PUBLIC CONSULTATION

Day-ahead Balance Obligation of the Balance Responsible Parties

September 22nd 2020

Content

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Executive summary

In Belgium, each BRP must submit Nominations to Elia after the Day-ahead market clearance and these Nominations have to be balanced on a quarter-hourly basis, in compliance with what is called the **"Day-ahead balance obligation of the BRPs"**. This Day-ahead balance obligation was **introduced in the first Federal Grid Code of 2002**[1] and hence in the first Belgian BRP contract. At that time, the picture provided by the Day-ahead nominations was quite representative of the Real-time situation, since not a lot of changes were supposed to happen during the Intraday timeframe: there was indeed no continuous Intraday market, the intermittent energy sources were limited and the demand presented little flexibility. **In the meantime, the European energy mix and markets have been evolving dramatically**. With the ongoing energy transition, the installed capacity of variable renewables is experiencing an explosive growth and new technologies enabling demand flexibility are constantly emerging. Market designs are progressively adjusted to this new reality, e.g. by allowing freedom of dispatch in Intraday or facilitating demand side management. As a consequence, the volumes of energy exchanged on Intraday markets - which are now continuously organized - are rapidly increasing and large changes regularly happen between the forecasts available in Day-ahead and the Real-time situation. This rapid and substantial evolution **somewhat questions the relevance of the current Day-ahead balance obligation of the BRPs.**

In this context, Elia performed an analysis in order to assess whether this Day-ahead balance obligation is still pertinent and whether it would remain justified in the coming years, or, on the contrary, whether it should **evolve to allow the BRPs balancing their portfolio closer to real time, while still continue ensuring the system security**. This questioning is moreover fully **in line with the European Regulation**[2], which by default, does not impose any Day-ahead balance obligation, but allows the TSO to introduce such an obligation in its Terms & Conditions BRP when it is deemed relevant.

The objective of this study was therefore to analyze the relevance of the current Day-ahead obligation, and, if need be:

- to identify the possible evolutions of this obligation;
- to suggest the **most appropriate solution for the Belgian context**, taking into account the feasibility, benefits and risks of each option;
- to propose a **realistic and safe implementation plan** for this solution.

The present document is the first version of a **final report** of this study that will be submitted **on December 23rd 2020**.

The study was organized in three steps:

- First of all, a **prospection work** was conducted to get a better understanding of the balancing scheme currently implemented in Belgium, and of the mechanisms used in other neighboring or more distant countries. To do so, several initiatives were taken:

[1] The Royal Decree of 19 December 2002, establishing a grid code for operating and accessing the electricity transmission system. Note that the Day-ahead balance obligation is no longer mentioned in the current version of the Federal Grid Code (version of 29th April 2019).
[2] Article 18 of the European Guideline for Electricity Balancing (EBGL)

  - **Interviews** were organized with Belgian Market Parties in order to discuss the pros and cons of the current Day-ahead balance obligation, as well as of its possible evolutions;
  - An **internal analysis** was realized to identify all the operational processes using the Day-ahead nominations and to assess whether balanced nominations are necessary to ensure the system security;
  - A **benchmark** with neighboring countries was performed in order to get a better understanding of other TSO's practices in terms of balance obligations and to get their feedback on their system efficiency;
  - An **in-depth literature review** was carried out in order to get a better knowledge of other market designs and assess if some aspects of these other designs can be transposed to the Belgian context. In particular, the 'virtual bidding' mechanism introduced in the US markets was analyzed and the risks, benefits and applicability of virtual bidding in the Belgian system were assessed;
- Based on the findings of the benchmark, interviews and literature review, and based on a careful analysis of the internal processes relying on the current Day-ahead balance obligation, the relevancy of the current Day-ahead obligation was assessed. The **feasibility and risk/opportunities of several possible evolutions** of the Day-ahead balance obligation were then analyzed, and a **clear recommendation was made**.
- Finally, an **implementation plan was prepared**, in order to allow a smooth and safe implementation of our recommendation.

Our prospection work, based on interviews with Belgian market parties, benchmark with other European TSOs, in-depth study of the American mechanism of "virtual bidding" and internal analysis of all the operational processes relying on the Day-ahead nominations, led to the following observations:

- Other countries, sometimes with balancing systems that are very similar to ours, **function well without any kind of Day-ahead balance obligation;**
- The Elia operational processes making use of the Day-ahead nominations (adequacy checks, congestion forecasts) **do not need balanced nominations** to work properly;
- The Day-ahead balance obligation **could jeopardize the quality of the information** communicated to Elia in Day-ahead;
- The current Day-ahead obligation introduces a **non-level playing field** between Physical BRPs (who could possibly circumvent the obligation) and Traders (for which a strict monitoring apply);
- It puts up **barriers to possible spot market improvements** (such as better price convergence between Day-ahead and Intraday markets, higher market liquidity, reduction of possible exercise of market power)
- Several Belgian and foreign experiences show that a **strong imbalance tariff is much more powerful** than a formal Day-ahead balance obligation, and is **even self-sufficient**, to prevent Real-time imbalances.

These observations confirmed our belief that the current Day-ahead balance obligation presents limitations and needs to evolve.

All **possible evolutions**, going from keeping a balance obligation in Day-ahead, while improving some of its aspects, to removing any kind of balance obligation before Real-time, were therefore **assessed and objectively compared**.

The comparison showed that the **full relaxation of the Day-ahead balance obligation** is the most appropriate option for the current Belgian context: it **addresses most of the limitations of the current system** and is future proof

since it also **removes the barriers to possible spot market improvements** that will become more and more relevant with increased renewables, demand flexibility and hence Intraday market liquidity. Even though the current Day-ahead balance obligation is sometimes considered as a safeguard to prevent large Real-time imbalances, **regular higher System Imbalances are not to be expected** with the relaxation of the Day-ahead balance obligation. The strong financial incentive given by the imbalance tariff should indeed discourage the BRPs to adopt large open positions in Day-ahead when the risk that they will not be able to hedge their position before the Real-time is important (e.g. in case of tense situations).

Elia therefore **recommends to fully remove the Day-ahead balance obligation while keeping the Day-ahead nomination process and the Real-time formal balance obligation unchanged in a first stage**. Elia analyzed the risks linked to the relaxation of the Day-ahead balance obligation and believes that the risk of higher System Imbalance is very unlikely. In order to confirm this assumption and make sure the relaxation of the Day-ahead balance obligation is **implemented in a smooth and safe way**, without impacting the Belgian System Imbalance, **two measures** were proposed:

- A **progressive relaxation** of the Day-ahead balance obligation, foreseeing a **temporary period** during which a **maximum Day-ahead open position** is defined for each BRP. An evaluation of this temporary period would then allow making the final decision to evolve towards a full removal of this obligation, to maintain its partial relaxation, or to revert back to a situation where a strict Day-ahead balance obligation apply.

- The **publication**, on Elia's website, **of new indicators** depicting the **total (i.e. aggregated) open position** taken by the BRPs at the **end of the DAM**[3]. By comparing their position against the global position of the market, BRPs could evaluate how easy it will be to find counterparties to balance their position before Real-time, or how interesting it can be to bid or offer additional supply/demand in the Intraday market.

A comprehensive **cost-benefit analysis** of this recommendation, taking the aforementioned mitigation measures into account, was then performed. The cost and benefits were quantified where possible. However, one has to keep in mind that the **final effects** of the suppression of the Day-ahead balance obligation will all **depend on the behavior of the BRPs**: if BRPs assess that the Intraday market liquidity is too poor to leave any position open at the end of the DAM, then the suppression of the Day-ahead balance obligation will have barely any impact at all. In particular, a very worst case scenario was built and simulated to estimate an upper limit of the impact of the removal of the Day-

[3] Day-ahead Market

ahead balance obligation on the Elia FRR capacity needs. The simulations showed that the impact would remain negligible, even in this worst case scenario.

Finally, **possible next steps and future evolutions** were identified, since the relaxation of the Day-ahead balance obligation might be seen as **a first step towards the simplification of the current balancing process**. It indeed opens the way to other adaptations, such as, for example, the rationalization of the information communicated by the BRPs to Elia in Day-ahead through the nomination process.

Terminology

Access Point	Physical location on the grid where electricity offtake or injection is possible
Area Control Error (ACE)	Difference, for a considered quarter-hour and expressed in MW, between the scheduled (“program”) and measured values of the interchanges of the Belgian control area, taking into account the effect of frequency bias.
Balance Responsible Party (BRP)	As defined in Article 2(7) of the EBGL and listed in the register of Balance Responsible Parties
(External or Internal) Commercial Trade Schedule	As defined in the EU SOGL Guideline.
Coreso	Centralised Regional Security Coordinator (RSC) performing services for the TSOs, such as providing a regional model of the grid or performing advanced calculations to tell TSOs which remedial actions are the most cost-efficient, without being constrained to national borders.
CIPU contract	The contract for the Coordination of Injection of Production Units concluded with ELIA, or any other regulated contract(s) that will replace the CIPU Contract, in accordance with the dispositions in Art. 377 of the Federal Grid Code.
Frequency Restoration Reserve (FRR)	As defined in Article 3 (2) of SOGL
Independent System Operator (ISO)	Organization that coordinates, controls and monitors the operation of the electrical power system within one or multiple states of the United States.
Load Frequency Control (LFC) block	As defined in Article 3 (2) of SOGL, also called control zone or control area in this report. ELIA LFC block represents the Belgian geographical area.
Net Regulation Volume (NRV)	Defined on a quarterly basis and is the difference between: • on one hand, the sum of the gross volume of upward regulation as ordered by Elia, for the considered quarter, for maintaining the balance in the Belgian control area, expressed in MW, and the strategic reserve volume injected in the balancing control area for the same quarter; • and on the other hand, gross volume of downward regulation as ordered by Elia, for the

	considered quarter, for maintaining the balance in the Belgian control area, expressed in MW.
Nomination	As defined in the EU FCA Guideline
Physical BRP	BRP with at least one: - Injection/offtake Access Point connected to the Elia grid, excluding those that supply a CDS connected to the Elia grid; - Distribution allocation; - Close Distribution System injection/offtake allocation; Allocated to its balancing perimeter.
Power Generating Module	As defined in article 2(5), article 2(9) and article 2(15) of the NC RfG.
Scheduling Agent	Any natural person or legal entity as defined in Article 3 (90) of the SOGL, and with whom Elia has concluded a contract for the Scheduling Agent in accordance with article 249 of the Federal Grid Code.
System Imbalance (SI)	Difference between the Area Control Error (ACE) and the Net Regulation Volume (NRV). The System Imbalance is obtained by neutralising the activated means (NRV) – deployed by Elia for managing balance in the Belgian control area – out of the ACE.
Trader BRP	BRP without any Access Point, distribution or Close Distribution System allocation allocated to its balancing perimeter. The balancing perimeter of this type of BRP only consists of internal and external commercial trades.

Introduction

In Belgium, each BRP must submit Nominations to Elia after the Day-ahead market clearance and these Nominations have to be balanced on a quarter-hourly basis, in compliance with what is called the **"Day-ahead balance obligation of the BRPs"**. This Day-ahead balance obligation was **introduced in the first Federal Grid Code of 2002**[4] and hence in the first Belgian BRP contract. At that time, the picture provided by the Day-ahead nominations was quite representative of the Real-time situation, since not a lot of changes were supposed to happen during the Intraday timeframe: there was indeed no continuous Intraday market, the intermittent energy sources were limited and the demand presented little flexibility. **In the meantime, the European energy mix and markets have been evolving dramatically**. With the ongoing energy transition, the installed capacity of variable renewables is experiencing an explosive growth and new technologies enabling demand flexibility are constantly emerging. Market designs are progressively adjusted to this new reality, e.g. by allowing freedom of dispatch in Intraday or facilitating demand side management. As a consequence, the volumes of energy exchanged on Intraday markets - which are now continuously organized - are rapidly increasing and large changes regularly happen between the forecasts available in Day-ahead and the Real-time situation. This rapid and substantial evolution **somewhat questions the relevance of the current Day-ahead balance obligation of the BRPs.**

In this context, Elia performed an analysis in order to assess whether this Day-ahead balance obligation is still pertinent and whether it would remain justified in the coming years, or, on the contrary, whether it should **evolve to allow the BRPs balancing their portfolio closer to real time, while still continue ensuring the system security**. This questioning is moreover fully **in line with the European Regulation**[5], which by default, does not impose any Day-ahead balance obligation, but allows the TSO to introduce such an obligation in its Terms & Conditions BRP when it is deemed relevant.

The objective of this study is therefore to analyze the relevance of the current Day-ahead obligation, and, if need be:

- to identify the possible evolutions of this obligation;
- to suggest the **most appropriate solution for the Belgian context**, taking into account the feasibility, benefits and risks of each option;
- to propose a **realistic and safe implementation plan** for this solution.

The present document is the first version of a **final report** of this study that will be submitted **on December 23rd 2020**. It is structured in four steps:

1. First of all, the **current approach followed to balance the Belgian control area** is explained and briefly assessed;
2. The focus is then set on the Day-ahead balance obligation as such, and the **relevance of this obligation is evaluated**:

[4] The Royal Decree of 19 December 2002, establishing a grid code for operating and accessing the electricity transmission system. Note that the Day-ahead balance obligation is no longer mentioned in the current version of the Federal Grid Code (version of 29th April 2019).
[5] Article 18 of the European Guideline for Electricity Balancing (EBGL)

a. From a **legal perspective** : the European harmonised requirements related to balancing, which are set out in EU regulation 2017/2195 establishing Electricity Balancing Guidelines (EBGL), are examined;
b. From the **Belgian stakeholders' perspective** : market parties that are active in Belgium were interviewed about the current Day-ahead balance obligation and its possible evolution, and their feedback is summarized in this report;
c. From a **benchmark perspective**:
    i. Exchanges were organized with **neighboring TSOs** in order to understand and assess the approach they developed to balance their control area, and the main observations and conclusions are reflected in this report;
    ii. **Virtual trading**, which is a concept introduced in the US and which relies on the possibility for the market players to take open positions in Day-ahead, was studied in details. The main elements and conclusions of this study are reported in this document.

3. Different **possible evolutions** of the Day-ahead balance obligation are then **compared**, in order to be able to **recommend the most appropriate solution for the future**. A cost-based analysis, based on both qualitative and quantitative assessments, is also performed for the proposed evolution.
4. And finally, a first discussion is being held regarding the **timeline for the implementation** of Elia's recommendation. A comprehensive implementation timeline will be suggested in the final report of this study, after further alignments with other projects and initiatives that are ongoing or are planned by Elia in the coming months

The present public consultation is an opportunity to **collect stakeholders' views** on the study in general and to receive feedback on some specific questions regarding the implementation approach. The stakeholders' feedback will facilitate the finalization of the study.

Current approach to balance the system in Belgium

1. The role and obligations of BRPs

To help maintain the balance in the grid between generation and consumption, a **Balance Responsible Party** (BRP) has to be designated at every Access Point of the grid. The BRP may be a producer, major customer, energy supplier or trader.

Each BRP is responsible for a **portfolio** consisting in:

- Physical **injections**[6] **and offtakes** from/to the grid (related to Access Points on the grid);
- And/or **commercial power trades** (via Over-The-Counter exchanges or via exchanges on the Day-ahead and Continuous Intraday Markets), including imports and exports;

The obligations of the BRP are described in the "BRP contract"[7]. Among these obligations, two are of particular interest in the context of this study and are described in the next sections:

- The **obligation to submit information to Elia**, which is used for several checks and security analysis;
- The **balance obligations**.

1.1 Information obligation

At the moment[8], the BRP bears two obligations of information transmission to Elia:

- Any BRP has to submit **Nominations** to Elia, according to the **BRP contract**;
- Any BRP with Power Generating Module(s) with a capacity greater or equal to 25MW in its portfolio has to sign a **CIPU contract**[9] and to **submit generation schedules** for this (these) large unit(s). This last obligation is nowadays borne by the BRP but will be taken over by the Scheduling Agent in the context of the ongoing iCAROS program (see section 1.3 for more explanation about the future evolution)

1.1.1 Nominations

Nominations are information about:

- The **expected physical injections and offtakes** of all Grid Users of the BRP portfolio. In this case nominations are provided per Access Point to the Elia grid[10] and aggregated per distribution grid;

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[6] Including physical generation from Power Generating Module(s) with an installed capacity greater or equal to 25MW, which are covered by a CIPU contract, and for which the nominations are performed according to the procedures described in the CIPU contract

[7] More information available on Elia website : https://www.elia.be/en/electricity-market-and-system/role-of-brp

[8] As explained in section 1.3, the second obligation will be taken over by the Scheduling Agent after the implementation of the 2nd phase of the iCAROS project, but is nowadays still borne by the BRP

[9] The CIPU contract is about to be replaced by a regulated contract named Terms & Conditions Scheduling Agent

[10] Including the CDS Access points to the Elia grid, which represent the aggregation of all the market access points of this CDS

- The **Internal/External commercial trade schedules** related to purchases and sales with other BRPs and/or related to imports and exports on the borders. Note that each Commercial Trade Schedule must be confirmed by a corresponding Commercial Trade Schedule submitted by its counterparty (being the BRP with whom the energy is exchanged) in order to be accepted by Elia.

They have to be submitted to Elia **after the Day-ahead market clearance**, for **each quarter-hour of the next day**.
Some elements of the nominations have to be updated by the BRPs in Intraday:

- External commercial trades schedule must be updated at the latest one hour before delivery, according to the Intraday cross-zonal gate closure time (XBID);
- Internal commercial trade schedules can be submitted until 2PM of the day following delivery.

The expected injections and offtakes at each Access Point or distribution grid do not have to be updated in Intraday, except for the generation of large production units that will be notified to Elia via the process described in the next section.

1.1.2 Generation schedules

Generation schedules represent the **expected production of a Power Generating Module** (expressed in MW) for a given quarter-hour.
At the moment[11], these schedules are only requested for large production units (mainly the units with an installed capacity greater or equal to 25MW) and must be submitted by the BRP to Elia **after the Day-ahead market clearance**, **for each quarter-hour of the next day**. Intraday production changes have to be notified to Elia. The Intraday production change requests can be introduced up to 45 minutes before delivery. When a change request is accepted, the generation schedule has to be updated accordingly.

The Nominations and generation schedules are used by Elia for three main purposes:

- The **consistency of commercial transactions** : Elia continuously checks the consistency[12] of commercial transactions between BRPs;
- The **adequacy checks**: Elia performs a first analysis after the closure of the Day-ahead market. This analysis is then continuously updated (on a 15 minutes basis) in Intraday. It consists of two checks:
    - Elia verifies that the total production forecast in the Belgian control zone[13], increased by the remaining upwards non-contracted capacity that would be available within the 15 minutes[14], is greater than the Elia total load forecast;
    - Elia controls that the margin between:

[11] This will evolve in the framework of the iCAROS project
[12] Elia controls that a commercial trade is notified by both the BRP and its counterparty, and that the commercial trade schedule communicated by the BRP matches the commercial trade schedule communicated by its counterparty. In case an inconsistency is detected, the commercial trade schedule can be rejected, or a tariff for external inconsistency may apply.
[13] Calculated as : "the net imports + the generation schedules of the non-renewable CIPU units + the forecast for renewable production + the forecast for the production of the non-CIPU units"
[14] This capacity is put at Elia's disposal under the form of non-contracted energy bids

  - On the one hand, the total production forecast in the Belgian control zone, increased by the remaining upwards non-contracted capacity that would be available within the 15 minutes and by the contracted upwards capacity;
  - And on the other hand, the total load forecast;

  is sufficient to cover the dimensioning incident (i.e. the loss of a nuclear unit).

  This analysis might trig several alarms which are then closely monitored by Elia and can eventually result in concrete actions if the scarcity risk is confirmed, such as the start of "slow"[15] production units which were not foreseen to be running according to the generation schedules received, or the start of strategic reserves. These concrete actions are typically launched closer to real time (e.g. a few hours before the Real-time) and not after the first Day-ahead analysis.
- The **congestion forecasts**: Elia and Coreso use imports/exports data and generation schedules to perform some security analysis, to compute available transfer capacities and to identify and manage congestions. Here again, the analysis is performed after the closure of the Day-ahead market and is updated in Intraday.

1.2 Balance Day-ahead & Real-time obligations

In accordance with the BRP contract, BRPs are bound by two balance obligations:

- The BRP has to submit **balanced Nominations in Day-ahead**;
- And the BRP has to **plan and utilize all reasonable means to maintain effective balance** (i.e. in real time) within its perimeter on a quarter-hourly basis.

This last obligation comes with one exception: a BRP can contribute in real time to the overall objective of maintaining the balance of the Belgian control area by deviating from the balance of its perimeter, provided that he is able to restore, in real time and at any time, the balance of its perimeter.
Implicitly, BRPs have the possibility to be temporarily in imbalance during the Intraday timeframe.

1.2.1 Day-ahead obligation

When the BRP submits its Nominations to Elia after the Day-ahead market clearance, it has to ensure that these Nominations are **balanced on a quarter-hourly basis**, which means that, for each quarter-hour, **the sum of injections, generations and purchases must equal the sum of offtakes and sales in its own perimeter**.
Elia verifies that the Nominations submitted by each BRP are balanced for each 1/4h and asks the BRP to adapt its Nominations in case of imbalances. In case of repeated failures to balance its Nominations (i.e. failures observed for 3 consecutive calendar days or 5 calendar days in one month), the BRP might be prohibited from utilizing the Intraday Market for 30 calendar days.
This Day-ahead balance obligation is described in Article 23 of the BRP contract which is based on Article 18 (7) of the EU EBGL Guideline:

[15] Units with a start-up time greater than 15 minutes

Article 18 - Terms and conditions related to balancing

...

7. *Each connecting TSO may include the following elements in the proposal for the terms and conditions for balancing service providers or in the terms and conditions for balance responsible parties:*

…

d) specific requirements with regard to the position of balance responsible parties submitted after the day-ahead market timeframe to ensure that the sum of their internal and external commercial trade schedules equals the sum of the physical generation and consumption schedules, taking into account electrical losses compensation, where relevant;

Figure 1: Extract of the EU EBGL Guideline

It was also mentioned in the first version of the Federal Grid Code of 2002, but has in the meantime been removed and does not longer belong to the version of 29th April 2019.

1.2.2 Real-time obligation

The BRP has to **provide and deploy all reasonable resources in order to be balanced in real time on a quarter-hourly basis**. Imbalances are computed for each quarter-hour based on the ex-post measurements. The imbalance is defined as the difference, for the concerned quarter-hour, between the actual injections[16] (including generations) and purchases on the one hand, and the actual offtakes[16] and sales on the other hand.

This Real-time obligation is an obligation of means and not an obligation of result. Upon Elia's request, the BRP needs to be able to justify its best effort to be balanced, by providing adequate evidence that it has made provisions for the resources needed to comply with its balancing obligation. However, even after deploying all reasonable means to reach the balance, a BRP **might still be in imbalance for a given quarter-hour**. In this case, it will be **subject to an imbalance tariff** as described in section 2.4.1.

