Preparation of the CRM Y-4 auction with Delivery Period 2028-29:

Report of the transmission system operator containing the information to determine the volume to be contracted and proposals for other parameters.

Elia – 15 November 2023

Contents

Executive summary – English Version

Context

This is the fourth time that the grid operator, Elia Transmission Belgium, has drawn up a report containing the information needed to determine the volume to be contracted and the proposed parameters that the TSO has to submit according to the Royal Decree for the CRM auction. For this auction, scheduled for October 2024 for the Delivery Period 2028-29, Elia follows the framework and instructions received from the Belgian authorities. In particular, this report is drawn up in accordance with the Royal Decree Methodology[1]. The reference scenario[2] and intermediate values[3] used in this report have been selected by the Minister of Energy and form the basis of this study.

This report consists of three main parts. First, the reference scenario, its calibration according to the applicable reliability standard and the intermediate values considered are presented. Secondly, Elia provides the necessary information and calculations to determine the volume to be contracted for the considered auction, based on the demand curve. Finally, the third part contains proposals from Elia on the other auction parameters, namely the derating factors, the intermediate price cap, the strike price and the reference price.

Reference scenario and intermediate values selected by the Minister

In order to carry out its tasks, Elia relies on the reference scenario and the intermediate values that were selected by the Minister in the Ministerial Decrees of 15 September 2023.

The reference scenario takes as a reference the latest European study published by ENTSO-E, namely the European Resource Adequacy Assessment 2022[4], updated according to the most recent data available for Belgium and neighboring countries, as described in the Excel "Assumptions Workbook" provided with this report. Furthermore, one additional sensitivity has been incorporated into the baseline scenario following the decision made by the Minister:

- French nuclear availability - 4 units: a lower French nuclear availability by 4 units on average during winter compared to ERAA22.

The intermediate values selected by the Minister, following a proposal made by the CREG, consist in a WACC (Weighted Average Cost of Capital) for a reduced list of technologies needed to determine the net cost of a new entrant in the Belgian control area, together with the associated cost values, and a correction factor X equal to 1.5, which is necessary for determining the maximum volume at the maximum price. In the determination of the

[1] Royal Decree of 28 April 2021 setting the parameters with which the volume of capacity to be provided for is determined, including their calculation methods, and the other parameters necessary for the organization of the auctions, as well as the method for and conditions for granting an individual exemption from the application of the intermediate price cap(s) under the capacity remuneration mechanism http://www.ejustice.just.fgov.be/eli/arrete/2021/04/28/2021041351/justel

[2] https://www.ejustice.just.fgov.be/cgi/article_body.pl?language=fr&pub_date=2023-10-02&caller=list&numac=2023045383

[3] https://www.ejustice.just.fgov.be/cgi/article_body.pl?language=fr&pub_date=2023-10-02&caller=list&numac=2023045381#top

[4] ERAA 2022 | ERAA 2022 by ENTSO-E (entsoe.eu)

technology setting the Net-CONE and thus the price cap of the auction, an evaluation of the potential of such technology should be made. Elia insists that the technology potential should also be understood as the potential of participation to the CRM, taking into account the known barriers for certain technologies.

Unless explicitly stated otherwise, all prices are expressed in € 2022.

Note that, in the framework of this calibration process, the calculation of the "missing-money" (used for the determination of the intermediate maximum price cap and the net cost of a new entrant) is based on the average expected revenues from the energy market in combination with the application of a risk premium to account for the investor's risk aversion. This approach is based on the methodology developed together with Professor Boudt[5] in line with the ERAA methodology. These principles are also reflected in the most recent version of the Royal Decree Methodology.

On the basis of these elements and in accordance with the Royal Decree Methodology, Elia has calibrated the reference scenario in such a way as to ensure that the legal reliability standard is met (3h of loss of load expectation (LOLE)). The calibrated reference scenario thus obtained is strictly applicable for the calculations and proposals made in the framework of this calibration report, applicable for the Y-4 auction of the 2028-29 Delivery Period.

Information and input for the establishment of the demand curve

According to the Royal Decree Methodology, Elia is not responsible for providing a proposal for the demand curve. This prerogative is the responsibility of the CREG, based on the necessary information which is provided in this report. The provided list of information and input corresponds at minima with the points as referred to in article 6, §2, 1° to 7° of the Royal Decree Methodology:

- Figure A presents the demand duration curve, which serves as the basis for determining the volume to be reserved for the Y-1 auction. It should be noted that discussions are ongoing regarding the introduction of a Y-2 auction as well as the introduction of a dynamic mechanism related to the reservation for the Y-1 auction. Since these changes have not yet been integrated into the legal framework at the time of writing this report, Elia has not incorporated these developments;
- Table A presents the different inputs required for the determination of the volume parameters of the demand curve;
- Figure B presents the revenues earned in the market by the different technologies from the reduced list of technologies as selected by the Minister serving as input for the net-CONE calculation;
- The following values are estimated for annual balancing service revenues for the technologies included in the reduced list of technologies for net-CONE: 15 €/kW/year for open-cycle gas turbines (OCGT) and autonomous gas engines, 3 €/kW for combined-cycle gas turbines (CCGT), 10 €/kW/year for demand side response (DSR) and 21 €/kW/year for batteries. There is no additional revenue considered for the other technologies, based on the arguments in this report.

[5] https://www.elia.be/-/media/project/elia/elia-site/public-consultations/2022/20221028reportboudtanalysisofhurdleratesforbelgianelectricitycapacityadequacyandflexibilityanalysiso.pdf

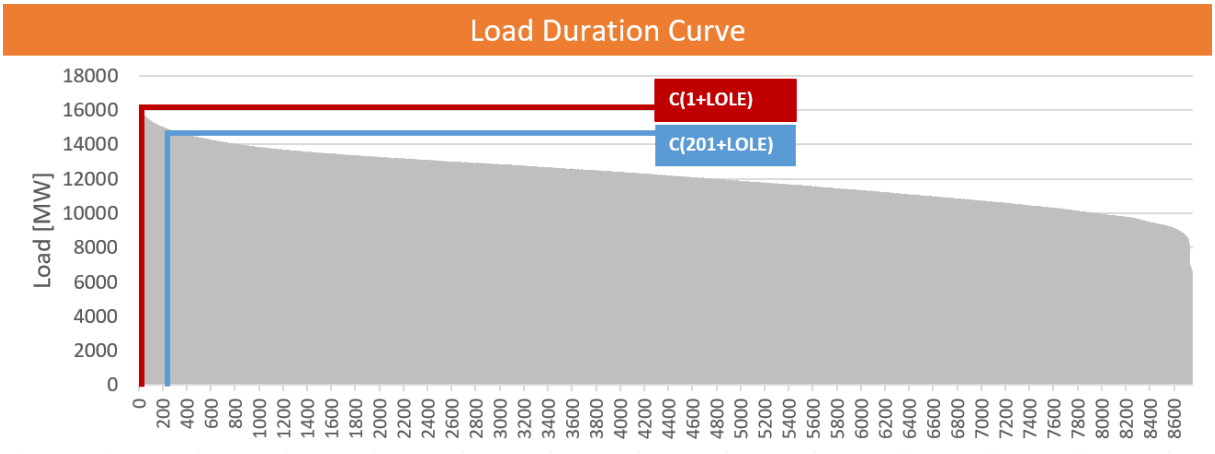


Figure A: Load duration curve (Art. 11, §2, 5° and Art. 11, §5)

Information and input required for the establishment of the volume parameters of the demand curve		
Description	**RD Reference**	**Capacity [MW]**
Average load during simulated scarcity periods (point A)	Art. 11, §2, 1°	15363
Average load during simulated scarcity periods (points B and C)		15453
Balancing need	Art. 11, §2, 2°	1136
Average energy not served during simulated scarcity periods (point A)	Art. 11, §2, 3°	612
Average energy not served during simulated scarcity periods (points B and C)		478
Non-eligible capacity Renewable capacity that receives operating aid	Art. 11, §2, 4° Art. 11, §3	745
Non-eligible capacity Individually modelled and profiled thermal capacity that receives operating aid		2030
Max Entry Capacity for Cross-border participation France	Art. 14	10
Max Entry Capacity for Cross-border participation Netherlands		497
Max Entry Capacity for Cross-border participation Germany		132
Max Entry Capacity for Cross-border participation Great-Britain		379

Table A: Volume parameters

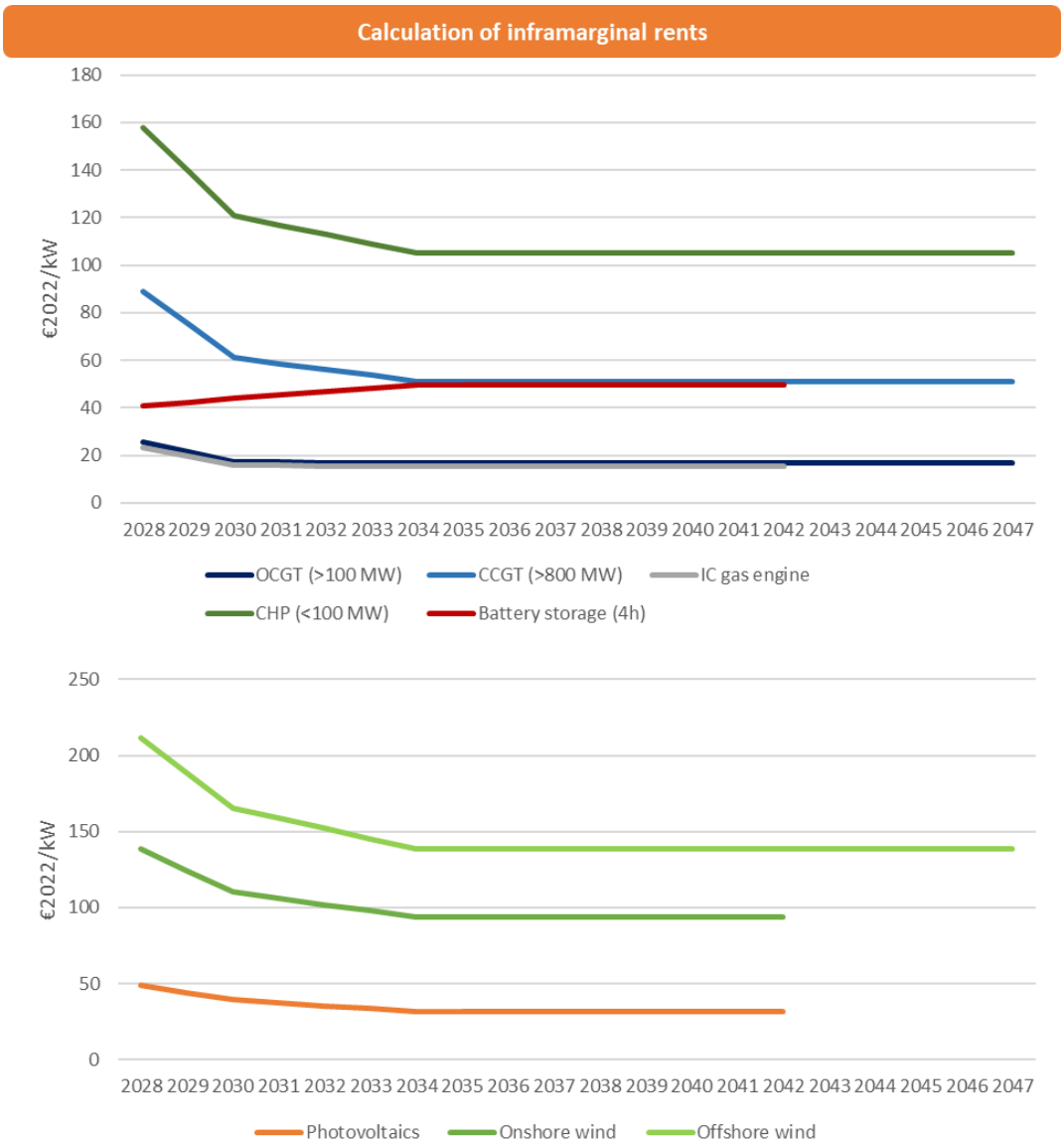


Figure B: Calculated annual inframarginal rents received in the energy market by the technologies included in the reduced list of technologies for the net-CONE

Proposals for the other auction parameters

In addition to the inputs for the determination of the demand curve, it is up to Elia to provide concrete proposals for several other parameters for the auction, according to article 6, §2, 7° of the Methodology Royal Decree:

- Table B presents Elia's proposal for **derating factors**, according to Chapter 5 of the Royal Decree Methodology;
- Elia proposes to consider an **intermediate price cap** equal to 23 €/kW/year (in €2022) according to Chapter 6 of the Royal Decree Methodology;
- Elia proposes to consider a value of 431 €/MWh for the **strike price** and to consider the Spot DA market price where the Nominated Electricity Market Operators (NEMOs: EPEX or Nord Pool Spot) are active in the Belgian bidding zone (or any NEMO operating in neighboring bidding zones for foreign capacities) for the **reference price**, according to Chapter 8 of the Royal Decree Methodology.

Category I: SLA	
Sub-Category	Derating Factor [%]
SLA-1h	19
SLA-2h	35
SLA-3h	48
SLA-4h	57
SLA-5h	65
SLA-6h	71
SLA-7h	76
SLA-8h	81
SLA-9h	86
SLA-10h	89
SLA-11h	93
SLA-12h	95
SLA unlimited	100
Category II: Thermal technologies with daily schedule	
Sub-Category	Derating Factor [%]
CCGT	94
OCGT	92
Turbojets	90
IC Gas Engines	92
IC Diesel Engines	90
CHP/Biomass/Waste	94
Nuclear	80
Coal	90

Category III: Energy-limited technologies with daily schedule	
Sub-Category	Derating Factor [%]
Storage 1h	22
Storage 2h	38
Storage 3h	50
Storage 4h	57
Storage 5h	62
Storage 6h	65
PSP	52
Category IV: Weather-dependent technologies	
Sub-Category	Derating Factor [%]
Offshore Wind	9
Onshore Wind	7
Solar	1
Hydro Run-of-River	48
Category V: Thermal technologies without daily schedule	
Sub-Category	Derating Factor [%]
Aggregated thermal technologies	64

Table B: Derating Factors

Executive summary – Version française

Contexte

C'est la quatrième fois que le gestionnaire du réseau, Elia Transmission Belgium, élabore un rapport contenant les informations utiles pour la détermination du volume à contracter et des propositions de paramètres dans le cadre des enchères du CRM. Pour cette quatrième enchère, prévue en octobre 2024 pour la période de fourniture 2028-29 Elia suit le cadre et les instructions reçues des autorités belges. En particulier, ce rapport est réalisé conformément à l'Arrêté Royal Méthodologie[6]. Le scénario de référence[7] et les valeurs intermédiaires[8] utilisés dans ce rapport ont été sélectionnées par la Ministre de l'énergie et constituent la base de cette étude.

Ce rapport est constitué de trois parties principales. D'abord, le scénario de référence, sa calibration selon la norme de fiabilité applicable et les valeurs intermédiaires considérées sont présentés. Ensuite, Elia fournit les informations et les calculs nécessaires permettant de déterminer le volume à contracter pour l'enchère considérée, sur base de la courbe de la demande. Enfin, la troisième partie contient des propositions de la part d'Elia sur les autres paramètres de l'enchère, à savoir les facteurs de réduction, le prix maximum intermédiaire, le prix d'exercice et le prix de référence.

Scénario de référence et valeurs intermédiaires sélectionnés par la Ministre

Afin de réaliser les tâches qui lui sont assignées, Elia se base sur le scénario de référence et sur les valeurs intermédiaires qui ont été sélectionnés par la Ministre dans les arrêtés ministériels du 15 septembre 2023.

Le scénario de référence prend comme référence la dernière étude européenne publiée par ENTSO-E, à savoir le « European Resource Adequacy Assessment 2022 »[9], mises à jour suivant les informations les plus à jour pour la Belgique et les pays voisins, comme présenté dans l'Excel « Assumptions Workbook » fourni avec ce rapport. De plus, une sensibilité additionnelle a été intégrée au scénario de référence suivant la sélection effectuée par la Ministre :

- Disponibilité nucléaire en France – 4 unités : une disponibilité du nucléaire en France plus faible de 4 unités en moyenne pour la période hivernale par rapport au niveau repris dans l'ERAA22.

[6] Arrêté Royal du 28 avril 2021 fixant les paramètres avec lesquels le volume de la capacité à prévoir est déterminé, y compris leurs méthodes de calcul, et les autres paramètres nécessaires pour l'organisation des mises aux enchères, ainsi que la méthode pour et les conditions à l'octroi d'une dérogation individuelle à l'application du ou des plafond(s) de prix intermédiaire(s) dans le cadre du mécanisme de rémunération de capacité. http://www.ejustice.just.fgov.be/eli/arrete/2021/04/28/2021041351/justel

[7] https://www.ejustice.just.fgov.be/cgi/article_body.pl?language=fr&pub_date=2023-10-02&caller=list&numac=2023045383

[8] https://www.ejustice.just.fgov.be/cgi/article_body.pl?language=fr&pub_date=2023-10-02&caller=list&numac=2023045381#top

[9] ERAA 2022 | ERAA 2022 by ENTSO-E (entsoe.eu)

Les valeurs intermédiaires sélectionnées par la Ministre[10] font suite à une proposition de la CREG et sont constituées d'un WACC pour une liste réduite de technologies nécessaires pour déterminer le coût net d'un nouvel entrant dans la zone de contrôle belge, ainsi que les valeurs de coût associées, et un facteur de correction X égal à 1,5, nécessaire pour la détermination du volume maximum au prix maximum. Lors de la détermination de la technologie fixant le Net-CONE et donc le plafond de prix de l'enchère, une évaluation du potentiel de cette technologie devrait être réalisée. Elia insiste sur le fait que le potentiel de chaque technologie doit également être compris comme le potentiel de participation au CRM, en tenant compte des barrières connues pour certaines technologies.

Sauf mention contraire, tous les prix et coûts repris dans ce rapport de calibration sont exprimés en € 2022.

Dans le cadre de ce processus de calibration, le calcul du « missing-money » (utilisé pour les déterminations du prix maximum intermédiaire et du coût net d'un nouvel entrant) est basé sur la moyenne des revenues du marché d'énergie estimées en combinaison avec l'application d'une prime de risque pour tenir en compte l'aversion de risque d'investisseurs. Cette approche est basée sur la méthodologie développée en collaboration avec le professeur Boudt[11] qui est en ligne avec la méthodologie ERAA. Ces principes sont aussi inclus dans la version la plus récente de l'Arrêté Royal Méthodologie.

Sur base de ces éléments et conformément à l'Arrêté Royal Méthodologie, Elia a calibré le scénario de référence de façon à s'assurer que les calculs et les propositions permettent de garantir l'atteinte de la norme de fiabilité légale, correspondant à un critère de LOLE de 3h. Le scénario de référence calibré ainsi obtenu est strictement applicable pour les calculs et propositions effectuées dans le cadre de ce rapport de calibration, applicable pour l'enchère Y-4 de la période de fourniture 2028-29.

