



CRM Design Note: Intermediate Price Cap

September 2019

Table of contents

Introduction and context	3
1 Rationale for intermediate price cap	6
1.1 Limiting the CRM cost by avoiding inframarginal CRM rents	6
1.2 Market power mitigation	8
2 Scope of intermediate price cap	10
2.1 The intermediate price cap is applicable to CMUs applying for one-year contracts	10
2.2 Intermediate price caps are an enduring measure	11
2.3 Intermediate price caps apply in both Y-4 and Y-1 auction	11
3 Calibration methodology of intermediate price cap	12
3.1 Worst performer analysis among existing technologies	12
3.2 Different steps of the calibration methodology	12
3.2.1 Step 1: Cost estimation for short-list of existing technologies (see principles (3)-(4)-(5))	13
3.2.2 Step 2: Revenue estimation (see principle (6))	13
3.2.3 Step 3: Missing-money estimation (see principle (7))	14
3.2.4 Step 4: Proposal of intermediate price cap (see principles (1)-(2))	14

Introduction and context

The purpose of the present design note is to provide all stakeholders with a clear view concerning on the one hand the rationale for having an intermediate price cap in the auctions and on the other hand, the scope and the methodology for calibration of this intermediate price cap.

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 welcomed. 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 **Friday 11 October 2019 at 6 pm**.

Early October also a second set of design notes will be launched by Elia for public consultation.

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 2019¹ (hereafter "CRM Law"), modifying the Electricity law of 29 April 1999 on the organization of the electricity market (hereafter "Electricity law") defines in Art. 2 a price limit ("prijslimiet/plafond de prix") as "the maximum price of bids permitted in the auctions and/or the maximum capacity remuneration received by capacity providers after auction closure."

The Electricity Law Art. 7undecies §2 foresees the introduction of one or more such price limits, which are to be interpreted as comprising both the global auction price cap and an intermediate price cap. This design note only focuses on the intermediate price cap, the global auction price cap is out of scope.

The CRM law further foresees the governance framework of the intermediate price cap

¹ <https://www.dekamer.be/FLWB/PDF/54/3584/54K3584001.pdf>

parameter, 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 calculation 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.

Bid caps or price caps?

For the sake of clarity and building further on the legal definition of a price limit, in this design note, an explicit distinction is made between a bid cap and a price cap. **While a bid cap only determines the maximum bid price for a bid in the auction, a price cap additionally also limits the maximum remuneration that capacity providers can receive from the auction for this bid to the level of this cap.** These principles are illustrated in Figure 1 below, in which also a distinction is made between a pay-as-bid and pay-as-cleared pricing rule.

