3rd Working Group
Consumer Centric Market Design

Elia – 15th September 2022

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Objective of the presentation

- CCMD as a solution to manage your **energy community**
- Discussion on the approach for **grid fee and taxes**
- Rationales for the **evolution of the imbalance price**
- **“Simplify”:** forecast of the system Imbalance

CCMD roadmap

Consumer Centric Market Design

Q2-Q4 2022

Working Groups CCMD (4-5)
Design discussion & implementation roadmap

Q2-Q4 2022

Demonstration projects
test & learn to feed design and implementation

Q4 2022

Public Consultation
Design & implementation note

Q1-Q2 2023

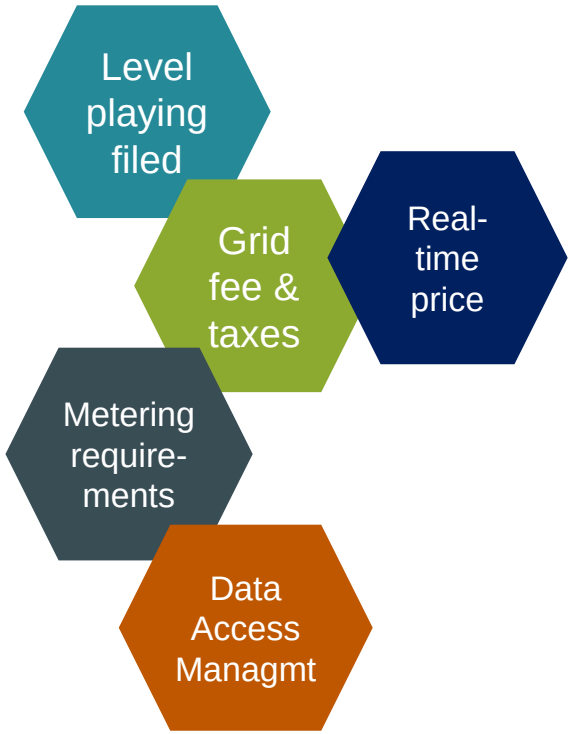
Discuss Stakeholders'
feedback & open points

Update
Design & implementation note

First Tests with stakeholders

Q4 2023 Go-Live

TSO Grid Users
Multiple BRPs Solution for ToE in aFRR



CCMD: a solution to manage your energy community

Context & timeline

Consumer Centric Market Design

Valorization of flexibility via third parties

Balancing
Congestion management

WG CCMD – 05.05.2022

Supply split - Physical reallocation between parties

WG CCMD – 20.06.2022

Exchanges between market parties

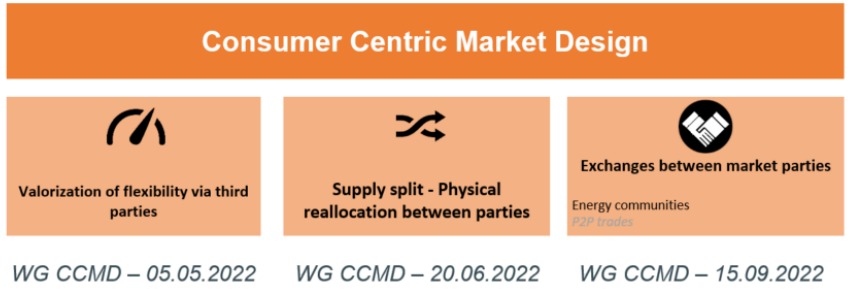
Energy communities
P2P trades

WG CCMD – 15.09.2022

Scope of today's discussion – How CCMD can be a solution to manage your Energy Community?

Context and timeline

One design solution applicable to all voltage levels.



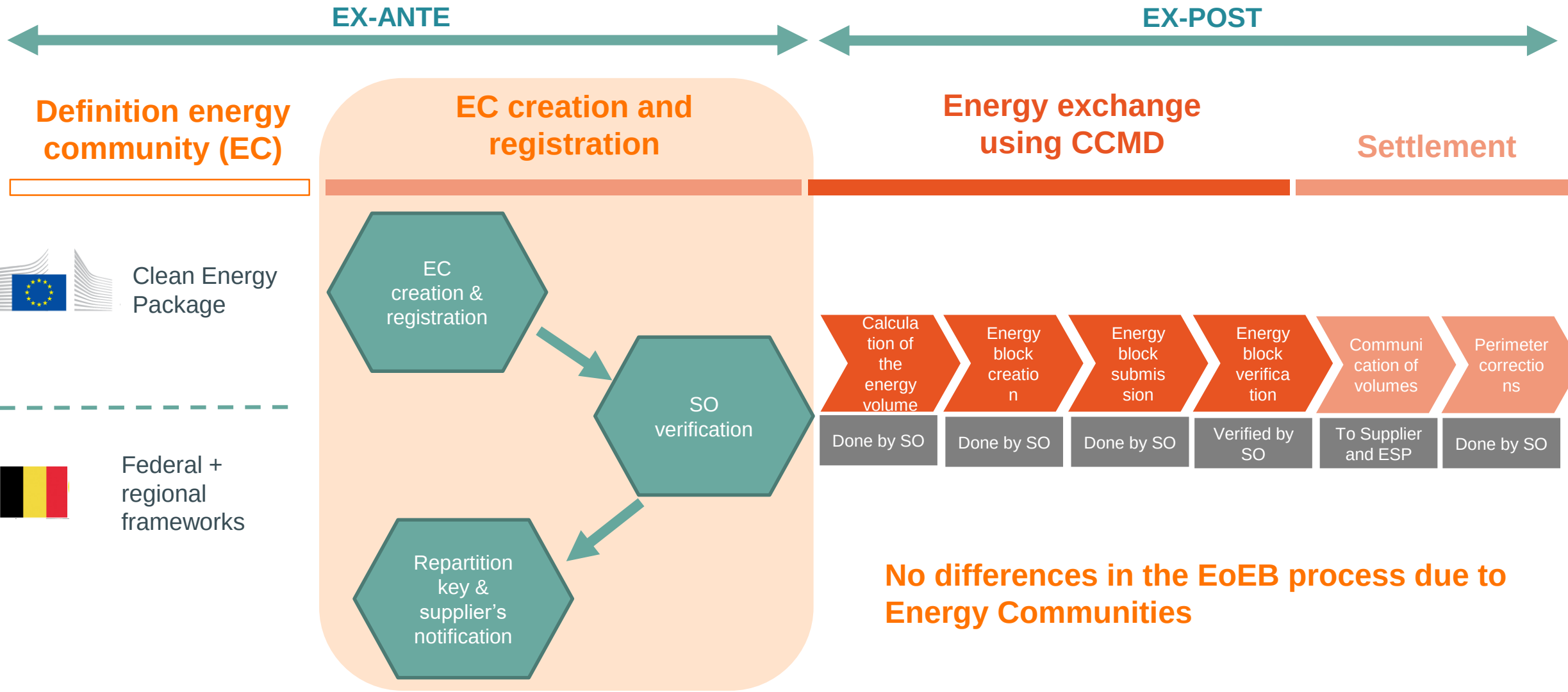
One design solution applicable to all voltage levels.

High level design discussion with stakeholders to **collect early feedback** and assess robustness of ELIA's proposed design solutions

By end of the year, the high level design is translated into **a detailed design note**, and **published to collect feedback** from market parties.

Updated design based on stakeholder's feedback and **implementation** of each building block.

Table of content



Definitions

What is an Energy Community – Definitions from EU legislation (Clean Energy Package)

	Citizen Energy Community	Renewable Energy Community
Definition	A **legal entity** that is based on voluntary and open participation, effectively controlled by shareholders or members who are natural persons, local authorities, including municipalities, or small enterprises, and micro-enterprises.	A **legal entity** that, in accordance with the applicable national law, is based on open and voluntary participation, autonomous, effectively controlled by shareholders or members that are located **in the proximity of the renewable energy projects that are owned and developed by that legal entity**; the shareholders or members of which are natural persons, SMEs or local authorities, including municipalities
Primary purpose	The primary purpose of a CEC is to provide environmental, economic or social community benefits for its members or the local areas where it operates rather than financial profits.	The primary purpose of a REC is to provide environmental, economic or social community benefits for its shareholders or members or for the local areas where it operates, rather than financial profits.
Activities	A CEC can be engaged in electricity generation, distribution and supply, consumption, aggregation, storage or energy efficiency services, generation of renewable electricity, charging services for electric vehicles or provide other energy services to its shareholders or members.	A REC can engage in activities based on renewable energy sources, including generation, energy efficiency, supply, aggregation, mobility, energy sharing, self-consumption, and district heating & cooling.

Key takeaways – assumptions followed to elaborate this design proposal

- → An Energy Community is represented by a **legal entity**, has **other purposes than financial profits** and can **engage in multiple activities**.
- → The notion of **proximity** to renewable projects owned by the EC is introduced for the Renewable Energy Community, yet without concrete definition. ELIA waits further clarification (through transposition into federal / regional legislation) to verify that criteria (if demonstrated needed) in the EC registration process.
- → Federal / regional legislation can foresee additional elements such as involvement of regulator. Today's discussion only focuses on the needed interactions between the SO and market parties.

Energy community creation and registration

EX ANTE | EX POST

Creation and registration of an energy community

Two major objectives when elaborating the design rules

Maximize possibilities for an Energy Community to perform smart allocation within its members. Such flexibility is essential seen the wide scope of possible activities.

Propose **generic design requirements** applicable to all voltage levels and **allowing cross SO energy communities**.

Creation and registration of an energy community

EX ANTE | EX POST

SO **verifies that the legal entity representing the EC effectively exists** and that the statuses contains at least the required information (such list depends on requirements set in regional legislation)

Each SO is responsible for the verification of the delivery point(s) connected to their grid.

Amongst those verifications (not exhaustive):

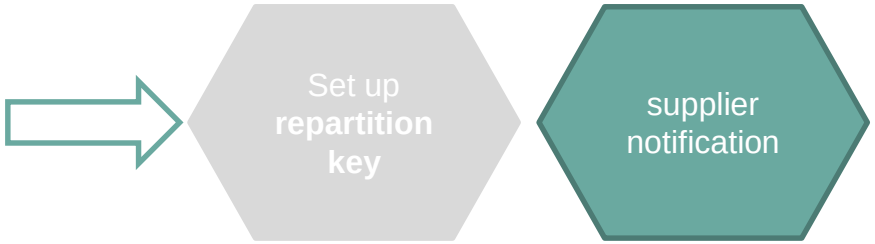
- ❑ Valid EANs of Access Points and Delivery Points;
- ❑ The AP is not yet registered in another energy community (one AP can only be part of one energy community)
- ❑ Certified metering devices (**digital meter on head meter**)
- ❑ Metering data exchange set up
- ❑ The installed capacity for injection DP
- ❑ Individual convention signed between each community member and the legal entity. **The content of such convention depends on requirements set in regional legislation.**

The **repartition key** represents the principles the EC follow to distribute the energy between its members.

- ➢ It serves as **basis to the SO** to perform the **ex-post energy block calculation**
- ➢ It is communicated to the **SO ex-ante** and can be adapted before start of each QH
- ➢ Non binding ex-ante volumes

Creation and registration of an energy community

EX ANTE | EX POST



The **supplier's notification** is sent by the SO:

- ❑ Once the EC is registered;
- ❑ Every time the EC composition evolves (new and/or members departure)

The **SO** does not communicate the repartition key to the suppliers as it can evolves **dynamically** (between 0 and 100 % of offtake covered by the EC production) **up to each QH**

The **supplier's notification** sent **to each supplier** which has one or several clients taking part into an energy community (either with injection or offtake)

The **supplier's notification** contains at least the following information:

- ❑ EANs of access point and delivery point
- ❑ Begin date / end date (if any)
- ❑ In case of injection DP, the max installed capacity of the asset taking part to the EC (Pmax)
- ❑ The size of the EC (number of members)

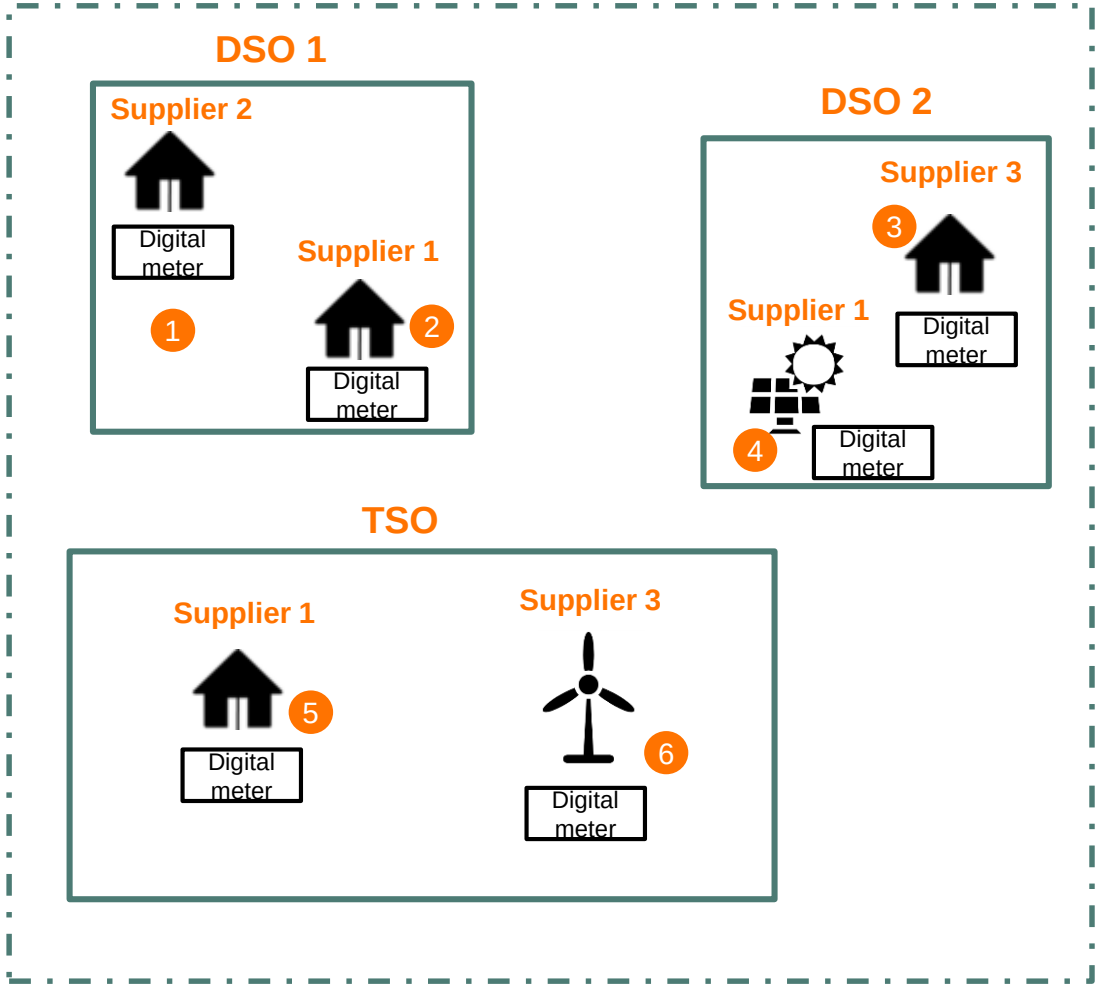
The supplier's notification sent by the SO to the supplier in the context of the registration process of an energy community corresponds to the supply split notice (notion introduced during WG CCMD 20.06 when discussing supply split design)

