CRM Design Note: Payback Obligation

2/10/2019

Table of contents

1 Introduction & context

1.1 Context and Goal of the Design Note

The purpose of the present design note is to provide all stakeholders with a clear view concerning the methodology for determining the Payback Obligation, the Reference Price and Strike Price in the context of the Reliability Option.

In addition to this design note, a single detailed list of definitions will be provided and publically consulted upon. As several concepts are relevant for different design options, a centralized approach via a single list is opted for.

About the public consultation

This design note is put for formal public consultation and any remark, comment or suggestion is welcome. It builds further on the discussions and proposals already made in the different TF CRM meetings gathering all relevant stakeholders and in the follow-up committee, the latter consisting of representatives of the CREG and Elia, under the presidency of the FPS Economy.

This public consultation runs in parallel with a public consultation on other design notes. Reactions to this public consultation can be provided to Elia via the specific submission form on Elia's website no later than **Wednesday 30 October 2019 at 6pm**.

On 13 September 2019 a first set of design notes has already been launched by Elia for public consultation.[1]

Note that, in line with their roles and responsibilities and the foreseen governance in the Electricity Law, also the FPS Economy and the CREG will consult on aspects within their competence according to their procedures.

Legal Framework

The Law setting up a Capacity Remuneration Mechanism, adopted on April 4th 2019[2] (hereafter "CRM Law"), modifying the Electricity law of 29 April 1999 on the organization of the electricity market (hereafter "Electricity law") introduces the concept of a Reliability Option implying a Payback Obligation when the Reference Price exceeds the Strike Price.

In Art. 2 the following elements are defined:

- The Reliability Option ("Option de fiabilité / betrouwbaarheidsopties") is defined as (own translation): the mechanism for which the Capacity Provider has to re-imburse the positive difference between the Reference Price and the Strike Price
- The Reference Price ("prix de reference / referentie prijs") is defined as (own

[1] https://www.elia.be/en/public-consultation/20190913_formal-public-consultation-on-the-crm-design-notes-part-i

[2] http://www.ejustice.just.fgov.be/eli/wet/2019/04/22/2019012267/staatsblad

translation): “the price reflecting the price that should be obtained by the Capacity Providers on the market”.

- The Strike Price (“prix d’exercice / uitoefenprijs”) is defined as (own translation): ”the predefined price that determines the threshold above which the Capacity Provider has to pay-back difference with the Reference Price”.

In Art. 7undecies, §2 the CRM law further foresees the governance framework for the determination of the Strike Price and the Reference Price, foreseeing a vast consultation procedure of market actors, the FPS Economy and the regulator, prior to determining on the one hand the methodology for the determination of the proposal of this parameter (scope of this design note) and on the other hand the yearly calibration (based on the methodology in this design note, translated into a Royal Decree) and decision of this parameter.

1.2 Structure of the design note

The purpose of this design note is to address the methodology to define and calibrate the Strike Price & Reference Price in the Payback Obligation in order to reach a clear common understanding of the choices made and to determine the according rules.

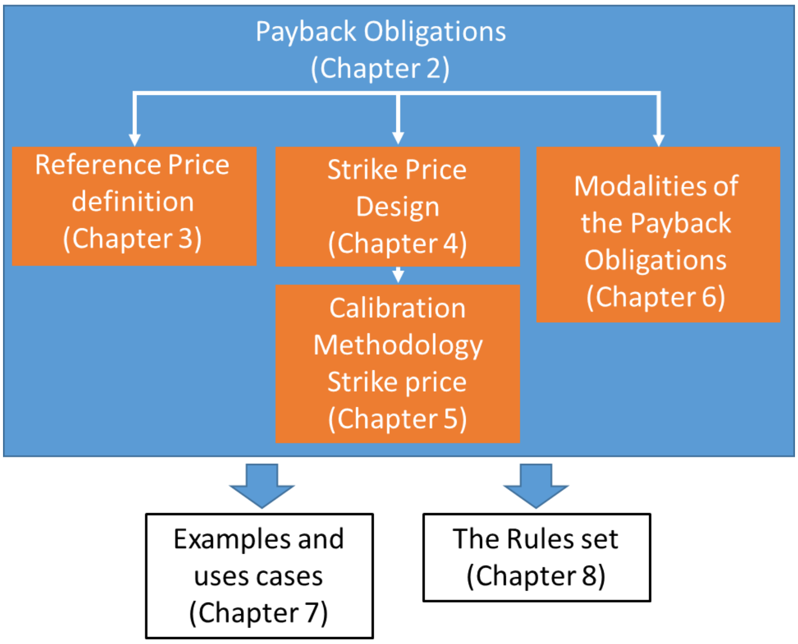

Figure 1: Structure of the Design Note

Chapter 2 will describe the Payback Obligation formula structure and its main ingredients.

Chapter 3, based on the information developed in chapter 2, will explain the proposal for determining the Reference Price.

Chapter 4 will describe the proposal for determining the fundamental design of Strike Price. This is further supported directly in Chapter 5 by the methodology for the Strike Price calibration.

Finally, Chapter 6 aims to discuss other relevant complementary modalities related to the Payback Obligation.

Use Cases and examples that help the comprehension of the Payback Obligation concept are described in Chapter 7.

A summary of the design proposals finalizes the document in Chapter 8.

1.3 Concept of Reliability Option & Payback Obligation

The Reliability Options concept in the CRM can be summarized as:

In a Reliability Option, the Capacity Provider receives a Capacity Remuneration from the CRM mechanism but is obliged to payback money to society (the so-called "Payback Obligation") whenever the reference energy price (e.g. Day-Ahead price) exceeds a pre-defined Strike Price (i.e. a pre-determined price level expressed in €/MWh).

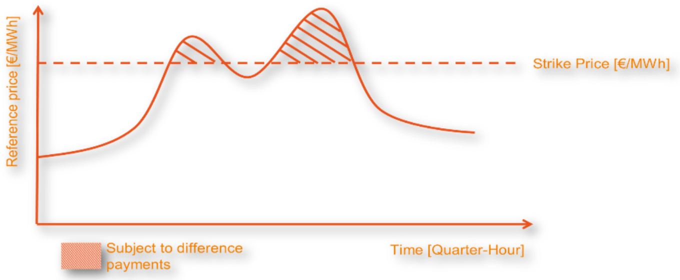

Figure 2: Payback Obligation trigger concept

In principle, such approach has typically two advantages for society.

Firstly, it contributes to the avoidance of windfall profits**.** As the Capacity Provider already receives a Capacity Remuneration on top of its 'normal' energy market revenues which – together - should cover all its costs, extreme energy prices would provide him with an extra, double remuneration insofar these revenues have not been accounted for when determining his offer price in the CRM. This would constitute a windfall profit.

Secondly, it strengthens the availability incentive. As the Capacity Providers are obliged to payback when the reference energy price exceeds the Strike Price and those moments will be strongly correlated with moments of (near-) scarcity, there is an extra incentive for Capacity Providers to be available for the system at such moments. Indeed, as they would have to payback an amount based on assumed energy market revenues, they have the incentive to actually deliver on energy in the energy market to earn those revenues in the first place.

In the Belgian CRM Framework and under the light of the Clean Energy Package and other European energy guidelines, the definition of the Payback Obligation is considered as a design element where several objectives and important considerations come together, amongst other: technology neutrality and openness, limitation of the overall CRM cost, windfall profit avoidance, respect of the Reliability option principle, limiting energy market interference, overall complexity avoidance and feasibility.

The strengthening of the availability incentive objective function has been considered as an upside of the Payback Obligation definition. Although in the proposed Belgian CRM design the availability incentive of the Reliability Option is recognized, other availability requirements are foreseen as well to make sure that the whole contracted capacity has sufficient incentives to deliver on its obligation and to ensure adequacy at system level.

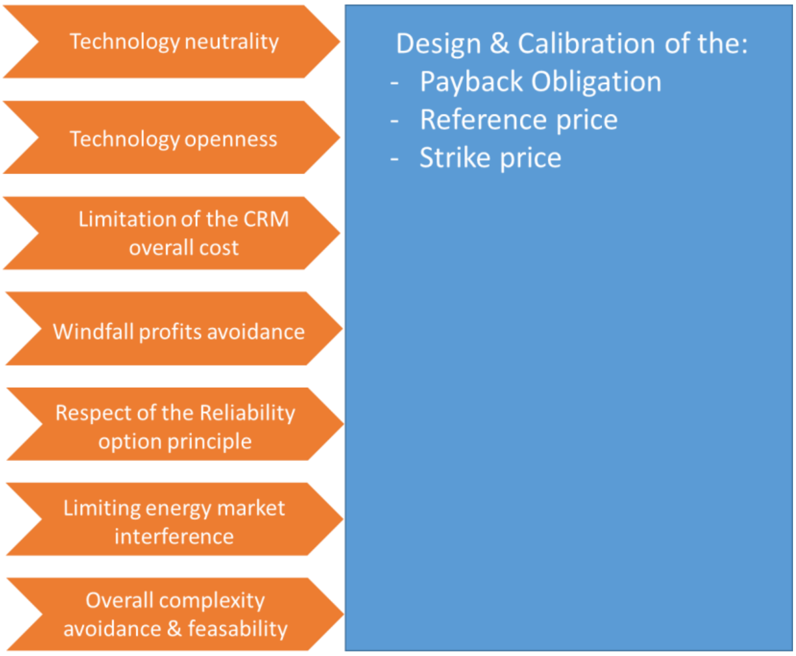

Figure 3: Design & calibration of the Payback Obligation elements deals with several objectives and considerations

It is fundamental to understand that each decision to re-inforce one element of the multi-objectives and considerations may influence on:

- Other objectives and considerations related to the Payback Obligation
- Impact on consistency with other CRM design elements

The design and the calibration therefore inevitably implies a trade-off, a compromise between the objectives and considerations. This element must be kept in mind at all stages of the proposal.

The objectives and considerations mentioned above are further detailed in Paragraph 1.3.

1.3.1 Technology neutrality

In the overall CRM design, the Payback Obligation and the definition of its parameters are driven by the consideration of technology neutrality at all steps. Technology neutrality should ensure a level playing field between technologies and aims at creating a homogeneous CRM design and product requirements. The importance of technology neutrality has also been demonstrated throughout the approval processes of earlier CRMs in Europe.

The rules are to be designed in order to make sure that all realistically potential technologies are able to participate in the CRM while taking into account their actual contribution to the Belgian adequacy (cf. Derating Factor rules presented in the Design Note 1).

One more concrete consequence to bear in mind is that technology neutrality should also imply the facilitation of the participation of aggregators to the CRM. Any differentiating based on technologies should not prevent aggregators from realistically participating (i.e. with a real chance to actually win a contract). As their added value typically lies in combining across multiple technologies, e.g. (smaller scale) generation, storage & DSR units, the rules should keep this in mind from the start.

1.3.2 Technology openness

The Clean Energy Package and other European guidelines consider technology openness as a main requirement for the design of the Market rules & methodologies. For instance, the Clean Energy Package in Art 22 §1 of the Energy Regulation states explicitly that capacity mechanism shall "[...] *be open to participation of all resources that are capable of providing the required technical performance, including energy storage and demand side management* [...]".

As long as a contribution to the Belgian Adequacy is ensured, the developed methodologies and rules have to ensure that there is no creation of undue entry barriers to the CRM.

It is to be avoided that the CRM design and also the Payback Obligation would create undue barriers for entry. Especially in the Strike Price design, the level of the Strike Price – if not well calibrated and not well embedded within a larger design – could risk to constitute such a barrier for entry. For instance, too low Strike Price levels not complemented with other design features (e.g. stop loss limits, cf. infra) may prevent the participation in the CRM from capacity characterized by higher short run marginal costs. Also the case of an aggregator possibly combining multiple technologies should not be confronted with unnecessary constraints, e.g. the number of different Strike Prices could impact this (cf. infra).

1.3.3 Limitation of the CRM overall cost

The Electricity Law clearly states that an important factor of the CRM is to limit its overall cost (cf. Art.7undecies, §1). In this respect it is crucial to not only address design elements individually, but also considering them within the bigger picture of the entire CRM. It could be that giving in (slightly) at one place in the CRM design could leverage more positively in terms of cost management elsewhere. In this context, allowing more technologies to participate to the CRM, by avoiding undue entry barriers, allows to increase the amount of participants and foster greater competition. Greater competition in the capacity auction by means of more technologies can only have a downward pressure on the overall CRM cost. In the context of the Payback Obligation, it is important to bear in mind that the impact design choices have on the potential for demand response to participate and create competition for (more conventional) generation technologies. A desired volume and price effect in the primary auction is to be traded off with for instance the impact on potential windfall profits resulting from Strike Price choices (cf. next section 1.3.4).