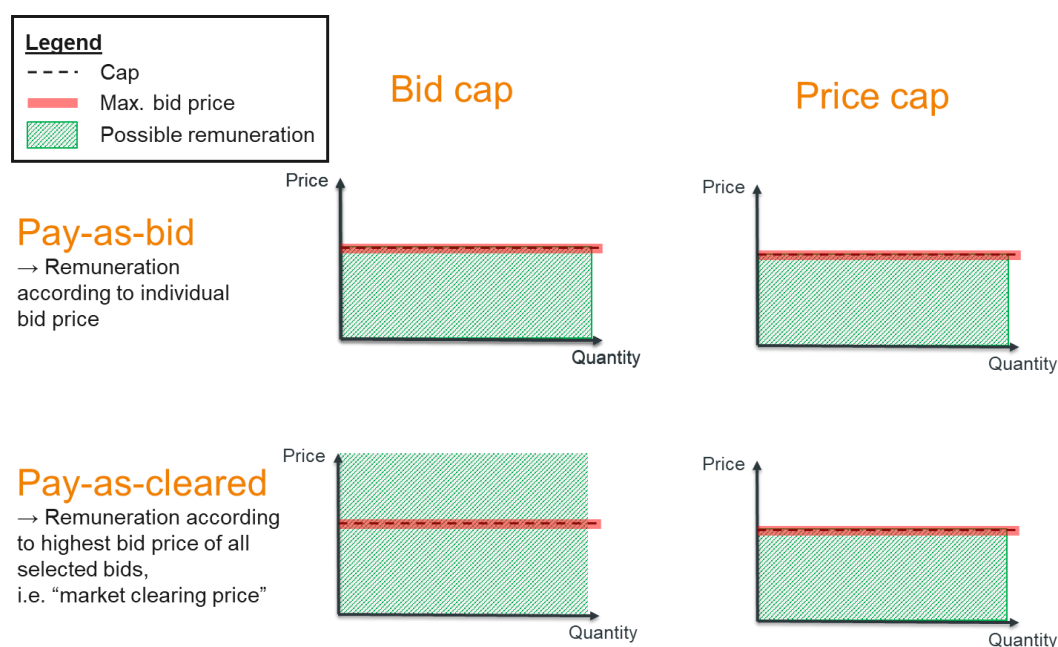


Figure 1: Implications for bids subject to a bid/price cap under a pay-as-bid/pay-as-cleared pricing rule in terms of maximum bid price and possible remuneration

From Figure 1, it can be derived that in case a pay-as-cleared pricing rule applies (cf. discussed in *CRM Design Note: Auction Algorithm²*), a bid cap (down, left on the figure)

² This design note will be launched for public consultation together with the second set of design notes early October.

limits the bid price for a bid but not the possible remuneration that can be received for this bid. Indeed, in case the market clearing price is higher than the bid cap (because of an accepted high price bid not subject to the bid cap), and since under pay-as-cleared this market clearing price applies to all bids, bids that are subject to the bid cap would receive a remuneration that is higher than this bid cap. This contrasts with the case of a price cap (below, right on the figure), whereby not only the bid price but also the possible remuneration for a bid is limited to the level of this price cap.

Also illustrated in Figure 1 (up on the figure), in case a pay-as-bid pricing rules applies (cf. discussed in *CRM Design Note: Auction Algorithm*), there is no additional impact of a price cap compared to a bid cap, as capacity providers are remunerated according to their individual bid price anyway.

Note that both the intermediate price cap (scope of this design note) and the global auction price cap (out of scope for this design note) fall into the category of price caps and not bid caps. The intermediate price cap will apply regardless of the implemented pricing rule, i.e. in both a pay-as-bid and pay-as-cleared mechanism.

Structure of the design note

In what follows, firstly the rationale for applying an intermediate price cap in the auctions is provided. Secondly, the scope of the proposed intermediate price cap is discussed, specifying which bids shall be subject to the intermediate price cap and explaining its enduring character. Finally, the calibration methodology of the intermediate price cap is outlined.

In annex, an overview is given of the complete set of proposed principles of this design note, which shall form the basis for drafting the proposal of Royal Decree articles with respect to the methodology for setting the intermediate price cap.

1 Rationale for intermediate price cap

In general, the introduction of an intermediate price cap serves two purposes.

Firstly, as further explained in section 1.1, by means of an intermediate price cap, windfall profits that may otherwise arise from disproportionate capacity remuneration can – at least partly – be avoided. As such, an intermediate price cap contributes to the overall objective as defined in the CRM law to keep the cost of the CRM as low as possible while at the same time ensuring a proportionate and appropriate remuneration for capacity providers.

The windfall profit avoidance reasoning, i.e. avoiding that capacity providers obtain a higher than necessary remuneration as a consequence of the auction design, is valid under both a pay-as-cleared and pay-as-bid pricing rule.

Secondly, as further explained in section 1.2, but only in case a pay-as-cleared pricing rule applies, an intermediate price cap also acts as a market power mitigation measure, discouraging and in some ways even preventing improper strategic behavior from CRM candidates in the auction. In particular, an intermediate price cap avoids so-called ‘economic withholding’ of capacity and discourages CRM candidates from engaging into strategic mothballing/closure behavior.

1.1 Limiting the CRM cost by avoiding inframarginal CRM rents

A CRM as being deployed in Belgium is conceived as a remuneration mechanism complementary to the energy market (incl. ancillary services) to ensure that capacity providers are capable to cover their costs including a reasonable and fair rate of return. Being complementary to the energy market implies that the initial sources of revenues should come from the energy market and that only the residual part, i.e. the so-called missing money, is ensured via the CRM.