Informations et données pour l'élaboration de la courbe de la demande

Conformément à l'Arrêté Royal Méthodologie, Elia n'est pas responsable de fournir une proposition pour la courbe de la demande. Cette prérogative est du ressort de la CREG, sur base des informations nécessaires fournies dans le cadre de ce rapport. L'ensemble des informations et données correspond a minima aux points mentionnés à l'article 6, §2, 1° à 7° de l'Arrêté Royal Méthodologie :

- la Figure A présente la courbe de durée de la demande, qui sert de base pour la détermination du volume à réserver pour l'enchère Y-1. Il convient de noter que des discussions sont en cours concernant l'introduction d'une enchère Y-2 ainsi que sur l'introduction d'un mécanisme dynamique relatif à la réservation pour l'enchère Y-1. Vu que ces changements ne sont pas encore intégrés dans le cadre juridique au moment de la rédaction de ce rapport, Elia n'a pas intégré ces évolutions ;
- le Tableau A fournit les différentes données requises concernant les paramètres du volume nécessaires à l'élaboration de la courbe de la demande ;

[10] https://www.ejustice.just.fgov.be/cgi/article_body.pl?language=nl&pub_date=2023-10-02&caller=list&numac=2023045381#top
[11] https://www.elia.be/-/media/project/elia/elia-site/public-consultations/2022/20221028reportboudtanalysisofhurdleratesforbelgianelectricitycapacityadequacyandflexibilityanalysiso.pdf

- la Figure B présente de manière graphique les rentes inframarginales annuelles perçues dans le marché de l'énergie par les technologies reprises dans la liste réduite de technologies, nécessaires à la détermination du coût net d'un nouvel entrant ; et
- les valeurs suivantes sont estimées pour les revenus nets annuels du marché des services d'équilibrage pour les technologies reprises dans la liste réduite de technologies : 15 €/kW/an pour les turbines à gaz à cycle ouvert (OCGT) et les moteurs au gaz autonomes, 3 €/kW pour les turbines à gaz à cycle combiné (CCGT), 10 €/kW/an pour la réponse du marché et 21 €/kW/an pour les batteries. Il n'y a pas de revenus supplémentaires considérés pour les autres technologies, sur base des arguments repris dans le présent rapport.

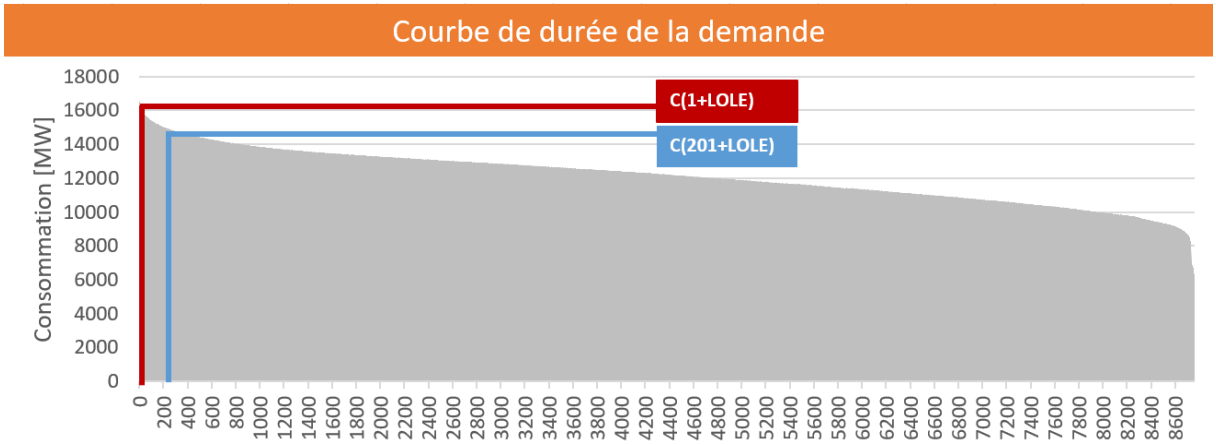


Figure A : Courbe de durée de la demande (Art. 11, §2, 5° and Art. 11, §5)

Informations et input nécessaires pour l'établissement des paramètres de prix de la courbe de la demande		
Description	**Référence de l'A.R.**	**Capacité [MW]**
Charge moyenne pendant les situations de pénurie simulées (point A)	Art. 11, §2, 1°	15363
Charge moyenne pendant les situations de pénurie simulées (points B et C)		15453
Besoin en réserves d'équilibrage	Art. 11, §2, 2°	1136
Prévision d'énergie non desservie moyenne pendant les situations de pénurie simulées (point A)	Art. 11, §2, 3°	612
Prévision d'énergie non desservie moyenne pendant les situations de pénurie simulées (points B et C)		478
Capacité non éligible Capacités renouvelables qui bénéficient d'aide au fonctionnement	Art. 11, §2, 4° Art. 11, §3	745
Capacité non éligible Capacité thermique profilée et modélisée individuellement qui bénéficient d'aide au fonctionnement		2030
Capacité d'entrée maximale disponible pour la participation de capacités étrangères indirectes France	Art. 14	10
Capacité d'entrée maximale disponible pour la participation de capacités étrangères indirectes		497

Pays-Bas		
Capacité d'entrée maximale disponible pour la participation de capacités étrangères indirectes Allemagne		132
Capacité d'entrée maximale disponible pour la participation de capacités étrangères indirectes Grande-Bretagne		379

Tableau A: Paramètres de volume

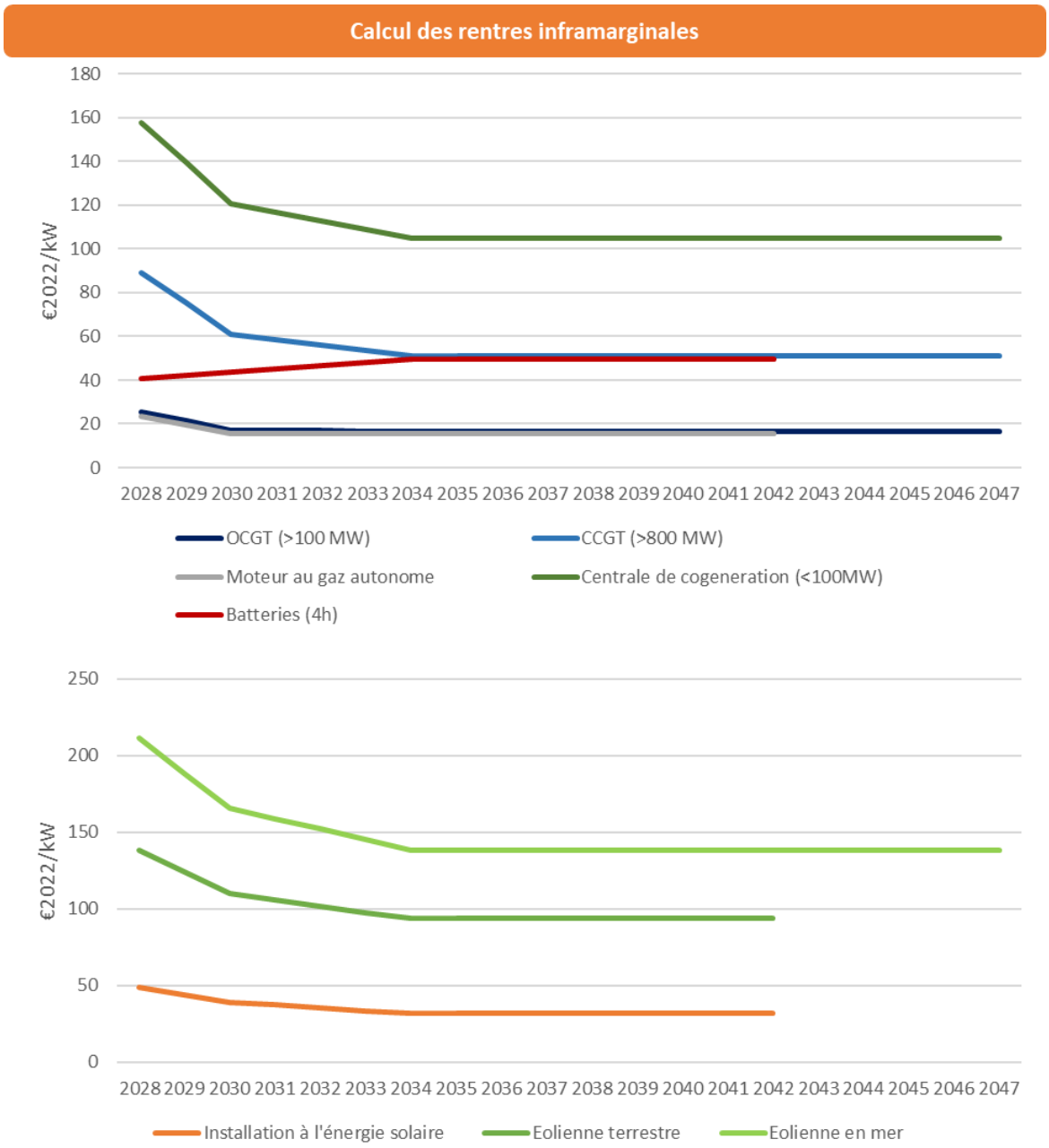


Figure B : Calcul des rentes inframarginales annuelles perçues sur le marché de l'énergie par les technologies reprises dans la liste réduite de technologies pour le net-CONE

Propositions pour les autres paramètres de l'enchère

Elia est également responsable de fournir des propositions concrètes quant à une série d'autres paramètres de l'enchère, conformément à l'article 6, §2, 7° de l'Arrêté Royal Méthodologie :

- la proposition d'Elia concernant les **facteurs de réduction** est présentée au Tableau B, conformément au Chapitre 5 de l'Arrêté Royal Méthodologie ;
- Elia propose de prendre en compte un **prix maximum intermédiaire** égal à 23 €/kW/an (en €2022), conformément au Chapitre 6 de l'Arrêté Royal Méthodologie ;
- Elia propose de prendre en compte un **prix d'exercice** égal à 431 €/MWh et de prendre en compte comme **prix de référence** le prix du marché journalier spot déterminé par les Opérateurs de Marché de l'Electricité Nominés (NEMO : EPEX ou Nord Pool Spot) opérant en Belgique pour la zone de réglage belge (ou un autre NEMO pour les zones de réglage voisines pour les capacités étrangères), conformément au Chapitre 8 de l'Arrêté Royal Méthodologie.

Catégorie I : Catégories d'accords de niveau de service (SLA)	
Sous-catégories	Facteur de réduction [%]
SLA-1h	19
SLA-2h	35
SLA-3h	48
SLA-4h	57
SLA-5h	65
SLA-6h	71
SLA-7h	76
SLA-8h	81
SLA-9h	86
SLA-10h	89
SLA-11h	93
SLA-12h	95
SLA illimité	100
Catégorie II : Technologies thermiques avec programme journalier	
Sous-catégories	Facteur de réduction [%]
Turbines gaz-vapeur	94
Turbines à gaz	92
Turbojets	90
Moteurs au gaz autonomes	92
Moteurs diesel autonomes	90
Centrales de cogénération / Centrales à biomasse / Installations d'incinération des déchets	94
Centrales nucléaires	80
Centrales à charbon	90

Catégorie III : Technologies à énergie limitée avec programme journalier	
Sous-catégories	Facteur de réduction [%]
Stockage 1h	22
Stockage 2h	38
Stockage 3h	50
Stockage 4h	57
Stockage 5h	62
Stockage 6h	65
Installations de pompage-turbinage	52
Catégorie IV : Technologies dépendantes des conditions climatiques	
Sous-catégories	Facteur de réduction [%]
Eoliennes en mer	9
Eoliennes terrestre	7
Installations à l'énergie solaire	1
Centrales hydrauliques au fil de l'eau	48
Catégorie V : Technologies thermiques sans programme journalier	
Sous-catégories	Facteur de réduction [%]
Agrégation de l'ensemble des technologies thermiques	64

Tableau B : facteurs de réduction

Executive summary – Nederlandstalige versie

Context

Dit is de vierde keer dat de netbeheerder, Elia Transmission Belgium, een rapport opstelt met de nodige informatie om het te contracteren volume en de voorgestelde parameters voor de CRM-veiling te bepalen. Voor deze vierde veiling, die gepland is voor oktober 2024 voor de leveringsperiode 2028-29, volgt Elia het kader en de instructies die het van de Belgische autoriteiten heeft ontvangen. Dit verslag is met name opgesteld overeenkomstig het Koninklijk Besluit Methodologie[12]. Het referentie scenario[13] en de intermediaire waarden[14] die in dit verslag worden gebruikt, zijn geselecteerd door de minister van Energie en vormen de basis van deze studie.

Dit verslag bestaat uit drie hoofddelen. Eerst worden het referentiescenario, de kalibratie daarvan volgens de toepasselijke betrouwbaarheidsnorm en de in aanmerking genomen intermediaire waarden gepresenteerd. Ten tweede verschaft Elia de nodige informatie en berekeningen om op basis van de vraagcurve het te contracteren volume te bepalen voor de veiling in kwestie. Tenslotte bevat het derde deel voorstellen van Elia over de andere veilingparameters, namelijk de reductiefactoren, de intermediaire maximumprijs, de uitoefenprijs en de referentieprijs.

Bepaling van het referentiescenario en de intermediaire waarden door de Minister

Voor de uitvoering van de opdrachten die het werden toevertrouwd, baseert Elia zich op het referentiescenario en de intermediaire waarden die door de Minister werden geselecteerd in de Ministeriële Besluiten van 15 september 2023.

Het referentiescenario is gebaseerd op de meest recente Europese studie gepubliceerd door ENTSO-E, namelijk de “European Resource Adequacy Assessment 2022”[15] geüpdatet in lijn met de meest recent beschikbare gegevens voor België en andere omliggende landen zoals beschreven in de Excel “Assumptions Workbook” die ter beschikking wordt gesteld met dit rapport. Bovendien werd er 1 additionele sensitiviteit geïncorporeerd in het basisscenario in lijn met de beslissing genomen door de Minister:

- Franse nucleaire onbeschikbaarheid - 4 eenheden: een lagere beschikbaarheid van 4 nucleaire eenheden tijdens de winter in vergelijking met ERAA22.

De door de Minister gekozen intermediaire waarden zijn gebaseerd op een voorstel van de CREG en bestaan uit een WACC voor een beperkte lijst van technologieën die nodig zijn om de nettokosten van een nieuwe toetreder in het Belgische controlegebied te bepalen, samen met de bijbehorende kostwaarden, en een correctiefactor X gelijk aan 1.5, die nodig is om het maximale volume tegen de maximumprijs te bepalen. Bij het bepalen van de technologie die

[12] http://www.ejustice.just.fgov.be/eli/besluit/2021/04/28/2021041351/justel
[13] https://www.ejustice.just.fgov.be/cgi/article_body.pl?language=nl&pub_date=2023-10-02&caller=list&numac=2023045383
[14] https://www.ejustice.just.fgov.be/cgi/article_body.pl?language=nl&pub_date=2023-10-02&caller=list&numac=2023045381
[15] European Resource Adequacy Assessment (ERAA) 2022 | ENTSO-E (entsoe.eu)

de Net-CONE en dus de maximumprijs van de veiling bepaalt, moet het potentieel van die technologie worden geëvalueerd. Elia benadrukt dat het technologisch potentieel ook moet worden begrepen als het potentieel voor deelname aan het CRM, rekening houdend met de gekende barrières voor bepaalde technologieën.

Tenzij expliciet anders vermeld zijn alle prijzen weergegeven in € 2022.

In het kader van dit kalibratieproces, is de berekening van de “missing-money” (gebruikt voor de bepaling van de intermediaire maximumprijs en de netto kost van een nieuwkomer) gebaseerd op het gemiddelde van de verwachte inkomsten uit de energiemarkt in combinatie met de toepassing van een risicopremie om de risico-aversie van investeerders in rekening te brengen. Deze aanpak is gebaseerd op de methodologie ontwikkeld in samenwerking met professor Boudt[16], in lijn met de ERAA methodologie. Deze principes staan ook vermeld in het Koninklijk Besluit Methodologie.

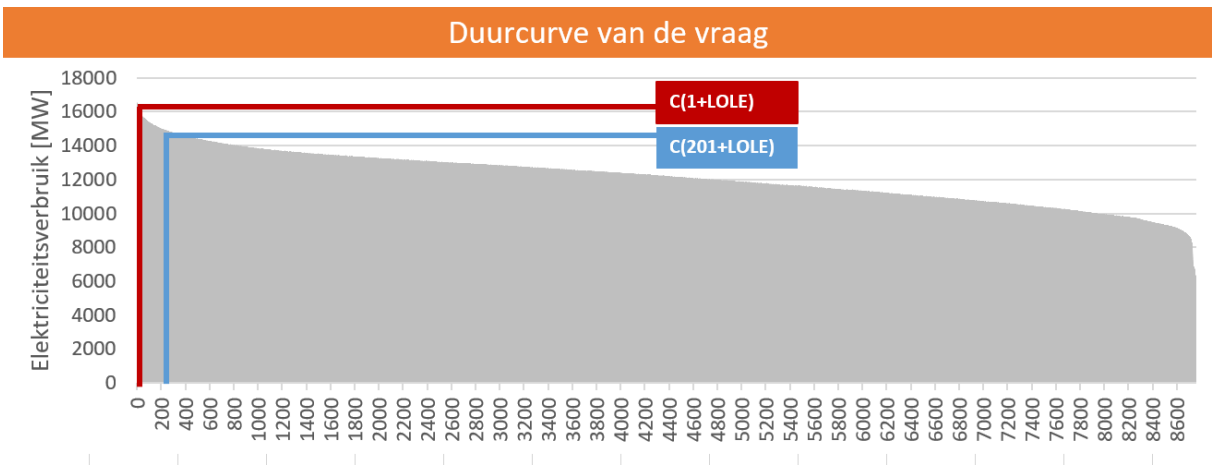
Op basis van deze elementen en overeenkomstig met het Koninklijk Besluit Methodologie heeft Elia het referentiescenario zodanig gekalibreerd dat de berekeningen en voorstellen het mogelijk maken te garanderen dat de wettelijke betrouwbaarheidsnorm (3u LOLE) wordt nageleefd. Het aldus verkregen gekalibreerde referentiescenario is strikt toepasselijk voor de berekeningen en voorstellen in het kader van dit kalibratierapport, dat van toepassing is op de Y-4 veiling van de leveringsperiode 2028-29.

