iCAROS implementation project – phase 1

iCAROS = Integrated Coordination of Assets for Redispatching and Operational Security

February 2021

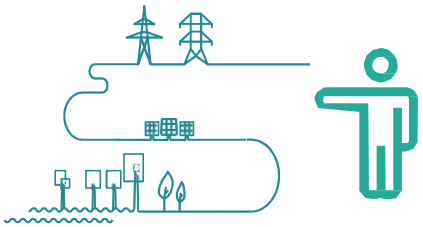
Content

Context : phased implementation
Focus on phase 1

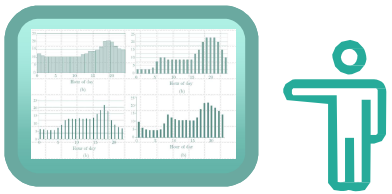
iCAROS = Integrated Coordination of Assets for Redispatching and Operational Security

Business Scope of iCAROS phase 1

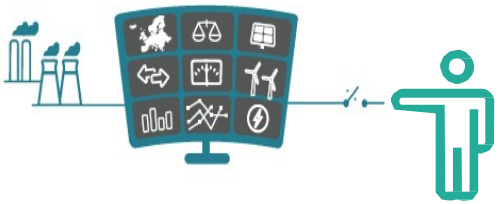
Exchange of operational data [from LT to realtime]



1
Outage Planning DA & ID



2
DA & ID scheduling



3
Congestion management

iCAROS : Phase 1 of the implementation

	From …	Phase 1 – Q2 2022
Relevant Assets	Only mandatory for large classic power generators [≥25MW]	Only mandatory for large SYNCHRONOUS POWER GENERATING MODULE (SPGM); POWER PARK MODULES per primary energy source (PPM) or ENERGY STORAGE DEVICE (ESD) [≥25MW]
Data Exchange	Non-standardized and obsolete data exchange	• NEW Outage Planning DA & ID • NEW : Scheduling • NEW : Redispatch (RD) energy bidding – explicit & aligned with bid properties mFRR
Tools & Technologies	Partially supported by obsolete tools & technologies [~15 years]	• New tool for DA & ID Outage Planning • New scheduling tool • New RD bidding module – explicit
Roles & Contracts	ROLES : • BRP = OPA = SA CONTRACT : • regulated T&C OPA & T&C SA & Coordination Rules	ROLES : BRP = OPA = SA CONTRACT : • regulated T&C OPA & T&C SA & Coordination Rules

Summary of design fine-tunings

Type	Name	Description
General /terminology	Alignment of terminology	TF, TU, OM etc
Scheduling	Exception of freedom of dispatch for offshore parks in case of storm events	For coordination of cut-in phase of offshore parks after a storm event, the schedule for cut-in needs to be validated by Elia
Scheduling	Schedule update after activation of a RD/mFRR bid	• After the activation of a RD/balancing bid by Elia, the schedule is only updated internally by Elia without communicating the updated schedule to the SA • The SA only sends his baseline to Elia i.e. the part of the schedule that the SA can freely adapt
Scheduling-Outage planning-Redispatching	Alignment of processes with new terminology	Rules for scheduling, outage planning and bidding in line with new terminology
Scheduling	Scheduling deadline	New and simplified definition of the scheduling deadline
Scheduling / Settlement	Schedule control	• Schedule control only in case of return to schedule command • No margin in case of deviation in the direction of the congestion risk • Exemption for non coordinable units
Redispatching / Activation	RD bid profile	Alignment of the RD bid profile with mFRR bid profile
Redispatching / Activation	Activation annulments	Specific rules for the timing and remuneration of the annulment of a RD bid
Redispatching / Activation	Direct activation of RD bid	Introduction of direct activation of a RD bid
Redispatching / Bidding	Bids properties	RD bids properties to be defined in the manual for energy bidding
Redispatching / Settlement	Activation control/Remuneration/BRP perimeter correction	Alignment of RD bids activation control, remuneration and BRP perimeter correction with mFRR design
Redispatching / Settlement	Penalty for non compliant RD bid activation	Target volume is strict but penalty price is cost-related
Redispatching / Settlement	Control of cost reflective bid price	Bid prices will be controlled based on a cost formula agreed at the signature of the T&C SA
Redispatching	Use of Redispatching Energy Bids for other purposes	Specific design will be defined later
Crosschecks	Crosscheck of data provided by different actors	Some crosschecks between data provided by the different actors have been defined

iCAROS terminology

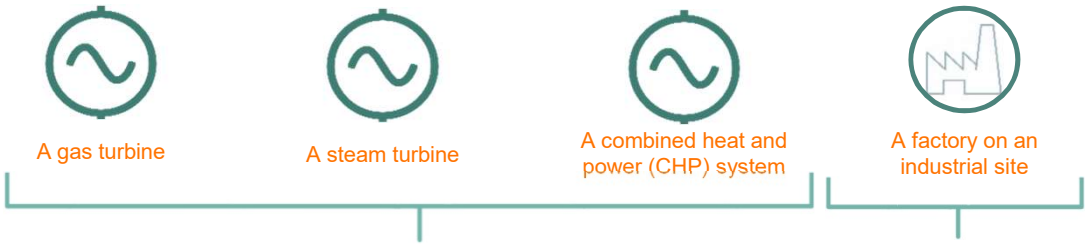
Technical Unit

Device or aggregation of devices connected directly or indirectly to the synchronous electrical network that produces and/or consumes electricity.

A Technical Unit can be :

- A Power Unit (PU)
- A Demand Unit (DU)

Examples :



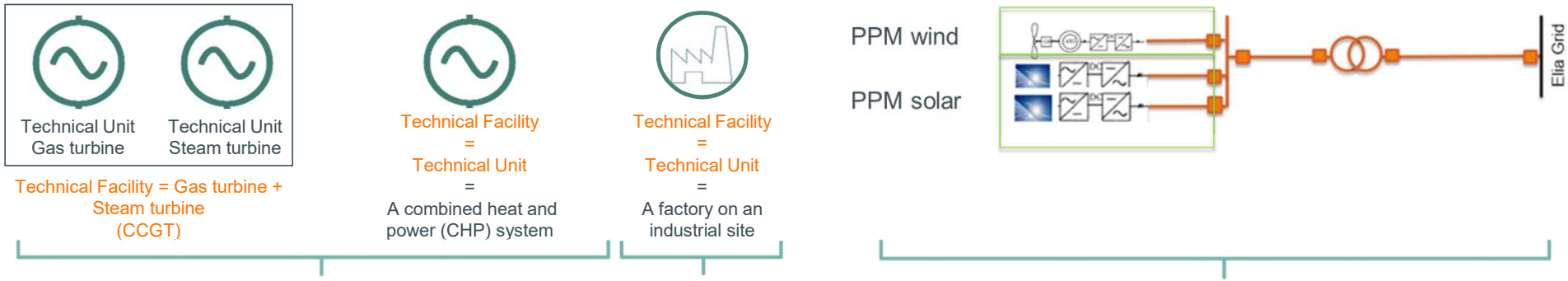
Technical Facility

Complete set of Technical Unit(s) which are operationally linked and which, combined together in one or several operating modes, can consume or generate electricity on its own.

A Technical Facility can be :

- Synchronous Power Generating Module (SPGM)
- Power Park Module (PPM) per primary energy source, i.e. the aggregation of all the components of the Power Park Module (as defined in NC RfG*) supplied from the same source of primary energy
- Demand Facility (DF)
- Energy Storage Device (ESD)

Examples :

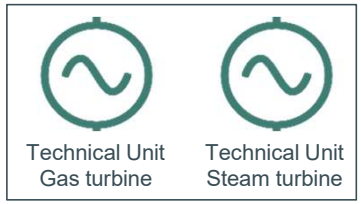


* Network code on Requirements for Generators : PPM = *a unit or ensemble of units generating electricity, which is either non-synchronously connected to the network or connected through power electronics, and that also* ***has a single connection point to*** *a transmission system, distribution system including closed distribution system or HVDC system*

Operating Mode

Any subset of Technical Units, being part of the same Technical Facility, that can generate or consume electricity on its own.

Examples :



Technical Facility = Gas turbine + Steam turbine (CCGT)

Operating modes:
- gas turbine working in open cycle
- gas turbine and steam turbine working in combined cycle
- …

Technical Facility = Technical Unit = A combined heat and power (CHP) system

➔ Only one operating mode

Outage Planning, Scheduling and Bidding obligations

- The Outage Planning, Scheduling and Bidding **obligations are** defined **on the level of Technical Facilities**.

  But beware that the definition of Technical Facility slightly defers from the definition of 'Asset' mentioned in the design note, since it refers to the notion of PPM per primary energy source and no longer to the general notion of PPM as defined in the RfG.

  E.g. A solar PPM with an installed capacity of more than 25MW should communicate DA and ID MW schedules to Elia

- The Outage Plans, Schedules and Redispatching Energy bids are exchanged at the following levels:

	Outage plan	Schedule	Redispatching Energy Bid
Delivery Point to which a Technical Unit is linked	Default	Default	
Operating Mode			Default

OUTAGE PLANNING AGENT: pragmatic approach for transition period Phase 1

SYNCHRONOUS POWER GENERATING MODULE (SPGM); POWER PARK MODULES per primary energy source (PPM) or ENERGY STORAGE DEVICE (ESD)

DEMAND FACILITIES

- ❖ **Availability status**
- ❖ **Temporary restrictions**

25 MW or more	1 – 25 MW	
Mandatory signature of OPA contract	• **Connected to Elia Grid directly or through CDS : default rules* or Voluntary** • **Connected to DSO Grid : Voluntary****	**Simplified information exchanges based on current practices – no operational change**

* Default rules = per default available & Pmax of connection contract as input

** SOGL Article 49

SCHEDULING AGENT: pragmatic approach for transition period
Phase 1

SYNCHRONOUS POWER GENERATING MODULE (SPGM); POWER PARK MODULES per primary energy source (PPM) or ENERGY STORAGE DEVICE (ESD)

DEMAND FACILITIES

- ❖ Active power schedules in day-ahead (DA) and intraday (ID)
- ❖ Explicit cost based Redispatching Energy bids in DA & ID market

25 MW or more

Mandatory signature of SA contract

1 – 25 MW

- **Connected to Elia Grid directly or through CDS : default rules* or Voluntary**
- **Connected to DSO Grid : Voluntary****

Exempted***

* Default rules = usage of Elia forecasts /profiles; no redispatch energy bids

** SOGL Article 49

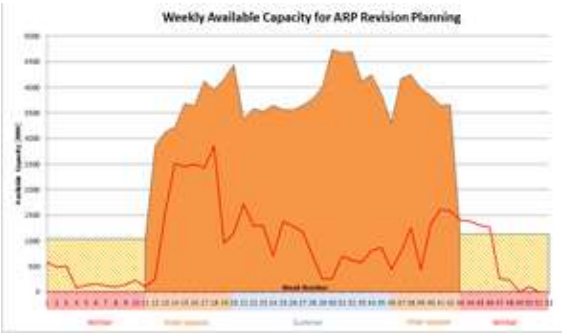
*** SOGL Article 52

Outage Planning DA & ID – phase 1

Purpose of outage planning

Adequacy check

The goal is to reduce the risks for scarcity throughout the year.



Local Congestion Check

The goal is to reduce the risk that insufficient flexibility would be available in case of congestions.

⇒ Avoid simultaneous unavailability of main PU in the same electrical zone

Maintenance planning check

Based on the outage planning Elia checks when specific works for maintenance on the Elia grid can be planned.

Risk assessment for unavailability of Ancillary Services

Avoid the simultaneous unavailability of a number of units delivering ancillary services (FCR, aFRR, mFRR, etc.)

