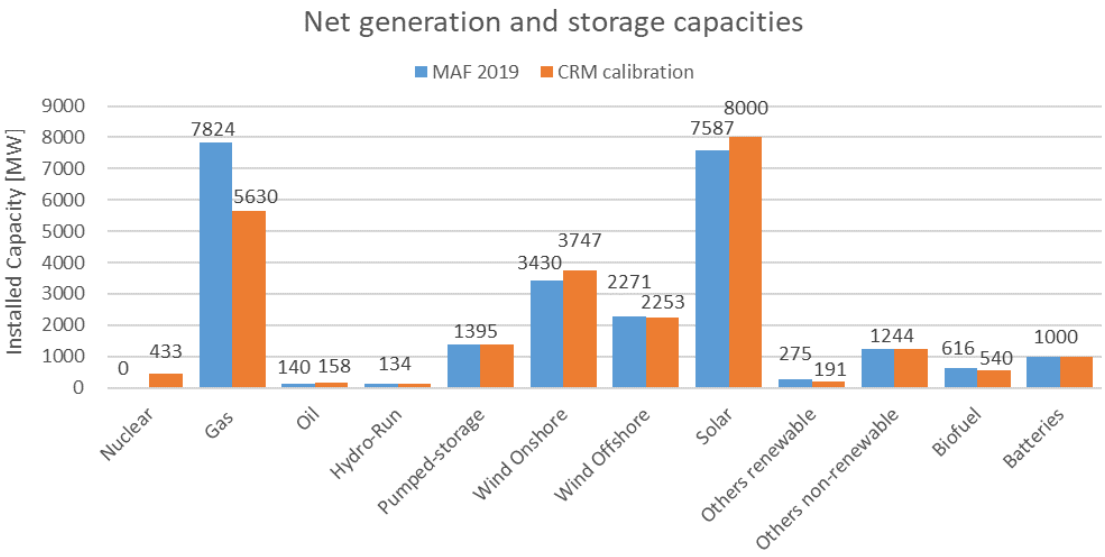

Figure 1: Installed capacity available to the market on Belgian market zone

First, MAF 2019 does not take into account any nuclear capacity for Belgium for its 2025 study (deliberate choice to assess the impact of a full nuclear phase-out in Belgium given that only the years 2021 and 2025 were assessed). However, Doel 2 must be considered for the analysis of 2025-2026 delivery period as its decommissioning date is on 1st December 2025[3]. It can therefore contribute to adequacy for a part of the 2025-2026 period and must be considered in the scenario.

For gas generation, MAF 2019 already considers 2500 MW of new capacity in Belgium (it was assumed to be CCGT but that could be any type of capacity) in 2025. This capacity is not taken into account for the reference scenario calibration. New capacity will be added to the reference scenario based on the pre-selected capacity types to make the scenario adequate for Belgium (see section 3.1), mentioned in article 7 §1. In addition, some updates regarding the different units are presented in §2.1.1.2. These updates are applied on the availability in the market or on the installed capacity of some units.

Profiled generation (both thermal, non-renewable and renewable) are in line with MAF 2019 assumptions and with the 10-year Adequacy and Flexibility study 2020-30 (Elia, 2019).

Finally, the renewable generation from MAF 2019 (wind, solar and other renewable) have been updated based on the latest Belgian's National Energy and Climate Plan (submitted to the EC end of 2019).

[3] The reference assumption on the existing nuclear generation in Belgium is exclusively based on the current law.

All the updates taken into account MAF 2019 categories are also summarized in Table 2. Note that:

- the gas category from MAF 2019 takes into account all individually modelled gas-fueled units;
- the biofuel category from MAF 2019 takes into account both individually modelled biomass and waste from CRM.

Net Generating Capacities [MW]	MAF 2019	CRM calibration	Comment
Nuclear	0	433	Doel 2 until 1st of December
Gas	7824	5630	- 2,5 GW of new CCGT + Monsanto Lillo WKK : 43 MW + Vilvoorde : 255 MW + Minor capacity updates
Oil	140	158	Ixelles-Volta TJ added (18 MW)
Hydro – Run of River	134	134	
Hydro – Pumped-Storage	1395	1395	
Wind Onshore	3430	3747	Updated based on final NECP (WAM scenario)
Wind Offshore	2271	2253	Updated based on final NECP (WAM scenario)
Solar	7587	8000	Updated based on final NECP (WAM scenario)
Others renewable	275	191	Updated based on final NECP (WAM scenario)
Others non-renewable	1244	1244	
Biofuel	616	540	Awirs 4 decommissioned (75 MW)
Batteries	1000	1000	

Table 2: Net generating and storage capacities – Comparison with MAF 2019

2.1.1.2 Individually modelled thermal generation

Section 1.2 of the Excel file details all individually modelled thermal generation facilities available for the 2025-2026 delivery period. The Excel document describes the name of the unit, the owner of the unit, its technology, its used fuel and the associated net generation capacity.

The list is based on the data used for the MAF 2019 and have been updated with the latest available information. The main differences are:

- Doel 2 is considered in the market until 1st December 2025 to be in line with the current law;
- Awirs 4 was considered in the market in the framework of MAF 2019. However, Electrabel informed that it will be definitely closed on the 31st of August 2020[4];
- Monsanto Lillo cogeneration unit, Vilvoorde gas turbine and Ixelles-Volta turbojet

[4] https://economie.fgov.be/sites/default/files/Files/Energy/Mise-arret-definitive-unite-Awirs-4.pdf

were considered out the market in the framework of MAF 2019 and are integrated to this scenario.

2.1.1.3 Storage

The storage installed capacity and reservoir volume for 2025-2026 delivery period is presented in the Excel (section 1.3).

Regarding both pumped-storage and batteries, the data are in line with MAF 2019 numbers and take into account the extension project of the Coo reservoirs (7.5 % increase of both the turbines and the reservoir). Storage data are based on the 'Energy Pact' figures which were also the ones used in the 10-year Adequacy and Flexibility study 2020-30 (Elia, 2019).

2.1.1.4 Profiled thermal generation

Section 1.4 of the Excel file details the profiled thermal generation. It takes into account the generation capacities for each category ('waste', 'biomass' and 'gas & other') and a normalized hourly generation, expressed as a percentage of the profiled generation capacity is presented. Both parameters are in line with the data from MAF 2019 and the 10-year Adequacy and Flexibility study 2020-30 (Elia, 2019).

2.1.1.5 Forced outage rates

The forced outage rates are presented in the Excel (section 1.5) and are based on the same methodology used in the other Elia adequacy studies.

For the generation technologies, these numbers have been calculated from the last 10 years availability data (from 2010 up to and including 2019). These data come from the ENTSO-E transparency platform[5] (ETP) and from Elia's internal database.

For each technology, the total forced outage periods have been divided by the availability which takes into account both planned and forced outages.

For the HVDC link forced outage rate, note that 6% is proposed by ENTSO-E for HVDC forced outage rate. However, in the scope of the strategic reserve volume determination, stakeholders have expressed the fact that 6% is too high. A consensus was reached with 5% of forced outage.

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

2.1.2 Consumption

Next sub-section is dedicated to the data related to the load which includes demand and market response parameters. The data comes from the Mid-Term Adequacy Forecast performed at ENTSO-E level and have been updated according to the most recent available information sources. Table 3 presents the main update implemented in the CRM calibration.

Data	Value in MAF 2019	Updated Value	Sources
Electricity total consumption	86.9 TWh	89.6 TWh	Final NECP (WAM scenario)
Market response shedding	982 MW	1000 MW + 565 MW	Rounded to the Energy Pact figure Addition of market response assumed to be dedicated to ancillary services MAF 2019 only takes into consideration the volume on the electricity market (which was considered to be 982 MW) for adequacy assessment
Market response shifting	0 MWh/day	500 MWh/day	Added (as category not present in MAF 2019) and based on Energy Pact

Table 3 : Update on consumption data

2.1.2.1 Electricity total consumption

Electricity demand is based on latest forecast from the final NECP (WAM scenario) published end of 2019 by the Belgian authorities (regions and federal) and submitted to the EC. It represents the total consumption of Belgium (including losses).