[16] https://www.elia.be/-/media/project/elia/elia-site/public-consultations/2022/20221028reportboudtanalysisofhurdlieratesforbelgianelectricitycapacityadequacyandflexibilityanalysiso.pdf

Informatie en input voor het opstellen van de vraagcurve

In overeenstemming met het Koninklijk Besluit Methodologie is het niet de taak van Elia om een voorstel te maken voor de vraagcurve. Het is de verantwoordelijkheid van de CREG om op basis van de informatie die in dit verslag verstrekt wordt, een voorstel te maken. Het geheel van informatie en gegevens in dit rapport stemt minstens overeen met de punten vermeld in artikel 6, §2, 1° tot 7° van het Koninklijk Besluit Methodologie:

- Figuur A toont de duurcurve van de vraag, die dient als basis voor de bepaling van het volume dat moet worden gereserveerd voor de Y-1 veiling. Het is belangrijk op te merken dat er momenteel discussies gaande zijn over de introductie van een Y-2 veiling, evenals over de invoering van een dynamisch mechanisme met betrekking tot de reservering voor Y-1veiling. Aangezien deze veranderingen nog niet zijn geïntegreerd in het wettelijk kader op het moment van het schrijven van dit rapport, heeft Elia deze ontwikkelingen nog niet opgenomen.
- Figuur B geeft een grafische voorstelling van de jaarlijkse inframarginale rentes die op de energiemarkt worden ontvangen door de technologieën die zijn opgenomen in de beperkte lijst van technologieën, welke nodig is om de nettokost van een nieuwkomer op de markt te bepalen; en
- Voor de jaarlijkse netto-inkomsten uit de markt voor balanceringsdiensten voor de technologieën die in de beperkte lijst van technologieën zijn opgenomen worden de volgende waarden geraamd: 15 €/kW/jaar voor gasturbines (OCGT) en autonome gasmotoren, 3€/kW voor stoom- en gasturbines (CCGT), 10 €/kW/jaar voor marktrespons en 21 €/kW/jaar voor batterijen. Op basis van de argumenten in dit verslag worden geen extra inkomsten overwogen voor de andere technologieën.



Figuur A : Duurcurve van de vraag (Art. 11, §2, 5° en Art. 11, §5)

Informatie en input vereist voor de vaststelling van de volumeparameters van de vraagcurve		
Beschrijving	**KB Referentie**	**Capaciteit [MW]**
Gemiddelde elektriciteitsverbruik in gesimuleerde tekortsituaties (punt A)	Art. 11, §2, 1°	15363
Gemiddelde elektriciteitsverbruik in gesimuleerde tekortsituaties (punten B en C)		15453
Vereiste reserves voor het bewaren van het evenwicht in het netwerk	Art. 11, §2, 2°	1136
Gemiddelde niet-geleverde energie in gesimuleerde tekortsituaties (punt A)	Art. 11, §2, 3°	612
Gemiddelde niet-geleverde energie in gesimuleerde tekortsituaties (punten B en C)		478
Niet in aanmerking komende capaciteit Hernieuwbare capaciteit die al exploitatiesteun ontvangt	Art. 11, §2, 4°	745
Niet in aanmerking komende capaciteit Individueel geprofileerd en gemodelleerd thermisch vermogen dat exploitatiesteun ontvangt	Art. 11, §3	2030
Maximale beschikbare toegangscapaciteit voor de deelname van de indirecte buitenlandse capaciteiten Frankrijk	Art. 14	10
Maximale beschikbare toegangscapaciteit voor de deelname van de indirecte buitenlandse capaciteiten Nederland		497
Maximale beschikbare toegangscapaciteit voor de deelname van de indirecte buitenlandse capaciteiten Duitsland		132
Maximale beschikbare toegangscapaciteit voor de deelname van de indirecte buitenlandse capaciteiten Groot-Brittannië		379

Tabel A : Volumeparameters

Figuur B : Prijsparameters – Inkomsten voor elke technologie om de net-CONE te bepalen (Art. 10, §§2 and 6)

Voorstellen voor de andere veilingparameters

Elia is ook belast met het maken van concrete voorstellen voor een andere reeks veilingparameters, overeenkomstig artikel 6, §2, 7° van het Koninklijk Besluit Methodologie:

- Het voorstel van Elia voor de **reductiefactoren** is opgenomen in Tabel B, overeenkomstig hoofdstuk 5 van het Koninklijk Besluit Methodologie;
- Elia stelt voor om rekening te houden met een **intermediaire maximumprijs** van 23 €/kW/jaar (in €2022), in overeenstemming met hoofdstuk 6 van het Koninklijk Besluit Methodologie;
- Elia stelt voor om rekening te houden met een **uitoefenprijs** die gelijk is aan 431 €/MWh en om als **referentieprijs** de dagelijkse spotmarktprijs in aanmerking te nemen die door de NEMOs (Nominated Electricity Market Operators: EPEX of Nord Pool Spot) actief voor de Belgische regelzone (of een NEMO actief in een aangrenzende regelzone voor buitenlandse capaciteiten) wordt bepaald, in overeenstemming met hoofdstuk 8 van het Koninklijk Besluit Methodologie.

Category I: SLA	
Subcategorieën	Reductiefactor [%]
SLA-1h	19
SLA-2h	35
SLA-3h	48
SLA-4h	57
SLA-5h	65
SLA-6h	71
SLA-7h	76
SLA-8h	81
SLA-9h	86
SLA-10h	89
SLA-11h	93
SLA-12h	95
SLA onbeperkt	100
Categorie II: Thermische technologieën met dagelijks programma	
Subcategorieën	Reductiefactor [%]
Stoom- en gasturbines	94
Gasturbines	92
Turbojets	90
Autonome gasmotoren	92
Autonome dieselmotoren	90
Centrales met warmtekrachtkoppeling / Biomassacentrales / Afvalverbrandingsinstallaties	94
Kerncentrales	80
Steenkoolcentrales	90

Categorie III: Technologieën met beperkte energie met dagelijks programma	
Subcategorieën	Reductiefactor [%]
Opslag 1u	22
Opslag 2u	38
Opslag 3u	50
Opslag 4u	57
Opslag 5u	62
Opslag 6u	65
Pomp-opslaginstallaties	52
Categorie IV: Van weersomstandigheden afhankelijke technologieën	
Subcategorieën	Reductiefactor [%]
Windturbines op zee	9
Windturbines op het land	7
Zonne-energie installaties	1
Waterkrachtcentrales op waterlopen	48
Categorie V: Thermische technologieën zonder dagelijks programma	
Subcategorieën	Reductiefactor [%]
Geaggregeerde thermische technologieën	64

Tabel B : Reductiefactoren

Introduction

Following article *7undecies §3* of the Electricity Act[17] Elia Transmission Belgium (hereafter Elia) is tasked with providing a report with the necessary information and proposals for the organization of the CRM auction. The different parameters are calculated based on the Royal Decree Methodology[18] (hereafter RD Methodology).

This year, two different auctions will take place. One for the Y-1 auction with Delivery Period 2025-26 and another one for Y-4 auction with Delivery Period 2028-29. Elia wrote one calibration report for each auction. This report centers on the information related to the Y-4 auction with Delivery Period 2028-29.

This report is structured as follows: firstly, Elia briefly presents the legal and regulatory framework within which the calibration exercise takes place. The different parameters are then presented in three main parts.

- Part I: the reference scenario deals with the elaboration of the reference scenario selected by the Minister that Elia needs to follow in the course of this report.
- Part II: information and data for the establishment of the demand curve then goes more into detail about the different parameters that are used in the determination of the demand curve.
- Part III: proposals for the other auction parameters involves parameters such as the derating factors, the intermediate price cap and the strike price.

This calibration report also includes an annex with additional information such as inframarginal rents and prices occurrences on day ahead.

[17] (NL) Wet van 29 april 1999 betreffende de organisatie van de elektriciteitsmarkt
(FR) Loi du 29 avril 1999 relative à l'organisation du marché de l'électricité

[18] (NL) Koninklijk Besluit van 28 april 2021 tot vaststelling van de parameters waarmee het volume aan te kopen capaciteit wordt bepaald, inclusief hun berekeningsmethode, en van de andere parameters die nodig zijn voor de organisatie van de veilingen, alsook de methode en voorwaarden tot het verkrijgen van individuele uitzonderingen op de toepassing van de intermediaire prijslimieten(en) in het kader van het capaciteitsvergoedingsmechanisme
(FR) Arrêté Royal du 28 avril 2021 fixant les paramètres avec lesquels le volume de la capacité à prévoir est déterminé, y compris leurs méthodes de calcul, et les autres paramètres nécessaires pour l'organisation des mises aux enchères, ainsi que la méthode pour et les conditions à l'octroi d'une dérogation individuelle à l'application du ou des plafond(s) de prix intermédiaire(s) dans le cadre du mécanisme de rémunération de capacité

Legal and regulatory framework

As already highlighted in the introduction the legal and regulatory justifications that set the framework for this report can be found in the Electricity Act on the one hand and the RD Methodology on the other. This framework has been approved by the European Commission in its decision of August 27, 2021[19]. On the 29th of September 2023, the European Commission confirmed the validity of the Belgian Capacity Remuneration Mechanism, taking into account among others the nuclear extension of two power plants for 10 years [20].

These texts have been adapted over time based on due discussion among market parties. The main platform for interaction between market parties is the Working Group Adequacy[21], whereas the main body between the public authorities is the “Comité de Suivi”, composed of representatives of the FPS Economy, the cabinet of the Minister of Energy, the CREG and Elia.

The elements that need to be included are defined in article 6, §2 of the RD Methodology[22].

[19] State aid: Commission approves Belgian capacity mechanism
[20] https://ec.europa.eu/competition/state_aid/cases1/202340/SA_104336_B04EFF8A-0000-CDF2-866E-13BF028481FA_65_1.pdf
[21] Working Group Adequacy
[22] (NL) Art. 6, §2 van het KB methodologie
(FR) Art. 6, §2 de l’AR Méthodologie

Part I: Reference Scenario

The reference scenario is built on several assumptions with regards to electricity consumption, production from different technologies, storage, active participation or response of the demand, import capacity and other technical and economic parameters and forms the basis for the calculations for the proposals for the parameters for the fourth CRM Auction. It is paramount that these parameters are clearly defined so that market parties can optimally prepare for the auction. As a result, only one reference scenario is defined, resulting in a single proposal for each parameter that needs to be calculated.

As a reminder, the reference scenario is selected by the Minister of energy based on a proposal of the CREG, recommendations from Elia (after consultation of the market parties) as well as an advice from the SPF economy.

This chapter goes more into detail about the main elements that constitute the reference scenario selected by the Minister, as well as the intermediate values that were retained and to present the calibration of the reference scenario to ensure it satisfies the criteria set in the Electricity Act.

1.1 Determination of the reference scenario

1.1.1 Steps in the selection of the reference scenario

The methodology to establish the reference scenario is detailed in article 3 of the RD Methodology[23].

In first instance Elia has selected several scenarios and sensitivities in collaboration with the SPF economy and concertation of the CREG.

The scenario chosen at the end of this process took as its reference the latest European study published by ENTSO-E, namely the “European Resource Adequacy Assessment 2022[24]”, considering the most up-to-date information for Belgium and neighboring countries. 13 sensitivities that could have an impact on Belgium's security of supply, including events beyond its control, were proposed during the public consultation to be integrated as part of the reference scenario (these are shown for information in Figure 1).

[23] (NL) Art. 3 van het KB methodologie
(FR) Art. 3 de l’AR méthodologie
[24] ERAA 2022 | ERAA 2022 by ENTSO-E (entsoe.eu)

Figure 1: Proposed sensitivities menu during the public consultation for the reference scenario of the auction Y-4 DY2028-29

Altogether, the scenarios, sensitivities and data for the CRM parameter calculation have been subject to a public consultation[25], as also required by the RD Methodology. This information has also been presented in the Working Group Adequacy[26].

Following the public consultation, Elia has submitted a public consultation report to the Minister of Energy, the FPS economy and the CREG that have been presented during another Working Group Adequacy[27]. Along with this public consultation report Elia has also provided its final recommendations with regards to the selection of the reference scenario, taking into account the feedback received from different market parties in the public consultation as well as during the discussions of the Working Group Adequacy.

[25] Public consultation on the scenarios, sensitivities and data for the CRM parameter calculation for the Y-1 Auction for Delivery PeriodDelivery Period 2025-2026 and the Y-4 Auction for Delivery PeriodDelivery Period 2028-2029 (elia.be)
[26] https://www.elia.be/en/users-group/adequacy-working-group/20230414-meeting
[27] https://www.elia.be/en/users-group/adequacy-working-group/20230616-meeting

Elia's recommendation was to start from the latest available European study, the "European Resource Adequacy Assessment 2022[28]", whose data had been updated with the most recent information for Belgium and neighboring countries and taking into account feedback from stakeholders. It should be noted that the total reserve capacity was updated from 1450 MW to 1136 MW. This update takes into account the fact that renewable prediction risks are expected to be lower during scarcity periods, and then the FRR capacity is limited to the dimensioning incident.

In addition, Elia recommended incorporating a number of sensitivities into the reference scenario (see Figure 2):

- Regarding the sensitivity on the possible closures of thermal units, Elia proposed to include the closure of 190 MW of TJ and OCGT because of the CO_2 thresholds in the CRM.
- Regarding the sensitivity on the nuclear availability in France, Elia proposed to consider 4 units of 900 MW as unavailable on top of the nuclear unavailability according to the ERAA22.

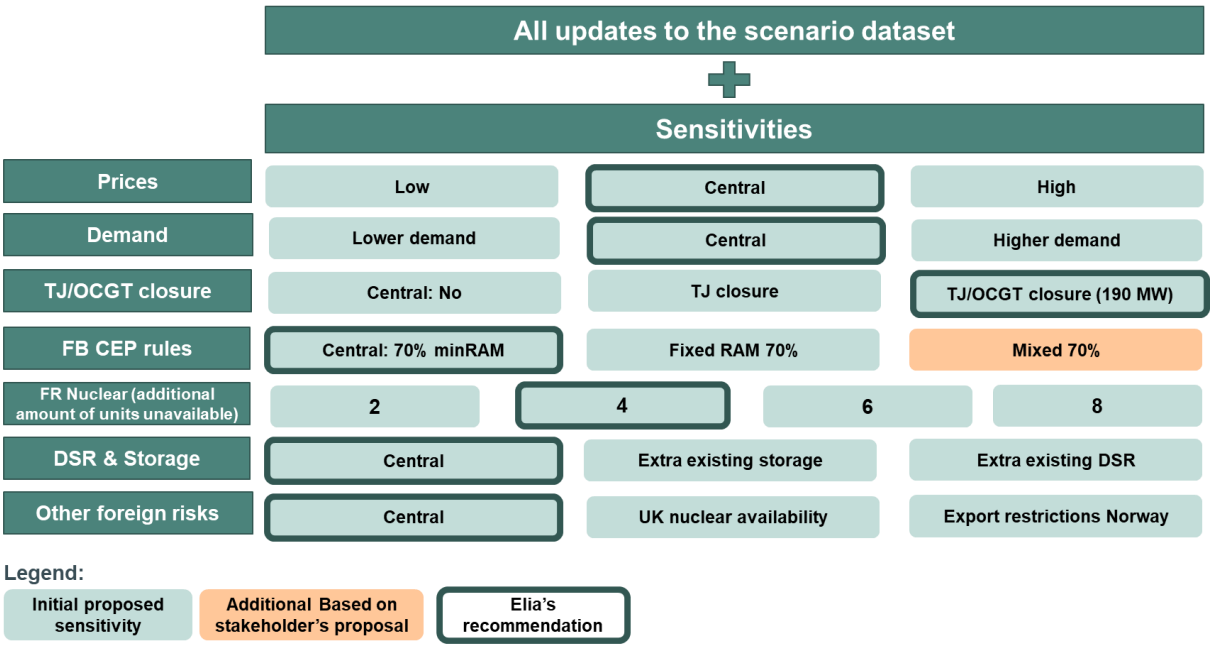


Figure 2: Visual representation of Elia's recommendation after the public consultation

Following Elia's recommendation, an update regarding the total load and the volume of Market Response in Belgium was presented respectively by Climact and E-cube during the Adequacy Working Group on August 25, 2023[29]. Furthermore, an update on prices, as well as an update of the data for France, Great-Britain, and Italy, were communicated bilaterally to the CREG and the FPS.

[28] https://www.entsoe.eu/outlooks/eraa/2022/
[29] https://www.elia.be/en/users-group/adequacy-working-group/20230825-meeting

Following article 3, §6 of the RD Methodology the CREG has provided a proposal for the reference scenario which was published in its note « Proposition (C)2631 » on August 31 2023[30] . More specifically, the proposal recommended:

- to not consider the closure of 190 MW of TJ and OCGT due to the CO_2 thresholds.
- to consider the dataset from the study "European Resource Adequacy Assessment 2022", taking into account the announcements and/or decisions likely to have a significant impact on data from neighboring countries;
- to account for an extra unavailability of 2 units of 900 MW in the French nuclear fleet, on top of the nuclear unavailability considered in the ERAA22;
- to take into account a destruction in demand of 4.7 TWh, resulting in a total demand of 101 TWh for the Y-4 auction for the Delivery Period 2028-29;
- to include a growth rate on top of 1843 MW of Market Response estimated by E-cube for the winter 2022-23 in function of the evolution of the demand.

The FPS Economy has then published its advice « Avis de la Direction générale de l'Energie du SPF Economie sur les propositions (C)2630 et (C)2631 du 31 août 2023 du régulateur relatives respectivement aux scénarios de référence à utiliser pour l'enchère Y-1 pour la période de livraison 2025-2026 et pour l'enchère Y-4 pour la période de livraison 2028-2029 » on September 5, 2023[31]. The DG Energy of the FPS economy advised the Minister to consider a scenario for the Y-4 auction with Delivery Period 2028-29 Delivery Period, taking into account:

- no closure of the 190 MW of TJ and OCGT due to the CO_2 thresholds;
- a total electricity demand of 101 TWh for 2028;
- a constant volume of 1,843 MW of DSR over the 2023-2028 period;
- to consider the dataset from the study "European Resource Adequacy Assessment 2022", updated to take into account the latest information available for Belgium and Europe, and the comments of stakeholders to the public consultation.
- the latest CO_2 and fuel price data (as provided bilaterally by Elia);
- a minRAM of 70% for cross border calculations;
- to account for an extra unavailability of 4 units of 900 MW in the French nuclear fleet, on top of the nuclear unavailability already considered in the ERAA22 for France.

[30] (FR) Proposition de scénario de référence pour l'enchère T-4 couvrant la période de fourniture 2028-2029 | CREG : Commission de Régulation de l'Électricité et du Gaz
(NL) Voorstel van referentiescenario voor de T-4 veiling met leveringsperiode 2028-2029 | CREG : Commissie voor de Regulering van de Elektriciteit en het Gas
[31](NL) Advies-AD-Energie-scenario-y-4-28-29-y-1-25-26.pdf (fgov.be)
(FR) Avis-DG-Energie-scenario-y-4-28-29-y-1-25-26.pdf (fgov.be)

1.1.2 Reference Scenario selected by the Minister

Subsequently the Minister has selected by means of the Ministerial Decree of September 15, 2023[32] the reference scenario that is to be considered for the Y-4 auction with Delivery Period 2028-29. This Ministerial Decree states that the data included "must be considered by Elia in further work on the Y-4 auction with Delivery Periods 2028-29 and comes from the ERAA 2022 database, whose data for Belgium and other countries are updated as mentioned in the appendix to Elia's consultation report of June 16, 2023. The data in the annex to the consultation report for neighboring countries has also been updated with the latest available information".

More specifically the Ministerial Decree takes into account:

- no closure of the 190 MW of TJ and OCGT due to the CO_2 thresholds;
- a total electricity demand of 102.4 TWh;
- 1,843 MW of DSR;
- to consider the dataset from the study "European Resource Adequacy Assessment 2022", updated to take into account the latest information available for Belgium and Europe, and the comments of stakeholders to the public consultation.
- The CO_2 and fuel price data based on futures and the World Energy Outlook 2022;
- a minRAM of 70% for cross border calculations;
- to account for an extra unavailability of 4 units of 900 MW in the French nuclear fleet, on top of the nuclear unavailability already considered in the ERAA22 for France.