A concrete example

A concrete example of a Renewable Energy Community in the registration process

EX ANTE | EX POST

Renewable Energy Community – REC1



REC 1 registration process

Members	Inj.	Offtake	EAN AP	EAN DP	Supplier AP	Certified metering	Individual convention
David (1)		x	xxx1	yyy	Supplier 2		Yes
Thibaut (2)		x	xxx2	yyy	Supplier 1		Yes
Anna (3)		x	xxx3	yyy	Supplier 3		Yes
Amandine (5)		x	xxx4	yyy	Supplier 1		Yes
Wind turbine (6)	1 MW		xxx5	yyy	Supplier 3		Yes
PV panels (4)	0,02 MW		xxx6	yyy	Supplier 1		Yes

REC 1 initial repartition key

For each QH with available generation (sum of PV + wind > 0), apply the following repartition:

Members	Offtake
David	10 %
Thibaut	40 %
Anna	20 %
Amandine	30 %

!! This example is one amongst multiple possibilities to elaborate repartition keys (see next slide)

Concrete methodologies and proposed approach to validate a repartition key with its SO

Maximize possibilities for an Energy Community to perform smart allocation within its members. Such flexibility is essential seen the wide scope of possible activities.

Based on **known use cases** and **feedback** shared by market parties, **a first list of acceptable repartition keys** will be determined and implemented. (E.g: priorities, percentage, what to do with excess energy…)

If a repartition key is not defined in that acceptable list, the EC representative presents it to the SO.

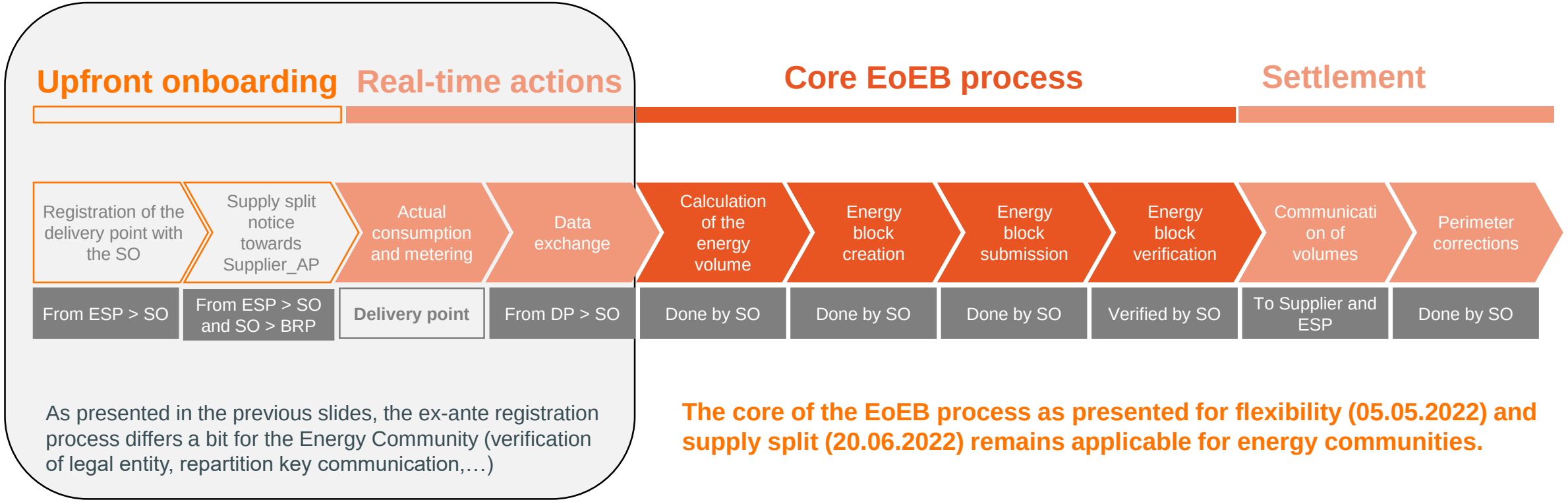
SO analyses if the proposal allows an ex-post energy calculation by the SO and can be implemented

Once implemented, it becomes an option to all energy communities.

Energy allocation process using Exchange of Energy Blocks

Overview of EoEB process

EoEB process as presented in WG CCMD on 20.06.2022 (on supply split)



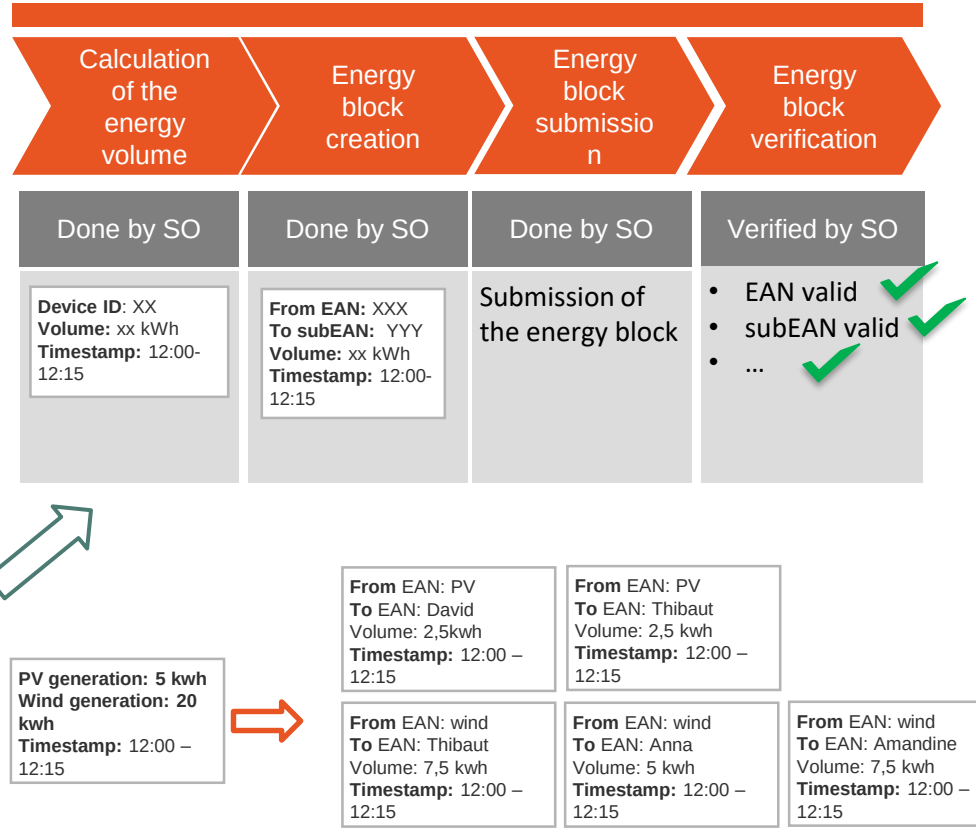
As presented in the previous slides, the ex-ante registration process differs a bit for the Energy Community (verification of legal entity, repartition key communication,…)

The core of the EoEB process as presented for flexibility (05.05.2022) and supply split (20.06.2022) remains applicable for energy communities.

Core EoEB process: Energy block calculation & creation

EX ANTE | **EX POST**

Calculation of Energy volume and energy block creation process



Members	Offtake
David	10 %
Thibaut	40 %
Anna	20 %
Amandine	30 %

Calculation of the energy volume:

- The volume of the energy block is calculated in kWh on a quarter-hourly basis based on thrusted data from certified meters .

Energy block creation & verification

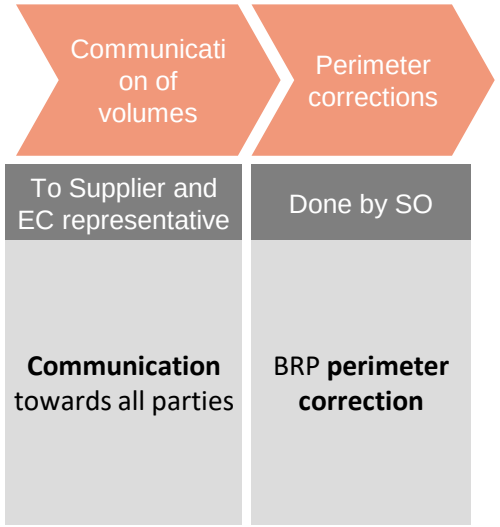
- The required data for the energy block is combined. This data includes the information of the accounts from and to whom an energy block is exchanged, the volume of the energy block and a timestamp.
- The SO can create this energy block based on the **repartition key communicated ex-ante.**

Reminder: the energy allocated following repartition key is capped to the measured offtake. The EC representative determines what to do with the excess energy.

EX ANTE | EX POST

Settlement: Communication

Settlement



Communication
The purpose of the communication is to be transparent towards the supplier_AP and the EC representative so they can correctly invoice their customers.

- The individual consumption per DP is sent to the ESP
- The corrected consumption at level of the AP is sent to the Supplier_AP

BRP Perimeter correction
The BRP perimeters related to the energy block transaction are corrected at the level of the access point.

Conclusions

Conclusions

Exchange of energy block mechanism facilitates the operation of a cross system operator energy communities as it follows a voltage neutral approach

- Each SO remains responsible for the registration and energy block calculation of each delivery points falling within their perimeter
- Need to set up coordination between SO for validation of an Energy Community covering multiple System Operators

Repartition key can be adapted up to start of each QH. It provides **flexibility** to tailor made the operation of each energy communities. Proposed stepwise approach also guarantees feasible implementation.

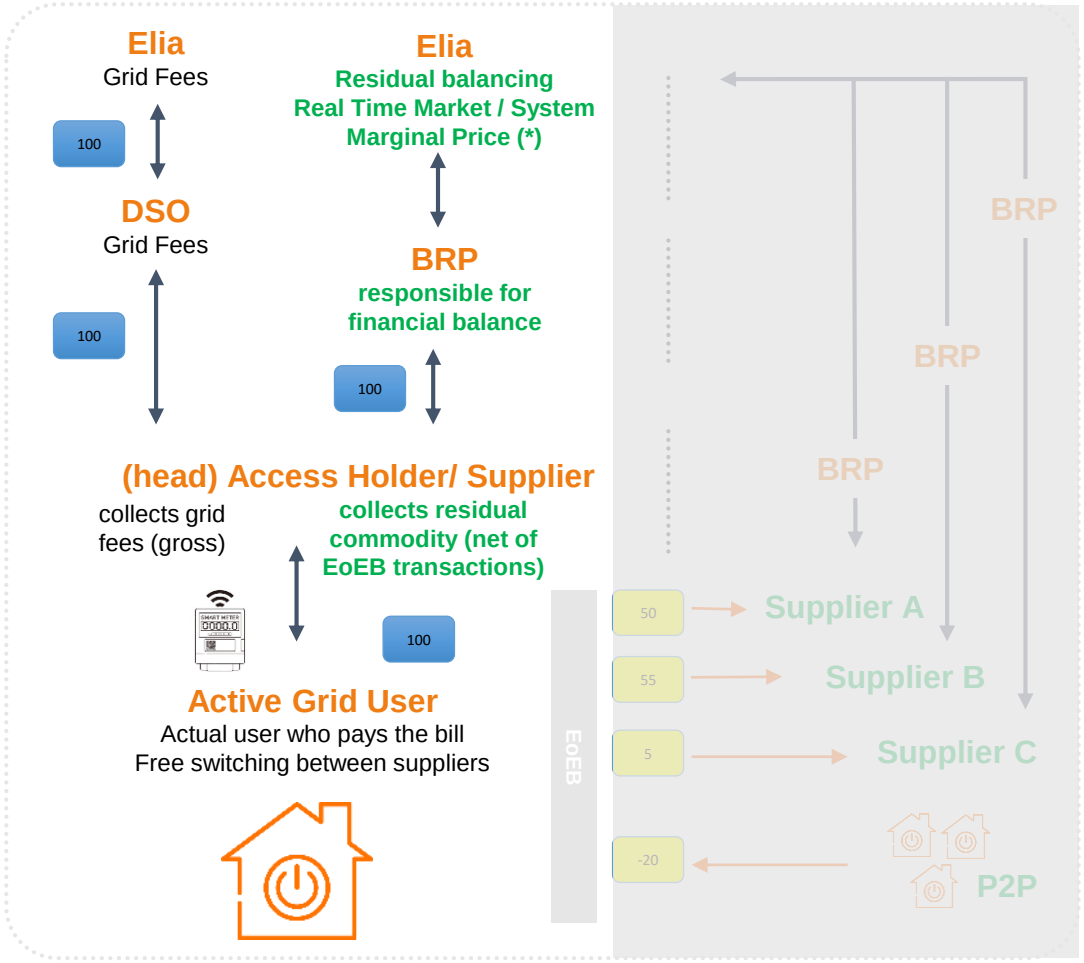
The ex-post EoEB process (calculation and settlement of energy blocks) remains exactly the same than the one already imagined for flexibility and supply split. **One generic solution for all three services.**