As the CRM is complementary to the energy market and residual as revenue stream, there is no economic rationale behind an inframarginal rent resulting from the CRM auctioning mechanism. Indeed, in the CRM auction, competitive bids should correspond with the missing-money levels for the respective Capacity Market Units (CMUs). The missing-money of a CMU can be interpreted as already consisting of the share of investment/refurbishment and fixed O&M costs that cannot be recovered through anticipated revenues from the energy, balancing and ancillary service markets, plus a certain mark-up to secure a fair and sufficient return on investment. Hence, there is no economic rationale for allocating an additional surplus inframarginal rent on top of the bid price of the capacity providers. The bid price of the capacity provider should be driven by its level of missing money. Such surplus inframarginal rent could be considered as a

windfall profit and should be avoided in order to limit the overall cost of the CRM.³

Inframarginal rent in CRM auctions can arise when the CMUs that compete are characterized by diverging levels of missing-money. It is reasonable to expect that new capacity CMUs requiring substantial capex investments are associated with significantly higher levels of missing-money than existing capacity CMUs currently already operating in the market. As such, especially when new capacity is expected to be selected in the auction given a significant adequacy concern, an important potential for inframarginal rent – and hence windfall profits – arises for existing capacity when no intermediate price cap applies.

This reasoning is valid for both the pay-as-cleared and pay-as-bid pricing rule. Under a pure pay-as-cleared mechanism, where all winning bids receive the same (clearing) price, the higher market clearing price would automatically apply to all accepted bids. In a pay-as-bid mechanism, where each winning bid receives its own bid price, rational bidding behavior implies to bid in close to the anticipated market clearing price thereby directly incorporating an expected inframarginal rent in the price of the bid.

Through the introduction of an intermediate price cap, it is possible to significantly limit the share of the inframarginal rents, as conceptually illustrated in Figure 2 below, and thereby reduce the cost of the CRM. For illustrative purposes and sake of simplicity only, a sloped demand curve and pay-as-cleared pricing rule are assumed.

The intermediate price cap – in line with the proposal explained further in this design note – applies only to bids related to CMUs applying for a 1-year capacity contract. Although the intermediate price cap does not eliminate all inframarginal rents as there could remain differences within the 1-year capacity contract category and/or within the multi-year category, it may manage to avoid a significant part of the otherwise disproportionately allocated inframarginal rents (avoided windfall profits are illustrated by a green rectangle in Figure 2 below).

Note that no additional intermediate price caps are foreseen to differentiate between multi-year contracts of different lengths as - unlike the clear difference between existing and new or refurbished CMUs – there is no necessary correlation between the level of investment and the level of anticipated missing money (see also section 2.1).

³ Note that unlike in a CRM, inframarginal rents earned via the energy market constitute a crucial part of the revenues of a capacity provider and particularly serve at covering fixed costs, etc.

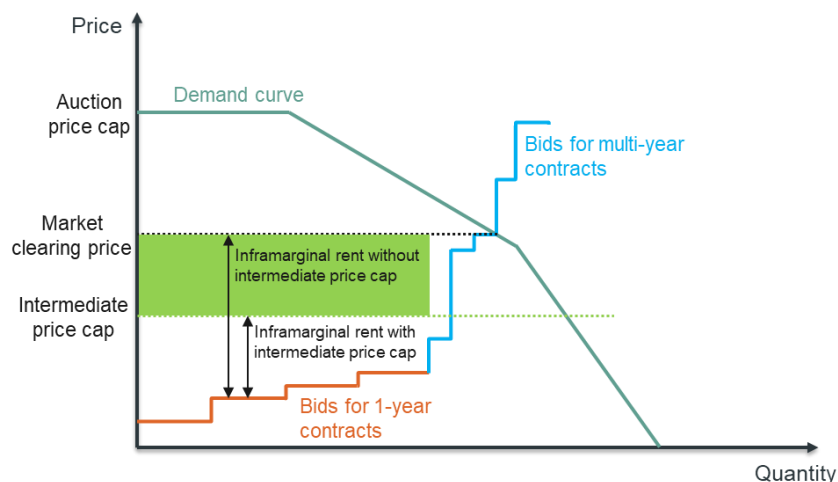


Figure 2: Conceptual illustration on the windfall profit avoidance through intermediate price cap. The green area indicates the gain for society by introducing the intermediate price cap

1.2 Market power mitigation

In case a pay-as-cleared pricing rule applies, an intermediate price cap acts as a market power mitigation measure, defining both the maximum bid price allowed to bid into the auction and additionally also the maximum capacity remuneration that can be received by capacity providers after closure of the auction.