Besides, as mentioned above, a BRP is allowed, under certain circumstances, to deviate from balancing its perimeter in order to contribute in real time to maintaining the balance of the Belgian control area. This principle constitutes the so-called "reactive balancing" scheme which will be further described in section 2.2.

This Real-time balance obligation is described in Article 15 of the BRP contract, which is compliant with Article 17 of the EU EBGL Guideline :

Article 17 - Role of balance responsible parties

1. *In real time, each balance responsible party shall strive to be balanced or help the power system to be balanced. The detailed requirements concerning this obligation shall be defined in the proposal for terms and conditions related to balancing set up pursuant to Article 18.*

Figure 2: extract of EU EBGL Guideline

[16] Based on the metering data from each Access Point

1.3 Evolution of the role and obligations of BRPs in the context of iCAROS

The European Guidelines have strongly impacted the roles and responsibilities of the parties involved in the provision of ancillary services as a whole. In order to translate these Guidelines into new contractual and operational frameworks, Elia has launched several projects to further develop the designs of the different products affected.
Among these projects, the iCAROS program aims at developing a new framework for the coordination of assets for system operations and market procedures.
This **iCAROS project** will introduce some changes that will **impact the roles and responsibilities of the BRP**:

- A new role of "Scheduling Agent" has been introduced. The **Scheduling Agent will be responsible to communicate the** Day-ahead **generation schedules to Elia** and to update them in Intraday. ELIA also assigns to the Scheduling Agent the responsibility for bidding flexibility on the asset to ELIA to be used for redispatching purposes. At the moment, the role of the Scheduling Agent is still borne by the BRP, but as from the implementation of the 2nd phase of the iCAROS project (planned in early 2023), the role of Scheduling Agent and BRP might be assumed by different actors. From then on, **the BRP**, as a role, **will no longer bear the responsibility to communicate generation schedules to Elia**.
- As from the 2nd phase of the iCAROS project, the **obligation** to communicate generation schedules will be **extended** to generation units with an **installed capacity between 1MW and 25MW**. However, the schedule obligation will be less stringent since the Scheduling Agent might deliver ON/OFF schedules instead of MW schedules.
- As from the 1st phase of the iCAROS project (planned in early 2022), the **bidding process** to offer flexibility for mFRR and redispatching **will become explicit**.

2. Balancing process

2.1 Process timeline

Day-ahead: After the **submission of balanced Day-ahead nominations** and of the generation schedules, Elia actively starts preparing the next day by performing **several checks and security analysis**, as described in section 1.1.

Intraday: These analyses are repeated during the Intraday timeframe, taking into account the updated generation schedules and commercial trade schedules. During this Intraday timeframe, the BRPs continue **taking all the reasonable measure to respect their Real-time obligation** and have their perimeter balanced for a given quarter-hour, by using their physical assets or exchanging energy with other BRPs. These means can be used by the BRPs up to different deadlines in Intraday:

H-1: External commercial transactions must be closed one hour before delivery, according to the Intraday cross-zonal gate closure time (XBID).

H-45': Generation schedules are frozen. However, deviations from the last schedules received are tolerated in Real-time (for self or reactive balancing purposes) if the unit can immediately come back to its schedule when requested by Elia for grid security reason.

H-5': Internal commercial trades can be realized until 5 minutes before delivery (even though they might be communicated to Elia until 2PM the day after delivery)

Real-time: The BRP that are allowed to participate to the **reactive balancing** scheme (see next section) can help maintaining the balance of the Belgian control area. At the same time, Elia activates **FRR means**. Both actions intend to help reducing the Belgian Area Control Error.

Post-delivery: Imbalances are computed for each BRP and each quarter-hour, **and settled at the imbalance tariff** of the given quarter-hour.

This process is illustrated on the figure below:

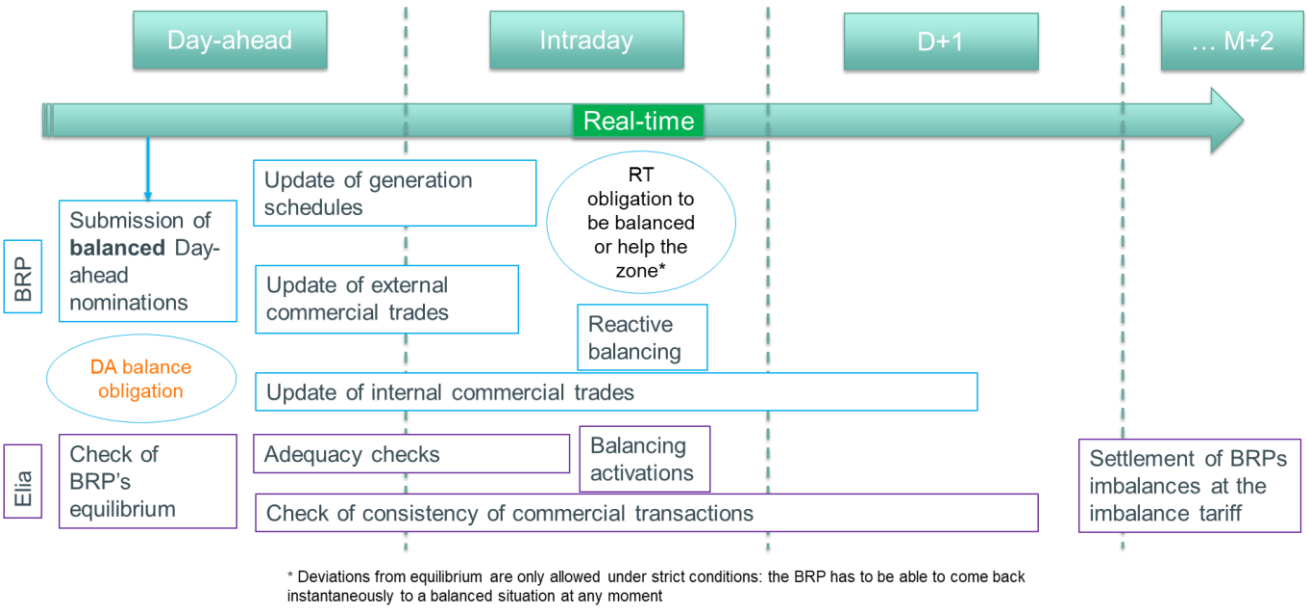


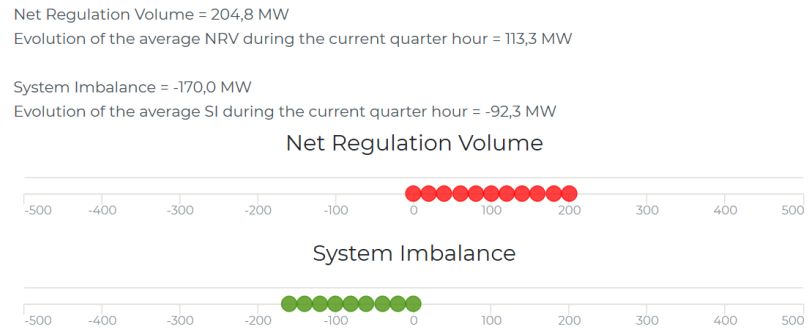
Figure 3: Timeline of the current balance process in Belgium

2.2 Reactive balancing

The reactive balancing scheme implemented in Belgium allows the BRPs to **voluntarily deviate from balancing their perimeter in order to help balance the Belgian control area**.

These deviations are only **allowed under strict conditions**: the BRP has to be able to **instantaneously come back to a balanced situation at any moment**. This limits the participation to the reactive balancing scheme to the flexible capacity a BRP can have in its portfolio, and aims at avoiding important voluntary imbalances in one direction (caused by BRPs expecting the Belgian area to be imbalanced in the opposite direction) that cannot be resorbed in Real-time if it appears that these premeditated imbalances eventually do not help the system (e.g. in case of wrong estimation of the system imbalance or in case of over-reaction of BRPs causing the system imbalance to switch to the other direction). This condition implicitly prevents Trader BRPs from participating to the reactive balancing scheme, since they can no longer trade energy after the Belgian hub gate closure time, 5 minutes before delivery, and it would therefore not be possible for them to come back to a balanced situation if it happened to be necessary in Real-time.

In order to help the BRPs balance the Belgian control area, **Elia publishes information** about system imbalance, imbalance price and imbalance price components in near-real time[17]. However, Elia cannot be held responsible of the voluntarily deviations of the BRPs and their possible consequences.



Situation at 27/08/2020 from 16:21 to 17:19

uarter	Minute	Quality status	NRV (MW)	SI (MW)	α (€/MWh)	MIP (€/MWh)	MDP (€/MWh)	SR (€/MWh)	SI < -I C (MW)	Price (€/MWh)
:15 > 17:30	17:19	Non-validated	123,022	-49,865	0,00	**58,29**	6,73			58,29
:15 > 17:30	17:18	Non-validated	153,007	-84,082	0,00	**58,29**	6,73			58,29
:15 > 17:30	17:17	Non-validated	192,025	-128,205	0,00	**58,29**	6,73			58,29
:15 > 17:30	17:16	Non-validated	210,778	-158,720	1,24	**58,29**	6,73			59,53
:15 > 17:30	17:15	Non-validated	205,191	-170,399	1,36	**58,29**	6,73			59,65
:00 > 17:15	17:14	Non-validated	-76,202	81,372	0,00	58,29	**6,73**			6,73
:00 > 17:15	17:13	Non-validated	-95,653	99,760	0,00	58,29	**6,73**			6,73

Figure 4: example of data published by Elia to help the BRPs balance the Belgian control area

2.3 Use and dimensioning of reserves

The role of the system operator in balancing the system is complementary to the market because it **neutralises the residual imbalance between injection and offtake that is not covered by market players**. Due to the reactive balancing mechanism described in section 2.2, a large part of the required flexibility is delivered by intra-day markets and Real-time actions and not by Elia. However, residual flexibility usually needs to be activated by Elia.

To maintain the balance of the Belgian control area[18], Elia activates flexibility **using different balancing products**:

- **Frequency restoration with automatic activation** (aFRR), which is mainly used to compensate for short and random imbalances;
- **Frequency restoration with manual activation** (mFRR), which serves as compensation for long, persistent and/or very extensive imbalances.

The means that are at Elia's disposal and the way they can be used to balance the zone are described in details in the Balancing Rules[19].

[17] This information is available on Elia website: **https://www.elia.be/en/grid-data**
[18] Which is monitored by means of quality criteria assessing the Belgian Area Control Error
[19] More information is available on Elia website : **https://www.elia.be/en/electricity-market-and-system/system-services/keeping-the-balance**

To make sure Elia has enough means at disposal to balance the system in real time, **Elia reserves FRR capacity in advance**. Elia's FRR reserve capacity needs are **dimensioned according to a dynamic methodology** specified in the LFC block operational agreement[20], approved by the CREG, where FRR needs are determined in Day-ahead with a resolution of 4-hours.

The methodology is based on a **probabilistic methodology** estimating the imbalance risks for each quarter-hour of the next day and determining the required reserve capacity on FRR to **cover 99.0% of the imbalance risks**. The probabilistic method is based on machine learning algorithms relating the imbalance risk to Day-ahead predicted system features such as renewable generation, demand, weather conditions, and taking into account the imbalance risks due to forced outages of available power plants and to the Nemo Link interconnector.

In parallel, Elia **considers the dimensioning incident by means of a deterministic methodology**. This method aims at ensuring that the positive and negative FRR needs shall not be less than the positive and negative dimensioning incident of the LFC block, as required by Article 157(2)e and 157(2)f of the SOGL. The dimensioning incident is defined by Article 3 of the SOGL as the highest expected instantaneously occurring active power imbalance within a LFC block in both positive and negative direction. In practice, the dimensioning incident of the Belgian control area is often defined by the loss of a nuclear plant (~1040 MW) for upward FRR and the loss of NEMO link (~1000 MW) for downward FRR.

Finally, in order to be in line with Articles 157(2)h and 157(2)i of the SOGL, Elia applies an additional minimum threshold to ensure that the required positive and negative reserve capacity is **sufficient to cover at least the positive and negative System Imbalances for 99.0% of the time, based on historical records** that are described in details in the Explanatory Note on Elia's LFC block operational agreement, and that include a rolling-period of two years.

This dimensioning methodology implies that the final FRR needs are **partially determined by the ability of the market to maintain the balance in their portfolio**. When assessing the effect of a design change or of a market evolution on the volumes of FRR contracted, one therefore first needs to evaluate if a modification of the BRPs way of working might be expected and, in turns, if this modification can cause a significant and recurrent increase or decrease of the System Imbalance. This question will be addressed later in this study, in order to assess the potential impact of an evolution of the Day-ahead balance obligation on Elia's FRR reserve capacity needs.

Note that, currently, the results of the deterministic methodology generally exceed the 99% of the estimated imbalance risk in upward direction and the largest incident therefore usually drives the upward reserve dimensioning. The downward FRR needs is determined by the results of the probabilistic approach when NEMO link is not scheduled in export.

2.4 Imbalance settlement

As mentioned above, the RT balance obligation is an obligation of means, and not an obligation of result. The residual imbalances of the BRPs are therefore settled at the imbalance tariff, which constitutes a strong financial incentive

[20] The last validated version of this document can be downloaded on the Elia website : **https://www.elia.be/en/electricity-market-and-system/system-services/keeping-the-balance**

for the BRPs to reduce their imbalances or to generate imbalances that actually help balance the Belgian control area.

2.4.1 Imbalance tariff

In Belgium, the imbalance tariff[21] is a **"single-price" system** based on the **marginal balancing bid price** with an **additional incentive component α**:

		System Imbalance	
		Positive	Negative or zero
Imbalance of the balance responsible party	Positive	MDP – α	MIP + α
	Negative		

Figure 5 : Tariffs for maintaining and restoring the residual imbalance of individual BRP for the tariff period 2020-2023

Where:

- MDP is the marginal price of downward activation of balancing bids
- MIP is the marginal price of upward activation of balancing bids
- α is an additional incentive component active in case of high imbalance (i.e. when the absolute value of the quarter-hour System Imbalance is greater than 150 MW)

This additional incentive **component α has been reinforced at the beginning of 2020**. In the previous imbalance settlement scheme, α was applied when the absolute value of the Belgian System Imbalance exceeded 140 MW in the ongoing Imbalance Settlement Period (ISP), and depended on the average of the squared System Imbalance over the ongoing ISP and the last seven ISPs. Its growth was slow and gradual. In the new scheme, α is active when the absolute value of the Belgian System Imbalance exceeds 150 MW in the current ISP. Moreover, the exact value of the α component depends on the average of the absolute values of the System Imbalance of the current and the previous ISP (cf. Figure 6 for a graphical representation). Note that the α component is expressed by an S-shaped curves, which makes it rise rapidly until 200 €/MWh and then flatten out at this maximum value of 200 €/MWh.

[21] The construction of the imbalance tariff is explained in details on Elia website : **https://www.elia.be/en/customers/invoicing-and-tariffs**

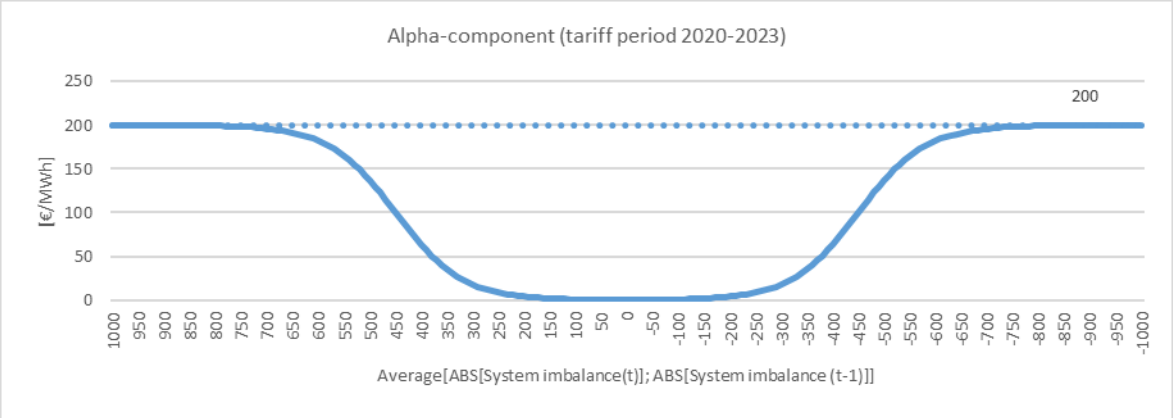


Figure 6 : Value of alpha component for tariff period 2020-2023

The reinforcement of the α component is illustrated in Figure 7 in which we see that higher values (up to 200 €/MWh) are reached much faster (i.e. for smaller System Imbalances) in the new imbalance settlement scheme than in the old one. Note that, for the sake of simplicity, this figure was computed considering a stable System Imbalance over a few ISPs[22], in order to be able to express the two curves according to one single variable representing the System Imbalance of the current ISP.

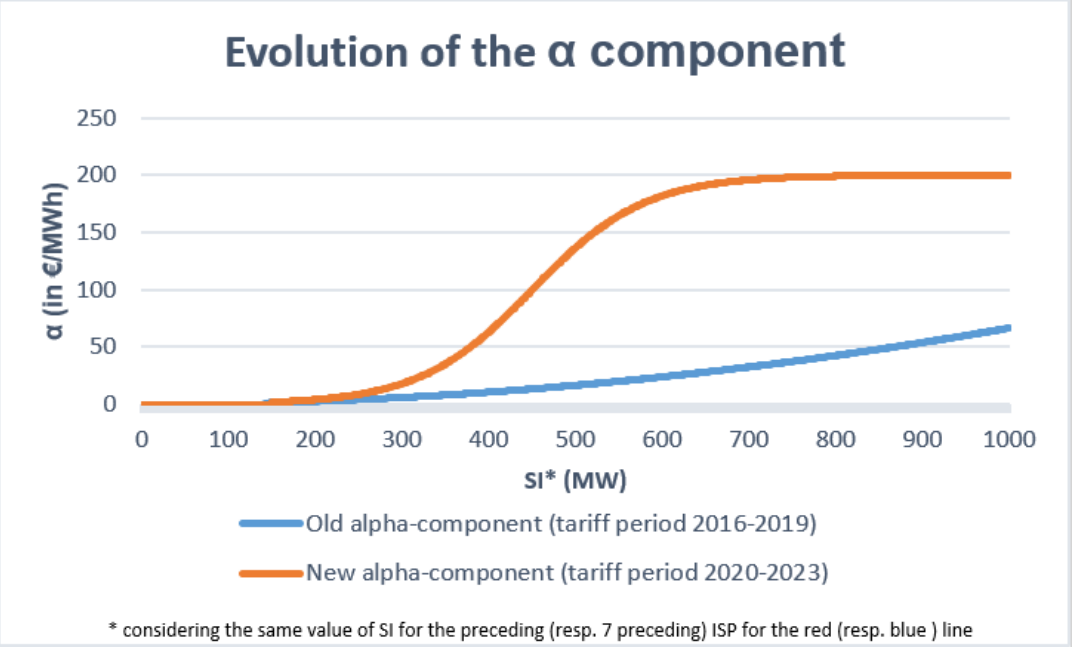


Figure 7: Evolution of alpha component before (in blue) and after (in red) 01/01/2020

The imbalance tariff is a “single-price” system, which means the same price applies to BRPs, regardless of their individual position (positive or negative imbalance). However, the tariff that applies to a positive imbalance (i.e. excessive injection of energy by the BRP) is a feed-in tariff for surplus energy and is therefore paid by Elia to the BRP if the imbalance tariff is positive; whereas the tariff that applies to a negative imbalance (i.e. insufficient injection of energy by

[22] 2 ISPs for the representation of the new α component, and 8 ISPs for the representation of the old one

the BRP) is a loss-making tariff for the sale of energy, which is therefore paid by the BRP to Elia if the imbalance tariff is positive.
The imbalance tariff is usually positive. However, it is possible, especially in the event of a downward adjustment, that the tariff be negative, hence reversing the payments between Elia and the BRPs (i.e. BRP with positive imbalances pays Elia and BRP with negative imbalances are paid by Elia).

2.4.2 Invoicing process

The imbalances of the BRPs are **settled monthly**. The invoice is sent **during the first half of month M+2**, once the following data are computed or collected, for each quarter-hour:

- Commercial transactions;
- Metering data from Elia measurement devices;
- Allocations from Distribution System Operators and Closed Distribution System Operators;
- Corrections of BRP perimeter after activations of a service on units located in the portfolio of BRP
- Imbalance tariff

The commercial transactions, metering data[23] and correction of BRP perimeters are used to compute the BRP imbalance for each quarter-hour of the considered month. The imbalance of each quarter-hour is then multiplied by the imbalance tariff applicable for this quarter-hour, and the results are summed over the whole settlement period.

2.4.3 Collaterals

Elia requires BRP to **cover potential defaults over a one-month period**, by depositing collateral. The collateral requirements are dimensioned in order to handle situations where the BRP is, in average, short up to 5% of his position (defined as the sum of his offtakes and sales)[24], considering an average imbalance price of 50€/MWh.

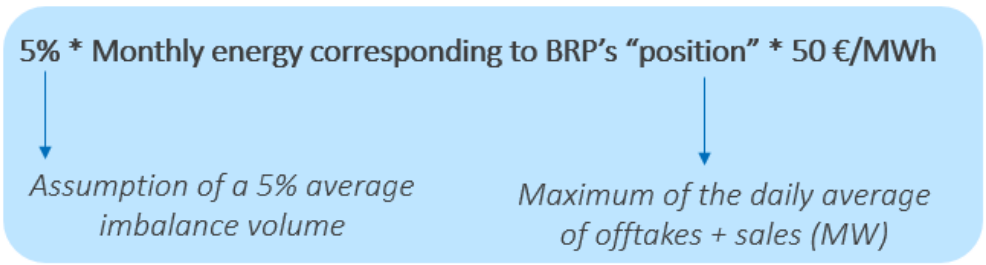


Figure 8 : current dimensioning of the collateral requirements

The collaterals must be adapted as soon as:

- the daily average of offtakes and sales exceeds twice a month and by more than 20% the "position" on which the collateral is dimensioned;
- the daily average of offtakes and sales exceeds by more than 40% the "position" on which the collateral is dimensioned;
- the average of the two last imbalance invoices is higher than the current value of collateral.