The Flemish energy decree provides that energy communities connected to the distribution as well as local transportation network are entitled to perform multiple transactions (energy sharing, peer to peer,…)

- Such decree is applicable to part of ELIA's grid
- ELIA considers the design on energy communities just introduced today as relevant to respect this requirement

Discussion on the approach for grid fee and taxes

Actual situation



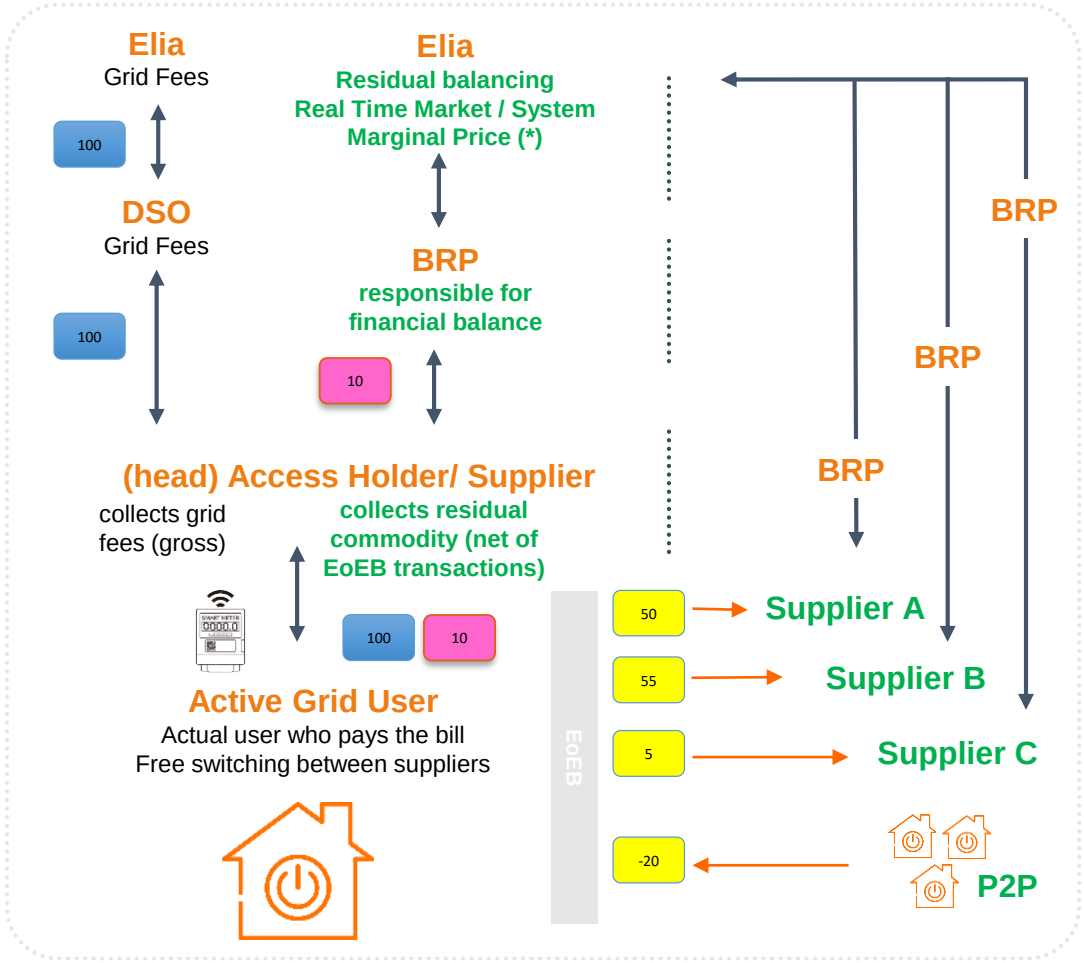
Metered (**regulated**)

Calculated

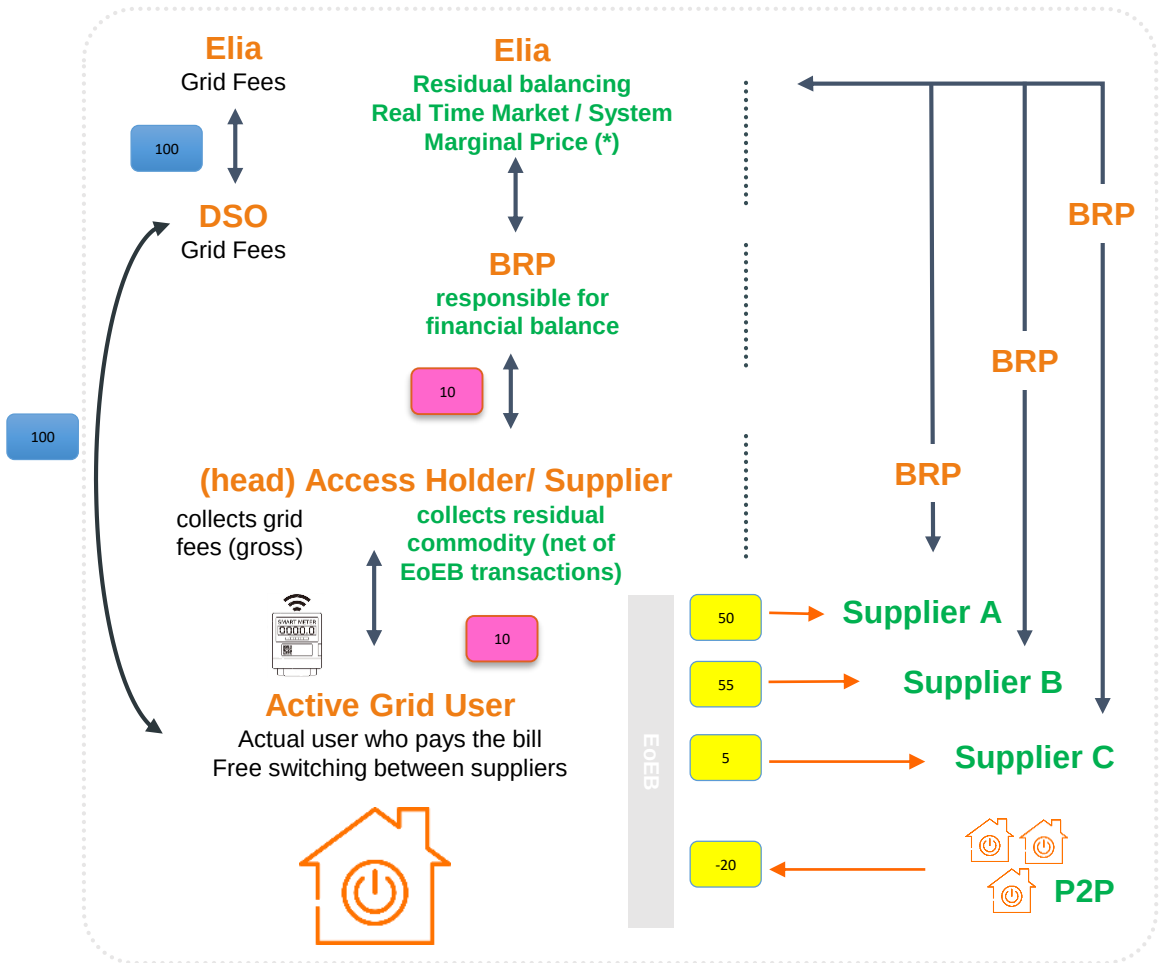
Declared or metered, depending on purpose

Different options

Option 1



Option 3



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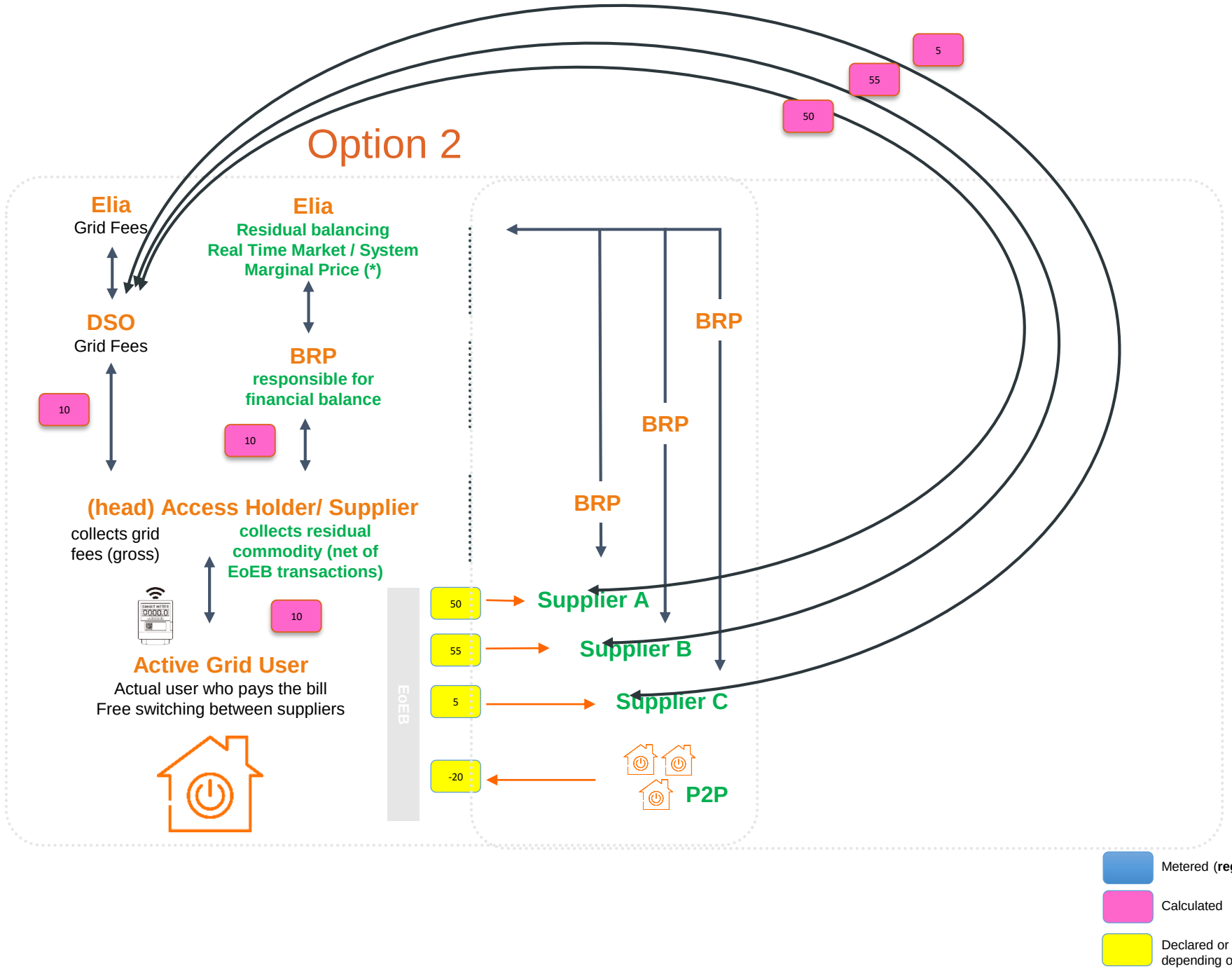
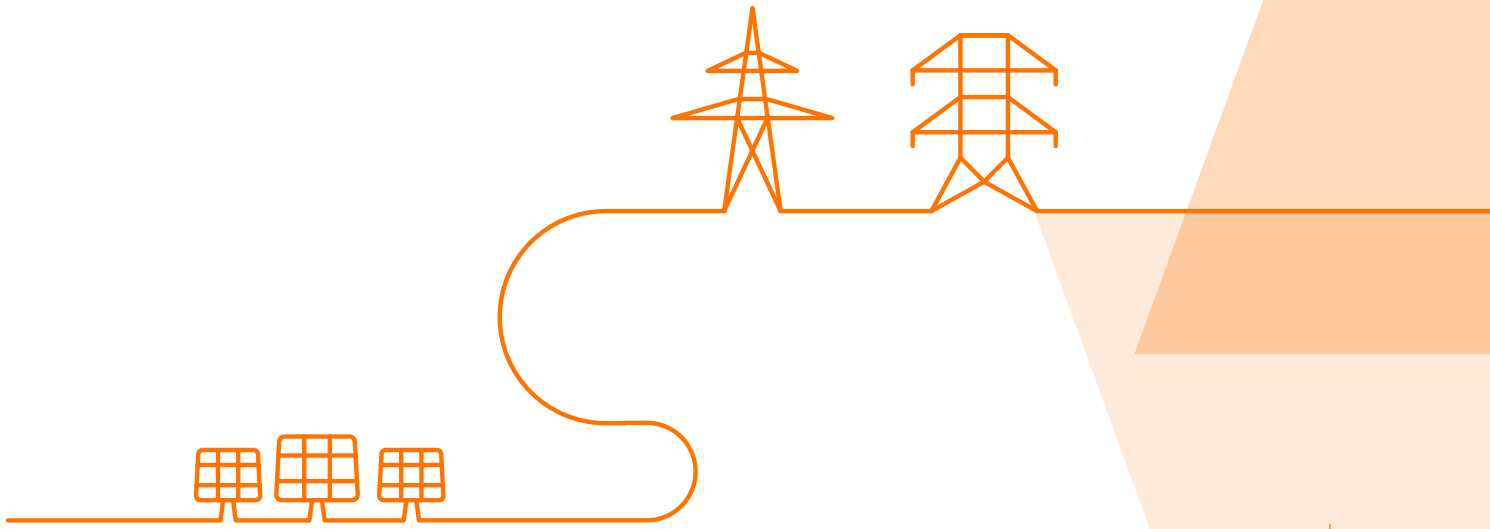


Rationales for the evolution of the imbalance price

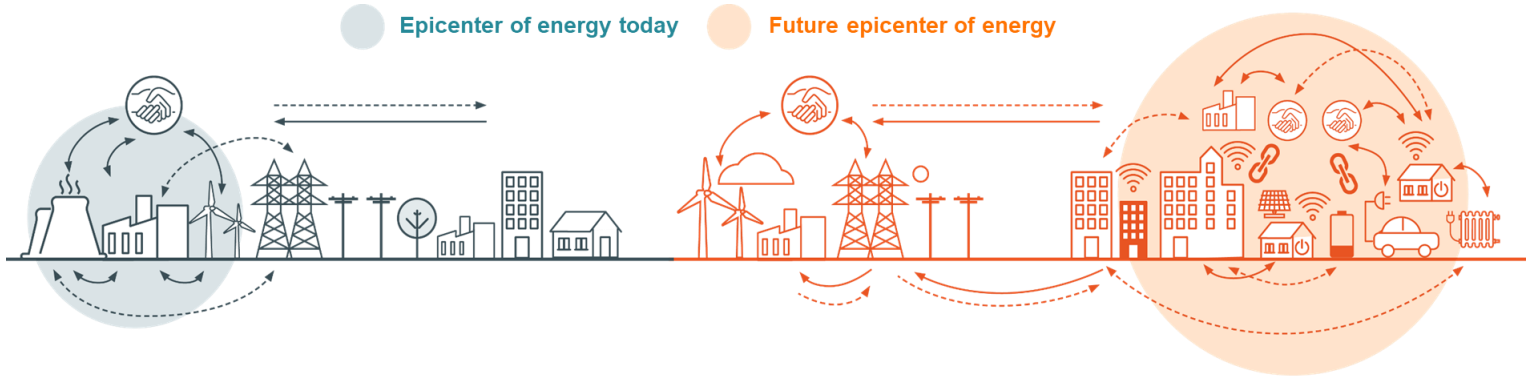
Agenda

1. Why does the Imbalance Tariff need to evolve to allow a more consumer-centric market?
2. Overview of ongoing initiatives and status
3. Zoom on the “Simplify” initiative – goal, model description & performance, next steps,…



Why does the Imbalance Tariff need to evolve to allow a more consumer-centric market?