Outage Planning Agent – phase 1

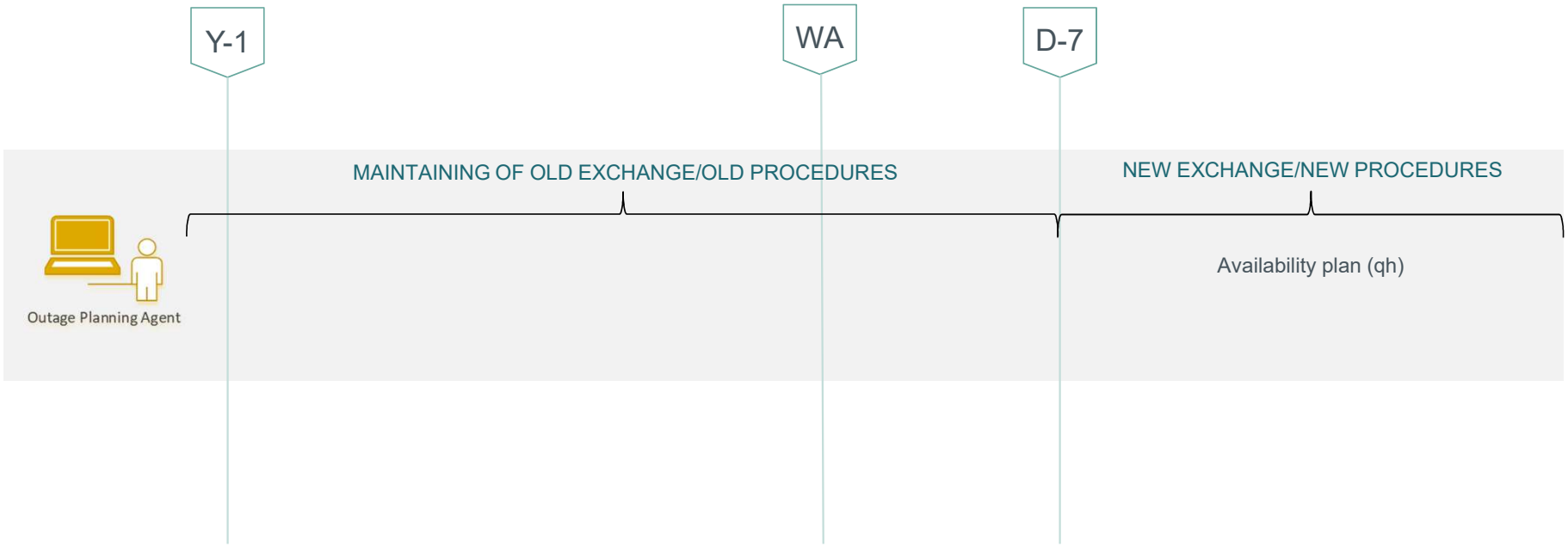
Who ?

- *In phase 1 the Outage Planning Agent = BRP*
- *Only Synchronous Power Generating Module (SPGM); Power Park Module (PPM) per primary energy source and Energy Storage Device (ESD) ≥ 25 MW*

What ?

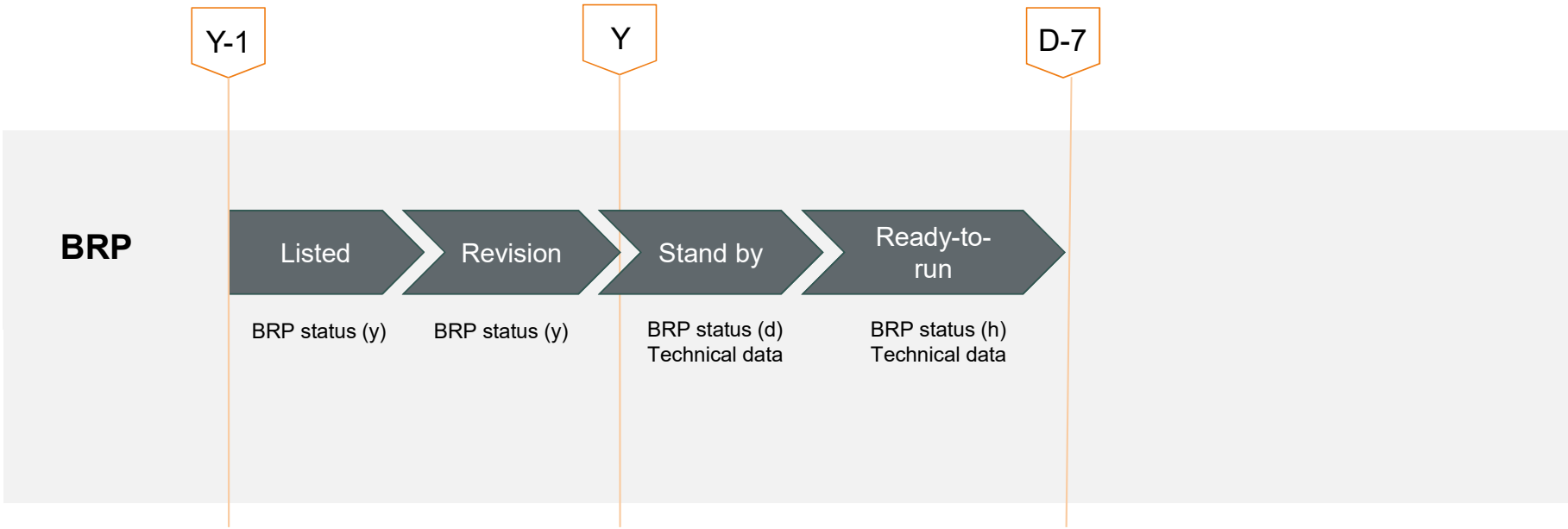
- *The **task of planning the availability status***
- *The **task of delivery active power capacity restrictions,** i.e., temporary deviations from the structural Pmax & Pmin*

Availability plans – phase 1



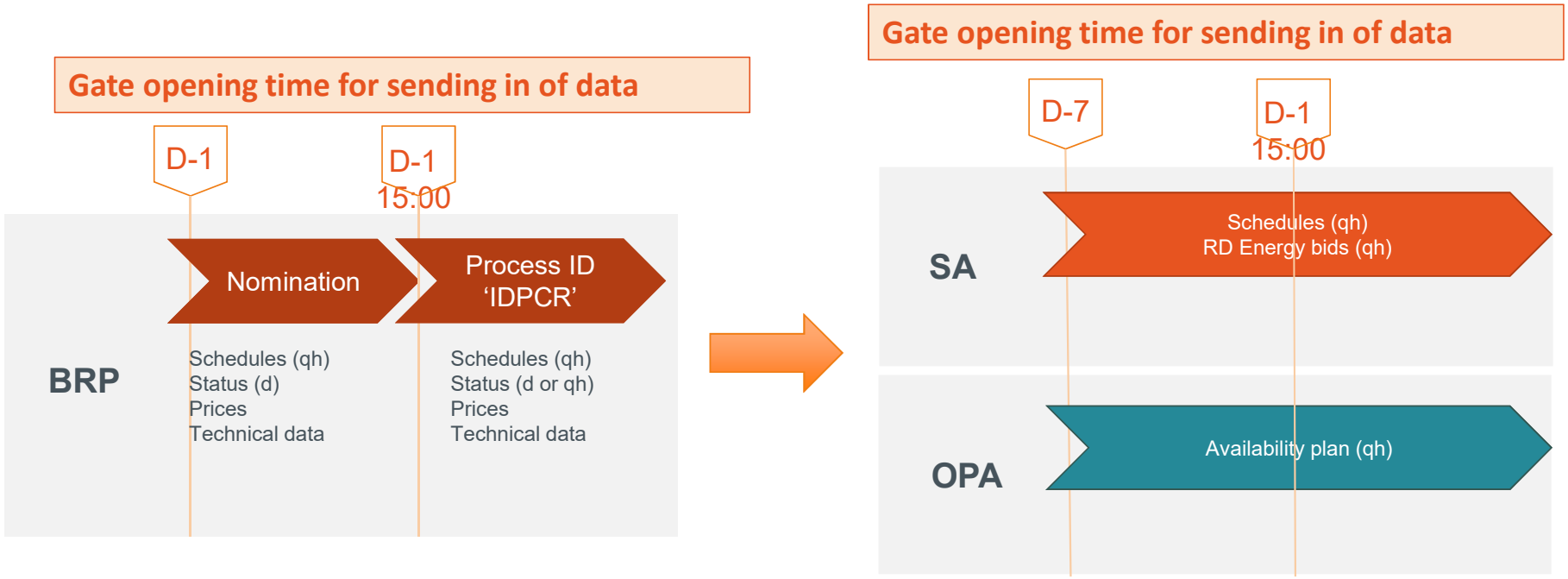
WA = weak ahead

Procedures/exchanges LT availability plans = maintaining OLD procedures/OLD exchanges



WA = weak ahead

Procedures/exchanges availability plans = NEW procedures/NEW exchanges



Outage Planning Agent D-1 & ID

Process

- Availability Status on quarter hour
- level of Availability Plan information exchange will be **on the Delivery Point to which a Technical Unit is linked**

Interaction

- Outage Planning Agent sends Availability Plan updates in D-1 & ID to Elia via dedicated interface
- Interface: OPA System to Elia System & simple User Interface for Availability Plan Updates

Delivery of availability plans D-1 & D

What ?

- Availability status
- Restrictions in the active power capability
- Additional information (depending on the status)

Granularity ?

- Quarter-hourly

Final design will be added as soon as available

Forced unavailability updates

Who ? All Outage Planning Agents

When ?

- In real-time, as soon as possible

A forced-outage always occurs in real-time, the OPA has the responsibility to inform ELIA as soon as possible and to indicate how long the effect will last.

This will be done through the data-platform.

What ?

- Inform Elia in case of forced unavailability (forced outage or forced restriction on the active power capability) on an asset
- Communicate the reason for the forced unavailability and the time to regain (fully) available

See also Scheduling Agent and Cross-checks

Scheduling DA & ID – phase 1

Purpose of schedules

Load flow calculations

Calculation of the loading on the elements of the Elia grid based on the schedules information. Application of preventive & curative remedial actions (non-costly and costly) to avoid congestion. Update the Congestion Risk Indicator of the zone.

Calculation of cross-border capacities

In coordination with other TSOs Elia updates the available capacity to the intraday market.
Schedules information is an input to the capacity calculation process in day-ahead.

Maintenance planning

Based on the received schedules and on the results of the load flow calculations, Elia confirms or cancels the conditional maintenances of elements on the Elia grid.

Unavailability risk of ancillary services

Elia analyses if the needed volume of ancillary services is reached at all time for the next day

Scheduling Agent – phase 1

Who ?

- *In phase 1 the Scheduling Agent = BRP*
- *Only Synchronous Power Generating Module (SPGM); Power Park Module (PPM) per primary energy source and Energy Storage Device (ESD) ≥ 25 MW*

What ?

- *The **task of providing schedules***
- *The **task of bidding for redispatching***

Scheduling

Process

- First schedule for D-1 15:00 and Intraday Schedule amendment
- Elia can send AD HOC request to return to schedule, in case a deviation of the Schedule might cause a significant grid security risk
- Level of schedule information exchange will be **on the Delivery Point to which a Technical Unit is linked**

Interaction

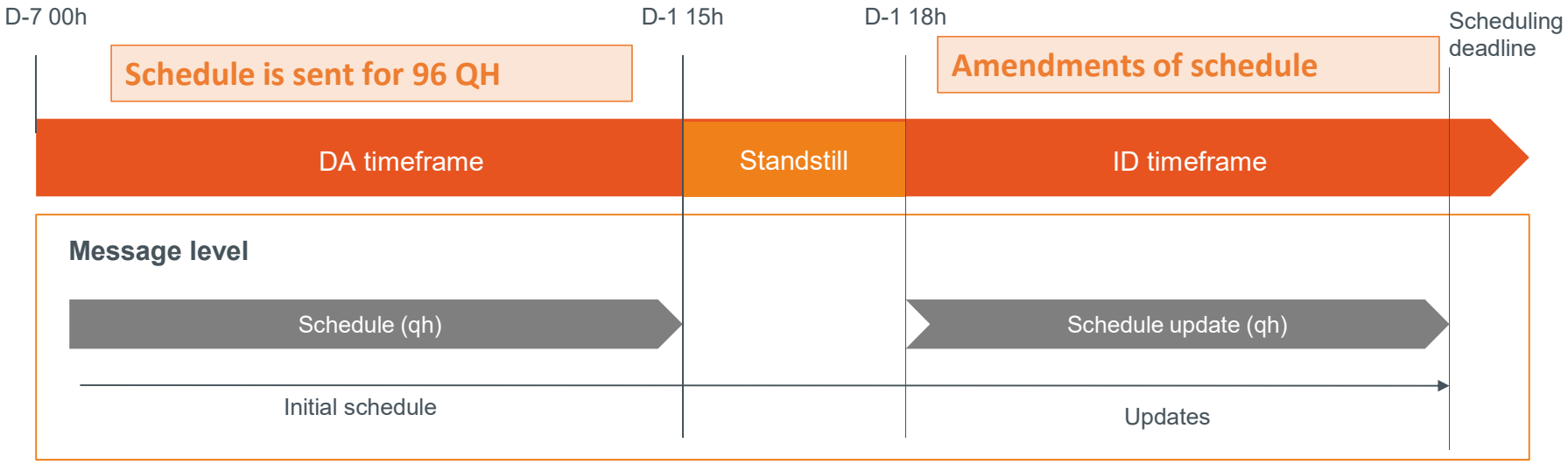
- Scheduling Agent sends Schedule/ Schedule amendment to Elia
- Interface: SA System to Elia System & simple User Interface for Schedules (as well as schedule updates)

Schedule update by SA

Schedule update by SA without RD/BAL activation

The SA sends his schedule to Elia i.e. the part of the schedule that the SA can freely adapt till scheduling deadline

- Before D-1 15h, at least one schedule is required to be delivered
- In ID timeframe only updates could be sent and it could be only a schedule for part of the day



Amendments to schedule by SA in Intraday

The Scheduling Agent **must inform ELIA without delay of any schedule modification** of an asset for quarter-hour in the permitted periods. Unless in the cases described below, the schedule amendment **does not require approval of ELIA**. ELIA will therefore allow the generators to grasp the opportunities in the Intraday market, regardless of whether the asset is located in a zone with or without congestion risks. ELIA will **analyze the impact of the schedule amendment** and if the circumstances require it, **activate flexibility on the asset or on another asset in the zone to reduce congestion risks.**

In the following cases the schedule amendment must be **requested to ELIA for approval**:

- A schedule amendment in the **opposing direction of an earlier requested activation** of flexibility for redispatching on the concerned asset for the concerned period;
- A schedule amendment **in violation of a Must-Run or May-Not-Run agreement** with ELIA;
- A schedule amendment in the **incremental direction** on an **offshore** PPM and for a forecasted or ongoing **storm event.**

Schedule update by SA after RD/BAL activation by Elia

- After the activation of a RD/balancing bid by Elia, the schedule is only **updated internally** by Elia without communicating the updated schedule to the SA
- **The SA only sends his schedule to Elia** i.e. the part of the schedule that the SA can freely adapt. The schedule sent by the SA does not consider the volumes activated by Elia.