1.3.4 Windfall profits avoidance

In the energy market, the so-called “infra-marginal rent” of the participating asset is the difference between its market revenue and its marginal cost. Windfall profit (or a double remuneration) would arise when such inframarginal rents would reach levels that are not counted upon initially when investing in the capacity.

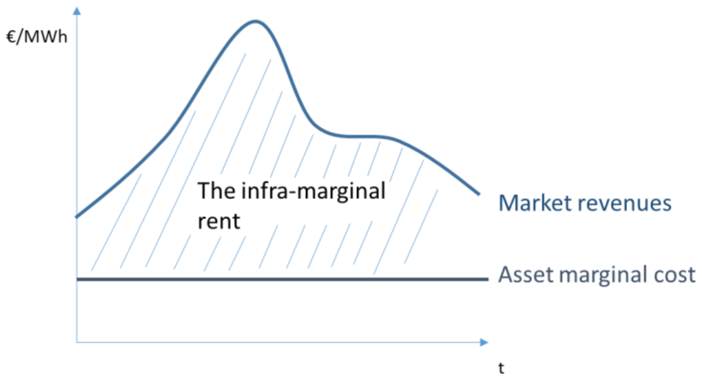

Figure 4: Infra-Marginal rent concept

This risk of windfall profits could exist in the CRM when the Capacity Provider receives a Capacity Remuneration from the CRM to complement its 'normal' energy market revenues. Together it should cover all its costs (incl. a fair remuneration for the investors). However, all extra unusual inframarginal rents originating from higher energy prices, that were not foreseen in the business case and hence not taken into account as market revenues in the CRM bid price, would provide an extra, double remuneration. This would constitute a windfall profit.

The windfall profit is thus the difference between the market revenues (or inframarginal rents) and a certain threshold defining the revenues that were taken into account in its Bid Price as revenue. Of course, such thresholds could vary from technology to technology and from investor to investor, for instance depending on his views on the future market outcomes as well as his risk appetite.

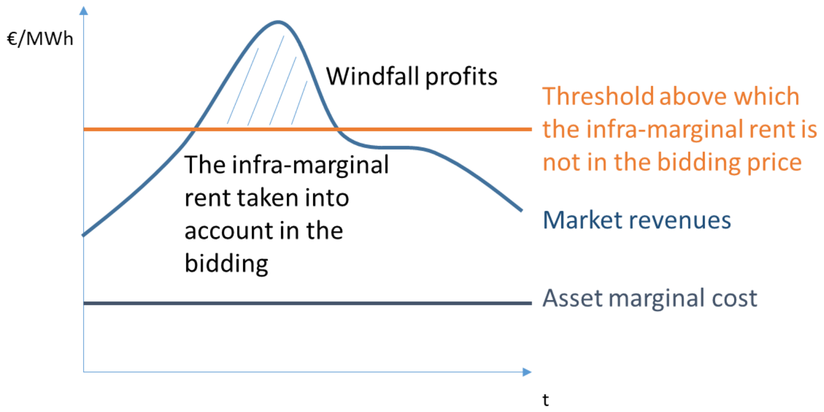

Figure 5: Windfall profit definition

The goal of the Payback Obligation requires thus a Strike Price and a Reference Price defined in order to limit as much as possible such windfall profits, not the least in case of 'extreme' energy market revenues.

1.3.5 Respect of the Reliability Option principle

The CRM law made the choice of a centralized Capacity Remuneration mechanism with a Reliability Option principle. This means that it should be sufficiently realistic that the Payback Obligation could occur. Otherwise, the principle put forward by the legislator remains hollow and without effect. Obviously, it is crucial to calibrate this prudently, in order not to overthrow the overall mechanism. This principle could easily be interpreted too strictly as well, particularly when taken together with the windfall profit avoidance, in such a way that a Payback Obligation would apply frequently, e.g. several times a year. Lower Strike Prices could achieve this. However, if the idea had been to capture *all* windfall profit perfectly and to have frequent paybacks, other mechanisms could have been more promising in the first place (e.g. based on contracts for differences). A more sensitive interpretation to the Payback Obligation in the context of this mechanism could lie in the avoidance of extremes, for instance the Payback Obligation should kick-in particularly at more extraordinary moments, e.g. when higher energy price levels (which could still be (far) below the price cap) occur. In this way the Payback Obligation provides a real protection to society and respects the overall principle.

1.3.6 Limiting energy market interference

The Design of the CRM rules (including the Payback Obligation aspects) should not hamper the good functioning of the energy market. A particular element is allowing a good assessment of energy market participants of the impact of Payback Obligation (and particularly Strike Price choices) on the price formation in the energy market. The more complex the Strike Price design would be, the more difficult the dynamics towards the energy market functioning could be, eventually even hampering its good functioning. From this perspective simplicity is to be preferred.

1.3.7 Overall complexity & feasibility

Feasible methodologies based on accurate logics that could be managed by all is key for the CRM. A manageable complexity of the CRM system is desirable in order to increase competition and limit the cost of the CRM, both in the development phase and in the risk aversion to uncertainty modelling within the CRM Bid Prices by the participants. Overly complex mechanisms, particularly in Strike Price design and calibration, risk in going beyond the effects. The more assumptions and choices needed, the more likely it is to make wrong choices. Also, the more complex the mechanism becomes, the less manageable it is. In this respect, feasibility also links to the overall market design in place. The Belgian energy market design is for instance characterized by portfolio bidding and comes with a specific degree of information sharing. Choices in, for instance, Strike Price design should bear in mind the available information on the Belgian market when for instance pursuing a calibration. For instance, by lack of a unit-based approach in the energy market (like for instance the case in more pool-based market organizations) there is also less information available on actual earnings and profits for individual assets, technologies and/or market players.

2 Overall Payback Obligation design

In this chapter, the proposed overall Payback Obligation formula is defined and its constituting elements are briefly introduced in order to provide already a high-level view. In the upcoming chapters, each of these constituting elements is further explained and detailed.

2.1 Reliability Option & Payback Obligation

The Payback Obligation formula is representing the Reliability Option principle according to which energy market revenues earned above a pre-defined threshold, the Strike Price, that will be applied to all CMUs of the CRM at all moments of their delivery period, will be reimbursed to society.

This calculation will occur for all participating technology types without distinction assuming that they all have access to the energy market respecting therefore the principles of technology neutrality and openness within the CRM design.

Finally, this Payback Obligation calculation will apply to all participating CMU's of a Capacity Provider for a defined operational period & obligated capacity. As presented in 1.3., a **positive** delta between the Reference Price and the Strike Price has to be applied on a CMU obligated capacity, at each moment of the delivery period, under pre-defined modalities. The modalities and possible exemptions related to the volume used for the calculation will be further detailed in Chapter 6. The amount that should be reimbursed is calculated **ex-post** in euro (€) by use of those modalities and when comparing the relevant Reference Strike & Strike Price.

The objectives and considerations of the Payback Obligation described in Paragraph 1.3 will be assessed carefully when developing the proposals for each constituting element, in particular: the Reference Price (chapter 3), Strike Price (chapter 4 & 5) and modalities of application (chapter 6).

2.2 The Payback Obligation formula

Obviously the application of the concept of Reliability Option on the Obligated Capacity becomes trickier when considering other elements of the CRM such as the various auctions and the secondary market.

The Payback Obligation formula is applicable for each individual participating CMU of a Capacity Provider. However, within a CMU, a distinction has to be made between its different obligations. Indeed, a CMU could provide, during the same delivery period "t", obligations coming from one or more auctions and/or obligations coming from one or more secondary market transactions as well.

Of course, each of these auctions or transactions' obligations is likely to have a different *Payback Obligated Capacity (CMU, t, Transaction Id).* This will be described in Chapter 6.

Finally, these different CMU Obligations may also have been contracted at different moments in time potentially corresponding to different Strike Prices: *Strike Price (CMU, at Transaction*

Date). This aspect will be covered in Chapter 4.

As a conclusion, the overall generic formula for a CMU Payback Obligation can be described as the sum of its Payback Obligations (being the positive delta between the common Reference Price and its Strike Price linked to each CMU Obligation transaction date) multiplied by the Obligated Capacity linked to the same transaction obligations.

Design Proposal #1: The Payback Obligation Formula

The Payback Obligation formula for a given CMU obligation is:

For all t hours where the CMU is under a Transaction Capacity,

Payback Obligations (CMU, t) =

Sum on all Transactions of the CMU:

*max[0; Reference Price (t) – Strike price (CMU, at Transaction Date)] * Payback Obligated Capacity(CMU, t, Transaction Id) [in €]*

The Reference Price formula is defined in Chapter 3 whereas Chapter 4 describes in detail the Strike Price (CMU, at Transaction Date). Calibration modalities are covered in Chapter 5.

The *Payback Obligated Capacity (CMU, t, Transaction Id)* is further defined in Chapter 6.

3 Reference Price design

The Reference Price should represent the most relevant energy market price signal (€/MWh) of the overall Belgian energy market revenue capturing relevant moments for adequacy, while sufficiently distinguishing with moments that are *not* relevant for adequacy.

It is one of the key parameters of the Payback Obligation formula as it will be compared to the Strike Price level in order to define the amount of the Payback.

In this chapter, the rationale behind the choice of the Reference Price will be presented in details.

3.1 Reference market choice

Several aspects are described below in order to assess and finally propose the most suitable Reference Price in the Belgian CRM design:

3.1.1 A standardized, market-wide Reference Price is preferred in the Belgian context

In the Italian and Irish Reliability Options mechanisms, an individualization of the Reference Price by each contractor has been settled based on Day-Ahead Market (DAM), Intraday Market (IDM) and Balancing Market.

It is very unlikely to reach such individualized Reference Price per Unit in the current functioning of the 'Self-dispatching' on the DAM/IDM on a portfolio basis in Belgium as the level of information available in Belgium is not as high as in the above-mentioned countries. Indeed, there are no individualized offer curves in both DAM and IDM markets and a lot of trading happens within portfolios or over the counter, and it is hard to change it without affecting the good functioning of the energy market.

In this context, the complexity of the calibration of such individualized Reference Prices per CMU or even per technology would have led to arbitrary definitions of parameters creating niches for some technologies & assets compared to others. It would have then made the technology openness & neutrality criteria impossible to fulfill, next to impacting very significantly the functioning of the energy market itself.

Therefore, a standardized, market wide reference appears to be the simplest, most transparent, equal and "energy market"-compatible solution given the current Belgian Self-dispatching on the DAM/IDM markets.

3.1.2 The Day-Ahead Market is considered as most suitable standardized, market-wide reference in the Belgian context

To determine which market is deemed most suitable for observing the Reference Price, different market segments have been considered: Forward market, Day-Ahead market, Intraday Market and the Balancing Market.

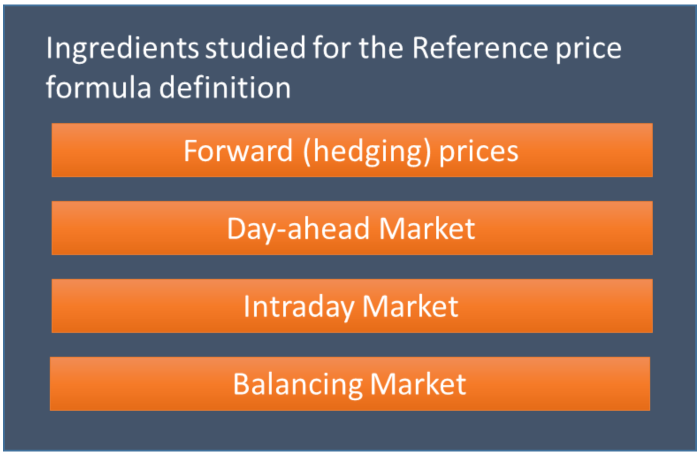

Figure 6: Considered market segments for the Reference Price definition

Forward (hedging) prices

The main issue with the forward prices inclusion in the Reference Price calculation to be used in a CRM lies in its granularity. forward prices are not closely enough linked to adequacy issues, there is for instance no hourly granularity on a day per day basis. Clearly, it also does not represent a sufficiently close signal to potential 'near scarcity' moments in the energy market (which is rather a matter of a few hours on a few days), even the shorter term available forward products still are not capable to actually distinguish between specific moments that are suffering from adequacy concerns from others.