[23] Including grid losses
[24] In other words, in Real-time, the BRP does not manage to cover 5% of the sum of his offtakes and sales

2.5 Assessment of the current balancing process

In order to assess the Belgian balancing process, the evolution of System Imbalance and ACE can be analyzed. When looking at the evolution of the monthly **average ACE and System Imbalance** (on a quarter-hourly basis) between 2012 and 2020, **an increase in quality can be noticed until 2015, followed by a stabilization, and this despite the increased penetration of renewables.**

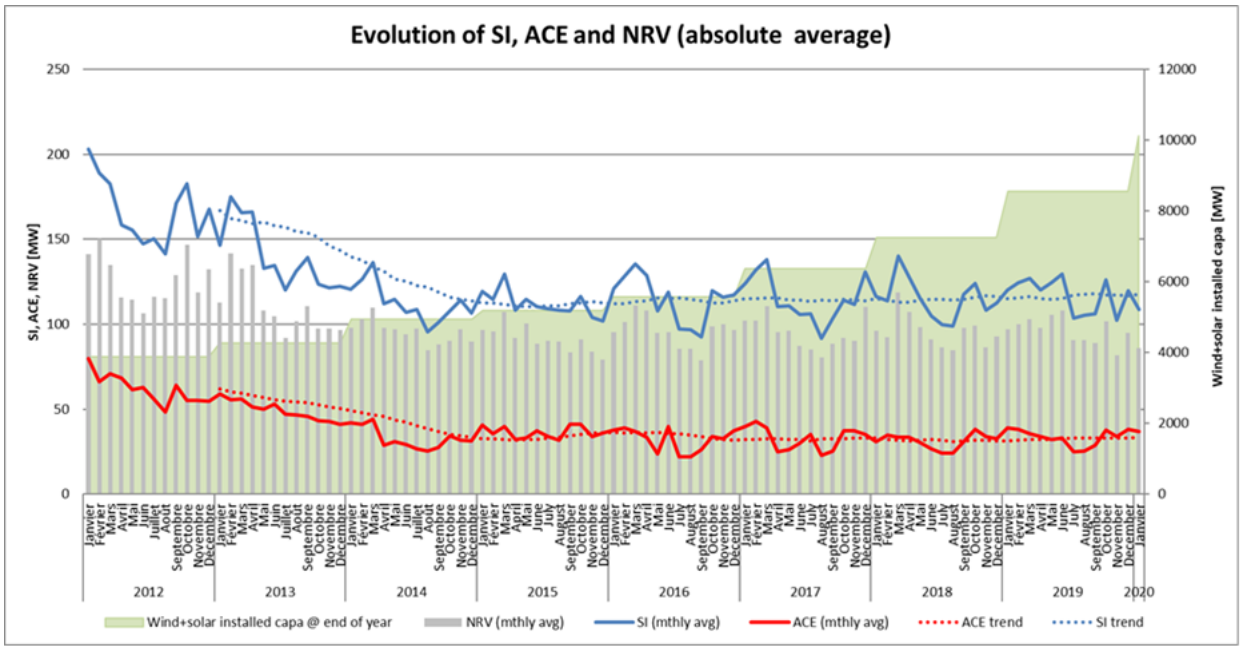


Figure 9: Evolution of the monthly average Net Regulated Volume, System Imbalance and Area Control Error between 2012 and 2018

These observations can be explained by several factors:

- In 2012, Belgium entered the **iGCC process** netting imbalances between some European control areas
- In 2012, Belgium introduced the **"single marginal" imbalance tariff** for BRPs, which is deemed as a strong financial incentive for the BRPs to avoid imbalances that do not help the zone in Real-time[25], and was even reinforced with the introduction of the new α component in 2020.
- In 2015, Belgium introduced the **reactive balancing scheme** enabling BRPs to help balancing the system

The fact that the System Imbalance follows the same stabilization trend as the Area Control Error over the last few years means that the BRPs imbalances are stable, and that the good regulation quality of the Belgian control area is not obtained by an increase in Elia's regulating actions.

[25] An imbalance tariff based on the marginal price of the activated balancing means is very efficient to incentivize the BRPs to take all possible measures to avoid imbalances that do not help the zone, because even small imbalances can be very costly when the marginal activated bid is expensive. Tariff based on weighted average prices of balancing activations can be considered as less risky and hence also as a less efficient incentive for the BRPs to avoid imbalances in the direction that does not help the zone.

The quality of BRPs balancing actions in the **current balancing process can therefore be deemed as satisfactory**. Besides, the improvement of the System Imbalance after the introduction of the "single marginal" imbalance tariff tends to **confirm the important role that a strong financial incentive plays in order to avoid imbalances that do not help the zone in real time**.

Rationale for modifying the Day-ahead Balance Obligation

3. Legal framework

The European harmonised requirements related to balancing are set out in EU regulation 2017/2195 establishing **Electricity Balancing Guidelines** (EBGL). This regulation mentions the following:

Article 17 - Role of balance responsible parties

1. *In real time, each balance responsible party shall strive to be balanced or help the power system to be balanced. The detailed requirements concerning this obligation shall be defined in the proposal for terms and conditions related to balancing set up pursuant to Article 18.*

Article 18 - Terms and conditions related to balancing

…

7. *Each connecting TSO may include the following elements in the proposal for the terms and conditions for balancing service providers or in the terms and conditions for balance responsible parties:*

…

d) specific requirements with regard to the position of balance responsible parties submitted after the day-ahead market timeframe to ensure that the sum of their internal and external commercial trade schedules equals the sum of the physical generation and consumption schedules, taking into account electrical losses compensation, where relevant;

Figure 10 : extracts from the EU EBGL Guideline

The current Day-ahead balance obligation **was introduced in the first Federal Grid Code of 2002**[26] and hence in the first Belgian BRP contract. At this time, requiring a balanced position in Day-ahead was deemed fully relevant, since little change was to be expected between the picture given by the Day-ahead nominations and the Real-time situation.

[26] The Royal Decree of 19 December 2002, establishing a grid code for operating and accessing the electricity transmission system. Note that the Day-ahead balance obligation does not exist anymore in the current Federal Grid Code of 29 April 2019.

However, **with a rapidly evolving energy landscape**[27], one can **legitimately wonder whether this Day-ahead balance obligation is still appropriate today**, and whether it will remain pertinent in the coming years.

The **European framework**, which **does not impose any kind of Day-ahead balance obligation**, but **allows**[28] the TSO to require[29] a Day-ahead balanced position ***if it is deemed relevant***, somehow reinforces the need for Elia to assess whether the current Day-ahead balance obligation is still justified in Belgium, or if it should be relaxed or removed, given the significant evolutions of the electricity markets since its introduction.

4. Feedback of the Belgian market regarding the current Day-ahead Balance obligation

Several market parties active in Belgium were interviewed in order to gather their opinions about the current Day-ahead balance obligation and its possible evolution. The interviewees were selected to represent as much as possible the diversity of the market parties (Federations or individual parties - Physical BRPs, Trader BRPs, Industrial consumers, etc.). In order to preserve the anonymity of the participants and the confidentiality of the discussions, only a summary of the interviews is restituted here. The interviews were realized by the consulting firm Compass Lexecon[30], who also supported Elia to draw the conclusions of these discussions.

4.1 Observations and conclusions

The results of the interviews clearly show that the current Day-ahead balance obligation is not perfect. Indeed, some **interviewees identified limitations in the present Day-ahead balance obligation**:

- All interviewees pointed that the Day-ahead balance obligation can be **circumvented by Physical BRPs**[31] and most of the interviewees suggested that voluntary arbitrages between Day-ahead and Intraday exist today in Belgium[32]. This limitation of the current Day-ahead balance obligation questions the **level-playing field** between Physical and Trader BRPs in the current situation.

[27] Including the creation of a continuous Intraday market which is expected to become more and more liquid with the growing penetration of intermittent energy sources and flexible demand.
[28] in art 18, §7.d
[29] In the Terms and Conditions for BRP,
[30] **https://www.compasslexecon.com/**
[31] Indeed, for Physical BRPs it is possible to send equilibrated programs while implicitly keeping open positions in Day-ahead e.g. by sending load/RES forecasts that do not perfectly reflect their best view, or by over-/underestimating the generation schedule of their production units. A perfect monitoring of the Day-ahead balance obligation is however impossible to ensure, as we will see further in this report.
On the contrary, the respect of the Day-ahead balance obligation is very easy to monitor and therefore impossible to circumvent by Trader BRPs : their nominations are indeed exclusively composed of commercial trades that have to be confirmed by the counterparties in order to be validated. Tweaking of nominations is therefore impossible for Trader BRPs.
[32] This possibility was already highlighted in [3] "Study on the general design of a mechanism for the remuneration of reserves in scarcity situations" by A. Papavasiliou, Y. Smeers and G. de Maere d'Aertrycke (available on CREG's website : https://www.creg.be/sites/default/files/assets/Publications/Notes/Z1986Annex.pdf)

- Some interviewees mentioned the practical limitations of the current Day-ahead obligation :
    - Some disequilibria are unavoidable because the tools available to BRPs to balance in Day-ahead do not perfectly match the 1/4h granularity of imbalance periods[33]. The current Day-ahead obligation **forces the BRPs to "flatten" their nominations artificially**.
    - More fundamentally, in tense situations (e.g. in case of adequacy issues), BRPs are theoretically not allowed to nominate unbalanced positions and signal Elia that they encounter difficulties. **The current Day-ahead balance obligation intends to penalize the BRPs that would communicate their difficulties transparently**, whereas this might be an important information for Elia.
- Some interviewees stated that the Day-ahead balance obligation does not make sense and **prevents efficiency of the markets** since:
    - The Day-ahead forecasts are increasingly unreliable due to RES and load forecast errors;
    - The Day-ahead balance obligation constitutes an important **barrier to implement transactions after the closure of the Day-ahead market that are valuable for the system** (such transactions are in fact already implemented in countries that do not have a Day-ahead balance obligation, e.g. the Netherlands).
- Further, if most interviewees considered that, as long as the Intraday liquidity is low, the benefit of removing the obstacles for trading after the DAM would be limited (as keeping an open Day-ahead position would be very risky), some of them claimed that additional transaction opportunities created by the suppression of the Day-ahead balance obligation **may increase the Intraday liquidity**.

However, some interviewees still considered that, despite its imperfections, the Day-ahead balance obligation constitutes a **safeguard to prevent Real-time imbalances** as much as possible and, in particular, to **avoid misconducts from Traders BRP**[34] leading to high imbalance tariffs and/or to increased electricity prices. Some interviewees even asked Elia to consider the **possibility to reinforce the Day-ahead obligation**. As mentioned above, **this view is not shared by all interviewees** since some of them are convinced that arbitrage between Day-ahead and subsequent markets would improve the quality of the dispatch and reduce TSO actions since the BRPs engaging in voluntary imbalances will be the first exposed to wrong anticipations and will therefore be naturally incentivized to perform well and limit the risks they take.

Finally, interviewees generally agree that the **Belgian imbalance tariff conveys a strong incentive for the BRP to reach the balance** and is further reinforced with the new α component, as illustrated in section 2.5.

[33] Balanced nominations are requested for each 1/4h, while production and load constantly change and while only hourly market products are available in the Day-ahead timeframe.
[34] Whose Day-ahead balance obligation is currently strictly monitored but who could, in the absence of the Day-ahead balance obligation, take large open positions in Day-ahead that they might not be able to hedge in Intraday in case of massive wrong bets of the next day conditions.

5. Benchmark with neighboring TSOs regarding the approach to balance the system

Three neighboring countries were included in the benchmark regarding the approach to balance the system. The countries selected all have self-dispatched systems but still adopt very different approaches to balance their control area. The consulting firm Compass Lexecon supported Elia for this benchmark.

5.1 RTE

In France, there is **no Day-ahead balance obligation** for the BRPs.

There is **no reactive balancing scheme** in place either. Generation schedules can be updated until one hour before delivery by the Scheduling Agent and deviations from schedules are not tolerated afterwards: the BRPs are therefore not allowed to help the system in Real-time. **As from 60 minutes ahead of time, only the TSO is allowed to take action when an imbalance is detected.**

Imbalances are settled at the imbalance tariff which is a **dual price system[35] based on weighted average prices of balancing energy activations** multiplied by a financial component which is different for positive and negative imbalance of the BRPs (and is used to equilibrate balancing costs and imbalance costs). The imbalance prices are therefore rather limited in comparison to the Belgian single price mechanism based on marginal prices.

The first **invoice** is sent **at the end of month M** and RTE **requires collaterals that are dimensioned taking into account the Day-ahead open position of the BRPs**.

5.2 TenneT NL

In the Netherlands, there is **no Day-ahead balance obligation anymore**. There used to be a Day-ahead obligation until February 2019 but, since this obligation was only monitored for Trader BRPs (for which the sum of the commercial trades had to be equal to 0) and not for Physical BRPs, it **was removed in order to grant a level-playing field** between BRPs.

A **reactive balancing scheme is implemented** : BRPs can act physically on the system until real time and are continuously responsible for what they are doing. To help them identify which deviations help the system, TenneT publishes information each minute (with 3-minute delays) about the activated amount of balancing energy and the price information of the activated balancing energy bids.

Real-time imbalances are settled at the imbalance tariff which, as such, is a **dual prices system based on the marginal price of balancing energy activations** but, most of the time, this system is equivalent to a single price system (i.e. when there is no balancing activation, or only activations in one direction, during the given imbalance settlement period). Additionally, the Dutch imbalance tariff also uses **an incentive component** (such as the alpha component in the Belgian imbalance tariff), which is established on a weekly basis taking into account the balancing performances in the control area. In practice though, this incentive is almost always equal to 0 €/MWh.

The imbalances are **settled on a weekly basis** and the first invoice occurs **within 10 working days**.

TenneT **requires collaterals** based on the highest daily transaction volumes and consumption of large consumers, multiplied by the average market price.

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[35] There are two imbalance prices: an imbalance price for BRP surplus and one for BRP shortage

5.3 50 Hertz

In Germany, **a balance obligation applies in Day-ahead**. In Intraday, temporary imbalances are tolerated but the BRPs have a **formal obligation to be balanced 15 minutes before delivery**. The temporary imbalances allowed in Intraday are limited to:

- 10% of BRP's maximum daily energy sales up to 2 hours before delivery;
- The same value capped at 50MW between 2 hours and 15' before Real-time.

Greater values can apply in case of derogations accepted by the TSO.

The nominations submitted to the TSO 15 minutes before delivery are not binding: BRPs are in theory still allowed to deviate from those nominations during the last 15 minutes before Real-time. However, 50 Hertz does not actively encourage BRPs to voluntarily deviate from their balanced position to help balancing the control area. **Reactive balancing is as such authorized, but not facilitated.**

Real-time imbalances are settled at the imbalance tariff, which is computed at a national level (i.e. including the 4 control zones of Germany) as the **weighted average of the costs of balancing actions**. Besides, special provisions apply to this tariff, e.g. to avoid voluntary arbitrage with the Intraday market price[36] (which is therefore used as a floor when positive balancing actions are necessary and as a cap otherwise).

The imbalance **settlement** process occurs **monthly, at the end of month M**.

If requested by 50Hertz, the BRP must provide **collaterals computed based on maximum sales, production and consumption declared by the BRP ex-ante**, and the average imbalance settlement prices of the past 12 months.

Note that 50 Hertz **recently reinforced some aspects of the BRP contract** (e.g. the obligation to provide balanced nominations 15 minutes before delivery, the link between imbalance tariff and Intraday market price, etc.). These changes have been introduced after having observed **large BRP imbalances in Real-time in June 2019, due to lower financial incentive (through the imbalance price) for the BRPs to balance their perimeter.**

At this time, the prices of balancing energy activation and capacity reservation were linked, which created a distortion: high capacity reservation prices (up to 38k€/MW) and lower energy activation prices were observed. Since the financial incentive for the BRP to be balanced in Real-time (i.e. the calculation of the imbalance tariff) is linked to the average costs of balancing activations, this incentive became less powerful. In some situations, the low imbalance tariff even discouraged the BRPs to hedge their position before Real-time, hence significantly increasing the Real-time imbalance of the zone.

5.4 Observations and conclusions

According to neighboring TSO's, the **balance obligations are not mandatory to ensure system security**:

- The **first incentive** for BRPs to be balanced in Real-time **is financial and is linked to the imbalance tariff.** The large imbalances observed in Germany in June 2019, while the imbalance tariff was impaired, confirm that the role of the Day-ahead formal balance obligation to prevent large System Imbalances is limited, and that only a strong financial incentive, via the imbalance tariff, can efficiently encourage the BRPs to be balanced or help the zone in Real-time.

[36] Calculated as "the volume-weighted average price of the 1-hour product for the hour in question from intraday trading on EPEX Spot"

- Furthermore, **financial risks for the TSO can be (partially) mitigated by adopting swift invoicing process and introducing dynamic collaterals** (e.g. reflecting the Day-ahead open positions of the BRP). This is especially true for TSOs which do not have Real-time formal balance obligation either and hence allow free arbitrage up to Real-time[37].
- TSO can also impose (temporary**) restrictions on the maximum open position authorized**.

Besides, it is interesting to note that TenneT NL removed their former Day-ahead balance obligation in order to **restore the level-playing field** between BRPs.

6. In-depth study of US markets where no Day-ahead balance obligation apply : the mechanism of virtual bidding

In order to further assess the opportunities and the risks linked to the relaxation of the Day-ahead balance obligation in Belgium, the situation of the US markets, where no Day-ahead balance obligation is enforced, and where, on the contrary, the trading between Day-ahead and Real-time timeframe is facilitated through a specific mechanism of virtual trading, was analyzed in detail. The analysis is based on a literature review, and on an in-depth review of the situation of two US ISOs (CAISO and PJM[38]) which was performed by Compass Lexecon. Since the US and European markets are radically different, some background information about the design of the US electricity markets is first provided. The mechanism of virtual bidding, which allows a financial arbitrage between the Day-ahead and Real-time markets is then further described, before examining in detail the benefits and the risks this mechanism introduces in the US markets. Finally, the way this mechanism could be transposed to the European context is assessed.

6.1 Background on US electricity market design

In North America, the standard market design is an integrated market in which the system operator **centrally optimizes the dispatch of resources**.

A **two-settlement system** is used by US ISOs : there are only two organized markets which are the **Day-ahead market** (DAM) and the **Real-time market** (RTM) [39] and which correspond to the two central optimizations run by the ISO. This implies that **each deviation from the Day-ahead schedule is settled at the Real-time price**.

Each optimization procedure aims at meeting the load using **unit-specific bids** (conventional units are generally obliged to offer all available capacity on the Day-ahead market, on a unit-based basis) and taking into account the transmission system constraints and marginal losses. At the end of the RTM, the ISO sends a Real-time schedule to all dispatchable units. **When transmission system constraints occur, different pri**ces (called Locational Marginal

[37] These TSOs take a risk of large System Imbalance in case of massive wrong anticipation of the imbalance price and may cover this risk by linking the size of the collaterals to the Day-ahead open position. TSOs which have no Day-ahead balance obligation but have a Real-time balance obligation are less exposed to this financial risk since the BRPs are supposed to hedge their open position before the end of the Intraday market.

[38] CAISO is the Californian ISO and PJM is active in all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia and the District of Columbia.

[39] Besides the two organised markets, companies serving load can procure energy from self-supply or bilateral trades. The latter can be performed before or after Day-ahead market. In the first case, bilateral transactions have to be submitted into the Day-ahead market and in the second case, in the Real-time market.

Prices) are set in different generation locations or transmission nodes to reflect the different values of electricity in different locations. **Financial Transmission Rights** (FTR) can be acquired by market participants **to hedge the locational risk associated with Locational Marginal Prices** and attain better price certainty when delivering energy across the grid. They entitle their holder to a revenue or a charge, which is calculated as the DAM price difference between an injection and the withdrawal points of the FTR.

In the US, there is no Day-ahead balance obligation. **All market participants are allowed to offer non-physical generation and load into the DAM and to settle those transactions in the RTM**. These non-physical offers are **called "virtual bids"**. They enable arbitrage between the Day-ahead and Real-time markets and can be used by traders to make money if they correctly anticipate the difference between the Day-ahead and Real-time prices, or by producers to shift their sale to the Real-time market if they expect better prices[40]. Note that business cases can also be built on a locational difference in DA/RT time spread[41] since congestion management is included in the market optimization and Locational Marginal Prices are used.

From the end of the DAM and throughout the day, the ISO runs specific security analysis, called **Residual Unit Commitment** (RUC), **to determine whether additional units need to be started prior to Real-time** in order to ensure there is sufficient capacity on-line or reserved to **meet the ISO's forecasts of actual demand**. Virtual bids are removed[42] from these RUC models that only use the cleared physical supply to perform the adequacy-check.

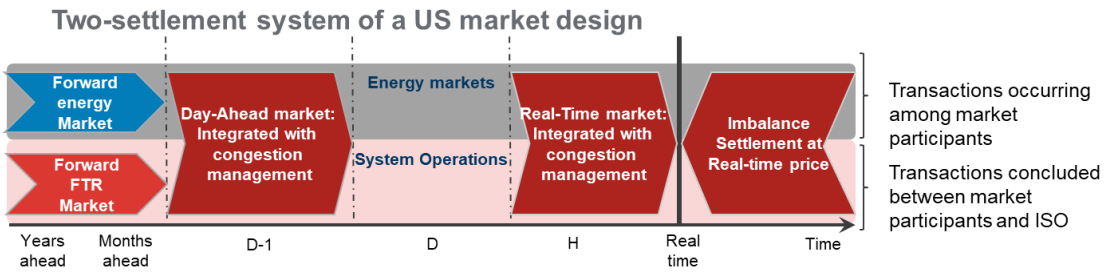


Figure 11 : illustration of the two-settlement system implemented in US market design

[40] The producer can offer his full capacity at cost in the Day-ahead market and buy Day-ahead with a virtual bid in order to be able to sell energy in the Real-time market where he expects better prices.

[41] These virtual transactions are called "Up-to-congestion" trades and are transactions between two nodes with two energy positions that (absent losses) net to zero physically

[42] Unit-based bidding enables to make a link between physical schedules and trades, and to flag virtual transactions explicitly

This quick glimpse of the US market design highlights that **there exist large differences between the US and EU market designs**. The following table summarizes the most important differences to keep in mind in the rest of this study:

	US MARKET DESIGN	BELGIAN MARKET DESIGN
TYPE OF DISPATCH	Central dispatch	Self-dispatch
TYPE OF BIDS	Unit-based	Portfolio based
MARKET TIMEFRAMES	DA and RT	DA, ID and balancing
TYPE OF PRICE	Nodal	Zonal
CONGESTION MANAGEMENT	Included in market optimization	After DA market optimization
BALANCE OBLIGATION	None	DA and RT

Figure 12: main differences between US and EU market designs

6.2 Definition and objective of virtual bidding

Virtual bidding is a mechanism implemented in the US **allowing financial arbitrage between the Day-ahead and Real-time markets**.

As mentioned above, bids in the Day-ahead market are unit-specific. For each generating unit, producers submit the bids reflecting the unit-specific parameters: the incremental energy cost, the no-load cost[43], and the cost of starting up and synchronizing to the grid. However, in addition to such physical bids, **purely financial or "virtual" bids are accepted in the Day-ahead market**. The virtual bids **are not associated with physical generation or load** but are treated the same way as physical bids in the Day-ahead market, which means they **can influence the results of the Day-ahead market optimization and clearing prices**. The virtual bids submitted in the Day-ahead market are then automatically removed from the Real-time market clearing[44] and **settled at the Real-time price**.