- Example of successive versions of a schedule for the same qh

Scheduling deadline

	Schedule version	V1	V2	V3	V4	V5	V6	V7	V8	V9
Data sent by the SA to Elia	Schedule (MW)	100	110	110	120	120	120	/	/	/
Data stored and managed by Elia	Schedule (MW)	100	110	110	120	120	120	120	120	120
	RD requested (MW)	0	0	0	30	50	50	100	100	100
	mFRR requested (MW)	0	0	0	0	0	0	0	0	20

Frozen data

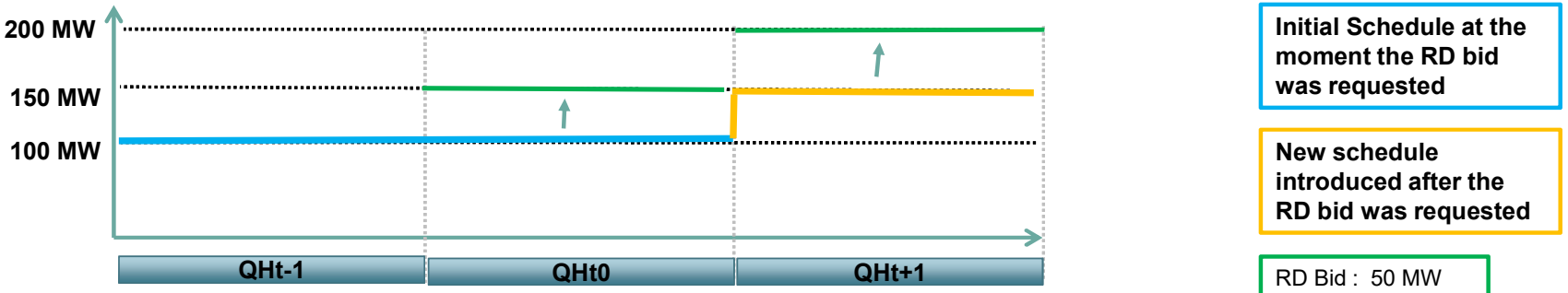
An update of the schedule results in an update of the RD Energy bids by the SA

Schedule update and requested RD bid

- If a 50 MW RD bid is requested, Elia expects that these 50 MW will be delivered whatever the change of schedule that the SA could introduce later
- A schedule amendment in the opposing direction of the requested activation of flexibility for redispatching on the concerned asset for the concerned period requires Elia approval

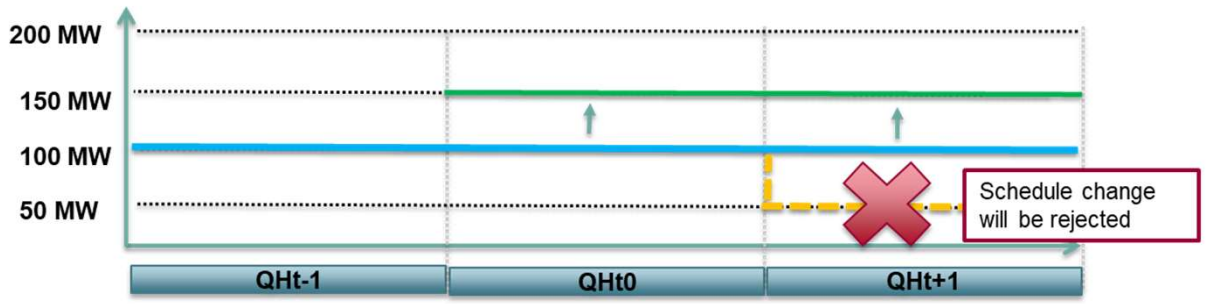
Example:
1. **An initial schedule is provided by the Scheduling Agent in D-1**
2. **An upward RD bid is requested at QHt-10 for QHt0**
3. **A new schedule is sent by the Scheduling Agent at QHt-7 (after the RD bid was requested)**

Change of schedule in the direction of the RD bid



Schedule update and activated RD bid

Change of schedule in the opposite direction of the RD bid



Initial Schedule at the moment the RD bid was requested

New schedule introduced after the RD bid was requested

RD Bid : 50 MW

Schedule exchange for D-1 and amendments of schedule for ID for Energy Storage Devices

The **same principles on energy storage devices as on Synchronous Power Generating Module (SPGM) and Power Park Module (PPM) per primary energy source**, the difference between them is that **two schedules are required which give a value in MW for each quarter-hour of day D**:

- **One schedule** represents the average generated power of the **discharge of the energy storage device** during the concerned quarter-hour, regardless of whether it feeds a local offtake or directly injects onto the electricity grid.
- **One schedule** represents the average consumed power of the **loading of the energy storage device** during the concerned quarter-hour, regardless of whether the energy storage device is charged by a locally connected Power Generating Module or by taking electricity off the grid (as is the case with pump-storage).

Energy Storage Device (ESD) ≥ 25MW baseline obligations for SA

- A MW schedule (baseline) provides MW output per quarter-hour of day D for the discharge of the energy storage device [information is given at Technical Unit level]

…	18:15	18:30	18:45	19:00	19:15	19:30	19:45	20:00	20:15	20:30	20:45	21:00	21:15	…
…	0	0	25,4	51,00	51,00	51,00	51,30	51,70	51,70	25	0	0	0	…

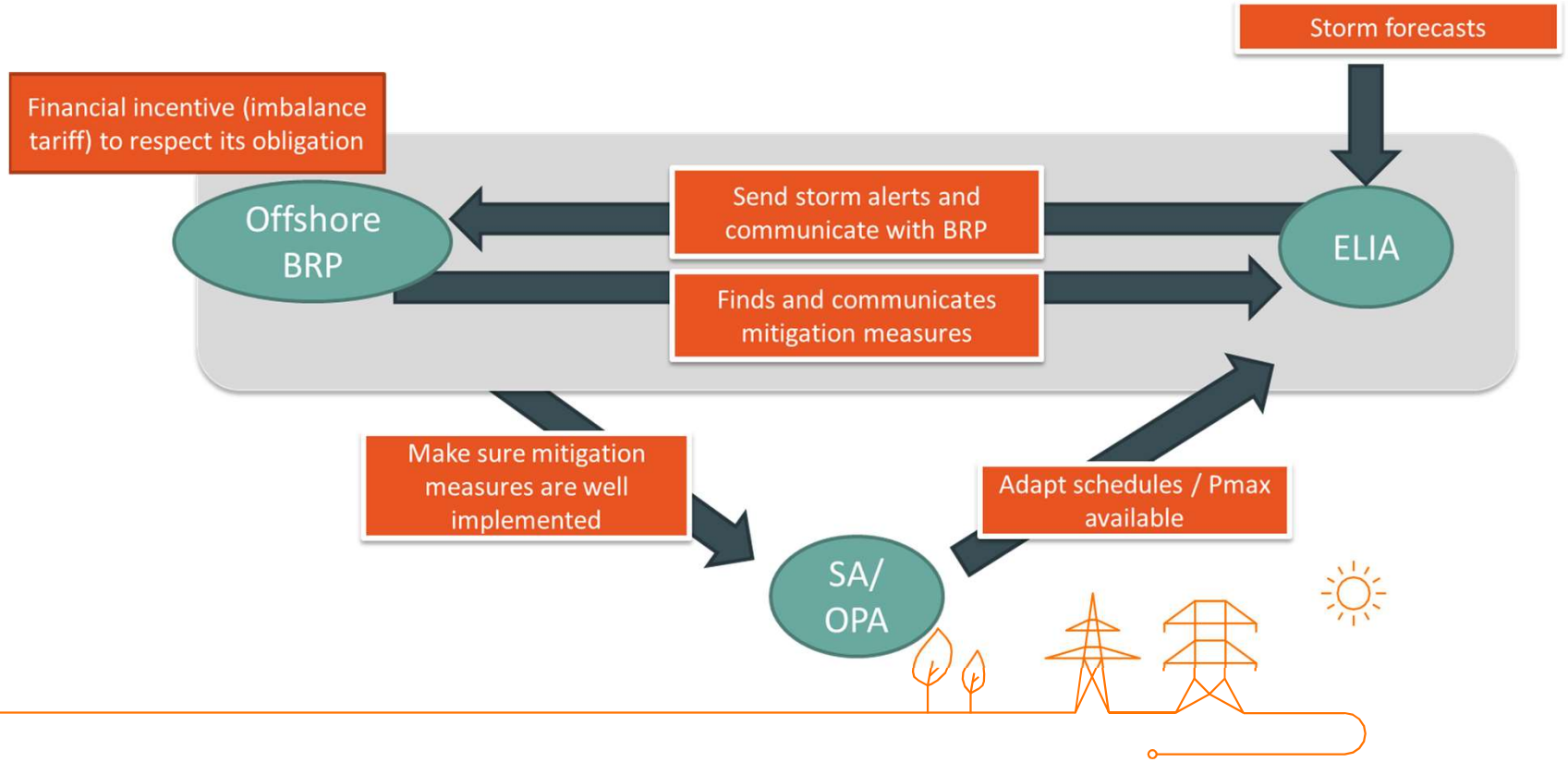
- A MW schedule (baseline).provides MW output per quarter hour of the day D for the loading of the energy storage device [information is given at Technical Unit level]

…	18:15	18:30	18:45	19:00	19:15	19:30	19:45	20:00	20:15	20:30	20:45	21:00	21:15	…
…	61,5	60	15	0	0	0	0	0	0	20,3	51,70	50,70	50,00	…

Schedule update by SA in case of storm risk

Schedule update by SA in case of storm risk – Storm mitigation procedure

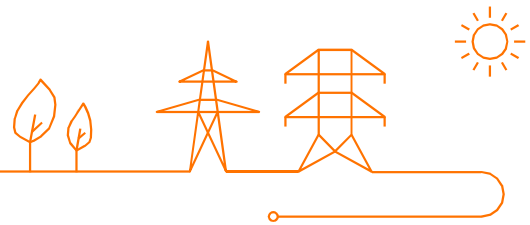
- A specific **storm mitigation procedure** needs to be followed to ensure the security of the system



Schedule update by SA in case of storm risk – Cut-in phase

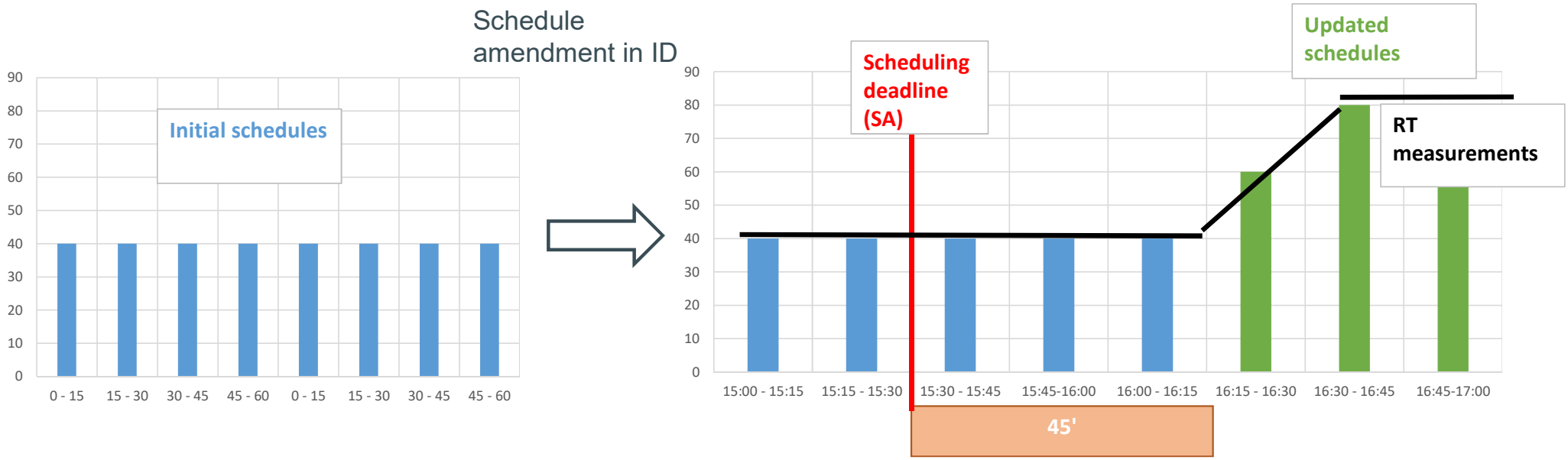
- Pursuant to article 252 of the Federal Grid Code, the **cut-in phase** of an Offshore Power Park Module following a forecasted (or ongoing) storm event **must be approved by Elia**, **and coordinated by the Parties**
- As described in the T&C SA, the current process to handle cut-in phase of offshore wind parks foresees that:
  - The SA provides a new schedule of an offshore park for the restart of the power production after the storm
  - This **new schedule needs to be validated** by Elia to coordinate the cut-in phase in order to ensure the security of the system during this phase