The MAF 2019 and the 10-year Adequacy and Flexibility study 2020-30 (Elia, 2019) were based on the draft NECP (WAM scenario) published end of 2018. There is an increase in the numbers between the draft and the final NECP (WAM scenario) which is mainly due to additional industrial consumption in Flanders considered by the authorities combined with slightly higher electrification rates.

2.1.2.2 Market response

Section 2.2 of the Excel file presents the data associated to market response in Belgium. These data are in line with the Belgian Energy Pact and with the 10-year Adequacy and Flexibility study 2020-30 (Elia, 2019).

Market response volumes can be considered as distributed capacity that can be activated when prices are above a certain level and for a limited time duration (depending on several constraints). These include shedding and shifting of consumption, storage and even small scale generators (not taken into account as generation units in the model such as for instance emergency generators). Note that in the CRM calibration, storage capacities are nevertheless considered in a separate category.

Market response shedding are subdivided in 5 categories depending on their availability (1h, 2h, 4h, 8h or no limit), as it has been done in the 10-year Adequacy and Flexibility study 2020-30 (Elia, 2019). A volume is associated for each category. The total volume of market response shedding is equal to 1565 MW. It includes both volume dedicated to the energy market and to the ancillary services. The 1565 MW volume has been determined by taking into account 1000 MW from Energy Pact and 565 MW of existing volume procured on DSR for balancing purposes based on historical data. The energy market volume from MAF 2019 only takes into consideration the volume on the energy market (982 MW) for adequacy assessment.

Moreover, a demand shifting category is implemented which is not the case in the MAF 2019, the difference with previous categories is that in this case, the electricity is consumed during another moment of the day. This amounts to 500 MWh/day and is based on the Energy Pact which was also considered in the 10-year Adequacy and Flexibility study 2020-30 (Elia, 2019).

2.1.3 Balancing capacity

This subsection is dedicated to the Belgian balancing capacity estimation. This is the expected reserve capacity to be contracted on Belgian thermal generation, demand and storage units to deal with unexpected variations in demand and generation. The balancing capacity applied for the Y-4 auction of 2025-2026 delivery period are presented in the Excel file (section 3).

The balancing capacity impacts the volume to be procured in each CRM auction. This estimation is required by article 11, §2, 2° of the proposed Royal Decree. The balancing reserve volume is indeed added to the average load during simulated scarcity hours. This volume takes into account both volume assumed to be procured by Belgian generation and storage units and by the Belgian demand (see §2.1.2.2) as they both need to be contracted in the CRM auction but it does not take into account the cross-border reserve capacity. This difference is presented in the Excel file.

The total reserve capacity needed is defined as the sum of the FCR[6] reserve capacity and the total FRR[7] reserve capacity for the delivery period 2025-2026.

- The FCR capacity is expected to increase to 88 MW towards 2023 and is then expected to remain stable towards 2025-26. Currently, the capacity is determined based on the share of generation and demand of Elia's LFC[8] block compared to the total generation and demand in Continental Europe. It is assumed that this share and therefore the FCR capacity remains stable towards the 2025-26 delivery period.
- The FRR capacity (aFRR + mFRR) is determined on day-ahead basis by means of Elia's dynamic dimensioning method. Future capacity needs therefore depend on system evolutions and performance of the market. In addition, a minimum level is legally required to deal with the dimensioning incident, i.e. which is expected to be 1000 MW. This minimum level is taken into account in the CRM, but while Elia does it best to minimize the impact of new system evolutions on FRR capacity, it cannot be excluded that the reserve capacity might increase towards the future.

Based on the above-mentioned assumptions, the total reserve capacity for 2025-26 delivery period is therefore assumed to be equal to 1088 MW.

Today, part of the reserve capacity is acquired outside Elia's LFC block and is therefore not to be taken into account in the CRM calculations as it is not to be reserved on Belgian thermal generation, demand or storage units. It concerns 50 MW of mFRR sharing and 53 MW of FCR balancing capacity exchange. These values are based on current observations and are minimum levels towards 2025 and 2026. Note that according Elia's sharing agreements, more capacity can be available that only 50 MW is considered to be firm in terms of available cross-border capacity. Cross-border reserve for 2025-26 delivery period is therefore assumed to be 103 MW but note it is subject to evolutions in cross-border reserve capacity and the FCR market. This leads to a total balancing capacity assumed to be procured by Belgian thermal generation and storage units and by the Belgian demand equal to 985 MW.

[6] FCR: Frequency Containment Reserves
[7] FRR: Frequency Restoration Reserves
[8] LFC: Load Frequency Control

Proposed Royal Decree Reference	
Art. 11.	**Art. 11.**
§ 2. Ces deux volumes sont déterminés en cinq étapes :	§ 2. Deze twee volumes worden in vijf stappen bepaald:
(…)	(…)
2° un volume correspondant au besoin en réserves d'équilibrage est ajouté à la charge visée au 1° ;	2° een volume dat overeenstemt met de vereiste reserves voor het bewaren van het evenwicht in het netwerk wordt toegevoegd aan het in 1° bedoelde verbruik;

Regarding the energy market model, only the volume of balancing capacity assumed to be provided by Belgian thermal generation and storage units will be taken into account in the model in order to be in line with MAF 2019 which includes 500 MW of balancing capacity assumed to be provided by Belgian thermal generation and storage units. This value from MAF 2019 will be kept constant in the model. The rest will be deducted from the market response shedding volume (Figure 2). However, note that the allocation over thermal generation, storage and demand response is determined by the market.

	Volume in CRM [MW]	Volume in MAF [MW]
Total reserve capacity	1088	
- Cross-border reserve capacity	- 103	
Balancing capacity to be included for the CRM Volume	985	
Balancing capacity assumed to be procured by Belgian thermal generation & storage units	500	500
Balancing capacity assumed to be procured by Belgian demand	485	

	Volume in CRM [MW]	Volume in MAF [MW]
Total Market Response shedding	1565	
Volume assumed for ancillary services	- 485	
Market response participating in the energy market	1080	982

Figure 2: Balancing capacity and market response

2.1.4 Cross border market capacities

This subsection presents the flow-based domain that will be implemented in the model. This domain will be complemented with the NTC values taken from the Mid-Term Adequacy Forecast (MAF 2019) of ENTSO-E for the borders which are not included in the flow based region. The MAF 2019 level only includes a NTC model in its base case (Table 4). The flow-based modelization is also integrated as an additional sensitivity but only for 2021. The CRM calibration will use a most up-to-date flow-based modelization and is presented in the Excel file (section 4).

