CRM Design Note:

Availability Obligation

June 2025

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1 Introduction

1.1 Context and goal of this design note

This Design Note is provided for explanatory purposes only and does not confer any rights or permissions to the reader. The implementation and detailed design of the design concepts outlined in this document may vary based on specific constraints, or evolving design considerations. This document does not serve as a strict instruction manual.

This document does not constitute a legal or binding commitment by Elia Transmission Belgium to undertake any specific design or development activities. For the most accurate and up-to-date information, it is recommended that the reader always relies on the latest available information, such as the CRM Functioning Rules.

By reading and using this Design Note, you acknowledge and accept the terms of this disclaimer. This design note was last updated in June 2025 following the CREG's publication of the CRM Functioning Rules on May 15, 2025.

The goal of this present note is to further clarify the current design of the Availability Obligation in the Belgian CRM. It provides the background for design decisions and elaborates how certain elements of the Availability Obligation have evolved over time.

1.2 Scope and structure of the present design note

1.2.1 Legal framework

This design note serves to explain the design concepts proposed for the Belgian CRM concerning Availability Obligation aspects. Article 7undecies § 12 of the Belgian Electricity Law[1] states the following on this aspect (own translation from the law):

"After consultation of the grid users, the transmission system operator submits the market rules of the capacity remuneration mechanism for approval to the Regulator…

The market rules of the Capacity Remuneration Mechanism entail in particular:

(…)

3° the availability obligations (…) for capacity providers, and the penalties for violation of these obligations;

(…)"

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

Furthermore, § 11 in this section of the law reads:

"…During the entire period of delivery of capacity, the transmission system operator will verify the availability of the contracted capacity, in accordance with the market rules of the capacity remuneration mechanism intended in paragraph 12."

This means that the law appoints to Elia the task of proposing the CRM Market Rules – to be approved by CREG – and also the execution of the availability verification during the Delivery Period.

The details for Availability Obligations will be mainly governed by the CRM Functioning Rules and further described in the Capacity Contract. Article 7undecies § 11 also gives a framework for this contract:

"The transmission system operator closes a Capacity Contract with the Capacity Provider. The Capacity Contract describes the rights and obligations of the Capacity Provider, in particular (…) the availability obligation.

(…)

The Capacity Contract is in accordance with the market rules of the Capacity Remuneration Mechanism intended in paragraph 12. The standard Capacity Contract is approved by the Regulator, upon proposal of the transmission system operator, and published on the website of the transmission system operator (…)."

1.2.2 Availability Obligation in the broader framework of the CRM

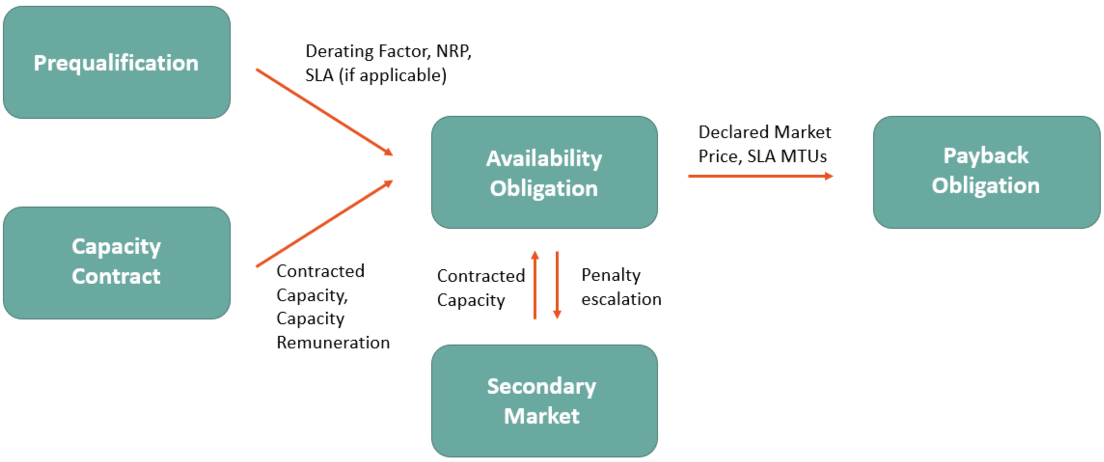

Figure 1: Availability Obligation and links to other CRM topics

The topic of the Availability Obligation interacts with many other elements of the CRM design. In particular the topics Derating Factors, Secondary Market and Prequalification Requirements – as indicated in the figure above – link strongly with the Availability Obligation and will be referred to throughout the text. The reader wishing to learn more about these topics is invited to read the respective design notes.

The Availability Obligation also forms a part of the larger view of the "Capacity Product", i.e. the functioning of a Capacity Market Unit (CMU) once it has been contracted in a CRM. The Availability Obligation plays a specific role and function in the Capacity Product that fits together with the other elements that compose the CRM design.

It is useful to highlight again the different classifications of CMUs as distinguished during Prequalification. In particular, whether or not a unit is Daily Schedule or Non-daily Schedule on the one hand and Energy Constrained or Non-energy Constrained on the other greatly impacts how the Availability Obligation is applied.

Furthermore, section 2 defines objectives the Capacity Product should respect, which are in line with the objectives of the Capacity Remuneration Mechanism and the Functioning Rules as defined in the Belgian Electricity Act[1]. It will conclude on two things:

1. Adequacy, cost-efficiency and no market interference are the prime objectives for the Capacity Product.
2. The Availability Obligation explained in this note as the prime driver of adequacy during the Delivery Period, contrary to the Payback Obligation (capturing windfall profits during the Delivery Period).

1.2.3 Design of the Availability Obligation

Knowing that the main function of the Availability Obligation is guaranteeing adequacy during the Delivery Period, the design is constructed to achieve this objective.

In order to address outages and maintenance, Capacity Providers can notify Elia of Unavailable Capacity which is then taken into account in the remainder of the Availability Obligation. The design of the declaration of Unavailable Capacity is further explained in section 3.

Section 4 develops the Availability Monitoring mechanism further. It selects a trigger-based mechanism using the Day-Ahead Market Price as a reference and most appropriate to achieve the Capacity Product objectives. This leads to the definition of AMT MTUs and AMT Moments that can be monitored. It will then define a method for all participating CMUs to assess a difference between Obligated and Available Capacity at relevant moments for Monitoring of availability.

In case the Availability Monitoring leads to insufficient proof of capacity to deliver energy when needed (i.e. Proven Availability) for certain CMU’s, they are prone to Availability Tests. These are explained in section 5.

Both in the framework of the Availability Monitoring and the Availability Tests, an Available Capacity and Obligated Capacity is established. An Unavailability Penalty applies to a positive difference between Obligated and Available Capacity not covered in the Secondary Market. This is referred to as “Missing Capacity”. Section 6 presents the method for calculating this penalty. Next to a proportional formula to this difference, it foresees modalities for the escalation of penalties.

In order to incentivize Capacity Providers to submit accurate Declared Prices for the Availability Monitoring (see also section 4.3.2.1), Overcapacity and an Overcapacity Penalty are explained in section 7.

Finally, section 8 includes some annexes. These go more into detail about the determination of the so-called SLA MTUs (section 8.1) as well as the calculation of the corrections for Ancillary Services and Redispatching Service (section 8.2).

2 Definition of the capacity product

The Capacity Product is defined as the complete set of rules and regulations that drive the behavior and performance of contracted capacity in the CRM. It thus entails the functioning of Capacity Market Units in the Capacity Remuneration Mechanism after contracting. Different forms of rules and regulations determine this:

- The Clean Energy Package
- the Belgian Electricity Law[1]
- the various Royal Decrees concerning the CRM
- the CRM Functioning Rules
- The Capacity Contract

In essence, the Capacity Product provides the right signals and incentives to achieve the desired objectives from the Capacity Product. Article 7undecies of the Belgian Electricity Law[1] provides a basis for these objectives (own translation):

- § 3. “The level of security of supply to be achieved predetermined before the CRM shall correspond with the demand curve…”
- §1: “…The CRM shall be designed so that the cost is as low as possible”

This means that the overall objective of the CRM for Belgium is to ensure a level of Security of Supply at the lowest cost possible. Both “Adequacy” and “Cost-Efficiency” are therefore considered as the first two primary objectives for the Capacity Product.

A third primary objective of the Belgian CRM is “No Market Interference”. This follows from the Clean Energy Package, which imposes that capacity mechanisms ensure among others:

- Technology neutrality of the mechanism
- Level playing field for all participants
- Limit the market distortions caused by a CRM

Figure 2 summarizes the three principal objectives of the capacity product.

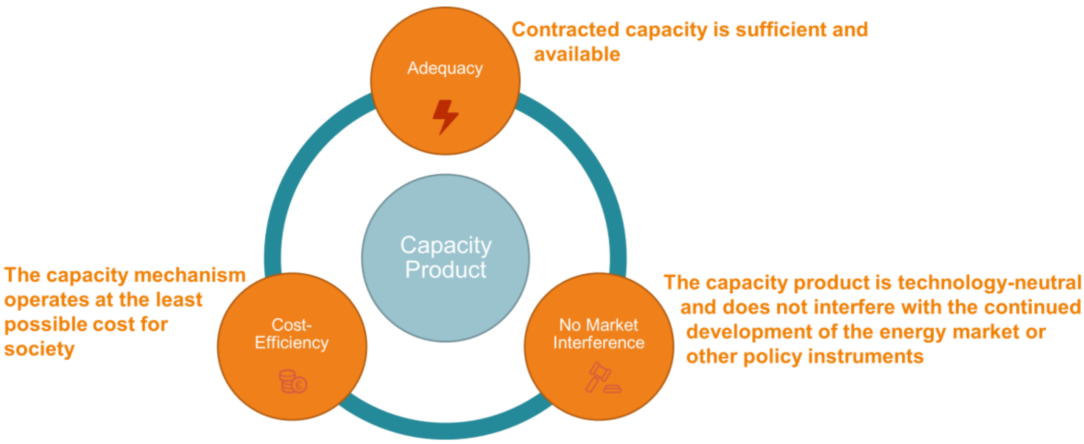

Figure 2: Principal Capacity Product objectives.

Before treating the Availability Obligation design, it is useful to define its role in the bigger picture of the capacity product. It is important to keep in mind that they only come into play after selection of a CMU in the auction and signature of the Capacity Contract. However, the interaction with other design elements applying at that point are also of importance. Particularly, the Pre-Delivery Monitoring and Payback Obligation have also their characteristics/boundaries and also serve objectives. They will thus also influence the aforementioned functioning of the Capacity Market Units. The boundaries and objectives of each of these elements thus warrant a clear definition.

In this light, the design considers the Availability Obligation as the **prime driver for adequacy during the Delivery Period**, by ensuring the availability of CMUs at adequacy-relevant moments. Figure 3 gives a summary of the relationship between Availability Obligations and Penalties, Pre-Delivery Monitoring and the Payback Obligation.

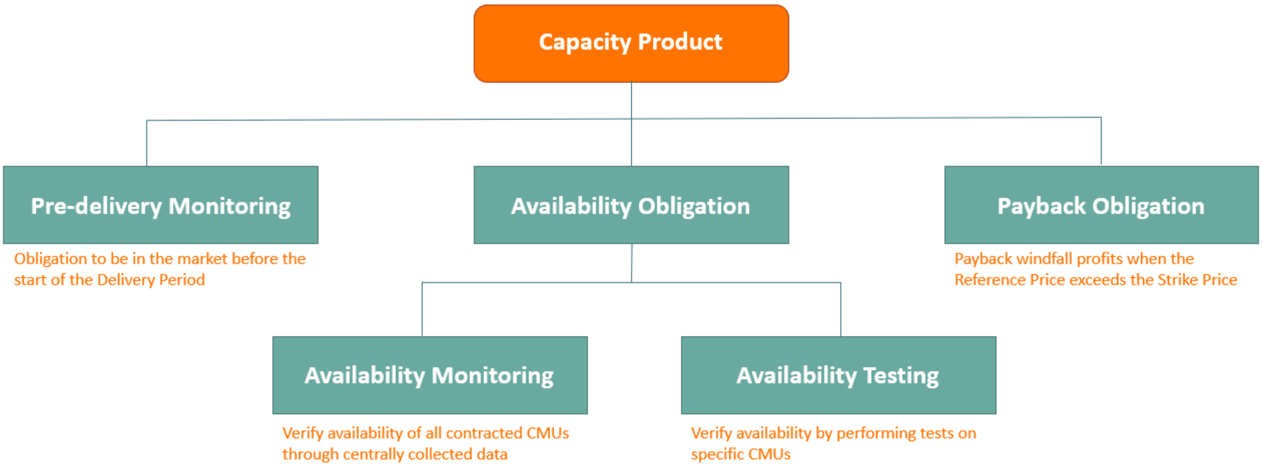

Figure 3: Summary of the different obligations of the Capacity Product

The Pre-Delivery Monitoring serves a twofold purpose:

- For Existing CMUs, to ensure that they remain in the market; and
- For Additional and/or Virtual CMUs, to ensure entry into market.