As the cut-in phase after a storm in the North Sea needs to be coordinated, a schedule amendment in the **incremental direction** on an **offshore** PPM for a forecasted or ongoing **storm event** must be **requested to ELIA for approval**



Scheduling deadline

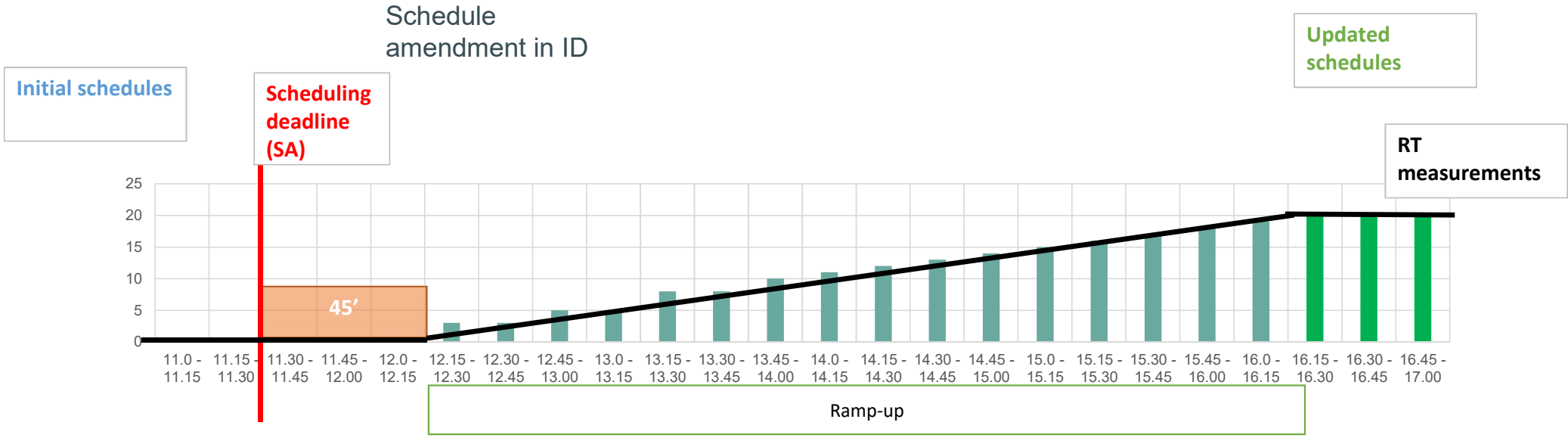
Scheduling deadline - Standard case – running units



Key principles:

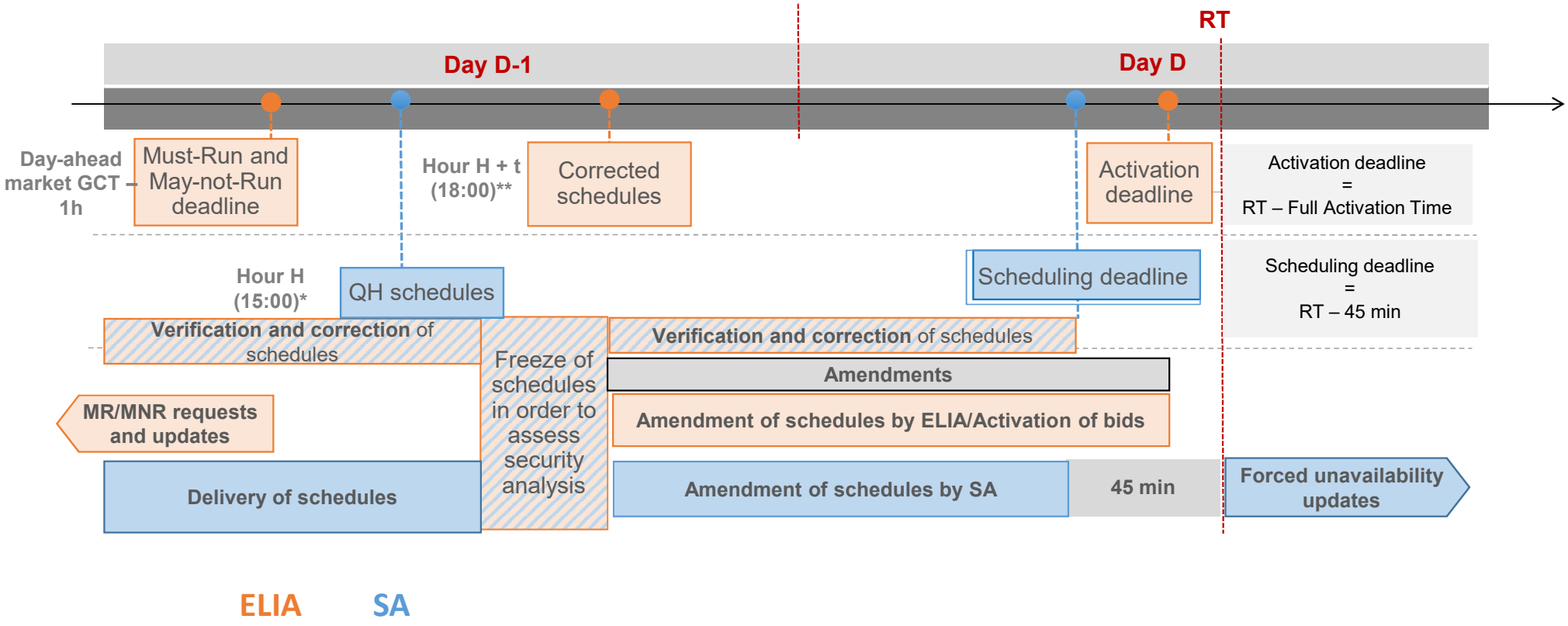
1) SA must notify Elia of an update of schedule 45 minutes before the start of the qh.
2) Ramp-up / down must be included in the schedules even below Pmin
3) The technical unit is expected to follow its last valid schedule

Scheduling deadline - Start-up / shut-down units



Overview of scheduling processes

Scheduling Agent Calendar



*According to the quality of the schedules, the DA schedules deadline could be moved to 14:30.

**According to the timing of the delivery of DACF files by TSO the DA schedules deadline could be moved before 18:00

Procedures

- Must-Run and May-Not-Run requests and updates
  (Before Day-ahead market GCT – 1h)
- Delivery of schedules
  (Before D-1 15h)
- Continuous Verification and Correction of schedules
- Amendment of schedules
  (Intraday)
- Forced unavailability updates
  (Real-time)

The forced unavailability update procedure is performed in coordination by the **Outage Planning Agent** through the Data Platform for Outage Planning. The Scheduling Agent has to update his schedule.

Must-Run/May-Not-Run requests and updates (ELIA → SA)

Who ? ELIA

When ? Before D-1 Day-ahead market GCT – 1h

What ?

Must-Run	Active power output equal to the minimal power.
Partial May-Not-Run	Active power output limited to a maximum value.
May-Not-Run	Active power output equal to 0MW, technical unit is shut down.

Granularity ? Quarter-hourly period

Who ? Synchronous Power Generating Module (SPGM); Power Park Module (PPM) per primary energy source and Energy Storage Device (ESD) ≥ 25 MW

What ?

- Price offer with possible associated costs

Must-Run and May-Not-Run requests do not free from bidding obligation

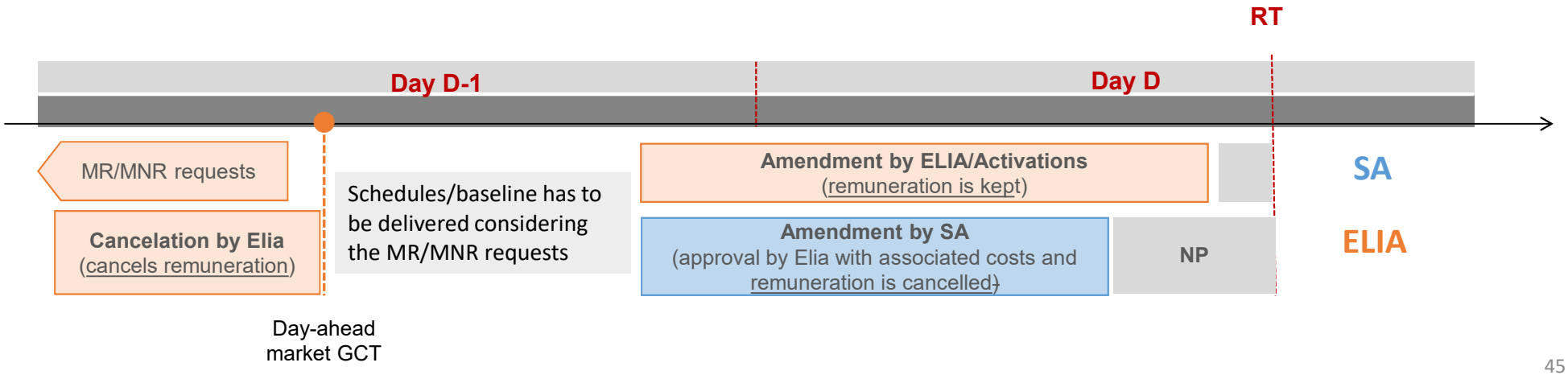
Remuneration

The remuneration is based on a negotiable price offer and may include an agreement for a reusable price methodology. If needed in the future, the remuneration mechanism may be redesigned to avoid contractual overload.

The requested costs have to be :

- Reasonable
- Directly-related to the requested amendment
- Demonstrable

For a must-run request, if DA/ID schedule or active power in real-time is above to the minimal power, it is considered as market opportunity and a cancellation of the must-run request. The Scheduling Agent has to reimburse ELIA for the associated costs.



Delivery of schedules

When ?

Before D-1 15h

What ?

Generation MW schedule for Technical Facility ≥ 25 MW

Granularity ?

Quarter-hourly

MW value	Average generated/consumed power in MW during the concerned QH

Schedules are delivered **per Technical Unit**.

Delivery of schedules

Overlap with Outage Planning

Available (A)	• MW schedule between <u>minimum and maximum power capacity</u>
Unavailable (U)	• <u>0 MW</u>
Testing (T)	• <u>Schedule of test</u>

QPA	QH1	QH2	QH3	QH4	QH5	QH6	QH7	QH8	QH9	QH10	…
Status	A	A	A	A	U	U	U	U	T	T	…
Capacity	100	100	100	100	0	0	0	0	50	50	…
SA	QH1	QH2	QH3	QH4	QH5	QH6	QH7	QH8	QH9	QH10	…
Schedule	50	50	0	0	0	0	0	0	50	50	…

Continuous Verification and Correction of schedules

(SA ↔ ELIA)

Who ? ELIA

When ? From D-1 on

What ?

- Verify the quality of schedules and contact SA in case of inconsistency

Who ? SA

When ? From D-1 on

What ?

- In case erroneous schedule has been delivered, the SA contacts ELIA
- Submit a corrected schedule

Amendment of schedules (SA → ELIA)

Who ? Scheduling agent

When ?

- Between D-1 18h and Scheduling deadline

What ?

- New MW schedule

Granularity ? Quarter-hourly

Amendments do **not need approval from ELIA** unless if :

- amendment in the opposite direction of an earlier requested activation of flexibility for redispatching
- amendment in violation of a Must-Run or May-Not-Run agreement
- amendment in the incremental direction on an offshore PPM and for a forecasted or ongoing storm event.