The data with respect to this scenario is summarized in the Ministerial Decree and is also included in the assumptions workbook that has been published alongside this calibration report.

[32] (FR) http://www.ejustice.just.fgov.be/eli/arrete/2023/09/15/2023045383/moniteur
(NL) http://www.ejustice.just.fgov.be/eli/besluit/2023/09/15/2023045383/staatsblad

1.2 Determination of the intermediate values

The methodology for the determination of the intermediate values is set out in article 4 of the RD Methodology[33]. The intermediate values consist of:

- The gross cost of a new entrant (gross-CONE), determined for a reduced list of technologies;
- The weighted average cost of capital (WACC) used in the determination of the gross-CONE, which corresponds to the sum of the minimum return and a risk premium, determined for a reduced list of technologies; and
- The correction factor X, which allows to determine the global auction price cap as well as the maximum volume to be procured in the auction.

These parameters are required in this calibration report for the following reasons:

- The correction factor X allows to calculate the maximum price of point A of the demand curve, the so-called global auction price cap. This maximum price can be calculated by multiplying the net-CONE calculated for a reference technology and the correction factor X. On the abscise, this point A corresponds to the volume that needs to be procured to comply with a reliability standard obtained by multiplying the legal reliability standard determined in article 7*bis* of the Electricity Act [34]and the correction factor X;
- The net-CONE is determined based on the gross-CONE of the reference technology, selected from a reduced list by subtracting the inframarginal rents and the net revenues from ancillary services from this gross-CONE and dividing the result by the derating factor.

[33] (NL) Art. 4 van het KB Methodologie
(FR) Art. 4 de l'AR Méthodologie
[34] (NL) Art. 7*bis* van de Elektriciteitswet
(FR) Art. 7*bis* de la Loi Electricité

1.2.1 Steps in the selection of the intermediate values

The CREG made a proposal in its note (C)2579[35] for the list of eligible technologies, the weighted average cost of capital (WACC), including the hurdle premium by technology, the gross cost of a new entrant (gross-CONE) for each technology as well as the components to calculate these values along with the correction factor X. This proposal was submitted for public consultation and followed by a public consultation report[36].

The Minister decided on the intermediate values in the Ministerial Decree of 15 September 2023[37], which included:

- A reduced list of technologies as well as their gross cost and risk premium as shown in Table 1;
- Minimal risk premium of 4,7% on top of which a technology specific risk premium is added to calculate a WACC;
- A correction factor X equal to 1,5.

Technology	EAC [€/kW/an]	Derating factor [%]	CONEfixed,RT [€/kW/an]	WACC [%]
OCGT (>100 MW)	83.3	93	89.6	8.0
CCGT (>800 MW)	100.2	93	107.7	6.9
IC gas engine	78.4	95	82.5	8.0
CHP (<100 MW)	166.9	93	179.5	6.9
Photovoltaics	78.2	1	7 820.0	5.1
Onshore wind	148.0	10	1 480.0	6.0
Offshore wind	241.9	11	2 199.1	5.2
Battery storage (4h)	106.7	60	177.8	5.0
DSR (0<300MW)	25	59	42.4	6.3
DSR (300<600MW)	50	59	84.7	6.3
DSR (600<900MW)	75	59	127.1	6.3
DSR (900<1200MW)	100	59	169.5	6.3

Table 1: Intermediate values selected by the Minister – gross cost and derated gross cost for the list of technologies as well as the risk premium per technology

Note that the derating factors proposed by the CREG and decided by the Minister are based on the calibration report for the Y-4 auction for Delivery Period 2027-28. Updated derating factors for the Delivery Period 2028-29 are provided in this calibration report in chapter 3.1.

[35](NL) https://www.creg.be/nl/publicaties/voorstel-c2579
(FR) https://www.creg.be/fr/publications/proposition-c2579
[36] (NL) https://www.creg.be/nl/openbare-raadplegingen/prd2579
(FR) https://www.creg.be/fr/consultations-publiques/prd2579
[37](NL) http://www.ejustice.just.fgov.be/eli/besluit/2023/09/15/2023045381/staatsblad
(FR) http://www.ejustice.just.fgov.be/eli/arrete/2023/09/15/2023045381/moniteur

1.3 Calibration of the Reference Scenario

The necessary steps to establish the Reference Scenario are described in more detail in article 6 of the RD Methodology[38].

One necessary step in this process is the establishment of the preselected capacity types, i.e. the capacities that are added to the scenario in order to reach the legal reliability standard. These capacity types were also publicly consulted on in parallel to the scenarios, sensitivities and data for the calculation of the parameters of the Y-4 Auction with Delivery Period 2028-29, after which 4 technologies were retained, as presented in Table 2.

Type	Category	Associated Technology	Associated Volume	Associated Marginal Cost
1	Semi-baseload	CCGT, CHP	Addition of new CCGT	Marginal price of a CCGT
2	Peakers 1	OCGT	Addition of new OCGT	Marginal price of an OCGT
4	Batteries	Large-scale batteries	Addition of a battery with energy content of 4h	/
5	DSR	DSR	Add new 24h DSR	Marginal cost of 24h DSR

Table 2: Preselected capacity types following the public consultation of Elia

[38] (NL) Art. 6 van het KB Methodologie
(FR) Art. 6 de l'AR Méthodologie

1.3.1 Determination of cost parameters associated to the preselected capacity types

In order to select which of the preselected capacity types are added, one needs to determine the annualized costs for each technology. These costs take into account the intermediate values as per section 1.2.

Other parameters such as the Fixed Operations & Maintenance costs (FOM) are included in Table 3 as well as the assumptions workbook attached to this report.

Type	Categories	CAPEX [€/kW]	FOM [€/kW]	Economic lifetime [y]	WACC [%]
1	Semi-baseload	700*	30	20	6.9
2	Peakers 1	550**	25	20	8.0
3	Batteries	900	20	15	5.0
4	DSR	0	See Figure 3	1	6.3

**CAPEX for CCGT >800 MW*
***CAPEX for OCGT>100 MW*

Table 3: Preselected capacity types – CAPEX & FOM used for the economic optimization loop

As for DSR, the heterogeneous characteristics of the technology are taken into account via a step-wise approach, where the increasing annualized costs are reflected by Figure 3 below:

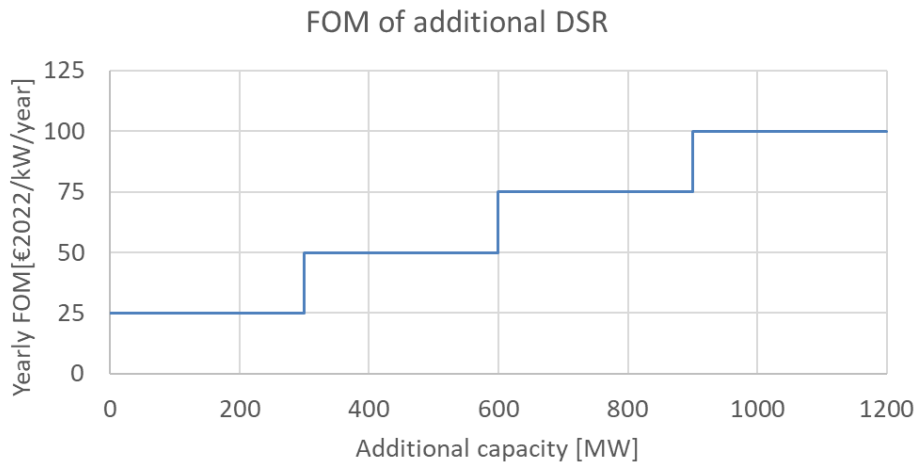


Figure 3: Annualized costs of additional DSR (on top of the already considered DSR in the reference scenario)

1.3.2 Revenue calculation and economic optimization loop

After the addition of the capacities that have been contracted in previous auctions, the revenues for each preselected technology are determined in subsequent economic optimization loops, thereby taking into account the additional capacity of previous iterations.

The revenues of the Delivery Period 2028-29 are subtracted from the annualized costs in order to obtain the missing money for each technology. The technology with the lowest missing money is considered as the best entrant in the model, and 100MW of this technology is added.

These steps are repeated until the reliability standard is reached.

1.3.3 Reliability standard

The Royal Decree of September 4, 2022[39] sets the reliability standard at 3 hours (LOLE).

1.3.4 Mix of additional capacity added to the reference scenario

By applying the aforementioned methodology, a mix of additional capacity is obtained that allows the reference scenario to meet the reliability standard. This additional capacity is added to the existing and new capacities that were already taken into account.

The added capacity corresponds to a capacity mix that allows to realistically determine the set of CRM parameters. It depends on the assumptions that were made during the selection of the reference scenario and the hypotheses regarding the gross cost of a new entrant for each preselected technology.

Note that for this auction, the volume contracted with long-term contracts in the Y-4 auction with Delivery Year 2027-28[40] was also accounted for. The derating factors applicable in the aforementioned auction can differ from the derating factors calculated in this calibration report. As such, the capacities which are expressed in derated MW may differ from the auction results.

Taking those elements into account, the mix of capacity added on top of the reference scenario selected by the Minister consists of:

- 1200 MW derated of semi-baseload category;
- 235 MW derated of peakers 1;
- 357 MW derated[41] of large-scale batteries with 4h of storage;
- 300 MW derated of 24h DSR.

[39] (NL) Koninklijk besluit van 4 september 2022 tot wijziging van het koninklijk besluit van 31 augustus 2021 tot vaststelling van de betrouwbaarheidsnorm en tot goedkeuring van de waarde van de verloren belasting en de kosten voor de nieuwe toegang
(FR) Arrêté royal du 4 septembre 2022 modifiant l'arrêté royal du 31 août 2021 relatif à la détermination de la norme de fiabilité et à l'approbation des valeurs du coût de l'énergie non distribuée et du coût d'un nouvel entrant

[40] https://www.elia.be/-/media/project/elia/elia-site/grid-data/adequacy/crm-auction-results/2023/y-4-2023-auction-report_en.pdf

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

Part II: Information and data for the calibration of the demand curve

Following article 6 of the RD Methodology[42] the regulator needs to make a proposal for the demand curve based on the parameters that have been provided in the report of Elia. These parameters are established in this part of the calibration report and include:

- Average electricity consumption during simulated scarcity situations (section 2.1);
- Volume corresponding to the balancing needs (section 2.2);
- The expected energy not served during simulated scarcity situations (section 2.3);
- Information with regards to non-eligible capacity (section 2.4);
    - Renewables (section 2.4.1);
    - Thermal units (section 2.4.2);
- Information regarding the load duration curve (section 2.5);
- Maximum entry capacity for indirect cross-border participation (section 2.6);
- Net-CONE: inframarginal rents obtained on the energy markets (section 2.7);
- Net-CONE: net revenues from ancillary services (section 2.8).

These parameters are also elaborated in article 11 of the RD methodology[43] and allow the calibration of both the volume and price parameters of points A, B and C of the demand curve.

[42] (NL) art. 6 van het KB Methodologie
(FR) art. 6 de l'AR Méthodologie
[43] (NL) art. 11 van het KB Methodologie
(FR) art. 11 de l'AR Méthodologie

2.1 Average electricity consumption during simulated scarcity situations

The calculation of the average electricity consumption during simulated scarcity situations is based on the consumption profiles that are taken into account in the hourly market simulations following the reference scenario of part I. For every simulated scarcity hour, the average consumption is retained, which corresponds to the amount of consumption after deducting part of the assumed flexibility in the scenario that is considered unlikely to participate to the upcoming Y-4 CRM auction but before activation of all means of production (centralized or decentralized), of large-scale storage and imports. It does not take into account the possibility of the system to provide these volumes.

The part of the flexibility considered in the average consumption during simulated scarcity situations for the upcoming Y-4 CRM auction consists of all end-user flexibility and the part of flexibility from newly electrified industry or new usages, corresponding to 81% of the flexibility from newly electrified industry or new usages.

The values for the point A, B and C of the demand curve depend on the two possible cases with a different reliability standard:

- For points B and C, the scenario is calibrated based on a LOLE equal to 3h;
- For point A, the scenario is calibrated based on a LOLE of 4,5h, a value which is obtained by multiplying the legal reliability standard (3h) and the correction factor X that have been defined in the intermediate values, i.e. X = 1,5.

The results of this methodology are summarized in the table below:

Results obtained by Elia	
Average electricity consumption during simulated scarcity situations (point A)	15363 MW
Average electricity consumption during simulated scarcity situations (points B and C)	15455 MW

2.2 Volume corresponding to the balancing needs

This parameter corresponds to the foreseen upwards operational needs that need to be provided by thermal production units, demand flexibility and storage in Belgium in order to respond to unexpected variations of the consumption and production. Following the royal decree this volume is directly added to the average consumption during simulated scarcity hours.

The volume that is applied is part of the reference scenario, and only takes into account Belgian units; in scarcity situations it is assumed that no remaining XB capacities are available for fulfilling balancing needs.

The volume corresponds to the necessary balancing needs during scarcity and is defined as the sum of the needs of FCR and FRR for the Delivery Period 2028-29. As selected by the Minister, these volumes are 97 MW and 1039 MW, respectively, resulting in a total of 1136 MW of balancing needs.

Value selected by the Minister	
Volume corresponding to the balancing needs	1136 MW

2.3 Expected energy not served during simulated scarcity situations

When the reliability standard is non-zero, it means that, during scarcity situations, a particular amount of energy remains unserved. This amount of unserved energy must be deducted from the overall auction volume.

The expected energy not served during simulated scarcity situations is based on the results of the hourly market simulations of the reference scenario and corresponds to the average amount of energy not served as obtained during each simulated scarcity situation.

Similar to the average electricity consumption, the result depends on the reliability standard on which the reference scenario was calibrated, i.e. a reliability standard of 3h for points B and C and 4,5h for point A.

By applying this methodology the following results are obtained:

Results obtained by Elia	
Volume corresponding to the expected energy not served during simulated scarcity situations (point A)	612 MW
Volume corresponding to the expected energy not served during simulated scarcity situations (point B and C)	478 MW

Based on the above parameters it is possible to establish the required volume for the points A, B and C, namely the sum of the average consumption during simulated scarcity hours and the volume corresponding to the balancing needs minus the expected energy not served during simulated scarcity hours. This volume does not correspond to the volume that is effectively contracted in the Y-4 auction. Indeed, as also explained in article 11 of the RD Methodology some other volumes also need to be subtracted.

2.4 Information with regards to non-eligible capacity

As mentioned in article 11, §2 of the RD Methodology[44], the volumes that are considered as non-eligible need to be subtracted from the required volume as per section 2.3.

The eligibility criteria have been introduced in article 4 of the CRM Law[45] and are described in in the royal decree concerning the establishment of the eligibility criteria and modalities for the prequalification procedure with regards to the rules concerning the minimum threshold and the cumulation of state aid[46].

More in particular and based on the aforementioned laws, capacities are considered non-eligible if either:

- They benefit from state aid in the course of the Delivery Period; or
- Their installed capacity multiplied with the appropriate derating factor defined in part III of this report is lower than the threshold of 1 MW.

The criterion concerning owners of capacity that do not respect the emission limits set by the EU[47] will not be considered in this report.

It is worth pointing out that units whose installed capacity multiplied with the appropriate derating factor is lower than the eligibility criterion of 1 MW still have the possibility to participate in the CRM via an aggregated CMU. As such the information provided here by Elia is a purely informative estimation for the determination of the non-eligible capacity.

2.4.1 Renewables

Elia takes into account the global hypothesis that all CMUs that consist of onshore wind turbines, offshore wind turbines, photovoltaics (PV) and run-of-river hydroelectricity are subject to the first criterion, i.e. the absence of state aid in the course of the considered Delivery Period. After applying the appropriate derating factor (Part III) to the installed capacities presented in Part I, the volumes presented in Table 4 are obtained.

[44] (NL) Art. 11 van het KB methodologie
(FR) Art. 11 de l'AR Méthodologie
[45] (NL) art. 4 van de CRM-wet
(FR) art. 4 de la loi CRM
[46] (NL) KB van 21 mei 2021 tot vaststelling van de ontvankelijkheidscriteria (…) betreffende de organisatie van de elektriciteitsmarkt, wat betreft de voorwaarden waaronder de capaciteitshouders die genieten of genoten hebben van steunmaatregelen het recht hebben tot deelname aan de prekwalificatieprocedure en wat betreft de minimumdrempel in MW
(FR) AR du 21 mai 2021 relatif à l'établissement des critères de recevabilité (…) relative à l'organisation du marché de l'électricité, en ce qui concerne les conditions dans lesquelles les détenteurs de capacité bénéficiant ou ayant bénéficié de mesures de soutien ont le droit ou l'obligation de participer à la procédure de préqualification et en ce qui concerne le seuil minimal, en MW
[47] (NL) Art. 22 (4) van de verordening (EU) 2019/943 van het Europees Parlement en de Raad van 5 juni 2019 betreffende de interne markt voor elektriciteit
(FR) Art. 22 (4) du règlement (UE) 2019/943 du Parlement Européen et du Conseil du 5 juin 2019 sur le marché intérieur de l'électricité

Category	Installed Capacity [MW]	Derating Factor [%]	Non-eligible Capacity [MW]
Offshore wind	2261	9	204
Onshore wind	4918	7	344
PV	12730	1	127
Run-of-river hydro	145	48	70
TOTAL			745

Table 4: Non-eligible Capacity - renewables

2.4.2 Thermal units

It is assumed that cogeneration units defined in the reference scenario do not renounce to their state aid, and as such these units are considered as non-eligible.

In order to realize its estimation Elia takes into account:

- The capacities modelled as aggregated units in the reference scenario, consisting of thermal technologies without daily schedule, biomass, and incineration of gas and waste. These volumes were included in the public consultation of the reference scenario; and
- For individually modelled units, Elia bases itself on the most up-to-date information received from the regions in order to establish which part benefits from state aid.

These considerations lead to the results presented in Table 5.

Category	Installed capacity [MW]	Derating Factor [%]	Non-eligible capacity [MWd]
Aggregation of thermal technologies without daily schedule	2209	64	1414
Individually modelled units	723	64 or 94	616

Table 5: Non-eligible Capacity – thermal units

2.5 Information regarding the load duration curve

The load duration curve is used to calculate the amount of volume that needs to be reserved for the Y-1 auction. The resulting volume as such needs to be subtracted from the required volume of both point A as well as B and C of the demand curve of the Y-4 auction.

The load duration curve is based on the consumption data used in the market simulations and is in line with the total electricity consumption defined in the reference scenario. The flexibility volumes are considered as defined in the average electricity consumption during scarcity (see §2.1). This curve is presented in Figure 4. More numerical details are presented in Annex 2.

This load duration curve is to be used as follows: let $C(h)$ be the load duration curve where h represents the h^{th} highest electricity consumption. The volume V that needs to be reserved for the Y-1 auction can then be determined based on the following equation that takes into account the reliability standard:

$$V = C(1 + LOLE\ criterion) - C(201 + LOLE\ criterion) = C(4) - C(204) \quad [1]$$

For illustrative purposes the application of [1] is added to Figure 4.