It takes place in the period starting from signature of the Capacity Contract right up until the Delivery Period. From this point onwards, the Availability Obligation will take over. The reader interested in the process of the Pre-delivery Monitoring is invited to read the dedicated design note.

The remainder of this design note will treat the cases where a CMU has successfully completed the Pre-delivery Monitoring and undergoes the Availability Obligations as from the start of the Delivery Period.

In parallel to the Availability Obligation, the Payback Obligation characterized by the Strike Price and Reference Price applies throughout the Delivery Period. The design note on the Payback Obligation contains the details of this specific component of the Belgian CRM.

3 Unavailable Capacity & Scheduled Maintenance

As highlighted in section 2, the CRM aims to not interfere with normal market behaviour. As a result, Elia recognizes that occasional unavailabilities are inherent to participation to the energy markets and provides the possibility to notify Elia of such Unavailabilities.

In addition to not interfering with normal market behaviour, another cornerstone of the capacity product is ensuring adequacy. To that extent the framework of the declaration of Unavailable Capacities provides incentives to still be available when the system needs them.

The Belgian CRM provides two frameworks that interact with each other:

- Unavailable Capacity allows Capacity Providers to notify Elia of outages and shorter maintenance.
- Scheduled Maintenance gives Capacity Providers the possibility to declare longer periods of unavailability when this is known some time in advance.

3.1 Unavailable Capacity

The framework of Unavailable Capacity allows Capacity Providers to notify Elia in case of a planned short-term outage, a forced outage, or any other limitation on the capacity of the unit relative to the Nominal Reference Power. A Capacity Provider must notify Elia of such unavailability as soon he becomes aware of it.

The result of a notification is the **Remaining Maximum Capacity**, which expresses how much of the Nominal Reference Power remains after taking into account the Unavailable Capacity. It is represented by the following formula and Figure 4:

$$P_{Max,Remaining} = NRP - P_{Unavailable}$$

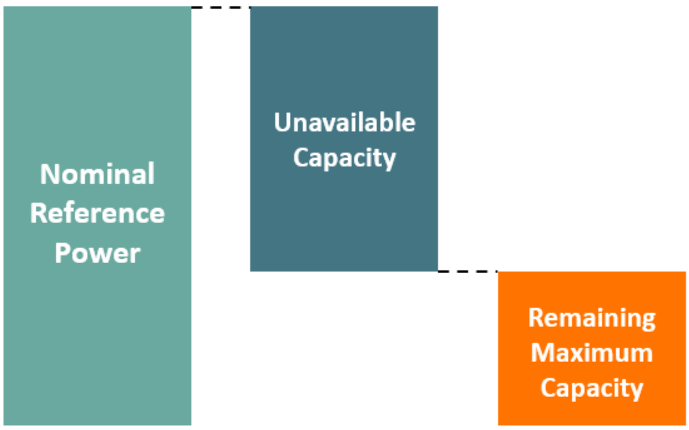

Figure 4: illustration of Remaining Maximum Capacity

The Remaining Maximum Capacity plays an important role in the remainder of the Availability Obligation. In case no Unavailable Capacity is declared, the Remaining Maximum Capacity equals the Nominal Reference Power.

In its notification of Unavailable Capacity, the Capacity Provider can indicate whether he wished for it to be applied as **Announced or Unannounced Unavailable Capacity**:

- Announced Unavailable Capacity can be notified for a maximum of 75 calendar days throughout the Delivery Period per CMU, of which maximum 25 calendar days during the Winter Period.
- Unannounced Unavailable Capacity can be notified without limitations throughout the Delivery Period.

In doing so, the design of Unavailable Capacity serves a twofold purpose. On the one hand, Announced Unavailable Capacity leads to a reduction but not an exemption of Unavailability Penalties, should these occur. It incentivizes Capacity Providers to correctly declare unavailabilities, but by means of a reduced penalty the goal is that they will still minimize its duration.

On the other hand, the limitation of Announced Unavailable Capacity means it cannot be continuously used. Capacity Providers exceeding these limitations will have to resort to Unannounced Unavailable Capacity.

Design Recap:

Capacity Providers can notify Elia of Announced Unavailable Capacity, which leads to a reduction of penalties, should these occur.

The declaration of Unavailable Capacity depends on whether or not a CMU is Daily Schedule or not. The different designs are explained in section 3.1.1 and 3.1.2, respectively.

The reduction of the Unavailability Penalty is established by means of the distinction between Announced Missing Capacity and Unannounced Missing Capacity as per section 6.1 and the corresponding correction factor as per section 6.2.

3.1.1 Unavailable Capacity for Daily Schedule CMUs

CMUs that are classified as Daily Schedule[2] are also subject to the Outage Planning Obligation[3]. As a result, Elia already disposes of detailed data concerning outages and unavailabilities of these units, and for the sake of efficiency these will directly be used.

In particular, Elia uses the data the Capacity Provider submitted in its Availability Plan and the $P_{max,available}$ therein to determine the Remaining Maximum Capacity. Whenever the submitted $P_{max,available}$ drops below the level of the Nominal Reference Power this is automatically considered by Elia as a notification of Remaining Maximum Capacity.

[2] Terms and Conditions of the Scheduling Agent
[3] Terms and Conditions of the Outage Planning Agent

Design Recap:

For Daily Schedule CMUs, the notification of Unavailable Capacity happens automatically based on their Outage Planning. The choice between Announced or Unannounced Unavailable Capacity is done through the CRM IT interface.

3.1.2 Unavailable Capacity for Non-daily Schedule CMUs

Since Non-daily Schedule CMUs are not subject to the Outage Planning Process, Elia does not dispose of data regarding their unavailabilities. Capacity Providers of Non-daily Schedule CMUs must submit their notifications of Unavailable Capacity via the CRM IT Interface.

Note that Non-daily Schedule CMUs can, on a voluntary basis, follow the Outage Planning Process. In that case they can notify Elia of this so that their unavailabilities are processed automatically as well according to section 3.1.1.

Design Recap:

Non-daily Schedule CMUs notify their Unavailabilities manually via the CRM IT interface.

3.2 Scheduled Maintenance

Whereas regular Unavailable Capacity serves for short-term unavailabilities, some longer unavailabilities that are known far in advance can be notified to Elia in the framework of Scheduled Maintenance.

Regular Unavailable Capacity as explained in section 3.1 only results in a reduction but not an exemption of possible Unavailability Penalties. This is done deliberately to still provide Capacity Providers with an incentive to resolve any outages as soon as possible.

In contrast, Scheduled Maintenance provides Capacity Providers with a possibility to be exempted from potential Unavailability Penalties if they notify Elia enough in advance and when it does not take place during the winter period. Scheduled Maintenance helps to maintain the unit in mint condition and prevent unexpected outages during the winter period, where they could prove much more impactful.

Scheduled Maintenance can be used for a maximum of 20 calendar days and must always be used outside of the winter period. Using days for Scheduled Maintenance consumes days from the ‘budget’ of days that can also be used for Announced Unavailable Capacity as explained in section 3.1.

Design Recap:

Capacity Providers can notify Elia more in advance of Scheduled Maintenance, which leads to an exemption of Unavailability Penalties

The difference between Unavailable Capacity and Scheduled Maintenance is summarized in Figure 5 below:

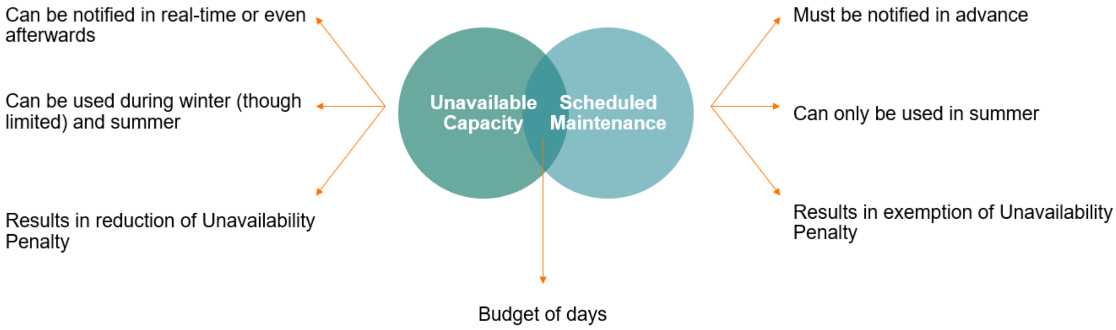

Figure 5: Unavailable Capacity and Scheduled Maintenance

The notification of Scheduled Maintenance depends on whether or not a CMU is Daily Schedule or not. The different designs are explained in section 3.2.1 and 3.2.2, respectively.

The notification of Scheduled Maintenance solely involves an indication of days where the works are supposed to take place. Any Announced Unavailable Capacity (as per section 3.1) that is then declared during these days is then automatically classified as Scheduled Maintenance.

3.2.1 Scheduled Maintenance for Daily Schedule CMUs

As already explained in section 3.1.1, Daily Schedule CMUs are also subject to the Outage Planning Process. Elia will take a snapshot of the Availability Plan on 30/11/Y and lists all days outside of the winter period where the status of the unit is unavailable, denoted by the status code “U”. The Capacity Provider has until 31/12/Y to then select 20 days of Scheduled Maintenance for year Y+1.

3.2.2 Scheduled Maintenance for Non-daily Schedule CMUs

Non-daily Schedule CMUs do not necessarily participate in the Outage Planning Process. Capacity Providers of Non-daily Schedule CMUs can submit their days for Scheduled Maintenance via the CRM IT Interface. However, note that any scheduled maintenance for a CMU without Daily Schedule must be notified at least 90 calendar days in advance.

4 Availability Monitoring

The Availability Monitoring forms the main mechanism for Elia to verify the availability of contracted units. To the degree to which this is possible the Availability Monitoring takes place using centrally collected data. The Availability Monitoring follows a stepwise process that is elaborated in the following sections.

Firstly, section 4.1 discusses the identification of the moments during which Elia will check availability. These **AMT Moments** are characterized as being relevant for adequacy.

In addition to the moments of monitoring, the mechanism defines the required level of availability. This will lead to the definition of **Obligated Capacity** in section 4.2. The definition of Obligation varies depending on whether or not the CMU is Energy Constrained.

Elia then establishes the **Available Capacity** at every moment of monitoring, based on the centrally collected data. The method for the determination of the Available Capacity differs depending on whether or not the CMU is Daily Schedule. This is explained in section 4.3.

4.1 AMT MTUs and AMT Moments

As stated previously, the moments of monitoring have to be relevant for adequacy so that an evaluation of the availability of a CMU reflect its actual contribution to adequacy. An objective manner to identify these moments is necessary. This will further be referred to as the **Availability Monitoring Trigger (AMT)**, a trigger based on the Day-Ahead price exceeding a certain level. Moments identified by this trigger are defined as **AMT Moments**. Hence, anytime the Day-Ahead price exceed the pre-defined AMT price, there is an AMT Moment.

Design Recap:

Elia can perform Availability Monitoring subsequent to an Availability Monitoring Trigger (AMT). Elia can assess the Available Capacity on all CRM-contracted capacity during the AMT Moments identified by an AMT.