In this specific cases, ELIA can :

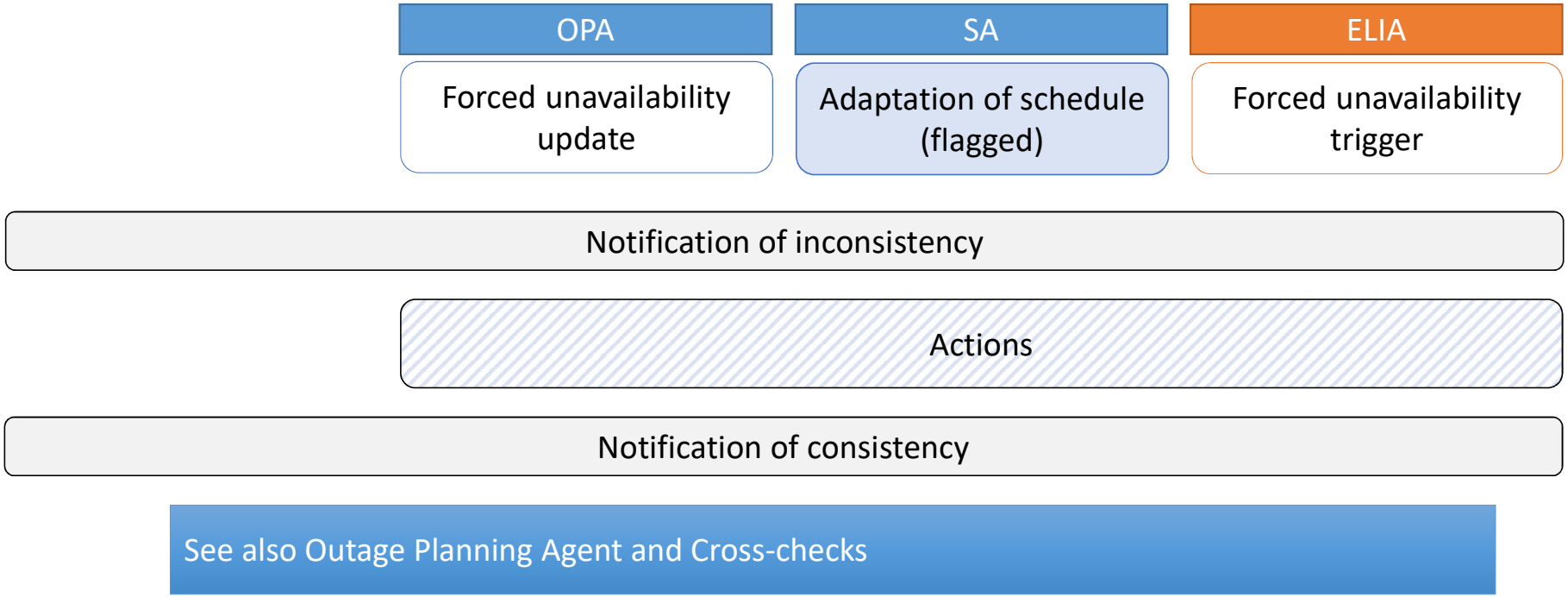
- Agree
- Agree with associated conditions and/or costs
- Refuse with reasons

Forced unavailability updates

Interaction with other parties

When ? In real-time, as soon as possible

What ? Adapt the schedules in case of forced unavailability (with flag)



See also Outage Planning Agent and Cross-checks

MW schedule control [baseline + RD activations + BAL activations]

Schedule obligation

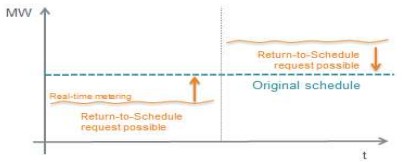
Schedule obligation

Elia requires schedules of Technical Units before 15:00 D-1. No explicit monitoring system will be implemented on D-1 schedules, but a **contractual term** will be foreseen, allowing Elia to **question the SA and take actions** if abusive behaviors are observed.

When necessary, the SA must **update the schedules** before the scheduling deadline. The **last valid Daily Schedule** is expected to be **firm** and Elia can enforce the SA to return to this schedule.

In practice, Elia will only enforce the SA to **return to the schedule** when deemed **necessary for grid security:**

- Elia might ask ***a specific Technical Unit*** to return to the schedule **if a deviation** from the schedule is observed in RT and this deviation **causes or aggravates a congestion risk**



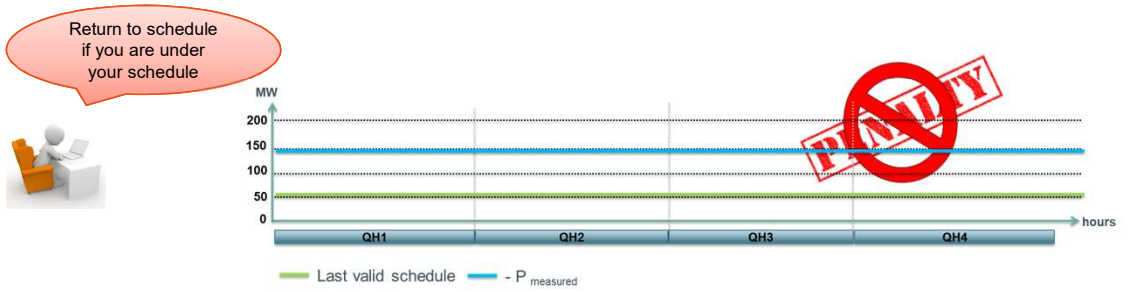
- **When an incremental (resp. decremental) risk is detected** in the zone but it cannot be associated to one specific unit (e.g. because some units are not equipped with telemetering), Elia might ask ***all the units of a zone*** to return to their schedule **if they are above (resp. under)** their last valid schedule

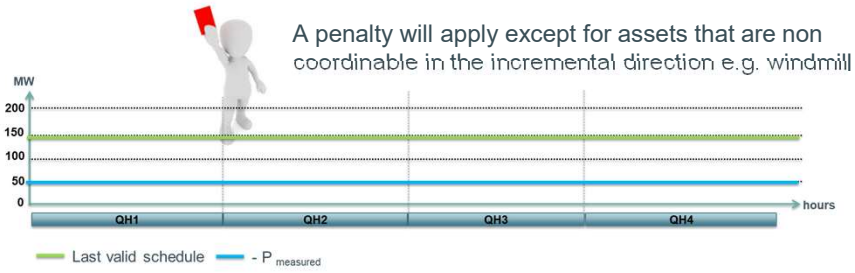
Schedule control

The respect of the **last valid Daily Schedule** will be verified **ex-post**, according to the following rules:

1. The last ID valid Daily Schedule will only be controlled **when Elia explicitly asked** the unit **to return to the schedule**
2. A schedule will be considered as non correctly respected **as soon as the ex-post measurement deviates from the last valid schedule** (in the direction of the congestion risk)
3. The technical units that are **non coordinable** in one direction will be **exempted** from control and penalty in case of deviation in the opposite direction

E.g. A windmill which is not coordinable in the incremental direction won't be penalized in case of deviation in the decremental direction





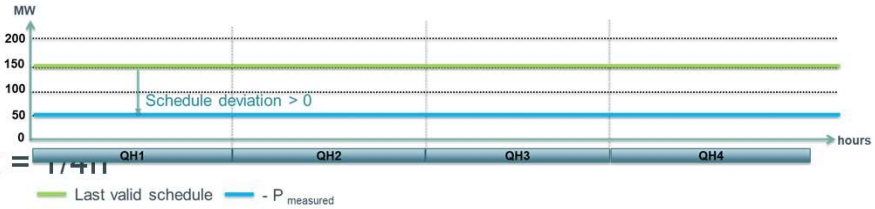
Penalty in case of deviations in the direction of the congestion risk

$$Penalty = \sum_{\substack{non\ compliant \\ time\ unit}} MAX\ (0; (time\ unit\ x\ schedule\ deviation) x\ Penalty\ price)$$

Where :

- **schedule deviation =** last valid schedule − **(**− Pmeasured[1]**)**
- **penalty** = a lump-sum penalty per MWh of deviation (to be defined in the contract)

Return to schedule if you are under your schedule



- **time unit =** 1/4h

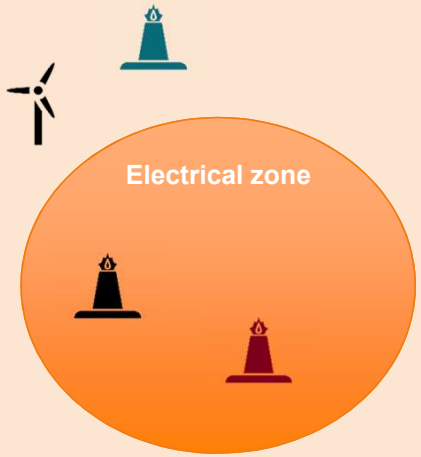
An additional **contractual clause** will be foreseen**,** allowing Elia to **question the SA and take actions** if abusive behaviors are observed (e.g. schedule deviations in case of large imbalance tariff).

[1] *Pmeasured is defined as "The difference between gross offtake and gross injection, measured at a Delivery Point." Net injection into the Elia Grid is therefore considered as a negative value.*

Return to Schedule – baseline + RD activations + BAL activations

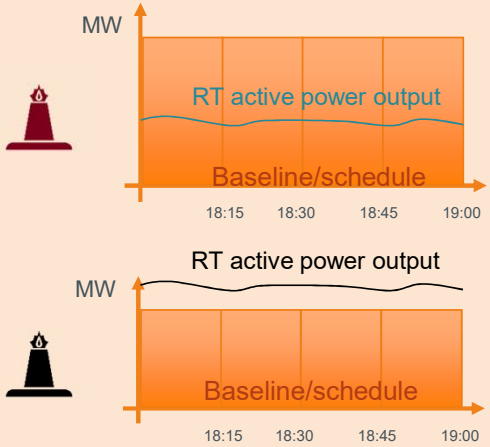
Return to schedule – illustration

1. Determine congestion risk for an electrical zone



Up : injection limitations in the electrical zone
Down : offtake limitations in the electrical zone

2. The RTS can be sent to one Delivery Point (DP) with linked Technical Unit (TU), to a selection of DPs with linked TUs or all DPs with linked TUs in an electrical zone



3. Result

Illustration of possible application : RTS message requires only reaction of the DPs with linked TU with schedule deviation aggravating the congestion

	In case of an Up limitation	In case of a Down limitation
	no reaction needed	Reaction needed in order to go back to schedule
	Reaction needed in order to go back to the schedule	No reaction needed

The Return To Schedule (RTS) message includes a specific direction. SA only needs to react if schedule deviations aggravates the congestion situation

Redispatching – phase 1

Bidding of Redispatching energy bids

Process

- Explicit cost-based bidding for redispatching energy bids

Interaction

- Scheduling Agent submits redispatching energy bids (volumes & prices only valid for redispatching energy bids) to Elia via existing BMAP application and in accordance with the RD energy bid manual

- Interfaces:
  - Scheduling Agent System to Elia System
  - Scheduling Agent can connect via user interface (Similar to current situation)

Activation of Redispatching energy bids

Process

- Explicit bidding for redispatching energy bids
- Exact rules to define the level of redispatching energy bids exchange can be found in RD Energy Bid Manual

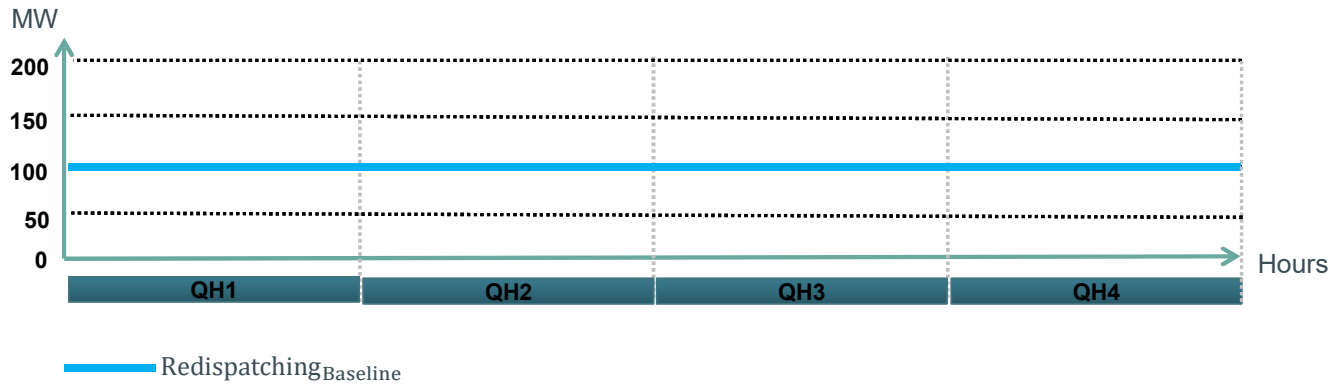
Interaction

- Elia sends activation request for a redispatching to the Scheduling Agent via new Selection & Activation application
- Interface: Elia System to Scheduling Agent System