Indeed, forward prices are driven by averages for certain delivery periods: the inclusion of these prices in a Reference Price formula might drastically lower the Reference Price. The dilution effect of these 'near-scarcity' events due to the 'average' of the forward price delivery period is too extreme to truly consider the inclusion of forward prices as (part of) the Reference Price

Also, the Forward market in Belgium is much less transparent and its liquidity is rather limited, compared to other market segments. Its accessibility, the bid-ask spreads identified and the quasi non-existence of peak prices indicate its limited potential as true reference market for the purpose of the Payback Obligation.

Nevertheless, one could wonder whether the hedging on Forward markets of the Capacity Providers would justify an exemption to the Payback Obligation. The question raised would be whether Capacity Providers run the risk of a Payback Obligation despite a potential absence of revenues earned in case of (near) scarcity (due to an absence on the market during these moments). In other words, should Capacity Providers payback when triggered by high spot prices whereas they had not captured high revenues in the first place (because of the hedging/forward volumes already sold at typically lower price levels than a Strike Price based on spot price levels)?

Whereas hedging on Forward markets is an inherent part of the functioning of the overall energy market, the choice to hedge (or not) in the end boils down to an individual market actor's choice driven by a risk management internal policy and for which no standard procedure applicable to all Capacity Providers exists. It is, for instance, very likely that some technologies such as demand response are far less active on Forward markets than others.

Uniformly applying exemptions would not be correct and applying it at individual level, i.e. at CMU-level, is not compatible with functioning and available transparency on the Forward market, which is not organized at CMU-level.

The question on whether such exemption on forward hedged volumes should apply raises a more fundamental question on forward price formation and whether particularly the "Forward backwardation principle" applies in this market in Belgium. As far as Elia can tell, the literature on the Energy markets was inconclusive on this topic and remains open whether forward prices do or do not include a sufficient and correctly calibrated premium to reflect (expected) high spot prices. For example, (Bessembinder and Lemmon, 2002) takes several assumptions on the functioning of the electricity market and states that the forward price is a linear formula of Expectancy, Variance and Skewness of spot prices. In practice, the model is insufficient as it relies on its own assumptions to assess the relation between both spot and forward prices. Other literature articles like (Boterrud 2009), (Lucia and Torro 2008) and others contributed to show that 'the Bessembinder and Lemmon realization' was not persistently observed. 'The Bessembinder and Lemmon realization' has been tested and is therefore not sufficiently validated by the empirical literature to be proven to be applied in the Belgian energy market context.

In conclusion, for the above reasons such exemption related to forward hedged volumes is not deemed appropriate in the context of the Payback Obligation in the Belgian CRM.

Day-Ahead Market (DAM)

The daily published hourly DAM prices provide a very interesting option to be considered as Reference Price in the case of a CRM. Indeed, the Day-Ahead market encompasses relevant drivers for adequacy. The main advantages for considering the Day-Ahead Market as Reference Price market are:

- The DAM represents the most relevant market signal related to adequacy issues given that most of the drivers of the market actors' positions are incorporated in the production planning and forecasts at the moment of DAM-clearing. All program changes after the daily matching are rather considered as adjustments and managed via the market and ancillary services. Any structural, i.e. adequacy issues, to be expected are already identified at that time or should ultimately be revealed through the DAM.
- The previous element is further reinforced as after the Day-ahead matching, in the Belgian system, all BRPs have to present balanced portfolios (nomination DA at 3 PM) and at that unique moment, the entire market is considered as settled. This is a unique opportunity in the product timeline and it shows that the market is accessible to all desirable market parties.
- The DAM has a strong price signaling function and represents the strongest, most liquid spot market in Belgium. It is by far considered as the most accurate, liquid and transparent market in the Belgian electricity landscape with a traded volume estimated at 25-30% of the Total Load in Belgium. This figure must be considered as high given that the Belgian transactions in the Day-Ahead Market are portfolio based, meaning that only position nettings of the market actors appear. Indeed, it is not mandatory to trade the gross production and gross consumption positions apart. Most of the Belgian contracts nowadays

refer to this price signal as a reference for transaction settlements. Due to its fair and liquid price, almost all other products available in the Market are benchmarking their revenue expectations with the DAM for their asset volume allocation in their operational strategy.

- The Day-Ahead Market, due to its timing position in the spot markets, allows all technologies (e.g. also 'slow capacity') to react upon. Indeed, the adequacy goal is not a matter of speed or quick ramping like for flexibility. The use of the Day-Ahead Market as Reference Price ensures that some 'slower' technologies that are nevertheless reliable and useful assets for adequacy (e.g. slower generation units requiring a few hours to start-up or industrial demand processes requiring sufficient notification time to react) can also participate to the CRM. This contributes to the technology openness of the CRM.

Also in Elia's recent Adequacy & flexibility study for Belgium 2020-2030 study of June 2019, it is mentioned in page 7 that *"An electricity system is 'adequate' if there is sufficient capacity to meet the relevant needs (via generation, imports, storage, demand-side management and so on). Flexibility relates to the ability to cope with fluctuations between production and consumption due to the increasing volatility of generation"*. In the CRM design phase, it has been considered that all DAM relatively high prices are reflecting adequacy issues as it provides for the best summary of all system conditions (available generation portfolio, import contribution, impact of temperature on load, etc.). In contrast, short-term balancing prices reflect in the first place flexibility need. Not every flexibility problem is also an adequacy problem (e.g. high balancing prices on a summer day are possible, but are not likely to be the consequence of an adequacy issue).

For all the above reasons, the DAM is considered an appropriate reference market for the Payback Obligation in the Belgian CRM.

Intraday Market (IDM)

The possible inclusion of IDM has been considered. Its lack of liquidity undermines however the reference value of the market. Also the continuous pricing method (clearly limits the reference value as it is not straightforward to determine what precisely would be the Reference Price that could be used in a standardized manner. It currently doesn't represent or add an extra signal of adequacy compared to the Day-ahead Market.

Rather acting as an adjustment market, adequacy issues ought already to be identified in the day-ahead stage.

Also, the technology neutrality and level-playing field principle could suffer from the shorter lead times in Intraday compared to for instance Day-Ahead, e.g; up to only few hours in advance of their expected adequacy participation. Indeed, it is not possible for all technologies (e.g. slower generation capacity as well as industrial demand response with slower lead times) to react upon. In conclusion, it thus creates a bias towards a subset of faster assets and technologies while the adequacy need does not require it.

Balancing market

In the Belgian landscape, the Balancing prices are representing in the first place a flexibility signal rather than an adequacy signal. Indeed, most of the peak prices appearing in the balancing timeframe are related to the need to cover for a flexibility issue at moments where there is as such no any adequacy concern. Basing the Reference Price in an adequacy-oriented CRM on the Balancing price could result in many ‘false positive’ signals.

As argued on Intraday, a fortiori it is also impossible for all technologies to react upon Balancing prices within the same time frame and therefore it creates a competitive advantage for a subset of assets while the adequacy need does not require such short lead-time. This clearly could also affect the overall cost of the mechanism, as limiting to flexible technologies only may come at higher costs than allowing a larger set of (also slower) technologies to participate.

3.1.3 Other Reference Price aspects

A number of other dimensions related to the Reference Price have been considered.

- **Ex-ante or ex-post Reference Price**

In the case of an ex-ante Reference Price, the coefficients of a Reference Price formula and its corresponding values are disclosed before the delivery period. This decreases the Market parties’ risks and would have, a priori, a virtuous impact on the CRM Cost.

In the case of an ex-post Reference Price, the coefficients of a Reference Price formula and its corresponding values are only revealed after the delivery period. This increases the market parties’ uncertainty and ends up priced in the Auction bid price as it creates an extra possible exposure for market parties.

An ex-ante approach is favored as this would be facilitating the market parties’ participation because of its simplicity and the lower risk exposure attached to it. Lowering risks in such way also contributes to lowering the overall cost of the mechanism.

Opting for the Day-ahead Market as (single) reference market follows this preference for an ex-ante solution.

- **Single or multiple Reference Price**

Multiple Strike Prices definition is the existence of a categorization of the Strike Price. This means that a Strike Price will be inherent to a feature of a participating CMU. The most common Multiple Strike Price differentiation element is the technology. In that case, it requires to assign a technology to each CMU. Being assimilated to a technology will automatically defines the Strike Price that will be applied to the CMU for its Payback Obligation calculation.

The question related to a single or multiple Reference Price is a key question when considering technology neutrality and complexity. Having multiple Reference Prices drawn on the different technologies present in the market would have led to a non-technology neutral situation as no unique solution would have been applicable to all technologies.

Besides, the calibration of these multiple Reference Prices would have an influence on the various technologies targeted by these prices. Any inaccuracy on the calibration could create a potential distortion of the capacity market by advantaging/dis-advantaging a technology in respect to the others. Furthermore, it would have potentially had an influence on Payback Obligation as well as it is calculated by differentiating the Reference and the Strike Prices.

3.1.4 Conclusion

For all reasons explained above, the proposal is to work with a strong, accessible, reliable and liquid market, ex ante Standardized Reference Price i.e. **the Day-Ahead Market price.**

Design Proposal #2: Reference Price definition

The Reference Price must be observed for each hour of the Payback Obligation in the Belgian Day-Ahead Market segment.

3.2 Choice of the specific Day Ahead NEMO

The Belgian Day-Ahead energy market allows for more than one power exchange (NEMO) to operate and provide a Day-Ahead Market price. Already today this multiple NEMO setting is a reality with both EPEX and Nordpoolspot being active.

For the CRM design and particularly the determination of the Reference Price, this is to be taken into account.

Given that in the energy market, all market actors are free to choose their NEMO Reference Price this should be followed in the Reference Price as well, i.e. leaving the choice to the Capacity Provider or Prequalified CRM Participant to select for each CMU the NEMO best fitting its own functioning on the energy market reference.

- EPEX Day-Ahead spot Belgium[3]

It is the most liquid exchange market related to the Day-Ahead transactions. Its gate closes at 11.30 am and its matching occurs daily around 12pm for delivery products of the day after. The current granularity is hourly.

- NordPool Day-Ahead spot Belgium[4]

It has been recently launched in Belgium and a matching occurring at 2.30 pm UK time. Its granularity is by half hour.

- Reference Price Day-Ahead Belgium (publication by ELIA)

It represents a publication of the Belgian zone Day-Ahead prices

The CMU chosen Belgian Day-Ahead market Reference Price will be used as CRM Reference Price in the Payback Obligation calculation: Reference Price (t)

[3] https://www.belpex.be/market-results/the-market-today/dashboard/

[4] https://www.nordpoolgroup.com/

Design Proposal #3: CMU choice of NEMO for its Reference Price

A CRM participating Capacity Provider or Prequalified CRM Participant shall choose for each of its CMUs in the Prequalification process, a NEMO operating in Belgium in the Day-Ahead time frame for setting his Reference Price.

The CMU chosen Belgian Day-Ahead market price reference will be used as CRM Reference Price in the Payback Obligation calculation: Reference Price (t)

Any contracted CMU can during the delivery period notify a modification of the NEMO choice for the Reference Price to Elia (and the Contractual Counterparty) up to 5 working days prior to a new calendar month of delivery, with the change being effective as from the 1st day of the next month.

In case of missing or conflicting data on its NEMO choice related to a specific CMU, the Reference Price Day-Ahead Belgium (publication by ELIA) will be used as fallback value.

For example, if no matching occurred on the delivery period dd/mm/20xx hh:mm on the EPEX spot Day-Ahead, then the ELIA Reference Price Day-Ahead published for the same delivery period will be applied.

Design Proposal #4: modification of the Day-Ahead Reference Price & missing data

The Capacity Provider has the possibility for each CMU to notify a modification of its earlier NEMO choice for the Belgian Day-Ahead Market Reference Price of a CMU up to 5 working days prior to a new month of delivery.