Data	Value in MAF 2019	Updated Value	Sources
Interconnection for COREMOD	NTC	Flow-based	Elia calculation

Table 4: Update on interconnection

2.1.4.1 The 'mid-term flow-based' modelling framework used in the CRM calibration

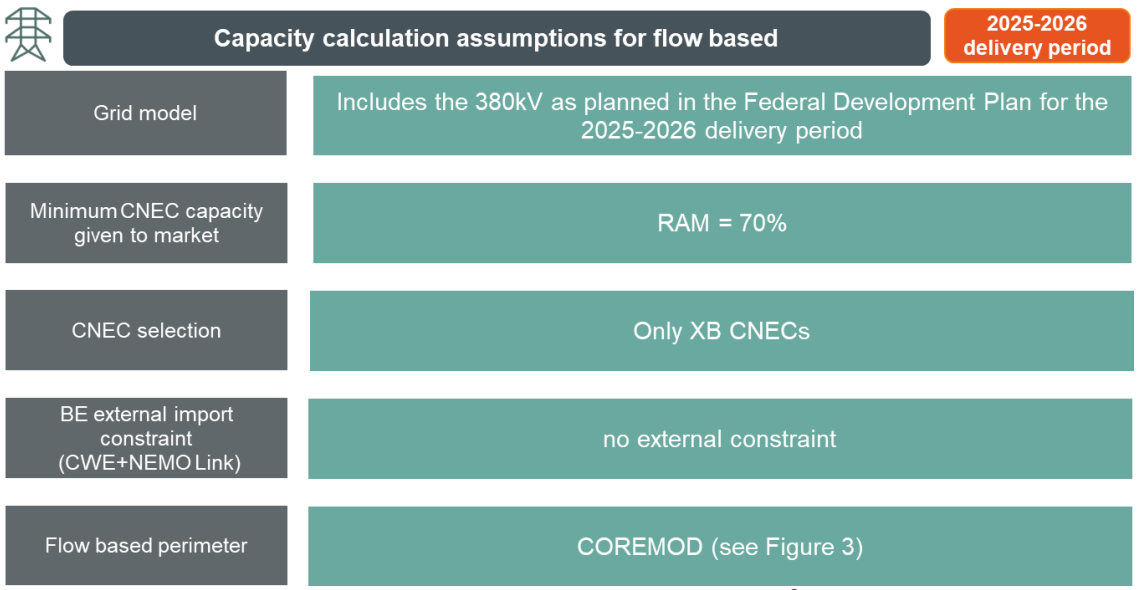

Figure 3: Capacity calculation assumptions[9]

The flow-based capacity calculation is a complex process involving many parameters. To build market models where market exchanges adhere to the rules depicted in a flow-based coupled market, multiple approaches are possible. For short term forecasts and analyses, a framework relying on the flow-based domains conceived in the SPAIC process was developed[10]. This framework however leans heavily on historical data. As historical domains are strongly related to the historical grid & generation situation this approach is not suited for studies on a longer time horizon where significant evolutions in the market design rules, grid or generation mix occur.

Elia has developed a mid-term flow-based framework which does not rely on historical domains, but instead aims to mimic the operational flow-based capacity calculation workflow, for which the required inputs are forecasted for the targeted time horizons. This framework was already used in the 10-year Adequacy and Flexibility study 2020-30 (Elia, 2019) and created domains were re-used by the latest PentaLateral Energy Forum (PLEF) Generation Adequacy Assessment (GAA) report that will be published in May 2020.

[9] Federal Development Plan : https://www.elia.be/fr/infrastructure-et-projets/plans-investissements/plan-de-developpement-federal-2020-2030

[10] http://jao.eu/support/resourcecenter/overview?parameters=%7B%22IsCWEFBMC%22%3A%22True%22%7D

2.1.4.2 Calculation of PTDFs

The first step of the mid-term flow-based framework is the definition of a set of PTDFs[11]. To obtain these, a European grid model is built, which is for the CRM calibration based on the TYNDP 2018 reference grid[12] (target year 2027), upon which grid modifications for Belgium are applied to fall back to the 2025 target horizon. This grid model is then used to calculate the PTDFs.

A PTDF matrix consists of lines/rows representing the different CNEC[13]'s that are taken into account, and columns representing the variables in the flow-based domain. Only cross-border CNECs at or above the 380kV voltage level are taken into account in the CRM calibration.

- Each CNEC refers to the combination of a Critical Network Element and a Contingency. In the grid model that was used for the CRM calibration, many hundreds of CNECs were considered;
- The variables can represent the net positions of the market nodes under consideration, the HVDC[14] flows, PST positions, etc; depending on the degrees of freedom that are given to the market coupling algorithm.

Aside from a PTDF matrix, the flow-based mid-term framework also requires the capacity of each Critical Network Element. These correspond to the steady-state seasonal ratings of the network elements.

2.1.4.3 Flow-based perimeter

The perimeter describes the zone in which flow-based market coupling is in effect. In 2015 the first European flow-based market coupling was established in the CWE region (BE+DE/LU/AT+FR+NL). In 2018 the German bidding zone split into separate German-Luxembourg and Austria bidding zones.

Today, in 2020, the perimeter thus contains 5 bidding zones: BE, DE/LU, FR, NL and AT. A project to launch flow-based capacity calculation on the CORE region (Figure 4) has been launched. The go-live date of a CORE-wide FBMC is expected to happen mid-2021.

An ongoing project is investigating how to incorporate CH grid limitations into the CORE FB capacity calculation between 2022 & 2025. Similarly, ACER has asked TSOs to do an analysis if it makes sense to move the bidding zone borders between Europe and UK from the Channel CCR into the Core CCR. Next, a merger between CORE, HANSA & Italy North may be investigated.

[11] PTDF = Power Transfer Distribution Factor. A PTDF coefficient for a CNEC & zone represents the change in flow on the CNEC related to the change in net position of the zone

[12] https://tyndp.entsoe.eu/tyndp2018/

[13] CNEC = Critical Network Element and Contingency

[14] An HVDC link is a controllable device by nature. Power electronics allow for completely control the flow on the link, therefore not making it subject to Kirchhoff laws.

For the 2025 target horizon, a CORE approximation is used called COREMOD. The difference is visualised in the image below. COREMOD takes into account Switzerland and the Italy North Bidding Zone in the flow-based perimeter, while it excludes CORE countries Slovakia, Hungary, Romania and Croatia.

Switzerland and Italy were included in the MOD version because they have a bigger impact on France and by consequence on Belgium. Eastern European countries are omitted in this representation because of their reduced impact on Belgium.

This results hence in taking into account 11 dimensions instead of the 6 dimensions of CWE (including ALEGrO): FR, BE, DE, NL, AT, CZ, PL, SI, CH, IT and ALEGrO.

Figure 4: CORE in blue vs COREMOD (circled in green) representations

Note that this is a major evolution with regards to the methodology used in the 10-year Adequacy and Flexibility study 2020-30 (Elia, 2019). Including additional zones significantly increases the complexity of the domain and by consequence the calculation.

2.1.4.4 Treatment of external flows

In this context external flows are flows in the COREMOD grid which are induced by exchanges on bidding zone borders that do not belong to the COREMOD region.

External flows can be linked to the flow-based region in one of two ways: standard hybrid coupling (SHC) or advanced hybrid coupling (AHC). In the former, a capacity margin is reserved on all CNEC's to accommodate the external flows before flow-based market coupling. In the latter, the external flow is part of the flow-based optimisation variables and its impact on the CNEC flows is described through PTDF coefficients.

Today SHC is in effect on the borders of the CWE FB perimeter. The target model for CORE-FB is AHC. The best estimate for AHC is 2025. In the CRM calibration, NEMOlink, IFA1, IFA2 and Britned (respectively interconnectors between GB-BE, GB-FR, GB-FR and GB-NL) will be considered in AHC adding hence an extra 4 dimensions to the optimisation problem. Other external flows are not considered in AHC.

2.1.4.5 External constraints

The target model is to have no external constraints limiting the market. However, if through an extensive economic analysis, it can be shown that it makes from a welfare point of view sense to keep an external constraint, its inclusion will still be allowed. Currently, it is expected that external constraints will still be allowed during a 2 year transition period after the go live of CORE. After that, from 2024 onwards no external constraints should be taken into account. It is therefore assumed for the CRM calibration that no external constraints are applied to the flow-based domain.

2.1.4.6 Representation of flow-based domains

The extension of the flow-based perimeter to COREMOD as well as the use of AHC increases the number of variables in the optimisation from 6 to 15. This increase in complexity leads to calculation difficulties when trying to apply the approach as performed in the 10-year Adequacy and Flexibility study 2020-30 (Elia, 2019). Indeed one domain comprehends now about 1 million vertices while the domains made for the former study had less than 500.