Section 4.1.1 discusses the selection of the Day-Ahead price for the AMT. Subsequently, section 4.1.2 explains the determination of the AMT price level, the surpassing of which triggers an AMT Moment. Section 4.1.3 goes more into detail how such surpassing is determined and notified to market parties.

4.1.1 AMT based on Day-Ahead price

In a market environment like the electricity market, scarcity moments are strongly correlated with electricity market price, as this price is driven by the merit order of capacity offered to the system. The higher the market price, the less margin typically remains between production and demand and the more the system approaches complete exhaustion of these resources (i.e. scarcity). Stated otherwise, a market price is a good and reliable summary of the state of the system in terms of adequacy.

A market price has the extra advantage that it is a market-wide signal, for which transparent information exists available to all market parties. It also implicitly takes into account the import capabilities, as foreign offers integrate in the same merit order via the single day-ahead market coupling mechanism.

In order to be an effective signal for all market parties, it is essential that it is continuous and visible for all Belgian market participants, thereby setting a single reference for all CRM actors. To that extent, the **Belgian Day-Ahead** price is used.

There are several other advantages to using the Day-Ahead price as a scarcity indicator:

- Its transparency is attested by e.g. the numerous contract applications where it is used as a reference for transaction settlements.
- It is relevant for structural adequacy, since after Day-Ahead closure uncertainties are managed via Intraday transactions, Balancing and Ancillary Services. This is more the territory of flexibility, which is not the overall goal of the CRM. It is important to highlight that Capacity Providers that provide their capacities via the Intraday or Balancing market will still be counted as available, see also section 8.2.
- Its accessibility to market players is attested by its liquidity compared to other markets with transparent information (25-30% of the total load in Belgium).
- The interval between selling and delivery allows for participation of technologies with slow ramping and start-up constraints. Considering structural adequacy, these types of technologies definitely contribute as well. The CRM design should also accommodate these technologies, which could include slower starting generation units, but also industrial processes that could deliver demand response when timely informed.

Design Recap:

The Availability Monitoring Trigger is based on a pre-defined price threshold (the AMT Price), which needs to be surpassed on the Day-Ahead market.

4.1.2 AMT Price and AMT Price calibration

In order to identify AMT Moments a price threshold is established, the **AMT Price**. Whenever the Day-Ahead price exceeds the AMT Price, Elia defines the Market Time Unit during which this happens as an **AMT MTU**. A series of consecutive AMT MTUs forms an **AMT Moment**.

Figure 6 below serves as an illustrative example to determine AMT MTUs and AMT Moments.

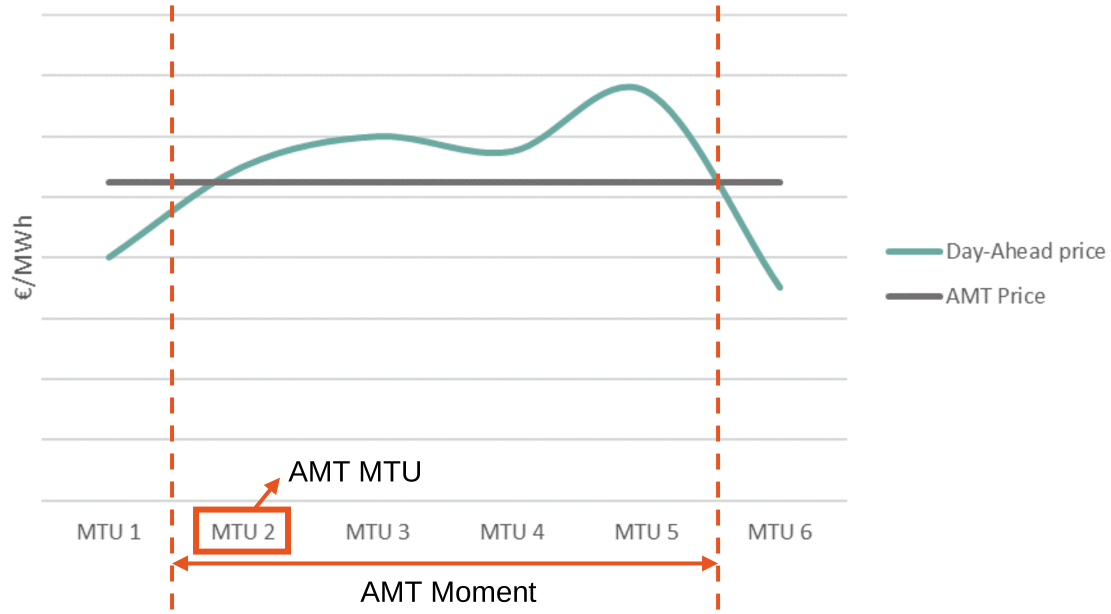

Figure 6: Determination of AMT Moments

4.1.2.1 Design of the AMT Price

The AMT Price is a value that is calculated before the start of each Delivery Period. For the sake of clarity, it remains stable throughout the entire Delivery Period and applies to all contracted units.

Elia has carried out numerous analyses regarding the possibilities of an AMT Price that evolves in case of significant price fluctuations on the market. Elia will continue using a stable, single price for the following reasons:

- Only an ex-post adapted AMT Price could fully capture evolutions in the Day-Ahead price. A dynamic ex-ante adaptation (based on the data of the past month for example) will by definition always lag behind events (those effects would only be taken into account after the fact). The essence of the AMT Price is that it needs to be known in advance so that Capacity Providers know when AMT Moments take place, and as such provides little benefit compared to a static AMT Price;
- A stable AMT Price has the benefit of clarity and simplicity. Adapting the AMT Price in the course of the Delivery Period risks causing confusion among Capacity Providers;
- Seeing as an ex-post indexation, such as already existing for the Strike Price, is not possible for the AMT Price, an indexation method for the AMT Price would by default be different from the Strike Price indexation. As a result, Strike Price and AMT Price could evolve in different ways, which is confusing at best and conflicting at worst.

> **Design Recap:**
>
> The AMT Price is calculated and communicated before the start of the Delivery Period and does not change during the Delivery Period.

4.1.2.2 Calibration of the AMT Price

The AMT Price is calibrated by Elia after the conclusion of the Y-1 Auction and ahead of the start of the Delivery Period. Elia runs the simulations of the Reference Scenario that was used for the calibration of the Y-1 Auction, where all the capacities that have been contracted in said Auction replace the capacities that were added on a hypothetical basis to attain the LOLE criterion. In doing so, Elia effectively arrives at the most accurate representation of the production mix for the Delivery Period.

During the simulations, Elia carries out a great number of parallel runs, each of which is characterized by the same scenario combined with a unique random seed of, for example, forced outages on the modeled units. As a result, each simulation year yields a unique price duration curve that represents the Belgian energy market.

Elia uses the price duration curves from all of these simulation years. In particular, the AMT Price is equal to the minimum of:

- The median value of the price in each simulation year that is surpassed during one hundred hours; and
- The tenth percentile lowest value of the price in each simulation year that is surpassed during twenty hours.

The AMT Price thus reached is adapted for inflation that occurred between the calibration of the Reference Scenario and the start of the Delivery Period.

Elia publishes the value of the AMT Price for each Delivery Period on its website by May 15 prior to the start of the Delivery Period. The timing of the AMT Price calibration is summarized on the timeline below:

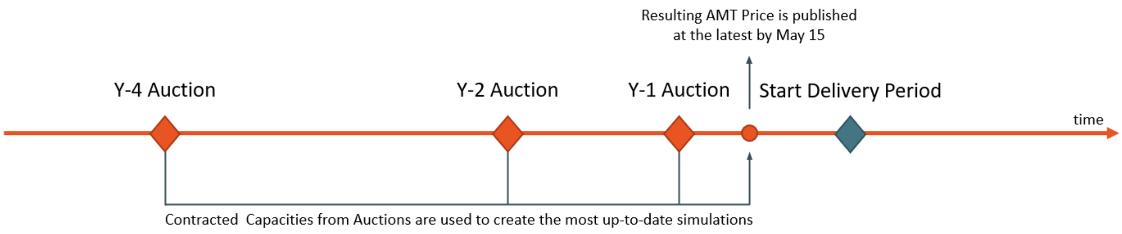

Figure 7: Auctions and calibration of the AMT Price

4.1.3 Enforcement of the Availability Monitoring

Whenever the AMT Price is surpassed, Elia publishes this online so as to inform Capacity

Provider of the upcoming AMT Moment[4]. This publication takes place within two hours of the publication of the Day-Ahead market clearing results.

It is important to note that Elia does not necessarily verify the Obligated and Available Capacity during all AMT Moments. From all the AMT Moments that are observed, Elia can verify at most thirty. This is an upper limit: on average, Elia intends to verify the Availability Moments fifteen times per year.

Design Recap:

An AMT Moment signifies that Elia can enforce the Availability Monitoring, but Elia will do this at most thirty times per Delivery Period.

4.2 Obligated Capacity

The Obligated Capacity, also noted as $P_{Obligated}$, establishes the amount of capacity that a contracted CMU is expected to provide during scarcity-relevant moments.

The goal of this section is to define the capacity required at AMT moments from each CMU. Therefore, it will define the rules to establish the "Obligated Capacity" or $P_{Obligated}$ for each CMU and each AMT MTU. The CMU has to make the Obligated Capacity available at every AMT MTU individually in order to ensure adequacy. Paragraph 4.2.1 explains the motivation and application of this principle further.

Generic rules to define the Obligated Capacity apply to all CMUs. In order to ensure the contracted adequacy, the obligation needs to be consistent with how the adequacy model takes the CMUs into account, i.e.: considering the derating factors. For this reason, there is a difference between non-energy constrained and energy constrained CMU's, further explained in sections 4.2.2 and 4.2.3 respectively.

The Monitoring Mechanism will then compare this with the measured Available Capacity (section 4.3) to assess any volume that is liable to an Unavailability Penalty in section 6.

Design Recap:

The Obligated Capacity establishes the amount of capacity the CMU is expected to contribute during the AMT Moments.

4.2.1 Ensuring adequacy during each MTU

A system is adequate when the capacity in the system is able to cover the load at any time in line with the reliability standard. This is why the CRM Auctions procure a derated volume covering peak demand up until a reliability standard. Therefore, to be adequate,

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[4] This happens via the webpage on AMT Price and AMT Moments

the market should be able to rely on this volume of capacity at adequacy-relevant moments.

The Availability Monitoring mechanism serves as a verification that the procured capacity could indeed respond to a market signal in day-ahead in order to meet the demand. This means that every CMU should make at least the capacity for which they have been contracted available to the market. Moreover, they should do so at every individual AMT MTU, as insufficient capacity at one AMT MTU could cause an adequacy issue. Figure 8 illustrates this principle. The volume required to be available for a specific AMT MTU is referred to as the Obligated Capacity.