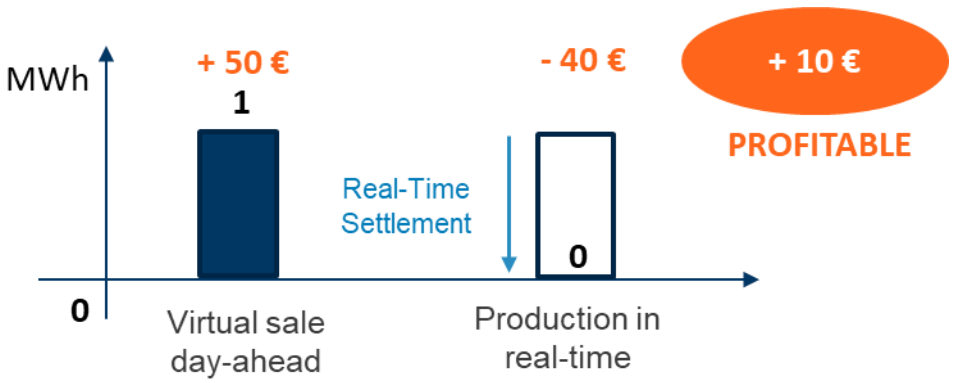


Figure 13: example of profitable virtual sell bid in DAM at 50€/MWh which is settled in RTM at 40€/MWh (source: Compass Lexecon)

[43] The cost just to be online or at the minimum stable generation level
[44] They are not considered in the Real-time central optimization procedure to come up with the final dispatch

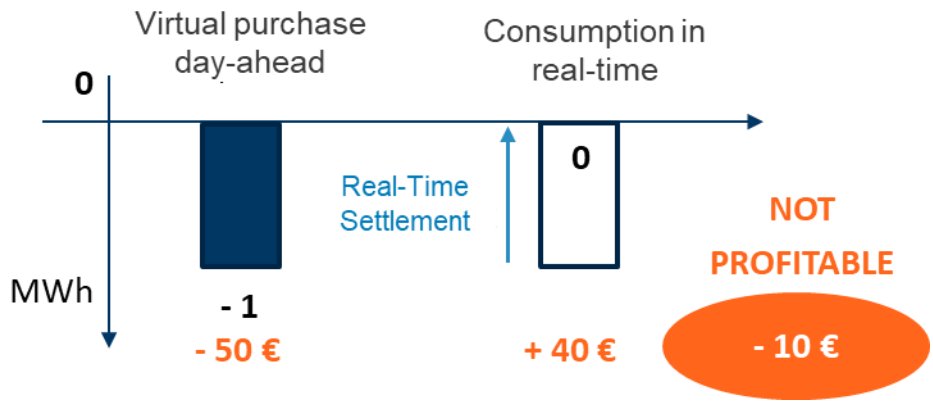


Figure 14: example of unprofitable virtual buy bid in DAM at 50€/MWh which is settled in RTM at only 40€/MWh (source: Compass Lexecon)

The main purpose of virtual bidding is to **add liquidity** to the Day-ahead and Real-time markets and **facilitate price convergence** between DAM and RTM, hence **sustaining market incentives to bid and offer into the DAM**. This price convergence is illustrated in Figure 15. Let's suppose that a trader anticipates lower prices in Real-time than in Day-ahead because he expects more wind than forecasted. He therefore places a virtual supply bid to sell energy in Day-ahead, knowing that he is not able to produce it, but hoping he will buy this energy back at a lower Real-time price. Compared to a situation where no virtual bid is allowed, we see in the figure below that the virtual supply bid placed by the trader decreases the DAM price, hence reducing the price spread between the DAM and the RTM.

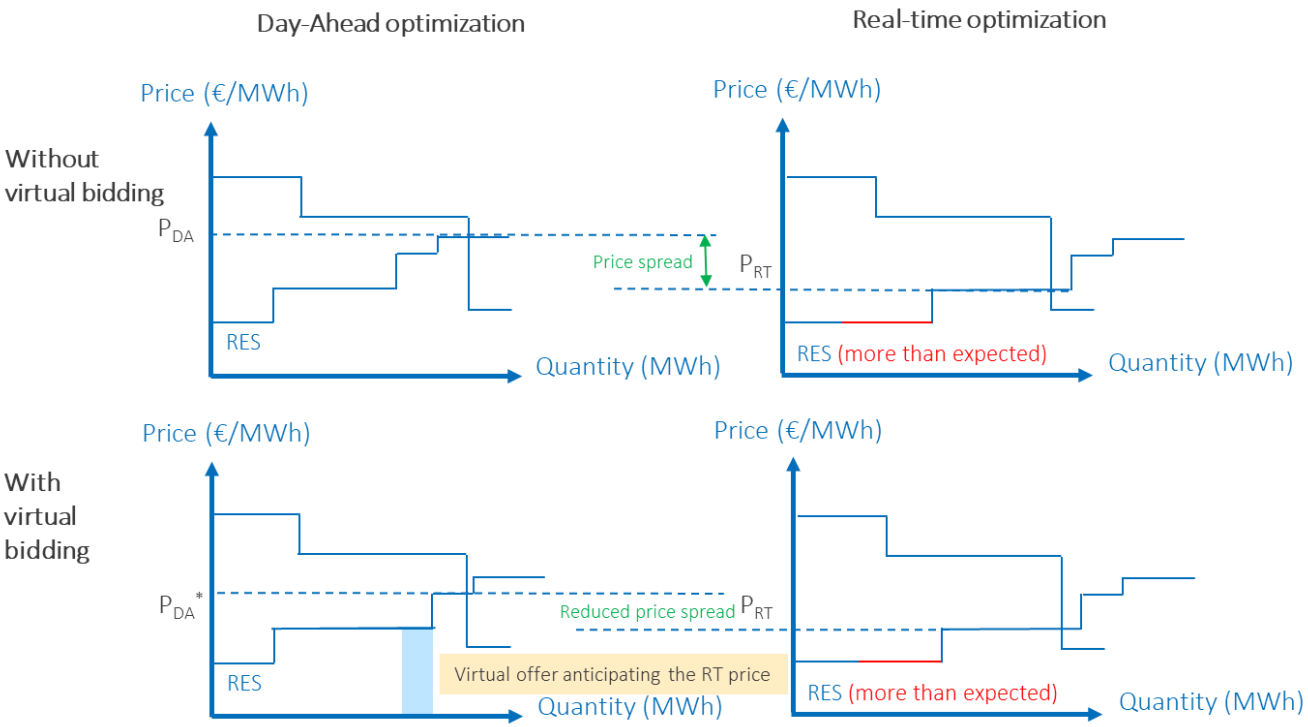


Figure 15 : Illustration of price convergence facilitated by virtual bidding

6.3 Benefits of virtual bidding

Virtual bidding demonstrated the following **benefits** in the context of US electricity markets:

- **Improved convergence of the prices** between DAM and RTM: as illustrated in the previous section, when virtual bidding is allowed, the Day-ahead prices tend to converge to the expected Real-time prices.
- **More efficient Day-ahead unit commitment**: virtual bidding incentivizes RES participants to bid their best forecast in the DAM, and conventional producers to bid their full capacity into the DAM, so that DAM commitment is based on full set of bids and offers[45].
- **Increased market liquidity**: virtual bids represent an appreciable part of the volumes traded in the DAM. Furthermore, we just saw that virtual bidding encourages the market participants to bid/offer their full quantity of supply or load in the DAM[45], which also ensures the DAM liquidity.
- **Reduction of the exercise of market power** in the DAM[46] :
    - Market power of large suppliers : large retail suppliers may exercise their market power by decreasing their purchases in the DAM and thus reducing the DAM price at which they procure the bulk of their energy at the cost of a slightly higher price in the RTM. The possibility given to all market participants to place virtual bids mitigate this market power, by allowing other market participants to offer the load that was under-scheduled by the large supplier.
    - Exercise of supply-side market power: similarly, if a large supplier withholds capacity to increase the DAM clearing price, virtual supply bids provide other market participants the opportunity to offset this by bidding the missing capacity.

6.4 Risks of virtual bidding

Some **potential risks** or drawbacks of virtual bidding have been identified, and sometimes observed in the US markets:

- Various types of **potential manipulation of Day-ahead prices** have been noticed with respect to virtual bidding. For example, holders of Financial Transmission Rights may have incentive to manipulate Day-ahead prices, which define the pay-out under the FTR contract, by implementing unprofitable virtual transactions.
- Differences between the Day-ahead and Real-time market prices may be used by virtual traders to capture profits. A spread between Day-ahead and Real-time markets may be driven by different market conditions between these two markets, for instance in case of load or RES forecast errors. In this case virtual trading

[45] In the absence of the possibility to submit virtual bids, a market participant expecting lower (resp. higher) prices in Real-time than in Day-ahead may have the incentive to over- or under-bid their physical generating capacity and load. This incentive may lead to Day-ahead schedules that are inefficient relative to the Day-ahead price, e.g. capacity that is offered in the Day-ahead market above its cost. The possibility to offer virtual bids allows market participants to make profitable transactions if they correctly anticipate the Real-time price without using the physical bids. This way, suppliers maintain the incentive to offer their capacity in the Day-ahead market at cost.

[46] Virtual bidding may limit the market power exercise in the Day-ahead market by creating the arbitrage with the Real-time market. However, structural market power that impacts both the Day-ahead and Real-time markets is still addressed by market power mitigation measures implemented in each of the markets.

serves its purpose and ensures price convergence if forecast errors are correctly anticipated by virtual traders. However, other systematic discrepancies between Day-ahead and Real-time prices may be caused by inherent structural differences in the clearing algorithms of the DAM and RTM (e.g. due to different representation of transmission constraints), that cannot be removed by the virtual trades. In this case, virtual transactions will allow the traders to **capture profit without adding value to the system**. These profits are therefore called **"parasitic profits"**.

- **Potential risks for system security** have been identified in case of wrong anticipation of the Real-time conditions by the virtual traders, and are mitigated through the Residual Unit Commitment process, as explained in the next section.

6.5 Risk mitigation measures

American ISOs implemented different types of **mitigation measures** to control the risks introduced by the virtual trading mechanism:

- ISOs **carefully monitor virtual bids** in order to ensure that they are **not used to impact the settlement prices for a trader's positions in related markets**. For example, some ISOs limit the virtual trading possibilities for Financial Transmission Right contract holders: they introduce a specific market rule which enforces revenue capping when a participant virtually bids on a node which affects the revenue stream from a Financial Transmission Right he also owns.
- The **market design and models are constantly monitored and reviewed in order to assess possible discrepancies** between the Day-ahead and Real-time clearing mechanisms, which could give rise to "parasitic profits"[47]. Mechanisms and monitoring systems could be developed to prevent the traders from trading around design features that cannot be addressed by the evolution of the market design.
- ISOs ensure the security of the system is not jeopardized by implementing several measures:
    - First of all, they run a **Residual Unit Commitment process** from the end of the DAM to Real-time **to make sure additional units are started on time if they happen to be required to meet the ISO's forecasts of actual demand.**

      The virtual trading might increase the need for Unit Commitment through RUC and hence increase its costs. In particular, a high virtual supply position may result in a too low commitment of physical units relative to the forecasted load and the need to commit additional units through RUC.
    - The virtual traders are also **discouraged from taking risky positions** by several means:
        - They are **naturally incentivized to limit their risk since they are directly exposed to uneconomic positions**: traders implementing virtual transactions face a financial risk in case of wrong expectation of the Real-time price[48]. Furthermore, the virtual traders also support the uplift costs reflecting the RUC needs they triggered in case of wrong bets on the Real-time conditions. This financial risk discourages the traders from taking large open virtual positions in the DAM, especially in tense situations during which the Real-time price and RUC recovery costs could be very high.

[47] See section 336.4 for the definition of 'parasitic profit'
[48] This is illustrated in Figure 14 above

- Besides, to allow a smooth introduction of the virtual trading mechanism, some ISOs considered a phased approach and **progressively increased the allowed Day-ahead position limits** in % of MW installed capacity or MW load by node.
- Finally, ISOs **require market participants engaging in virtual bidding activity to provide financial guarantees**. The volume of allowed virtual transactions is then defined by financial guarantees: the ISO may reject virtual bids in case they do not meet the credit requirement.

6.6 Lessons learned on virtual trading from the US markets

The analysis of the US markets, and especially of the cases of PJM and CAISO, shows that **virtual trading generally brings the expected market benefits**, even though this mechanism introduces some additional challenges. There are strong indications that **virtual trading positively contributed to market efficiency (e.g. price convergence, market liquidity) in both PJM [8] and CAISO [3] cases**:

- A 2015 study [9] [49] comparing the expected trading profits before and after the introduction of virtual trading (referred to as "convergence bidding" or "CB" in the study) in California indicates that the deteriorated profitability after the introduction of virtual trading reflects a better price convergence and an improved market efficiency. Yet the remaining profitability after the introduction of virtual trading shows that trading opportunities still exist and that the price convergence is therefore not perfect despite the application of virtual trading. This is illustrated in Figure 16 : in the column highlighted in red, we see that the expected return of virtual trades was much higher before the introduction of virtual bidding ("Pre-CB" cases) than after ("Post-CB" cases). However, even after the introduction of virtual bidding ("Post-CB" situation), we see that the profitability of virtual bids is not zero, which shows the convergence between DAM price and RTM price is not perfect.

Expected return of virtual trades

Strategy Parameter	Expected Return	Standard Deviation	Sharpe	Max Drawdown
Pre-CB In-Sample Performance				
$\gamma = 0.02\ \eta = 0.99$	267.77%	37.04%	7.18	1.19%
$\gamma = 0.02\ \eta = 0.98$	296.75%	44.60%	6.61	1.14%
$\gamma = 0.02\ \eta = 0.95$	341.83%	59.30%	5.74	1.42%
Pre-CB Out-of-Sample Performance				
$\gamma = 0.02\ \eta = 0.99$	245.86%	47.78%	5.10	6.59%
$\gamma = 0.02\ \eta = 0.98$	266.79%	55.65%	4.76	7.23%
$\gamma = 0.02\ \eta = 0.95$	284.81%	66.01%	4.29	7.80%
Post-CB In-Sample Performance				
$\gamma = 0.02\ \eta = 0.99$	47.35%	11.54%	3.86	2.75%
$\gamma = 0.02\ \eta = 0.98$	52.93%	13.29%	3.77	3.16%
$\gamma = 0.02\ \eta = 0.95$	60.82%	16.58%	3.50	4.60%
Post-CB Out-of-Sample Performance				
$\gamma = 0.02\ \eta = 0.99$	22.58%	16.56%	1.19	4.02%
$\gamma = 0.02\ \eta = 0.98$	25.55%	17.87%	1.27	5.29%
$\gamma = 0.02\ \eta = 0.95$	22.18%	22.83%	0.84	9.01%

Figure 16: expected return of trades before and after the introduction of virtual trading in California (source: "Ruoyang Li et al., Efficiency Impact of Convergence Bidding in the California Electricity Market, 2015" [9])

- The analysis of the PJM case shows that virtual trading plays an important role in market liquidity as the yearly volumes of virtual trades represent between 20 and 35% of the total demand :

[49] https://www.tse-fr.eu/sites/default/files/TSE/documents/conf/energy_climat/Slides/oren.pdf

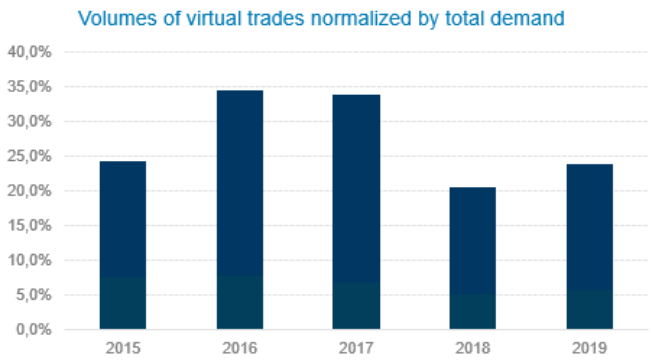


Figure 17: yearly volumes of virtual trades normalized by the total demand in PJM (source: Compass Lexecon)

However, virtual bidding also introduced new issues that the ISOs had to overcome by developing sound mitigation mechanisms. For instance, in April 2011 in CAISO, virtual bidding at the interties first led to parasitic profits[50] and no system efficiency improvement. CAISO suspended virtual bidding at its interties in November 2011 and put several precautions in place [10][51].

6.7 Transferability of virtual bidding to the Belgian context

Section 6.3 teaches us that **virtual bidding might help addressing several limitations of the current Belgian balancing mechanism** that were pointed out by the Belgian market players (e.g. non-level playing field, missed opportunities for trading actions that are valuable for the system, etc.). It is therefore worth investigating whether this mechanism of virtual bidding can be transposed to the Belgian context.

6.7.1 Suppression of balance obligations in the EU markets can be regarded as the equivalent of the American virtual bidding mechanism

As summarized in Figure 12, **the EU and US market designs differ in various aspects**. In particular, portfolio bidding used in the EU electricity markets makes it difficult to make a clear distinction between the physical bids and financial or virtual bids, and allows combining both types of bids. **Therefore, it is non-trivial to define the virtual bidding mechanism in the European context.**

However, considering that virtual trading is a mechanism allowing financial arbitrage between the Day-ahead and Real-time markets, **one can regard this concept as the suppression of both Day-ahead and Real-time balance obligation of the BRPs in a European model** (while keeping the financial incentives for Real-time balancing):

- The suppression of the Day-ahead obligation means that the BRP does not have to balance its perimeter for the clearance of the DAM and may keep open positions after the Day-ahead market clearance.
- The removal of the Real-time balance obligation means that the BRP does not have to provide and deploy all reasonable resources in order to be balanced in real time: the BRPs are free to voluntary keep open Real-time positions settled at the Real-time imbalance tariff, anticipating that the imbalance tariff would make profitable transactions.

[50] See section 336.4 for the definition of 'parasitic profit'
[51] Financial Arbitrage and Efficient Dispatch in Wholesale Electricity Markets, 2015

In particular, the suppression of the Day-ahead and Real-time balance obligations is the exact equivalent of the virtual bidding mechanism for purely financial players operating no physical supply or demand portfolio, allowing them to implement transactions between the Day-ahead and Real-time markets,
It is important to note that there is no equivalent to the "Up-to-congestion" virtual trades in a European context, since congestion management is not included in the Day-ahead market optimization which leads to one unique zonal price in Europe. The mechanism of virtual bidding would therefore be somewhat simplified in the European context, since virtual traders would not have to anticipate congestions and differences in locational prices in their models.

Since the focus of this work is the evolution and possible suppression of the Day-ahead balance obligation, without modifying the rest of the balancing process, **the next sections of this note will focus on the (partial) implementation of virtual bidding in the EU context, through the relaxation of the Day-ahead balance obligation, but without further relaxation of the Real-time balance obligation**. In particular, the legal compliance of the suppression of the Real-time balance obligation with respect to the European guidelines will not be examined. The benefits and the risks that might be introduced by the suppression of the Real-time balance obligation in Europe will not be detailed either. In the next sections, **we will therefore examine whether the virtual bidding mechanism implemented in the US can be *partially* transposed to the Belgian context, by allowing financial arbitrage between the Day-ahead and Intraday markets[52], while still requiring the BRPs to hedge themselves before the Real-time**. We will, in particular, assess if this partial implementation of the virtual bidding mechanism through the suppression of the Day-ahead balance obligation would allow us to grasp the same benefits as in the US, and whether it would come along with the same challenges.

6.7.2 Impact of virtual bids on EU market mechanisms

Before studying the benefits and risks of this partial implementation of the virtual bidding mechanism (through the relaxation of the Day-ahead balance obligation), it is useful to assess the impacts of virtual bids on the operation of the DAM, as well as on all the regional and national analyses that are based on the results of the DAM clearing.

6.7.2.1 Impact on Euphemia clearing algorithm

The possibility to place virtual bids in the DAM (implemented through relaxation of the Day-ahead balance obligation) **does not affect the way this market is operated and cleared**. Producers are incentivized to bid their available capacity at the marginal costs and consumers have an interest in offering their full load in Day-ahead. On top of these physical supply and load bids, open Day-ahead positions can be held with offers placed at a price that anticipates the Intraday conditions of the next day. In case Trader or Physical BRPs anticipate a higher price for the next day (e.g. because they anticipate lower renewables than forecasted), they might submit an additional virtual demand, whereas they would place an additional virtual supply bid if they anticipate a lower price for the next day. Implemented through the relaxation of the Day-ahead balance obligation, these **virtual bids would be treated exactly the same way as other portfolio bids by the Euphemia algorithm in the DAM clearing**, so that they can effectively influence the results and prices of the DAM.

[52] As a reminder, there is no organized Intraday market in the US (where a two-settlement system is implemented), which means this partial implementation of virtual bidding can only make sense in the European context

Besides, such virtual bids are in principle already possible in today's power market, since most of European countries already allow Trader BRPs to have open positions at the clearance of the DAM.

6.7.2.2 Impact on security analysis performed by Elia

The results of the DAM are used by Elia for both regional and national security analysis. In particular, **the resulting generation schedules, submitted at the end of the Day-ahead timeframe, are used for congestion analyses** in order to determine whether redispatching actions need to be foreseen.

When a net virtual supply or load is cleared in the DAM, it has an influence on the generation schedules of the production units: in case of a net cleared virtual supply[53], the generation schedules will be lower than in a situation where no virtual bid is allowed, and the opposite is true in case of a net cleared virtual load[54]. We therefore need to ask ourselves if this influence of virtual bids will improve or, on the contrary, jeopardize the security analysis. The answer depends on the quality of the virtual bids that have been placed in the DAM:

- **If the BRPs which submitted virtual bids correctly anticipated the condition of the next day**, the physical dispatch of the production units communicated to Elia at the end of the Day-ahead timeframe will be closer to the Real-time situation. In this case, **the virtual bids improve the quality of the information used for security analysis.**
- **In case of massive wrong anticipation of the next day conditions** by the virtual traders[55], the generation schedules received in Day-ahead might be overestimated (in case of a net cleared virtual load) or underestimated (in case of a net cleared virtual supply). **The quality of the results of the Day-ahead security analysis might then be affected by the virtual bids**. However, this situation **will be corrected in the security analyses performed in Intraday**, when the virtual trades are progressively hedged to reach balance in Real-time[56]:
    - If the Day-ahead generation schedules were overestimated because of a net cleared virtual load which did not correctly anticipate the actual conditions of the system, the virtual traders will have to sell their surplus of energy at an advantageous price, which might incentivize the BRPs with physical production unit to buy this cheap energy instead of producing it at a higher cost. This way, the Intraday generation schedules will progressively converge to their Real-time situation.
    - If the Day-ahead generation schedules were underestimated because of a net cleared virtual supply which did not correctly anticipate the actual conditions of the system, the virtual traders will have to buy extra energy at a potentially high price, hence involving production units that were not

[53] When the sum of the virtual bids accepted in the DAM is greater than the sum of the virtual offers accepted in this market

[54] When the sum of the virtual offers accepted in the DAM is greater than the sum of the virtual bids accepted in this market

[55] This situation of massive wrong 'bet' should of course remain exceptional, since the virtual traders aim at making profitable transactions and are likely to adapt their risk strategy according to the reliability (confidence index) of their forecasting model for the next day conditions.

[56] Since, as explained in section 6.7.1, we assumed in the context of our study that the virtual trading mechanism of the US would only be partially transposed to the Belgian context, and that the existing Real-time balance obligation would remain unchanged.

selected in the clearing of the DAM. This way, the Intraday generation schedules will progressively increase to their Real-time situation.