Results obtained by Elia	
Load duration curve	Cf. Figure 4 & Annex 2

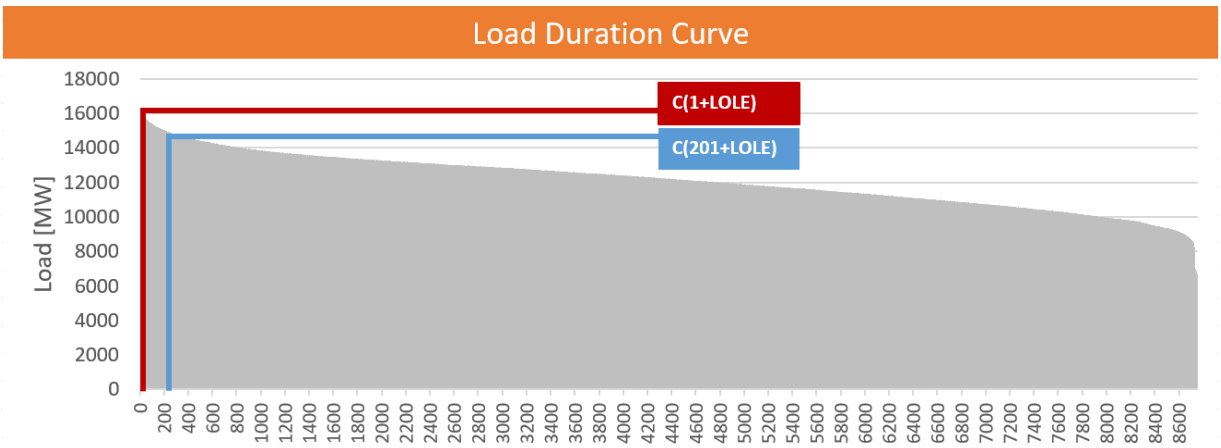


Figure 4: Load duration curve

2.6 Maximum entry capacity available for participation of foreign indirect capacities

The Belgian CRM allows for the participation of capacities of neighboring countries that are part of the European Union. The contribution of Great Britain is also taken into account.

The methodology for the calculation of the maximum entry capacity follows article 14 of the RD Methodology[48]. The results are as such based on the hourly market simulations.

The results of this approach can be found in the table below.

Maximum entry capacity per border obtained from the simulations	
France	10 MW
The Netherlands	497 MW
Germany	132 MW
Great Britain	379 MW
Total	**1018 MW**

[48] (NL) art. 14 van het KB Methodologie
(FR) art. 14 de l'AR Méthodologie

2.7 Net-CONE – yearly inframarginal rents obtained on the energy market

The yearly inframarginal rents are determined for the technologies that have been retained in the shortlist of technologies, which has been determined by the Minister in the context of the intermediate values as per section 1.2.

The inframarginal rents are determined as per article 10, §3 and §6 of the RD Methodology[49].

The shortlist of technologies as well as their associated parameters such as the CAPEX, the FOM and the economic lifetime have been established by the Ministerial Decree of 15 September 2023[50] and are presented in Table 6.

Technology	CAPEX [€/kW]	FOM [€/kW/an]	Economic lifetime [years]
OCGT (>100 MW)	550	25	20
CCGT (>800 MW)	700	30	20
IC gas engine	500	20	15
CHP (<100 MW)	1000	70	20
Photovoltaics	600	20	15
Onshore wind	1000	45	15
Offshore wind	2000	70	20
Battery storage (4h)	900	20	15
DSR (0<300MW)	0	25	1
DSR (300<600MW)	0	50	1
DSR (600<900MW)	0	75	1
DSR (900<1200MW)	0	100	1

Table 6: Parameters for the calculation of the gross-CONE (CREG (C)2579[51] and Ministerial Decree)

One important element in the hourly market simulations is the variable cost of each technology, which takes into account the efficiency as well as the fuel and CO_2 costs as defined in the Ministerial Decree concerning the reference scenario.

Concerning the efficiency and VOM of each technology the assumptions are based on AdeqFlex'23 and are summarized in Table 7.

Note that the batteries in this exercise have a round-trip efficiency of 85% as well as an energy capacity of 4 hours.

[49] (NL) Art. 10 van het KB Methodologie
(FR) Art. 10 de l'AR Méthodologie
[50] (NL) http://www.ejustice.just.fgov.be/eli/besluit/2023/09/15/2023045381/staatsblad
(FR) http://www.ejustice.just.fgov.be/eli/arrete/2023/09/15/2023045381/moniteur

Categories	Efficiency [%]	VOM [€/MWh]	Fuel price [€/MWh]	CO2 price [€/t]	CHP credits	Marginal cost [€/MWh]
CCGT	61	2.4	27	109.1	NA	88
OCGT	42	13.2	27	109.1	NA	137
Gas engine	40	13.2	27	109.1	NA	143
CHP	33	8.3	27	109.1	91	75

Table 7: Net-CONE: Assumptions for the marginal cost for different technologies

In order to determine the revenues for the overall lifetime for each technology different time horizons have been simulated based on scenarios of existing studies. The scenarios that have been used for this purpose are highlighted in Figure 5.

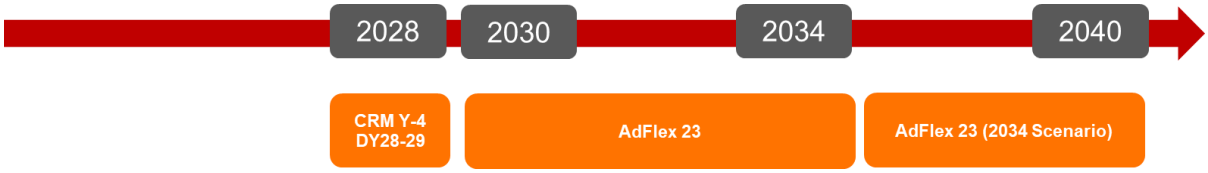


Figure 5: Choice of scenarios from other studies for the time period after the Delivery Period

In line with the decision of the Minister in the framework of the reference scenario, the scenarios for post-delivery years were chosen from AdFlex 23. The scenarios “CENTRAL/EU-SAFE” (in line with the decision of the Minister to consider 4 additional nuclear units in France as unavailable), “Mix” (in line with the results of the first CRM auction with Delivery Period 2025-26) and “Central price” (based on the actually observed market prices) have been selected for the time horizons 2030 and 2034.

After 2034 the inframarginal rents are considered constant based on the results obtained for 2034.

For Delivery Periods not covered by the aforementioned studies or scenarios a linear interpolation between each “pivot” year, as defined on Figure 5, is applied.

The results for the inframarginal rents obtained on the energy markets can be found on Figure 6.

Results obtained by Elia	
Yearly inframarginal rents	Cf. Figure 6 & Annex 3

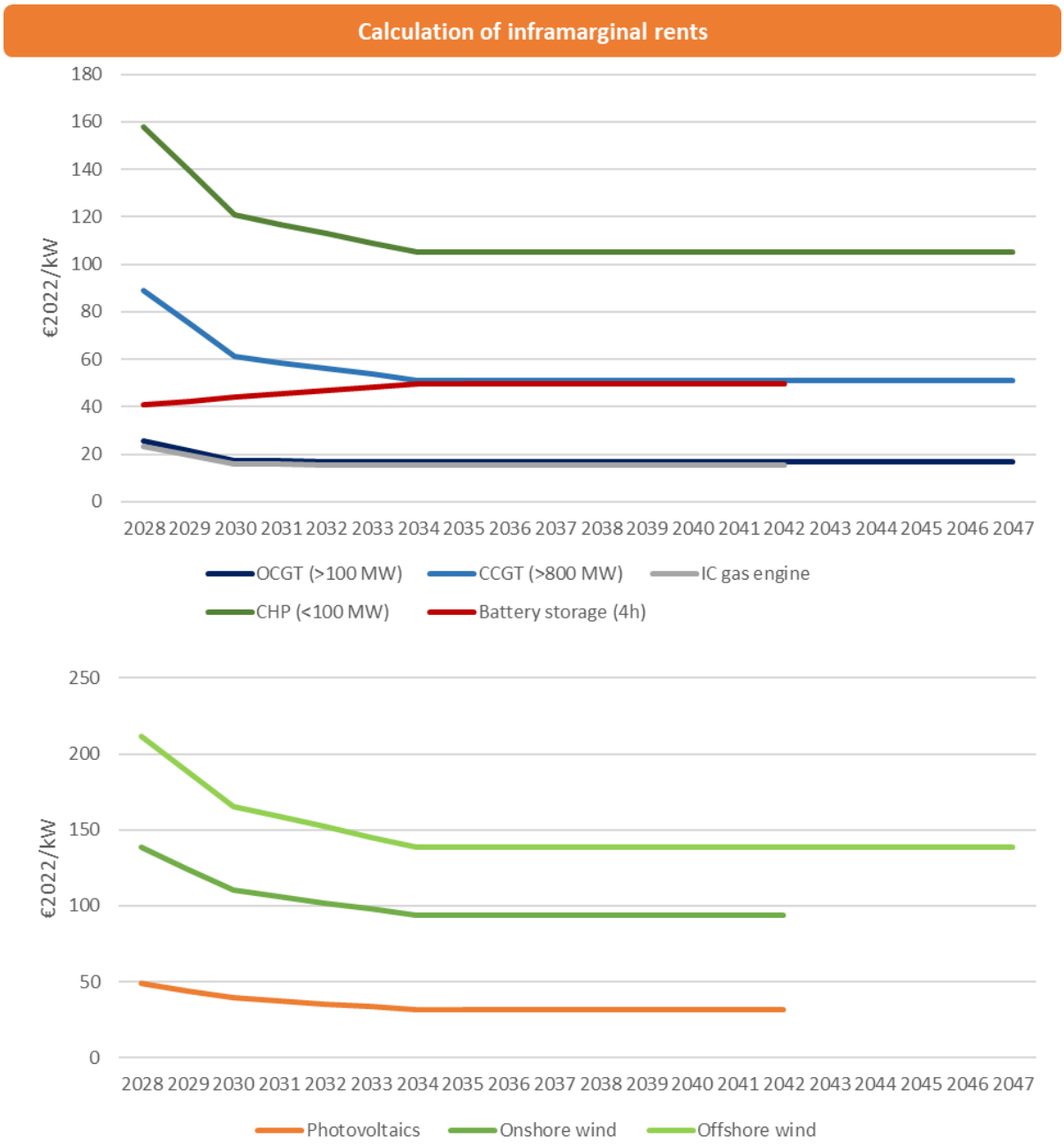


Figure 6: Calculated annual inframarginal rents received in the energy market by the technologies included in the reduced list of technologies for the net-CONE

2.8 Net-CONE – net revenues from ancillary services

This section deals with the determination of the net annual revenues obtained from ancillary services for the technologies that are included in the list of technologies eligible for the determination of the Net-CONE. The determination of the net revenues happens based on the stipulations of Article 10, § 7 of the RD Methodology[52].

In collaboration with Compass-Lexecon, Elia aimed at improving the estimation of the net balancing revenues. The results of this study form the basis of the determination of the net balancing revenues used in this calibration report. It should be noted that the study itself will be made available online (through the webpage of the WG adequacy) and that this report summarizes the findings but does not elaborate on the details of the methodology itself.

The estimations with regards to the different ancillary services available are described here, as well as their impact on the calculation of the Net-CONE:

- **FCR**:

  FCR revenues are only considered relevant for batteries[53] to obtain possible net revenues following the provision of balancing services. These have therefore been calculated in accordance with the provisions of the Royal Decree on Methodology, based on FCR's historical reservation costs over the last 36 months (taking into account opportunity costs)[54].

  Given the initial assumption that the FCR is covered solely by batteries and the volume of batteries considered in the reference scenario, there is strong competition between batteries to supply the necessary FCR capacity. This competition is expected to be reflected in the net revenues earned by batteries when supplying FCR. In other words, a higher amount of capacity providing FCR is expected, all things equal, to exert a downwards pressure on the bidding of the capacities participating and to push their net revenues downwards as well. Given the current level of competition and given that it can be expected to continue to increase with an increase in installed capacity, Elia considers a growth factor reflecting the future evolution of the installed capacity. In turn, the average net revenue per kW installed battery capacity is decreased with this growth factor which allows to assess on average what installed battery capacity could gain by participating in the FCR capacity auction in addition to its potential gain on the energy market.

  Indeed, the FCR needs for the Belgian zone amount to 97 MW in 2028-29, whereas the battery capacity 'in the market' (Large scale storage) already amounts to 327 MW as previously put forward in the public consultation note on the scenarios, sensitivities and data for the calculation of the auction parameters Y-4 for the 2028-29 delivery period and Y-1 for the 2025-26 delivery period. For 2028-29. Elia wishes to emphasize that much more than these 327 MW can be expected to be installed already. The expected installed capacity of batteries weighted over 2028 & 2029 reaches around 1261 MW and is

[52] (NL) Art. 10 van het KB Methodologie
(FR) Art. 10 de l'AR Méthodologie

[53] This is similar to the assumption made by Fichtner in his report and as explained in the section on the maximum intermediate price limit.

[54] As is the case for net revenues from mFRR provision, publicly available data for the FCR via the Regelleinstung Datacenter FCR/aFRR/mFRR platform (regelleistung.net) can be consulted. The data used runs from July 2020 to September June 2023 included.

compared to the average historic capacity installed for the 36 months considered for the estimation of net balancing revenues (on average 100 MW). Elia divides thus net revenues coming from the provision of FCR by 12.6 (1261 MW/100MW =12.6).

It is also worth remembering that the increase in installed battery capacity in Europe can be expected to lead to an increased competition for the supply of FCR as a whole in the FCR cooperation. Increased competition for the supply of FCR in the future should push prices for the provision of FCR down in the direction of the prices observed in particular on the German FCR market, which indicates that a future decline can be expected on the FCR market in Belgium. In fact, Elia expects the price observed on the Belgian FCR market to converge towards the German price in the future, thanks to a more liquid FCR market.

Moreover, it is important to note that in its calculation of net revenues from the supply of FCR for batteries, Compass Lexecon also takes into account the opportunity costs that batteries must take into account when participating in FCR[55]

Finally, a final correction factor is considered to obtain the net revenues obtained by batteries via the supply of FCR. This relates to the period under consideration, which covers the years 2020 to 2023, when there was a major energy crisis impacting the various energy markets and, consequently, the net income potentially received by batteries through the supply of FCR. The correction made for this period of energy crisis is different for each balancing product and is explained in more detail in the Compass Lexecon presentation[56]. However, this correction does not impact FCR net revenues in a significant way for batteries.

In conclusion, for the calculation of the net-CONE, on the basis of the arguments detailed above, it is proposed to consider a revenue of 1 €/kW/year of net income for a new battery coming solely from the supply of FCR.

- **aFRR**:

  Batteries and CCGTs are the technologies in which we have seen significant participation in aFRR. The estimate of these revenues was based on an analysis of aFRR data (both upward and downward reservation) collected over a 36-month period in accordance with the requirements of the Royal Decree on Methodology.

  The aFRR net revenues considered respectively for the 2 relevant technologies differ by their cost structure, more particularly by their opportunity costs. Indeed, CCGTs can have important costs inherent in their participation in the balancing market that can be significant:

  - On the one hand, when participating in the aFRR capacity auction, CCGTs must anticipate their start-up costs as well as the risk of having to run at Pmin and bear the costs if necessary. Both the need to run at Pmin (in order to be ready to react upwards or downwards) and the fact of having to bear start-up costs increases the price of the bids submitted by the CCGTs in the capacity auction, impacting their revenues upwards. However, it is essential to emphasize that these costs do not represent a

[55] These costs are deducted for revenues estimated initially for the provision of FCR and are represented by the potential gains from batteries on the daily or intraday market, as explained in slide 15 of the Compass Lexecon presentation.
[56] Slide 36 from Compass Lexecon presentation.

net income for the CCGTs, but rather a cost that they have to bear, which inflates their bids in the capacity auction.

- On the other hand, the Clean Spark Spread (CSS) represents an opportunity cost for CCGTs when they decide to participate in the supply of aFRR instead of participating in the energy market. The value of the CSS in such situation represents a missed opportunity that has to be considered as well when correcting for net balancing revenues.

CCGTs' revenues from the provision of aFRR must therefore be adjusted for the above factors in order to be considered net[57].

Batteries do not have to bear costs equivalent to those of CCGTs when they participate in aFRR. However, the net revenues they capture must also take into account the opportunity costs they may incur by participating in the energy market via the day-ahead market or the intraday market. The net revenues that can be received by batteries are therefore adjusted for the opportunity cost associated with their participation in the aFRR provision.

Finally, as in the case of the energy crisis correction carried out for the FCR, a correction for the period under consideration is made specifically in relation to the aFRR product.

In conclusion, for the calculation of the net-CONE, based on the argumentation detailed above, it is proposed to consider **an income of 17 €/kW/year of net revenue for a new battery coming solely from the provision of aFRR (upwards and downwards) and an income of 3 €/kW/year of net income for a new CCGT coming solely from the provision of aFRR (upwards and downwards).**

- **mFRR**:

  The estimated net revenues from mFRR are based on the analysis of mFRR data (upwards) collected for a period of 36 months in accordance with the requirements of the Royal Decree Methodology. mFRR revenues are considered relevant for OCGT, IC Gas Engine and DSR. These are estimated using the mFRR Standard (considering the fact that net revenues from mFRR Flex are close to zero and are therefore approximated at 0).

  Thermal technologies like OCGTs have to bear non-negligible costs to participate in the mFRR capacity auction: the Clean Spark Spread (CSS) represents an opportunity cost for OCGTs (or IC gas Engines) when they decide to participate in the supply of mFRRs instead of participating in the energy market. It has to be integrated in their bidding and must be corrected for when assessing their net revenues.

  The revenues of OCGTs and IC gas engines from the provision of mFRRs must therefore be adjusted in order to be considered net.

  In the case of DSR, still in the context of net-CONE calculations, the reasoning shown above is somewhat different. This technology has zero opportunity costs to participate in

[57] These elements are explained in further details in the slides 13-14 presented by Compass Lexecon in WG Adequacy.

the mFRR capacity auction. This means that the corrections made for thermal units above do not apply to DSR.

Finally, it is also worth mentioning that given the expected arrival of a significant amount of batteries, Elia assumes that a small amount of mFRR capacity will potentially be covered by batteries by 2028-29.

However, some factors still need to be considered when calculating the net revenues of technologies participating in the mFRR provision:

- On the one hand, the technology mix used to deliver mFRR is likely to evolve especially considering the additional industrial flexibility expected to arrive into the grid in the coming years.

- On the other hand, the installed capacity likely to participate in the provision of mFRRs is evolving and Elia expects it to keep growing by 2028-29. This last factor therefore leads to a higher expected DSR capacity, which, all other things being equal, will lead to greater competition for DSR wishing to participate in the delivery of mFRRs. As a result, estimated net revenues from DSR are impacted downwards by this expected increase. Additionally, it is worth mentioning that the amount of installed capacity of OCGTs is also increasing by then as highlighted in the results of the Y-4 auction linked to the Delivery Period 2027-28[58]

Finally, as in the case of the energy crisis correction carried out for the FCR and the aFRR, a correction for the period under consideration is made specifically in relation to the mFRR product.

In conclusion, **for the calculation of the net-CONE**, assuming new capacity built for **IC Gas Engine technologies and OCGTs**, as announced above, it is proposed to consider **net revenues from the provision of balancing services (from mFRR only) at €15/kW/year**.