The change will be effective as from the 1st calendar day of the next month. In case of missing or conflicting data related to a specific CMU' NEMO choice, the Reference Price Day-Ahead Belgium (publication by ELIA) will be used as fall-back value. The Reference Price Day-Ahead Belgium is determined as the 'Belgian Bidding Zone Day-Ahead Reference Price'. The valid and binding price for the Belgian bidding zone is the single Day-Ahead coupling price ("Belgian SDAC Price") which is calculated by the Market Coupling Operator (MCO) function jointly performed by all Nominated Electricity Market Operators (NEMOs), and is published on the ENTSO-E Transparency Platform and on the websites of the Belgian NEMOs. (https://www.elia.be/fr/donnees-de-reseau/transport/prix-de-reference-day-ahead)

4 Strike Price design

4.1 Decision & Choice: storyline

As the Reference Price, the Strike Price definition is fundamental for the Payback Obligation and has a crucial impact on the assessment of the different objectives and considerations.

The design of the Strike Price encompasses several dimensions which together should bring an adequate trade-off related to the objectives and considerations.

- **A single Strike Price is preferred over a multiple Strike Price(s)**

The number of Strike Prices applied for the Payback Obligation is obviously a crucial design element. Different options exist and have been studied and discussed with the stakeholders in the Task Force CRM preceding the launch of the public consultation on this note. In addition, two short surveys were organized among the stakeholders to gather early feedback allowing to better develop the current proposal.

Next to the existing practice in other European countries with Reliability Options, the use of a single Strike Price brings a number of advantages:

- In terms of level playing field and technology neutrality, it ensures a more homogeneous product with similar requirements laid upon every contracted capacity in the CRM.
- A single Strike Price is inherently less complex, both in assessing and appreciating the overall CRM design as well as for its (annual) calibration.
- The impact of a Single Strike Price towards the proper functioning of the energy market is more limited. For the energy market, it is relevant to understand how capacities active in the market are impacted by Payback Obligations and at which price levels those obligations become active.

Especially the first advantage related to the level playing field and homogenous product requirement is fundamental. Multiple Strike Prices (i.e. two or more) would typically rely on a differentiation based on technology starting from the hypothesis that different technologies have different cost structures and revenue expectations. For instance, short-run marginal costs of generation technologies are typically deemed lower than for demand response technologies and the energy price level as from which inframarginal rents in the energy market would no longer serve as necessary revenue but rather be considered as a so-called windfall profit could differ greatly.

Notwithstanding that it looks appealing at first glance to differentiate between Strike Price levels on a technology basis, particularly when dealing with the objective to avoid windfall profits and keeping costs low, a closer analysis reveals that this is not straightforward and that the perceived advantages are not necessarily correct:

- There exist many technologies, each with its own cost structures. This is true for various generation technologies (peakers versus based load, different fuel types, varying efficiency levels, varying ages of installations, etc). This is applicable for Demand Side Response and Storage as well. The activation price for demand response is typically distributed over a very large price range (going from a few hundred euros up to – theoretically – the Value of Lost Load). In order to correctly differentiate between technologies, a large set of (sub)-technologies should be distinguished. This raises at least questions on the complexity and feasibility of such approach. A reduction to for instance two groups (e.g. generation versus demand response) would be oversimplifying reality and overthrowing the goal of differentiating in the first place.

- If the Strike Price level was differentiated across technologies, this would clearly be with the intention to "manage" the revenues of such technologies. If the choice was to differentiate, in the CRM design, the product in such way to "correct" between technologies, wouldn't it be crucial to apply this principle more generally? In other words, shouldn't we have also considered differentiating the allowed revenue in the capacity auction of the CRM (e.g. via technology differentiated price caps), as capex levels and missing money levels are also not similar across technologies? This clearly goes beyond the purpose of the CRM and Reliability Option concepts as it would imply a full revenue regulation of the whole capacity participating in the CRM, rather than considering the CRM as a technology-neutral complement to the energy market.
- Finally, differentiating between Strike Price levels would create difficulties for aggregated portfolios to participate. As aggregators create added value by bringing together different technologies (e.g. complement small-scale generation with demand response and/or Storage), it would require either very arbitrary rules on how to assess the Strike Price of such aggregated, differentiated portfolio or it would result in obliging aggregators to compose portfolios within the same (sub)technology (e.g. aggregate Storage with Storage, metallurgy demand response with metallurgy demand response, small-scale CHP with small-scale CHP, etc.). This would hamper the added value and participation of aggregated portfolios in the CRM.

For the above reasons, a single Strike Price is preferred over multiple (two or more) Strike Prices.

- **The level of the Strike Price requires a careful trade-off**

The level of the single Strike Price is essential to respect a number of objectives and considerations of the Payback Obligation, but like with other design aspects, it unfortunately also implies a trade-off to be made.

Firstly, having a relatively low Strike Price compared to Spot Reference Price expectations better ensures that windfall profits could be avoided, particularly by technologies with lower short-run marginal costs. This argument of course only holds to the extent that inframarginal rents above the Strike Price would not normally be accounted for when determining the offer price in the CRM auction. If put too low, a low Strike Price could even risk in augmenting the cost of the capacity auction.

Secondly, a relatively high Strike Price scores well in terms of making the mechanism sufficiently technology open, particularly towards technologies with higher short-run marginal costs. They otherwise bear the risk of having a Payback Obligation while not being dispatched by the energy market in the first place. Although a higher Strike Price may avoid such effects to some extent, other measures (such as a Stop-Loss limit on the Payback Obligation) help mitigating this risk (cf. infra).

The trade-off between lower and higher Strike Prices is more subtle that simply preventing from windfall profits versus being more open towards some technologies. An important indirect effect is that thanks to a higher Strike Price, more technologies can be facilitated, this has the chance to create more competitive pressure in the CRM auction and thereby impact the capacity mix obtained and lower the overall cost of the CRM. Notwithstanding its relevance, a too narrow focus on the Strike Price oriented on windfall profit avoidance could backfire when zooming out and looking at the broader picture.

In conclusion, the Strike Price should be sufficiently high to ensure a realistic chance for all technologies to participate in the CRM. This is particularly relevant with respect to high SRMC technologies, not less for demand response. However, the Strike Price should not be excessive in order to respect the spirit of the CRM law, i.e. ensuring a Reliability Option with a Payback Obligation and to limit any windfall profits of lower SRMC-technologies, to the extent that not all inframarginal rents from the energy market are not accounted for in setting the CRM offer prices.

Chapter 5 will proposes a concrete calibration methodology bearing in mind the above conclusions.

The **Transparency** offered by a single and market-wide Strike Price towards the Energy market actors creates fairness and enhances competition in **a level playing field** and market-wide mechanism delivering a solution to the society SoS-issues. In the European energy context and the existing CRM, the same type of Strike Price has been settled in the Irish mechanism with a Strike Price level of 500€/MWh.

For the sake of clarity, all assets having a higher activation cost than the single Strike Price valuation are of course allowed to participate to the mechanism.

The **Simplicity & feasibility** of a single Strike Price development and follow-up is evident. Its simplicity will enhance competition with the participation of new type of technologies and market participants having the opportunity to acquire the required modelling for their auction bids.

As mentioned in Paragraph 1.3., the proposed Design is a trade-off of the multi-objectives function of the Payback Obligation. The choice of the Strike Price with all involved Stakeholders in the Tasks Forces was not straightforward as they have different interests.

For all these reasons, the Strike Price proposal is:

Design Proposal #5: One Single Strike price choice

One Single Strike Price will be applied to all Transactions of the CMUs at the same Transaction Date.

4.2 Strike price in time

Following Art. 7undecies §2 of the CRM Law, the determination of the Strike Price parameters will be decided by Ministerial Decree each year no later than 31/03 of that year. This means that the Strike Price could evolve over time and that contracts concluded as the result of one Auction do not necessarily include the same Strike Price as for contracts concluded following another Auction. In any case, prior to each Auction, the Strike Price applicable for the contracts that will be concluded following that Auction will be known upfront, allowing participants to duly factor in this information in their bids without further risks on the Strike Price level applicable on them.

It is proposed that the last published Strike Price will also be applicable for traded obligations in the Secondary market when calculating the due amount of the Payback Obligation. The timestamp of transaction notification will settle which Strike Price will be applicable: in the case of a Secondary Market transaction, the latest published Calibrated Strike Price will be used for the CMU taking over and delivering on the Obligation, this independently from the Initial Strike Price of the initial CMU selling its obligation. This element is further detailed in the design note dealing with Secondary Market arrangements.

Because of such Secondary Market deals, but even more due to multiyear contracts concluded from earlier Auctions and because of Y-4 and Y-1 auctions targeting the same delivery year do not necessarily rely on the same Strike Price, it is likely that in a given Delivery Period, several Strike Prices are active. Nevertheless, the Strike Price of an obligation is related to an Auction or to Secondary Market transactions for which the Strike Price was properly settled and known. The definition of the Single Strike Price remains valid for the entire period of delivery of the elected CMUs bid.

Design Proposal #6: Update of the Strike Price

For capacity contracted in a Y-4 or Y-1 Auctions, the Strike Price for the relevant Delivery Period as decided by Ministerial Decree no later than 31/3 of the year that Auction applies.

For contracts covering more than one Delivery Period, the Strike Price is not updated during the lifetime of the contract.

The last published Strike Price will also be applicable for Transactions in the Secondary market when calculating the due amount of the Payback Obligation. The timestamp of transaction notification as known by Elia will settle the Strike Price of a CMU Secondary Market transaction.

One Single Strike Price will be applied to all Transactions of the CMUs at the same Transaction Date:

Strike Price (CMU, t, Transaction Id) = Calibrated Strike Price (Transaction Date) [€/MWh]

Where *Calibrated Strike price (Transaction Date)* represents the value of the Strike price actualization at the Transaction Date. The methodology & calculation of the Strike price calibration will be defined in Chapter 5 – Strike price calibration.

The yearly Strike Price calibration result will be described in Chapter 5 Calibration of Strike Price. As a Specific CMU may trade different obligations for the same Delivery Period at different moments, it is important to distinguish the related Strike Prices per obligation in the Payback Obligation calculation.

This leads to a principle of a Single Strike Price associated to a CMU elected bid for an Auction result period. In case of a transfer of obligation via the Secondary Market, the latest published Strike Price at notification for the related delivery year will be applied to the new 'Obligated' Party.

Example 1: Primary Auction

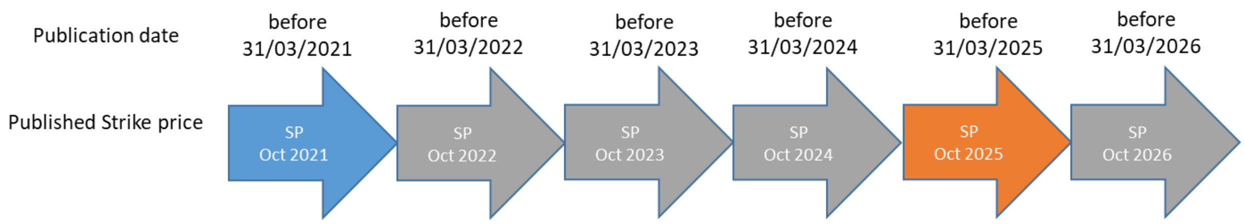

Figure 7: Strike Price update considered for an Auction

CMU1 is awarded in Auction 2021 (Y-4) for a 15 years contract starting in Nov 2025 (SP 2025 of Y-4)

CMU2 is awarded in 2021 (Y-4) for one year delivery starting in Nov 2025 (SP 2025 of Y-4)

CMU2 is awarded in 2025 (Y-1) for one year delivery starting in Nov 2026 (SP 2026 of Y-1)

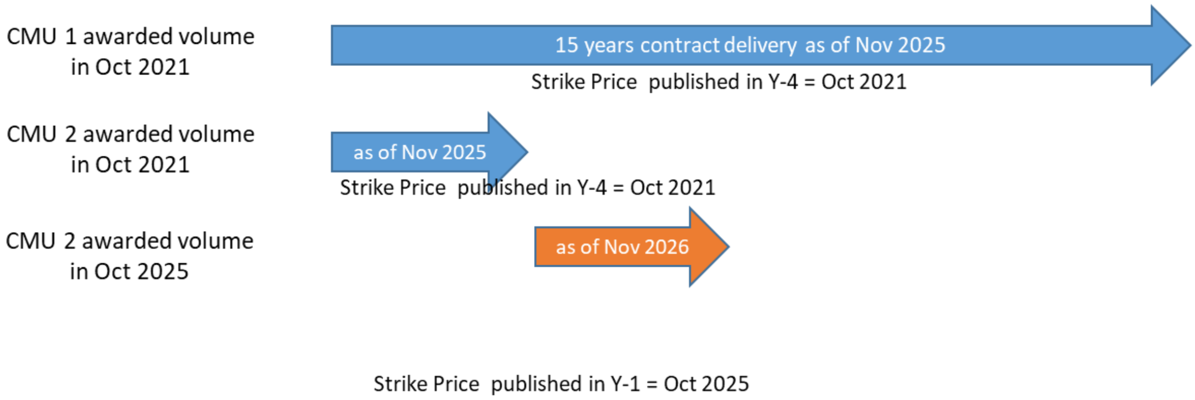

Figure 8: Example 1: different Strike Prices for the same Delivery Period

- ⇨ CMU1 will be guaranteed on the same Strike Price for the Delivery Period [Nov 2025 – Oct 2039]
- ⇨ Both CMU1 and CMU2 will have the same Strike Price for the Delivery Period [Nov 2025-Oct 2026]
- ⇨ Possibly, CMU1 and CMU2 will have different Strike Prices for the Delivery Period [Nov 2026-Oct 2027]

Example 2: Secondary Market transactions based on Example 1

In August 2025, a Secondary Market Transaction occurs : CMU 1 releases part of its obligation to CMU2 for the period of Nov 2026 until Oct 2028 included.