In the context of CEP, many countries submitted derogation plans showing the complexity of complying with such a high minRAM standard, and therefore making it unlikely that the the domains will end up bigger than a minRAM70% domain at the 2025 horizon. Therefore the preferred solution to the computational complexity problem is to apply a strict minRAM 70%, fixing the RAM of all CNEC's to 70%. Within the context of action plans until 2025 this approximation does not appear conservative.

The flow-based domain used in the CRM calibration will then be unique and presented as a presolved H-polytope (see Excel), displaying the most restrictive faces defining the flow-based domain.

2.1.5 Other countries data

The same data as presented in §2.1.1 and §2.1.2 are also necessary for other countries. In the framework of the CRM calibration, EU22 will be taken into account. This corresponds to the same area than for the 10-year Adequacy and Flexibility study 2020-30 (Elia, 2019) and is represented on Figure 5.

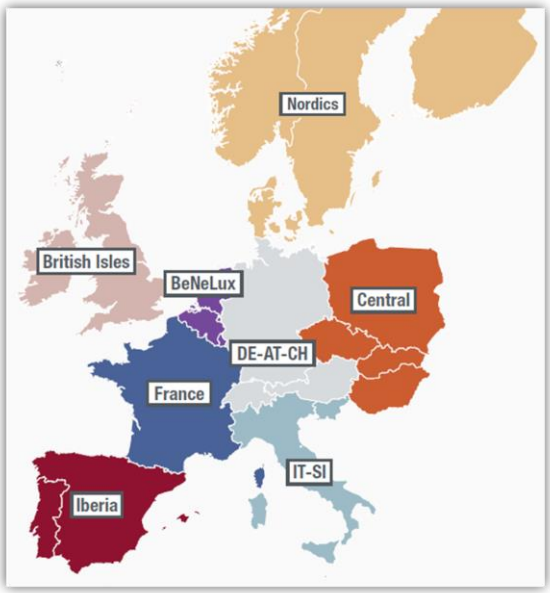

Figure 5: EU22 simulation area.

These data come from the latest Mid-term Adequacy Forecast performed at ENTSO-E level. Figure 6 presents a graphical view of the net generation capacities applied to each country. A link to the ENTSO-E study and database is presented in the Excel (section 5).

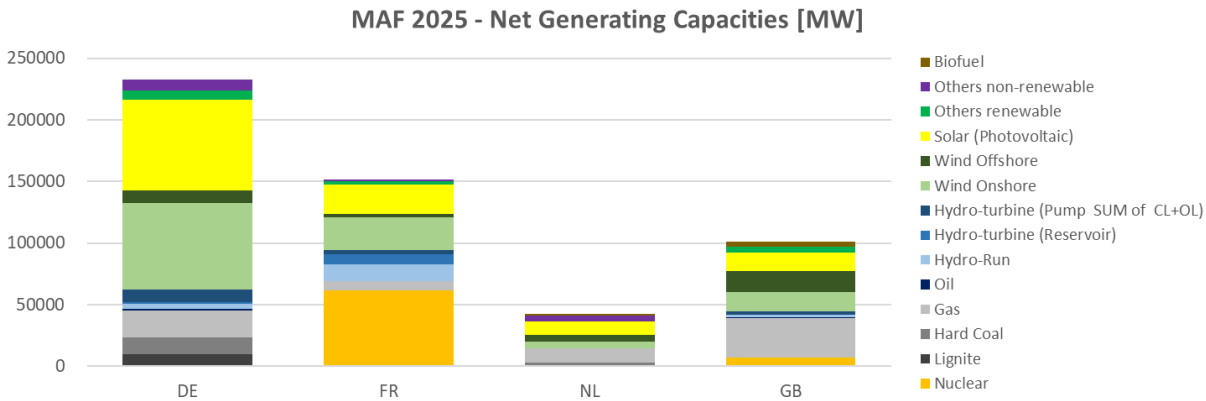

Figure 6: Net generation capacities for Belgium's neighboring countries (MAF 2019)

Section 5 of the Excel file also presents the update of these data that will be applied in the CRM calibration, as mentioned in article 4, §3 of the proposed Royal Decree. The data from MAF 2019 are updated with the numbers applied in the latest study from the Pentalateral Energy Forum (PLEF GAA that will be published in May 2020) as mentioned in Table 5. The table from the Excel file directly comes from this study.

Data	Value in MAF 2019	Updated Value	Sources
Other countries installed capacities	Figure 6	Excel file section 5	PLEF 2020 Generation Adequacy Assessment

Table 5: Update on other countries data

2.1.6 Economic parameters

The last point of this section is dedicated to data and assumptions for the scenario's economic parameters, necessary to calculate as precisely as possible the market revenues that are required to determine the net-CONE, one of the parameters that calibrates the demand curve.

The parameters presented in section 6 of the Excel file comes from the World Energy Outlook 2019[15]. It includes the fuel cost for oil, gas and coal, expressed in €/MWh, and the CO_2 cost, expressed in €/tCO_2.

The update in comparison with MAF 2019 and PLEF GAA 2020 are presented on Table 6.

Data	Value in MAF 2019	Updated Value	Sources
Oil Price [€/GJ]	13.3	11.7	World Energy Outlook (IEA) 2019
Gas Price [€/GJ]	6.5	6.4	World Energy Outlook (IEA) 2019
Coal Price [€/GJ]	3.8	2.6	World Energy Outlook (IEA) 2019
CO_2 Price [€/tCO_2]	23	27	World Energy Outlook (IEA) 2019

Table 6: Update on economic parameters

[15] https://www.iea.org/reports/world-energy-outlook-2019

2.2 Sensitivities that could be integrated in the reference scenario

This section presents the sensitivities that could be integrated in the reference scenario, according to article 4, §4. The purpose of the sensitivities is to take into account additional assumptions that can have an impact on the Belgian security of supply.

Proposed Royal Decree Reference	
Art. 4.	**Art. 4.**
§ 4. En outre, d'autres sensibilités peuvent être définies, lesquelles peuvent avoir un impact sur la sécurité d'approvisionnement de la Belgique, notamment des évènements en dehors de la zone de réglage belge.	§ 4. Daarnaast kunnen andere gevoeligheden gedefinieerd worden die een impact kunnen hebben op de bevoorradingszekerheid in België, met inbegrip van gebeurtenissen buiten de Belgische regelzone.

The sensitivities have been selected by Elia in collaboration with FPS and in concertation with the CREG. These sensitivities, the associated assumption and data modification and their purpose are then submitted to public consultation. Elia provides then a public consultation report integrating the feedback from the stakeholders and provides recommendations. Based on this report, CREG will propose to the Minister a set of data and assumptions that constitutes a reference scenario on which FPS transmits an advice. Finally, the Minister decides which sensitivities should be applied in order to establish the reference scenario.

The sensitivities menu is presented in the Excel, section 7. This explanatory note explains further the purpose, the source and the impact of each proposed sensitivity.

Figure 7 presents the different sensitivities proposal for the Y-4 auction of 2025-2026 delivery period. 6 sensitivities are split in three categories depending on their source. Three sensitivities have already been applied in the framework of the 10-year Adequacy and Flexibility study 2020-30 (Elia, 2019). It concerns the French nuclear availability, the uncertainties linked to the achievement of CEP rules regarding interconnections and the absence of new capacities or the delay in commissioning. Two sensitivities have been applied in the framework of the PLEF GAA that will be published in May 2020. It concerns an additional gas closure abroad due to economic reason ("Low Gas") and a reduction of nuclear availability in France in Switzerland ("Low Nuc").The last sensitivity is inspired of MAF 2018 and 2019 and concerns the coal phase-out acceleration, leading to lower thermal capacities levels in Western Europe.