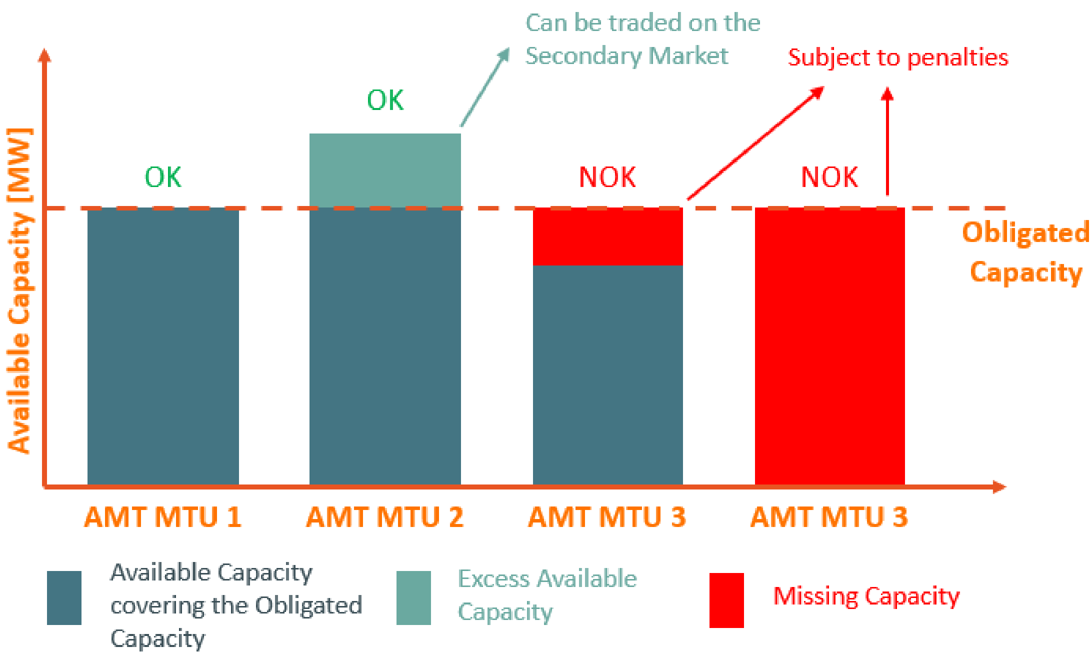

Figure 8: Conceptual illustration of Obligated Capacity for each AMT MTU (i.e. for non-energy-constrained CMU's

It is important to note that the AMT MTUs are the moments for which the capacity was contracted in the first place. Any unavailability during these hours detracts from the contracted service. For this reason, Availability Monitoring will apply regardless of forced outages. The attentive reader will remember that this relates to the notification of Unavailable Capacity as per section 3.1. Indeed, the Availability Obligation holds even when such a notification took place, but the penalties are less severe as per section 6.2. The obligation is also not load-following, since the check is on availability of capacity, not delivery of energy. This means that the Obligated Capacity does not increase further when scarcity grows more severe.

Section 4.3 defines the rules for measuring Available Capacity in the Availability Monitoring Mechanism. In case of Missing Capacity – i.e. a positive difference between Obligated and Available Capacity not covered in the Secondary Market – a penalty could apply, as section 6 describes. To avoid such a penalty, the CMU could instead source the missing capacity on the Secondary Market of the CRM. In contrast, "AMT MTU 2" in

Figure 8 illustrates that a CMU could also be available beyond their Obligated Capacity during AMT MTUs. In this case, the excess capacity can be sold on the Secondary Market.

At a system level, this creates an incentive to maximize available capacity during AMT MTUs. Therefore, this design principle incentivizes system adequacy at all AMT MTUs.

Design Recap:

The Obligated Capacity is established at every AMT MTU individually.

The determination of the Obligated Capacity differs depending on whether the CMU is Non-energy Constrained or Energy Constrained, which is explained in section 4.2.2 and 4.2.3, respectively.

4.2.2 Obligated Capacity for non-energy constrained CMUs

For these CMU types, the duration of the AMT moment (i.e. the number of AMT MTUs) does not cause unavailability. This is why a uniform Obligated Capacity for every AMT MTUs should not affect the expected expenses and revenues.

The Derating Factor of non-energy constrained CMU's is based on statistical drivers, such as forced outage rates and – for e.g. renewable sources – climate conditions. In other words, Elia knows that on average a Non-energy Constrained CMU will be able to provide the derated volume during adequacy-relevant moments.

In the CRM Auctions, Capacity Providers can submit a bid where the volume is capped by the (Remaining) Eligible Volume, which already takes into account the Derating Factor. The Contracted Capacity resulting from the Auction is as such a derated quantity as well and can be used to determine the Obligated Capacity.

Design Recap:

For Non-energy Constrained CMUs, the Obligated Capacity is equal to the Total Contracted Capacity, i.e. the derated capacity.

In practice, these units will be available at full capacity at some AMT moments and significantly less or not at all at others (when e.g. a forced outage is taking place). Using the principles of Secondary Market trading as explained above, the CMUs should be able to deliver at least the Total Contracted Capacity on average.

As per section 3.2, Capacity Providers can notify Elia of periods of Scheduled Maintenance. Upon acceptance of this notification by Elia, the Obligated Capacity is reduced by the amount of capacity included in the notification. Be that as it may, the notification of unavailabilities always includes a non-derated amount of capacity. The Obligated Capacity as such takes into account Scheduled Maintenance after application of the Derating Factor.

Design Recap:

The Obligated Capacity takes into account the notification of Scheduled Maintenance.

The Obligated Capacity can be described by the following formula:

$$P_{Obligated}(CMU, t) =$$

$$Total\ Contracted\ Capacity(CMU, t) - P_{Announced,Unavailable,Maintenance}(CMU, t) \cdot Derating\ Factor(CMU, t)$$

4.2.3 Obligated Capacity for energy constrained CMU's

If a CMU is energy constrained (e.g., a battery or an industrial process which can only run for a limited time), it knows beforehand that at AMT Moments lasting longer than its energy constraint it will not be technically feasible to continuously contribute to adequacy.

To cope with this, Elia's simulations of the energy market also do not demand such a continuous contribution. It determines their contribution **according to their Service Level Agreement (SLA)** comprising the energy constraint. This constraint is characterized by:

- The maximum duration of the respective SLA category;
- One activation per day

This leads to a categorization depending on the service the asset can provide. The Derating Factors are calculated based on the simulated availability of a unit with such a SLA during scarcity, thereby taking into account one activation per day.

Table 1: SLAs for Energy Constrained CMUs from Elia's 2024 calibration report

SLA Category	Derating Factor [5] [%]
SLA-1h	16
SLA-2h	29
SLA-3h	40
SLA-4h	49
SLA-5h	56
SLA-6h	63
SLA-7h	69
SLA-8h	74
SLA-9h	79

[5] Based on Elia's proposal in the 2024 calibration report for the 2025 Y-4 Auction with Delivery Period 2029-2030. Note that Derating Factors are calculated anew for each Delivery Period and for every Auction individually.

SLA-10h	83
SLA-11h	86
SLA-12h	89
SLA unlimited	100

In order to be adequate, it is sufficient that these CMU types make their capacity available as long as their energy is not depleted. However, at such moments, the system requires the non-derated capacity, as opposed to the derated capacity in case of Non-energy Constrained CMUs.

Design Recap:

Energy Constrained CMUs are characterized by their SLA, determining how long they can contribute with their non-derated capacity to adequacy.

Figure 9 illustrates this principle for a CMU with a Service Level Agreement of 1 hour. Even though the AMT Moment lasts for 2 hours (i.e. 8 MTUs) the CMU only has an Obligated Capacity for the duration of its SLA. For all other MTUs, no Obligated Capacity is applied. The unit might "re-charge" during AMT MTU 5-7 to supply a small amount of excess capacity during AMT MTU 8.

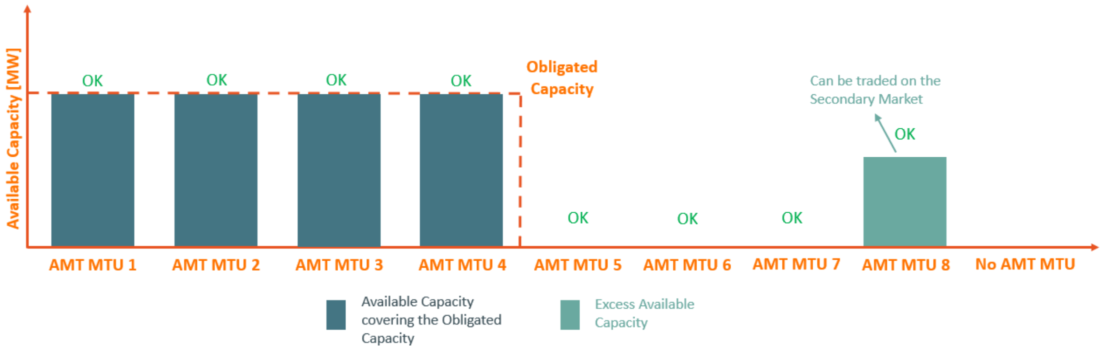

Figure 9 Example of Energy Constrained Obligated Capacity

The subset of MTUs during which the Obligated Capacity is applied for Energy Constrained CMUs are called the **SLA MTUs**. The determination of SLA MTUs is carried out following the methodology set out in annex 8.1.

A Capacity Provider has the freedom to choose a SLA-category that is lower than its actual technical specifications. In that case the unit will normally have more spare capacity to offer on the Secondary Market, but a less advantageous Derating Factor (see also Table 1) means that he will have contracted less remuneration for the same capacity in the first place.

Design Recap:

Elia determines the SLA MTUs for each Energy Constrained CMU based on their market behaviour. Notwithstanding ex-post Secondary Market Transactions, Obligated Capacity is only applied to Energy Constrained CMUs during their SLA MTUs

As said, an Energy Constrained CMU can acquire additional Contracted Capacity on the Secondary Market. This can impact the Obligated Capacity in different ways, depending on whether the Secondary Market Transaction is considered ex-ante or ex-post.

- In case of ex-ante Secondary Market Transactions, the capacity involved in the Transaction is expressed as a derated quantity. Similar to capacity contracted on the Primary Market, this capacity then needs to be divided by the relevant Derating Factor in order to be correctly considered for the Obligated Capacity.
- In case of ex-post Secondary Market Transactions the capacity involved in the Transaction needs to be delivered regardless of the Derating Factor. As a result, the involved capacity need not be divided by the Derating Factor since the energy constraint – which is the prime reason for the derating factor – is not relevant to assess the past performance.
- In practice, this can result in two different cases:
  - In case the Transaction Period of the ex-post Secondary Market Transaction coincides with the SLA MTUs, the involved capacity is added to the Obligated Capacity that the CMU had to provide anyways based on its already existing obligations;
  - In case the Transaction Period of the ex-post Secondary Market Transaction falls outside of the SLA MTUs, there originally was no Obligated Capacity. Seeing as the Capacity Provider deliberately engaged in an ex-post Transactions he knows that he had some excess availability, meaning that it allows Elia to, exceptionally, impose an Obligated Capacity outside of the SLA MTUs.

All that being considered, the Obligated Capacity for Energy Constrained CMUs **during the SLA MTUs** can be described by the following formula:

$$P_{Obligated}(CMU,t) =$$

$$\frac{Total\ Contracted\ Capacity_{ex-ante}(CMU,t)}{Derating\ Factor(CMU,t)} + Contracted\ Capacity_{ex-post}(CMU,t)$$

$$-P_{Announced,Unavailable,Maintenance}(CMU,t)$$

Outside the SLA MTUs only the ex-post Transactions are taken into account. As such, the Obligated Capacity **outside SLA MTUs** is equal to:

$$P_{Obligated}(CMU,t) = Contracted\ Capacity_{ex-post}(CMU,t)$$

Design Recap:

The Obligated Capacity for Energy Constrained CMUs is equal to the non-derated Contracted Capacity during its SLA MTUs.

4.3 Available Capacity

The Obligated Capacity as established in section 4.2 must be covered by Available Capacity. The latter expresses the amount of capacity that a CMU contributes at a given moment to security of supply.

However, the CRM remunerates availability, not sheer Measured Power. From that perspective Elia makes the distinction between **Proven Availability** and **Unproven Availability**.

The determination of Proven and Unproven Availability depends on the type of CMU as well as the specific situation and is elaborated in the following sections. As a general rule of thumb however, one can say that Proven Availability is established once the availability is backed up by actual Measured Power, whereas the opposite is true for Unproven Availability.

It is important to note that both Proven and Unproven Availability counts equally towards Available Capacity. As illustrated in the figure below, a CMU can have complete Proven Availability, complete Unproven Availability or any combination of the two, and Elia will equally consider them as Available Capacity.