For **DSR**, the estimated **net income from the provision of balancing services (mFRR only) is €10/kW/year**.

For batteries, the estimated **net income from the provision of mFRR services is €3/kW/year**.

With regard to the other technologies listed in the Ministerial Decree, Elia would like to stress that renewable energy sources are more suited for downward balancing provision as they are not capable of providing the upward balancing services targeted in this framework.

It is important to remember that these revenues are to be considered when determining the net-CONE, which answers a 'marginal' question, i.e. how much revenue a unit of this technology, or even a single MW of this technology, is likely to receive. This reasoning obviously cannot be extrapolated simplistically to (too) large a volume, as this would influence the price obtained on the market for ancillary services, where several players and technologies are active and where the volume is limited to the need for ancillary balancing services to be covered.

[58] https://www.elia.be/-/media/project/elia/elia-site/grid-data/adequacy/crm-auction-results/2023/y-4-2023-auction-report_en.pdf

Results obtained by Elia	
Net revenues from Ancillary Services	3 €/kW/y for CCGTs 15 €/kW/y for IC Gas Engines & OCGTs 10 €/kW/y for DSR 21 €/kW/y for batteries 0 €/kW/y for any other technology.

Part III: Proposals for the other auction parameters

This part concerns the proposals for the other parameters that are necessary for the organization of the auction as defined in Article 7*undecies*, §2, 2° of the Electricity Act[59]. Following article 6, §2 of the RD Methodology[60] these parameters include:

- the derating factors (section 3.1)
- the intermediate price cap (section 3.2)
- the reference price (section 3.3.1)
- the strike price (section 3.3.2)

[59] (NL) art. 7*undecies* van de Elektriciteitswet
(FR) art. 7*undecies* de la Loi Electricité
[60] (NL) art. 6 van het KB Methodologie
(FR) art. 6 de l'AR Méthodologie

3.1 Derating factors

The derating factors are defined in article 2, 83° of the Electricity Act[61] as the weighting of a considered capacity determining its contribution to security of supply in order to establish the eligible volume to participate in the auction. The proposed derating factors are in line with article 13 of the RD Methodology[62].

The methodology described in the aforementioned article of the Royal Decree is summarized in Table 8 and is applied to the reference scenario for the Y-4 auction with Delivery Period 2028-29.

The obtained values are presented in Table 9.

Proposal from Elia	
Derating factors	Cf. Table 9

[61] (NL) art. 2 van de Elektriciteitswet
(FR) art. 2 de la Loi Electricité
[62] (NL) art. 13 van het KB Methodologie
(FR) art. 13 de l'AR Méthodologie

Category	Calculation method	Associated technologies
Thermal technologies with daily schedule	100 – forced outage rate[63]	CCGTs OCGTs Turbojets IC gas engines[64] IC diesel engines[65] CHPs Biomass units Waste incineration Nuclear plants Coal plans
Energy constrained technologies with daily schedule	Average expected contribution of each technology category during simulated scarcity situations based on a fictional unit of 1 MW[66]	Pumped storage installations Large-scale storage
Categories with service level agreement (SLA)		1h to 12h No limit
Weather-dependent technologies	Average expected contribution of each technology during simulated scarcity situations / aggregated nominal reference power of the applicable technology	Onshore wind Offshore wind PV installations Run-of-river installations
Thermal technologies without daily schedule	Average expected contribution of these technologies during simulated scarcity situations / aggregated nominal reference power of the applicable technology	Aggregated thermal technologies

Table 8: Methodology for the calculation of the derating factors

[63] The forced outage rates have been subject to public consultation and are part of the Ministerial Decree concerning the reference scenario.
[64] For IC gas engines the same forced outage rate as OCGT's is assumed.
[65] For IC diesel engines, the same forced outage rate as turbojets is assumed.
[66] In order to ensure an identical calculation of the derating factor for each technology whether it exists in the market based on the reference scenario or not.

Category I: Categories of service level agreements (SLA)	
Sub-Category	Derating Factor [%]
SLA-1h	19
SLA-2h	35
SLA-3h	48
SLA-4h	57
SLA-5h	65
SLA-6h	71
SLA-7h	76
SLA-8h	81
SLA-9h	86
SLA-10h	89
SLA-11h	93
SLA-12h	95
SLA unlimited	100
Category II: Thermal technologies with daily schedule	
Sub-Category	Derating Factor [%]
CCGT	94
OCGT	92
Turbojets	90
IC Gas Engines	92
IC Diesel Engines	90
CHP/Biomass/Waste	94
Nuclear	80
Coal	90
Category III: Energy-limited technologies with daily schedule	
Sub-Category	Derating Factor [%]
Storage 1h	22
Storage 2h	38
Storage 3h	50
Storage 4h	57
Storage 5h	62
Storage 6h	65
PSP	52

Category IV: Weather-dependent technologies	
Sub-Category	Derating Factor [%]
Offshore Wind	9
Onshore Wind	7
Solar	1
Hydro Run-of-River	48
Category V: Thermal technologies without daily schedule	
Sub-Category	Derating Factor [%]
Aggregated thermal technologies	64

Table 9: Derating factors

3.2 Intermediate Price Cap

This section deals with the proposal for the Intermediate Price Cap or IPC following the stipulations of chapter 6 (i.e. articles 15 up until and including article 20) of the RD Methodology[67].

In accordance with article 18 of the RD methodology the IPC is established based on a study carried out by an independent consultant. Over the course of the last months Elia and the CREG have been working on an updated study by Entras, the first results of which have already been presented in the Working Group Adequacy. That being said, the final report of the Entras study has not yet been published, and Elia believes it would be inopportune to use its conclusions for this iteration of the calibration. As a result Elia will still be using the previous cost of capacity study carried out by Fichtner[68] and reviewed by Afry[69].

Moreover, it is relevant that these costs are determined for a list of eligible technologies for the determination of the IPC. By definition this list is composed only of existing technologies, in contrast to the list of technologies associated to the determination of the Net-CONE which refers to new units.

Elia has already shared several input parameters in the context of the public consultation on the reference scenario[70]. More specifically, these included:

1) The list of technologies under consideration for the IPC;
2) The cost elements for said technologies, including the FO&M and the activation costs for DSM;
3) The revenue elements for said technologies, including the VO&M and the efficiencies.

This section is structured as follows:

- Section 3.2.1 goes more into detail about the reduced list of existing technologies;
- Section 3.2.2 describes the different cost elements;
- Section 3.2.3 elaborates on the revenues;
- Section 3.2.4, based on the previous sections, involves the calculation of the missing money;
- Finally, section 3.2.5 concludes with a proposal for the IPC.

[67] (NL) hoofdstuk 6 van het KB Methodologie
(FR) chapitre 6 de l'AR Méthodologie
[68] https://www.elia.be/-/media/project/elia/elia-site/public-consultations/2020/20200505_fichtner-report-cost-of-capacity-crm_en.pdf
[69] https://www.elia.be/-/media/project/elia/elia-site/public-consultations/2022/20221028_afry_update-of-the-peer-review-of-cost-of-capacity-for-calibration-of-belgian-crm.pdf
[70] Public consultation on the scenarios, sensitivities and data fort he CRM parameter calculation for the Y-1 Auction with Delivery Period 2025-2026 and the Y-4 Auction for Delivery Period 2028-2029

3.2.1 Reduced list of existing technologies

In accordance with article 18, §1 of the RD Methodology[71] Elia establishes a reduced list of existing technologies in function of the calibration of the IPC, based on the study of an independent expert, in this case Fichtner, afterwards reviewed by Afry.

The final reduced list of existing technologies that are taken into account for the calibration of the IPC consists thus of:

- CCGTs;
- OCGTs;
- Turbojets;
- Pumped Storage Plants (PSP);
- DSR with an activation duration of 4h.

3.2.2 Estimation of the costs

Pursuant the aforementioned article 18 of the RD Methodology Elia has evaluated, based on the study of Afry, the different cost elements that are relevant for the calibration of the IPC for each technology included in the reduced list.

Elia has already submitted the values for the fixed operating and maintenance cost (FOM) to a public consultation.

For the different technologies as mentioned above, the following assumptions have been made:

- For CCGTs, the estimation of the FOM is based on the "AFRY 2022 (4000h, no elec)" values. As opposed to the Fichtner study, which works based on 8000 running hours, Afry estimates that 4000 running hours are closer to the operational reality. The "no elec" sensitivity was selected seeing as grid costs can be considered as variable;
- For OCGTs, the estimation of the FOM is based on the "AFRY 2022 (excl. grid charge)" values;
- For the turbojets, the estimation of the FOM is based on the "AFRY (excl. grid charge)" values;
- For the PSP units, the estimation of the FOM is based on the analysis of Afry carried out in 2022;
  For DSM with an activation period of 4 hours, the estimation of the FOM is based on AdeqFlex'23.

Table 10 gives an overview of the fixed operations and maintenance costs for the reduces list of existing technologies that are taken into account for the IPC.

[71] (NL) art. 18 van het KB Methodologie
(FR) art. 18 de l'AR Méthodologie

Technologies	FOM costs [€/kW/an] (Including non-yearly maintenance costs such as major overhauls)		
	Low	**Mid**	**High**
CCGT	37	38	53
OCGT	25	25	50
Turbojet	29	36	36
PSP	20	32	40
DSM with an activation duration of 4h	7	12	17

Table 10: Estimations of the FO&M costs for the existing technologies included in the reduced list

For the estimation of the revenues discussed in section 3.2.3 multiple components of the variable costs are needed. To that extent Table 11 presents an overview of the efficiencies as well as the variable operating and maintenance (VOM) costs. These estimations were also included in the Assumptions Workbook. A Low, Mid and High estimation is included. It is worth noting that DSM and PSP are not included seeing as these technologies do not consume fuel but act in function of arbitrage opportunities (in case of PSP) or in function of opportunity costs of electricity consumption (in case of DSM).

The CO_2 price has been estimated at 109.1 €/tCO_2, in line with the Ministerial Decree concerning the parameters for the reference scenario for the Y-4 auction with Delivery Period 2028-29.

Technologies	**efficiency [%]**			**VOM cost [€/MWh]**
	For revenues Low	**For revenues Mid**	**For revenues High**	
CCGT	50	54	58	2.4
OCGT	35	40	44	13.2
Turbojet	21	28	35	4

Table 11: IPC - Estimation of the variable costs for the existing technologies of the reduced list

Elia also provides an estimation of the activation costs for the availability tests as per the royal decree. These costs were also consulted during the public consultation on the reference scenario[72].

[72] Originally this analysis yielded a value of 0,74 €/kWh, expressed in €2015. Seeing as this report is written in €2022, the result is indexed correspondingly.

Taking into account the average price for an activation of 4 hours during the winter of 2015-2016 for DSM, and considering one availability test of 15 minutes per year, the activation costs for availability tests are calculated as follows:

$$0.82\ \frac{€}{kWh} * 0.25\ \frac{h}{year} = 0.2\ \frac{€}{kW.year} \quad [4]$$

Elia multiplies these costs with the risk premium seeing as the FOM costs need to be borne by market parties in order to be able to be present in the CRM. As a result these costs are considered as investment expenses that are done by market actors with a capacity contract of one year. Subsequently, based on the principle of risk aversion of investors, the risk premium is applied to these expenses.

Total costs

Pursuant article 20 of the RD Methodology[73] the final costs supported by the different technologies in the reduced list of technologies eligible for the IPC are equal to the FOM costs provided by Afry. These are presented in Table 12, multiplied with 1 plus the risk premium. For reference, these risk premia can be found in the annex 1 of the RD Methodology.

[73] (NL) art. 20 van het KB Methodologie
(FR) art. 20 de l'AR Méthodologie

Technologies	FOM costs [€/kW/year] (Including non-yearly maintenance costs such as major overhauls)			Activation costs for availability tests [€/kW/year]	WACC [%] to be applied following the methodology of the study of Professor Boudt (minimal risk premium + additional risk premium)		Total costs [€/kW/year] FOM costs multiplied with (1 + total risk premium)					
					Without investments associated to an economic lifetime > 3 years	With investments associated to an economic lifetime > 3 years	Without investments associated to an economic lifetime > 3 years			With investments associated to an economic lifetime > 3 years		
	Low	**Mid**	**High**				**Low**	**Mid**	**High**	**Low**	**Mid**	**High**
CCGT	37	38	53	0	5,7%	8,2%	39	40	56	40	41	57
OCGT	25	25	50	0	6,2%	9,7%	27	27	53	27	27	55
Turbojet	29	36	36	0	6,2%	9,7%	31	38	38	32	39	39
PSP	20	32	40	0	7,7%	12,2%	22	34	43	22	36	45
DSM with an activation duration of 4h	7	12	17	0,2	7,7%	12,2%	8	13	19	8	14	19

Table 12: Summary of the costs applicable for the determination of the missing money in the context of the IPC

3.2.3 Estimation of the revenues

Following article 19, §1 of the RD Methodology[74] Elia provides an estimation of the annual revenues for each technology that was included in the reduced list determined based on article 18 of the same RD Methodology[75]. The components of these annual revenues are the following:

- Inframarginal rents captured on the energy markets (in €/MW/year) based on the simulation of the reference scenario selected by the Minister (see also section 1.1); and
- The net revenues obtained from ancillary services (in €/MW/year), which represent (in some cases) additional revenues on top of the aforementioned inframarginal rents.

Inframarginal rents captured on the energy markets (€/MW/year)

The inframarginal rents captured on the energy markets are based on a probabilistic simulation of the energy markets in accordance with article 12 of the RD Methodology[76], thereby taking into account the reference scenario described in Part I of this report for the Delivery Period 2028-29 following the stipulations of the aforementioned article 19 of the RD Methodology.

Moreover, again in accordance with article 19 of the RD Methodology, the inframarginal rents are calculated based on average revenues, taking into account a strike price of 431 €/MWh that caps the revenues from the energy markets, which follows from the proposal for the strike price in section 3.3.2 in this report.

It is important to emphasize that the calibrated strike price is comprised of two distinct components: a fixed component and a variable component. The fixed component is established in the current report, as detailed in Section 3.3.2. On the other hand, the variable component is derived from the monthly average price of the day-ahead market. Consequently, Elia has the possibility to compute the variable component for each month, enhancing the precision of capturing inframarginal rents.

The average revenues captured on the energy markets are considered in the framework of this calibration. In order to take into account the risk aversion of investors, an additional risk premium is considered on top of the average revenues to calculate the missing money.

The annual inframarginal rents captured on the energy markets are represented in Table 13 at the end of this section.

Net revenues obtained from ancillary services

In accordance with article 19, §3 of the RD Methodology the net revenues from ancillary services are evaluated for each technology considered in the reduced list of eligible technologies. As such, the estimation for these revenues is based on the average of the

[74] (NL) art. 19 van het KB Methodologie
(FR) art. 19 de l'AR Méthodologie
[75] (NL) art. 18 van het KB Methodologie
(FR) art. 18 de l'AR Méthodologie
[76] (NL) art. 12 van het KB Methodologie
(FR) art. 12 de l'AR Méthodologie

historical reservation costs of the last 36 months and takes into account the associated costs – including the opportunity costs – in order to avoid double-counting with regards to the aforementioned inframarginal rents.

The reasoning considered for the estimation of net revenues arising from the reservation of balancing products applying here for IPC is partially similar than the one elaborated for net-CONE in section 2.8 with some difference(s) to be highlighted:

- It is worth highlighting again that different types of units are to be considered here with respect to the estimated net revenues presented in section 2.8 since existing units are the ones to be considered here compared to new units for net-CONE purpose. The type of unit impacts the efficiency of thermal units and impacts therefore the estimation of net balancing revenues of these units as well.
- The technologies as well as their technical specifications considered are different for net-CONE & IPC purposes.

The reasoning regarding the different balancing products is as follows:

- **FCR:**
  In line with the reasoning put forward during the public consultation, FCR revenues are not considered relevant to the technologies included in the reduced list. According to the study realized by Fichtner in the past and in line with the assumption taken by Elia repeatedly, batteries are the dominant technology for the delivery of FCR, which - since it is considered that they derive a positive economic benefit from the supply of FCR - is not a technology taken into account for the calibration of the maximum intermediate price[77].

- **aFRR:**
  Batteries and CCGTs are the technologies relevant for the provision of aFRR. However, as raised above batteries aren't part of the technologies from the short list considered for the determination of the IPC. Therefore, only the revenues from CCGTs should be considered here.

  As raised in the section 2.8 above, CCGTs can have important costs inherent in their participation in the balancing market that can be significant:

  - On the one hand, when participating in the aFRR capacity auction, CCGTs must anticipate their start-up costs as well as the risk of having to run at Pmin and bear the costs if necessary. Both push the bid price of CCGTs upwards in the capacity auction, impacting their revenues upwards. However, it is essential to emphasize that these costs do not represent a net income for the CCGTs, but rather a cost that they have to bear, which inflates their bids in the capacity auction.
  - On the other hand, the Clean Spark Spread (CSS) represents an opportunity cost for CCGTs when they decide to participate in the supply of aFRR instead of participating in the energy market. The value of the CSS in such situation represents a missed opportunity that has to be considered as well when correcting for net balancing revenues.

---

77 "*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*", Fichtner, 2020.

CCGTs' revenues from the provision of aFRR must therefore be adjusted for the above factors in order to be considered net[78].

As a final point when comparing to revenues estimated for CCGTs in the framework of the net-CONE, it is worth adding that existing CCGTs may have, all things equal, a lower opportunity cost given their smaller chance of running on energy markets due to their lower efficiency. This reduced opportunity cost impacts their net balancing revenues upwards given that all things equal, they have a higher chance to be selected to the capacity auction when participating to balancing markets, compared to new CCGTs having a higher opportunity cost.

In conclusion, for the calculation of the IPC, based on the argumentation detailed above, it is proposed to consider **an income of 1 €/kW/year of net income for an existing CCGT coming solely from the provision of aFRR (upwards and downwards).**

- **mFRR:**

  The estimate of these revenues was based on the analysis of mFRR data (upwards) collected for a period of 36 months in accordance with the requirements of the Royal Decree Methodology.

  mFRR revenues are considered relevant for OCGT, IC Gas Engine, Turbojets and DSR. These are estimated using the mFRR Standard for the reason highlighted in section 2.8.

  Thermal technologies have to bear non-negligible costs to participate in the mFRR capacity auction: the Clean Spark Spread (CSS) represents an opportunity cost for OCGTs (or IC gas Engines) when they decide to participate in the supply of mFRRs instead of participating in the energy market. It has to be integrated in their bidding and must be corrected for when assessing their net revenues.

  For the Turbojets, net revenues from the reservation of mFRR are to be considered as well. Given their important variable costs, it can be expected that Turbojets do not really have an opportunity cost of participating to such balancing services.

  In the case of DSR, the reasoning applicable to thermal units above is somewhat different. This technology has zero opportunity costs to participate in the mFRR capacity auction. This means that the corrections made for thermal units above do not apply to DSR. However, some factors still need to be considered when calculating the net revenues of technologies participating in the mFRR provision:

  - On the one hand, the technology mix used to deliver mFRR will evolve in the future as quite some additional flexibility is expected to arrive on the grid in the coming years and to take over the provision of mFRR realized by other technologies.