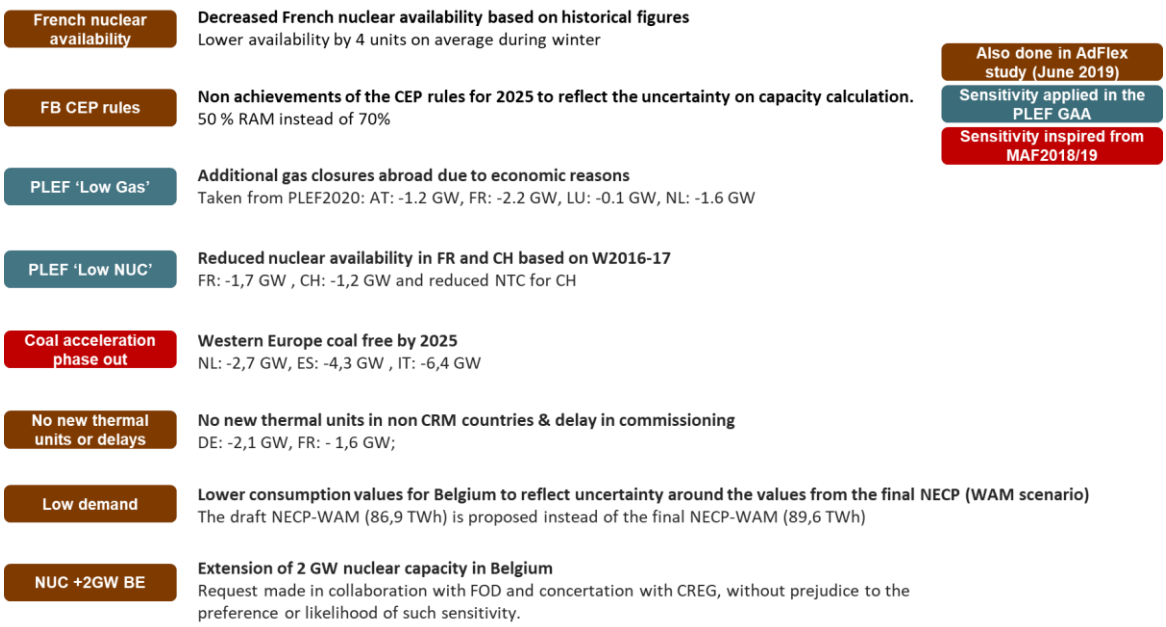

Figure 7: Sensitivities menu

2.2.1 French nuclear availability

The first sensitivity is in line with the 10-year Adequacy and Flexibility study 2020-30 (Elia, 2019) and is presented in §2.6.8. It includes a nuclear availability reduced by 4 units in winter.

The reasoning behind this scenario is justified by recent observations on the unavailability of the French nuclear fleet:

- RTE (the French TSO) has confirmed that the observed maintenance is usually much higher than the one forecasted by the producer. RTE has made an historical analysis of the forecasted and realised length of the 'VD' on nuclear units in France. It showed that on average, the duration of realised 'VD' is on average 2 months longer than forecasted (but with sometimes much more longer delays)[16].
- **Figure 8 : Point 1**
  In the scenario described in §0, an average outage rate (maintenance and forced) is used. This corresponds to the green dotted line of Figure 8. The average unavailability observed in the last 4 winters was much higher (dark dotted line of Figure 8). The data from Figure 8 have been determined by Elia based on the public available data from RTE and EDF.

[16] https://www.rte-france.com/sites/default/files/bp2018_analyses_complementaires_vf.pdf

- **Figure 8 : Point 2**
  During last winter (2019-20), the expected planned unavailability was of around 6000 MW (public available data from EDF). Based on the historical data of RTE, the nuclear unavailability ended up to be higher than 16000 MW. This represents a gap of 10 GW for the previous winter period.

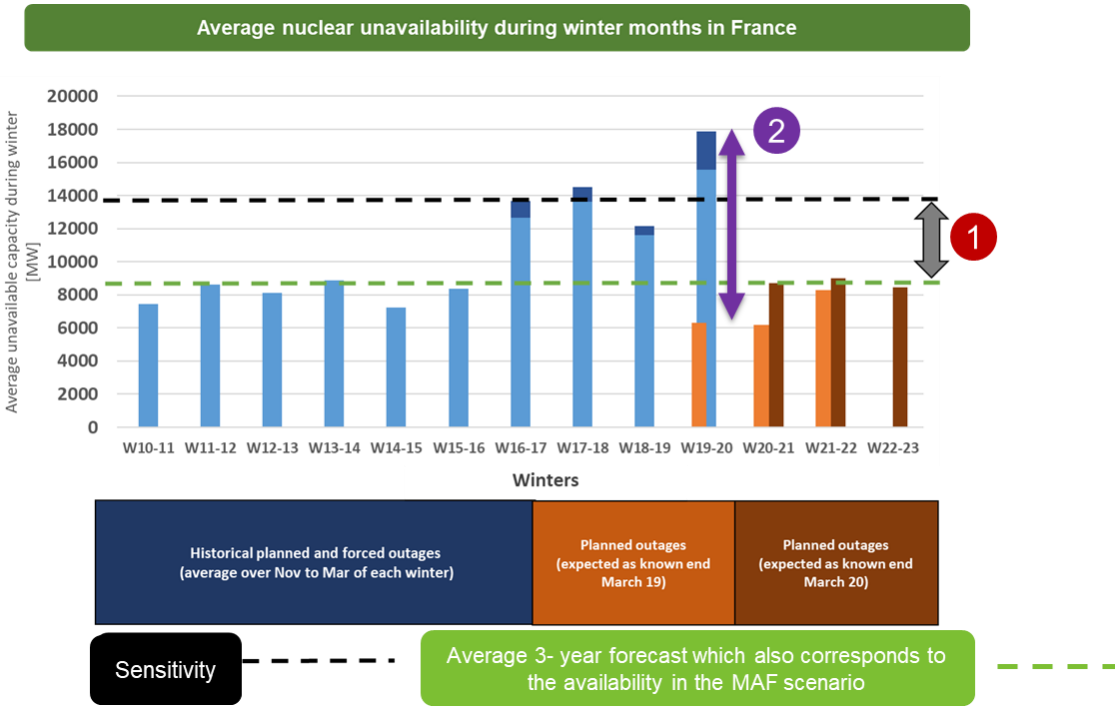

Figure 8: Average nuclear unavailability during winter months in France

Moreover, future events might also affect this unavailability. Indeed, inspection delays following the '4th Decennial inspections' starting from this year could have a significant impact. Given that it will be the first time that units are going to extend their lifetime above 40 years in France and that there is no framework yet in place for those, new requirements could be put in place by the French nuclear safety authority (ASN). This could lead to longer inspections and 'common mode failures' in the case of issues found which affect more than one nuclear unit.

It can be also stated that ageing can have an impact on the availability of the nuclear fleet. The historical data presented in Figure 8 seem to confirm this trend.

To take those uncertainties into account and reflect what happens in the past 4 winters, a lower nuclear availability for France of around 4 units (difference between the green and black dotted lines) will be applied.

2.2.2 Flow-based CEP rules

The next sensitivity is also derived from the 10-year Adequacy and Flexibility study 2020-30 (Elia, 2019) and is presented in that study on §2.7.4. While MAF 2019 is in NTC, it is proposed to use a flow-based model guaranteeing 70% of RAM on each cross-border CNEC. However, there are uncertainties on whether such margin will be available at all times. This sensitivity therefore integrates a 50% RAM value.