Redispatching Energy Bids definitions

Redispatching $_{\text{Baseline}}$

Redispatching $_{\text{Baseline}}$ (MW) = the last valid Daily Schedule of the Delivery Point DP_{SU} sent by the SA for quarter hour qh, at the moment of the scheduling deadline



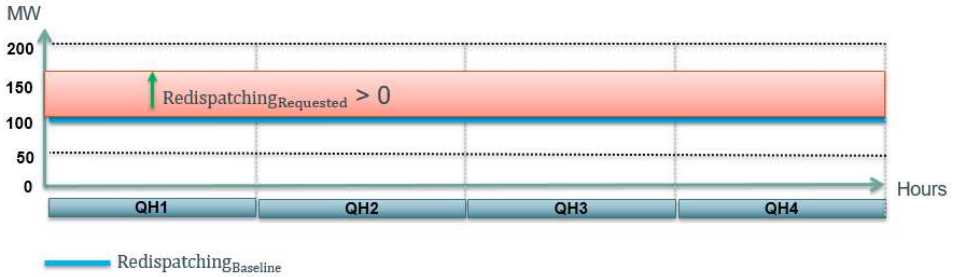
Redispatching $_{Requested}$

Redispatching $_{Requested}$ (MW) = the value of the Redispatching activation:

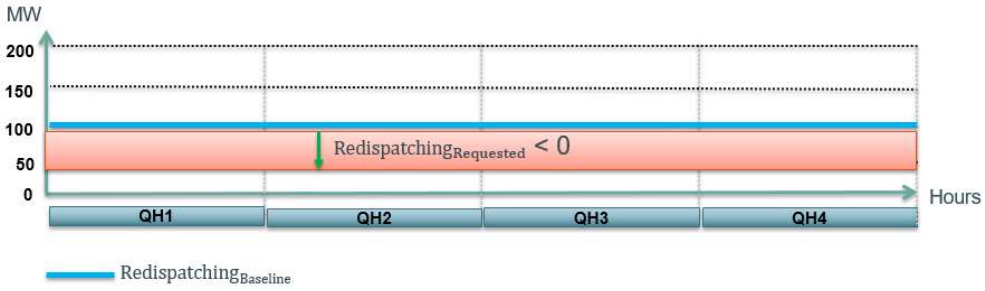
- > 0 in case of incremental activation
- <0 in case of decremental activation

Redispatching Energy $_{Requested}$ (MWh) is the energy corresponding to the **Redispatching $_{Requested}$** (MW) for the concerned quarter-hour

Incremental Redispatching activation :



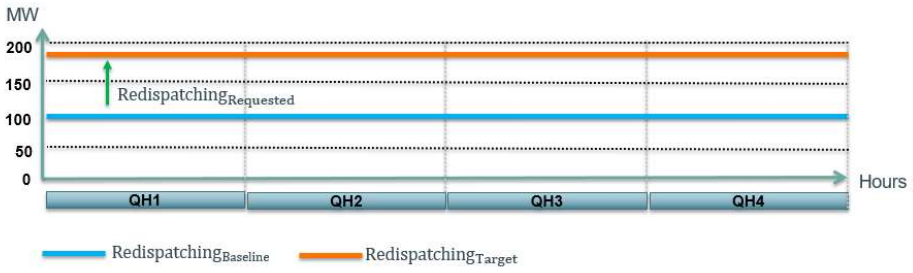
Decremental Redispatching activation :



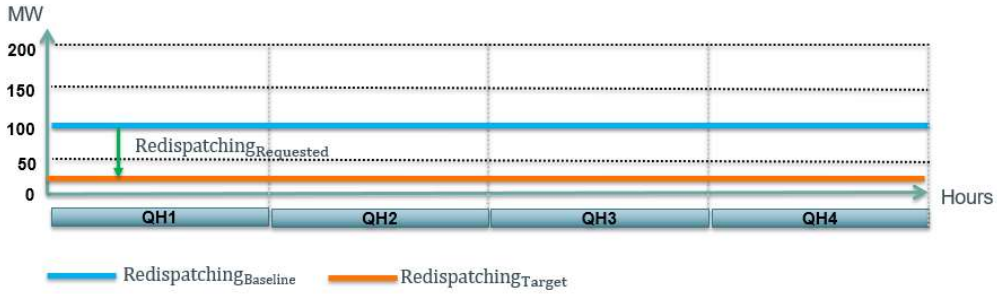
Redispatching $_{Target}$

Redispatching $_{Target}$ (MW) = Redispatching Baseline + Redispatching $_{requested}$

Incremental redispatching activation :

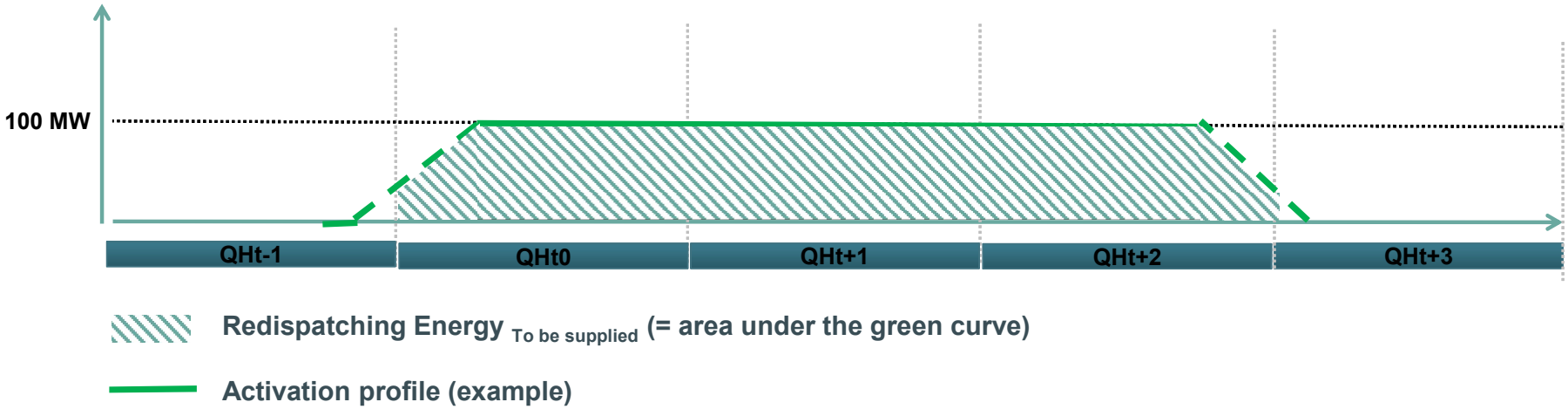


Decremental redispatching activation :



Redispatching Energy $_{\text{To be supplied}}$

Redispatching Energy $_{\text{To be supplied}}$ = **Redispatching Energy** $_{\text{Requested}}$ except for the first and last quarter-hour of a Redispatching activation (due to the specific activation profile)



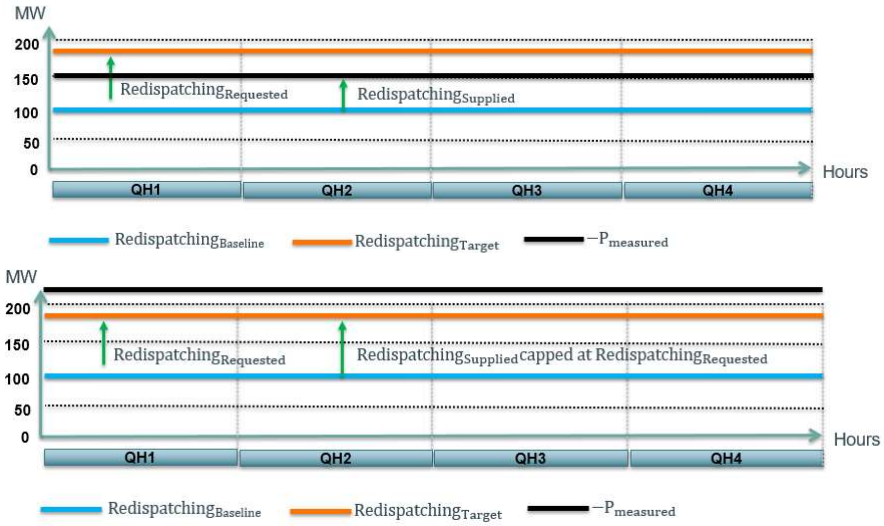
Redispatching Supplied

Difference between the measure and the baseline, with a cap at Cong $_{requested}$ and a floor at 0MW

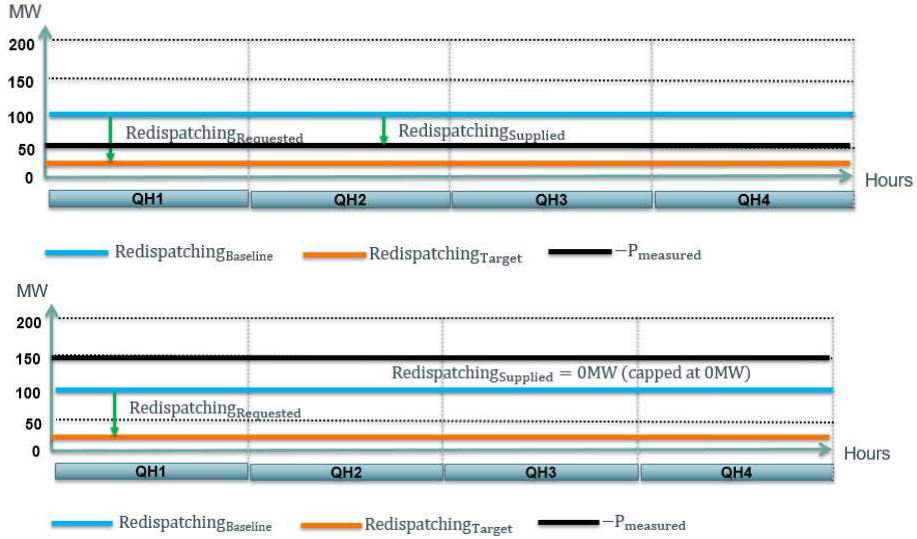
Redispatching $_{Supplied}$ (MW) =

- Max (0;min(− Pmeasured[1] − Redispatching $_{Baseline}$; Redispatching $_{requested}$)) **in case of incremental activation**
- Min (0;max(− Pmeasured − Redispatching $_{Baseline}$; Redispatching $_{requested}$)) **otherwise**

Incremental Redispatching activation :



Decremental Redispatching activation :



[1] *Pmeasured is defined as "The difference between gross offtake and gross injection, measured at a Delivery Point." Net injection into the Elia Grid is therefore considered as a negative value.*

Redispatching Energy – Summary of definition

Redispatching Energy $_{\text{Requested}}$ (MWh) is the energy corresponding to the **Redispatching** $_{\text{Requested}}$ (MW) for the concerned quarter-hour

Redispatching Energy $_{\text{To be supplied}}$ = **Redispatching Energy** $_{\text{Requested}}$ except for the first and last quarter-hour of a Redispatching activation (due to the specific activation profile)

Redispatching Energy $_{\text{Supplied}}$ (MWh) is the energy corresponding to the **Redispatching** $_{\text{Supplied}}$ (MW) for the concerned quarter-hour

Redispatching Energy $_{\text{Missing}}$ (MWh) = **Redispatching Energy** $_{\text{To be supplied}}$ **- Redispatching Energy** $_{\text{Supplied}}$

- > 0 in case of incremental activation
- <0 in case of decremental activation

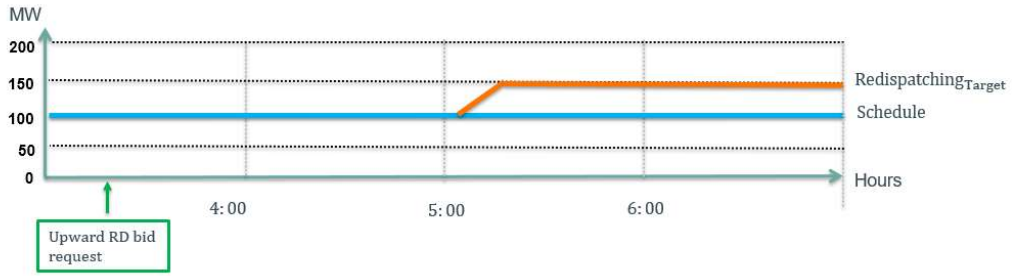
Scheduled and Direct redispatching activation

Context

Remedial actions (among which redispatching actions) can be taken **preventively** (i.e. before the contingency occurs) or **curatively** (i.e. after the contingency occurs).