Since the best practices applied by Elia in terms of congestion management encourage the dispatchers to **wait closer to Real-time before activating redispatching actions** (in order to make sure the congestion is confirmed), the **influence of unprofitable virtual bids on the operation of the system will be limited**.

6.7.2.3 Impact on adequacy checks

The **adequacy check performed by Elia after the clearance of the DAM also strongly relies on the results of this market**. This means that **here too, the fact that a virtual load or a virtual supply is cleared in the DAM might have an influence on the results of the adequacy check**. Similarly to the RUC in the US system, the purpose of the adequacy check is to make sure there is enough online capacity to cover the load forecast of Elia[57]. If an adequacy issue is detected, Elia might decide to start slow units or to activate strategic reserves to make sure there is enough capacity to cover the load in Real-time.

Here again, if the virtual traders correctly anticipated the next day conditions, the information received by Elia at the end of the DAM regarding the capacity that will be online for the next day[58] **will depict the Real-time situation in a more accurate way than in the absence of virtual bids**. In this case, the alarms raised by the adequacy check and the actions resulting from this check will be even more relevant than without virtual bids. If, for example, the BRPs submitted virtual offers because they correctly anticipated less wind than forecasted for the next day, then more generation units would have been cleared in the DAM than in a situation where virtual bids are forbidden. In a situation with no virtual bid, an alarm stressing the need to start additional units might have been raised by the adequacy check, whereas this alarm would actually not have been relevant considering the next day conditions.

However, in case of massive wrong anticipation of the next day conditions by the virtual traders, the results of the adequacy check performed in Day-ahead might be less accurate. If, this time, the BRPs submitted virtual supply because they anticipated more wind than forecasted for the next day, but that their bet eventually happens to be wrong, then the generation schedules received by Elia in Day-ahead would have been underestimated and an alarm stressing the need to start additional units might have been raised by the adequacy check, whereas it would not have been the case in the absence of these virtual bids (because more generation units would have been cleared in the DAM resulting in more online capacity). As explained in the previous section, **the accuracy of the data used for the adequacy checks will however be improved during the Intraday timeframe when the virtual trades are hedged**. In our previous example, the virtual traders would have to buy extra energy at a potentially high price in Intraday in order to hedge their position before the Real-time, hence involving production units that were not selected in the clearing of the DAM. This way, the Intraday generation schedules would have progressively converged to their Real-time situation.

Similarly to the philosophy followed by Elia for the activation of redispatching actions, Elia will also wait until the adequacy problem is confirmed before activating strategic reserves or starting additional units. **The adequacy check performed in Day-ahead will typically serve to activate alarms and raise awareness about a potentially tense situation, but this Day-ahead check alone will not trigger any concrete activation of additional units**. Therefore, **if the accuracy of the Day-ahead adequacy check is negatively influenced by virtual bids, it will not have**

[57] A more detailed description of the adequacy checks performed by Elia is available in section 1.1
[58] This information is currently derived from the generation schedules received in Day-ahead

concrete consequences, as long as the situation is corrected in time during the Intraday timeframe (which should be the case as long as Real-time unbalance is not allowed). Furthermore, massive wrong 'bets' from the virtual traders are not likely to happen during tense situations, since traders would then probably limit the open position they take in Day-ahead in order to keep the risk they take under control.

6.7.3 Benefits of virtual bidding that can be achieved by relaxing the Day-ahead Balance Obligation

As mentioned earlier, the relaxation of the Day-ahead balance obligation allows BRPs to place virtual bids in the DAM, but as long as the Real-time balance obligation remains in place, it does not yet authorize the BRP to voluntarily remain in imbalance until Real-time and source/sell energy at the imbalance tariff. Therefore, the suppression of the Day-ahead balance obligation would **allow creating a continuum between the Day-ahead and Intraday timeframes**, hence allowing the BRPs with strong forecasting competences to anticipate the intraday conditions till the last gate of the Intraday market. However, this would not apply till the balancing timeframe, since the BRPs would not be allowed to gamble on the imbalance tariff and on the Real-time direction of the Belgian zone.

The **concrete benefits that can, in theory, be expected from the relaxation of the Day-ahead balance obligation** are therefore very similar to those observed in the US even though they should sometimes be slightly nuanced due to this remaining 'discontinuity' with the balancing timeframe:

- **Price convergence and pertinence of the Day-ahead price signal**: a better price convergence between the Day-ahead and subsequent market prices could be expected, although not necessarily till the Real-time prices (such as in the US), as the Real-time balancing obligation would be maintained.

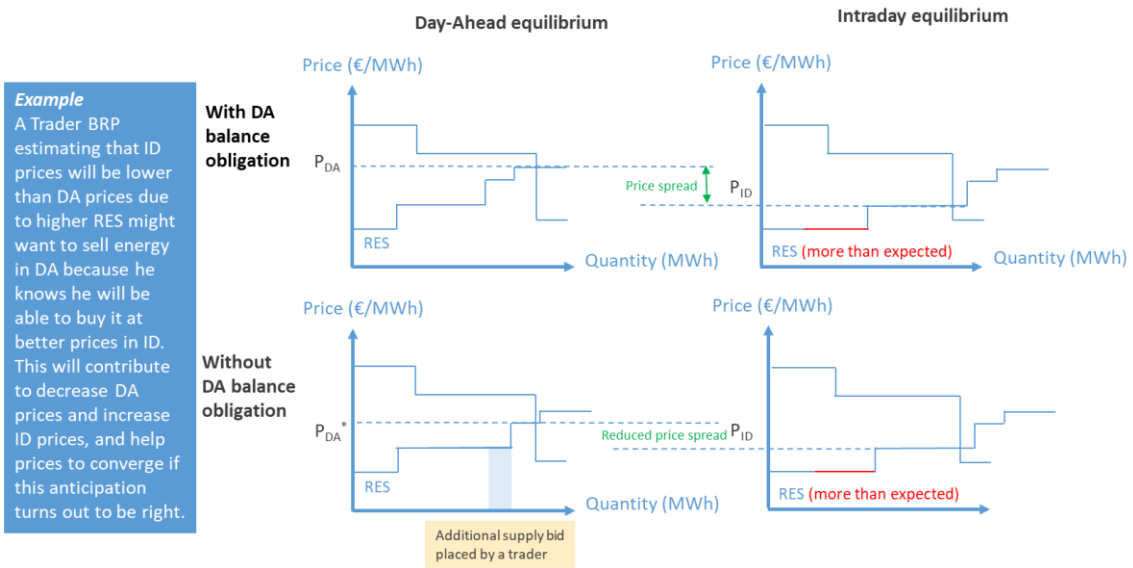


Figure 18 : The relaxation of the Day-ahead balance obligation removes barriers to a better price convergence between Day-ahead and Intraday markets

This example shows that allowing open positions in Day-ahead helps the Day-ahead price converge towards the expected Intraday price, and hence better reflect the next day conditions when these are correctly anticipated by the market. In theory, the relaxation of the Day-ahead balance obligation might therefore strengthen the relevance of the Day-ahead price signal in Belgium.

- **More efficient physical Day-ahead schedules**: as in case of the US, the implementation of virtual bidding in the EU context through relaxation of the Day-ahead balance obligation would incentivize producers to bid

their full capacity at cost into the DAM and suppliers to bid their expected load. This way, the result of the Day-ahead market clearing might be more representative of the next day conditions, and the quality of the information received by the TSO in Day-ahead might improve.

- **Increased market liquidity**: transposing the lessons drawn from the US experience, an increase participation of Trader BRPs could be expected in the Day-ahead and Intraday markets. Furthermore, we just saw that virtual bidding should encourage the market participants to bid/offer their full capacity or load in the DAM. A liquidity shift from the Day-ahead to the Intraday market is therefore not to be expected: producers have no incentive to hoard capacity to the Intraday market if they anticipate higher prices in Intraday than in Day-ahead, since they could instead place demand bids on the Day-ahead market to buy additional energy that they will be able to sell at better prices the next day. The increased liquidity of the Day-ahead market is illustrated in the example below: without the Day-ahead balance obligation in place, producers maintain the incentive to offer their capacity at marginal cost in the Day-ahead market, and more energy is cleared in Day-ahead due to the additional virtual demand bids placed.

Example
A producer expects higher prices in ID than in DA due to lower RES than forecasted. Instead of voluntarily hoarding his generation capacity to the ID timeframe (e.g. by overbidding and pricing itself out of the DAM), he can, if DA open positions are allowed, place an additional demand bid, hence allowing the DA price to converge towards a price better reflecting the next day conditions, and making a profitable "virtual" transaction.

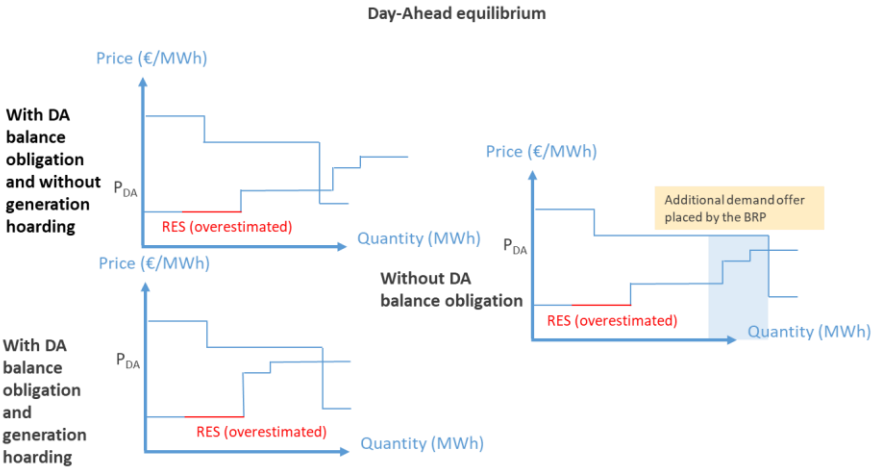


Figure 19 : The relaxation of the Day-ahead obligation might help discourage capacity hoarding

- **Reduction of the exercise of market power in the DAM**: the relaxation of the Day-ahead balance obligation allows all BRPs to submit virtual bids in the DAM and hence to compensate the strategy that could be adopted by large BRPs to influence the prices of this DAM. Just as in the US, we can expect virtual bids to play a role in mitigating the possible market power of physical participants in the DAM.

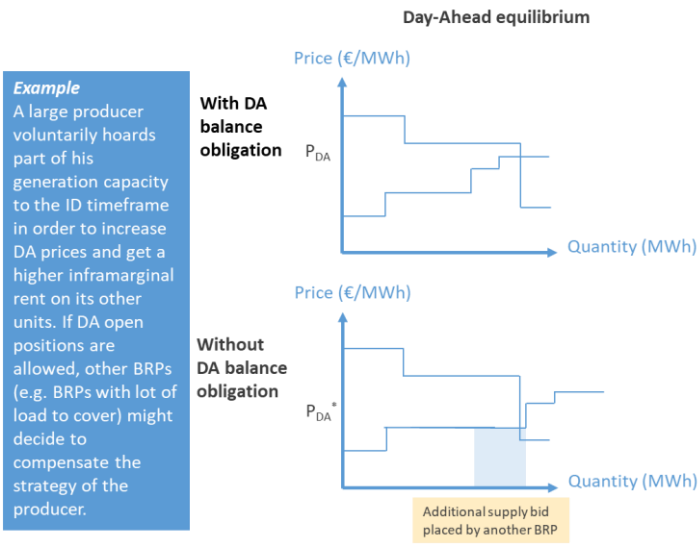


Figure 20 : The relaxation of the Day-ahead balance obligation might help reduce the possible exercise of market power by large participants

- **Restoration of a level-playing field between market participants**: several studies point out the fact that the European approach to portfolio bidding enables financial arbitrage between the Day-ahead and Intraday timeframes, at least to some extent and for some market participants, which can be regarded as "implicit" virtual bidding[59]. The CORE study [2] on the general design of a mechanism for the remuneration of reserves in scarcity situations indeed states that "*even in the way that the existing Belgian system is set up with agents bidding portfolios as opposed to true physical assets, it can be argued that virtual trading is effectively allowed to a certain extent*" , and clearly highlights the non-level playing field introduced between Physical and Trader BRPs : "*In practice, BRPs have a certain degree of flexibility in the Day-ahead time frame in terms of bidding. For example, BRPs can submit their own renewable supply forecasts. Since forecasts are private information, there is no way to strictly enforce physical constraints on the energy position of BRPs. On the other hand, financial institutions without any ownership of physical assets are not allowed to participate in the Day-ahead energy market, which is in stark contrast to certain US market designs*". Allowing all market participants to place virtual bids in the DAM, implemented through the relaxation of the Day-ahead balance obligation, could therefore help improve the level-playing field between Physical and Trader BRPs.

Of course, **the relaxation of the Day-ahead balance obligation is not the only condition to achieve these benefits**. It should be regarded as a **necessary precondition to reach the aforementioned improvements** of market efficiency and competition. However, it cannot be considered as a sufficient condition, since **the actual benefits will strongly depend on the behavior of the BRP**. For instance, if the BRPs consider that the liquidity of the Intraday

[59] The distinction between Explicit Virtual Bidding and Implicit Virtual Bidding is defined in [1] "The benefits and risks of virtual bidding in multi-settlement markets" by A.G. Isemonger:
- Explicit virtual bidding : "*submission of bids for the financial purchase or sale of energy in the Day-ahead and Real-time energy markets without intending to physically consume or produce energy in real time"*
- Implicit virtual bidding : *"piggybacking the virtual transactions onto existing physical transactions"*

market is most of the time too poor to allow them hedging their position before the Real-time, they probably won't take the risk to place virtual bids and take open positions at the end of the DAM. In this case, the relaxation of the Day-ahead balance obligation won't bring any significant change with respect to the current situation. However, one may also expect that new trading opportunities provided by the relaxation of the Day-ahead balance obligation could increase liquidity of the Intraday market.

6.7.4 Risks of virtual bidding that can be introduced by relaxing the Day-ahead Balance Obligation

Some of the risks introduced by the virtual bidding mechanism in the US system **do not apply to the European context**:

- As mentioned earlier, the **absence of locational prices in the Belgian design somewhat simplifies the concept of virtual bidding** : in Belgium, the system would not be exposed to manipulative virtual transactions in order to create congestions and influence the Day-ahead locational prices that define the pay-out of the Financial Transmission Right contract holders, such as in the US[60].
- Similarly, there is **no structural and systematic difference between the construction of the Day-ahead and Intraday prices in Belgium**[61]. In particular, the European intention is to make the CACM process as consistent as possible between the Day-ahead and Intraday timeframes, which should ensure that there is no systematic difference in the cross-border capacity configuration between the two timeframes. The risk that virtual traders take advantage of systematic differences to capture **'parasitic' profits** without adding any value to the system **is therefore limited**. Note that this conclusion remains valid if we compare the construction of the Day-ahead price and the imbalance tariff. In Belgium, there is no systematic gap between the Day-ahead and imbalance prices: since 2012, we indeed see that the average spread between these prices is close to zero (with standard deviation which is quite important), which tends to demonstrate that there is no systematic flaw that could be used by virtual traders.

[60] In case of FTRs existing in Europe and defined between national bidding zones, one should expect that incentives for manipulation of their payoffs through virtual bidding would be considerably lower than in case of the nodal FTRs in the US. This is because the lower sensitivity of the zonal prices to transaction volumes would require running large losses on the unprofitable virtual transactions and that may not be offset by additional benefits from FTR payoffs.

[61] As a reminder, in the US, systematic differences between Day-ahead and Real-time prices may occur mainly due to discrepancies in the representation of internal network constraints in the Day-ahead and Real-time algorithms (which is not applicable in Belgium)

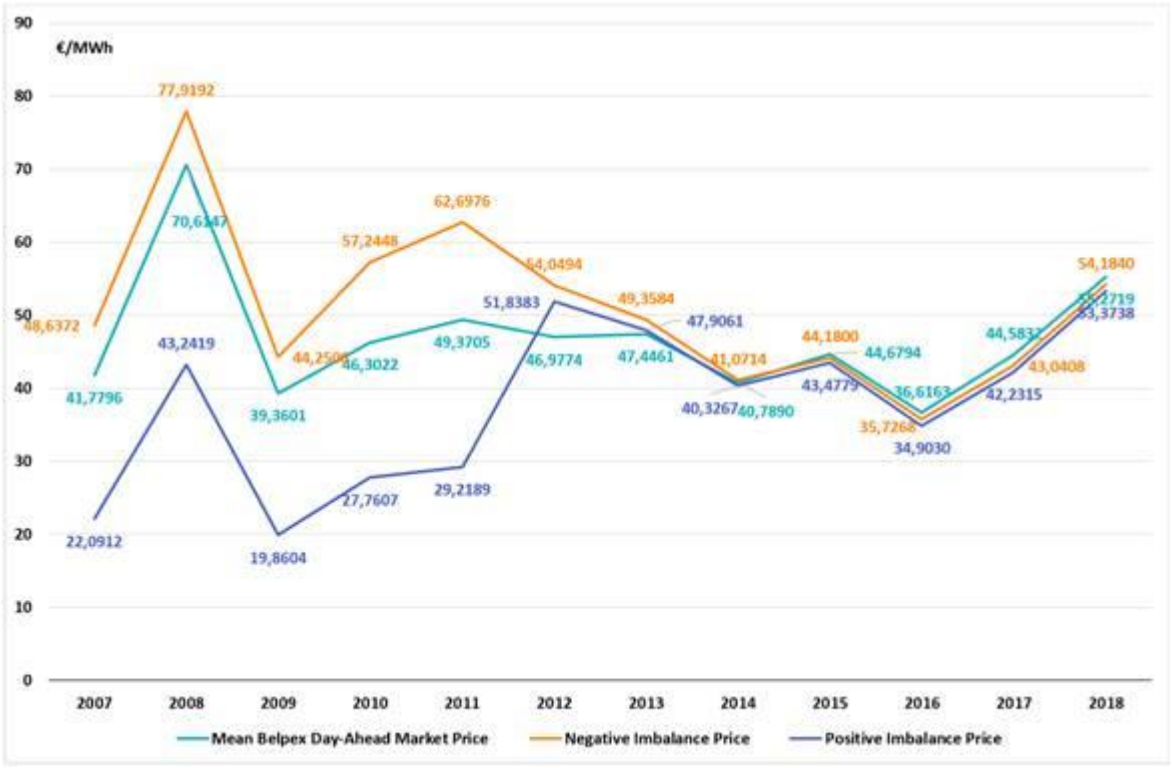


*Figure 21: Historical Belpex Day-Ahead Market and Negative/Positive Imbalance prices (Source: [18] CREG monitoring report 2018, study (F)1958, **https://www.creg.be/fr/publications/etude-f1958**)*

The **only remaining issue in the European context would therefore be to deal with the potential risks for system security** in case of massive wrong anticipation of the Intraday conditions by the virtual traders. Here again, the assessment of this risk should be slightly nuanced when compared to the US situation: **since we consider in this study that the Real-time balance obligation is maintained, and since a more liquid and structured Intraday market exists in Belgium than in the US, we can consider that the greatest part of the open positions taken in Day-ahead have to and will be hedged before the last gate of the Intraday timeframe.** With this in mind, even the errors of anticipation made by the traders in Day-ahead should not jeopardize the security of the system. The only residual risk concerns massive wrong anticipation of the next day conditions by the virtual traders, combined with a poor liquidity of the Intraday market, that could prevent the BRPs from hedging their position before Real-time, hence leading to higher Real-time imbalances. However, as already mentioned in the previous sections, important virtual transactions are unlikely when tense situations/poor Intraday liquidity are expected, since the risk taken by the virtual traders would be too important.

6.7.5 US mitigation measures that can be transposed to the Belgian system

Some of the **mitigation measures** used by the US ISOs to mitigate the potential risk on the system security **could easily be transposed** to the Belgian system:

- First of all, in order to avoid large system imbalance, it is of course important that BRPs are incentivized to be in balance (or help the zone) in Real-time. The first natural incentive for the BRPs to avoid as much as

possible being imbalanced in the wrong direction[62] is the imbalance tariff they are exposed to[63]. **It is therefore of upmost importance that the imbalance tariff is strong enough to encourage the BRPs to hedge themselves before the Real-time in any situation**[64], and to discourage them from taking too risky positions when tense situations or lack of Intraday liquidity are expected[65]. As illustrated in section 2.5 and confirmed by market parties in chapter 4, the current Belgian imbalance tariff seems to already convey a strong incentive for the BRP to reach the balance in Real-time.

- Secondly, **a phased relaxation of the Day-ahead balance obligation could be considered in Belgium**. This way, the amount and volumes of cleared virtual bids represented as open Day-ahead positions would be limited in a first stage, allowing the market to mature before completely removing the Day-ahead balance obligation. This phased implementation would also allow observing the behavior of the BRPs and confirm the aforementioned assumptions (e.g. strong enough imbalance tariff to discourage risky positions in case of tense situations, etc.).
- **A modification of the calculation of the bank guarantee, to align its value with the volume of virtual transactions that a BRP is allowed to submit**, could be envisaged. However, **the relevancy of this mitigation measure if only the Day-ahead balance obligation is suppressed can be questioned**: unlike in the US system, the open positions taken in Day-ahead are supposed to be closed before Real-time, which makes it difficult to defend that the financial risk taken by the TSO is proportional to the volume of virtual transactions placed in Day-ahead.
- Finally, an **equivalent to the Residual Unit Commitment** process should of course exist to make sure enough capacity is available to meet the actual demand. As explained in section 6.7.2.3, this process already exists in Belgium under the name of **"adequacy checks"**. As mentioned before, in case only the Day-ahead balance obligation is relaxed, virtual bids are not expected to trig additional concrete actions during the adequacy check process (since potential missing capacity will be started when the virtual bids are hedged during the Intraday timeframe).

7. Rationale for modifying the current Day-ahead Balance Obligation

Based on chapters 4,5 and 6, we can conclude that the current Day-ahead Balance Obligation presents some limitations, and that it is therefore worth assessing whether there is a good reason to maintain it. This initiative is fully consistent with the Electricity Balancing Guideline (EBGL[66]) which encourages the use of Day-ahead balance obligation only where it is deemed relevant.

This chapter sums up lessons learned during the discussions with Belgian market parties and with neighboring TSOs, as well as those that can be deduced from the study of the virtual bidding in the US systems.

[62] Direction which does not help balance the Belgian control area
[63] This is in addition to the formal obligation to be balanced (or help the zone) in Real-time that exists in Belgium
[64] Hence avoiding situations where the imbalance tariff is lower than the Intraday prices, as observed in Germany in 2019
[65] These situations could prevent the BRPs from hedging themselves before the Real-time
[66] Article 18.7. (d) of the EBGL as mentioned in Figure 10

7.1 Few TSO's make use of a Day-ahead balance obligation

The **use of a Day-ahead balance obligation is quite specific to Belgium. Other countries**, sometimes with balancing systems that are very similar to ours, **function well without any kind of Day-ahead balance obligation**.

7.2 The Day-ahead security analyses don't need balanced nominations to work properly

All the operational processes using the Day-ahead nominations (e.g. adequacy checks, congestion forecasts) were identified and soundly analyzed. This assessment showed that the **security analyses performed in Day-ahead do not need balanced nominations to work properly**.