  - On the other hand, the installed capacity likely to participate in the provision of mFRRs is evolving and Elia expects it to increase significantly by 2028-29. This last factor

[78] These elements are explained in further details in the slides 13-14 presented by Compass Lexecon in WG Adequacy.

therefore leads to a higher expected DSR capacity, which, all other things being equal, will lead to greater competition for DSR wishing to participate in the delivery of mFRRs. As a result, estimated net revenues from DSR are impacted downwards by this expected increase.

Finally, as in the case of the energy crisis correction carried out for the FCR and the aFRR, a correction for the period under consideration is made specifically in relation to the mFRR product.

In conclusion, for the calculation of the IPC, based on the argumentation detailed above, it is proposed to consider **an income of 16 €/kW/year of net income for an existing OCGT & IC gas engine coming solely from the provision of mFRR reservation.**

For Turbojets, the estimated **net income from the provision of mFRR reservation equals 27 €/kW/year.** Elia reminds that Turbojets are not allowed anymore to participate to the CRM auctions due to the adapted CO2 requirements that entered into force. Revenues for Turbojets considered at a level of 0 in the calculations below within a CRM framework.

For **DSR**, the estimated **net income from the provision of balancing services is €10/kW/year**.

When it comes to Pump Storage, no net income from the provision of ancillary balancing services is considered for PSP technology in this calibration report. This assumption is made in order to avoid revealing potentially sensitive information, as there are only two pumped storage units in Belgium. This section is therefore discussed in another confidential appendix.

In conclusion, net balancing revenues coming from the provision of reservation of balancing services are considered for the technologies presented in Table 13 below.

Total revenues

Table 13 represents an overview of the estimated and simulated revenues for the technologies of the reduced list, thereby containing both the inframarginal rents as well as the net revenues from ancillary services.

In order to estimate the total annual revenues for each technology in the reduced list, the two components are summed. In this calibration exercise the revenues from ancillary services – including the opportunity costs – are effectively net revenues on top of the inframarginal rents. In doing so, a more realistic estimation of the total annual revenues is presented.The assessment of the degree of the net balancing revenues (Low – Mid – High) is assessed based on the degree of efficiency of the units considered for thermal units. Units with a higher degree of efficiency are expected, all things equal, to be running on energy markets and thus have a higher opportunity cost leading to a small net income coming from balancing provision.

Technologies	Average inframarginal rents captured on the energy markets [€/kW/year]			Net revenues from ancillary services [€/kW/year]			Total revenues [€/kW/an]		
	Low	Mid	High	Low	Mid	High	Low	Mid	High
CCGT	49	60	74	1	2	3	50	62	77
OCGT	19	23	28	15	15	16	34	38	44
Turbojet	1	6	11	27	27	27	28	33	38
PSP	35	35	35	/	/	/	35	35	35
DSR with an activation duration of 4h	0	0	0	10	10	10	10	10	10

Table 13: Intermediate Price Cap - revenues

3.2.4 Estimation of the missing money

In this section the estimations of the costs and revenues that have been determined in section 3.2.2 and 3.2.3, respectively, are combined in order to provide an estimation of the missing money for each of the technologies in the reduced list. The estimation of the missing money is established by means of formula [7], described in article 20 of the RD Methodology:

$$Missing\ money\ = (FOM\ cost + Activation\ costs\ for\ availaiblity\ tests) * (1 + hurdle\ rate) - Total\ revenues) \quad [7]$$

To reflect the variability with regards to the costs and revenues different levels of missing money are estimated. The six levels are established as follows:

- **Level 1**: costs *Mid* and revenues *High*
- **Level 2**: costs *Mid* and revenues *Mid*
- **Level 3**: costs *Mid* and revenues *Low*
- **Level 4**: costs *High* and revenues *High*
- **Level 5**: costs *High* and revenues *Mid*
- **Level 6**: costs *High* and revenues *Low*

Similar to last year, the costs Low have not been considered. Indeed, the sources that Afry used in its 2022 update might themselves underestimate certain developments that have since taken place. In order to take into account this possible underestimation of costs, only the costs Mid and High are considered.

The activation costs for availability tests are only taken into account for DSM. This follows from article 20, §1, 1° of the RD Methodology, which explains that this cost element should only be taken into account for technologies with a high activation cost. Seeing as availability tests are particularly important for units with high activation costs following the functioning rules, Elia reckons that this cost component is particularly relevant for DSM.

The estimated levels of the missing money are divided by the derating factor linked to each technology in order to consider an intermediate price cap that is sufficiently representative with regards to the behavior of market parties in the auction. Indeed, seeing as the potential capacity remuneration is only applied to the eligible volume, i.e. the nominal reference power multiplied with the derating factor, this derating factor needs to be taken into account in the bidding strategy of the market parties and, as such, in the IPC.

The derating factors are derived from section 3.1 of this report. Table 14 (cfr. infra) presents the estimated levels of the missing money for each of the technologies part of the reduced list. Note that the missing money has been set to zero when the calculation resulted in a negative value.

Similar to the calibration reports that have been presented for previous auctions the pumped storage power (PSP) technology is in the end not withheld in the final overview. The estimations of the missing money for PSP are not considered representative seeing as:

- Only two units with vastly different levels of maximum power are present in the Belgian market. In terms of cost estimation, and as indicated by Afry, the size of these units have a significant impact on the annual fixed costs. As a result, an approach based on the

average costs does not sufficiently take this aspect into account.

- From a revenue perspective the size difference is also considered to have a significant impact on the profitability of the provided services. As a result, it seems difficult and not recommended to derive cost and revenue estimations that should be representative for both units on the Belgian market.
- As also discussed in section 3.2.3, in order to not reveal potentially confidential information no net revenues from ancillary services are provided in the revenue estimations. Moreover, these revenues can equally result from self-balancing and/or reactive balancing, which is particularly relevant for very flexible PSP units. Seeing as the value for self-balancing and/or reactive balancing strongly depends on the portfolio of the market actor, this evaluation is not performed in the aforementioned revenues.

For all these reasons Elia proposes to no longer consider the PSP technology as a candidate reference technology for the establishment of the IPC. A confidential annex linked to this report includes these elements for PSP in Belgium as well as the difficulties to obtain an accurate estimation for PSP.

By virtue of the definition of the IPC, the analysis for its determination must involve all technologies highlighted by the study of the independent expert, and as such includes Turbojets. Elia notes that as a result of the adapted CO_2 limits[79] that need to be respected in order to participate in the CRM auctions, Turbojets can no longer take part in the CRM. To fully comply with the RD Methodology Elia has still included Turbojets in this analysis, but will not determine the IPC based on this technology.

[79] (NL) https://economie.fgov.be/sites/default/files/Files/Energy/compass-lexecon-co2-thresholds-report-nl.pdf
(FR) https://economie.fgov.be/sites/default/files/Files/Energy/compass-lexecon-co2-thresholds-report-fr.pdf

Technologies	Derating factor [%]	WACC (minimal risk premium + additional risk premium)	FOM costs [€/kW/year]			Activation costs for availability tests [€/kW/year]	Total revenues [€/kW/year]			Missing Money with total risk premium for investments linked to an economic lifetime of more than 3 years (divided by the derating factor) [€/derated kW/year]					
		Investments linked to an economic lifetime > 3 years	Low	Mid	High		Low	Mid	High	Lvl. 1 Mid Cost – Hig Rev	Lvl. 2 Mid Cost – Mid Rev	Lvl. 3 Mid Cost – Low Rev	Lvl. 4 High Cost – Hig Rev	Lvl. 5 High Cost – Mid Rev	Lvl. 6 High Cost – Low Rev
CCGT	94%	8,2%	37	38	53	0	50	62	77	**0**	**0**	**0**	**0**	**0**	**8**
OCGT	92%	9,7%	25	25	50	0	34	38	44	**0**	**0**	**0**	**12**	**18**	**23**
Turbojet	90%	9,7%	29	36	36	0	28	33	38	**2**	**7**	**13**	**2**	**7**	**13**
DSR (activation duration of 4h)	57%	12,2%	7	12	17	0,2	10	10	10	**6**	**6**	**6**	**16**	**16**	**16**

Table 14: Intermediate Price Cap – Estimation of the missing money for the existing technologies part of the reduced list with application of the risk premium for investments linked to an economic lifetime exceeding 3 years

Technologies	Derating factor [%]	WACC (minimal risk premium + additional risk premium)	FOM costs [€/kW/year]			Activation costs for availability tests [€/kW/year]	Total revenues [€/kW/year]			Missing Money with total risk premium for investments linked to an economic lifetime of less than 3 years (divided by the derating factor) [€/derated kW/year]					
		Investments linked to an economic lifetime < 3 years	Low	Mid	High		Low	Mid	High	Lvl. 1 Mid Cost – Hig Rev	Lvl. 2 Mid Cost – Mid Rev	Lvl. 3 Mid Cost – Low Rev	Lvl. 4 High Cost – Hig Rev	Lvl. 5 High Cost – Mid Rev	Lvl. 6 High Cost – Low Rev
CCGT	94%	5,7%	37	38	53	0	50	62	77	**0**	**0**	**0**	**0**	**0**	**6**
OCGT	92%	6,2%	25	25	50	0	34	38	44	**0**	**0**	**0**	**10**	**16**	**21**
Turbojet	90%	6,2%	29	36	36	0	28	33	38	**0**	**6**	**11**	**0**	**6**	**11**
DSR (activation duration of 4h)	57%	7,7%	7	12	17	0,2	10	10	10	**6**	**6**	**6**	**15**	**15**	**15**

Table 15: Intermediate Price Cap – Estimation of the missing money for the existing technologies part of the reduced list with application of the risk premium for investments linked to an economic lifetime not exceeding 3 years

3.2.5 Conclusion: Proposal of Elia for the Intermediate Price Cap

Based on the estimations of the missing money presented in section 3.2.4, this section presents Elia's proposal for the IPC. Pursuant article 16, §1 of the RD Methodology[80] the IPC is equal to the missing money of the technology with the highest missing money among the technologies part of the reduced list of existing eligible technologies. As already mentioned, it is worth pointing out that this missing money is divided by the derating factor as defined in section 3.1.

Based on Table 14 and Table 15, **Elia proposes to consider OCGT as the technology with the highest missing money among the technologies included in the reduced list**. Upon observation of the different levels the missing money to be considered amounts to 23 €/kW/year (expressed in €2022), which corresponds to the missing money of an OCGT unit with high costs and low revenues for investments linked to an economic lifetime of more than 3 years. This is in line with the definition of the IPC as mentioned in the previous paragraph.

Proposal from Elia
In conclusion Elia proposes, whilst taking into account all aforementioned arguments, an Intermediate Price Cap equal to 23 €/kW/year for the Y-4 auction organized in 2024 with Delivery Period 2028-29.

[80] (NL) art. 16 van het KB methodologie
(FR) art. 16 de l'AR Méthodologie

3.3 Reference Price and Strike Price

The strike price and reference price are defined in the Electricity Act, art. 2, 81° and 81°[81], respectively.

The **strike price** is the pre-defined price indicating the price level above which the capacity provider has to reimburse the difference with the strike price.

The **reference price** is the price reflecting the price that is considered to have been obtained by the capacity provider on the energy markets.

The Belgian CRM foresees, in the framework of reliability options, a payback obligation when the reference price exceeds the strike price. The payback obligation has a twofold purpose:

- To limit the revenues of capacity providers in the CRM so that they do not capture revenues exceeding the inframarginal rents
- To limit the cost of the CRM. From that perspective, and in order to foster participation in the auction and a higher degree of competition, it is important to calibrate the strike price in such a way that it is technology neutral.

Seeing as both parameters are linked, Elia's proposal for both elements are elaborated together in this section. The calibration of both parameters follows chapter 8 of the RD Methodology[82].

Following the RD Methodology the calibration of the strike price is based on data from EPEX and NordPool Spot, the two NEMOs[83] that are active at this moment in Belgium. The data analysis has been realized by E-CUBE based on the resulting prices in the Belgian bidding zone. That being said, the resulting strike price is also applicable to foreign capacities if they are contracted.

This data analysis forms the first step in the calibration of the strike price as per article 27 of the RD Methodology[84] and is based on the elastic volume on the day-ahead market as well as block orders during periods relevant for adequacy. The result of this analysis is the calibration curve and forms the basis for the remainder of the calibration process.

A more detailed explanation of E-CUBE's analysis can be found in their report that is published alongside this calibration report.

The analysis is based on data that spans the winter periods of 2020-21, 2021-22 and 2022-23.

This part of the report is structured as follows:

- Section 3.3.1 presents more information with regards to the reference price and includes Elia's proposal for the reference price.
- Section 3.3.2 includes the different steps of the calibration of the strike price, as well as Elia's proposal.

[81] (NL) art. 2 van de Elektriciteitswet
(FR) art. 2 de la Loi Electricité
[82] (NL) hoofdstuk 8 van het KB Methodologie
(FR) chapitre 8 de l'AR Méthodologie
[83] NEMO: Nominated Electricity Market Operator
[84] (NL) art. 27 van het KB Methodologie
(FR) art. 27 de l'AR Méthodologie

3.3.1 Reference price

The parameters with regards to the reference price are defined in the Electricity Act and the RD Methodology. Following these, the reference is not subject to a quantitative calibration like the strike price.

Articles 24 and 25 of the RD Methodology[85] explain the requirements for the reference price.

As a result that the NEMO where the reference price is observed can be chosen by capacities operating on the Belgian energy market at this moment, which are EPEX and Nord Pool Spot.

Moreover, § 3 of the aforementioned article 25 of the RD Methodology already sets out the modalities and conditions for NEMOs for foreign capacities. To that extent the following NEMOs are available for the respective neighboring countries that can participate in the Belgian CRM:

France: EPEX or Nord Pool Spot

Germany: EPEX, Nord Pool Spot or EXAA AG

The Netherlands: EPEX or Nord Pool Spot

It is worth pointing out that should a new NEMO become active on the Belgian, French, German or Dutch bidding zone before the start of the Delivery Period of 2028-29 (starting on November 1, 2028) this NEMO can equally be selected by a CRM candidate, regardless of the fact that this NEMO was initially not included in de decision of the Minister.

Proposal from Elia	
Reference price	Day-ahead Market segment of a NEMO operating in the Belgian bidding zone: EPEX or Nord Pool Spot Day-ahead Market segment of a NEMO operating in the French bidding zone: EPEX or Nord Pool Spot Day-ahead Market segment of a NEMO operating in the German bidding zone: EPEX, Nord Pool Spot or EXAA AG Day-ahead Market segment of a NEMO operating in the Dutch bidding zone: EPEX or Nord Pool Spot[86]

[85] (NL) art. 24 van het KB Methodologie ; art. 25 van het KB Methodologie
(FR) art. 24 de l'AR Méthodologie ; art. 25 de l'AR Méthodologie

[86] Or eventually any other NEMO operating on the day-ahead market segment for the Belgian, French, German or Dutch bidding zone if he becomes active after the decision of the minister with regards to the reference price regarding the Delivery Period 2028-29 and before the start of said Delivery Period.

3.3.2 165Strike price

Determination of the 75-85 % calibration window

The calibration method for the strike price is based on an analysis of the elastic volume observed on the day-ahead markets from EPEX and Nord Pool Spot, as well as the prices at which these volumes were offered over the last three relevant winters[87] on weekdays during peak hours. These so-called calibration curves are established based on the principles set out in article 27 of the RD Methodology[88].

The calibration curves take into account the regular bids and block orders of the NEMOs EPEX and Nord Pool Spot. The reader who is interested in the establishment of the calibration curves is invited to read E-CUBE's report that is published alongside this calibration report.

Based on the analysis of E-CUBE the calibration window equal to [75 - 85] % of the elastic volume observed on the Belgian day-ahead market for the average weighted curve over the winters of 2020-21, 2021-22 and 2022-23 is equal to [292 - 431] €/MWh for the Y-4 auction linked to the Delivery Period 2028-29.

Following the calculation of the calibration window, Elia applies the different criteria that are listed in the aforementioned article 27 of the RD Methodology.

The calibration window is also visualized on Figure 7 based on E-CUBE's report.

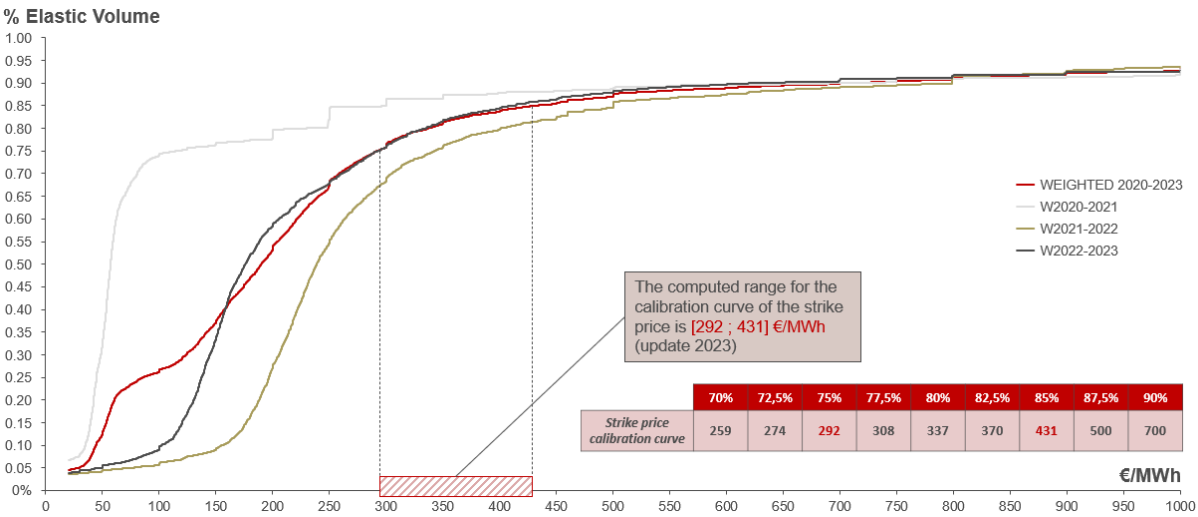


Figure 7: Calibration curve of the strike price based on the winters 2020-21, 2021-22 and 2022-23

Once the price window corresponding to an elastic volume of [75 - 85] % has been established at a level of [292 - 431] €/MWh, the calibration exercise boils down applying the 5 criteria of article 27 of the RD Methodology. Each of these criteria is discussed in the subsequent section.

[87] For the scope of this report, this involves the winters of 2020-21, 2021-22 and 2022-23

[88] (NL) art. 27 van het KB Methodologie
(FR) art. 27 de l'AR Méthodologie

Application of the criteria detailed in article 27, §2 of the RD Methodology

Article 27, §2 of the RD Methodology[89] lists the 5 criteria for the calibration of the strike price, namely that it must take into account:

- The variable costs of units with a daily schedule on the market, so that the strike price exceeds this variable cost; and
- The shape of the calibration curve; and
- The evolutions on the energy market; and
- The stability strike price, thereby taking into account the actualization mechanism; and
- A reasonable chance that the reference price reaches the strike price.

The calibration process is as such based on an individual evaluation of each of these criteria. These individual considerations are then assembled in order to make a proposal for the calibrated strike price.