The roadmap to net zero implies a paradigm shift

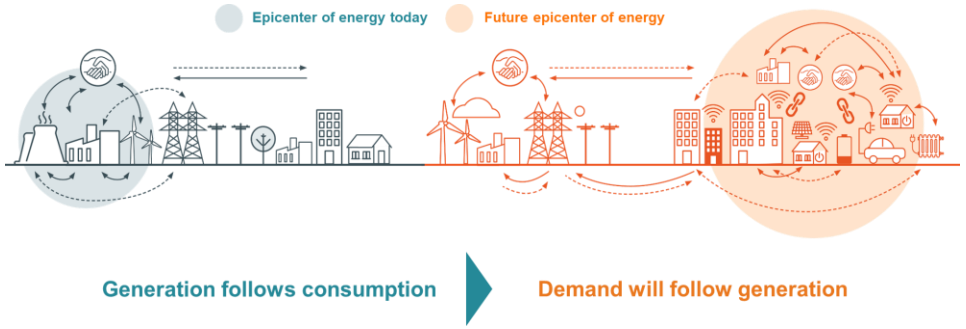


Generation follows consumption → **Demand will follow generation**

Demand can only follow generation if it receives an appropriate signal to do so. This signal can be an explicit activation by the TSO, or an implicit financial incentive. Since all the flexible assets will not be able or interested in offering their flexibility explicitly to the TSO, it is crucial that these assets get **easy access to clear price signals** in order to **capture the whole flexibility available in the system**. The **imbalance tariff therefore needs to evolve** towards **a clear real-time signal** incentivizing all the remaining available flexibility to **help balance the system** in real-time and, through an efficient back-propagation, also during all the previous timeframes.

From a penalty to an incentive

The current imbalance tariff is a ***penalty*** for the ***imbalances*** (in the wrong direction) of BRPs who have ***the legal and physical obligation to be balanced*** (or, in some conditions**, help the system) in real-time



The future imbalance tariff should provide a clear **incentive** to **all BRPs** to help balance the system in real-time.

To do so, the future imbalance tariff could f.i. evolve towards a self-sufficient signal, it should be known as soon as possible and it should aim at using the flexibility available in the system in the best possible way* (see details in next slides).

* E.g. in an integrated EU balancing market, the imbalance tariff should be the result of an optimization taking a.o. into account the price of the flexibility available abroad, but also the grid constraints on the borders.

** For BRPs with physical assets in their portfolio, that, due to their market situation, are able to quite accurately anticipate the imbalance tariff at the end of the ISP

From real-time/ex-post calculation to ex-ante forecast

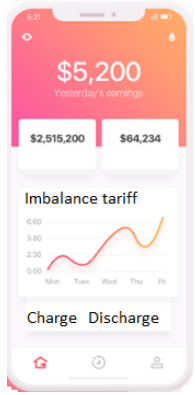
The current imbalance tariff is only **known at the end of the ISP***. **Real-time calculations** of the imbalance tariff are published on a one minute basis **during the ISP**, but these publications **do not reflect the expected evolution of the system** until the end of the ISP or over the upcoming ISP's.

In the future, a **forecast** of the imbalance tariff could be made available **before the beginning of the ISP** and/or be provided **within the ISP**, so that each BRP, whatever their market situation and whatever their forecasting ability, has the possibility to participate in balancing the system in real-time.

* Imbalance Settlement Period (currently equal to 15')

From multiple to single key indicator

The current one minute publications of imbalance tariff **cannot be used in a stand-alone manner** by BRPs to efficiently calibrate implicit reaction (e.g. the BRPs need to look at the BE SI and to anticipate other BRPs' implicit reaction to avoid switching the system*)



In the future, Elia could facilitate BRPs in calibrating their implicit reaction **by publishing Imbalance Price forecasts** that already take into account the other parameters that BRPs should otherwise look at (e.g. that consider the expected total implicit reaction), hence making it easier for small/new market participants to help the system.

* Calibration of implicit reaction might become even more complex with the connection to EU balancing platforms

From local to EU optimization

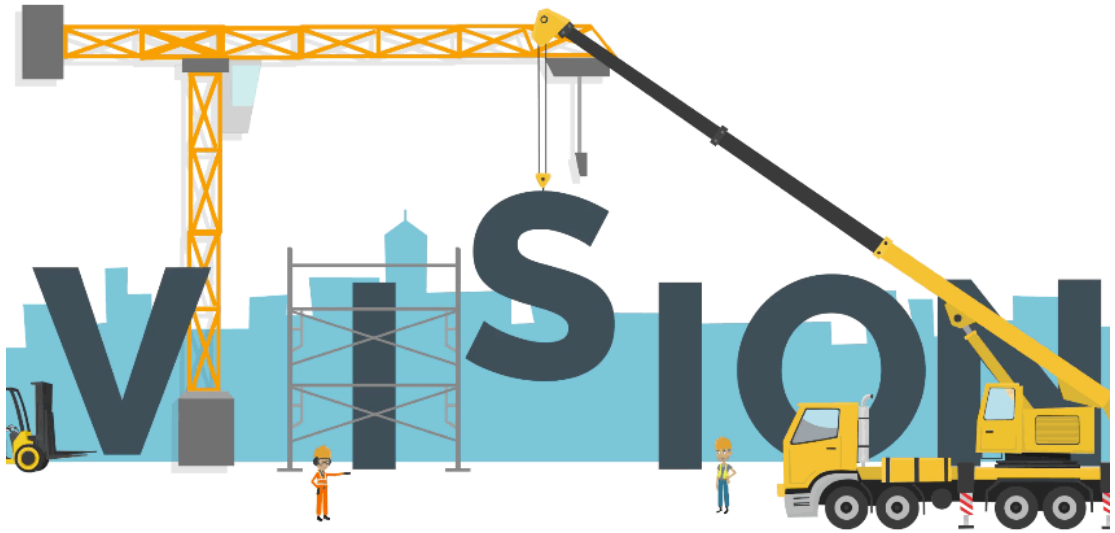
The current imbalance tariff aims at **reducing the local system imbalance** at all times

In the future, the imbalance tariff should aim at **balancing the grid in the most efficient way while guaranteeing operational security** at all times. The imbalance tariff should therefore be the result of an optimization taking into account the local market sensitivity curve to a real-time price signal, the price of the flexibility available abroad, as well as the grid constraints on the borders and the amount of reserves locally available*.

* The Imbalance price could f.i. incentivize BRPs to aggravate the local system imbalance (up to a given limit) when there are a lot of ATCs on the borders and this local system imbalance is entirely netted (and hence sold/bought at a very advantageous price)

Overview of ongoing initiatives and status

Building a vision and a roadmap for the imbalance price evolutions

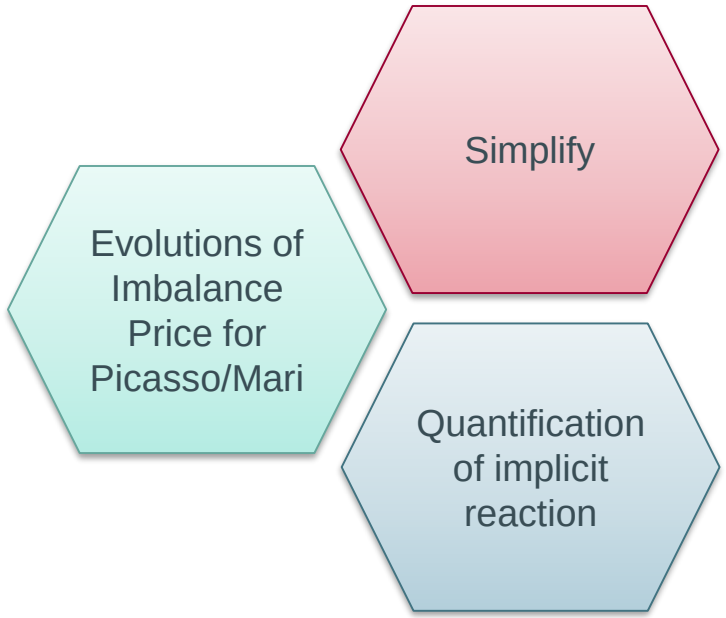


- Elia has started collecting feedback from market parties regarding their needs, constraints and issues when calibrating their implicit reaction based on (a.o.) imbalance tariff. All additional feedback would be welcome (please contact amandine.leroux@elia.be and caroline.bosschaerts@elia.be)

- Elia collaborates with several external market experts to inform the debate and challenge the conclusions.

While initiating some “no regret” actions

A few initiatives that might constitute some of the building blocks of the future roadmap were already started because they are needed anyway in the context of other evolutions (“no regret” actions):



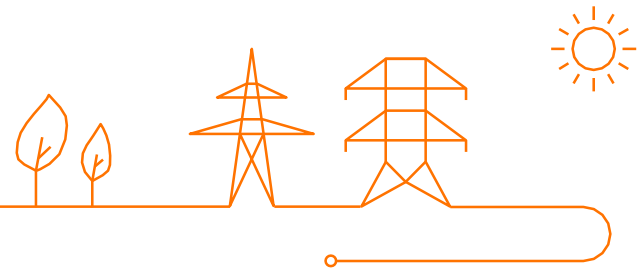
- Simplify
  - Project aiming at **forecasting the Belgian System Imbalance**
  - Is anyway considered as a prerequisite to support the decision-making process for the activation of mFRR balancing energy after the connection to MARI
  - See details in the next presentation
- Quantification of implicit reaction
  - Project aiming at understanding and **quantifying the existing implicit reaction** in Belgium
  - Is needed anyway to objectivize discussions and decisions regarding the reactive balancing model in Belgium
  - The results of this initiative will be presented in 2023
- Evolutions of imbalance price for Picasso/Mari
  - Some of the evolutions of the imbalance price proposed in the context of the **connection to the EU balancing platforms** have a beneficial **“smoothing effect”** on the Imbalance Tariff (e.g. taking all the Optimization Cycles into account, Dead Band)
  - These evolutions are needed for Picasso/Mari anyway and are also desirable when encouraging flexibility to help the system in real-time (a smooth” construction of the Imbalance Tariff increases predictability and hence reduces risks).

Zoom on Simplify

Simplify: forecast of the system Imbalance

Agenda

1. **Recall the 2021 study** on SI forecasts
2. Provide an overview of the **realized performance improvements** following the 2021 study
3. Provide an overview of the **realized model improvements** following the 2021 study
4. Provide **practical information** on the launch of the publication of the SI forecasts **and outlook**



2021 Elia study on SI forecasts

Objectives related to the development of system imbalance forecasts

Short term (2022-2023)

Focus today

1. Publish SI forecasts in order to support portfolio/system balancing
   - Facilitate efficient implicit reaction
   - Increase transparency on drivers of system imbalances

2. Support the decision-making process for the activation of mFRR balancing energy
   - With MARI, it becomes increasingly challenging to determine the volume of mFRR to activate

Long term

3. No-regret action in the context of the roadmap for the evolution of the imbalance tariff

Recall: 2021 Study* on system imbalance forecasts - Scope

- Different machine-learning models to **forecast the average quarter-hourly system imbalance** in the ongoing quarter hour and the two next quarter hours have been developed and tested

- A preferred model has been selected (based on performance, interpretability of results and reproducibility)
- The selected model has been tested in a // run (testing phase) for different system conditions
- The relevance of publishing the SI forecasts has been evaluated

* The 2021 study can be found on the Elia website.