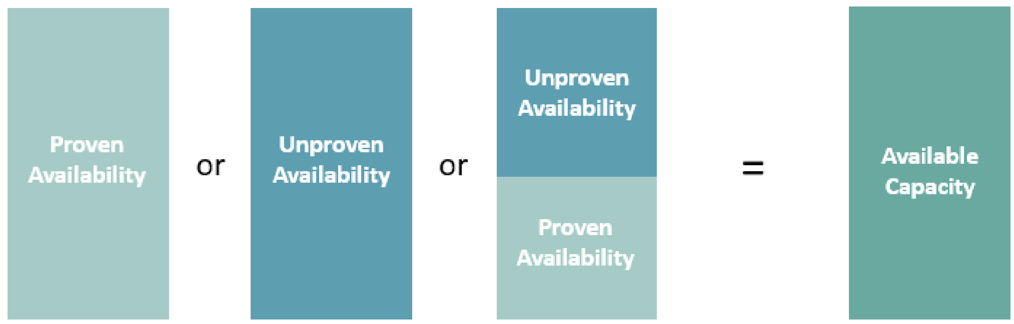

Figure 10: Proven and Unproven Availability for Available Capacity in Availability Monitoring

Be that as it may, Elia wants to avoid a situation where it pays remuneration to a unit that is never observed in the market. To that extent, when Elia continuously observes large quantities of Unproven Availability it might subject a CMU to a dedicated Availability Test to demonstrate its availability, as explained in section 5.

Design Recap:

Available Capacity represents the amount of capacity a unit had available for the system. It can be either Proven or Unproven.

In addition to trading on energy markets and acquiring inframarginal rents, there are also other options by means of which a CMU can contribute to security of supply. These include participation in frequency-related Ancillary Services and Redispatching Services. Participation in these services is not necessarily reflected in the Measured Power of a CMU. Indeed, a unit that is contracted in an Ancillary Services reservation will on purpose hold back capacity and will not be present in the market, but this does not mean it is unavailable. As a result, Elia carries out corrections for participation in these services.

Design Recap:

The determination of the Available Capacity takes into account participation to Ancillary Services and Redispatching Services.

The determination of the Available Capacity differs depending on whether the CMU is a Daily Schedule CMU of Non-daily Schedule CMU, which is explained in section 4.3.1 and 4.3.2, respectively.

4.3.1 Available Capacity for Daily Schedule CMUs

As already highlighted in section 3.1.1 Daily Schedule CMUs are subject to the Outage Planning Process. In order to reduce the administrative burden for Capacity Providers, Elia directly uses the information provided by Capacity Providers in the framework of the Outage Planning.

In particular, in the Outage Planning Process the Capacity Provider needs to submit its Availability Plan, which includes the $P_{max,available}$. In the Outage Planning Terms & Conditions[6], this is defined as:

> "The maximum power (in MW) as defined in the Availability Plan that the Delivery Point can inject into (or take off) the ELIA Grid for a certain quarter hour, taking into account all planned restrictions in power known at the time of notification to ELIA, without taking into account any participation of the Delivery Point in the provision of Balancing Services."

In other words, the $P_{max,available}$ represents the amount of capacity that the CMU could at most contribute to the system. This can be compared to the Measured Power $P_{measured}$ to see how much of it then actually was actually provided.

This allows Elia to use both metrics to distinguish between Proven and Unproven Availability. The total Available Capacity is set by the $P_{max,available}$. The proportion that is actually delivered as per the Measured Power is considered as Proven Availability, any remaining part is viewed as Unproven Availability. This is also illustrated in Figure 11:

[6] Terms and Conditions of the Outage Planning Agent

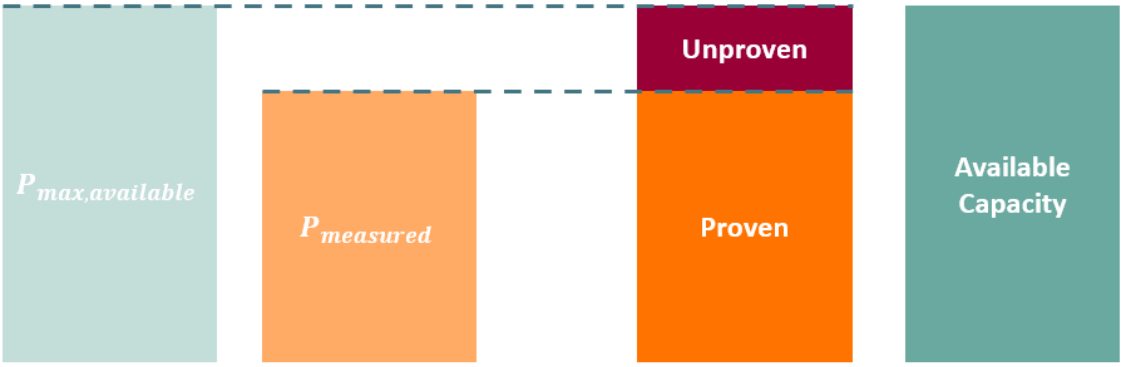

Figure 11: Proven and Unproven Availability for Daily Schedule CMUs

The amount of Proven Availability will still be corrected in case of participation in frequency-related Ancillary Services or Redispatching Services.

Design Recap:

Available Capacity for Daily Schedule CMUs is based on their Availability Plan.

The Proven Availability is based on the Measured Power, including any corrections for the participation to frequency-related Ancillary Services and Redispatching Services.

The remainder is then considered as Unproven Availability.

4.3.2 Available Capacity for Non-daily Schedule CMUs

Non-daily Schedule CMUs are not subject to the Outage Planning or Scheduling Process. As a result, Elia does not dispose of the same level of information allowing to calculate the Available Capacity, let alone the Proven and Unproven Availability.

In order to properly assess CMUs' Availability, Elia provides the framework of the Declared Prices.

4.3.2.1 Declared Prices

The Declared Prices allow Capacity Providers to submit a value representing their variable activation cost to Elia. From the moment the market price exceeds this Declared Price, Elia then knows that the CMU is expected to react to this price signal and will provide Proven Availability. When the Declared Price is not surpassed, the CMU's capacity is considered as Unproven Availability. Note that this data is treated as strictly confidential and will never be shared.

The surpassing of the Declared Prices leads to the establishment of the **Required Volume**, i.e. the amount of capacity that is expected to react to the market price signal based on the Declared Prices. Elia will monitor whether this Required Volume was actually observed in the market and will apply penalties when this is not the case.

The framework of the Declared Prices offers a wide variety for Capacity Providers to suit the specific behaviour of the CMU. The specific options for the Declared Prices are explained in the following sections. It's important to note that in order for the Availability

Obligation to function, the CMU needs at least one value for the Declared Price as established in section 4.3.2.1.1. Any additional submitted information on top of that (as per section 4.3.2.1.2, 4.3.2.1.3 and 4.3.2.1.4) is optional.

Design Recap:

The Declared Prices represent the variable costs of the CMU and allow Elia to determine how much a CMU is expected to react to a price signal.

Note that submitting accurate Declared Prices is important for a correct assessment of the Availability Obligation by Elia. To incentivize Capacity Providers to maintain accuracy, a possible penalty for Overcapacity (see also section 7) is foreseen.

4.3.2.1.1 "main" Declared Price

The Capacity Provider has to submit at least a single Declared Price that is related to the Day-Ahead market. The Required Volume linked to this single Declared Price is the NRP of the CMU. In other words, whenever the Declared Price is surpassed on the Day-Ahead market, the CMU is expected to deploy its full Nominal Reference Power.

The Nominal Reference Power (and as such, the Required Volume) can, depending on the situation, exceed the Obligated Capacity that has been established based on section 4.2. However, as discussed previously, a Capacity Provider can valorize any availability in excess of its Obligated Capacity via a Secondary Market Transaction. As a result the entire CMU is monitored, but penalties are only applied in case the availability drops below the level of the Obligated Capacity.

The example below highlights the Required Volume as a result of the comparison between the Day-Ahead market price and the Declared Price.

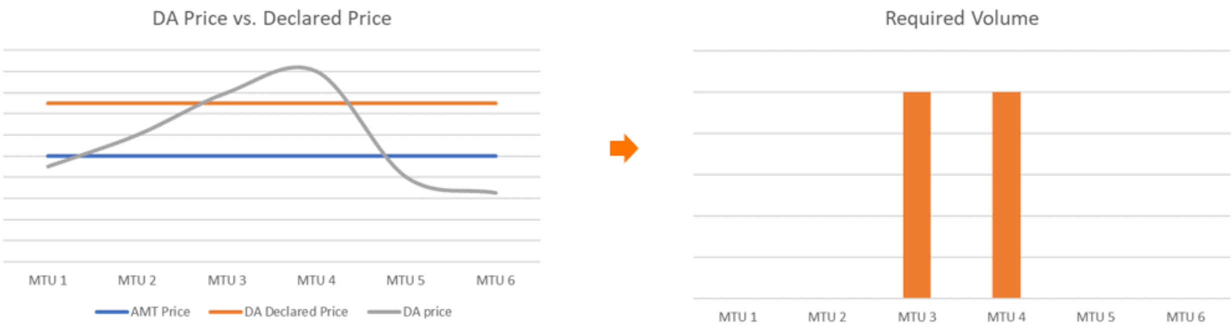

Figure 12: Required Volume as a result of surpassing of the Declared Price

Design Recap:

A Non-daily Schedule CMU is obliged to submit a single Day-Ahead Declared Price. When this price level is exceeded, the CMU is expected to dispatch its full NRP.

4.3.2.1.2 Declared Prices for separate price references

Elia recognizes that a CMU might not only react to price signals on the Day-Ahead market. Indeed, some units are also present on Intraday or Balancing markets.

Additionally, CMUs could have slightly different variable costs for these respective price references. For example, a unit might keep an eye on the imbalance prices, but only react when they are significantly higher due to an extra cost associated with the shorter reaction times.

Elia as such provides the possibility to submit a separate Declared Price for both Intraday and Balancing, on top of the obligatory "main" Declared Price for Day-Ahead. Whenever the Declared Price on either Day-Ahead, Intraday or Balancing is exceeded the Required Volume is equal to the NRP.

Design Recap:

A Non-daily Schedule CMU has the possibility to declare different Declared Prices for Day-Ahead, Intraday or Balancing markets.

4.3.2.1.3 Partial Declared Prices

The CRM allows for the participation of Aggregated CMUs, i.e. CMUs that consist out of multiple Delivery Points. These separate Delivery Points can have different variable costs and react to different price levels on the market. Indeed, it could occur that some Delivery Points react and some don't, resulting in a partial activation of the NRP.

To capture such partial activations Elia provides the possibility to submit Partial Declared Prices. This is a set of incremental price levels along with the cumulative volume that reacts to that price, which is called the Associated Volume. It essentially allows Capacity Providers to provide their very own merit order of an aggregated CMU. This is also highlighted in Figure 13.

partial Declared Price	Associated Volume
70	5
100	10
140	15

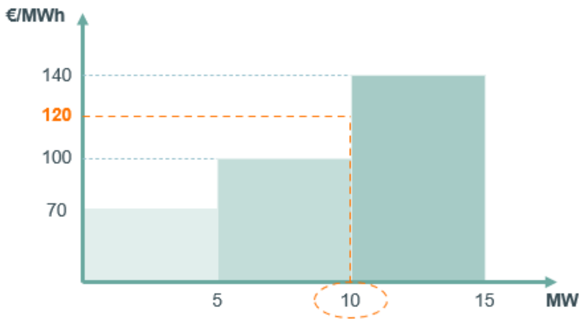

Figure 13: Partial Declared Prices and resulting Required Volume

In Figure 13 on the graph on the right, a price of 120 €/MWh is reached on the market. The Required Volume of the CMU is then equal to 10 MW, namely the highest Associated Volume for which the Partial Declared Price is exceeded.

Design Recap:

A Non-daily Schedule CMU has the possibility to submit partial Declared Prices that trigger partial activations of the CMU.

4.3.2.1.4 Declared Prices throughout the day

Variable costs of a CMU might vary throughout the day, depending on for example fuel spot prices.

Rather than submitting one single Declared Price to Elia, Capacity Provider as such have the possibility to submit a time series of Declared Prices for the entire day, where the values vary in function of their own variable cost. An activation is only expected when the market price exceeds the Declared Price for that particular quarter hour in the time series, as shown in the example below:

Figure 14: fluctuating Declared Price and resulting Required Volume

Design Recap:

A Non-daily Schedule CMU has the possibility to submit a timeseries of Declared Prices where values can fluctuate throughout the day.

4.3.2.2 Active Volume

Non-daily Schedule CMUs include units that contribute to adequacy by injection or by the reduction of offtake. Whereas injection can be assessed through Measured Power, reduction of offtake is less straightforward. Moreover, it would be cumbersome to, in the calculations of the Available Capacity in section **Error! Reference source not found.**, always include separate calculation methods for injection and offtake Delivery Points.