The Strike Price has been updated before March 31st 2025 ➔ before Oct 2025.

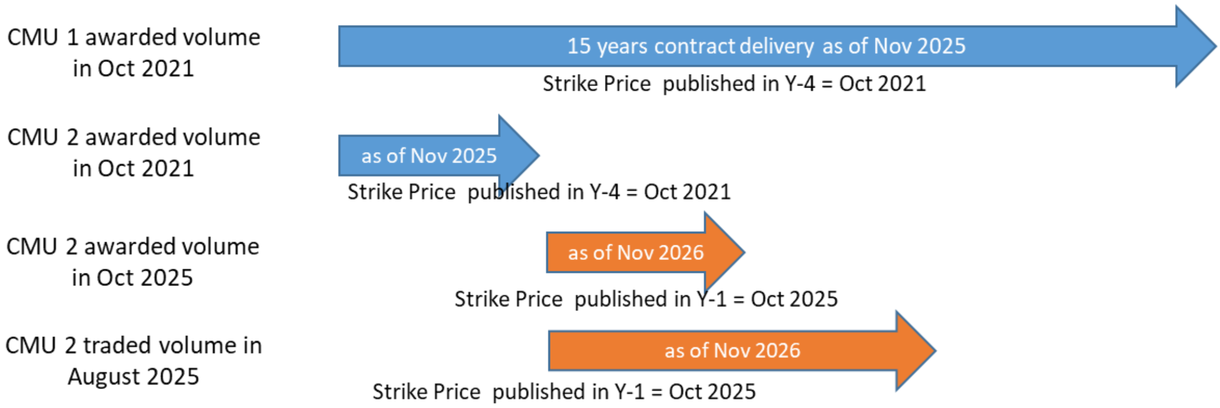

Figure 9: Example 2: different Strike Prices for the same delivery period

- ⇨ For the considered Transaction Period, CMU 1 keeps on Strike Price published before Oct 2021 for its remaining volume

- ⇨ CMU 2 has two obligations with the same Strike Price for the Delivery Period Nov 2025 – Oct 2026

⇨ If CMU 2 is awarded in Y-1 auction Nov 2026 of capacities for Nov 2027-Oct 2028, the Strike Price will be different for the same period than the one applied for its Secondary Market transaction (of August 2025).

It is then possible to summarize the Strike Price of a specific CMU valid for a specific obligation (selected or traded at a specific date).

5 Calibration methodology of the Strike Price

As mentioned in the Chapter 4, the Strike Price will be calibrated yearly and determined via Ministerial Decree no later than March 31st prior to the Y-4 and Y-1 Auctions. It is the purpose of the current chapter 5 to define the methodologies for the calibration of the Strike Price in line with the design principles already described in the previous chapter.

5.1 Considerations and objectives of the Payback Obligation

As previously presented in paragraph 1.3., the Payback Obligation and the Strike Price should take into account considerations and objectives of the CRM. These include technology neutrality and openness, limitation of the CRM overall cost, windfall profits avoidance, insurance of a functioning reliability option principle and keeping the complexity of the CRM under control. These considerations and objectives remain essential when calibrating the Strike Price level.

As pointed out in the previous chapter, particularly technology openness and windfall profit avoidance are directly impacted by the Strike Price level, but the other objectives and considerations should not be overlooked as they could be indirectly impacted.

5.2 Calibration methodology

When developing a methodology, it is deemed important that the outcome of the methodology can be considered objective, tailored to the situation and its calculation is transparent.

Therefore, the proposed calibration methodology relies on observable, measurable and tangible data from the Belgian Day-Ahead Markets. Note that looking at the Belgian DAM is overall coherent with other design aspects such as the choice of the Reference Price, the functioning of the Availability Monitoring Mechanism, etc. In general, the reasons justifying the choice of the Belgian DAM for those aspects remain valid here.

The hourly DAM market offer and demand curves are transparent and are fair signals of the sensitivity to price of capacity present in the Belgian energy market. Although prices have not necessarily often reached high (or extreme) levels, those curves reflect real market behaviors and correspond to actual prices market parties of various technologies are willing to pay/accept in return for energy.

In a nutshell, the proposed methodology boils to the following:

> The Strike Price should be set at a price level within a pre-specified range, that ensures that a reasonable volume of capacity was offered in DAM, would be selected in the DAM prior to reaching the Strike Price level. To assess this price level, a rolling window of historical DAM curves will be used, complemented where needed with further considerations on the market.

More concretely, this methodology aims to collect historical hourly offer and demand curves of all Belgian DAM Markets (i.e. EPEX Spot and Nordpoolspot) and to use these data to construct an aggregated curve indicating the DAM participation (expressed as volume) as function of the price level.

Before using such data, relevant pre-filtering is done to be consistent with and focus on adequacy relevant moments. Therefore, and in line with earlier practice for assessing market response volumes, only weekly peak hours during the Winter period are used. More specifically this concerns: Months November to March, hours [8:00 to 20:00[, weekdays only. At least the so-called aggregated curves provided by the NEMOs shall be used. It will be further investigated how also the volumes in more complex bid types can be incorporated or estimated in the approach depicted below.

In a 1st step, all demand and offers curves of the Belgian Day-Ahead Markets must be collected (this includes their prices and their volumes). A first filter is then applied, for timing matters, by considering only the last 3 Winter periods in the calculation. Limiting to only recent periods allows to factor in market evolutions, such as the emergence of market response or other technologies. By using three Winters rather than only one outlier, effects are smoothened as DAM participation levels may be subject to exogenous effects (e.g. general economic situation or alike). Next to filtering to the relevant dataset (cf. above), all prices of the offer and demand curves below 0 €/MWh and at the market price cap are excluded of the datasets as they are not considered as market prices reacting to adequacy matters, these are considered as inelastic. The simple blocks, linked blocks, exclusive groups or loop blocks are not considered. In other words, it is reasonable to assume that these volumes would have (been) offered/asked at a higher price cap (at any price) if it had been needed/possible. This for instance due to BRPs needing to complete their portfolio balance.

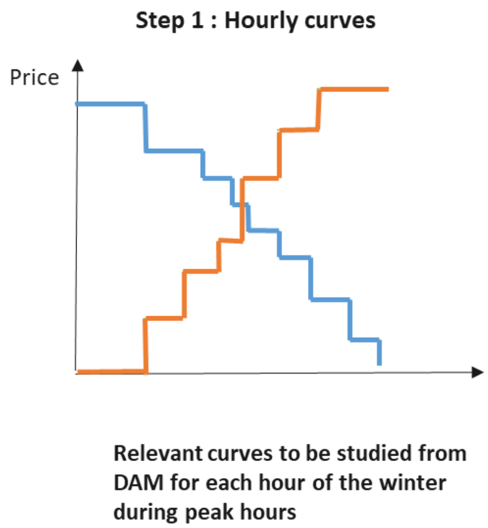

Figure 10: Concept of elastic hourly demand and offer curves

As the Belgian Day-Ahead Markets offer and demand curves are built by netting the market parties portfolio positions, both have to be considered at the same level of price sensitivity. It is not possible to distinguish, from the demand and offer curves, the volumes related to production assets or demand assets that could be participating in the CRM. As a consequence, it is necessary to sum up their contribution.

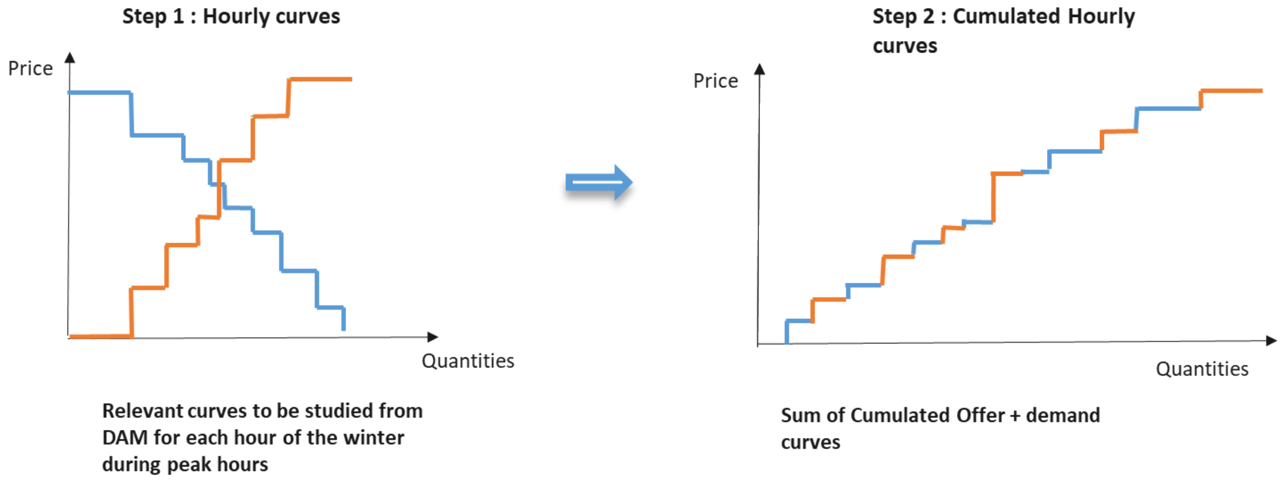

Figure 11: From the elastic hourly demand and offer curves to a Day-Ahead Market cumulative price sensitivity curve

In a second step, all orders are sorted according to their price levels. This provides an hourly cumulative curve.

In a third step, an average cumulative curve for a Winter period is determined. A simple average from the sum of all demand and offer curves of all Belgian Day-Ahead markets leads to a result of a quantity reacting to prices for a considered Winter weekly peak period. From this cumulated curve, the Winter hourly average total quantity reacting to price in Belgium can be deducted. It is the maximal value of the Simple Average of the Sum of Cumulated offer + demand curve of all Belgian Day-Ahead markets (see green dot on the Fig. 12).

Figure 12: Winter weekly peak hours aggregation of Day ahead Market cumulative price sensitivity curve

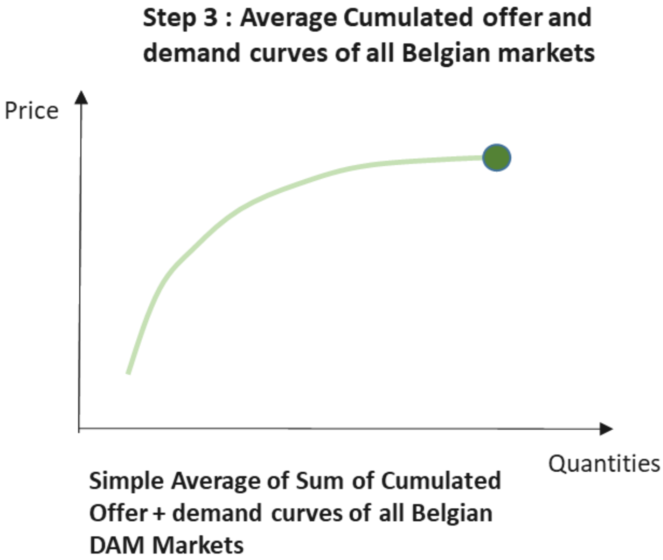

Figure 13: Determination of the Maximal quantity of a Winter weekly peak hours cumulative price sensitivity curve

In step 4, the quantities of the dataset of the Winter (by looking at them cumulatively) are divided by the Maximal volume of the Simple average of Sum of cumulated offer and demand curves. This gives a common percentage of the offer and demand reacting to a market price.