7.3 The current Day-ahead obligation could jeopardize the quality of the information communicated to Elia in Day-ahead

Some market parties rightly pointed out that the current Day-ahead balance obligation does not incentivize the BRPs to communicate their difficulties to reach a balanced position in a transparent way during tense situations, whereas this might be an important information for Elia.

Besides, the experience feedback from the US teaches us that a more efficient unit commitment can be reached in Day-ahead with the introduction of virtual transactions[67]. If this benefit is grasped in Belgium, this means that Elia would, in average, have better information at its disposal to perform Day-ahead congestion forecasts and adequacy checks than in the current system.

Allowing Day-ahead unbalanced nominations might therefore even increase the validity and accuracy of the security analyses performed by Elia in Day-ahead.

7.4 The current Day-ahead obligation introduces a non-level playing field

All interviewed market parties pointed that the **Day-ahead balance obligation could be circumvented by Physical BRPs, whereas a perfect monitoring of the Day-ahead balance obligation is performed for the Trader BRPs**.

This limitation of the Day-ahead balance obligation was confirmed by TenneT who removed this obligation in 2019 in order to restore the level playing field between Physical and Trader BRPs. Finally, the existing possibility for Physical BRPs to perform virtual bidding to a certain extent, because there is no way to strictly enforce physical constraints on the energy position of BRPs, was also highlighted in the CORE study [2] on the general design of a mechanism for the remuneration of reserves in scarcity situations.

Besides, the lessons drawn from the American model show that the introduction of virtual transactions in the DAM could help mitigating the market power of large actors and hence improve the competition conditions between actors.

7.5 The current Day-ahead obligation puts up barriers to spot market improvements

Some interviewees regretted the fact that **the current Day-ahead balance obligation prevent some BRPs to make transactions that**, according to them, **would be valuable for the system** and reduce the number of interventions required by the TSOs.

[67] See section 6.3 for more explanation

This statement was confirmed by the analysis of the PJM and CAISO cases, where the introduction of virtual bidding has been demonstrated to be effective in improving price convergences between markets, as well as market liquidity.

7.6 The financial incentive brought by the imbalance tariff is stronger than the Day-ahead balance obligation to prevent large Real-time imbalances

Some interviewees consider the current Day-ahead balance obligation as a safeguard to prevent large Real-time imbalances, but several Belgian or foreign experiences showed that **a strong imbalance tariff is much more powerful** than a formal Day-ahead balance obligation, and **even self-sufficient, to prevent disequilibria**:

- Large Real-time imbalances were observed in Germany when the imbalance tariff was impaired, and this despite the existence of a Day-ahead balance obligation.
- Other TSOs, such as TenneT NL, do not have any balance obligation and yet they do not observe misconduct from BRPs, thanks to their efficient imbalance tariff (based on the marginal price of the balancing activations, such as in Belgium).
- A large improvement of the Belgian System Imbalance was observed after the introduction of a single marginal imbalance price, without changing anything (e.g. reinforcing) to the formal balance obligations.

The current Day-ahead obligation is therefore questionable and evolutions are needed to remove the limitations it brings in the system.

Most appropriate evolution of the Day-ahead Balance Obligation

As mentioned in chapter 7, the current Day-ahead balance obligation presents some limitations. It would therefore be interesting to assess whether evolutions of this obligation can be proposed, in order to remove these limitations. This exercise is performed in the present section. In chapter 8, all the possible evolutions of the Day-ahead obligation are first described. These various options are then compared from different perspectives in chapter 9. The most efficient evolution according to this comparison is studied in greater details in chapter 10 : the benefits and risks of this option are detailed in a cost-benefits analysis, possible risk mitigation measures are examined, and a realistic implementation plan is proposed. Chapter 0 recaps the conclusions and recommendation of this study and finally, chapter **Error! Reference source not found.** suggests some possible next steps in case of successful implementation of the recommendation of this study.

8. Description of the possible evolutions of the Day-ahead Balance Obligation

Three families of options were considered in this study:

- **Keeping the balance obligation in Day-ahead while making some adjustments** and trying to answer to some of the limitations of the current system;
- **Shifting** the Day-ahead obligation **to the Intraday timeframe**;
- **Removing** any kind of balance obligation before the Real-time.

Each of the above family was declined in several alternatives, as described in the next sections.

8.1 Keeping the Day-ahead Balance Obligation

A first possible evolution would be to **fine tune the current system** to try and solve some of the issues that have been identified in the previous chapters. This option has been suggested by some Belgian market parties during the interviews and would definitely be required if we came to the conclusion that the other possible evolutions of the Day-ahead balance obligation are not acceptable for the security of the grid.
Two possible improvements of the current systems were considered:

- A **reinforcement of the monitoring of the Day-ahead balance obligation** for the BRPs with physical assets, in order to restore the level playing field between Trader BRPs and Physical BRPs.
- The **possibility to ask a derogation from the balance obligation in tense situations**, in order to facilitate the communication of correct information.

8.1.1 Reinforcing the monitoring of the obligation

Physical BRPs have to provide Elia with balanced nominations in Day-ahead. However, even when this balance obligation is formally respected, implicit arbitrage between the Day-ahead and the following timeframes can still be performed by Physical BRPs. Their nominations are indeed based on their own forecasts of load, renewables and dis-

patchable plants onto which virtual transactions could be "piggybacked"[68]. In this option, **we examined the possibility to reinforce the checks performed by Elia in order to detect and avoid this implicit arbitrage as much as possible**, hence restoring a better level playing field between Physical and Trader BRPs.

Enforcing formal balance obligation for Physical BRPs before Real-time **requires setting a standard for acceptable deviations between the forecasted values and the Real-time measurement**. Acceptable deviations should be defined for load, RES and dispatchable units. This is already complex for load and RES[69], but it is unfortunately totally pointless for dispatchable units[70]. The exercise would besides be made even more complex due to the fact that Elia is not informed of the physical capacity installed in a BRP portfolio, namely the one connected to distribution systems.

Our conclusion is therefore **that it is not possible to properly enforce any formal balance obligations before the Real-time**: the monitoring of the obligation would remain imperfect anyway, and this first option would therefore ultimately be quite similar to the current situation of which the main disadvantages were described in chapter 7. This conclusion is also supported by the CORE study [2] on the general design of a mechanism for the remuneration of reserves in scarcity situations, which says that: "*In practice, BRPs have a certain degree of flexibility in the day-ahead time frame in terms of bidding. For example, BRPs can submit their own renewable supply forecasts. Since forecasts are private information,* ***there is no way to strictly enforce*** *physical constraints on the energy position of BRPs".*
As a consequence, **this evolution has not been considered as an option on its own in the rest of this study.**

8.1.2 Allowing justified imbalance in tense situations

This option consists in allowing the BRPs to **ask a derogation from the Day-ahead balance obligation when this can be justified by tense situations**. The main advantage of this option compared to the current solution would be to improve the information quality received by Elia, since the BRPs would no longer be incentivized to artificially balance their portfolio in Day-ahead, when they know this will not depict the Real-time situation.

[68] As explained in [1] "The benefits and risks of virtual bidding in multi-settlement markets" by A.G. Isemonger
[69] An upper threshold would have to be set on the forecasting margin of error to define the acceptable deviations between Day-ahead forecasts and Real-time measurements
[70] A lot of situations can justify large deviations between the Day-ahead schedule and the Real-time measurement of a production unit: an outage of the unit; the use of this unit to compensate the outage of another unit in the perimeter of the BRP, or to compensate forecast errors; the use of this unit to help the system at Elia request (through the activation of specific products), or on a voluntarily basis (via the reactive balancing scheme); etc. Some of these situations can be easily monitored by Elia (e.g. the activation of some specific products, a forced outage), others are impossible to control (e.g. intention of a unit to perform reactive balancing)

8.2 Shifting the Day-ahead Balance Obligation to Intraday

We could also imagine **to abandon the Day-ahead balance obligation while introducing a balance obligation closer to Real-time, during the Intraday timeframe**. The purpose of this shift of the balance obligation from Day-ahead to Intraday would be to remove the current rupture between the Day-ahead and Intraday timeframe which, as raised by some of the interviewed market parties, does not make sense anymore in a world where volatility of production and demand continuously increases. The balance obligation could then be set closer to real time, when the forecasts become more reliable. This evolution would partly solve the issues of the current system in terms of level-playing field, information quality and market efficiency. Note that here again, the BRP should be allowed to ask a derogation from the balance obligation in tense situations, in order to facilitate the communication of correct information towards Elia and properly address the limitation of the current obligation.

In this family of options, the BRPs would still have to send nominations after the clearance of the DAM[71], but these nominations would no longer have to be balanced. **They would then have to send new nominations, which would have to be balanced this time[72], during the Intraday timeframe, either at fixed Intraday gates, or following a rolling Intraday gate.**

8.2.1 Fixed Intraday gates

In this option, balanced nominations would be **required at fixed Intraday gates**, each time for a pre-defined part of the relevant day. The Intraday gates could be defined according to several criteria:

- The number of gates should remain limited (otherwise this option converges towards the solution described in the next section, using a rolling window);
- The gates should allow covering a whole 24-hour period;
- The gates should be defined to allow Elia receiving the most up-to-date information regarding critical periods of the day (e.g. morning and evening peaks) when Elia still has enough time to react (e.g. start slow units) if needed.

Based on these criteria, the following Intraday scheme has been assigned to this option in the rest of the study[73]:

- A first gate at 10PM in Day-ahead covering the period from midnight to 6AM;
- A second gate at 2AM covering the period between 6AM and 6PM[74];
- A third gate at 2PM covering the period between 6PM and midnight[75].

---

[71] At least in a first stage, in order to allow a smooth implementation of these options (see section 10.1 for more details). The possibility to suppress or simplify the Day-ahead nomination process could be assessed in a next stage.
[72] Except in tense situations, where they could ask for a derogation.
[73] The number of gates and their timing might still be adjusted and reviewed according to the experience feedback if this evolution was to be implemented
[74] This gate allows Elia to receive the most up-to-date information regarding the morning peak around 4 hours ahead of Real-time, which is the time needed by Elia to analyze the situation and take actions (e.g. start additional slow units) when needed.
[75] This gate allows Elia to receive the most up-to-date information regarding the evening peak around 4 hours ahead of Real-time, which is the time needed by Elia to analyze the situation and take actions (e.g. start additional slow units) when needed.

8.2.2 Rolling Intraday gate

Here, the communication of balanced nominations for a given time period would **systematically be required X hours before the beginning of this time period.**

In this study, a time unit of one hour has been selected in order to avoid multiplying the number of gates[76]. In order to allow Elia to perform analysis based on the nominations received, and to take actions (e.g. start slow units) when required, a time delay of 4 hours has been considered between the communication of the nominations for a given time period and the beginning of this time period.

This option would therefore foresee an hourly gate at hour H, starting from 8PM in day-ahead to 7PM in the relevant day, and covering each time the period between H+4 and H+5.

8.3 Removing the Day-ahead Balance Obligation

The last option that was considered in this study consists in **removing the Day-ahead balance obligation without introducing any other balance obligation before the Real-time.**

The Day-ahead nomination process would however be maintained[77] (with the only difference that the sum of the nominations would no longer have to be equal to zero).

With this evolution, the continuum between the Day-ahead and the Intraday timeframes is even better ensured. This solution therefore allows to even better tackle the limitations of the current system in terms of level-playing field, information quality and market efficiency.

9. Comparison of the possible evolutions of the Day-ahead Balance Obligation and selection of the most appropriate solution

9.1 Comparison criteria

The different possible evolutions of the Day-ahead balance obligation were **compared from 6 different perspectives that were deemed as the most relevant criteria for our comparison**. First of all, three criteria were selected to assess to which extent the proposed evolutions solve the issues that were identified in the current system. Each option was therefore compared from the three following perspectives:

- **Market efficiency**
- **Information quality**
- **Competition conditions**

[76] A quarter-hour granularity could be used, but it would require 96 gates a day, which is hardly bearable from an organizational perspective

[77] At least in a first stage, in order to allow a smooth implementation of these options (see section 10.1 for more details). The possibility to suppress or simplify the Day-ahead nomination process could be assessed in a next stage.

Of course, it also seemed important to assess the potential additional risks introduced by each evolution. As mentioned in section 6.7.4, the potential risks for system security in case of massive wrong anticipation of the Intraday conditions should be assessed when Day-ahead open positions are implicitly or explicitly allowed. Therefore, each one of the proposed options was assessed from a **system security perspective**.

Once we have a clear picture of the risks and benefits brought by each option, it is also important to keep in mind the efforts (in terms of budget and human resources) that would be required to implement these options, and to assess if the proposed evolutions are robust to future evolutions of the electricity market. It would indeed not make any sense to implement a very expensive option that seems to be the most appropriate today, if we are very well aware that this option will be obsolete within the next few years. For instance, a higher liquidity of the Intraday market is often considered as a pre-requisite for the relaxation of the Day-ahead balance obligation to bring added value to the system, as keeping an open Day-ahead position would be very risky if the liquidity of the Intraday market is too poor. However, a quick glimpse at the recent evolution of the Intraday market in Belgium (depicted in Figure 22) shows that a substantial growth has been achieved over the last few years, with exchanged volumes that almost tripled between January 2019 and August 2020. The benefits of removing the obstacles for trading after the DAM will therefore probably become increasingly obvious in the coming months and years. This very rapid increase of the Intraday market liquidity definitely reinforces the need to make changes to the current Day-ahead balance obligation and to make it evolve towards a solution which is robust to ongoing and future evolutions of the electricity markets.
The **implementation efforts** and the **robustness to future evolutions** are therefore the two last criteria we used in our comparison.

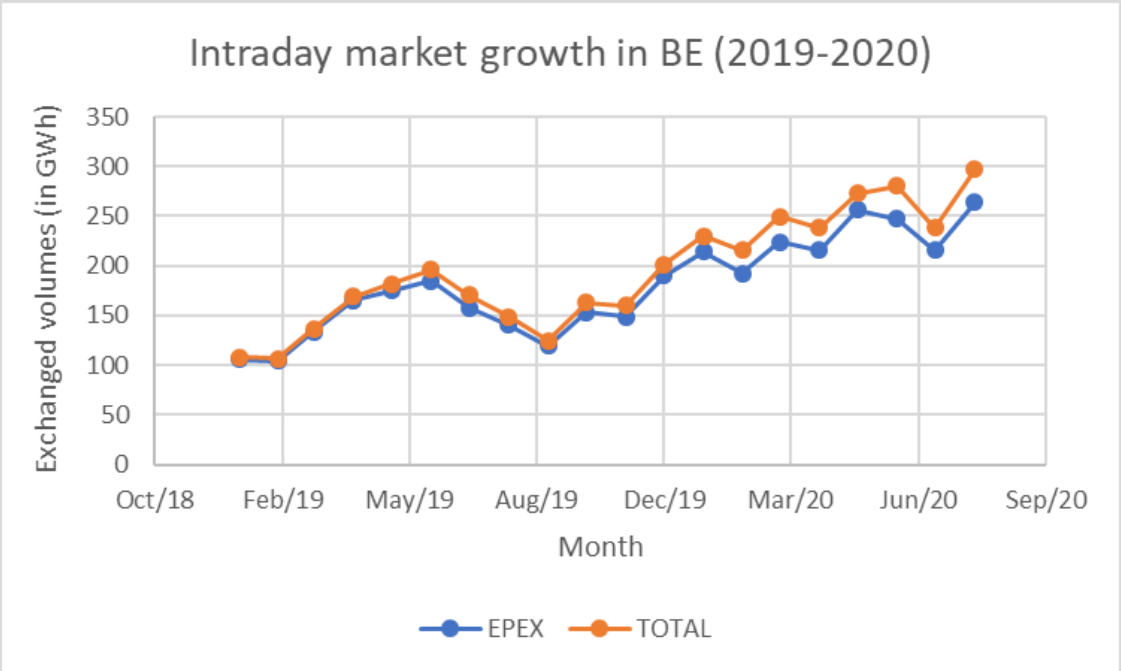


Figure 22 : Monthly evolution of the volumes exchanged on the Intraday market in Belgium (defined as the sum of the volumes sold and bought, divided by 2) over the period 2019-2020 (source: EPEX)

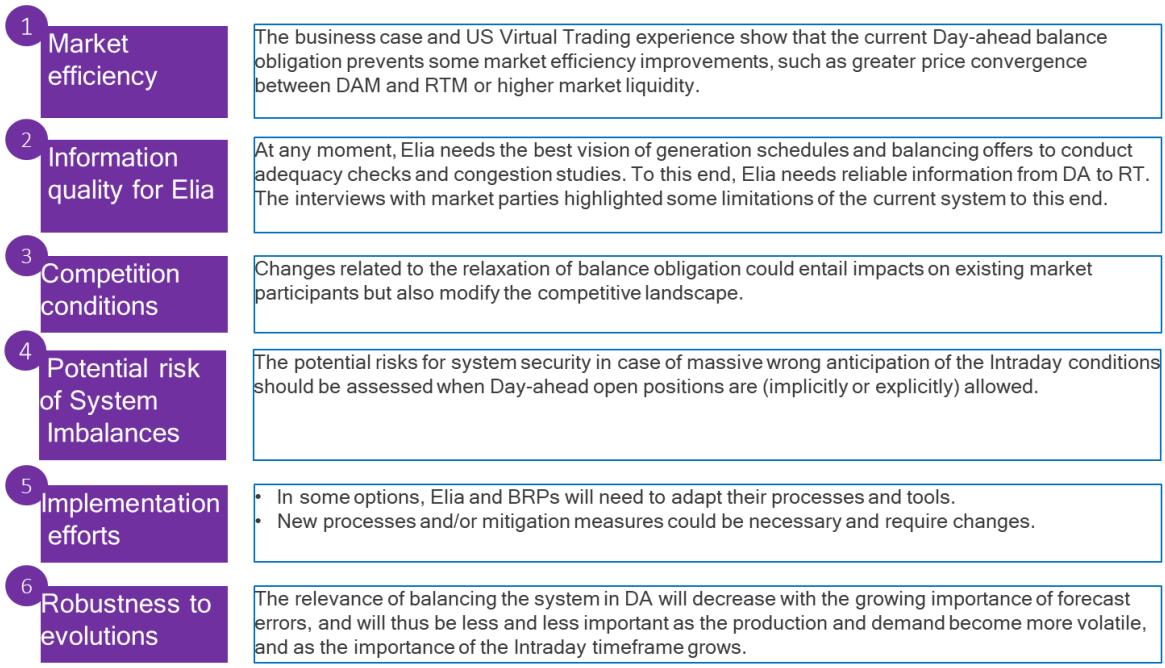


Figure 23 : criteria used to compare the different possible Day-ahead balance obligation evolutions

9.2 Reference and scale used for the comparison

The **reference case** which was naturally used for the comparison **is the current situation**. A qualitative scale was then used to compare each of the proposed evolution to the current situation:

- "++" means that the proposed evolution implies "significant improvement" with respect to the current situation for the criterion which is evaluated
- "+" means that the situation is improved
- "=" is used in case of stability
- "-" reflects a degradation
- "--" is used when the situation is significantly degraded.

To help the interpretation of the reference situation, the review of the current Day-ahead balance obligation is summarized here below and a colour code was used to indicate the degree of satisfaction of the current system:

- Green = satisfactory
- Orange = concerns
- Red = issue

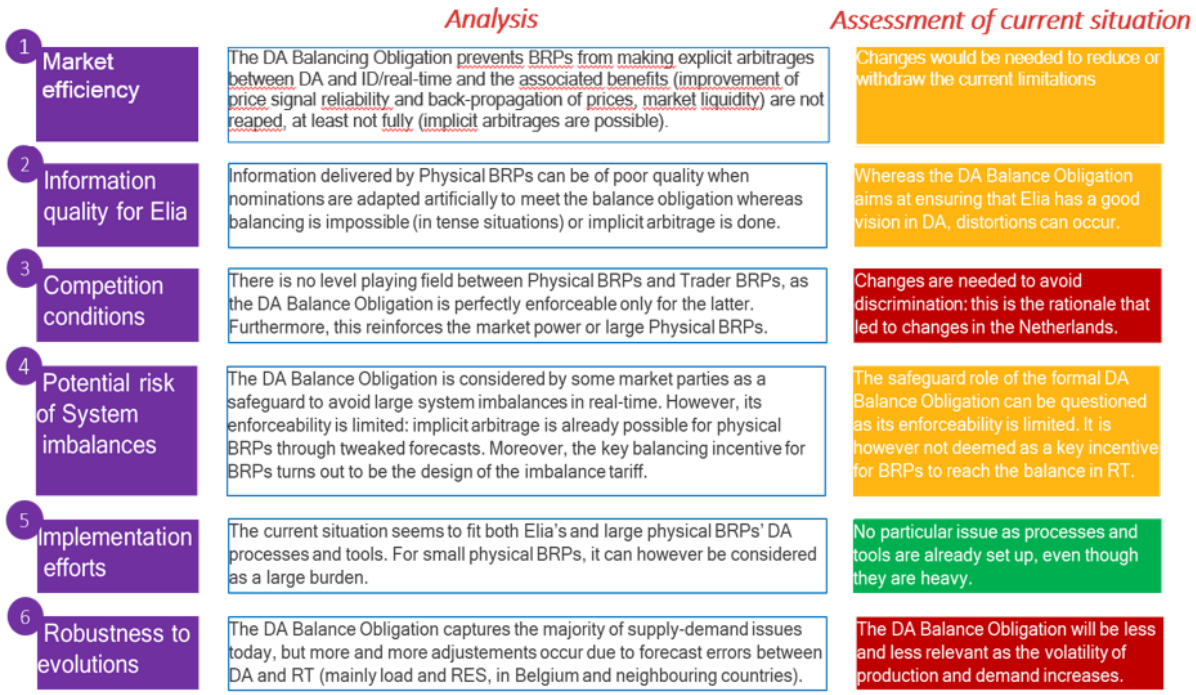


Figure 24 : evaluation of the reference case (current Day-ahead balance obligation)

9.3 Evaluation of each option and comparative table

Using the comparison scale explained in the previous section, each option was individually compared to the reference situation for the 6 criteria that were deemed as relevant in our study. The individual assessment of each option is detailed in the next paragraphs.