While CEP requirements target a minimal margin level of 70% by 2025 at the latest, different reasons (in Belgium or in other European Member States) might exist that could lead to domains smaller than those determined as explained in previous sections of this report. A reason could be that current requirements do not exclude the existence of internal grid elements internal to a Bidding Zone constraining the market. Decreasing the margin can be considered as proxy to the inclusion of internal constraints into the market coupling.

To capture the impact of this uncertainty, a sensitivity is assessed where the exchange capacities given for cross-border exchanges are reduced. It is assumed that a margin of 50% is ensured for the market. Such a scenario might not be in line with the general CEP requirements (and therefore require one or more derogations), but could still remain in line with CEP in case internal constraints are considered.

2.2.3 PLEF 'Low Gas' sensitivity

This sensitivity comes from the PentaLateral Energy Forum (PLEF) and has been applied to the 2020 GAA study that will be published in May 2020. It considers a reduction of 5,1 GW of gas due to mothballing and/or decommissioning. This reduction is applied to Austria, France, Luxembourg and Netherlands.

This sensitivity has been justified in the framework of the PLEF study:

- Since high penetration of renewables and moments of high renewable in-feed to the European electricity grid can lead to low price levels on the energy market, the commercial viability of thermal power plants, especially of those with high marginal prices is significantly impacted;
- Consequently, power plants might be mothballed or decommissioned due to a low number of full load hours and in turn low profitability. Furthermore, such economic conditions might prevent new investments in gas units too;
- In the PLEF study, a total thermal capacity of 7.6 GW at risk was identified for the whole PLEF region and removed (it included also 2.5 GW for Belgium considered on the ex-ante assumed new capacity for 2025).

Note that for Belgium, the 2,5 GW capacity was also assumed 'at risk' (assume ex-ante new capacity in 2025) but this does not impact the results as the scenario will be made 'adequate' to comply the security of supply criteria of Belgium, through the preselected capacity types presented in section 3.1 of this document.

2.2.4 PLEF “Low NUC” sensitivity

This sensitivity also comes from the PentaLateral Energy Forum (PLEF) and has been applied to the 2020 GAA study that will be published in May 2020. It takes into account a reduction of nuclear availability in France (1,7 GW) and Switzerland (1,2 GW) combined with lower NTC in Switzerland.

This sensitivity has been justified in the framework of the PLEF study:

- This sensitivity was created based on the historic experience of the winter 2016/2017.
- At the time the situation became tense from system operations perspective due to a combination of the following events:
    - Lower nuclear availability than expected in France and Switzerland due to unplanned outages;
    - Compensation of the additional unplanned outages by higher Swiss hydro generation in January, contributing to emptying the Swiss hydro reservoirs, which in turn was resulting in very high imports in February;
    - Combined with grid constraints caused by the exclusion of Swissgrid infrastructure elements from the Flow-Based Market Coupling (FBMC) algorithm this could pose an adequacy risk, especially in a 70% minRAM flow-based scenario with a resulting lower import capacity.

2.2.5 Coal acceleration phase-out

This sensitivity is derived from some sensitivities applied in the framework of the latest Mid-Term Adequacy Forecast performed at ENTSO-E level (MAF 2018 and MAF 2019). Its purpose is to assess an acceleration of the coal phase-out in Western Europe. Starting from the installed coal capacity of the MAF 2019, it takes into account an accelerated coal phase-out in the Netherlands (2,7 GW), Spain (4,3 GW) and Italy (6,4 GW).

The purpose of this sensitivity is to take into account that due to economic or environmental reasons, coal units are at risk in several countries[17]:

- Regarding Spain, there is a massive overcapacity and a high potential for renewable energy generation. It could retire coal plants without impacting its energy security. Moreover, a set of old coal plants is due for retirement by 2020 because of EU pollution legislation. Discussions are ongoing and a full coal phase out for 2025 is not excluded;
- Regarding Netherlands, the Dutch government announced a legal ban of electricity generation with coal on the 1st of January 2030 in order to reach its greenhouse gas emissions objectives. In addition, there are discussions to

[17] Source : BeyondCoal

further accelerate this decommissioning. Therefore the three most recent coal-fired plants could be closed earlier than expected;
- Regarding Italy, a non-binding coal phase-out by 2025 have been announced in the National Energy Strategy. All the coal capacity could therefore shut down by 2025.

2.2.6 No new thermal units or delays

This sensitivity is derived from the 10-year Adequacy and Flexibility study 2020-30 (Elia, 2019) and is presented in that study on §2.6.9.2 (EU-NONEW). It includes a reduction of 2,1 GW in Germany and 1,6 GW in France.

The reasons associated with this sensitivity are the following:

- On the one hand, in the scenario presented in §0, a certain volume of new built gas-fired capacity (CCGT, OCGT or CHP) is assumed in some of the countries. A part of these additional capacities are still uncertain however, as projects might not be viable without support. This sensitivity aims to evaluate the needed capacity in Belgium if those plans do not materialize. Therefore, no new gas-fired units are integrated in Germany on top of what is planned for 2021. Germany has no market wide CRM and economic viability of new units could be at risk, hence removing new capacities.
- On the other hand, this sensitivity takes into account a delay in commissioning of Flamanville in France (1,6 GW) as the project was already postponed several times.

2.2.7 NECP Low demand

This sensitivity build upon the draft National Energy and Climate Plan (NECP) and is inspired of a sensitivity that had been implemented in the 10-year Adequacy and Flexibility study 2020-30 (Elia, 2019). Lower consumption values for Belgium are considered to reflect uncertainties around the value from NECP.

The scenario presented in §2.1.2.1 takes into consideration the WAM scenario and comes from the final National Energy and Climate Plan (NECP) published end of 2019 by the Belgian authorities (regions and federal) and submitted to the EC. It represents the total consumption of Belgium (including losses).

An increase compared to the draft NECP (WAM scenario that was used for the 10-year Adequacy and Flexibility study 2020-30 (Elia, 2019)) is considered due to additional industrial consumption foreseen in Flanders and more electricity of transport.

Therefore, the value from the draft NECP (86,9 TWh) is proposed instead of the final NECP (89,6 TWh), as illustrated on Figure 9.

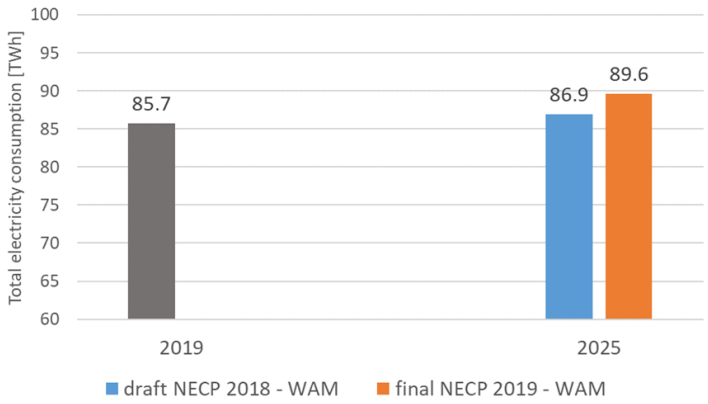

Figure 9: Low demand sensitivity

2.2.8 Extension of 2 GW nuclear capacity in Belgium

The last sensitivity concerns the lifetime extension of 2GW nuclear capacity in the Belgian control zone. This sensitivity follows from the alignment meetings that have been held with FPS and with CREG (as stipulated in the proposed Royal Decree, the consultation is to be organised after collaboration with FPS and concertation with CREG), without prejudice to the preference or likelihood of such sensitivity.

Indeed, this sensitivity is integrated in the framework of the CRM calibration given the uncertainties and current discussion on the Belgian energy market. However, note that the associated assumption is not in line with the current law governing the nuclear phase-out.

A similar sensitivity has been implemented in the framework of the 10-year Adequacy and Flexibility study 2020-30 (Elia, 2019), as it had been suggested by some stakeholders during the public consultation of that study.