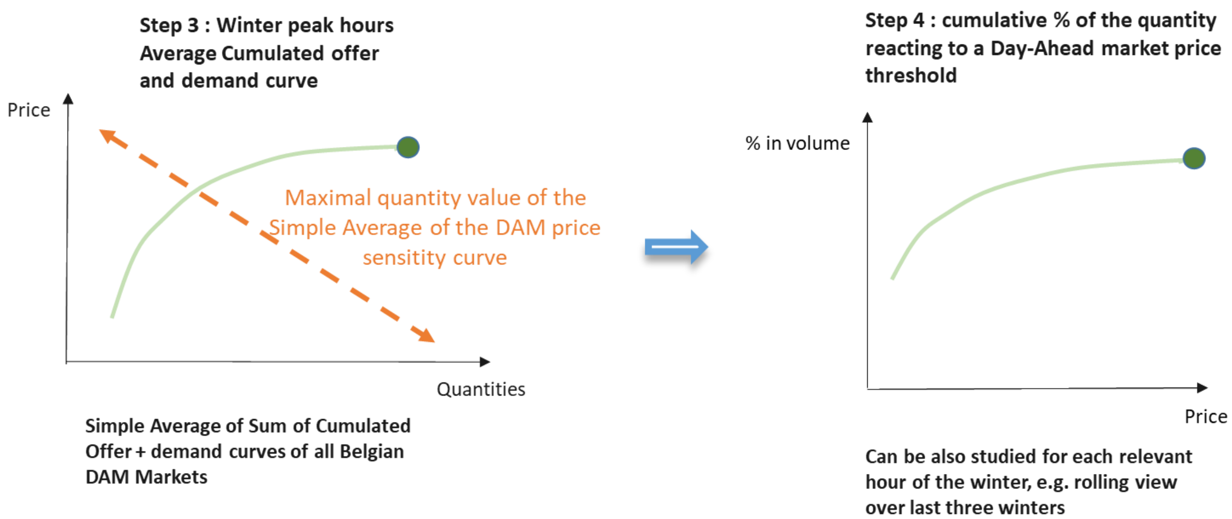

Figure 14: Normalization of the Winter weekly peak hours cumulative price sensitivity curve

Having repeated this for each considered Winter in step 5, the weighted average (Maximal volume based (see Fig. 14)) of the three last Winter's curves is deducted in step 6. From this latter curve, the DAM participation rate (% in volume) at various price levels can be observed.

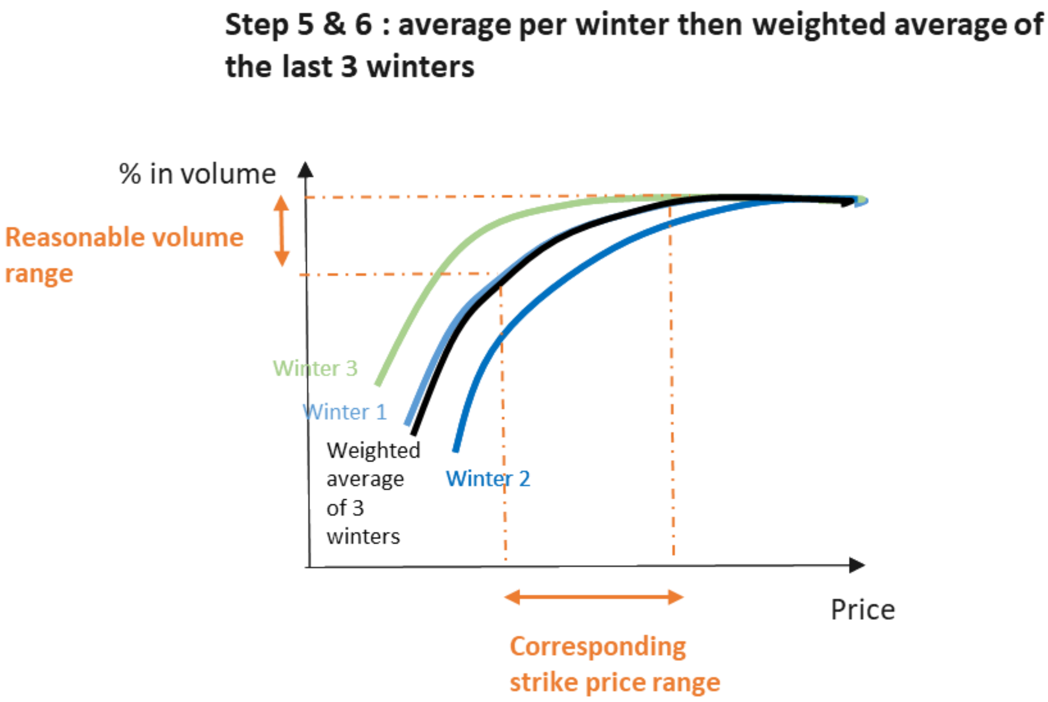

Figure 15: Weighted Average (Maximal volume based) of the last three Winters weekly peak hours cumulative price sensitivity curve

To finally calibrate the Strike Price at a certain level, a "% in volume" is to be chosen at which a Strike Price level corresponds. It is proposed that the methodology (to be set in a Royal Decree) specifies a range of such percentages, thereby already limiting the Strike Price levels that could result, but still leaving the necessary margin to interpret the curve (e.g. in terms of inflection point, flat areas where changing the Strike Price level hardly impacts the volume accommodated, etc.) and to take into account other relevant aspects.

It is to be noted that by such approach two important objectives and considerations can be covered in a quantitative and objective manner. The % in volume of DAM participation is a clear indicator of the technology openness of the Strike Price level choice. The higher the percentage chosen, the higher the volume that is facilitated. On the other hand, the resulting price levels are indicative to the risk of windfall profits, the lower the price level, the smaller the risk of windfall profits.

For example the exercise has been done on the last 4 Winters average and is giving the following results:

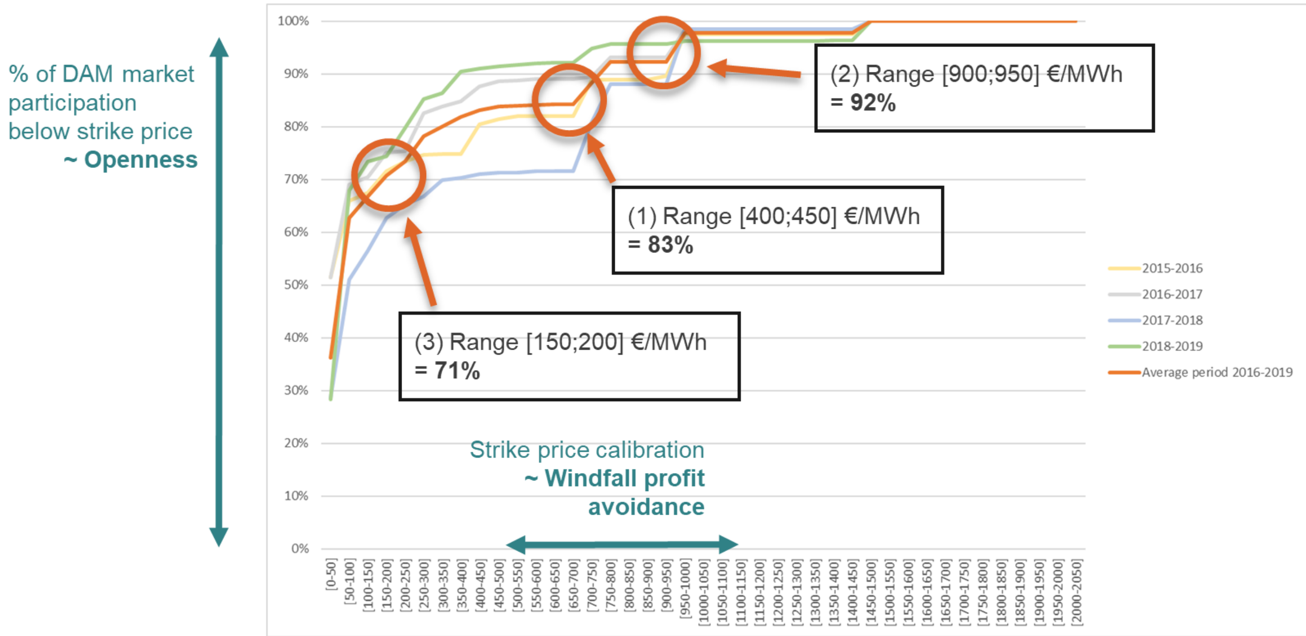

Figure 16: Example of Calibration curve of the last 4 Winters and Average

The Strike Price Calibration and its methodology are now relying on the % range of quantities defined as reasonable volume below the Strike Price.

It is proposed is to apply a range of percentage range between [70; 90] % in order to calibrate the yearly update of the Strike Price. The definition of this % range as going from 70% to 90% is based on the observed shapes of the average calibration curve observed for the last 3 years for Winter weekly peak hours: whether the curve is reaching a flat area ("plateau") at the lower/upper bound of the cumulated % level and whether the inflection points are sufficiently "within range". The 70% is, a fortiori, a floor under which the inframarginal rent is decreasing severely as the windfall profit possibility while at the same time the technology openness is limited.

At the opposite, the 90% is creating a cap above which it is implying that the windfall profits are appearing in disproportionate growth while at the same time technology is openness is reaching a major potential of new participating assets.

In the rolling process, the percentage within the range that will define the Strike Price level will be yearly carefully assessed and proposed to the Minister following a study on the shape of the average calibration curve observed (applied to the 3 previous Winters, for weekly peak hours) e.g. whether the curve is reaching a plateau at the lower/upper bound of the cumulated % level. This will be evaluated taking into account clear and observable market evolutions possibly having an impact on prices & market actors' reactions while at the same time having a willingness to stabilize the Strike Price over time.

For all these elements,

Design Proposal #7: Calibration of the Strike Price

Within the One single Strike Price applicable to all Transactions of the CMU's at the same Transaction Date, a *Calibrated Strike Price (obligation transaction date)* is required:

Once a year and before March 31st:

Considering the construction of a *calibration curve* equal to the Weighted average of the last previous 3 Winters (November 1st to March 31st) of the sum of all the weekly peak hours (weekdays from [8:00 to 20:00[) gathering the elastic part of the cumulative hourly offer and demand curves of all Day-Ahead Belgian Market exchanges (which are taken as couple of prices €/MWh and cumulative quantities in MW) modelled by the following formula:

$$= \begin{matrix} Weighted\ Average \\ on\ 3\ last\ Winters\ of \end{matrix} \sum_{i=1}^{\substack{All\ Winter \\ Peak\ hours}} \sum_{j=1}^{\substack{All\ Belgian \\ DA\ Markets}} \begin{matrix} Elastic\ Part\ of\ demand\ curve\ (i,j) \\ + \\ Elastic\ Part\ of\ offer\ curve\ (i,j) \end{matrix} \Big/ \begin{matrix} Number \\ of\ peaks \\ hours\ of \\ Winter \end{matrix}$$

The Elastic part of the cumulative hourly demand and offer curves is including all registered orders except the simple blocks, linked blocks, exclusive groups or loop blocks, and the ones below or equal to a price of zero and the ones at market Price Cap.

The volume part of the constructed curve will be normalized for the quantities part leading to a curve representing a % range of quantities with their corresponding prices in €/MWh.

The weighted average on the last three Winters will be volume based using the Winter Maximal volume of the Simple average of Sum of cumulative offer and cumulative demand curves.

A Calibrated Strike Price (in €/MWh) will be selected for the next publication date on the calibration curve which will represent a % range of cumulated volume of reaction within a range of [70;90]%

The selected Strike Price level and % within the predefined range shall take into account:

- The shape of the average calibration curve observed (applied to the 3 previous Winters, for weekly peak hours): whether the curve is reaching a plateau at the lower/upper bound of the cumulated % level
- Market evolutions possibly having an impact on prices & market actors' reactions
- The stability of the Strike Price over time

The *Calibrated Strike Price* will be settled for all Transactions of the Primary Market selected and Secondary Market traded at a transaction date above or equal to its publication date and before the next *Calibrated Strike Price* publication date.