The determination of a maximum bid price is useful as market power mitigation measure, since it limits the potential for improper strategic behavior of CRM candidates in the form of so-called ‘economic withholding’ of capacity. Economic withholding occurs when CRM candidates would set the bid price for a certain CMU at such high level that it is effectively priced out of the market. By means of economic withholding, CRM candidates could exploit a pivotal position in the auction, leading to a higher market clearing price that would then benefit other accepted CMUs in their portfolio.

Economic withholding is an alternative to physical withholding, whereby CRM candidates refrain from even offering their CMU into the auction. Physical withholding of existing capacity is neutralized in the CRM design by means of an obligated notification to the grid operator when prequalified capacity – and all eligible production capacity within the Belgian control zone is obligated to prequalify according to Art. 7undecies §4, third paragraph of the Electricity Law – will not (or only partly) be offered into the auction. In line with Art. 7undecies §6, final paragraph of the Electricity Law this allows the grid operator to take the necessary measures to correct for this so-called opt-out capacity, thereby also preventing capacity holders to behave strategically through physical withholding so as to influence the market clearing price. The treatment of opt-out capacity will be discussed in detail in *CRM Design Note: Auction Algorithm*.

An intermediate price cap is additionally useful as market power mitigation measure, to discourage market parties from even more aggressive strategic behavior to influence the market clearing price. By strategically mothballing or closing existing capacity, thereby

effectively taking capacity out of the market (hence no contribution to adequacy), market parties could create capacity scarcity, influencing the market clearing price. The intermediate price cap, by determining the maximum capacity remuneration that existing CMUs subject to this price cap can receive, discourages market parties from engaging into strategic mothballing or closing existing capacity as the potential benefit (i.e. via the capacity remuneration for capacity that remains in the market) from doing so is restricted. Also timings foreseen for the notification obligation on definitive or temporary closure following Art. 4bis of the Electricity Law of 1999 contribute to limiting such behavior.

2 Scope of intermediate price cap

Firstly, this chapter clarifies the choice for a single intermediate price cap applicable to all CMUs applying for one-year capacity contracts, and no intermediate price cap for CMUs applying for multi-year capacity contracts. Secondly, the enduring character of the proposed intermediate price cap is argued. Finally, it is explained why it is appropriate to apply the intermediate price cap in both Y-4 and Y-1 auctions.

2.1 The intermediate price cap is applicable to CMUs applying for one-year contracts

A single intermediate price cap shall be applicable to all CMUs applying for a one-year capacity contract, including CMUs voluntarily applying for a one-year contract despite being eligible for a multi-year capacity category (cf. *infra*). There will be no intermediate price cap for CMUs applying for a multi-year capacity contract, which are thus only subject to the global auction price cap.

In line with the rules that will be set out by the regulator on investment thresholds, before the auction and in parallel with the prequalification process, a CRM candidate can apply for a multi-year capacity contract for each CMU that requires significant investments. In alternative CRM terminology, this process is defined as the application for another capacity category (max. 3, 8 or 15 years) than the one-year capacity category to which each CMU is assigned by default. By the end of the prequalification process, the CRM candidate has to indicate – for each CMU – the contract duration for which it wants to apply, which can of course not be longer than the capacity category to which it has been assigned. Multi-year contracts facilitate participation to the auction of projects with high capital expenditure, in a way that it provides a level playing field for them compared to projects not requiring substantial investments.

As such, by design, CMUs within the one-year capacity category are confronted with no or minimal investments to cover for and hence also a lower expected level of missing-money. Therefore, to avoid windfall profits for CMUs within the one-year capacity category, it makes sense to apply an intermediate price cap to the one-year capacity category. Indeed, awarding them a capacity remuneration equal to the missing-money level of capacity projects requiring substantial investments would be disproportionate (cf. *supra*).