It is also important to mention that extending the lifetime of nuclear capacity would lead to prolongation works. Given the high safety standards and the possible works required, those could lead to (long lasting) unavailabilities prior to the currently planned phase-out or during the first years of the lifetime extension (as it was the case to prior nuclear extensions). In the CRM calibration, the effect of this potential extra unavailability should be further assessed in a quantitative way.

3. Other parameters

This chapter describes the parameters that have to be submitted to public consultation according to article 6 of the proposed Royal Decree, but that are not fixed by the Minister. This includes the sources of scenarios for periods after the delivery period in order to calculate the market revenues according, the preselected capacity types to be added to the reference scenario in order to reach the security of supply criteria and the intermediate price cap parameters.

Proposed Royal Decree Reference	
Art. 6. § 2. Les sujets suivants au moins sont soumis à une consultation publique: (…) 3° le type de capacité supplémentaire visé à l'article 7, § 1er ; 4° les sources publiques des scénarios pour les années postérieures à l'année de livraison à partir desquelles les données d'entrée sont utilisées pour le calcul des rentes inframarginales visées à l'article 10, §6 ; 5° la liste réduite des technologies existantes qui seront raisonnablement disponibles et qui sont éligibles pour la détermination du prix maximal intermédiaire visé à l'article 18, §1er.	**Art. 6.** § 2. Ten minste de volgende onderwerpen worden openbaar geraadpleegd: (…) 3° het type bijkomende capaciteit bedoeld in artikel 7, § 1; 4° de publieke bronnen van de scenario's voor de jaren na het leveringsjaar waaruit de invoergegevens gebruikt worden voor de berekening van de inframarginale inkomsten, bedoeld in artikel 10, § 6; 5° de beperkte lijst van bestaande technologieën die redelijkerwijs beschikbaar zullen zijn, en die in aanmerking komen voor de bepaling van de intermediaire maximumprijs, bedoeld in artikel 18, §1.

3.1 Preselected capacity types

In this section, the parameters are described that are included in the scope of this public consultation towards the preselected capacity types that shall apply in the Y-4 auction for delivery period 2025-2026.

Once the reference scenario is defined by the Minister, it does not mean that this scenario meets the legal security of supply criteria, as defined in article 7undecies, §3 of the electricity law. Indeed, the scenario choice takes into account data and assumptions from the latest European or National Resource and Adequacy Assessment updated with the most up-to-date available information and might take into account some sensitivities in or out of the Belgian market zone that can have an impact on the Belgian security of supply. The next step in the methodology is therefore to calibrate the scenario to the security of supply criteria in order to reach the right volume to be procured for the Y-4 auction of 2025-26 delivery period.

The proposed preselected capacity types are presented in the Excel file (section 8). Four categories are mentioned: semi-baseload, peakers 1, peakers 2 and market response. Each category is associated with a typical technology available on the Belgian energy market.

- Volume
  For the first three categories, incremental capacity of the reference technology (new CCGT, new OCGT or new IC engine) is added step by step.
  For market response, incremental capacity is added to each of the categories already defined for the Belgian market zone (see §2.1.2.2) proportionally to each market response category size.
- Marginal Price
  For the first three categories, the marginal price will be calculated based on the parameters associated with a new entrant of each technology.
  For market response, the marginal price is defined based on a weighted average of the existing market response categories.

As long as the security of supply criteria are not reached, additional capacity from one of these categories is added step by step. The step size will be in line with the European Resource and Adequacy Assessment methodology and shall not exceed 100 MW. For each step, capacity will be iteratively added based on an economic optimization loop.

At the end of this process, the security of supply criteria are reached and a mix of capacities from the different category will be selected based on the defined economical loop.

Proposed Royal Decree Reference	
Art. 7. §1er. Le gestionnaire du réseau s'assure que le scénario de référence tel que déterminé selon l'article 4, §7, répond aux critères pour la sécurité d'approvisionnement requis par l'article 7undecies, §3, de la loi du 29 avril 1999 en ajoutant, si nécessaire, une capacité supplémentaire à la zone de réglage belge :	**Art. 7**. §1. De netbeheerder verzekert zich ervan dat het referentiescenario zoals bepaald volgens artikel 4 §7 beantwoordt aan de criteria voor de bevoorradingszekerheid die worden geëist door artikel 7undecies, § 3, van de wet van 29 april 1999 door, indien nodig, aan de Belgische regelzone bijkomende capaciteit toe te voegen:
1° provenant des types de capacité présélectionnés selon l'article 10 et proposés par le gestionnaire de réseau dans la consultation publique visée à l'article 6 et ensuite choisis par le gestionnaire de réseau en collaboration avec la Direction générale de l'Energie et en concertation avec la commission ;	1° afkomstig van de volgens artikel 10 voorgeselecteerde types van capaciteit die voorgesteld worden door de netbeheerder ter openbare raadpleging bedoeld in artikel 6 en daarna door de netbeheerder in samenwerking met de Algemene Directie Energie en in overleg met de commissie gekozen worden;
2° d'une manière itérative sur la base d'une boucle d'optimisation économique avec l'incrément comme utilisé dans l'évaluation de l'adéquation des ressources à l'échelle européenne ou nationale visée aux articles 23 et 24 du Règlement (UE) 2019/943 et de maximum 100 MW.	2° op een iteratieve manier op basis van een economische optimalisatielus op basis van incrementele stappen zoals gebruikt in de Europese of nationale beoordeling van de toereikendheid van de elektriciteitsvoorziening, bedoeld in de artikelen 23 en 24 van Verordening (EU) 2019/943 en van maximaal 100 MW.

3.2 Scenario post-delivery period

In this section, the parameters are described that are included in the scope of this public consultation towards the scenarios for the periods after the 2025-2026 delivery period used to calculate the market revenues for the technology with a lifetime longer than one year.

Indeed, point B of the demand curve is calibrated at the net-CONE. Three parameters are required to determinate it: the gross-CONE, the market revenues and the ancillary services revenues (defined in §3.3.3). Just as the gross-CONE takes into account the costs of the entire lifetime for the reference of each technology, market revenues must also be determined on this period. This requires more than the delivery period scenario to have a correct estimation. This is the reason why additional existing scenario from public available sources are taken into account. If a scenario is not available for one of the years of each reference technology lifetime, an interpolation is made between the values of the years for which a public scenario is available.

The proposed post-delivery period scenarios are presented in the Excel file (section 9). For 2028 and 2030, the proposal is to take the 10-year Adequacy and Flexibility study 2020-30 (Elia, 2019) as public source. For 2035 and 2040, it is proposed to use the 2020-2030 Federal Development Plan (Elia, 2019) as reference. For each of these time horizons, a scenario as close as possible to the reference scenario of 2025-2026 delivery period defined by the Minister will be selected.

Proposed Royal Decree Reference	
Art. 10. §6. (…) Si le scénario de référence n'est pas disponible pour une année sur la durée de vie de la référence pour chaque technologie, une interpolation est réalisée entre les valeurs des années pour lesquelles le scénario de référence existe, éventuellement corrigé par des données disponibles complémentaires.	**Art. 10.** §6. (…) Indien het referentiescenario niet beschikbaar is voor een jaar uit de levensduur van de referentie voor elke technologie, wordt een interpolatie uitgevoerd tussen de waarden van de jaren waarvoor het referentiescenario bestaat, eventueel bijgestuurd door bijkomende beschikbare gegevens.

3.3 Intermediate Price Cap parameters

In this section, the parameters are described that are included in the scope of this public consultation towards the calibration of the intermediate price cap that shall apply in the Y-4 auction for delivery period 2025-2026.