Recall: 2021 Study on system imbalance forecasts – Main conclusions

- The **linear regression model has been selected** considering that this model achieved the best performance, was robust and enabled the highest transparency and interpretability

- The performance of the SI forecasts decreases strongly with an increasing forecast horizon and the **performance of the Qh1 and Qh2 forecasts was not considered sufficient yet** to merit an implicit reaction or to take operational decisions
  - RMSE Qh0 forecast ~30 MW
  - RMSE Qh1 forecast ~124 MW
  - RMSE Qh2 forecast ~140 MW
  - No indication of confidence levels

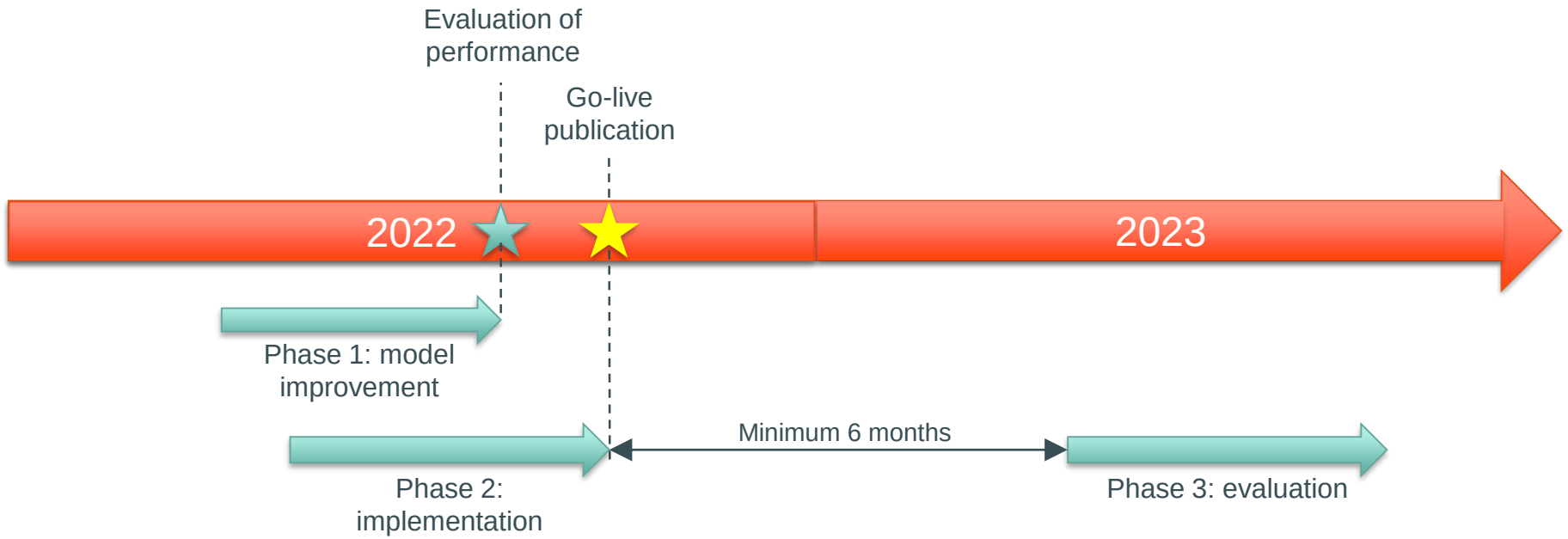
- The proof-of-concept of using the models in an operational environment revealed the **need to develop a robust tool and data flows** in order to avoid erroneous forecasts or absence of forecasts

Recall: 2021 Study on system imbalance forecasts - feedback

- **Stakeholders indicated the publication of the SI forecasts could bring benefits** by attracting additional flexibility at the right moments and by creating additional transparency
    - Certain stakeholders indicated that the publication of the SI forecasts was considered **mainly relevant if sufficient accuracy can be obtained** for BRPs to act upon without taking excessive risks (particularly relevant for the Qh1 and Qh2 forecasts)
    - Stakeholders **did not express a preference for withholding the publication in case certain thresholds are not obtained** (at least if sufficient information is provided on the confidence level)
- The **choice of the linear regression model was** generally **supported** for the point forecasts
- Stakeholders expressed a **preference for publishing a categorical forecasts** (confidence intervals) in addition to the point forecasts (exact forecasted value)

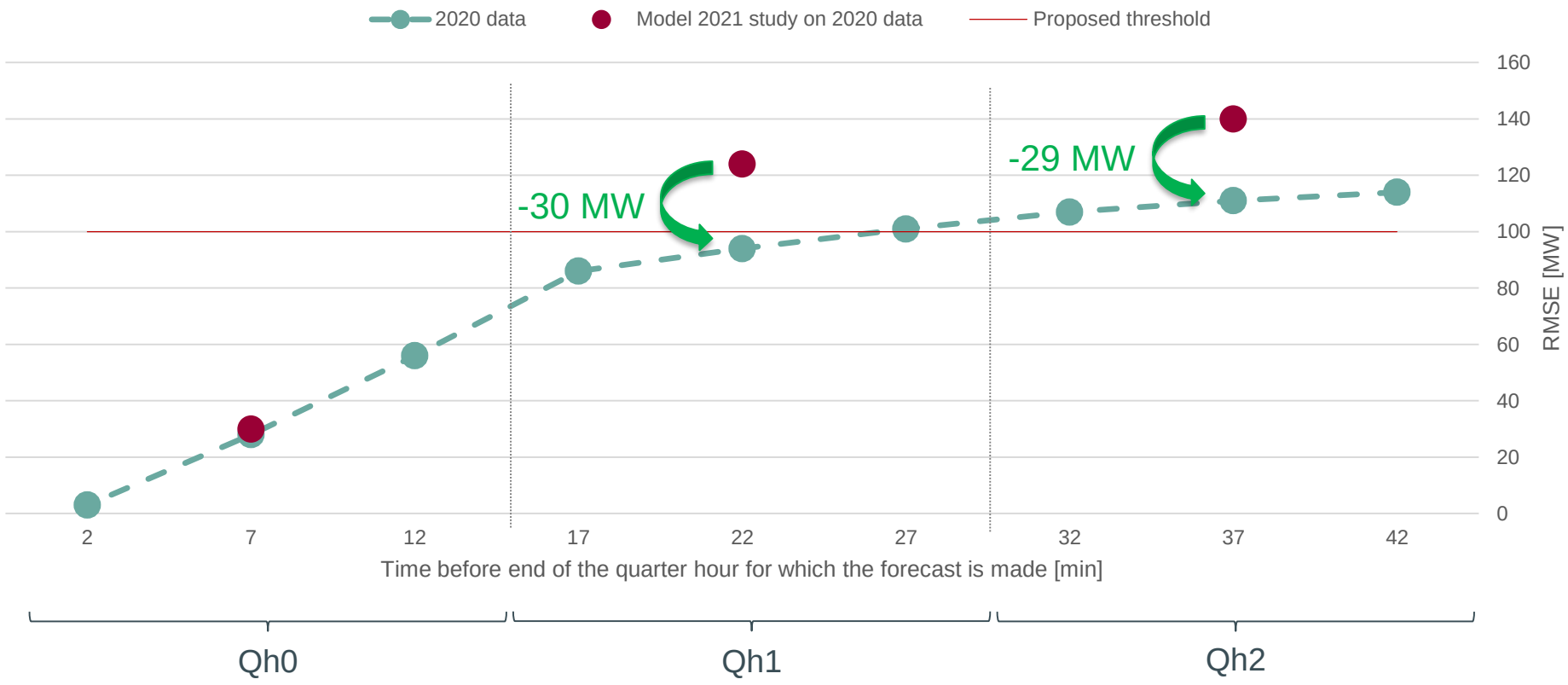
Recall: 2021 Study on system imbalance forecasts – implementation plan

- Elia proposed to industrialize the tool and **launch the publication of the SI forecasts** on the EliaOpenData platform **following additional work to improve the performance**
- For starting the publications, a **performance threshold** was proposed (RMSE < +/- 100 MW)
- Elia proposed to develop and publish the **categorical predictions in addition to the point forecasts**
  - Note: the categorical predictions are estimations of the probability that the SI will lie in a certain pre-defined interval. The categorical predictions would be made from a separate model that is independent from the linear regression model used for making the point forecasts.
- All forecasts would be **updated every minute** based on the latest available information

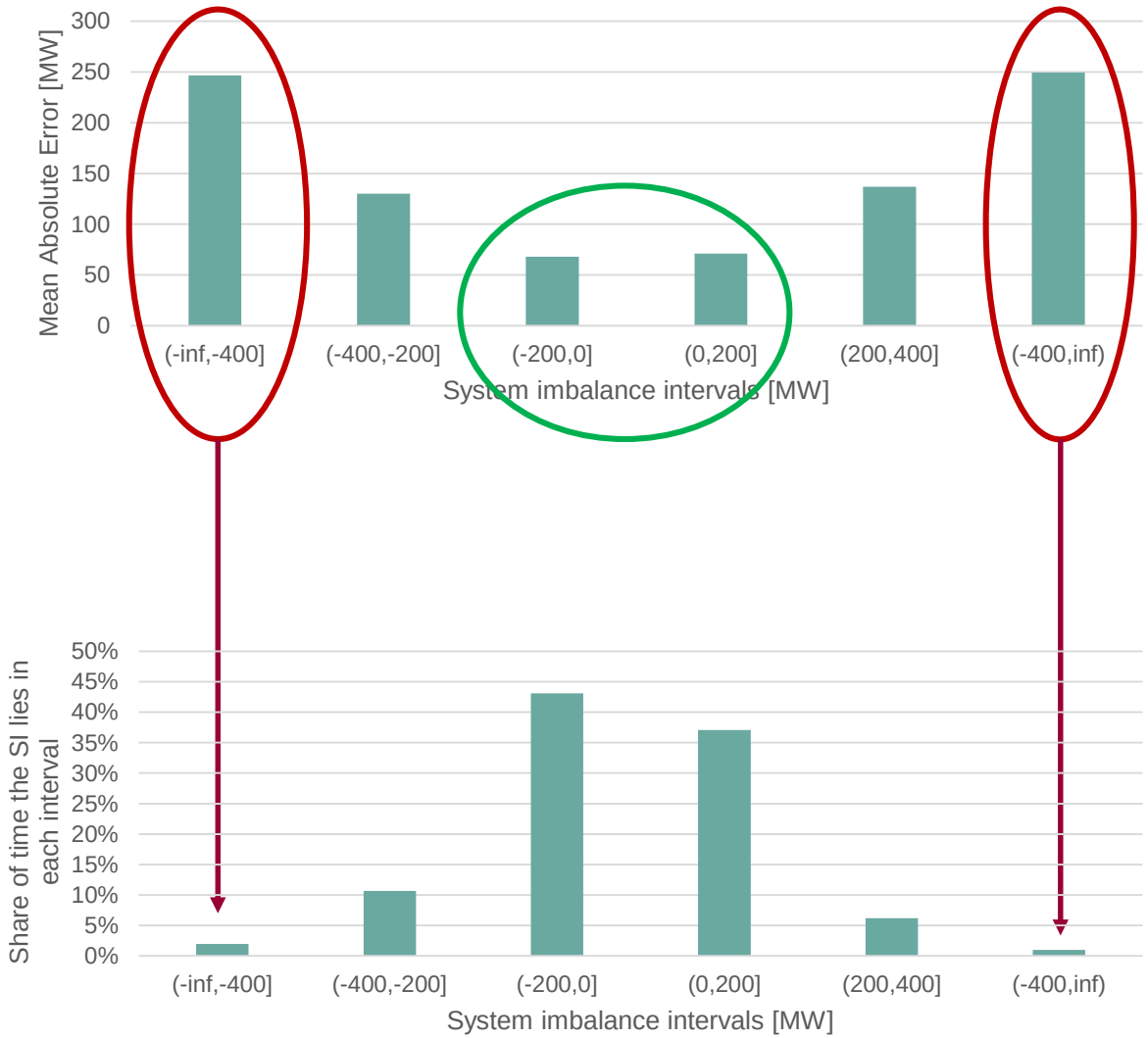


Realized performance improvements

The accuracy of the point forecasts has been significantly improved



Important point: the accuracy remains to vary strongly with the magnitude of the SI …

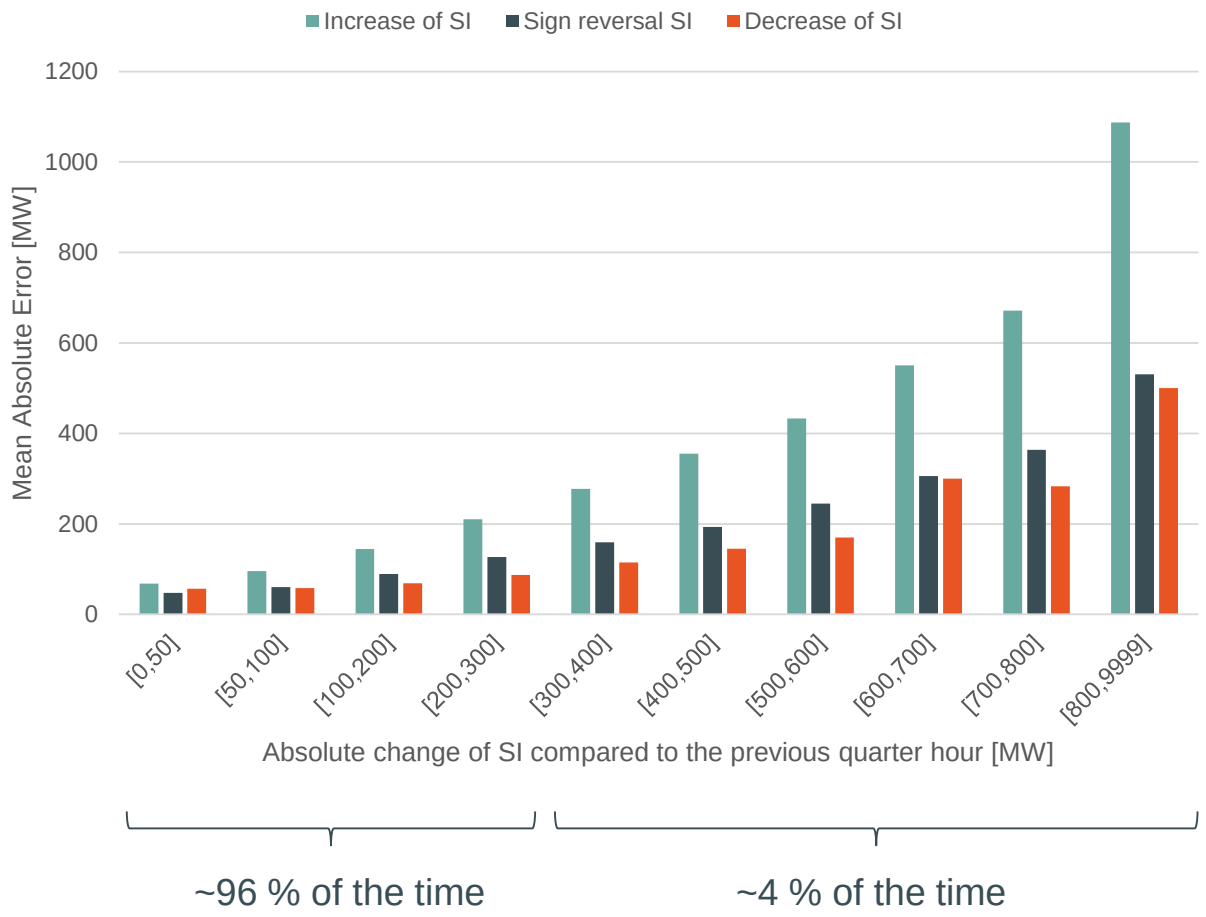


Forecasts are less accurate in moments of high/low SI

Such high forecast errors have a relatively limited impact on the RMSE due to their limited frequency of occurrence