Regarding the CMUs applying for multi-year contracts, which all require substantial investments, it is not straightforward to separate projects or capacity categories in terms of missing-money levels. Although, for instance, the investment cost for a new OCGT unit is expected to be lower compared to the required investments to build a new CCGT unit, the missing-money for both units might be similar due to higher anticipated energy market revenues for the CCGT unit, for instance linked to a higher amount of running hours during which it can collect inframarginal rents in the energy market. It is therefore not considered appropriate to differentiate further intermediate price caps to CMUs

applying for multi-year contracts, let alone apply a different intermediate price cap to each multi-year capacity category. Note, however, that also CMUs applying for a multi-year contract are in any case subject to the global auction price cap, thereby also putting a cap at their potential revenue from the CRM.

2.2 Intermediate price caps are an enduring measure

The intermediate price cap applicable to CMUs within the one-year capacity category is proposed as an enduring measure in the CRM design, meaning that such intermediate price cap shall be defined for each auction that will be organized. The argument concerning the fact that there is no economic rationale behind inframarginal rent in a CRM context as explained above as well as the advantages linked to market power mitigation, remain valid over time.

Assuming a pay-as-cleared pricing rule, the selection of even a limited investment capacity project with high missing-money, would result in disproportionate inframarginal rent allocation to all existing capacity in case no intermediate price cap would be applied.

2.3 Intermediate price caps apply in both Y-4 and Y-1 auction

Following the above drivers for an intermediate price cap, there is no reason to differentiate with respect to the application of an intermediate price cap between Y-4 and Y-1 auctions. The appropriate level of the intermediate price cap could however vary per delivery period and per auction (Y-1, Y-4). Indeed, the potential for inframarginal rents can arise in both Y-4 and Y-1 auctions, as CMUs with high levels of missing-money (and possibly applying for multi-year contracts in case substantial investments are required) can participate and be selected in both. Also the potential for market power abuse and hence the need for an intermediate price cap as market power mitigation measure are valid irrespective of the timing of the capacity auction.

Summary of the proposed principles following from Chapter 2 Scope of the intermediate price cap

- (1) An intermediate price cap is a price cap that applies to all bids related to CMUs applying for a one-year capacity contract
- (2) A single intermediate price cap shall be determined for each Y-1 and Y-4 capacity auction organized.

3 Calibration methodology of intermediate price cap

A good calibration of the intermediate price cap is key. On the one hand, the intermediate price cap should be sufficiently low to be effective and to ensure that disproportionate inframarginal rents are avoided to a maximum extent possible. On the other hand, the intermediate price cap should also not be too low, as this could obstruct some CMUs – subject to the intermediate price cap and confronted with a higher level of missing-money than the level of this cap – from participating in the CRM and thereby be confronted with a potentially unnecessary market exit signal.

3.1 Worst performer analysis among existing technologies

It is considered the most accurate approach to align the intermediate price cap applicable to all CMUs applying for a one-year capacity contract with the missing-money level of the worst performing technology class currently in the market, i.e. the technology class with the highest missing-money.

Although the set of CMUs applying for a one-year capacity contract does not necessarily exclusively correspond with existing capacities, a worst performer analysis among existing technology classes is deemed an appropriate benchmark for missing-money of CMU's requiring minimal investments. Besides, it is neither possible nor desirable from a cost-efficiency point of view to consider all possible technologies with limited investments – hence also new and currently unknown – to calibrate the intermediate price cap.

By looking at both costs and revenues, the proposed calibration methodology results in a decreasing intermediate price cap when market conditions improve and levels of anticipated missing money drop, thereby ensuring that the intermediate price cap remains proportionate. Furthermore, by looking at existing technologies currently in the market, there is a strong correlation between the calibration methodology and the target group of the intermediate price cap – being CMUs requiring minimal investments and thereby largely corresponding with existing capacities.

3.2 Different steps of the calibration methodology

In general, on a yearly basis an intermediate price cap will be determined for all auctions that will be organized. The intermediate price cap will be calibrated to the delivery period to which this auctions relates.