Elia as such introduces the **Active Volume**, which is calculated differently depending on whether it concerns an injection or offtake Delivery Point, but they allow Elia to simply use Active Volume for the remainder of the Available Capacity calculation without distinguishing between injection or offtake.

Design Recap:

The Active Volume is an in-between step to determine activations uniformly for both injection and offtake units.

The Active Volume is in first instance calculated per Delivery Point i. To obtain the total Active Volume for the CMU, the Active Volume for all Delivery Points of the CMU are summed.

The Active Volume is the amount of capacity that has reacted to the price signal. For injection Delivery Points it is equal to:

$$V_{Act,i}(CMU,t) = -P_{Measured,i}(CMU,t)$$

For offtake Delivery Points, the Active Volume is calculated as follows:

$$V_{Act,i}(CMU,t) = MAX\{P_{Baseline,i}(CMU,t) - P_{Measured,i}(CMU,t); 0\}$$

For the CMU as a whole, thereby taking into account both injection and offtake Delivery Points, the total Active Volume is then calculated as follows:

$$V_{Act,initial}(CMU,t) = \sum_{i=1}^{n_{DP}} V_{Act,initial,i}(t)$$

These values are called initial since they can still be corrected for participation for frequency-related Ancillary Services or Redispatching Services as per section 8.2. Following these corrections, the final Active Volume for each CMU is determined as:

$$V_{Act}(CMU,t) = V_{Act,initial}(CMU,t) + V_{Correction}(CMU,t)$$

The Active Volume is subsequently used to determine the Available Capacity in section **Error! Reference source not found.**.

4.3.2.3 Determination of the Available Capacity for Non-daily Schedule CMUs

Elia determines the Available Capacity for Non-daily Schedule CMUs based on the Active Volume as per section 4.3.2.2, and how it relates to the Required Volume based on the Declared Prices as per section 4.3.2.1.

For a Non-daily Schedule CMU, Elia calculates the Available Capacity as follows:

$$P_{Available}(CMU,t) = Min\left(V_{act}(CMU,t) + \left(NRP(CMU,t) - V_{req}(CMU,t)\right); P_{max,remaining}(CMU,t)\right)$$

The Available Capacity is determined as the sum of Active Volume (including the corrections for the participation to Ancillary Services and Redispatching Services) and the Nominal Reference Power reduced with the Required Volume as the Required Volume is expected to be visible as Active Volume. This sum is capped by the Remaining Maximum Capacity: indeed, seeing as the Capacity Provider himself declared (as per section 3) that the he only has the Remaining Maximum Capacity left, the Available Capacity is capped at this value.

For a Non-daily Schedule CMU, the Proven Availability is calculated as:

$$P_{Proven}(CMU,t) = Min\left(P_{max,remaining}(CMU,t); V_{Act}(CMU,t)\right)$$

This Proven Availability reflects the proportion of the Available Capacity determined above that was actually observed in the market.

5 Availability Tests

The Availability Monitoring described in section 4 aims to verify the CMU's compliance with the Availability Obligation. However, in some cases the Monitoring might not prove fully adequate to capture all nuances. For one, as already highlighted in section 4.3, high quantities of Unproven Availability make it hard to justify the remuneration when the unit is never actually observed in the market. What's more, a Capacity Provider could on purpose consistently submit very high Declared Prices that are never met by the market price, so that he never needs to react to a price signal.

To cover this possibility Elia foresees the Availability Tests. It is important to note that it serves as an incentive; CMUs who dutifully fulfill their Availability Obligation via the Availability Monitoring should only in extreme cases be subjected to a Test. The exceptional nature of a Test is important, seeing as any costs caused by them are to be borne by the Capacity Provider.

Design Recap:

Availability Tests are an incentive for CMUs that are not always observed via the Availability Monitoring.

The selection for an Availability Test based on some criteria as well as some practical modalities are discussed in section 5.1. Identical to the Availability Monitoring an Obligated Capacity is established that the CMU is expected to cover with Available Capacity. These are discussed in section 5.2 and 5.3, respectively.

5.1 Modalities of Availability Tests

Elia selects CMUs for an Availability Test that is approved by the CREG but not disclosed publicly. In doing so, Capacity providers cannot prepare specifically for an Availability Test.

Though classified, the selection procedure takes into account at least the following criteria:

- High amounts of Unproven Availability; and
- Previously failed Availability Tests; and
- Missing Capacity in the framework of the Availability Monitoring; and
- Bad correlation between the CMU's output and it Declared Prices in accordance with section 4.3.2.1.

A Capacity Provider is notified of a Test between 09:00 and 09:30 the day before it is supposed to take place. This notification also contains the start and end time of the Test. Obligated Capacity is established following section 5.2 and the Capacity Provider must cover the Obligated Capacity with Available Capacity for the entirety of the test duration for it to be successful. The test duration is either one quarter hour or the full SLA of the CMU, where the latter can only be applied when a previous Test failed.

From the moment of the Test notification, the CMU is prohibited from trading obligations on the Secondary Market that have a Transaction Period covering the Test date; this would otherwise allow the CMU to reduce its Obligated Capacity.

Design Recap:

Identical to the Availability Monitoring, the Availability Testing establishes an Available and Obligated Capacity. The selection for a Test is based on a CMU's performance during the Availability Monitoring and is notified one day in advance to the Capacity Provider.

5.2 Obligated Capacity

The Obligated Capacity in the framework of the Availability Tests differs slightly from the one established in the Availability Monitoring.

For Energy Constrained CMUs, as well as Non-energy Constrained CMUs during the Winter, the Availability Testing requires the non-derated Contracted Capacity, thereby taking into account any notifications of Announced Unavailable Capacity that were received before the notification of the Test. As such, the Obligated Capacity is equal to:

$$P_{Obligated}(CMU,t) =$$

$$MIN\left(NRP(CMU,t) - P_{Unavailable,Announced}(CMU,t); \frac{Total\ Contracted\ Capacity(CMU,t)}{Derating\ Factor(CMU,t)}\right)$$

Thermal efficiency is typically lower during Summer, making it difficult for Non-energy Constrained CMUs to reach this non-derated level. As a result, for Non-energy Constrained CMUs during Summer a different level of Obligated Capacity applies:

$$P_{Obligated}(CMU,t) =$$

$$MIN\left(NRP(CMU,t) - P_{Unavailable,Announced}(CMU,t); Total\ Contracted\ Capacity(CMU,t)\right)$$

This Obligated Capacity is strictly speaking only applied during the quarter hours spanning the Test.

5.3 Available Capacity

In the Availability Testing Elia does no longer apply the distinction between Proven and Unproven Availability. All Available Capacity must be demonstrated via Measured Power. As a first step, initial Available Capacity is determined per Delivery Point i. This differs depending on whether the Delivery Point provides capacity by the potential for injection or offtake.

For injection Delivery Points, this results in:

$$P_{Available,initial,i}(t) = -P_{measured,i}(t)$$

For offtake Delivery Points, this results in:

$$P_{Available,initial,i}(t) = Max\{P_{Baseline,i}(t) - P_{measured,i}(t); 0\}$$

The total initial Available Capacity is calculated as the sum over all Delivery Points of the CMU.

To reach the final Available Capacity corrections for frequency-related Ancillary Services and Redispatching services are applied.

Design Recap:

Available Capacity for the Availability Testing is based on the Measured Power. It also takes into account other commitments such as Ancillary Services or Redispatching Services**.**

6 Unavailability Penalties

In both the Availability Monitoring (section 4) and the Availability Testing (section 5) an Obligated and Available Capacity is established. When the Capacity Provider fails to cover its Obligated Capacity with Available Capacity a Missing Capacity is determined which is then penalized following the principles set out here.

6.1 Missing Capacity

Missing Capacity can be established in two ways.

As already mentioned, Elia requires that the Obligated Capacity must be covered by Available Capacity. This is results in the Missing Capacity being the positive difference between these two parameters:

$$MAX\left(0; P_{Obligated}(CMU,t) - P_{Available}(CMU,t)\right)$$

This is also illustrated by the following figure:

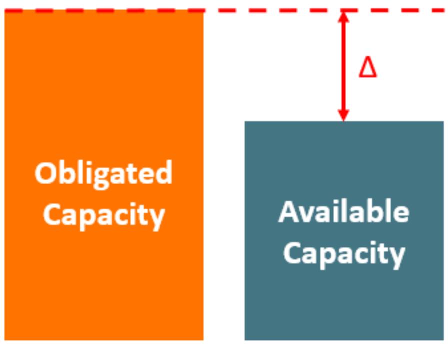

Figure 15: determination of Missing Capacity based on Obligated and Available Capacity

On the other hand, Elia also allows for units to trade obligations ex-post on the Secondary Market. In this specific case though, Elia requires that the capacity contracted ex-post is covered by Proven Availability in order to prevent gaming. From this perspective, Missing Capacity is defined as the positive difference between the ex-post Contracted Capacity and the Proven Availability:

$$MAX\left(0; Contracted\ Capacity_{ex-post}(CMU,t) - Proven\ Availability(CMU,t)\right)$$

These two equations can then be combined in the final formula for the Missing Capacity, where the maximum is simply taken of all aforementioned elements.

$$MC(CMU,t) =$$

$$MAX\left(0; P_{Obligated}(CMU,t) - P_{Available}(CMU,t); Contracted\ Capacity_{ex-post}(CMU,t) - Proven\ Availability(CMU,t)\right)$$

Design Recap:

Missing Capacity can originate from either a lack of Available Capacity compared to the Obligated Capacity, or a lack of Proven Availability compared to ex-post Secondary Market obligations.

Once the total Missing Capacity is established, Elia makes the distinction between Announced Missing Capacity and Unannounced Unavailable Capacity. This distinction is based on the Capacity Provider's declaration of Announced Unavailable Capacity as set out in section 3.1. As will be explained in section 6.2, Announced Missing Capacity will be penalized less severely compared to Unannounced Missing Capacity, effectively giving the Capacity Provider an incentive to correctly submit its declarations of Unavailable Capacity.

The Announced Missing Capacity (AMC) is defined as the part of the Missing Capacity that is covered by the Announced Unavailable Capacity. It is defined by the following formula:

$$AMC(CMU,t) = MIN\left(P_{Unavailable,Announced}(CMU,t); MC(CMU,t)\right)$$

The Unannounced Missing Capacity (UMC) is then simply the remaining part of the Missing Capacity, if any:

$$UMC(CMU,t) = MAX\big(0; MC(CMU,t) - AMC(CMU,t)\big)$$

This determination of the Announced and Unannounced Missing Capacity is also illustrated below:

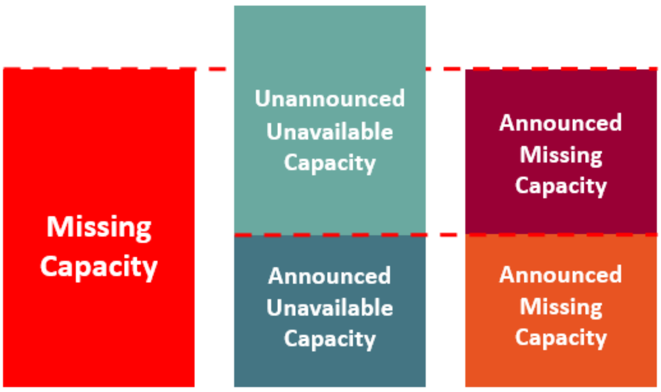

Figure 16: AMC and UMC determination

It's important to note that in case Missing Capacity was determined during a moment that was highlighted by the Capacity Provider as Scheduled Maintenance as per section 3.2 is fully considered as Unannounced Missing Capacity. Indeed, in case of Scheduled Maintenance any Announced Unavailable Capacity is already taken into account in the determination of the Obligated Capacity; using it again here for Announced Missing Capacity would effectively give a double benefit to the Capacity Provider, which is not the goal of the Scheduled Maintenance design.

Design Recap:

Missing Capacity can be either Announced Missing Capacity or Unannounced Missing Capacity. Announced Missing Capacity is penalized less severely and is based on the Capacity Provider's declarations of Unavailable Capacity.