* Results shown on this slide correspond to the point forecasts made 27 minutes before the end of the quarter hour for which the forecast is made (i.e., at minute 3 of Qh-1)

… and the volatility of the SI

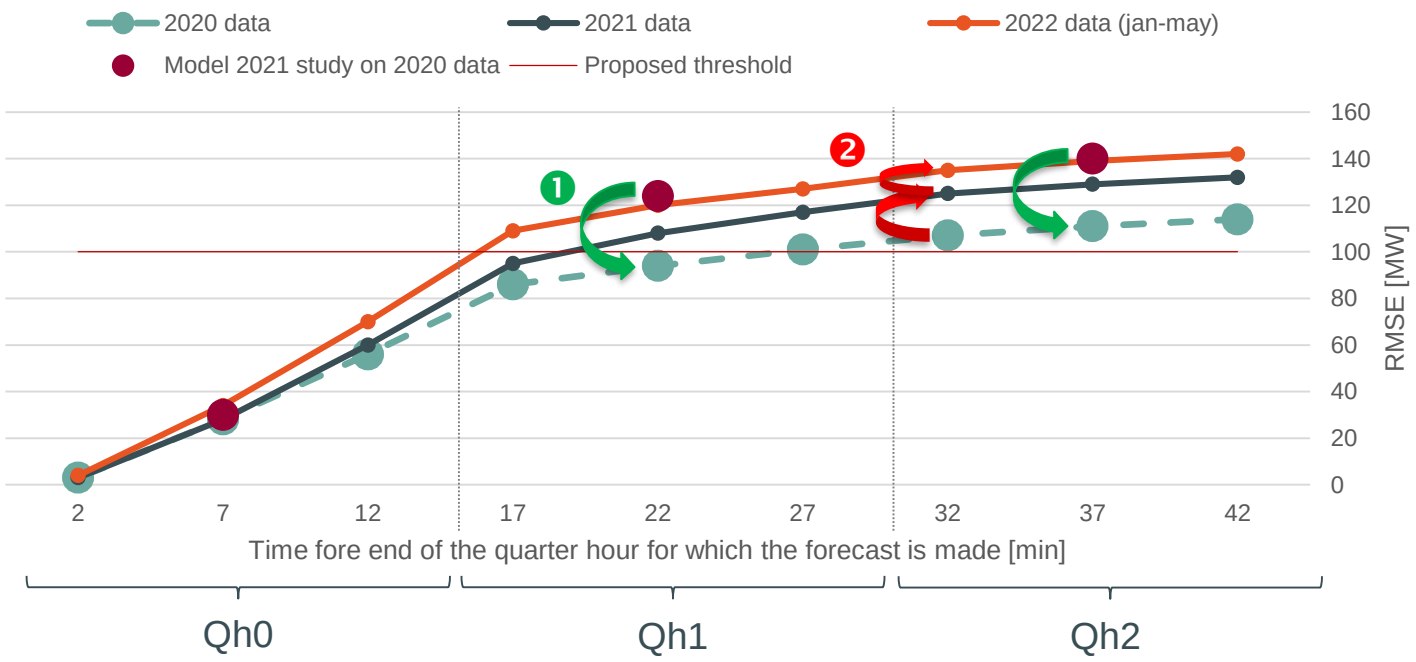


1. Forecasts are less accurate in moments of high changes in the SI

2. Decreases of the absolute SI are forecasted significantly better than increases of the SI

* Results shown on this slide correspond to the point forecasts made 27 minutes before the end of the quarter hour for which the forecast is made (i.e., at minute 3 of Qh-1)

Recent increasing periods of high |SI| and increasing SI volatility resulted in a reduction of the average forecasting accuracy



❶ Accuracy increase following model improvements

❷ Reduction of the average accuracy due to more difficult system conditions

- ~25% lower frequency of |SI| < 100 MW in 2022 compared to 2020
- ~50% higher frequency of |SI| in the range [300-400] in 2022 compared to 2020
- ~300% higher frequency of |SI| > 600 MW

- Note: the forecasting accuracy for a given SI interval is stable over the different data sets (years)

NEW

The developed categorical model provides complementary information regarding the confidence of the forecasts

- The categorical model is a second and independent model that is used in addition to the model developed for making the point forecasts
- The categorical forecasts are made by a classifier type of machine-learning model that estimates the probability that the SI lies in a given predefined interval
  - The SI intervals are selected as (-inf, -400], (-400,-200], (-200,0], (0,200], (200,400], (400, inf)

Illustration 1

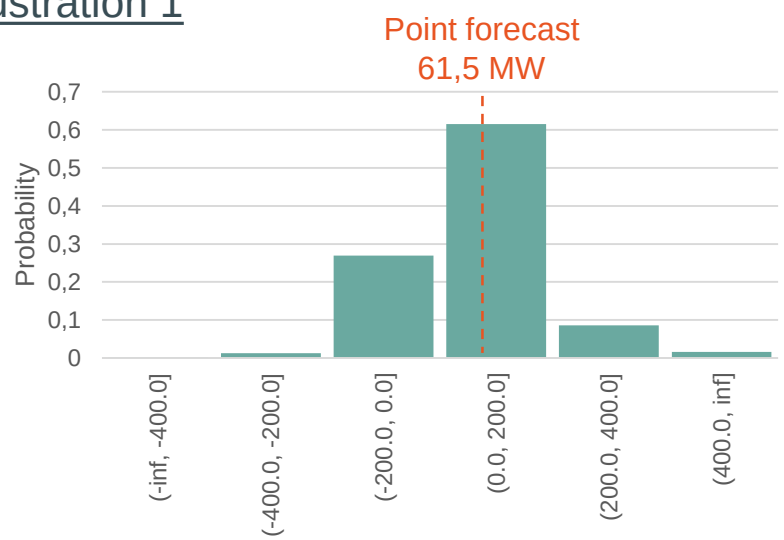
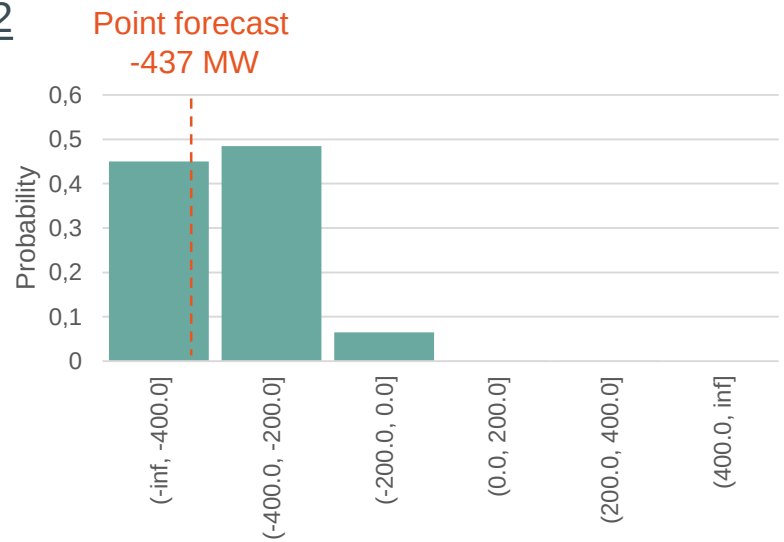
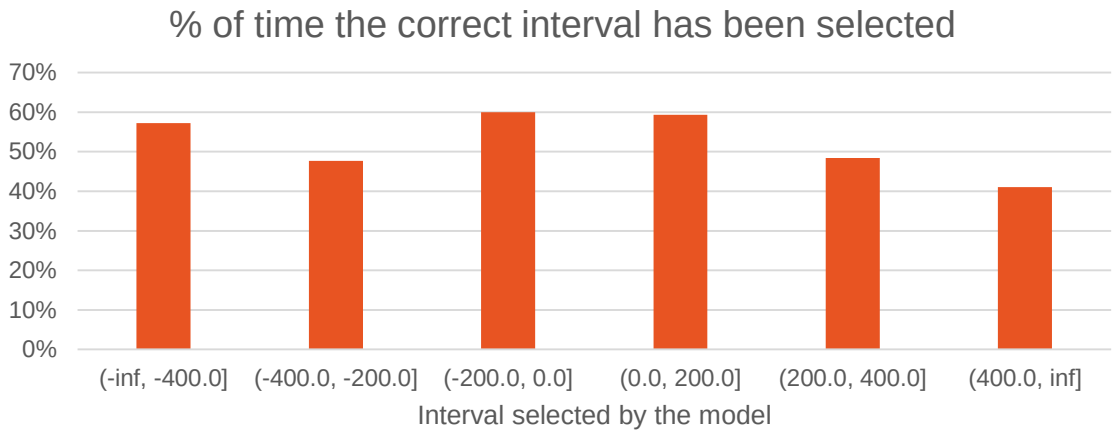


Illustration 2

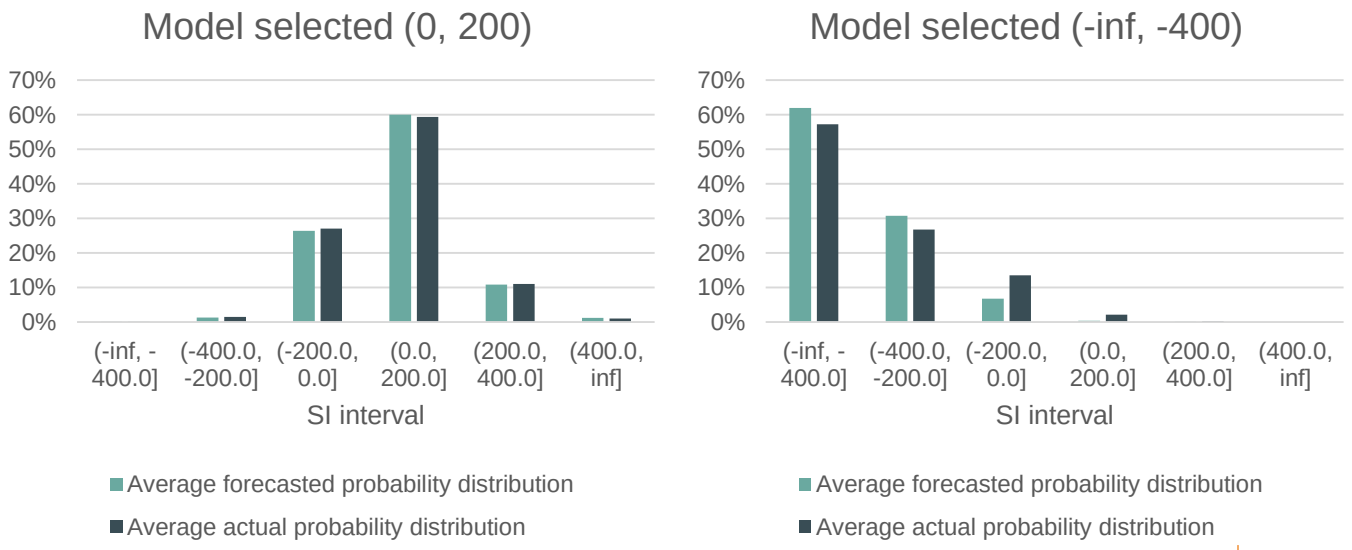


The categorical model achieves a good performance*

1. 50-60% of the time, the SI is located in the interval “selected” by the model (i.e., the interval with the highest probability)
   - The performance is relatively stable over the different SI intervals



2. The probabilities provided by the model correspond well to actual observations
   - Note: the probabilities reflect estimations and should not be considered firm (e.g., probabilities close to or equal to 0)
   - In moments of relatively high SI, it is observed that the model tends to provide slightly too narrow probability distributions



* Results shown on this slide correspond to the categorical forecasts made 27 minutes before the end of the quarter hour for which the forecast is made (i.e., at minute 3 of Qh-1)

Model improvements

Main model improvements – input data (predictors)

- Addition of forward-looking data:
  - New: Last available ID total load forecast for ongoing and upcoming quarter hours
  - New: Net export/import position of the Belgian zone (for past and upcoming quarter hours)
  - New: Aggregated Offtake Nominations (for past and upcoming quarter hours)
- New: Inclusion of most recent available SI and NRV minute values
- New: Removal of predictors used during the 2021 study that did not yield significant performance gains* in order to increase transparency and robustness

Input data used in the new version of the model

Data	Period
SI	4 past Qhs + 4 last available cumulative minute values
NRV	
Imbalance tariff	4 past Qhs
New: Net export/import position (in DA and in ID) based on aggregated XB Nominations	4 past Qhs and 4 future Qhs
Last available ID total load forecast	4 past Qhs and 4 future Qhs
New: Aggregated Offtake Nominations (TSO APs + DSO)	4 past Qhs and 4 future Qhs

* The variable selection is based on the performance of the model used for making the point forecasts. This might be re-evaluated in the future for the categorical forecasts.

Many other predictors have been tested but did not lead to improvements*

- Forecasts:
  - Wind and solar forecasts
- Measured values for past quarter hours:
  - Total load
  - Wind and solar generation
  - XB flows
- Transformed variables:
  - Gradients (rate of change between (quarter) hours)
  - Difference between quarter-hourly value and hourly average
- Disaggregation of used predictors:
  - Individual Offtake Nominations and measurements (for large industries)
  - XB Nominations for individual borders
- Available non-reserved volumes of incremental and decremental mFRR bids (split between hydro and non-hydro)
- SI in neighboring countries

* The variable selection is based on the performance of the model used for making the point forecasts. This might be re-evaluated in the future for the categorical forecasts.