In Figure 3 hereunder, the sequential steps of the calibration methodology towards the construction of an intermediate price cap are outlined, also indicating who is responsible for each step and the intended frequency of updating each component. A detailed explanation of each step can be found below.

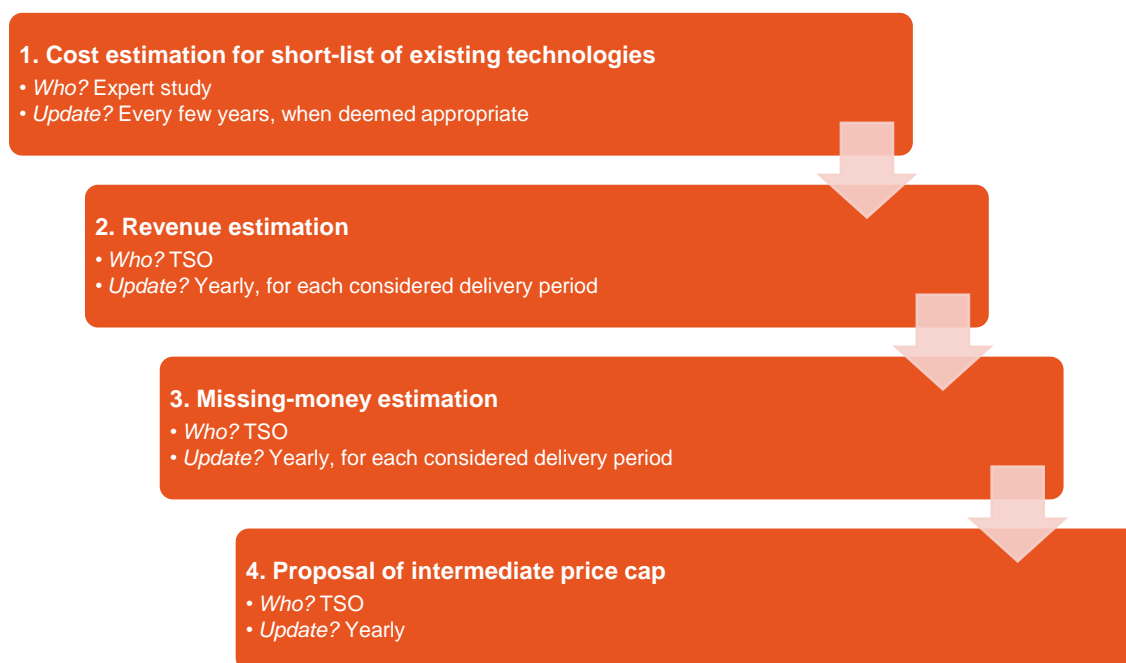


Figure 3: Steps in calibration process towards intermediate price cap

3.2.1 Step 1: Cost estimation for short-list of existing technologies (see principles (3)-(4)-(5))

A short-list of existing technology classes to be considered in the calibration methodology of the intermediate price cap shall be determined via an independent expert study on behalf of and in collaboration with the TSO and the regulator. This expert study shall include, for each technology on the short-list, the following cost components with respect to a reference delivery period (e.g. 1 November 2025 – 31 October 2026):

- Annualized routine investments not directly linked to a life-time extension or capacity augmentation;
- Yearly fixed O&M costs;
- Short run marginal costs (possibly including but not limited to: primary fuel costs, CO2 costs, variable O&M costs, efficiency rates, etc.).

In addition, the expert study shall determine a methodology to translate each cost component to a delivery period when market or technological conditions have not changed considerably and hence a full update of the study is not required, e.g. by means of an indexation parameter.

This step will be performed at the beginning of the CRM process and updated only when deemed appropriate, e.g. every few years. In case of an update, the cost components will be estimated related to a new reference delivery period and also the methodology to translate each cost component to a delivery period shall be reviewed.