Criterion n°1: the variable costs of daily schedule units must be covered by the strike price

The first criterion calls for an analysis of the variable cost of daily schedule units, i.e. units with a capacity exceeding 25 MW. As a result the following technologies are considered, based on the hypotheses in the Assumption Workbook excel file joint to this report:

- CCGT
- OCGT
- Turbojets (TJ)
- CHP

The variable cost of these technologies is the result of multiple parameters, which are included in Table 16.

[89] (NL) art. 27 van het KB Methodologie
(FR) art. 27 de l'AR Méthodologie

Technologies	Efficiency [%]	VOM [€/MWh]	CO2 price [€/ton]	Fuel price [€/MWh]	CHP credits [€/MWh]	Variable cost [€/MWh]
CCGT	61	2.4	109.1	27.0	NA	88
OCGT	42	13.2	109.1	27.0	NA	137
TJ	26	4	109.1	34.8	NA	305
CHP	33	8.3	109.1	27.0	91	75

Table 16: Parameters for the calculation of the marginal cost of daily schedule units

The analysis shows that in order to cover the variable cost of all daily schedule technologies the strike price should be higher than 305 €/MWh.

Elia concludes that following an analysis for the first criterion a strike price with a minimal value of 305 €/MWh should be considered.

Criterion n°2: the calibration of the strike price needs to take into account the shape of the calibration curve

The second criterion is based on a scrutiny of the shape of the calibration curve as calculated by E-CUBE.

When looking at the general shape of the calibration curve as presented in Figure 7 one can clearly observe that the curve only starts to display asymptotic behavior when it reaches the upper edge of the calibration window. Indeed, the curve only starts to truly flatten out starting from a value of around 500 €/MWh. As a result, in order to take into account the second criterion Elia believes that a value should be considered in the upper part of the calibration window.

According to Elia the second criterion shows that the strike price should be selected from the upper range of the calibration window.

Criterion n°3: the calibration of the strike price needs to take into account the evolution of the energy market

The third criterion underlines that the calibrated strike price must take into account evolutions on the energy market. Put differently, this criterion requires to estimate how the energy market might change structurally under normal market circumstances.

When looking at how electricity prices have evolved over the last couple of years, one can see that the low levels observed before the COVID-19 pandemic are not reached again. More still, the energy crisis of 2022, though subdued, seems to have led to a structural price increase compared to the pre-COVID-19 era.

The geopolitical reality is that energy prices have become more volatile. Only recently, strikes in Australia or an incident at a gas pipeline connecting Finland and Estonia caused prices to surge. In order to address these price fluctuations an actualization of the strike price during the Delivery Period is foreseen, allowing the strike price to evolve in function of changing

energy prices. To that extent the evolution in time of the energy market is by default taken into account, and this criterion does not have a big influence on the calibration on the strike price. As a result, Elia concludes that the third criterion does not point in a certain direction for the calibration.

According to Elia, the third criterion does not provide an indication for the calibration of the strike price.

Criterion n°4: the stability of the strike price over time

The fourth refers to the need for a strike price that is stable over time.

It is important to highlight that the RD Methodology specifically foresees to take into account the actualization mechanism that has been introduced in the CRM Functioning Rules. This actualization mechanism foresees splitting the strike price into a fixed and a variable component.

The variable component is determined ex-post. As such, Elia can at this moment make no estimation of its evolution to take it into account for the calibration here.

The fixed component can be calculated here. As a result, in order to ensure stability over time of the strike price Elia will assess the stability of the fixed component.

Following section 12.3.1.2.2 of the CRM Functioning Rules, “the fixed component is equal to the difference between the calibrated strike price (…) and the DAM simple average prices for the winter months of the same years than as the ones used for the calibration of the strike price (…).” Later, it is further specified that this DAM simple average is “the average of Day-Ahead prices during peak hours, working days and winter months (…).

Figure 8 below gives an overview of the fixed components of the auctions that have already taken place.

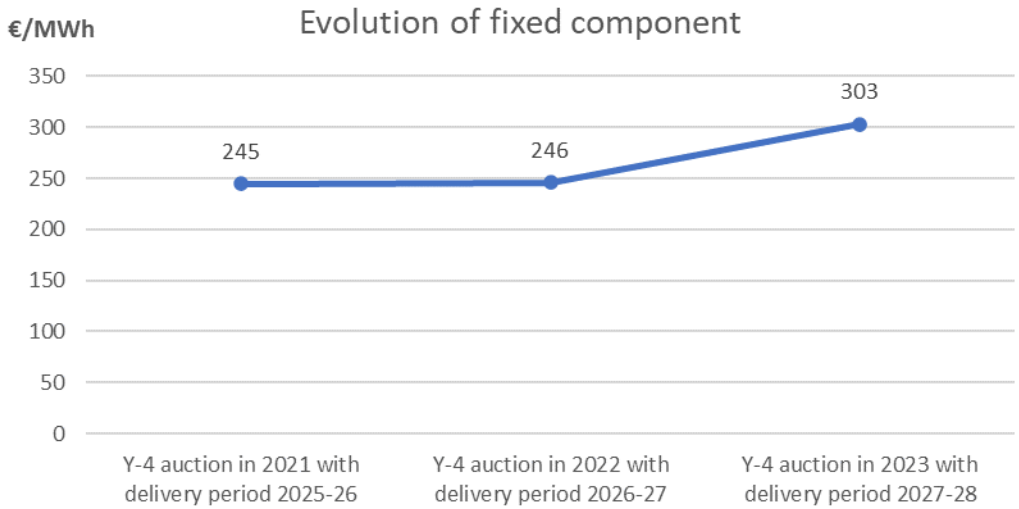


Figure 8: Evolution of fixed component for previous auctions

In previous calibration iterations Elia has always selected the maximal value of the calibration window. It is worth verifying the fixed component in case Elia would also select the maximal value of the calibration window in this iteration.

The average DAM price calculated as described above over the winter periods 2020-21, 2021-22 and 2022-23 yields a result of 165 €/MWh. Correspondingly, if the maximal value of the calibration window, i.e. 431 €/MWh were to be selected, the resulting fixed component would be equal to 266 €/MWh, as highlighted in Figure 9 below:

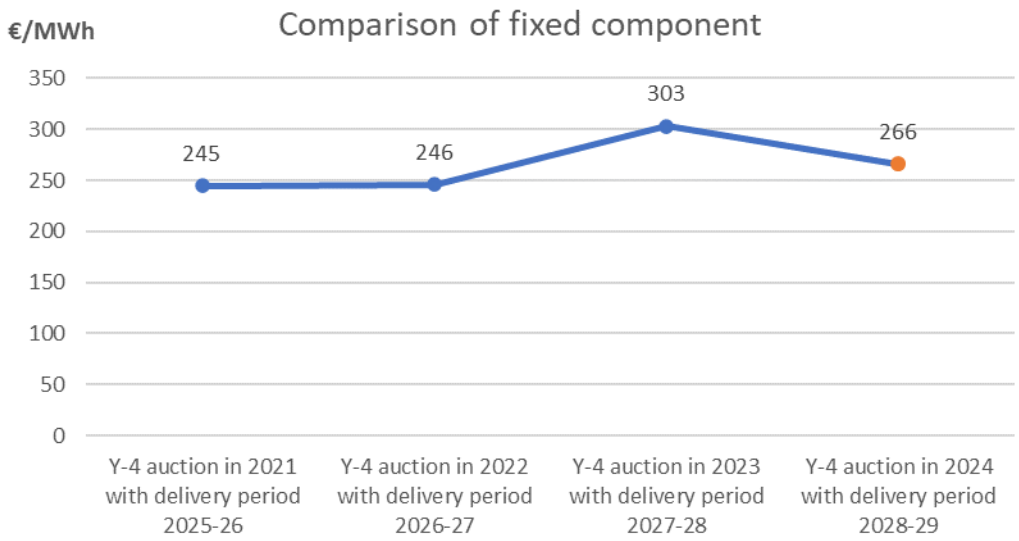


Figure 9: Comparison of fixed component of current calibration to previous iterations

Elia finds that the resulting fixed component is line with the fixed components that result from previous auctions. In other words, a strike price of 431 €/MWh guarantees stability over time.

The conclusion of the fourth criterion is according to Elia that 431 €/MWh must be considered for the calibration of the strike price.

Criterion n°5: the strike price must be able to guarantee a reasonable probability for the payback obligation

The fifth and last criterion reflects the probability that the strike price is reached, and as such serves to ensure that the payback obligation is triggered with a reasonable probability.

In order to evaluate this criterion, Elia has performed an analysis of the day-ahead prices on the Belgian market since 2006. For the price levels between 292 €/MWh and 431 €/MWh, i.e. the minimal and maximal values of the calibration window of [75 - 85] %, the occurrences these price levels are observed. For the sake of argument price levels until 500 €/MWh are added as well.

The results of this analysis can be seen in Annex 4 of this report. It can be seen that over the observed period prices exceeding 400 €/MWh occurred regularly over the last 3 years, especially during the 2022 energy crisis. It is for this reason the actualization mechanism has been introduced. It is worth pointing out that prices above 400 €/MWh have not been observed thus far in 2023. This, however, does not hamper the goal of the payback obligation, namely that exceptional windfall profits must be paid back; these exceptional price levels just haven't

taken place (yet) in 2023. Moreover, the introduction of the actualization mechanism means that it is hard to assess this criterion based on the calibrated strike price rather than the actualized strike price.

As a result, according to Elia the upper range of the calibration window must be observed when considering the fifth criterion.

Conclusion

Having considered the five criteria listed in the RD Methodology individually, Elia concludes that all qualitative criteria indicate to consider the upper part of the calibration window. Based on this conclusion and in order to ensure stability over time of the fixed component based on the arguments listed for criterion n°4, Elia proposes to use the maximal value of the calibration window for the strike price.

As a result, and in accordance with the criteria listed in the RD, Elia proposes to consider a strike price equal to 431 €/MWh.

Proposal from Elia	
Strike price	431 €/MWh

Annex 1: Maximum values of unproven capacities

Following discussions with market parties and the interactions that took place in the framework of the CRM, the concept of unproven capacities has been defined as the capacities that, at the moment of submission of the prequalification file, have not yet been associated to a specific delivery point.

This type of capacity is also not associated to a particular technology but represent the capacity with a limited maturity that could still develop in the course of the pre-Delivery Period. For this reason, the pre-delivery monitoring, as explained in the functioning rules, gives strong incentives to accurately monitor the development of these capacities.

Be that as it may, it can be justified to limit the volume that can be contracted from this type of capacity in order to not needlessly expose a volume too large of the CRM to the risks that are associated to a capacity with such limited maturity.

Moreover, this volume must still be sufficiently large so that it can still be competitive in the auction.

Correspondingly, Elia makes a proposition for the maximum value of unproven capacities that can be contracted in the auction. Elia proposes to set this value at 400 MW for the auction linked to this calibration report, for the following reasons:

- This volume corresponds to the typical size of large units currently present in the Belgian market, allowing such new units of this size to participate;
- This volume does not pose an excessive risk in terms of adequacy for the considered Delivery Period, seeing as the Y-1 auction still allows to contract the needed volumes;
- This volume has been thoroughly discussed in the Working Group Adequacy and has been found reasonable by its participants;
- The pre-delivery controls have, so far, not lead to capacities that should have been taken into account for the volume that has been identified for previous calibration exercises.

A second limit considers the maximum amount of unproven capacity that could be offered by one single capacity provider. A value below the total 400 MW could lead to certain projects not being offered, thereby potentially preventing the contracting of the most cost-efficient solution. As a result, Elia proposes to put the limit of the unproven capacity offered by a single capacity provider at 400 MW.

Proposal from Elia	
Maximum value of unproven capacity in the auction	400 MW
Maximum value of unproven capacity for a capacity provider	400 MW

Annex 2: Details of the demand curve

h	C(h)
1	16680
2	16557
3	16504
4	16460
5	16416
6	16380
7	16341
8	16309
9	16288
10	16261
11	16230
12	16212
13	16181
14	16155
15	16138
16	16110
17	16097
18	16072
19	16047
20	16040
21	16010
22	16024
23	15999
24	15983
25	15958
26	15956
27	15954
28	15929
29	15922
30	15912
31	15908
32	15894
33	15858
34	15862
35	15856
36	15835
37	15833
38	15807
39	15817
40	15809
41	15790
42	15782
43	15775
44	15772
45	15762
46	15756
47	15749
48	15742
49	15717
50	15704
51	15700
52	15687
53	15699
54	15677
55	15670
56	15661
57	15673
58	15652
59	15635
60	15635
61	15634
62	15635
63	15631
64	15618
65	15612
66	15600
67	15579
68	15575
69	15578
70	15584
71	15563
72	15560
73	15535
74	15545
75	15541
76	15529
77	15536
78	15533
79	15506
80	15513
81	15503
82	15492
83	15489
84	15487
85	15486
86	15469
87	15457
88	15466
89	15477
90	15451
91	15448
92	15442
93	15438
94	15439
95	15416
96	15437
97	15433
98	15418
99	15401
100	15397
101	15393
102	15407
103	15385
104	15386
105	15374
106	15380
107	15386
108	15353
109	15370
110	15369
111	15356
112	15341
113	15348
114	15335
115	15321
116	15325

117	15338
118	15320
119	15320
120	15302
121	15302
122	15292
123	15289
124	15292
125	15286
126	15296
127	15274
128	15272
129	15256
130	15256
131	15273
132	15250
133	15268
134	15260
135	15245
136	15234
137	15253
138	15220
139	15241
140	15224
141	15227
142	15222
143	15208
144	15207
145	15221
146	15211
147	15193
148	15200
149	15204
150	15188
151	15172
152	15175
153	15193
154	15176
155	15177
156	15176
157	15154
158	15161
159	15161
160	15154
161	15152
162	15159
163	15143
164	15127
165	15131
166	15142
167	15137
168	15123
169	15122
170	15116
171	15129
172	15125
173	15100
174	15101
175	15106
176	15113
177	15104
178	15106
179	15075
180	15095
181	15095
182	15059
183	15073
184	15081
185	15076
186	15064
187	15079
188	15052
189	15066
190	15069
191	15046
192	15057
193	15046
194	15029
195	15038
196	15030
197	15047
198	15026
199	15019
200	15035
201	14993
202	15037
203	15023
204	14999
205	15018
206	15010
207	15017
208	14997
209	14988
210	14999
211	14999
212	14998
213	14976
214	14995
215	14973
216	14969
217	14979
218	14977
219	14971
220	14974

Table 17: Details of the demand curve

Annex 3: Details on the inframarginal rents

This annex provides more details with regards to the inframarginal rents observed on the energy markets for the reference plant of each technology mentioned in the list of technologies applicable for the calculation of the Net-CONE.

The inframarginal rents are determined:

- for the year 2028, based on the reference scenario defined in Part I;
- for the years 2030, 2034 and post-2034, based on the "CENTRAL/EU-SAFE"-scenario selected from Elia's "Adequacy and Flexibility 2024 - 2034"- study;
- for the other years in the table, a linear interpolation is made between the years for which values for the inframarginal rents are available.

Table 18 provides these different inframarginal rents expressed in €/kW.

€/kW	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047
OCGT (>100 MW)	26	21	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
CCGT (>800 MW)	89	75	61	59	56	54	51	51	51	51	51	51	51	51	51	51	51	51	51	51
IC gas engine	23	20	16	16	16	15	15	15	15	15	15	15	15	15	15					
CHP (<100 MW)	158	139	121	117	113	109	105	105	105	105	105	105	105	105	105	105	105	105	105	105
Photovoltaics	49	44	39	37	35	34	32	32	32	32	32	32	32	32	32					
Onshore wind	138	124	110	106	102	98	94	94	94	94	94	94	94	94	94					
Offshore wind	212	189	166	159	152	145	139	139	139	139	139	139	139	139	139	139	139	139	139	139
Battery storage (4h)	41	42	44	45	47	48	50	50	50	50	50	50	50	50	50					
DSR (0<300MW)	0																			
DSR (300<600MW)	0																			
DSR (600<900MW)	0																			
DSR (900<1200MW)	0																			

Table 18: Net-CONE – Details on the inframarginal rents captured on the electricity markets over the economic lifetime

Annex 4: Price occurrences on day-ahead prices since 2006

	Occasions of payback obligation if the strike price would be equal to:										
year	**300 €/MWh**	**310 €/MWh**	**320 €/MWh**	**330 €/MWh**	**340 €/MWh**	**350 €/MWh**	**360 €/MWh**	**370 €/MWh**	**380 €/MWh**	**390 €/MWh**	**400 €/MWh**
2006	2	2	2	2	2	2	2	2	2	2	2
2007	33	29	29	29	29	28	26	25	24	24	24
2008	5	4	4	4	4	4	4	4	4	4	4
2009	0	0	0	0	0	0	0	0	0	0	0
2010	0	0	0	0	0	0	0	0	0	0	0
2011	1	1	1	1	1	1	1	1	1	1	1
2012	0	0	0	0	0	0	0	0	0	0	0
2013	0	0	0	0	0	0	0	0	0	0	0
2014	0	0	0	0	0	0	0	0	0	0	0
2015	14	12	9	9	8	7	7	7	7	7	5
2016	5	5	5	5	4	4	4	3	3	3	3
2017	2	1	1	1	0	0	0	0	0	0	0
2018	9	9	8	6	5	5	3	3	3	2	2
2019	0	0	0	0	0	0	0	0	0	0	0
2020	0	0	0	0	0	0	0	0	0	0	0
2021	271	237	199	180	157	135	110	92	87	80	64
2022	2447	2277	2119	1959	1823	1693	1589	1471	1353	1252	1143
2023	2	2	2	1	0	0	0	0	0	0	0
Total	**2791**	**2579**	**2379**	**2197**	**2033**	**1879**	**1746**	**1608**	**1484**	**1375**	**1248**

Table 19: Price Occurrences between 300 and 400 €/MWh on the Belgian day-ahead market since 2006

Occasions of payback obligation if the strike price would be equal to:										
year	**410 €/MWh**	**420 €/MWh**	**430 €/MWh**	**440 €/MWh**	**450 €/MWh**	**460 €/MWh**	**470 €/MWh**	**480 €/MWh**	**490 €/MWh**	**500 €/MWh**
2006	2	2	2	2	2	2	2	2	2	2
2007	22	22	21	21	21	20	19	19	18	18
2008	3	3	3	3	3	3	3	3	3	3
2009	0	0	0	0	0	0	0	0	0	0
2010	0	0	0	0	0	0	0	0	0	0
2011	1	1	1	1	1	1	1	1	1	1
2012	0	0	0	0	0	0	0	0	0	0
2013	0	0	0	0	0	0	0	0	0	0
2014	0	0	0	0	0	0	0	0	0	0
2015	5	5	5	5	0	0	0	0	0	0
2016	3	3	3	3	3	3	3	3	3	3
2017	0	0	0	0	0	0	0	0	0	0
2018	2	1	1	1	1	1	1	1	1	0
2019	0	0	0	0	0	0	0	0	0	0
2020	0	0	0	0	0	0	0	0	0	0
2021	51	41	35	30	29	25	20	16	14	12
2022	1056	964	879	803	733	654	594	535	490	441
2023	0	0	0	0	0	0	0	0	0	0
Total	**1145**	**1042**	**950**	**869**	**793**	**709**	**643**	**580**	**532**	**480**

Table 20: Price Occurrences between 410 and 500 €/MWh on the Belgian day-ahead market since 2006