Main model improvements – AI/ML methodology

Different AI/ML methodologies have been tested for both the point forecast and the categorical forecast:

- For the **point forecast**, the **linear regression model** remains achieving the best performance[1]
- For the **categorical forecasts**, a **logistic regression classifier model** achieves the best performance[2]

Note: following several discussions with internal and external AI/ML experts, there seems to be a general consensus that additional performance improvements are more likely to come through improvements on the input data or the general model set-up part rather than through the use of more advanced/complex AI/ML methodologies

[1] Other methodologies tested for making point forecasts include: K-nearest-neighbors, stochastic gradient descent, ridge, lasso and elastic net regression, bagged linear regression and a combination of different models (stacked regression, bagged regression and ridge regression)
[2] Other technologies tested for marking categorical forecasts include: random forest classifier, K-nearest-neighbors classifier, ada boost classifier, bagged logistic regression classifier

Main model improvements – Model training

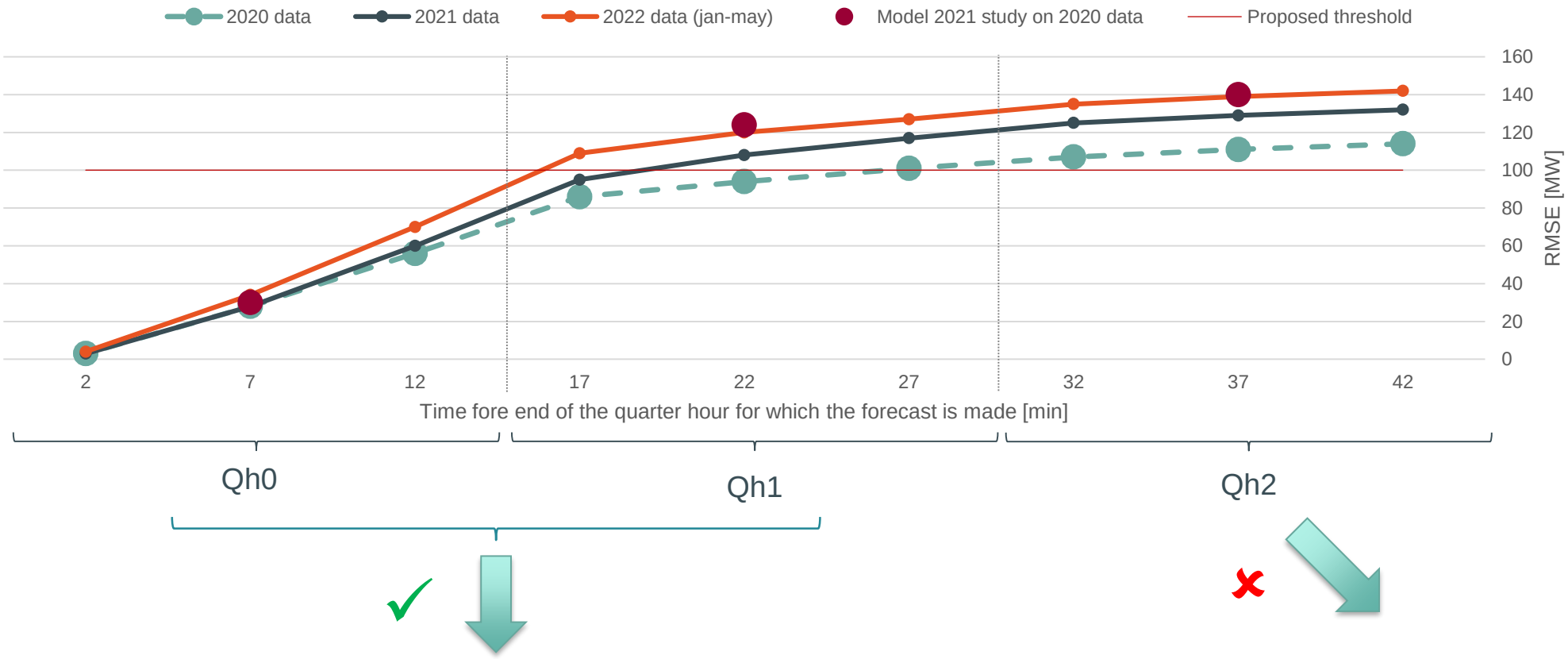
- Following the changes in the input data used, the optimal training period duration has been reevaluated

- Conclusions:
  - Extending the training period from 2 months to 6 months slightly improved the performance
  - Including M of Y-1 further provided a minor improvement
  - Increasing frequency of re-training to more than 1/month provides insignificant benefits

- ⇨ The model used will be retrained on a monthly basis
- ⇨ The training period for a model making the SI forecast predictions in a given month M corresponds to M-12 + M-7 to M-2
  - Example: the model used for making forecasts in November 2022 will be trained on data from [November 2021; April 2022-September 2022]

Practical information and outlook

Elia proposes to launch the publication of the Qh0 and Qh1 forecasts



Elia will start the publication of the SI forecasts for Qh0 and Qh1

Elia will not (immediately) proceed with the publication of the SI forecasts for Qh2

- Accuracy Qh1 forecast reached proposed threshold of +/- 100 MW RMSE
- Complementary information from the categorical model allows assessing the uncertainty/confidence on the forecast

Publication on EliaOpenData portal

- 2 new datasets will be published on EliaOpenData portal:
  - System imbalance forecasts for the current (ongoing) quarter hour
  - System imbalance forecasts for the next quarter hour
- Each publication consists of both the point forecast (in MW) and the categorical forecast (i.e., an estimation of the probability that the SI will lie in the different intervals)

Illustration Forecast next quarter hour

When forecast is made

Start of the Qh for which the forecast is made

Point forecast

Categorical forecasts

	Datetime	Quarter hour	Input Data Availa-bility	SI forecast	SI < -400 MW	SI in [-400 MW;-200 MW]	SI in [-200 MW;-0 MW]	SI in [0 MW;200 MW]	SI in [200 MW;400 MW]	SI > 400 MW
Updated forecast every minute	Sep 15 4:34PM	Sep 15 4:45 PM	1	273 MW	0	0	0,05	0,20	0,6	0,15
	Sep 15 4:33PM	Sep 15 4:45 PM	1	267 MW	0	0	0,06	0,21	0,59	0,14

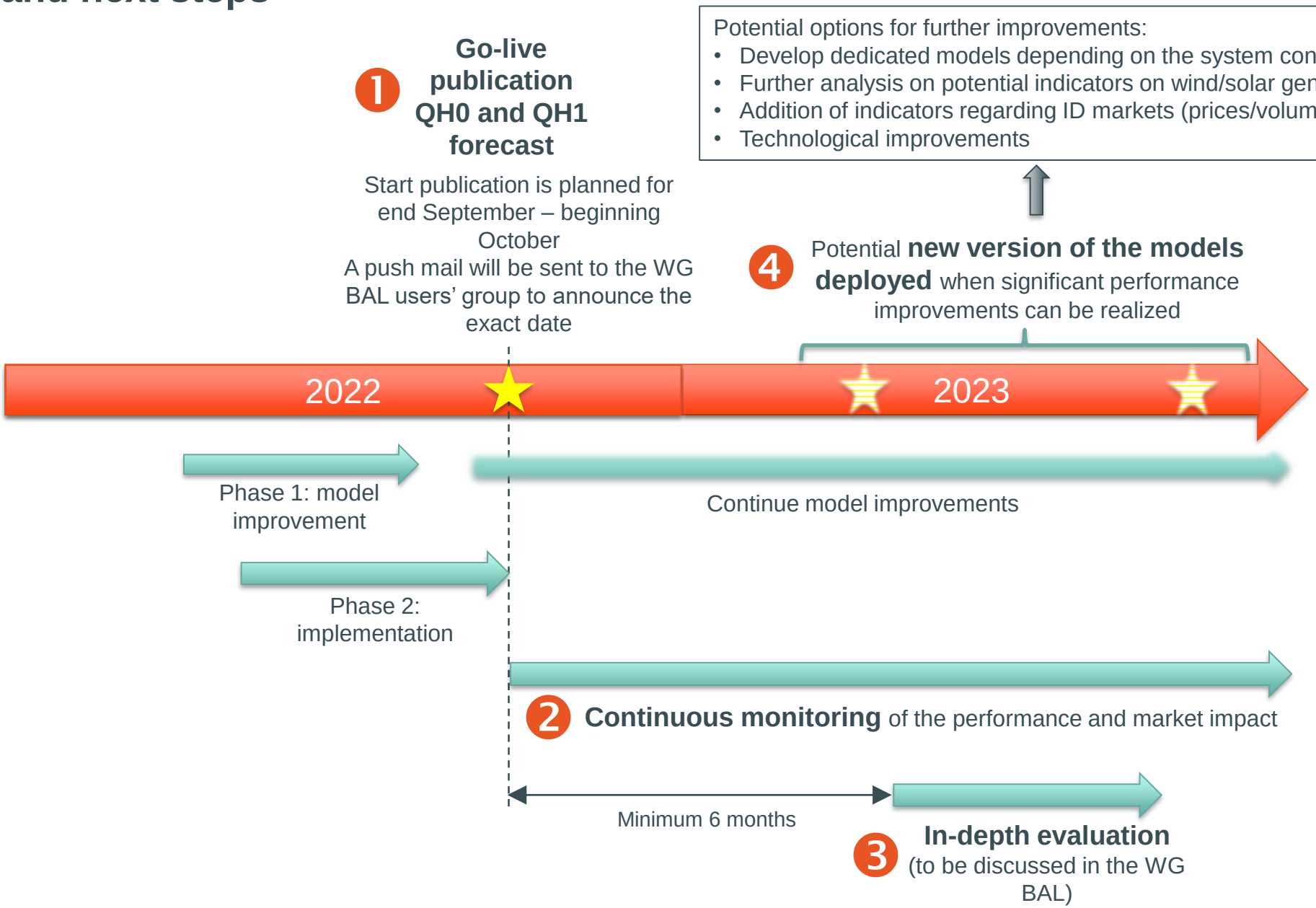
- Disclaimer: The published data is voluntarily shared for informational purposes and reflects forecasts that have a error margin.

Supplementary information will be provided on the Elia Grid Data page

- A new webpage will be developed on Elia Grid Data > Balancing

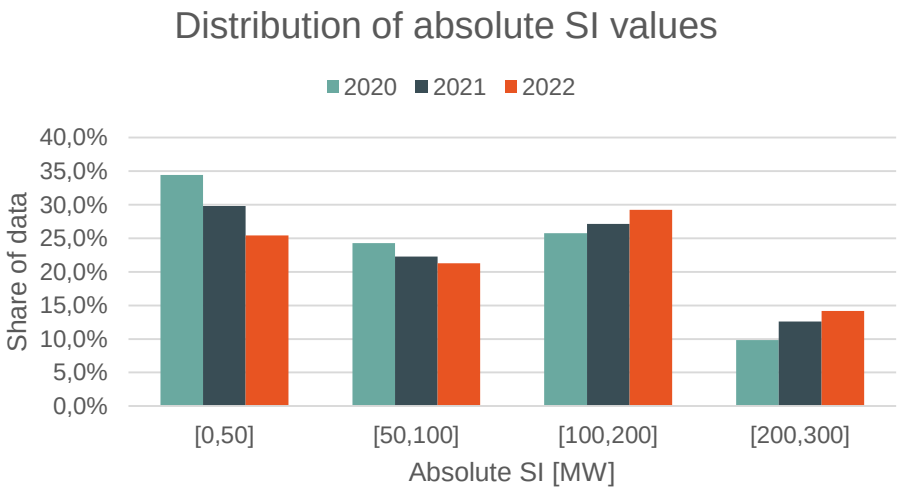
- This webpage will provide additional information:
  - A description of the publications and links to the corresponding EliaOpenData platform pages
  - Documentation of the methodologies and data used for making the SI forecasts
  - Contact in case of questions regarding the published data
  - Information regarding the performance of the models deployed in operation (when the information is available)

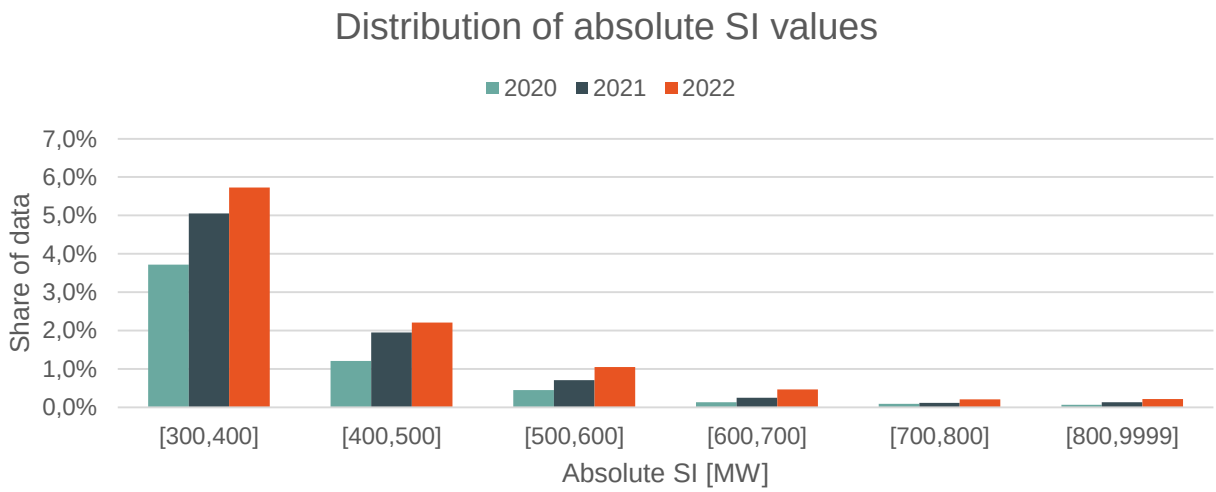
Outlook and next steps



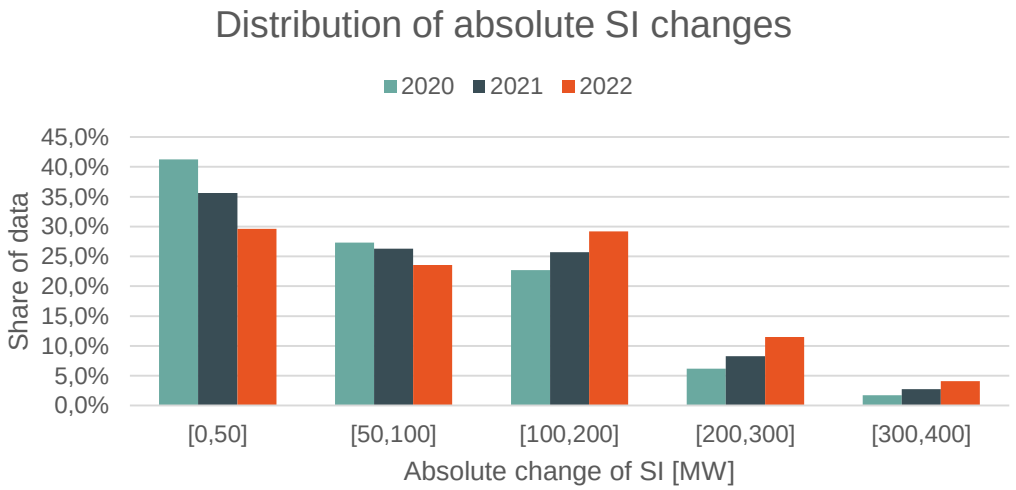
Thank you.