3.2.2 Step 2: Revenue estimation (see principle (6))

For each technology listed in step 1, a revenue estimation shall be performed by the

TSO with respect to the applicable delivery period. For each technology, the following revenue components shall be estimated:

- Yearly inframarginal rents earned on the energy market
 - determined based on a probabilistic market modeling tool;
 - taking into account a reference scenario that reflects expected circumstances⁴;
 - taking into account the short run marginal costs as determined by the expert study in step 1;
 - considering P50 revenues and taking into account the applicable strike price level, as defined in the Royal Decree methodology meant in Art. 7undecies §2 of the Electricity Law.
- Yearly balancing and ancillary service market revenues
 - determined based on total historical procurement cost for balancing and ancillary services.

This step will be performed during the yearly process defining the auction parameters to be proposed.

3.2.3 Step 3: Missing-money estimation (see principle (7))

Based on the results of steps 1 and 2, a missing-money estimation shall be performed by the TSO with respect to the relevant delivery period. For each technology, the missing-money shall be estimated as follows:

Missing-money =

- annualized routine investments
- + yearly fixed O&M costs
- yearly energy market revenues
- yearly balancing and ancillary service market revenues

This step will be performed during the yearly process defining the auction parameters to be proposed.

3.2.4 Step 4: Proposal of intermediate price cap (see principles (1)-(2))

In this final step, a proposal for the intermediate price cap shall be put forward by the TSO. The proposed intermediate price cap shall be equal to the highest missing-money of the technologies considered for the relevant delivery period. Note that one

⁴ The scenario used here shall be consistent with the one(s) determined to calibrate the volume to be procured through the CRM as defined in the Royal Decree methodology meant in Art. 7undecies §2 of the Electricity Law.

intermediate price cap shall be proposed per auction. Therefore, several intermediate price caps will be proposed when more than one auction will be organized (e.g. two when one Y-4 and one Y-1 auction will be organized).

This step will be performed during the yearly process defining the auction parameters to be proposed.

Summary of the proposed principles following from Chapter 3 Calibration methodology of intermediate price cap

When? How many?

(1) On a yearly basis, an intermediate price cap will be proposed for each auction that will be organized, related to the relevant delivery period to which this auction relates.

How?

(2) The intermediate price cap shall be equal to the missing-money of the technology with the highest missing-money among the technologies listed in (3).

The missing-money for each technology listed in (3) shall be estimated according to the formula provided in (7), taking into account the cost estimation as referred to in (4)-(5) and revenue estimation as referred to in (6).

• technologies

(3) A list of existing technologies to be considered for the calibration of the intermediate price cap shall be based on an independent expert study on behalf of and in collaboration with the TSO and the regulator. This list of technologies shall be updated only when deemed appropriate, i.e. when market or technological conditions have changed considerably.

• costs

(4) For each technology listed in (3), the following cost components shall be estimated based on an independent expert study on behalf of and in collaboration with the TSO and the regulator, with respect to a reference CRM delivery period:

(a) annualized routine investments not directly linked to a life-time extension or capacity augmentation (in €/year),

(b) yearly fixed O&M costs (in €/year),

(c) short run marginal costs (in €/MWh).

The cost component estimation shall be updated only when deemed appropriate, i.e. when market or technological conditions have changed considerably.

(5) A methodology shall be determined by an independent expert study on behalf of and in collaboration with the TSO and the regulator to translate each cost component as determined in (4) to another delivery period.

This methodology shall be updated together with, and hence when deemed appropriate

for, the cost estimation as referred to in (4).

• **revenues**

(6) For each technology listed in (3), the following revenue components shall be estimated by the TSO:

(a) yearly inframarginal rents earned on the energy market (in €/year)

i) determined based on a probabilistic market modelling tool

ii) taking into account a reference scenario consistent with the one(s) determined to calibrate the volume to be procured through the CRM as defined in the Royal Decree methodology meant in Art. 7undecies §2 of the Electricity Law base case scenario

iii) taking into account the short run marginal costs as determined in the cost component estimation as referred to in (4) (c)

iv) considering P50 revenues and taking into account the applicable strike price level, as defined in the Royal Decree methodology meant in Art. 7undecies §2 of the Electricity Law and considering P50 revenues.

(b) yearly balancing and ancillary service market revenues (in €/year) determined based on total historical procurement cost for balancing/ancillary services based on historical data.

The revenue component estimation shall be updated on a yearly basis.