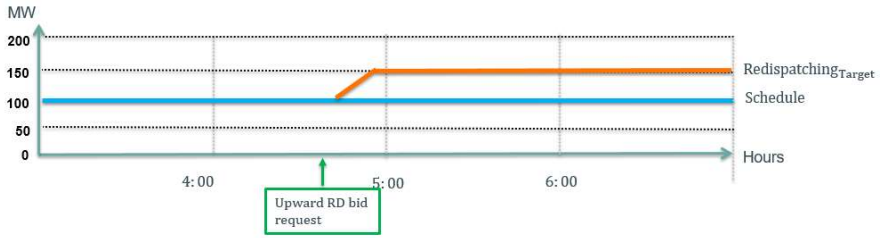
Scheduled activation of a RD bid

In case of **preventive** actions, the redispatching activations are usually requested **well ahead** of real-time (e.g. up to one to two hours before real-time).



Direct activation of a RD bid

In case of **curative** actions, the redispatching activations are requested **in real-time** and **need to be executed directly** in order to respect the **thermal limits** of the grid elements.



Introduce the concept of Redispatching ‘direct’ activation[1]

- A ‘direct’ activation is an activation that can be requested **at any time** by Elia and which implies an **immediate reaction** of the activated Technical Facility since the Redispatching $_{target}$ should be reached **within the Full Activation Time (FAT) after the activation request is sent** by Elia.
- All the Redispatching Energy Bids of are **eligible for ‘direct’ activation**
  - **The time at which the Technical Unit reach the target volume is defined by the FAT**

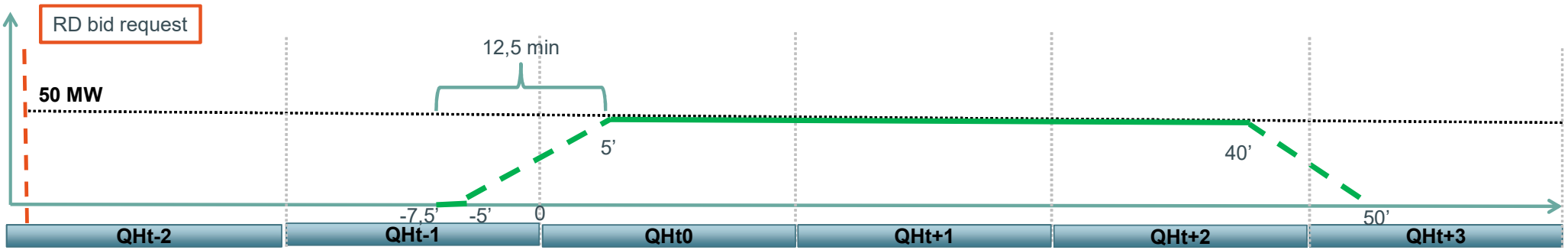
[1] Only valid for iCAROS phase 1 : the extension of this concept for smaller units will be assessed during the preparation of iCAROS phase 2.

RD energy bid delivery shape

RD energy bid delivery shapes – Scheduled Activation

- **The RD energy bid delivery shape has been aligned with the TSO-BSP shape used for mFRR energy bids**
- **Consequences**:
  - Alignment with the shortest Full Activation Time (FAT) with mFRR: 12,5 min (default FAT for RD bid)

Scheduled activation of a RD bid – FAT 12,5 min

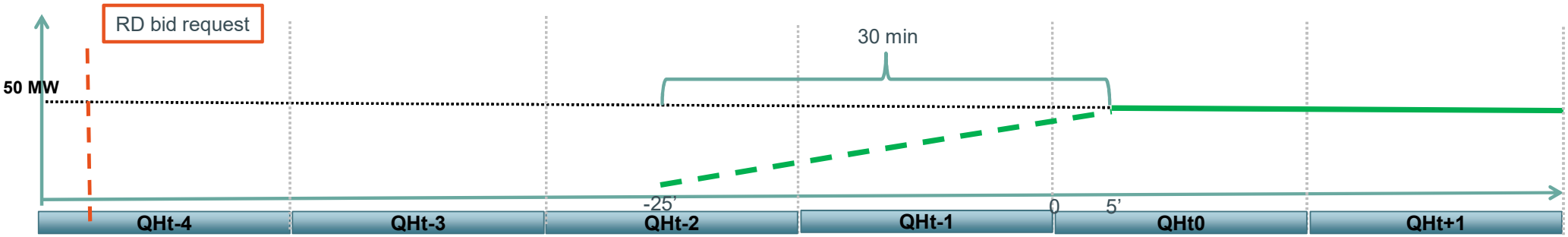


- RD bid was requested in QHt-2 for QHt0 till QHt+2
- The TU follows the TSO-BSP profile for the ramp-up and reach the target volume in 12,5 min i.e. 5 min after the start of the QHt0

RD energy bid delivery shapes - Scheduled Activation

The RD energy bid delivery shape has been aligned with the TSO-BSP shape used for mFRR energy bids

Scheduled activation of a RD bid – FAT 30 min

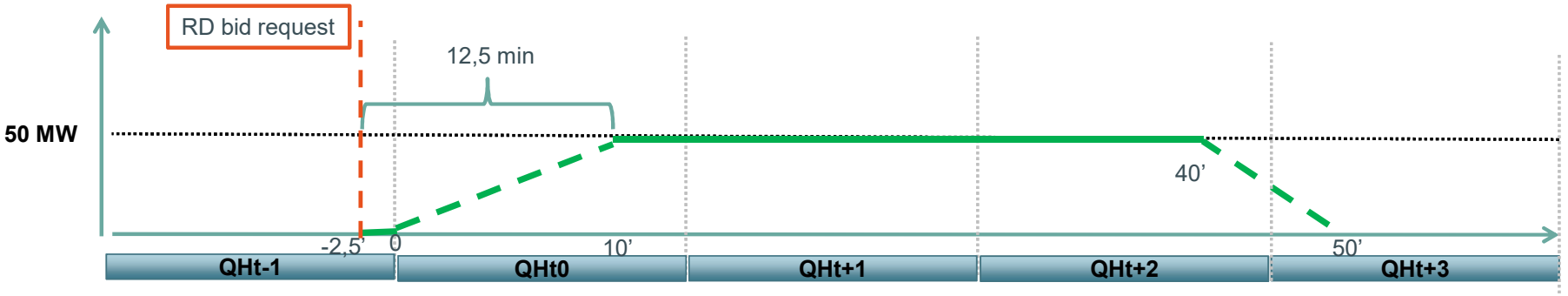


- RD bid was requested in QHt-4 for QHt0 till QHt+8
- The TU follows the TSO-BSP profile for the ramp-up and reach the target volume in 30 min i.e. 5 min after the start of the QHt0

RD energy bid delivery shapes - Direct Activation

The RD energy bid delivery shape has been aligned with the TSO-BSP shape used for mFRR energy bids

Direct activation of a RD bid – FAT 12,5 min

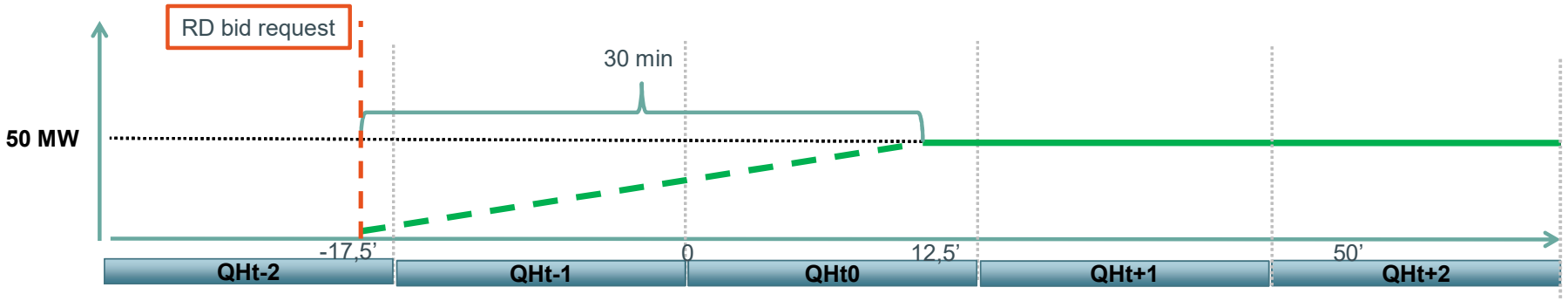


- RD bid was requested for QHt0 2,5 min before the start of QHt0
- The TU follows the TSO-BSP profile for the ramp-up and reach the target volume in 12,5 min i.e. 10 min after the start of QHt0

RD energy bid delivery shapes - Direct Activation

The RD energy bid delivery shape has been aligned with the TSO-BSP shape used for mFRR energy bids

Direct activation of a RD bid – FAT 30 min



- RD bid was requested for QHt0 17,5 min before the start of QHt0
- The TU follows the TSO-BSP profile for the ramp-up and reach the target volume in 30 min i.e. 12,5 min after the start of QHt0

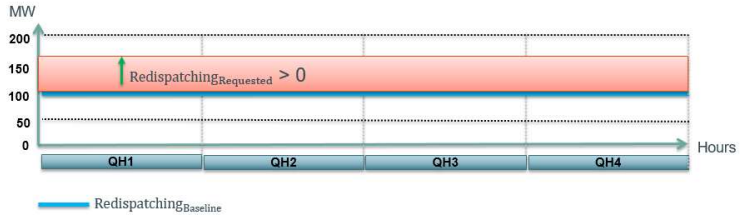
Redispatching activation remuneration

Rules for scheduled redispatching activation remuneration

Remuneration = Redispatching Energy $_{requested}$ (MWh) x Redispatch Energy bid price (€/MWh)

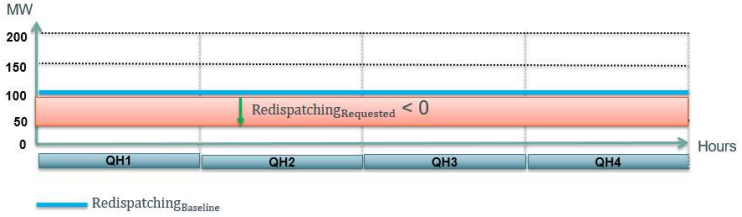
- **Incremental** activations are paid by **ELIA to the Scheduling Agent** (provided a positive bid price)
- **Decremental** activations are paid by **the Scheduling Agent to ELIA** (provided a positive bid price)
- Redispatch Energy **bid price** should **reflect the costs** for activating the flexibility and therefore be reasonable, directly related to the activation, and demonstrable

Incremental redispatching activation :



- The bid price reflects the cost of production, such as the cost of the fuel, and is usually positive
- The remuneration is usually positive

Decremental redispatching activation :



- The bid price can reflect the costs saved by not producing, in this case it is positive and the remuneration is negative
- But it can also include the decreased revenues from the Guarantee of Origin (Green Certificates), the bid price is then negative and the remuneration is positive

Rules for control of cost-reflective prices

- The bid prices **will be controlled** by Elia
- The control will be performed based on a **cost formula*** that will be proposed by the SA and challenged/approved by Elia at the signature of the **T&C SA**. It might be negotiated again at the request of one of the parties (e.g. in case of structural changes of the technical unit following a retrofit).
    - iCAROS phase 1 : cost formula for large SPGM/PPM per primary energy source /ESD are already used today to compute DA congestion bid price → the concept will need to be extended to ID
- Recurrent abuses (e.g. unexplained deviation from the cost formula) will be **reported to the CREG**

** The cost formula should be communicated on Operating Mode level*

Scheduled redispatching activation annulments

- ELIA can **revoke an earlier Scheduled redispatching activation** fully or partially until the **activation deadline** of the activated bid for the concerned quarter-hour. In this case, the corresponding flexibility will be available again for other products.
- The remuneration of the scheduled redispatching activation will **only be canceled** if Elia revokes the scheduled redispatching activation **in DA**. If the annulment is done **in ID** (and not triggered by a Forced Outage of the activated unit), **the remuneration will be maintained** (as costly actions might already have been taken on the unit and market opportunities might be lost).