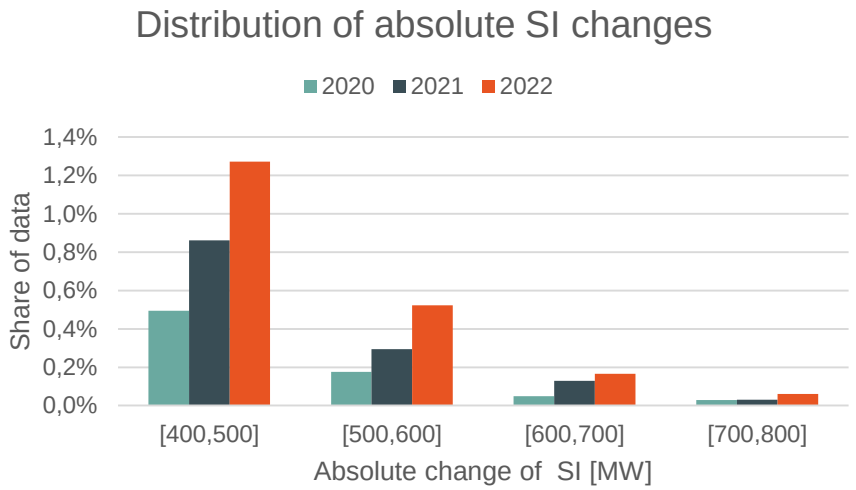
Increasing periods with relatively high SI



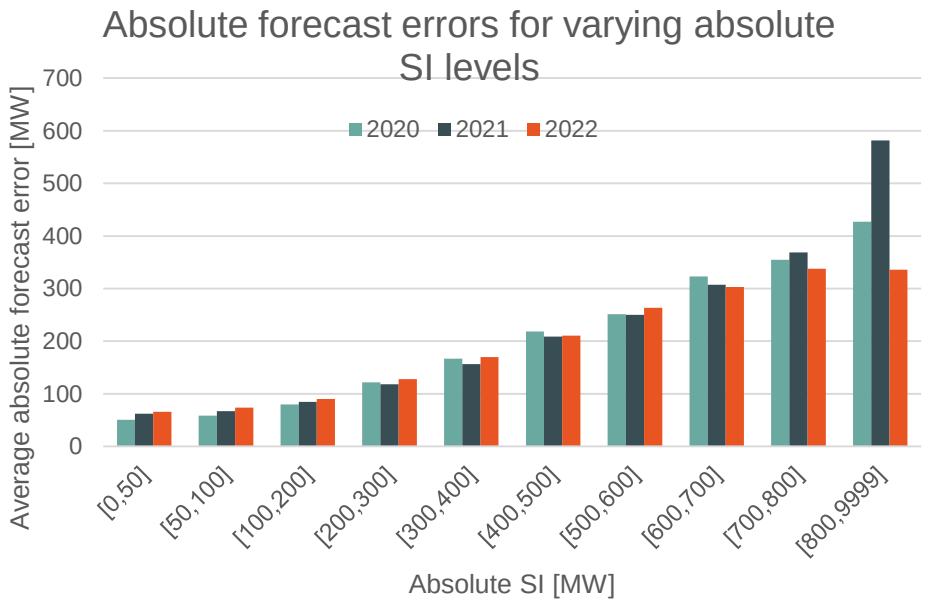


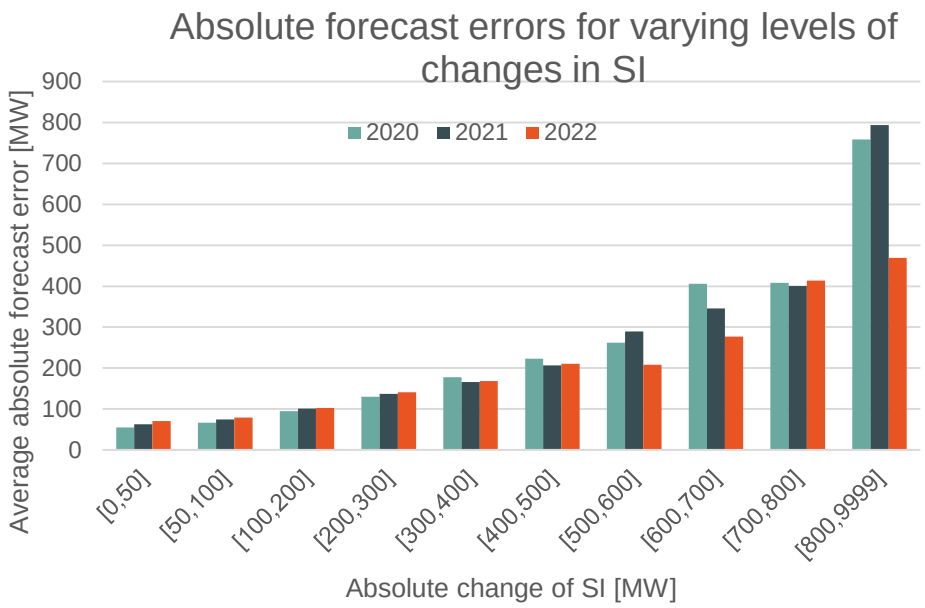
Increasing volatility of the SI



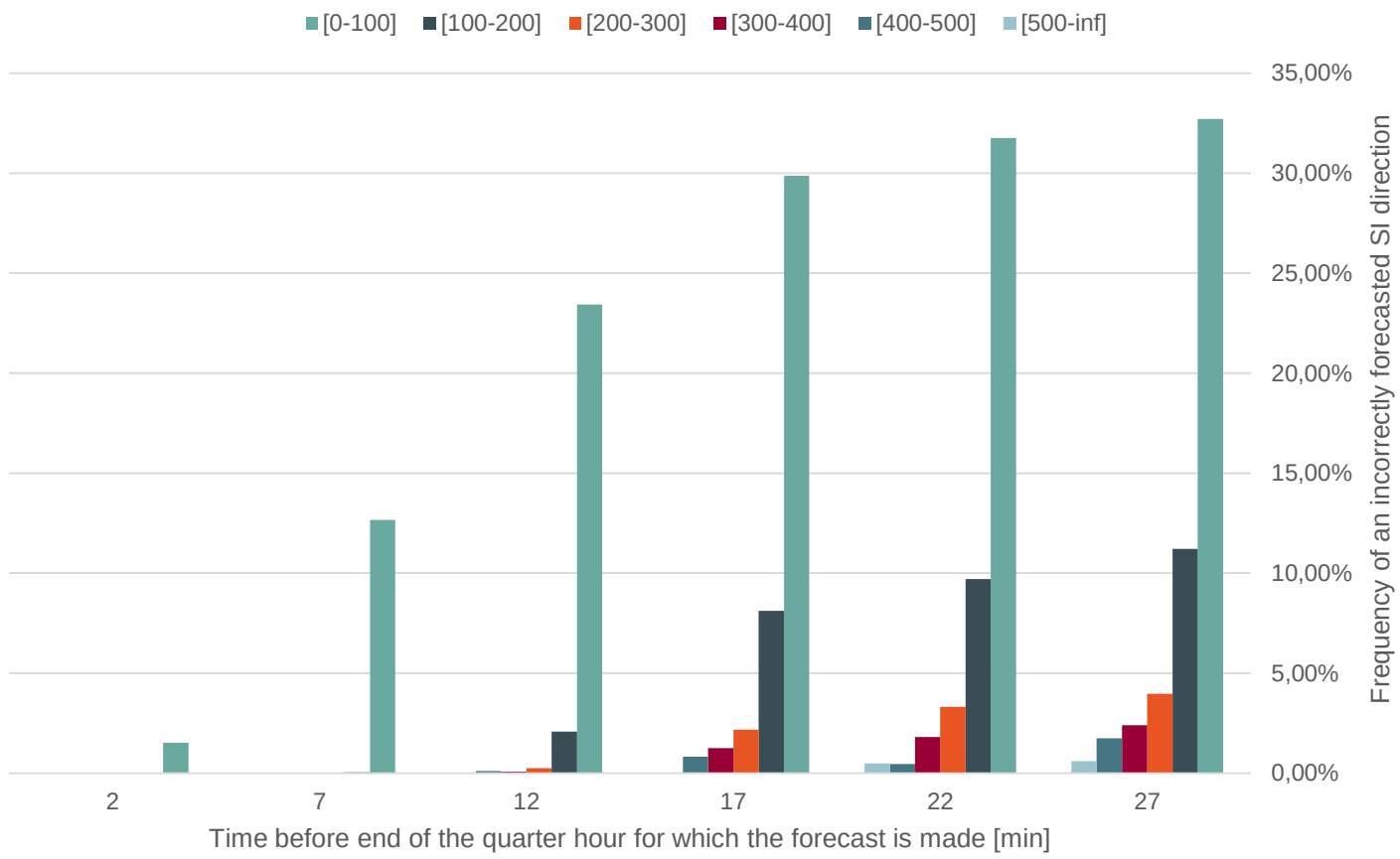


The forecasting accuracy for the improved model is stable for the different SI intervals



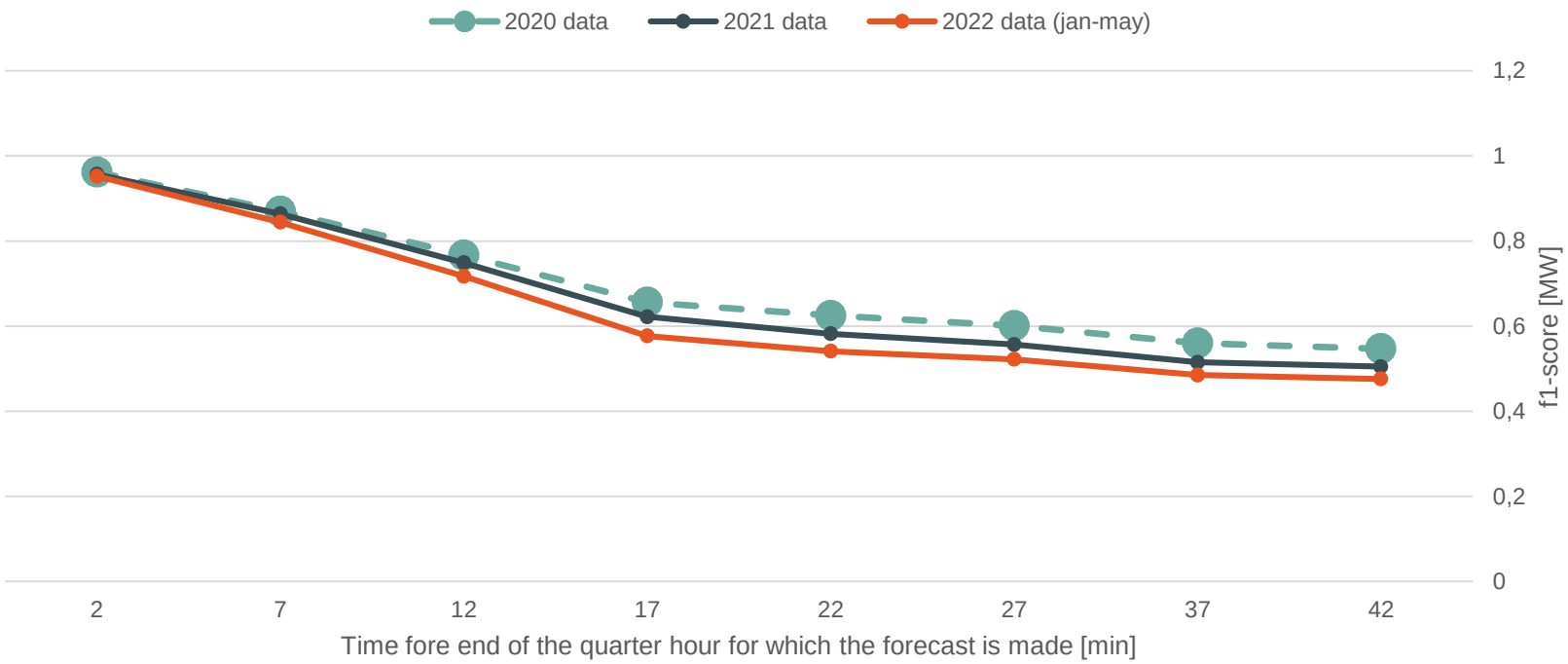


Frequency of incorrectly forecasted SI direction as a function of the size of the forecasted SI



Performance of the categorical model

- Categorical or classifier models are typically evaluated using the so-called f1-score



The categorical model provides significant added value by narrowing down the probability distribution in any given moment in time

During moments the SI ended up in this interval, the ML model provides a probability that is 11,5 times higher than the overall probability that the SI lies in this interval