6.2 The Unavailability Penalty

Using the Announced and Unannounced Missing Capacity as calculated above, Elia proceeds to calculate the Unavailability Penalty.

The penalty is calculated based on the amount of remuneration the Capacity Provider receives for the CMU in question, i.e. the contract value. When CMUs have a single contract, this is straightforward, but it becomes more complicated when CMUs have multiple contracts with overlapping Transaction Periods.
To that extent, Elia calculates the Weighted Contract Value as the volume-weighted average of the individual contracts. In case of N contracts, this becomes

$$weighted\ contract\ value(CMU,t) =$$

$$\frac{\sum_i^N Capacity\ Remuneration_i \cdot Contracted\ Capacity_i}{\sum_i^N Contracted\ Capacity_i}$$

Design Recap:

The Unavailability Penalty is based on the average Capacity Remuneration that is paid to the Capacity Provider.

In the Unavailability Penalty calculation, different importance is attached to the aforementioned Announced and Unannounced Unavailable Capacity. Moreover, Elia considers Missing Capacity more severe during the winter period compared to the summer period. In the Unavailability Penalty, this leads to the use of a correction factor X that covers these different possibilities and impacts the penalty depending on their considered severity:

	Winter Period 01/11/20xx – 31/03/20xx	Summer Period 01/04/20xx – 31/10/20xx
Announced Missing Capacity	0,9	0
Unannounced Missing Capacity	1,4	0,5

Table 2: Penalty Factor X

The penalty is then calculated for every MTU individually, and is summed over MTUs T of either the AMT Moment or the duration of the Availability Test.

$$Unavailability\ Penalty =$$

$$\frac{1}{Q \cdot UP}\left[\sum_{t=1}^{T}(1+X) \cdot weighted\ contract\ value(CMU,t) \cdot UMC(CMU,t) + \sum_{t=1}^{T}(1+X) \cdot weighted\ contract\ value(CMU,t) \cdot AMC(CMU,t)\right]$$

In this formula the value of X varies in function of the Missing Capacity with which it is multiplied.

UP is a fixed value. It represents the number of AMT Moments that Elia intends to verify and is equal to 15. Note that this is but an order of magnitude; the actual amount of verified AMT Moments can vary, but the value of this parameter remains the same. T is the set of MTUs of the AMT Moment or Availability Test, respectively. The formula sums over all these MTUs and takes into account the Missing Capacity of each MTU individually. Q on the other hand represents the cardinality of this set T, i.e. the total amount of MTUs part of the AMT Moment or Availability Test, depending on the case.

Design Recap:

The Unavailability Penalty is higher when it involves Unannounced Missing Capacity and when it took place during the Winter period.

6.2.1 Penalty cap

Elia foresees a penalty cap so that Capacity Providers will not receive unlimited penalties. This cap guarantees that participation in the CRM does not result in a financial loss for the Capacity Provider.

Elia applies both a yearly and a monthly cap. The yearly cap is equal to the total remuneration that is received for Primary Market Transactions as well as Secondary Market Transactions if they cover the full Delivery Period in question. The monthly cap is equal to twenty percent of that same yearly cap.

Design Recap:

Both yearly and monthly penalty caps exist to prevent excessive penalizing of CMUs.

6.3 Notification and escalation

6.3.1 Monthly reporting

For every month M during which the Capacity Provider has a contract, Elia sends a monthly activity report on the 15th of month $M + 2$. The timing of this report is illustrated below:

Figure 17: timing of notification

1. AMT Moments and Availability Tests occur during month M.
2. Metering data needs to be validated before use, which can take until the end of month $M + 1$.
3. On the 15th om month $M + 2$ Elia sends the monthly activity report.

The monthly activity report contains all information regarding the AMT Moments and Availability Tests that took place, including, among other things, the resulting Obligated Capacity, Available Capacity and Missing Capacity. It also includes information concerning the Overcapacity and Overcapacity Penalty, as per section 7.

Design Recap:

The Capacity Provider receives a report for every month where it has a contract, detailing its performance in the Availability Monitoring and Testing, as well as the Unavailability Penalties, if applicable.

6.3.2 Downwards revision of remuneration

In case of repeated occasions of Missing Capacity Elia revises the monthly Capacity Remuneration. This is only applied when:

- on three different occasions Missing Capacity was observed
- each of these occasions constituted an Unannounced Missing Capacity of more than twenty percent of the Obligated Capacity during the MTU in question.

The reduction of the monthly revision is notified to the Capacity Provider via the aforementioned monthly activity report and is based on the maximum ratio of Missing Capacity compared to the Obligated Capacity over the three occasions that triggered the revision.

The original remuneration is automatically restored when after the notification, the CMU successfully meets its Obligated Capacity on three consecutive occasions, be they AMT Moments or Availability Tests. To that extent, the Capacity Provider can request Elia to organize an Availability Test on purpose to meet this criterion.

When the Capacity Provider fails to reinstate the original remuneration for two consecutive Delivery Periods, the revision is permanent. In case this revision involved a reduction to zero MW, the Contract is subsequently terminated.

Design Recap:

The monthly Capacity Remuneration can be reduced in case of multiple occasions of Missing Capacity. The original remuneration can be reinstated when the CMU reports sufficient Available Capacity again.

One practical consideration for the application of the downwards revision is that the Capacity Remuneration is paid at the beginning of each month, whereas the determination of Missing Capacity (and as such, the instatement of downwards revision) only takes place two months later (see also Figure 17). Reducing the monthly Capacity Remuneration with a two-month delay could lead to inefficiencies, in particular towards the end of a Delivery Period.

As a result, the calculated reduction of Capacity Remuneration is added as a separate financial penalty in the monthly report as per section 6.3.1. These penalties originating from the downwards revision also count towards the penalty cap as per section 6.2.1.

7 Overcapacity

Based on the information submitted by the Capacity Provider for its Non-daily Schedule CMU via the Declared Prices (see also section 4.3.2.1), Elia calculates the Required Volume by comparing these Declared Prices to the observed prices on the market.

The Required Volume plays an important role when calculating the Available Capacity for Non-daily Schedule CMUs (section 4.3.2). As a result, it is important that Elia disposes of accurate and up to date information concerning the Declared Prices.

Inaccurate Declared Prices results in a situation where the Required Volume differs from actually observed reaction of the CMU, i.e. the Active Volume (section 4.3.2.2). There are two possible outcomes:

- The CMU has an Active Volume that is lower than the Required Volume, i.e. he contributes less than what he declared. In that case, the formula for the Available Capacity for Non-daily Schedule CMUs will detect the difference as a Missing Capacity, and it will be penalized as such. Additional measures are not needed here.

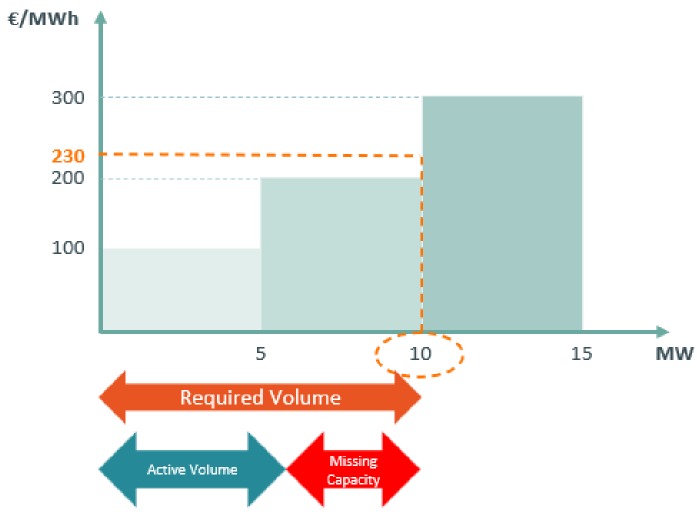

Figure 18: insufficient Active Volume to cover the Required Volume leads to Missing Capacity

- The CMU has an Active Volume that is higher than the Required Volume. In this case the CMU contributes more to the system than promised. Even though this is not necessarily problematic, especially in the framework of a scarcity-triggered product, it can be useful to provide incentives for Capacity Providers to more accurately submit Declared Prices. This incentive is given by the Overcapacity Penalty.

Recap

The Overcapacity Penalty serves to provide an incentive to Capacity Providers of Non-daily Schedule CMUs to continuously submit accurate Declared Prices.

This section continues as follows: in section 7.1 the amount of Overcapacity is determined based on the different parameters used in the Availability Monitoring. Once the Overcapacity is established, a penalty formula is set out in section 7.2.

7.1 Overcapacity determination

Overcapacity is only assessed and penalized when the Required Volume is equal to zero. Put differently, only when an Active Volume was observed even though the unit was not supposed to be in the market in the first place, a possible penalty is applied. Moreover, Overcapacity can only apply until the level of the Obligated Capacity; CMUs obviously remain free to do with their unit with the portion of capacity that is not subject to the Capacity Contract.

When determining the amount of Overcapacity multiple characteristics of the CRM must be taken into account:

- The CMU's Active Volume includes a correction for Ancillary Services and Redispatching Services. These can include activations that are not driven by market prices and as such do not constitute excess delivery;
- The Required Volume is always calculated compared to the CMU's NRP, while the Availability Obligation only holds until the CMU's Obligated Capacity;
- A modest difference between the Active Volume and the Required Volume is normal due to e.g. Baseline fluctuations or changes in thermal efficiency;

This results in the following formula for the Overcapacity OC:

$$OC(CMU,t) = Max\left(Min\left(\underbrace{V_{Act,initial}(CMU,t)}_{1}; \underbrace{P_{Obligated}(CMU,t)}_{2}\right) - \underbrace{0.2 * NRP(CMU,t)}_{3}; 0\right)$$

1. Using the Active Volume gives a distorted view of the CMU's reaction to market prices seeing as it already includes a correction for Ancillary Services and Redispatching Services. To filter this out, the Overcapacity is based on the initial Active Volume of the CMU, calculated in accordance with section 4.3.2.2.
2. The Availability Obligation only holds until the level of Obligated Capacity. In theory a CMU can overperform in excess of this Obligated Capacity, but the CRM cannot penalize beyond what was contracted. That is why the Overcapacity is capped to the level of the Obligated Capacity.
3. A margin of 20% relative to the CMU's NRP is foreseen to account for natural deviations between the Active Volume and Required Volume. Only excess capacity beyond this margin will be penalized.

7.2 Overcapacity Penalty

Based on the amount of Overcapacity a penalty is applied. The penalty depends on a penalty factor F that depends on the difference between the observed market price and the lowest Declared Price of the CMU. When this price difference is negligible, the penalty will be very small or even zero. In contrast, when this price difference is larger the penalty will be quite sizeable. This is also illustrated by Figure 19.

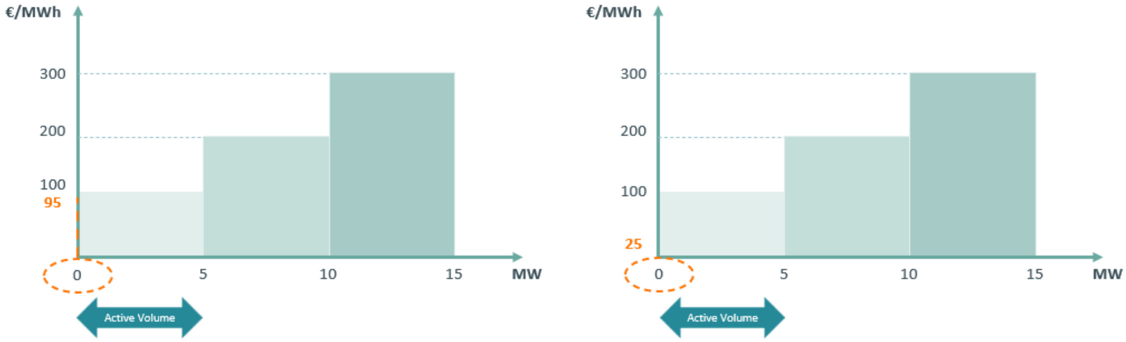

Figure 19: Overcapacity and price spreads

Both graphs depict a situation where the Required Volume is 0. On the left, the market price is equal to 95 €/MWh, which is very close to the CMU's partial Declared Price to react with its first 5 MW. If an Active Volume equal to that first 5 MW is observed, the price difference between the market price (95 €/MWh) and the first partial Declared Price (100 €/MWh) is small enough so that no penalty will be applied.
In contrast, the graph on the right presents a case where the price difference between the market price (25 €/MWh) and the first partial Declared Price (100 €/MWh) is a lot bigger. This activation is a serious deviation from the submitted Declared Prices, resulting in a penalty.