➔*Calibrated Strike Price (at Transaction date) = Calibrated Strike Price (at publication date)*

6 Modalities of Payback Obligation

The main ingredients of the Payback Obligation, i.e. the Reference and Strike Price, have been described in the precedent Chapters. It is, however, key to complete the Payback Obligation with the necessary modalities of application of this Calibrated Strike Price, such as the volume and quantities on which the Payback Obligation is due.

As starting point, in principle the Payback Obligation calculation will be continuous and is valid for all hours during the Delivery Period. Nevertheless, it is reasonable to take into account a number of corrections to this general principle.

In the Payback Obligation part of the formula introduced in chapter 2, it is crucial to clearly determine the *Payback Obligated volume(CMU, t, Transaction Id)*:

*max[0; Reference Price (t) – Strike Price (CMU, at Obligation id transaction date)] * Payback Obligated Volume (CMU, t, Transaction Id)*

This chapter defines this concept further (6.1) and introduces three particular elements:

- The Availability Ratio (t) (6.2)
- The Load Following Ratio (t) (6.3)
- Application of the Payback Obligation on CMUs with an Energy-Constrained service level (6.4)
- Stop-Loss limit on the Payback Obligation (6.5)

6.1 Payback Obligated volume of an obligation

The *Payback Obligated Capacity (CMU, t, Transaction Id)* is the total of hourly capacity in MW on which the Payback obligation will be applied. It will be of course related to the Transaction Capacity of the CMU but should also include all types of exemption.

As each obligation of the CMU hasn't been contracted in the same Market (Primary or Secondary) and hasn't been contracted at the same moment with the same Payback Obligation parameter (Strike Price), it is important to differentiate the calculation and to introduce the *Transaction Id* which is representing the identification of a CMU Obligation linked to a specific Transaction. This Transaction Id is related to a Transaction.

In the paragraphs 6.2. and 6.3., the two ratios of Availability and Load following will be defined. These ratios will correct the Payback Obligated Capacity (CMU, t, Transaction Id) and may decrease the Payback Obligation.

Design Proposal #8: Payback Obligated volume definition

Payback Obligated Capacity (CMU, t, Transaction Id) = Transaction Capacity (CMU, t, Transaction Id) * Availability Ratio (CMU, t) * Load Following Ratio (t)

6.2 Availability Ratio

The Payback Obligation targets the re-imbursement to society of any earned revenues above a pre-defined Strike Price. To the extent it is reasonable to assume that for such a moment the revenues have not been earned in the first place (and thereby no unreasonably high inframarginal rents would have been earned), it is also reasonable not to require a payback during those moments. Otherwise, this would unnecessarily increase risks that would be priced in the bids in the Auction, thereby risking to increase the overall cost of the mechanism.

Therefore, it is proposed that all planned and unplanned unavailabilities (e.g. planned maintenance, forced outages,…) as also considered according to the Product Availability & Monitoring design, are exempted of the Payback Obligation calculation to the extent of their unavailability. Note that this only concerns unavailabilities that have been duly communicated to Elia.

As explained above, such exemption allows a better risk management by the Capacity Provider, while at the same time it does not dilute the incentives for Capacity Providers to be available. As moments with the Reference Price exceeding the Strike Price are in principle also moments during which other availability obligations apply (with penalties), there is an incentive to continue to deliver on the service.

This is summarized in the Availability ratio (t) on which the Payback Obligation is due.

Design Proposal #9: Availability Ratio definition

For a CMU the Availability Ratio (t) equals:

MIN[1; [Available Capacity (CMU, t)) / Obligated Capacity (CMU, t)]

This value is always lying between 0 and 1.

6.3 Load Following Ratio

The CRM will be dimensioned in such a way that Belgian adequacy needs can be met. In a very simplified manner the CRM could be considered as being dimensioned to cover for the Belgian Reference Peak Load. This means that the sum of contracted capacities should equal the Reference Peak Load.[5]

Of course, (near-)scarcity moments and moments where the Strike Price exceeding the Reference Price can occur at moments during which the Total Load is lower than the Reference Peak Load for which the system has been dimensioned. As the CRM targets availability rather than delivery of energy, it is logical that at such moment not all contracted capacities are dispatched via the energy market. For instance, if the CRM is dimensioned for

[5] Obviously, such simplified view ignores several elements such as opt-out volumes, corrections for non-eligible volumes. Also it by no means intends to capture the subtleties related to the determination of the actual volume to be procured, i.e.. by means of a demand curve.

a Reference Peak Load of 14 GW and the moment that a Payback Obligation would be applicable, the Total Load is only 12 GW, it is reasonable to assume that 2 GW of the contracted capacities won't be delivering energy in the energy market (but are nevertheless available to do so).

Therefore, a ratio with a maximal value of 1 will be applied in the Payback Obligation formula. This ensures that the Payback Obligation is proportionate to the actual Total Load level whereas the Belgian Load Following Ratio (t) is defined as the Total Load at t moment divided by the dimensioning Reference Peak Load level for that Delivery Period. In the above example the ratio (t) would equal 12 GW/14 GW = 0,8571.

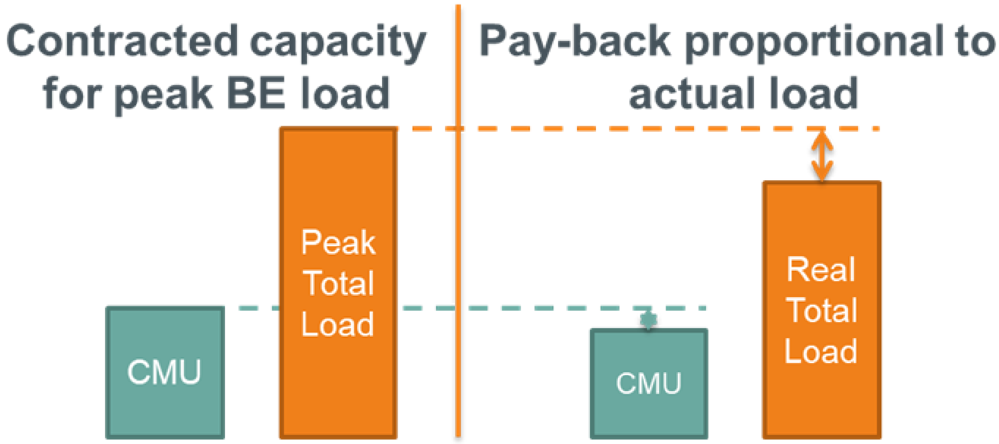

Figure 17: Load Following ratio applied in the Payback Obligation formula

Design Proposal #10: Load Following Ratio definition

For all CMUs the Load Following Ratio (t) equals:

min [1; [Total Load (t) / Reference Peak Load (t)]]

This value is always lying between 0 and 1.

6.4 Application of the Payback Obligation on CMUs with an Energy-Constrained service level

In the Prequalification phase, it is possible for the Capacity Provider or Prequalified CRM Candidate of Energy Constrained Asset or aggregate to select a SLA (Service Level Agreement), implying that its participation to adequacy is limited in to a predefined set of consecutive hours in the day.

As the Energy Constrained CMUs are allowed to trade and take over extra obligations in the Secondary Market outside of their SLA hours (see Design Note 7 Secondary Market), it is required to impose the Payback Obligation on these hours and their Transaction Capacities.

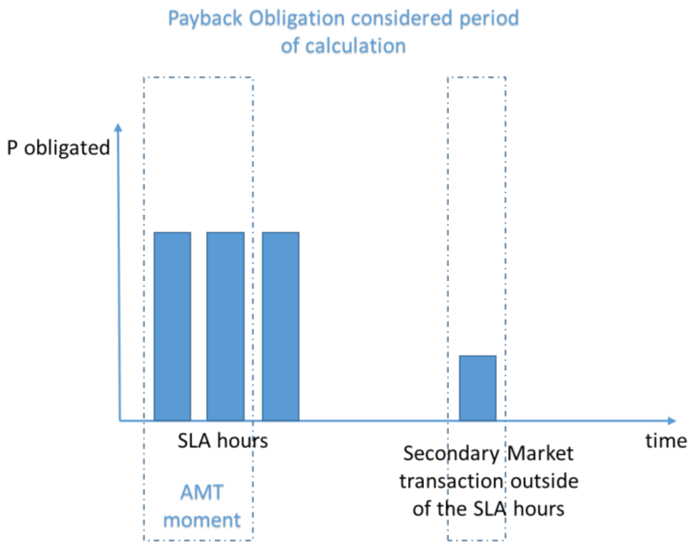

Figure 17: Energy Constrained considered period for Payback Obligation calculation

As the Payback Obligation is calculated on the Transaction Capacities, an exemption outside of the committed SLA should occur for the Energy Constrained CMU.

As described in the De-rating factors Design Note and the Availability Requirements and Penalties Design Note, the considered hours regarding the SLA are known and the Payback Obligation will be applied on those.

It is a reasonable assumption that the Strike Price level will be above the P AMT which will define the AMT moments. Therefore, in case of Day Ahead market prices above the Strike Price level, those moments will be considered as AMT moments. The main objective of this exemption is to select the hours of application of the formula during an AMT moment for the assets under a SLA.

Design Proposal #11: Payment exemption outside of the SLA hours and extra hourly Transaction Periods for the Energy Constrained CMU

The Payback Obligation is due at any period of the Transaction for which the AMT moments are considered for Penalties according to the CMU SLA for the Energy Constrained CMU. It is also due for any other period of its extra Secondary Market hourly Transactions (during the SLA hours and non-SLA hours).

6.5 Stop-Loss limit on the Payback Obligation

The Payback Obligation has obviously a very clear interaction with the energy market and – as discussed when designing and calibrating the Strike Price (cf. chapters 4 & 5) – the Strike Price level takes into account the technology openness of the mechanism. Without further measures, lower Strike Price levels create risks to technologies with higher short-run marginal costs. If their short-run marginal cost is above the Strike Price, they may be subject to a Payback Obligation while they have not yet been called upon by the energy market.

As the above risk would be unlimited without further measures and therefore difficult to achieve a reasonable price when bidding in the Auction, a stop-loss limit is considered appropriate to limit this risk to the contractual value. This contributes to the reflection on the trade-off when setting the Strike Price and considering technology openness as with such stop-loss limit all technologies can effectively assess the risk and price it.

Note that creating such stop-loss limit on the Payback Obligation is also from a broader market design perspective desirable. Without such stop-loss limit, contracted capacities would remain liable to a Payback Obligation if at very low CRM remuneration levels. This could become problematic when considering to phase-out the CRM when adequacy concerns have sufficiently faded away. Indeed, when the energy(-only) market provides sufficient returns, incl. at moments where prices would exceed the Strike Price, the CRM should not become a roadblock for capacities to earn their revenues via the energy market. A stop-loss limit prevents that too many energy market revenues would have to be reimbursed, thereby unnecessarily inflating bid prices in the CRM Auction and thereby making it more difficult to abandon the CRM one day. Stated otherwise, such stop-loss limit on the Payback Obligation more easily allows the CRM Auction to tend to zero €/MW as capacity remuneration.

Therefore, it is proposed to create a Stop-Loss mechanism equivalent to the contractual value of the CMU as a maximum. This will be calculated based on the CRM annual contractual value (i.e. per Delivery Period, starting in November) and will be totally independent from the Stop-Loss related to Penalties of the Availability Requirement and Penalties Design Note. Only the Obligation of a Contracted Capacities (from the Primary Market) could apply for the Stop-Loss. This means that the transactions of the Obligated Capacity of a CMU coming from the Secondary Market are not taken into account in the Stop-Loss calculation and their payments are duly expected even once the Stop-Loss limit has been reached. The rationale comes from the non-implication of the CRM contractual counterparty in the Secondary Market transaction payment and price. As the initial Capacity Provider releasing its obligation continues to be paid, if there is a willingness of Stop-Loss from the Capacity Provider taking over the obligation, it may be part of the bilateral (or exchange) agreement.

Design Proposal #12: Payback Obligation Stop-loss on Primary Market obligation

A Stop-Loss mechanism applies on the Payback Obligations regarding a Delivery Period of a CMU Contracted Capacities (solely from the Primary Market). It cannot exceed the contract value for that Delivery Period.

7 Examples and uses cases

The objective of the section is to describe examples that help the comprehension of the Payback Obligation concept.

The examples are driven by the present Design Scope related to Strike & Reference Price comprehension as a goal and could/will not replace the future contract details.