3.3.1 Shortlist of technologies

In accordance with art. 6, §2, 5° of the proposed Royal Decree on the volume methodology (cf. section 1), this public consultation includes a shortlist of existing technologies reasonably considered available during the delivery period 2025-2026, and deemed relevant for the calibration of the intermediate price cap. The shortlist is presented in the Excel file (section 10.1).

Based on the expert study by Fichtner (2020)[18] and Elia's assessment, this shortlist of technologies is believed to represent a list of technologies likely to include the technology with the highest missing-money across the whole set of existing technologies reasonably expected to be available during the delivery period 2025-2026. Therefore, this shortlist serves as a basis towards the calibration of the intermediate price cap.

Compared to the shortlist put forward in the expert study by Fichtner (2020), Elia proposes two adaptations. Firstly, the *CHP decentralized* technology included in Fichtner (2020) is not retained in the final shortlist proposal. Since the installations included in the *CHP decentralized* technology class are expected to derive a significant part of their revenues from other sources than selling energy (e.g. from CHP certificates and/or from the value of produced heat), they are not considered to be characterized by high levels of missing-money. Secondly, *Market response*, which is not included in Fichtner (2020), is introduced into the final shortlist proposal. The type of *Market response* that is considered – following art. 6, §2, 5° of the proposed Royal Decree requiring technologies to be existing or reasonably considered available – is aligned with the requirements to provide mFRR, as *Market response* is currently active especially in the mFRR market. Therefore, the *Market response* technology considered is associated with an energy activation duration of 4 hours.

[18] Conform art. 17, §1 of the proposed Royal Decree, ELIA has initiated a study – in concertation with the CREG – by an independent expert to determine the cost components associated to the technologies deemed relevant towards the calibration of the intermediate price cap. The resulting expert study by Fichtner titled "Cost of Capacity for Calibration of the Belgian Capacity Remuneration Mechanism (CRM)" was finalized in April 2020 and is included in the set of documents published for this public consultation as a supporting document.

Proposed Royal Decree Reference	
Art. 18. §1er. Le gestionnaire du réseau détermine, sur la base de l'étude visée à l'article 17, après la consultation publique visée à l'article 6, une liste réduite de technologies existantes qui seront raisonnablement disponibles et qui seront considérées pour la détermination du prix maximal intermédiaire.	**Art. 18.** §1. De netbeheerder stelt op basis van de studie bedoeld in artikel 17, na de openbare raadpleging bedoeld in artikel 6, een beperkte lijst op van bestaande technologieën die redelijkerwijs beschikbaar zullen zijn en die in aanmerking genomen zullen worden voor de bepaling van de intermediaire maximumprijs.

3.3.2 Cost components

In addition to a shortlist of technologies and beyond the legal requirements regarding the scope of the public consultation for the calibration of the intermediate price cap (i.e. the above mentioned shortlist of technologies), this public consultation also consults on various cost components relevant for the calibration of the intermediate price cap. In particular, yearly fixed operation and maintenance (O&M) costs and the activation cost for an availability test are consulted upon.

The yearly fixed operation and maintenance (O&M) costs (cf. art. 18, §2, 1° and 2° of the proposed Royal Decree) are derived from the expert study by Fichtner (2020) and presented per technology included in the shortlist in Excel file (section 10.1). This cost component includes:

1. Fixed operating costs including personnel costs, administrative costs, electricity and gas transmission charges;
2. The O&M insurance for general liability, machine breakdown and interruption of operation of the power plant;
3. Fixed maintenance costs including intrayear maintenance and a provision for major overhauls that do not necessarily take place on a yearly basis.

In accordance with the proposed Royal Decree (art. 18, §2, 6°), the ***activation cost for an availability test*** is to be considered only for technologies with a high short-run marginal cost. Indeed because of the high short-run marginal cost these technologies are unlikely to be activated. As this makes it harder to monitor their availability in the market they are more likely candidates for availability tests. A CRM candidate offering such a CMU is therefore more likely to also include a provision for such an availability test in its bid. Among the technologies included in the shortlist, the activation cost is deemed relevant only for the *Market Response* technology, considered to be characterized by a high short-run marginal cost.

The activation cost – presented in Excel file (section 10.2) – is therefore to be associated to the *Market response* technology and is derived from the historical data published on the Elia website regarding contracted volumes and prices for Strategic Demand Reserves (SDR).[19] Considering the average activation price for SDR for winter period 2015-2016[20] for a 4 hour activation (associated with a derating factor X, expressed in %), and assuming one availability test of 15 minutes per year, the activation cost is calculated as follows:

$$\frac{0{,}73636€}{kWh} * 0{,}25h * \frac{1}{X}.$$

3.3.3 Net revenues from the provision of balancing services

Finally, this public consultation also includes a reasoning regarding the consideration of net revenues from balancing services (cf. art. 19, §3 of the proposed Royal Decree) towards the calibration of the intermediate price cap, which goes beyond the legally required scope regarding the public consultation for the calibration of the intermediate price cap. However, Elia considers it opportune to also consult on this specific aspect given it is the first time the methodology will be applied and stakeholder feedback can only contribute to a better application of the principles put forward in the proposed Royal Decree.

For the sake of clarity, no specific values are consulted upon in Excel file (section 10.3), only a general approach regarding the consideration of net revenues from the provision of frequency-related balancing services for each of the technologies included in the shortlist is presented in this document.

The net revenues from the provision of frequency-related balancing services, in order to avoid double counting and to consider only net revenues, will be considered to the following extent:

- ***FCR***: No net revenues from the provision of FCR are deemed relevant for any of technologies included in the shortlist. Battery storage – not included in the shortlist of technologies – is considered likely to become the dominant technology to provide FCR towards the relevant delivery period, i.e. by November 2025. Battery storage is not included in the shortlist of technologies, because, as mentioned in Fichtner (2020): "*Batteries are usually built for very specific system services, such as Frequency Containment Reserves (FCR), which cover their investment. They are therefore unlikely to have the highest amount of missing money as their remuneration depends on a structural need by a specific party (e.g. the TSO for FCR) rather than the instantaneous electricity price on the market".*

[19] https://www.elia.be/en/suppliers/supplier/energy-purchases/strategic-reserve-volume-and-prices

[20] Winter 2015-2016 is the most recent winter period in which SDR was contracted.

- ***aFRR***: No net revenues from the provision of aFRR are deemed relevant for any of the technologies included in the short list. It is assumed that technologies that provide aFRR arbitrage between the provision of aFRR and selling energy. Indeed, by offering a price for an aFRR reserve contract, the party knows that the capacity can no longer be used for delivering energy in the energy market. Its price for participating in the aFRR auctions will therefore account for the potential missed revenues from selling energy instead. Therefore, aFRR reservation fees are assumed not to represent a net revenue on top of the inframarginal rents earned on the energy market. Besides, any relevant must run costs following the reservation to provide aFRR are considered included in the trade-off between providing aFRR and selling energy, meaning that such must-run costs do not represent any additional net cost.
- ***mFRR***: The perfect arbitrage principle presented above for technologies providing aFRR, seems not to apply for some technologies in the Belgian mFRR market. Indeed, both the *Turbojet* and *Market response* technologies – both included in the shortlist of technologies – are believed to rely structurally on the mFRR reservation fees as primary source of income, seemingly unable to derive equivalent revenues from the energy market. Besides, for other technologies that are capable to provide mFRR, the prospective incomes that can be derived from the mFRR market may not be sufficiently attractive, such that they do not replace the technologies that currently provide mFRR. Therefore, net revenues from the provision of mFRR are deemed relevant for the *Turbojet* and *Market response* technologies included in the shortlist. For both technologies, the projected inframarginal rents from the energy market are weighed against a percentage of the weighted average mFRR reservation fee. Revenues shall be considered from the service, i.e. selling energy or providing mFRR, which leads to the highest value.