Table 3 below presents the different values for the penalty factor F in function of the price spread.

	Price spread < 50 €/MWh	**50€/MWh ≤ Price spread < 100 €/MWh**	**Price spread ≥ 100 €/MWh**
Penalty factor (F)	0	1	2

Table 3: values for penalty factor F

The Overcapacity Penalty is based on the weighted average contract value of the CMU and is calculated over all the different MTUs that constitute the AMT Moment, similar to the calculation of the Unavailability Penalty in section 6.2:

$$Overcapacity\ Penalty =$$

$$\frac{1}{Q * UP} * \sum_{t=1}^{T} F * weighted\ average\ contract\ value(CMU, t) * OC(CMU, t)$$

Moreover, the Overcapacity is subject to the penalty cap, as per section 6.2.1.

Design recap

The Overcapacity Penalty is equal to 0 when the difference with the activation price is very small. The Overcapacity Penalty increases with the weighted average contract value and the amount of Overcapacity.

8 Annexes

This section includes details concerning the determination of SLA MTUs, the corrections that are applied for participation in frequency-related Ancillary Services and Redispatching Services, as well as the methodology of the baseline. These elements are used in the determination of the Available Capacity in the framework of both the Availability Monitoring and the Availability Testing.

8.1 Determination of SLA MTUs

As discussed in section 4.2.3, the service of Energy Constrained CMUs is limited to:

- the duration of its Service Level Agreement; and
- one activation per day;

In case the AMT Moments observed over one day exceed either of these limits, Elia determines a subset of these AMT Moments, the SLA MTUs. Only during these SLA MTUs an Obligated Capacity is imposed, notwithstanding ex-post Secondary Market Transactions.

The SLA MTUs are largely determined based on the behaviour of the CMU. Elia assumes that, seeing as the Energy Constrained CMUs react to market price signals, their dispatch based on said price signals is also the most effective contribution towards security of supply.

The SLA MTUs are automatically calculated by Elia and do not require specific input from the Capacity Provider.

The methodology for the determination of the SLA MTUs differs depending on whether it concerns a Daily Schedule CMU or Non-daily Schedule CMU. The underlying steps and logic remain the same:

1. Elia retains all AMT Moments
2. For each AMT Moment identified in step 1, Elia looks at the length of the AMT Moment:
    a. In case the AMT Moment is shorter or equal to the duration of the CMU's SLA Elia retains all AMT MTUs of the AMT Moment;
    b. In case the AMT Moment is longer than the duration of the CMU's SLA Elia retains the set of consecutive AMT MTUs with the highest average activation, based on either the Daily Schedule or the Required Volume (see section 4.3.2.1), thereby not exceeding the SLA of the CMU.
3. From the sets of AMT MTUs identified in step 2, Elia retains the one single set with the highest average activation.
4. In case the average activation between sets in step 3 is the same, Elia retains the set where the highest Day-Ahead market price was observed.

In case no activation was observed over the entire day for the CMU, Elia considers all observed AMT MTUs as SLA MTUs. At first glance this might seem in contradiction of the limitations set out in the beginning of this section. However, as discussed in section 4.3 Elia will consider the CMU's capacity as Unproven Availability in these situations.

Design Recap:

The SLA MTUs are automatically determined based on the CMUs strongest reaction to the market price signal.

The example below explains the importance of each of these steps. In this hypothetical example, both AMT MTUs and regular MTUs take place. The CMU has a SLA of 1 hour, i.e. four quarter hours:

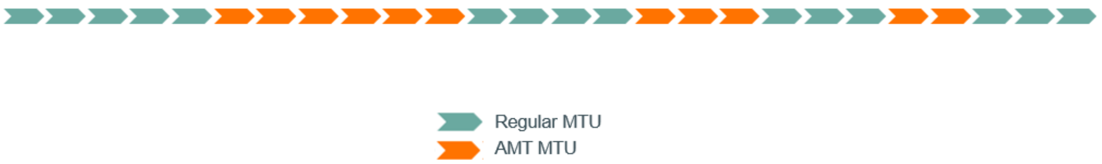

Figure 20: MTUs for SLA MTU determination

Following step 1, Elia selects all AMT Moments, i.e. all consecutive sets of AMT MTUs.

Figure 21: selection of all AMt MTUs

Following step 2, Elia looks at each selected AMT Moment individually. When the Moment is shorter than the SLA duration (four quarter hours), it is selected entirely.

- The second and third AMT Moment lasts three and two AMT MTUs, respectively. This means that they are shorter than the SLA duration and are selected entirely.
- The first AMT Moment is longer than the SLA duration. Elia selects the consecutive set within the AMT Moment with the highest activation. For Daily Schedule CMUs, this is based on the Daily Schedule. For Non-daily Schedule CMUs this is based on the Required Volume. In this example, the middle four MTUs are retained.

After this step, the first criterion of Energy Constrained CMUs, namely that an activation cannot be longer than their SLA, is satisfied.

Figure 22: selection of MTUs per AMT Moment

Following step 3, from the sets retained in step 2 Elia retains the single set with the highest average activation over that set. In this example, this means the second AMT Moment is selected for the SLA MTUs.

After this step, the second criterion of Energy Constrained CMUs, namely that only one activation per day can take place, is satisfied.

Figure 23: selection of SLA MTUs

The exact determination of SLA MTUs differs slightly depending on whether the CMU is Daily Schedule or not. These are each treated in the following sections.

8.1.1 Determination of SLA MTUs for Daily Schedule CMUs

The determination of activations takes place based on the information provided by the Capacity Provider in the Daily Schedule.

The methodology for the determination of SLA MTUs for Daily Schedule CMUs then looks as follows:

1. Elia retains all AMT Moments
2. From each AMT Moment identified in step 1:
    a. In case the AMT Moment is shorter or equal to the duration of the CMU's SLA Elia retains all AMT MTUs of the AMT Moment;
    b. In case the AMT Moment is longer than the duration of the CMU's SLA Elia retains the set of consecutive AMT MTUs where the Capacity Provider submitted the highest activation in its Daily Schedule.
3. From the sets of AMT MTUs identified in step 2, Elia retains the one single set with the highest average Measured Power.
4. In case the average Measured Power between sets in step 3 is the same, Elia retains the set where the highest Day-Ahead market price was observed.

8.1.2 Determination of SLA MTUs for Non-daily Schedule CMUs

The determination of activations takes place based on the Declared Prices (see also section 4.3.2.1). In particular, the Declared Prices allow Elia to determine the Required Volume that is expected to react to market prices.

The methodology for the determination of SLA MTUs for Non-daily Schedule CMUs then looks as follows:

1. Elia retains all AMT Moments
2. From each AMT Moment identified in step 1:
    a. In case the AMT Moment is shorter or equal to the duration of the CMU's SLA Elia retains all AMT MTUs of the AMT Moment;
    b. In case the AMT Moment is longer than the duration of the CMU's SLA Elia retains the set of consecutive AMT MTUs with the highest average Required Volume.
3. From the sets of AMT MTUs identified in step 2, Elia retains the one single set

with the highest average Active Volume as per section 4.3.2.2.

4. In case the average Active Volume between sets in step 3 is the same, Elia retains the set where the highest Day-Ahead market price was observed.

8.2 Corrections for Ancillary Services and Redispatching Services

In case a CMU participates in Ancillary Services and/or Redispatching Services their behavior might not necessarily correspond exactly to what Elia expects based on the market price signals. In this case, Elia applies certain corrections to take these effects into account.

Under Frequency-Related Ancillary Services, Elia understands the following three products:

- Frequency Containment Reserve (FCR)
- Automatic Frequency Restoration Reserve (aFRR)
- Manual Frequency Restoration Reserve (mFRR)

The correction for a CMU is calculated as the sum of the corrections for the Delivery Points that constitute it, which is represented by the following formula:

$$V_{Correction}(CMU,t) = \sum_{DP \in CMU} V_{correction,AS}(DP,t) + \sum_{DP \in CMU} V_{correction,RD}(DP,t)$$

Elia uses either the Measured Power (for Daily Schedule CMUs) or the Initial Active Volume (for Non-daily Schedule CMUs) as the starting point for the corrections. The attentive reader might remember that the Initial Active Volume is simply the Measured Power summed over the Delivery Point(s) of the CMU (or the reduction of offtake in case of offtake Deliver Points), as explained in section 4.3.2.2. Some reflections on the direction of the product are required before determining the corrections:

- **Upward direction:** In case the Delivery Point delivered Ancillary Services in the upward direction (i.e., by increasing its energy production), this increased production is included in the Measured Power and hence does not need to be accounted for in the correction. However, any volume reserved in the upward direction, is not included in the Measured Power, and should still be included in the correction.
- **Downward direction:** In case the Delivery Point delivered Ancillary Services in the downward direction (i.e., by lowering its energy production), this decrease is directly reflected in the Measured Power, as the Measured Power of the Delivery Point will be lowered, therefore the corrections need to include any downward activations.

Taking into account the considerations related to the direction of the product, Elia applies the following correction for the participation to frequency-related Ancillary Services:

$$V_{correction,AS}(DP,t) =$$

$$\sum_{p \in P} \left(Max\{0; V_{capacity,UP,p}(DP,t) - V_{energy,UP,p}(DP,t)\} + V_{energy,DOWN,p}(DP,t) \right) + V_{FCR}(DP,t)$$

The first part of the formula consists of a correction that is applied once for aFRR and then once for mFRR, resulting in a sum over both products p. For both aFRR and mFRR, the correction is determined as the difference between the volume reserved following a capacity auction for the product, and the volume of delivered energy. Volume which was reserved in the upward direction but not activated is naturally not included in the initial Active Volume of the Delivery Point and should be included in the correction. Figure 24 shows an example for the delivery of aFRR.

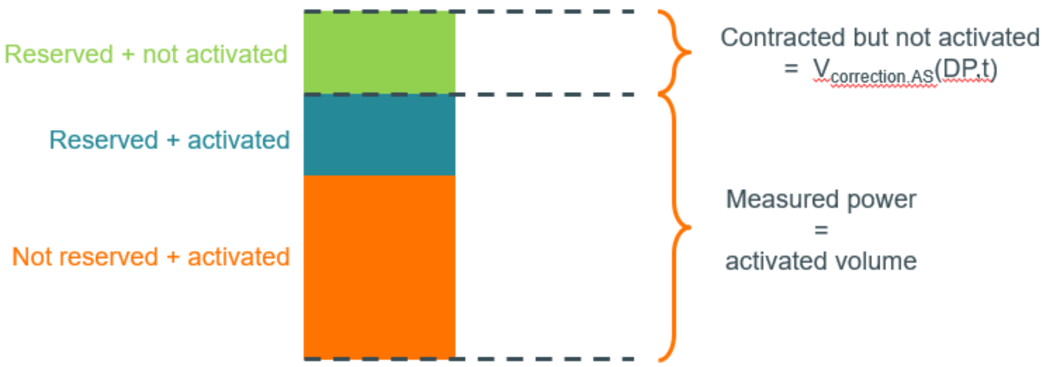

Figure 24: Correction for the participation to aFRR for a Delivery Point without Daily Schedule

In addition to the terms related to volume reservation in a capacity auction for the product, the correction also includes a term for any downwards activation.

Lastly, Elia corrects for FCR assuming a downward activation of the entire contracted FCR volume during the MTU t in question.

Next to a correction for the Frequency related ancillary services, Elia corrects for the participation to Redispatching Services. Elia corrects for any downward activation in Redispatching:

$$V_{correction,RD}(DP,t) = V_{RD,DOWN}(DP,t)$$