7.1.1 Example 1: Classical existing Production asset 400MW CCGT

In the Prequalification process, the Capacity Provider of an existing CCGT asset of 400MW, selected several parameters where one of them is the spot Day-Ahead Reference Price. EPEX spot Day-ahead has been selected.

A De-Rating Factor of 0,9 is granted, giving an Obligated capacity of 360MW.

The Prequalification occurred successfully on the Capacity Provider with its existing CCGT asset of 400MW.

The Capacity Provider hasn't 'Opted-Out' its capacity of the CRM mechanism and submits a bid in the Y-4 Auction of Oct 2021 for [November 2025 – October 2026] delivery period.

Under the bidding & Auction rules, the CCGT de-rated volume of 360MW is selected and awarded a contract.

The 360MW obligation is linked to a Strike Price of 500€/MWh.

In September 2025, in the Secondary Market, the CCGT 400MW CMU is taking over 20MW of obligation of another asset for the period November and December 2025. The latest published Strike Price at the time of the transaction notification to ELIA and Contractual counterparty was 525€/MWh.

In December 2025, for the delivery period of November 2025, the Payback Obligation is calculated according to the following :

During the month of November 2025, only 2 hours [19:00-20:00] of 29/11/2025 were having an EPEX spot Day-Ahead price above one of the both threshold with respectively

[825 and 721]€/MWh

The Load Following Ratio is considered at 0,97 for both hours and the asset availability at 100%.

The settlement of Payback Obligation is then:

- 0 € for all hours of November except for the 2 hours mentioned above
- For H19:00:
    - Primary Auction Y-4:

      = max(0;(825€/MWh-500€/MWh)*360MWh* 1 * 0,97)

= 113,49k€

  - Secondary Market trade:
    = max(0;(825€/MWh-52500€/MWh)*20MWh* 1 * 0,97)
    = 5,82k€
- For H20:00:
  - Primary Auction Y-4:

    = max(0;(721€/MWh-500€/MWh)*360MWh obligated* 1 * 0,97)

    = 77,1372k€

  - Secondary Market trade:
    = max(0;(721€/MWh-525€/MWh)*20MWh obligated * 1 * 0,97)
    = 3,8024k€

The monthly November 2025 total Payback Obligation that will be billed to the Capacity Provider is 200,25k€.

7.1.2 Example 2: Demand-Side management 10MW with 423€/MWh activation cost

In the Prequalification process, the Capacity Provider of 10 MW DSR process, selected several parameters where one of them is the spot Day-Ahead Reference Price. EPEX spot Day-ahead has been selected.

A De-Rating Factor of 0,4 is granted as the option 'no limit of duration' SLA category of DSR is chosen by the Capacity Provider, giving an Obligated Capacity of 4MW.

The Prequalification occurred successfully on the Capacity Provider asset.

The Capacity Provider proposed a bid for the Y-1 Auction of Oct 2024 for [November 2025 – October 2026] delivery period.

Under the bidding & Auction rules, the DSR de-rated volume of 4MW is selected and awarded a contract.

The 4MW Transaction is linked with a Strike Price of 525€/MWh.

In September 2025, in the Secondary Market, the DSR Capacity Provider is releasing 1MW of its obligation to another asset for the period December 2025. The latest published Strike Price at the time of the transaction notification to ELIA and Contractual counterparty was 500€/MWh.

In January 2026, for the delivery period of December 2025, the Payback Obligation is calculated according to the following:

During the month of December 2025, only the 1 hour [19:00] of 14/12/2025 was having an EPEX spot Day-Ahead price above one of the both threshold with 923€/MWh.

The Load Following Ratio is considered at 0,94 for both hours and the asset availability at 100%.

The settlement of Payback Obligation is then:

- 0 € for all hours of December except for 1 hour

- For H19:00:
  - Primary Auction Y-1:

    = max(0;(923€/MWh-525€/MWh)*3MWh obligated * 1 * 0,94)

    = 1122,36€

This is the Monthly December 2025 total Payback Obligation that will be billed to the Capacity Provider.

7.1.3 Example 3: Aggregate of capacities delivering a SLA of 2h and 5MW

In the Prequalification process, the Capacity Provider of a set of assets for an installed capacity of 25MW, selected several parameters where one of them is the spot Day-Ahead Reference Price. EPEX spot Day-ahead has been selected.

A SLA of 2 hours is chosen and the related De-Rating Factor of 0,2 is granted as the Capacity Provider has chosen its DSR category, giving Obligated Capacity of 25MW (according the Availability Monitoring & Penalties).

The Prequalification occurred successfully on the CMU pool of assets.

The Capacity Provider is now able to insert a bid in the Y-1 Auction of Oct 2024 for [November 2025 – October 2026] delivery period.

Under the bidding & Auction rules, the pool volume of 5MW is selected and awarded a contract.

The 15MW obligation is linked with a Strike Price of 525€/MWh.

In February 2026, for the delivery period of January 2026, the Payback Obligation is calculated according to the following :

During the month of January 2026, only 3 hours [18:00-20:00] of 17/01/2026 were having an EPEX spot Day-Ahead price above one of the both threshold with respectively

[950;872;861]€/MWh

Only the first 2 hours are considered according the AMT moments definitions of the Availability Monitoring & Penalties.

The Load Following Ratio is considered at 0,95 for both hours and the asset availability at 100%.

The settlement of Payback Obligation is then:

- 0 € for all hours of January except on the 3 hours
- For H18:00:
  - Primary Auction Y-1:

    = max(0;(950€/MWh-525€/MWh)*25MWh obligated * 1 * 0,95)

    = 10 093,75€

- For H19:00:
  - Primary Auction Y-1:

= max(0;(872€/MWh-525€/MWh)*25MWh obligated * 1 * 0,95)

= 8 241,25€

- For H20:00:
    - Primary Auction Y-1:

    = 0

Monthly January 2026 total Payback Obligation that will be billed to Capacity Provider is 18 335€.

8 The Rules Set

Design Proposal #1: The Payback Obligation Formula

The Payback Obligation formula for a given CMU obligation is:

For all t hours where the CMU is under a Transaction Capacity,

Payback Obligations (CMU, t) =

Sum on all Transactions of the CMU:

*max[0; Reference Price (t) – Strike price (CMU, at Transaction Date)] * Payback Obligated Capacity(CMU, t, Transaction Id) [in €]*

Design Proposal #2: Reference Price definition

The Reference Price must be observed for each hour of the Payback Obligation in the Belgian Day-Ahead Market segment.

Design Proposal #3: CMU choice of NEMO for its Reference Price

A CRM participating Capacity Provider or Prequalified CRM Participant shall choose for each of its CMUs in the Prequalification process, a NEMO operating in Belgium in the Day-Ahead time frame for setting his Reference Price.

The CMU chosen Belgian Day-Ahead market price reference will be used as CRM Reference Price in the Payback Obligation calculation: Reference Price (t)

Design Proposal #4: modification of the Day-Ahead Reference Price & missing data

The Capacity Provider has the possibility for each CMU to notify a modification of its earlier NEMO choice for the Belgian Day-Ahead Market Reference Price of a CMU up to 5 working days prior to a new month of delivery.

The change will be effective as from the 1st calendar day of the next month. In case of missing or conflicting data related to a specific CMU' NEMO choice, the Reference Price Day-Ahead Belgium (publication by ELIA) will be used as fall-back value. The Reference Price Day-Ahead Belgium is determined as the 'Belgian Bidding Zone Day-Ahead Reference Price'. The valid and binding price for the Belgian bidding zone is the single Day-Ahead coupling price ("Belgian SDAC Price") which is calculated by the Market Coupling Operator (MCO) function jointly performed by all Nominated Electricity Market Operators (NEMOs), and is published on the ENTSO-E Transparency Platform and on the websites of the Belgian NEMOs. (https://www.elia.be/fr/donnees-de-reseau/transport/prix-de-reference-day-ahead)

Design Proposal #5: One Single Strike price choice

One Single Strike Price will be applied to all Transactions of the CMUs at the same

Transaction Date.

Design Proposal #6: Update of the Strike Price

For capacity contracted in a Y-4 or Y-1 Auctions, the Strike Price for the relevant Delivery Period as decided by Ministerial Decree no later than 31/3 of the year that Auction applies.

For contracts covering more than one Delivery Period, the Strike Price is not updated during the lifetime of the contract.

The last published Strike Price will also be applicable for Transactions in the Secondary market when calculating the due amount of the Payback Obligation. The timestamp of transaction notification as known by Elia will settle the Strike Price of a CMU Secondary Market transaction.

One Single Strike Price will be applied to all Transactions of the CMUs at the same Transaction Date:

Strike Price (CMU, t, Transaction Id) = Calibrated Strike Price (Transaction Date) [€/MWh]

Design Proposal #7: Calibration of the Strike Price

Within the One single Strike Price applicable to all Transactions of the CMUs at the same Transaction Date, a *Calibrated Strike Price (obligation transaction date)* is required:

Once a year and before March 31st:

Considering the construction of a *calibration curve* equal to the Weighted average of the last previous 3 Winters (November 1st to March 31st) of the sum of all the weekly peak hours (weekdays from [8:00 to 20:00[) gathering the elastic part of the cumulative hourly offer and demand curves of all Day-Ahead Belgian Market exchanges (which are taken as couple of prices €/MWh and cumulative quantities in MW) modelled by the following formula:

$$= \begin{matrix} WeightedAverage \\ on\ 3\ last\ Winters\ of \end{matrix} \sum_{i=1}^{\substack{All\ Winter \\ Peak\ hours}} \sum_{j=1}^{\substack{All\ Belgian \\ DA\ Markets}} \begin{matrix} Elastic\ Part\ of\ demand\ curve\ (i,j) \\ + \\ Elastic\ Part\ of\ offer\ curve\ (i,j) \end{matrix} \Bigg/ \begin{matrix} Number \\ of\ peaks \\ hours\ of \\ Winter \end{matrix}$$

The Elastic part of the cumulative hourly demand and offer curves is including all registered orders except the simple blocks, linked blocks, exclusive groups or loop blocks, and the ones below or equal to a price of zero and the ones at market price cap.

The volume part of the constructed curve will be normalized for the quantities part leading to a curve representing a % range of quantities with their corresponding prices in €/MWh.

The weighted average on the last three Winters will be volume based using the Winter Maximal volume of the Simple average of Sum of cumulative offer and cumulative demand curves.

A Calibrated Strike Price (in €/MWh) will be selected for the next publication date on the calibration curve which will represent a % range of cumulated volume of reaction within a range of [70;90]%

The selected Strike Price level and % within the predefined range shall take into account:

 The shape of the average calibration curve observed (applied to the 3 previous Winters, for weekly peak hours): whether the curve is reaching a plateau at the lower/upper bound of the cumulated % level

 Market evolutions possibly having an impact on prices & market actors' reactions

 The stability of the Strike Price over time

The *Calibrated Strike Price* will be settled for all Transactions of the Primary Market selected and Secondary Market traded at a transaction date above or equal to its publication date and before the next *Calibrated Strike Price* publication date.

Design Proposal #8: Payback Obligated volume definition

Payback Obligated Capacity (CMU, t, Transaction Id) = Transaction Capacity (CMU, t, Transaction Id) * Availability Ratio (CMU, t) * Load Following Ratio (t)

Design Proposal #9: Availability Ratio definition

For a CMU the Availability Ratio (t) equals:

MIN[1; [Available Capacity (CMU, t)) / Obligated Capacity (CMU, t)]

This value is always lying between 0 and 1.

Design Proposal #10: Load Following Ratio definition

For all CMUs the Load Following Ratio (t) equals:

min [1; [Total Load (t) / Reference Peak Load (t)]]

This value is always lying between 0 and 1.

Design Proposal #11: Payment exemption outside of the SLA hours and extra hourly Transaction Periods for the Energy Constrained CMU

The Payback Obligation is due at any period of the Transaction for which the AMT moments are considered for Penalties according to the CMU SLA for the Energy Constrained CMU. It is also due for any other period of its extra Secondary Market hourly Transactions (during the SLA hours and non-SLA hours).

Design Proposal #12: Payback Obligation Stop-loss on Primary Market obligation

A Stop-Loss mechanism applies on the Payback Obligations regarding a Delivery Period of a CMU Contracted Capacities (solely from the Primary Market). It cannot exceed the contract value for that Delivery Period.