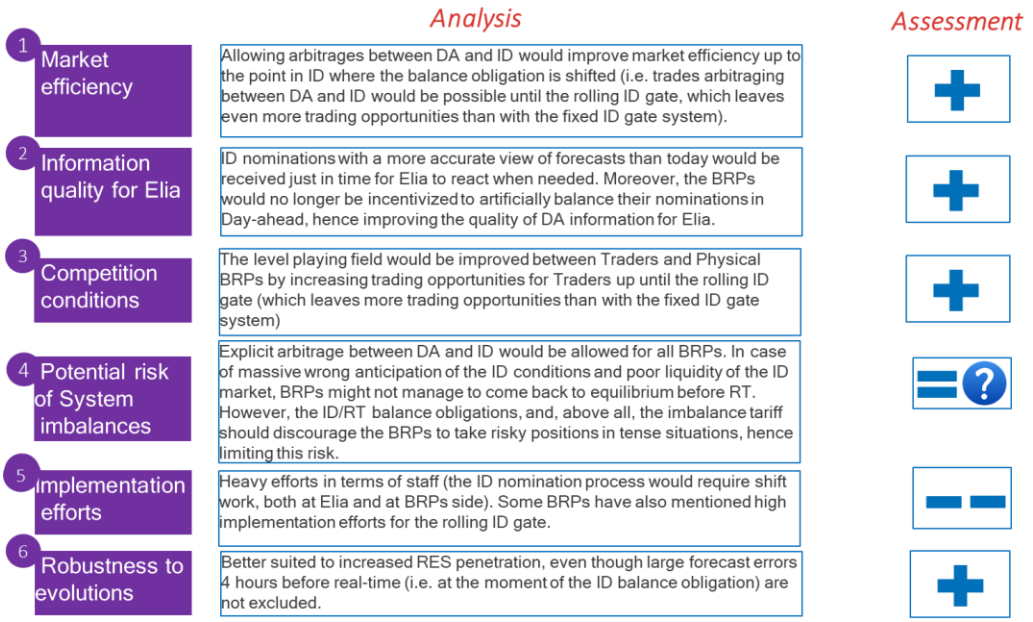
9.3.1 Keeping the Day-ahead balance obligation while allowing justified imbalance

	Analysis	Assessment
1 Market efficiency	Market efficiency would not be greater than today, i.e. limited to potential market efficiency benefits which are partially obtained today through implicit arbitrages between DA and ID by physical BRPs.	=
2 Information quality for Elia	Allowing justified imbalances (in tense situations) would improve the quality of nominations sent by BRPs and thus improve the quality of DA information for Elia.	+
3 Competition conditions	No change.	=
4 Potential risk of System imbalances	No change: it will remain impossible to monitor if the nominations are a real best estimate or if the forecasts are tweaked to hide voluntary open positions of physical BRPs.	=
5 Implementation efforts	No change.	=
6 Robustness to evolutions	No change.	=

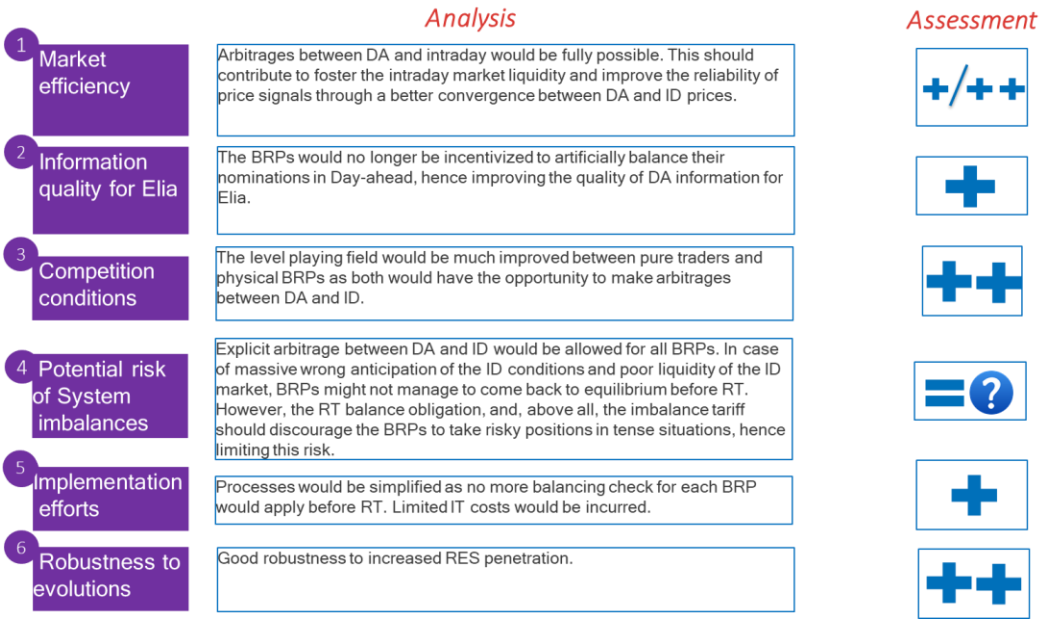
9.3.2 Shifting the Day-ahead balance obligation to fixed Intraday gates

	Analysis	Assessment
1 Market efficiency	Allowing arbitrages between DA and ID would improve market efficiency up to the point in ID where the balance obligation is shifted (i.e. trades arbitraging between DA and ID would be possible until the fixed gate closure times). This should contribute to foster the ID liquidity.	=/+
2 Information quality for Elia	ID nominations with a more accurate view of forecasts than today would be received by Elia. Moreover, the BRPs would no longer be incentivized to artificially balance their nominations in Day-ahead, hence improving the quality of DA information for Elia.	=/+
3 Competition conditions	The level playing field would be improved between Traders and Physical BRPs by increasing trading opportunities for Traders. However, this would only be valid up until the fixed ID gates.	=/+
4 Potential risk of System imbalances	Explicit arbitrage between DA and ID would be allowed for all BRPs. In case of massive wrong anticipation of the ID conditions and poor liquidity of the ID market, BRPs might not manage to come back to equilibrium before RT. However, the ID/RT balance obligations, and, above all, the imbalance tariff should discourage the BRPs to take risky positions in tense situations, hence limiting this risk.	=?
5 Implementation efforts	Heavy efforts in terms of staff (the ID nomination process would require shift work, both at Elia and at BRPs side).	--
6 Robustness to evolutions	Better suited to increased RES penetration, but adaptations would probably be necessary over time: as RES penetration increases, security issues will not necessarily occur at peak load hours anymore.	=/+

9.3.3 Shifting the Day-ahead balance obligation to a rolling Intraday gate



9.3.4 Removing the Day-ahead balance obligation



9.3.5 Comparative table

The overview of the evaluation of each possible Day-ahead balance obligation is provided in the comparative table below:

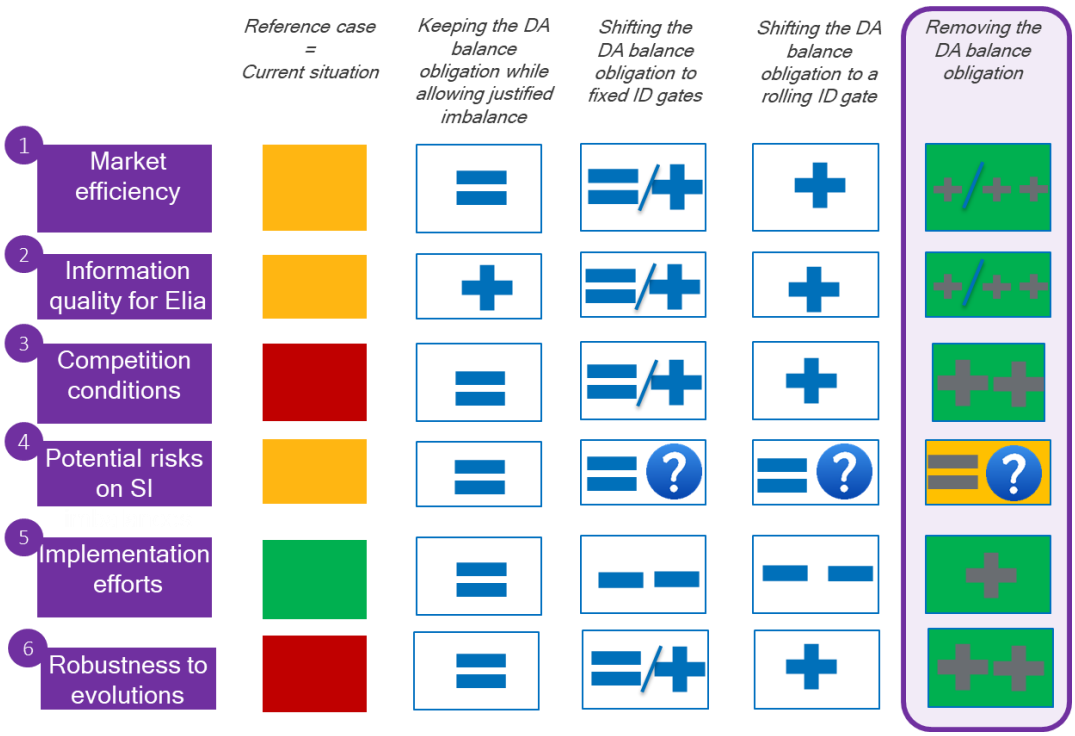


Figure 25: comparison of possible Day-ahead balance obligation evolutions

This table shows that **the suppression of the Day-ahead balance obligation outperforms all the other options** (including the current situation) **in most criteria.**

A full relaxation of the Day-ahead balance obligation would indeed be an **enabler to improve market efficiency**, it would **improve the quality of the Day-ahead information received by Elia** (as BRPs would provide their best estimates, without being tempted to tweak their forecast to artificially meet the balance obligation) and it **would restore the level playing field** between Physical and Trader BRPs.

Furthermore, the **implementation efforts[78] would be limited** (since the process will be mostly simplified), and the suppression of the balance check would positively impact the daily workload at Elia's side (and probably also, although to a lesser extent, at BRP's side since they would no longer need to flatten the nominations to reach the balance).

The removal of the Day-ahead balance obligation is also the **most robust option towards future evolutions of the energy landscape**, since it creates a continuum between the Day-ahead and the Intraday timeframes in a world where adjustments closer to real time will more and more be required (due to the growth of intermittent generation and the development of demand response and electricity storage), hence requiring a growing and efficient Intraday market.

If it is true that a massive wrong anticipation of the next day conditions by the BRPs, coupled with a poor Intraday market liquidity, could theoretically lead to larger system imbalances than with the Day-ahead obligation in place, **this risk is considered as very unlikely in the practice**. The experience of neighboring countries indeed showed that the role played by the Day-ahead balance obligation to reach the equilibrium in Real-time is very

[78] These will be detailed in section **Error! Reference source not found.**

limited[79], and in any case much less important than the financial incentive brought by the imbalance tariff. Since the imbalance tariff is unanimously considered as strong in Belgium, BRPs would be discouraged from taking risky open positions in Day-ahead and massive 'wrong bets' in case of tense situations (that could therefore not be corrected before the Real-time) are not to be expected.
Finally, note that the conclusions of this comparative table are consistent with the European guidelines (which do not impose any kind of Day-ahead obligation, but allow its use where it is relevant) and with the design applied in most of our neighboring countries.

10. Removal of the Day-ahead Balance Obligation

From the comparative analysis performed in the previous chapter, it is clear that the removal of the Day-ahead balance obligation is a future proof evolution for the Belgian market. This option is therefore analyzed in greater details in this chapter.
In particular, we mentioned in chapter 4 that the removal of the Day-ahead balance obligation raises the fear among some market parties that it may lead to misconduct of Trader BRPs, hence resulting in higher System Imbalances and imbalance tariff. As explained in previous chapter, the risk that this relaxation may deteriorate the Belgian System Imbalance is deemed very unlikely, considering the fact that these BRPs would be the first exposed to important imbalance invoices. **However, in order to confirm this assumption and make sure that the relaxation of the Day-ahead balance obligation does not impact the System Imbalance of the Belgian zone, Elia would like to attach concrete risk mitigation measures to it**. These mitigation measures are described in the next sections.
A **comprehensive cost-benefit analysis** of this option, taking the aforementioned mitigation measures into account, is then performed. The cost and benefits are **quantified where possible**. However, one has to keep in mind that the final effects of the suppression of the Day-ahead balance obligation will all depend on the behavior of the BRPs. As previously explained, if BRPs assess that the Intraday market liquidity is too poor to leave any position open at the end of the DAM, then the suppression of the Day-ahead balance obligation will have barely any impact at all.

10.1 Mitigation measures

In order to make sure the relaxation of the Day-ahead balance obligation has no effect on the Belgian System Imbalance, two concrete measures are proposed:

- The first measure consists in **relaxing the Day-ahead balance obligation in a phased way**, similarly to the approach followed by some US ISOs during the introduction of the virtual bidding mechanism in their market design;
- The second measure aims at **giving as much information as possible to the BRPs**, so that they can make the best possible decisions in the DAM and then, via a new indicator, **easily assess the open positions they took in order to react as soon as possible in case of "wrong bet".**

[79] The situation faced by the German TSOs in June 2019 shows that even with a Day-ahead balance obligation in place, large Real-time imbalances can occur when the Real-time imbalance tariff is not strong enough. Conversely, the experience of neighboring countries that have never had, or that suppressed, their Day-ahead balance obligation shows that a strong imbalance tariff is sufficient to prevent large Real-time imbalances.

10.1.1 Phased relaxation

A phased relaxation of the Day-ahead balance obligation allows foreseeing a **temporary period during which a maximum Day-ahead open position is defined for each BRP**. The purpose of this temporary restriction is twofold:

- It allows confirming that a relaxation of the Day-ahead balance obligation does not impact the Belgian System Imbalance, while however acting as a temporary safeguard and limiting the risk of large System Imbalances should this assumption be (partially) incorrect;
- It gives the market some time to adapt to the new system and mature before totally removing any balance constraint in Day-ahead if the evaluation of the temporary period gives positive results.

This measure should therefore **ensure a smooth implementation** of the relaxation of the Day-ahead balance obligation.

When nearing the end of this temporary period, an **evaluation** is to be organized in order to assess the behaviors of the BRPs and the overall **impact of the partial relaxation on the Belgian System Imbalance. In case of positive evaluation of this partial relaxation of the Day-ahead balance obligation, a full relaxation can be implemented**. Otherwise, it might be decided to maintain the partial relaxation of the obligation, or even to revert back to the current situation.

During the temporary period, the restriction on the Day-ahead open position is calculated according to the following guidelines:

- For each BRP, the maximum of the daily average of “offtakes + sales” is calculated over a 12-months period and updated once a year (if necessary). This parameter intends to give an idea of the size of the BRP portfolio. For the new BRPs, or the BRPs that significantly adapted their portfolio during this 12-months period, a specific process is followed to define this parameter based on the estimation from the BRP of the size of his portfolio.
- The BRPs are then classified according to the size of their portfolio (small, medium, large, very large)[80].
- For each category of BRPs, a threshold applies, that represent the maximum open position that a BRP belonging to this category is allowed to take in Day-ahead.

If the **threshold applicable** for a given BRP is **exceeded twice in one calendar month**, the BRP will be **prohibited from utilizing the Intraday Commercial Trade mechanisms for a period of 30 calendar days** starting as notified by Elia.

10.1.2 Publication of indicators reflecting the aggregated nomination imbalance

A lot of information regarding Elia’s forecasts is already available today on the Elia website. These publications can of course be used by the BRPs to get a view on the system situation as forecasted by Elia and to assess the day-ahead open position they intend to take. **On top of that, it might be interesting for BRPs to be able to assess the open position they took in Day-ahead, comparing it against the global position taken by the market**. This can be

[80] For instance (beware that these values are introduced in this note to illustrate the concept but are not to be considered as definitive since they will be reviewed and adapted during the implementation):
- From 0 to 100MW : small BRPs
- From 100 to 300MW : medium BRPs
- From 300MW to 600MW : large BRPs
- >600MW : very large BRPs

done using the **total (i.e. aggregated) imbalance resulting from the sum of all the Day-ahead nominations** received by the BRPs. This indicator can be published by Elia at the end of the Day-ahead timeframe and can give the BRPs an interesting signal to be active on the Intraday market. The indicator can indeed help BRPs evaluate how easy it will be to find counterparties to balance their position before Real-time, or how interesting it can be to bid or offer additional supply/demand in the Intraday market. They can then react accordingly.

Example:

Suppose a system consisting of 4 BRPs:

- BRP_A is a consumer, with 60 MW Day-ahead load forecast in his perimeter (assumed to be correct).
- BRP_B is a consumer, with 20 MW Day-ahead load forecast in his perimeter (assumed to be correct).
- BRP_C is a consumer, with 20 MW Day-ahead load forecast in his perimeter (assumed to be correct).
- BRP_D is a producer with a 100 MW installed capacity of renewables and a 200 MW dispatchable power plant with a start-up time of 2 hours. BRP_D's Day-ahead renewable forecasts in his perimeter are 80 MW (assumed to be correct).

BRP_A correctly anticipates 80 MW of renewables for the next day and submits purchase-bid in the Day-ahead market accordingly. However, BRP_B and BRP_c wrongly anticipate 90 MW of renewables, instead of 80 MW, and slightly underestimate the total load. Therefore, they both submit purchase-bids of 20MW at a low price in Day-ahead, because they think that the whole load will be covered by renewables.

The results of the clearing of the Day-ahead market are the following: the offer of BRP_A ,as well as 20 of the 40MW offered by BRP_B and BRP_C are accepted and covered by the 80MW of renewables of BRP_D. The 200MW dispatchable unit of BRP_D is not cleared in the Day-ahead market because the prices submitted by BRP_B and BRP_c are too low.

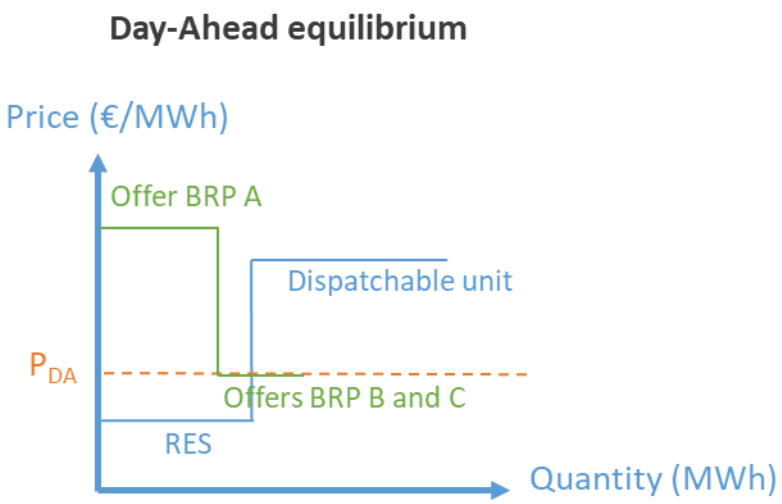


Figure 26: Results of the DAM clearing

The perimeters of BRP_A and BRP_D are balanced in Day-ahead. BRP_B and BRP_C however have a total short position of 20MW. Here, the indicator consisting in the sum of BRPs' imbalances is therefore -20 MW. Thanks to this indicator, all the BRPs know that there is an imbalance in the system and will interpret this as a signal to be active on Intraday markets:

- BRP_B and BRP_C know it might be harder than foreseen to close their open position in Intraday since the total imbalance of the zone is larger than the forecast error they had anticipated: they know they might have to submit a higher price than foreseen to hedge their position.
- BRP_D gets the signal it might be interesting to bid his dispatchable unit in order to sell additional energy on the Intraday market.

Let's suppose now that BRP_C anticipates 60MW of renewables instead of 80MW and therefore thinks that the Intra-day prices will be higher than the Day-ahead price. He therefore see an opportunity to make profits and, on top of his physical offer to cover his load, he places a virtual demand bid of 20MW at a price consistent with his forecasts for the next day.
In this case, the results of the clearing of the Day-ahead market might be the following: all the offers of BRP_A and BRP_C (including the virtual one) are accepted and covered by the renewables and dispatchable unit of BRP_D. The offer of BRP_B is not cleared because the submitted price is too low.

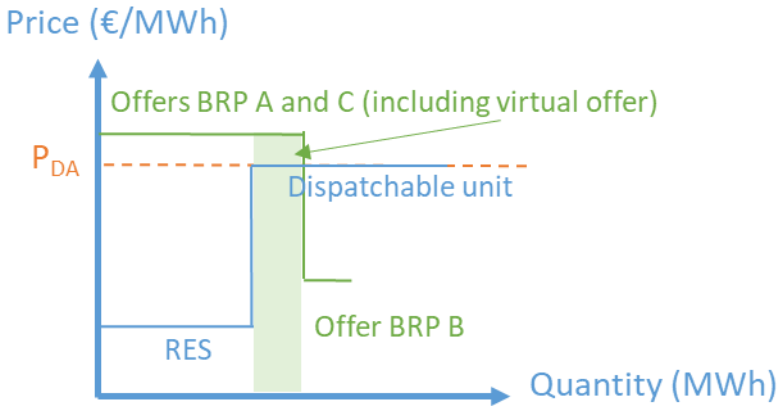


Figure 27: Results of the DAM clearing

The perimeters of BRP_A and BRP_D are balanced in Day-ahead. BRP_B has a short position of 20MW and BRP_C has a long position of 20MW. Here, the indicator consisting in the sum of BRPs' imbalances is equal to zero. Thanks to this indicator, BRP_B and BRP_C know that they can easily find counterparties in the Intraday market, because someone in the system has the opposite imbalance.

Based on this last example, we can think of **one additional further improvement of this indicator** that might be helpful for the BRPs: we might indeed consider **publishing two separate indicators respectively reflecting the global open position taken by the BRPs whose perimeter is long in Day-ahead, and the global open position taken by the BRPs whose perimeter is short in Day-ahead**. This way, the BRPs can get a better view on how active the Intraday market will be.

Example:
If a BRP_A adopted a short position in Day-ahead (e.g. -20MW) and the sum of all the Day-ahead nominations is equal to zero, two situations are possible:

- Either he is the only one who took a short position in Day-ahead which means that some BRPs are long for a total which exactly amounts his short position. In this case, the indicator reflecting the global open position

taken by the BRPs whose perimeter is long in Day-ahead would be +20MW and the indicator reflecting the global open position taken by the BRPs whose perimeter is short in Day-ahead would be -20MW.

- Or he is not the only BRP having adopted a short position in Day-ahead, which means that there exist a lot of possible counterparties who took a long position in Day-ahead. In this case, the indicator reflecting the global open position taken by the BRPs whose perimeter is long in Day-ahead might be e.g. +150MW and the indicator reflecting the global open position taken by the BRPs whose perimeter is short in Day-ahead would then be -150MW.

In the first case, the liquidity of the Intraday market might be limited and the number of possible counterparties for BRP_A might be reduced. In the second case, the Intraday market would be more active.

Elia **suggests to compute these two separate indicators**, reflecting the global Day-ahead open position taken by the BRPs whose perimeter is long in Day-ahead and the global Day-ahead open position taken by the BRPs whose perimeter is short in Day-ahead, **and to publish them on Elia's website at the end of the Day-ahead nomination procedure**. The relevance of these indicators will be **tested during the temporary period** allowing a partial relaxation of the Day-ahead balance obligation, and will be **assessed during the evaluation phase** of this temporary as well.

10.2 Cost-Benefit Analysis

In this section, a comprehensive cost-benefit analysis of the removal of the Day-ahead balance obligation, taking into account the mitigation measures described in previous section, is performed:

- The **implementation efforts** are first analyzed from Elia and BRPs' perspective. These cover the tools and processes adaptations required to relax the Day-ahead balance obligation and take into account the IT developments that would be required to allow the computation and the publication of the aggregation of the Day-ahead nomination imbalances;
- The **effect of the relaxation of the Day-ahead balance obligation on the System Imbalance, and hence, on the size of the contracted FRR** is then further investigated. As already mentioned, Elia does not expect any negative effect of a relaxation of the Day-ahead balance obligation on the System Imbalance of the Belgian zone. However, in order to determine an upper limit of the costs that might incur if Elia's assumptions happen to be wrong, a worst case scenario is simulated here and its impact on the size of the reserves is analyzed;
- The **various potential benefits of the relaxation** of the Day-ahead balance obligation are then summarized, with a more **qualitative approach**, since the final effects of the suppression of the Day-ahead balance obligation will all **depend on the behavior of the BRPs**, which can hardly be anticipated.