• **missing-money**

(7) For each technology listed in (3), a missing-money estimation shall be performed by the TSO, according to the following formula:

Missing-money =

Annualized routine investments not directly linked to a life-time extension or capacity augmentation, as referred to in (4) (a), if necessary translated to the relevant delivery period according to the methodology as referred to in (5)

+ Yearly fixed O&M, as referred to in (4) (b), if necessary translated to the relevant delivery period according to the methodology as referred to in (5)

- Yearly inframarginal rents earned on the energy market, as referred to in (6) (a)

- Yearly balancing and ancillary service market revenues, as referred to in (6) (b)

The missing-money estimation shall be updated on a yearly basis.

Annex: Summary of the proposed principles as a basis towards the intermediate price cap articles in the Royal Decree Methodology

Scope of the intermediate price cap:

- (1) An intermediate price cap is a price cap that applies to all bids related to CMUs applying for a one-year capacity contract
- (2) A single intermediate price cap shall be determined for each Y-1 and Y-4 capacity auction organized.

Calibration methodology of intermediate price cap:

When? How many?

- (1) On a yearly basis, an intermediate price cap will be proposed for each auction that will be organized, related to the relevant delivery period to which this auction relates.

How?

- (2) The intermediate price cap shall be equal to the missing-money of the technology with the highest missing-money among the technologies listed in (3).

The missing-money for each technology listed in (3) shall be estimated according to the formula provided in (7), taking into account the cost estimation as referred to in (4)-(5) and revenue estimation as referred to in (6).

• technologies

- (3) A list of existing technologies to be considered for the calibration of the intermediate price cap shall be based on an independent expert study on behalf of and in collaboration with the TSO and the regulator. This list of technologies shall be updated only when deemed appropriate, i.e. when market or technological conditions have changed considerably.

• costs

- (4) For each technology listed in (3), the following cost components shall be estimated based on an independent expert study on behalf of and in collaboration with the TSO and the regulator, with respect to a reference CRM delivery period:

- (a) annualized routine investments not directly linked to a life-time extension or capacity augmentation (in €/year),
- (b) yearly fixed O&M costs (in €/year),
- (c) short run marginal costs (in €/MWh).

The cost component estimation shall be updated only when deemed appropriate, i.e. when market or technological conditions have changed considerably.

- (5) A methodology shall be determined by an independent expert study on behalf of and in collaboration with the TSO and the regulator to translate each cost component as determined in (4) to another delivery period.

This methodology shall be updated together with, and hence when deemed appropriate for, the cost estimation as referred to in (4).

• **revenues**

(6) For each technology listed in (3), the following revenue components shall be estimated by the TSO:

(a) yearly inframarginal rents earned on the energy market (in €/year)

- i) determined based on a probabilistic market modelling tool
- ii) taking into account a reference scenario consistent with the one(s) determined to calibrate the volume to be procured through the CRM as defined in the Royal Decree methodology meant in Art. 7undecies §2 of the Electricity Law base case scenario
- iii) taking into account the short run marginal costs as determined in the cost component estimation as referred to in (4) (c)
- iv) considering P50 revenues and taking into account the applicable strike price level, as defined in the Royal Decree methodology meant in Art. 7undecies §2 of the Electricity Law and considering P50 revenues.

(b) yearly balancing and ancillary service market revenues (in €/year) determined based on total historical procurement cost for balancing/ancillary services based on historical data.

The revenue component estimation will be performed during the yearly process defining the auction parameters.

• **missing-money**

(7) For each technology listed in (3), a missing-money estimation shall be performed by the TSO, according to the following formula:

Missing-money =

- Annualized routine investments not directly linked to a life-time extension or capacity augmentation, as referred to in (4) (a), if necessary translated to the relevant delivery period according to the methodology as referred to in (5)
- + Yearly fixed O&M, as referred to in (4) (b), if necessary translated to the relevant delivery period according to the methodology as referred to in (5)
- Yearly inframarginal rents earned on the energy market, as referred to in (6) (a)
- Yearly balancing and ancillary service market revenues, as referred to in (6) (b)

The missing-money estimation will be performed during the yearly process defining the auction parameters.