10.2.1 Implementation efforts

At Elia's side**, the IT application used for the nomination process needs to be adapted**, in order **to allow each BRP to keep a Day-ahead open position** (up to the allowed threshold during a temporary period). Besides, a few developments are required **to allow the computation and publication of the indicator** that Elia intends to put at the BRPs' disposal. Some IT developments are also required to **support the Day-ahead security analyses** (adequacy check and congestion forecast). The purpose of the developments would be to make sure the dispatchers performing the Day-ahead security analyses, and the tools used to carry them out, are aware of the global open position

taken by the grid and can easily take it into account in the simulations they launch and in the interpretation of their results. A first evaluation of these IT developments shows that the **related costs remain limited**.

At BRPs' side, IT adaptations might occasionally be required but these should remain very limited. However, as explained below, the relaxation of the Day-ahead balance obligation will mostly have a positive impact on BRPs, by simplifying the nominations process (e.g. no need to "flatten" the nominations artificially to reach the balance on a ¼ hour basis, whereas only hourly market products are available in Day-ahead, and technical constraints such as power plants ramps need to be taken into account; no need to "tweak" the numbers when tense situations are detected; etc.).

10.2.2 Expected effect on SI and contracted FRR

Elia does not expect the relaxation of the Day-ahead balance obligation to cause any deterioration of the System Imbalance of the Belgian zone.

Indeed, since the BRPs have the formal obligation to be balanced (or help the zone) in Real-time, and since they face a strong imbalance tariff in case they are not, it can be expected that the greatest part of the open positions taken in Day-ahead will be hedged before the last gate of the Intraday market. Besides, Elia will publish an indicator in order to help the BRPs to assess their Day-ahead open position and hence correct it as soon as possible during the Intraday timeframe if they realize they made a wrong assumption on the next day conditions. This way, even the errors of anticipation made by the BRPs in Day-ahead will most of the time not impact the Real-time System Imbalance. The only risky situation would be a massive wrong anticipation of the next day conditions by the BRPs, combined with a poor liquidity of the Intraday market. In this case, the BRPs might not be able to hedge their position before Real-time, hence causing a high Real-time imbalance. However, as already mentioned before in this document, it is very unlikely that BRPs take large open positions in Day-ahead when tense situations/poor Intraday liquidity are expected, since the financial risk taken by the BRPs would be too important. Furthermore, in order to keep this last risk under control while taking the time to confirm the aforementioned assumptions, a temporary restriction will be set on the maximum Day-ahead open position allowed for each BRP before considering the full removal of the Day-ahead balance obligation.

Besides, the experience of other European countries shows that the presence of a Day-ahead obligation is not a sufficient condition to prevent large System Imbalances when the imbalance tariff is impaired and that, contrariwise, countries which do not have any Day-ahead balance obligation perfectly manage to keep their System Imbalances under control thanks to a robust imbalance tariff. Elia's assumption that the removal of the Day-ahead balance obligation would not impact the Belgian System Imbalance is even reinforced by the observations made in one of our neighboring country where the Day-ahead balance obligation has recently been removed. In this country, there is no formal Real-time obligation either, which means that the BRP may freely try and anticipate the real time tariff, hence introducing an additional risk of Real-time System Imbalance in case of wrong bets. Besides, no particular mitigation measure was taken to smooth the suppression of the Day-ahead balance obligation. Even under these circumstances, no shift was observed in the trend line followed by the 99th percentile of the System Imbalance of this country at the moment of the suppression of the balance obligation. Besides, no statistical difference was observed between the evolution of the 99th percentile of the System Imbalance of this country and the evolution of the 99th percentile of the System Imbalance of other neighboring countries which did not modify their balance obligations.

For all these reasons, Elia strongly believes that the relaxation of the Day-ahead balance obligation will not impact the Belgian System Imbalance nor Elia FRR reserve capacity needs.

However, in order to reassure the Belgian Market Parties who consider the Day-ahead balance obligation as a safeguard to avoid large System Imbalances and hence, at longer term, impact on the costs of the contracted FRR, a very worst case scenario was developed and simulated. The purpose of this worst case scenario is to estimate an upper limit of the costs that might incur if Elia's assumptions happened to be wrong and if higher System Imbalances were to be regularly observed after the relaxation of the Day-ahead balance obligation.

The absolute worst case scenario **introduces a one shot deterioration of the 99th percentile of the System Imbalance at the full removal of the Day-ahead balance obligation** (supposed in 2023[81]). A one shot deterioration of 1% (expressed as a percentage of the 99th percentile of the System Imbalance of the previous year) was considered and was introduced in the existing scenarios described in the MOG II System integration study[82], which aim at assessing the evolution of the need for contracted FRR in the coming years, given the increasing integration of offshore production in Belgium.

In the MOG II System integration study, three cases were investigated, reflecting different market performances:

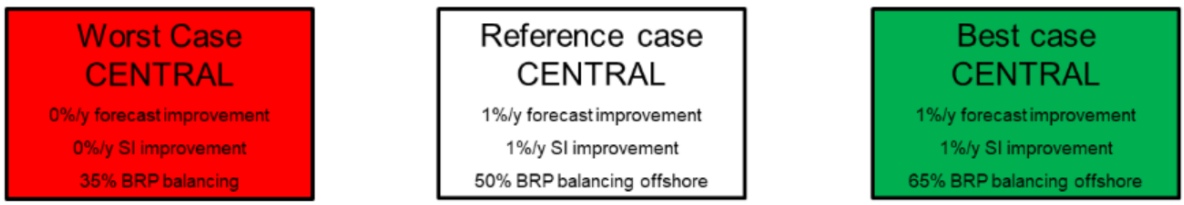


Figure 28: overview of the cases investigated in the MOG II System integration study (source : MOG II offshore integration study [15])

To build these cases, the assumption was made that the quality of the Belgian System Imbalance would at least remain stable (i.e. 0% improvement of the SI for each year). This assumption is represented in the "worst" case (in red in Figure 28). However, in the "reference" case and "best" case (i.e. the white and green scenarios in Figure 28), Elia estimated to achieve a yearly improvement of one percent per year.
For the purpose of this study, Elia considered that the absolute worst impact of the removal of the Day-ahead balance obligation would be to cancel out the one percent improvement of the 99th of the System Imbalance achieved in 2023 in the "reference" and "best" cases of the MOG II System integration study, and to decrease the quality of the Belgian System Imbalance by 1% in 2023 in the "worst" case.
The following scenarios were therefore simulated in the context of this Day-ahead balance obligation study:

[81] The exact implementation timeline still has to be confirmed (see last chapter of this study)
[82] The full study is available on Elia website https://www.elia.be/en/public-consultation/20200608_public-consultation-on-the-integration-of-additional-offshore-capacity

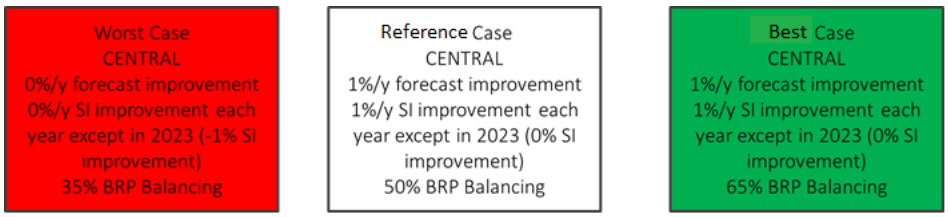


Figure 29 : absolute worst case scenarios simulated for the Day-ahead balance obligation study

The results of these new simulations were then compared to the results of the scenarios simulated in the MOG II System Integration study. The comparison **shows that the impact on the FRR needs of the one shot deterioration of the System Imbalance at the full removal of the Day-ahead balance obligation is negligible**:

- In 2020, the FRR needs remain strictly unchanged, since the one-shot deterioration of the System Imbalance has not occurred yet;
- As from 2023, the one-shot deterioration of the System Imbalance causes a very slight increase of the average FRR means of maximum 3MW for upwards FRR and 4MW for downwards FRR.

	MOG II integration study scenarios				one shot SI deterioration in 2023			
	2020	2023	2026	2028	2020	2023	2026	2028
Reference	1039	1039	1104	1246	1039	1040	1106	1248
Worst	1040	1042	1175	1466	1040	1042	1177	1469
Best	1039	1039	1087	1169	1039	1039	1088	1171

*Figure 30 : Evolution of the **average upwards** FRR needs over the period 2020-2028 for each of the scenarios simulated in the MOG II integration study – at the left side of the figure, and for the same scenarios considering a one-shot deterioration of the SI in 2023 – at the right side of the figure (all values are expressed in MW)*

	MOG II integration study scenarios				one shot SI deterioration in 2023			
	2020	2023	2026	2028	2020	2023	2026	2028
Reference	1006	981	1017	1111	1006	982	1018	1112
Worst	1008	992	1061	1340	1008	993	1063	1344
Best	1006	977	1006	1066	1006	978	1007	1067

*Figure 31: Evolution of the **average downwards** FRR needs over the period 2020-2028 for each of the scenarios simulated in the MOG II integration study – at the left side of the figure, and for the same scenarios considering a one-shot deterioration of the SI in 2023 – at the right side of the figure (all values are expressed in MW)*

These simulations show the very limited impact that a one-shot deterioration of the System Imbalance at the moment the Day-ahead balance obligation is removed would have on the contracted FRR costs.

10.2.3 Potential benefits

The lessons learned from our analysis of the American “virtual trading” mechanism, and the feedback received by some market parties, show us that the Day-ahead balance obligation constitutes a barrier to potential improvements in terms of market efficiency. Besides, our internal assessment of the operational processes impacted by the Day-ahead nominations also demonstrates that some improvements and simplifications might be reached by relaxing the Day-ahead balance obligation.

All these potential benefits are described in this section, with a more qualitative and theoretical approach this time, since the final effects of the suppression of the Day-ahead balance obligation will all depend on the behavior of the BRPs, which can hardly be anticipated. Indeed, if BRPs deem that the Intraday market liquidity is currently too poor, they might not make use of the possibility to take open positions at the end of the Day-ahead market. In this case, the benefits raised by the relaxation of the Day-ahead market might be limited in a first stage. However, the removal of the Day-ahead market obligation will not deteriorate the situation either and will suppress the barriers to future improvements, once the increased penetration of renewables and demand flexibility will have made the Belgian Intraday market more dynamic. The benefits of the relaxation of the Day-ahead balance obligation can therefore be expected to become larger and larger over time.

10.2.3.1 Better price convergence

As explained in section 6.7.3, the suppression of the Day-ahead balance obligation allows the BRPs with strong forecasting competences to anticipate the intraday conditions, and place additional purchase orders or supply bids in the DAM that let the Day-ahead price tend to converge towards the expected Intraday price. If these arbitrage opportunities are identified and grasped by the BRPs, the **Day-ahead price would better reflect the next day conditions** than with a Day-ahead balance obligation in place. Note that this better price convergence would not necessarily apply till the balancing timeframe, since the Real-time balance obligation would remain unchanged, which means that the BRPs would not be allowed to gamble on the imbalance tariff and on the Real-time direction of the Belgian zone.

10.2.3.2 Higher market liquidity

Market parties are generally concerned by the liquidity of the DAM in Belgium, and could therefore fear that the DAM would become less dynamic if the Day-ahead balance obligation is removed and no longer incentivizes the market participants to exchange their 'left-overs' at the day-ahead stage. In this section, we intend to demonstrate that **the removal of the Day-ahead balance obligation will not negatively impact the dynamic of the Day-ahead market and that, contrariwise, it could even improve it, depending on the behavior of the BRPs.**

First of all, the current capacity allocation configuration, where Day-ahead is allocated under a flow-based scheme which is more flexible than the Intraday available transfer capacity (ATC) scheme, suggests that the liquidity of the DAM will remain ensured, whether the Day-ahead obligation is maintained or not. Furthermore, the Clean Energy Package min ram 70% rule[83] for cross-border capacity calculation will most likely have as consequence that there will always be more cross-border capacity in Day-ahead than in Intraday, which is a strong incentive for all the large market participants to be and remain active in Day-ahead.

Besides, the American experience teaches us that allowing free arbitrage between the Day-ahead market and subsequent markets can only improve these markets liquidity:

- By removing all the incentives that market participants could have to hoard capacity to subsequent markets if they anticipate better opportunities in these subsequent markets :

[83] See Article 16 of the Regulation 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market for electricity

  - With a Day-ahead balance obligation in place, a BRP anticipating better prices in Intraday might try to push himself out of the DAM to conclude his transaction in Intraday;
  - Without Day-ahead balance obligation, the BRP can use alternative optimization strategies relying on the arbitrage possibilities between markets : for instance, a producer anticipating higher Intraday prices might bid his whole capacity at marginal costs in Day-ahead and place additional purchase order. This way, he will increase the DAM clearing price and get a higher inframarginal rent on the energy he sells in the DAM and, besides, he will be able to sell extra energy in Intraday at a higher price than the price he bought it in Day-ahead, hence making a profitable transaction.
- By allowing BRPs to place "virtual" purchase offers or supply bids in the DAM, that are not matched yet with any physical load or production. As observed in the American case study of PJM, these "virtual" bids can significantly contribute to market liquidity.

Here again, the actual benefits and improvement observed in Belgium will strongly depend on the bidding strategies adopted by the BRPs.

10.2.3.3 Improved competition conditions

One **clear and immediate benefit** of the suppression of the Day-ahead balance obligation is that **it restores the level playing field between Physical and Trader BRPs**. We indeed demonstrated that no perfect monitoring can be applied on the Day-ahead nominations of Physical BRPs, whereas a strict monitoring can be performed on the nominations of the Traders. This inherent imperfection of the monitoring system currently raises a non-level playing field between BRPs, since the Physical BRPs might implicitly perform arbitrage between the DAM and subsequent markets (even though this possibility remains limited), whereas this practice is totally impossible for Trader BRPs.

Besides, the transposition of the American experience in a European context shows that the removal of the Day-ahead balance obligation might help reduce the possible exercise of market power by large BRPs in the DAM, since any other BRP might compensate the manipulative bidding strategy by placing "virtual" bids in the DAM[84]. This way, large BRPs lose any incentive to try and manipulate the Day-ahead market.

10.2.3.4 Improved quality of Day-ahead price signal

The conclusion of the three previous sections **suggest that the relevance of the Day-ahead price signal can only be improved by the relaxation of the Day-ahead balance obligation** since:

- The Day-ahead price might tend to converge towards the prices expected for the next day, hence better reflecting the Real-time conditions;
- The DAM liquidity can only be increased by the relaxation of the Day-ahead balance obligation;
- Any tentative to exercise power market is discouraged since the manipulative strategy might be compensated by other actors.

[84] See section 6.3 for more explanation

10.2.3.5 Increase of the quality of Day-ahead information

An **important and immediate benefit** of the removal of the Day-ahead balance obligation is that the BRPs will no longer be penalized if they submit unbalanced nominations in Day-ahead and will therefore **no longer be discouraged to transparently communicate to Elia**, as from the end of the DAM, the unavoidable disequilibria they might expect in case of tense situations.

Besides, as explained in sections 6.7.2.2 and 6.7.2.3, if the BRPs make use of the arbitrage possibility between the Day-ahead and Intraday markets and correctly anticipate the next day conditions, the information received by Elia in Day-ahead will even better reflect the Real-time situation, since the generation schedules will be closer to the Real-time dispatch. Furthermore, as mentioned in section 10.2.1, some small tools and processes adaptations will be foreseen to inform the dispatcher in charge of the Day-ahead security analysis of the global open position taken by the market in Day-ahead, so that he can take this information into account when defining the assumptions of his simulations and when interpreting their results.

10.2.3.6 Simplification of operational processes

Finally, the relaxation of the Day-ahead balance obligation **opens up possibilities for simplification of operational processes, as well at Elia side as at the BRP's side**.

At short term, the partial relaxation of the Day-ahead balance obligation already allows the BRPs to somewhat simplify their processes, since they would **no longer need to "flatten" their nominations artificially**, in order to match, on a quarter-hourly basis, 1-hour market products with productions and load that are constantly changing[85].

In the medium term, the full relaxation of the Day-ahead balance obligation would **allow Elia to stop monitoring the equilibrium** (as it is done today) or the respect of the maximum Day-ahead open position allowed (as it is foreseen during the partial relaxation of the Day-ahead balance obligation).

And finally, at longer term, the removal of the Day-ahead balance obligation **even opens the way to a possible simplification of the Day-ahead nomination process** (e.g. allowing the BRPs to nominate their positions at a more aggregated level than the current practice[86], or even fully removing some components of the nominations, considering that the generation schedules will be communicated to Elia via the Scheduling Agent after the implementation of the iCAROS project - phase 2).

[85] See section 4.1 for more information about this limitation of the current Day-ahead balance obligation
[86] Injection/offtakes could for instance be submitted at portfolio level instead of at Access Point level, such as today

11. Conclusions and recommendations

The current Day-ahead balance obligation **was introduced in the first Federal Grid Code of 2002**[87] and hence in the first Belgian BRP contract. At this time, the picture provided by the Day-ahead nominations was quite representative of the Real-time situation, since not a lot of changes were supposed to happen during the Intraday timeframe: there was indeed no continuous Intraday market, intermittent energy sources were limited and the demand presented little flexibility**. In the meantime, the European energy mix and markets have been evolving dramatically** and large changes regularly happen between the forecasts available in Day-ahead and the Real-time situation. This somewhat **questions the relevance of the Day-ahead balance obligation**: is it still pertinent to request BRPs to reach an equilibrium at the end of the DAM, hence creating a discontinuity between the Day-ahead and Intraday timeframes and will this obligation remain justified in the coming years? This reassessment is supported by the European guidelines for electricity balancing (EBGL), which do not impose any Day-ahead balance obligation, but allow the TSO to add such an obligation in its Terms & Conditions BRP when it is deemed relevant.

Interviews with Belgian market parties, benchmark with other European TSOs, in-depth study of the American mechanism of "virtual bidding" and internal analysis of all the operational processes relying on the Day-ahead nominations led to the following observations:

- Other countries, sometimes with balancing systems that are very similar to ours, **function well without any kind of Day-ahead balance obligation;**
- The Elia operational processes making use of the Day-ahead nominations (adequacy checks, congestion forecasts) **do not need balanced nominations** to work properly;
- The Day-ahead balance obligation **could jeopardize the quality of the information** communicated to Elia in Day-ahead;
- The current Day-ahead obligation introduces a **non-level playing field** between Physical BRPs (who could circumvent the obligation) and Traders (for which a strict monitoring apply);
- It puts up **barriers to possible spot market improvements** (price convergence between Day-ahead and Intraday markets, higher market liquidity, reduction of possible exercise of market power)
- Several Belgian and foreign experiences show that a **strong imbalance tariff is much more powerful** than a formal Day-ahead balance obligation, and is even self-sufficient, to prevent Real-time imbalances.

These observations confirmed our belief that the **current Day-ahead balance obligation presents limitations and needs to evolve.**

All **possible evolutions**, going from keeping a balance obligation in Day-ahead, while improving some of its aspects, to removing any kind of balance obligation before Real-time, were therefore **assessed and objectively compared**.

[87] The Royal Decree of 19 December 2002, establishing a grid code for operating and accessing the electricity transmission system. Note that the Day-ahead balance obligation does not exist anymore in the current Federal Grid Code of 29 April 2019.

The comparison showed that the **full relaxation of the Day-ahead balance obligation is the most appropriate opti**on for the current Belgian context: it **addresses most of the limitations** of the current system and is future proof since it also **removes the barriers to possible spot market improvements** that will become more and more relevant with increased renewables and demand flexibility. Even though the current Day-ahead balance obligation is sometimes considered as a safeguard to prevent large Real-time imbalances, **regular higher System Imbalances are not to be expected** with the relaxation of the Day-ahead balance obligation. The strong financial incentive given by the imbalance tariff should indeed discourage the BRPs to adopt large open positions in Day-ahead when the risk that they will not be able to hedge their position before the Real-time is important (e.g. in case of tense situations).

Elia therefore **recommends to fully remove the Day-ahead balance obligation while keeping the Day-ahead nomination process and the RT formal balance obligation unchanged in a first stage**. Elia analyzed the risks linked to the relaxation of the Day-ahead balance obligation and believes that the risk of higher System Imbalance is very unlikely. In order to confirm this assumption and make sure the relaxation of the Day-ahead balance obligation has no effect on the Belgian System Imbalance, **two measures are proposed**:

- A **progressive** relaxation of the Day-ahead balance obligation:

- The **publication**, on Elia's website, **of new indicators** depicting the **total (i.e. aggregated) open position** taken by the BRPs at the **end of the DAM**. By comparing their position against the global position of the market, BRPs could evaluate how easy it will be to find counterparties to balance their position before Real-time, or how interesting it can be to bid or offer additional supply/demand in the Intraday market.

The relaxation of the Day-ahead balance obligation might be seen as **a first step towards the simplification of the current balancing process**: it opens the way to other adaptations, such as, for example, the rationalization of the information communicated by the BRPs to Elia in Day-ahead through the nomination process.

Implementation plan

As mentioned in section 10.2.1, the implementation of the phased relaxation of the Day-ahead balance obligation requires **some IT developments and/or process adaptations at both Elia and BRPs side**[88].

Besides, the evolution towards both the partial relaxation and the full removal of the Day-ahead balance obligation each time **requires small modifications of the T&C BRP**[89], which need to be publically consulted and approved by the CREG. In order to avoid multiplying the number of revisions of the contracts, Elia will strive to synchronize the modifications of the T&C BRP necessary for the implementation of the evolutions of the Day-ahead balance obligation with other modifications of the BRP contract that would be linked to other projects implemented by Elia.

Finally, **a sufficiently long period of observation and evaluation should be foreseen** between the partial relaxation of the Day-ahead balance obligation and the final decision to evolve towards a full removal of this obligation, to maintain its partial relaxation, or to revert back to a situation where a strict Day-ahead balance obligation apply.

Elia will take these different constraints into account and will suggest a comprehensive implementation timeline in the final report of this study, after further alignments with other projects and initiatives that are ongoing or are planned in the coming months. The purpose is to come up with a consistent and realistic implementation plan, taking into account all the transversal constraints and synergies.

However, based on the already available information, **Elia can announce her intention to start working on this project in 2021, even though the contractual stream would not start before April 2021** (which will sign the end of the previous review of the T&C BRP).

[88] For the BRP who are willing to take open positions in Day-ahead. Other BRPs, who want to continue working as they currently do and who do not intend to take open positions in Day-ahead, should not be impacted at all by the relaxation of the Day-ahead balance obligation.
[89] In order to mention the open position allowed in Day-ahead and to specify the technical penalty that would apply if the maximum allowed open position was violated (for the temporary phase).

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