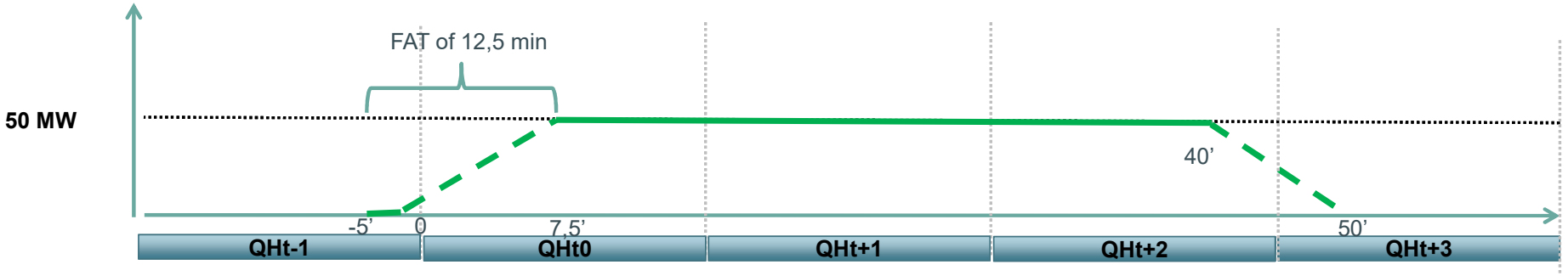
*Note : the annulment of a scheduled redispatching activation is a needed option for **exceptional circumstances** implying large unexpected changes in the grid. However, this option **shouldn't be used frequently** by Elia as congestion bids are typically activated once the need is confirmed.*

Rules for Direct redispatching activation remuneration – FAT of 12,5 min

For a Direct Activation requested for the concerned quarter-hour, then the RD Energy Requested is reduced in proportion to the delay of the activation request vis-à-vis the point of scheduled activation

$$\text{Remuneration} = \text{Redispatching}_{\text{requested}} * \frac{\Delta t}{15} * \frac{1}{4}\ [\text{MWh}] \text{ x Redispatch Energy bid price (€/MWh)}$$

with Δt = 15' – delay between point of scheduled activation and the time of the direct activation request



Example: request 5' before the start of Qh(t0)

- Considering a FAT of 12,5', the target volume will be reached at Qh(t0) + 7,5' i.e. 2,5 min later than expected for a scheduled activation

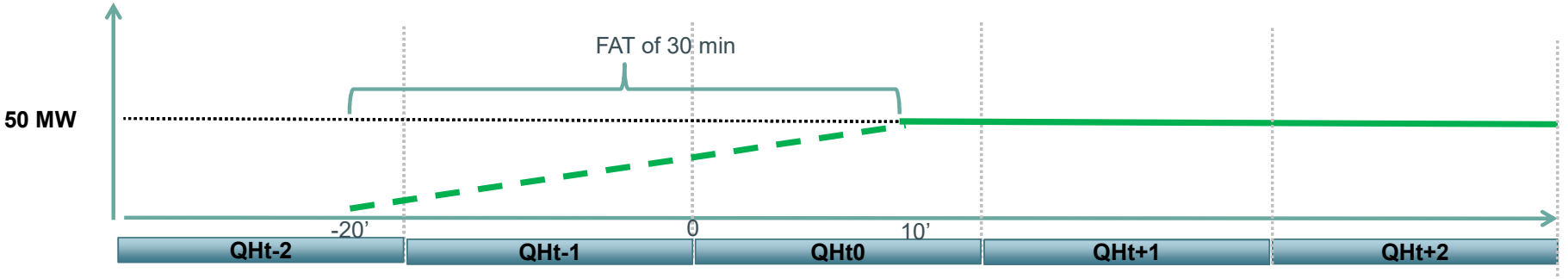
For Qh(t0): Δt = 15' – 2,5' = 12,5

$$\text{Remuneration} = \text{Redispatching}_{\text{requested}} * \frac{12{,}5}{15} * \frac{1}{4}\ [\text{MWh}] \text{ x Redispatch Energy bid price (€/MWh)}$$

For Qh(t+1): Δt = 15'

$$\text{Remuneration} = \text{Redispatching}_{\text{requested}} * \frac{1}{4}\ [\text{MWh}] \text{ x Redispatch Energy bid price (€/MWh)}$$

Rules for Direct redispatching activation remuneration - FAT of 30 min



Example: request at 20' before the start of Qh(t0),

- Considering a FAT of 30', the target volume will be reached at Qh(t0) + 10' i.e. 5 min later than expected for a scheduled activation

For Qh(t0): Δt = 15' – 5' = 10'

$$\text{Remuneration} = \text{Redispatching}_{\text{requested}} * \frac{10}{15} * \frac{1}{4}\ [\text{MWh}] \text{ x Redispatch Energy bid price (€/MWh)}$$

For Qh(t+1): Δt = 15'

$$\text{Remuneration} = \text{Redispatching}_{\text{requested}} * \frac{1}{4}\ [\text{MWh}] \text{x Redispatch Energy bid price (€/MWh)}$$

Redispatching activation control

Rules for Redispatching activation control

1. All the redispatching activations will be controlled
2. The activation control is based on the Redispatching Energy $_{\text{to be supplied}}$ whose computation has been aligned with the mFRR activation control design
3. A scheduled redispatching activation will be considered as **non-compliant** as soon as **Redispatching Energy $_{\text{missing}} \neq 0$** (without any margin – *contrary to what the design note foresees*).

Compliant decremental activation:

Deviation from target is tolerated in the decremental direction (direction of the scheduled redispatching activation)

Non compliant decremental activation:

Deviation from target is forbidden in the incremental direction (direction of the congestion risk)

➔ This means the congestion target is ***strict*** in the **direction of the congestion risk**

4. The activation of RD energy bids will be controlled **at 'Operating Mode'**

Penalty for non-compliant scheduled redispatching activation

$$Penalty = \sum_{\substack{non\ compliant \\ time\ units}} MAX\ (0;\ Redispatching\ Energy_{\ missing}\ x\ Penalty\ price)$$

Where

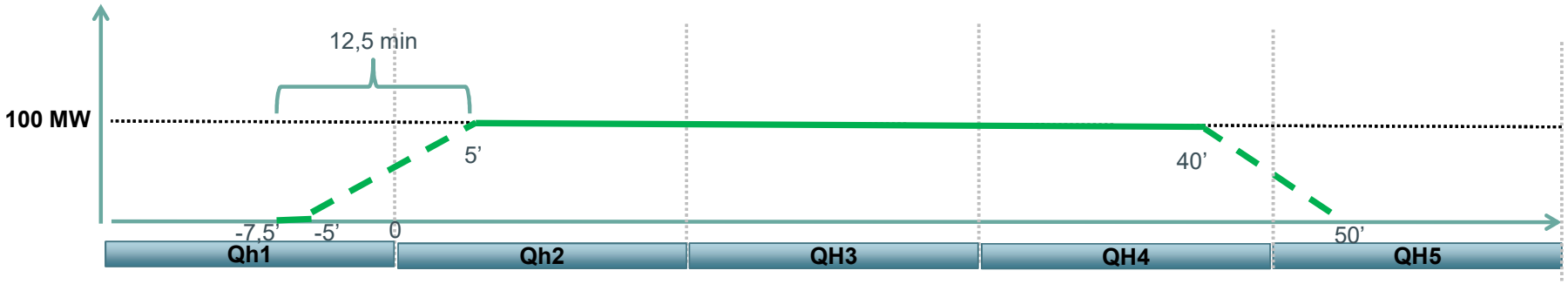
- **Penalty price** = k x price of the RD energy bid which is not correctly activated
- k = a **penalty factor** aiming at covering the (average) costs of the additional actions taken by Elia in response to a non-compliant activation (e.g. k=1,3)

An additional **contractual clause** will be foreseen, allowing Elia to **question the SA and take actions** if abusive behaviors are observed (e.g. target deviations in case of large imbalance tariff).

Design evolution : congestion target is strict, but penalty price is sized on bid price

Activation control – Scheduled activation with FAT of 12,5 min

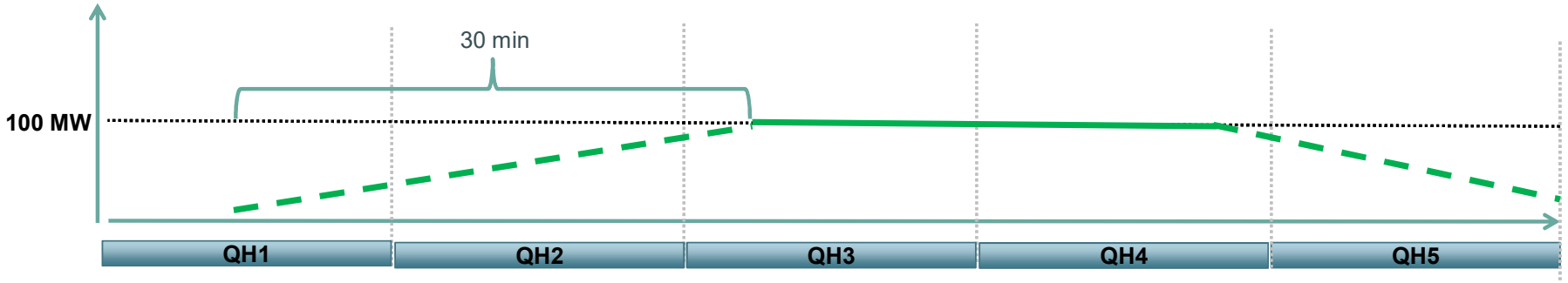
Activation control is based on the Redispatching Energy $_{\text{to be supplied}}$



Qh	Redispatching $_{\text{requested}}$	Redispatching Energy requested	Control?	Redispatching Energy $_{\text{to be supplied}}$
1	0 MW	0 MWh	No	0 MWh
2	100 MW	25 MWh	Yes	+/- 22,5 MWh i.e. about 90% of the Redispatching Energy $_{\text{requested}}$
3	100 MW	25 MWh	Yes	25 MWh
4	100 MW	25 MWh	Yes	+/- 22,5 MWh
5	0 MW	0 MWh	No	0 MWh

Activation control – Scheduled activation with FAT of 30 min

Activation control is based on the Redispatching Energy $_{\text{to be supplied}}$

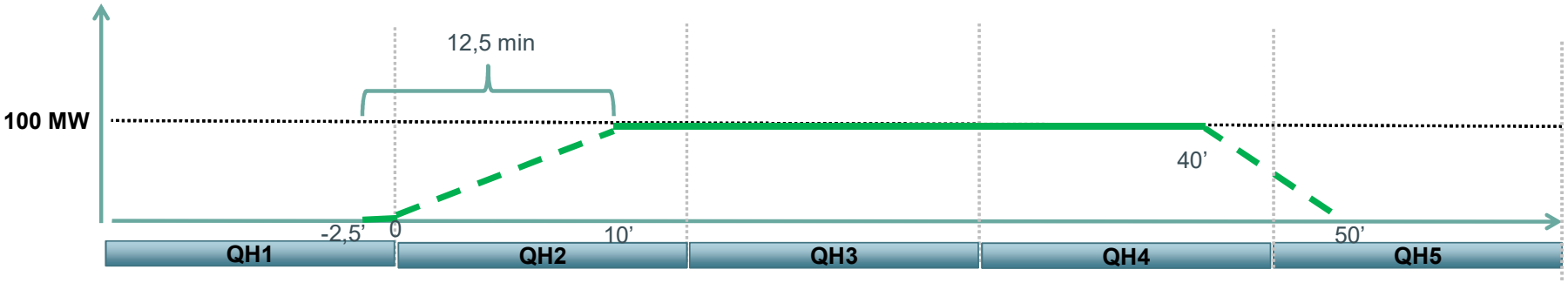


Qh	Redispatching $_{\text{requested}}$	Redispatching Energy $_{\text{requested}}$	Control?	Redispatching Energy $_{\text{to be supplied}}$
1	0 MW	0 MWh	No	0 MWh
2	0 MW	0 MWh	No	0 MWh
3	100 MW	25 MWh	Yes	+/- 22,5 MWh
4	100 MW	25 MWh	Yes	+/- 22,5 MWh
5	0 MW	0 MWh	No	0 MWh

The Redispatching Energy $_{\text{to be supplied}}$ for the first and last qh of delivery (QH3 and QH4 in the example above) is approximated to the one of a scheduled activation in 12,5 min (even if more energy is delivered due to a different ramp-up/ramp-down timing)

Activation control – Direct activation with FAT of 12,5 min

Activation control is based on the Redispatching Energy $_{\text{to be supplied}}$



Qh	Redispatching $_{\text{requested}}$	Redispatching Energy requested	Control?	Redispatching Energy $_{\text{to be}}$ supplied
1	0 MW	0 MWh	No	0 MWh
2	100 MW	25 MWh	Yes	+/- 16,67 MWh
3	100 MW	25 MWh	Yes	25 MWh
4	100 MW	25 MWh	Yes	+/- 22,5 MWh
5	0 MW	0 MWh	No	0 MWh

The Redispatching Energy $_{\text{to be supplied}}$ for the first qh of delivery (QH3 in the example above) is computed considering the later start of the activation

BRP perimeter correction in case of scheduled/direct redispatching activation

The current BRP perimeter correction will be maintained for iCAROS phase 1

Elia will continue correcting the perimeter of the BRP with the value of the requested energy (Redispatching Energy $_{requested}$)

Use of Redispatching Energy Bids for other purposes

Use of Redispatching Energy Bids for other purposes

- RD Energy Bids might be used for other purposes than national congestion (e.g. Countertrading, storm risk process)
- The exact design for the use of RD Energy Bids for other purposes will be defined later
- Special attention will be paid to the remuneration of these bids that might possibly be different than when they are used for national congestion management (to be analyzed)

Cross-checks – phase 1

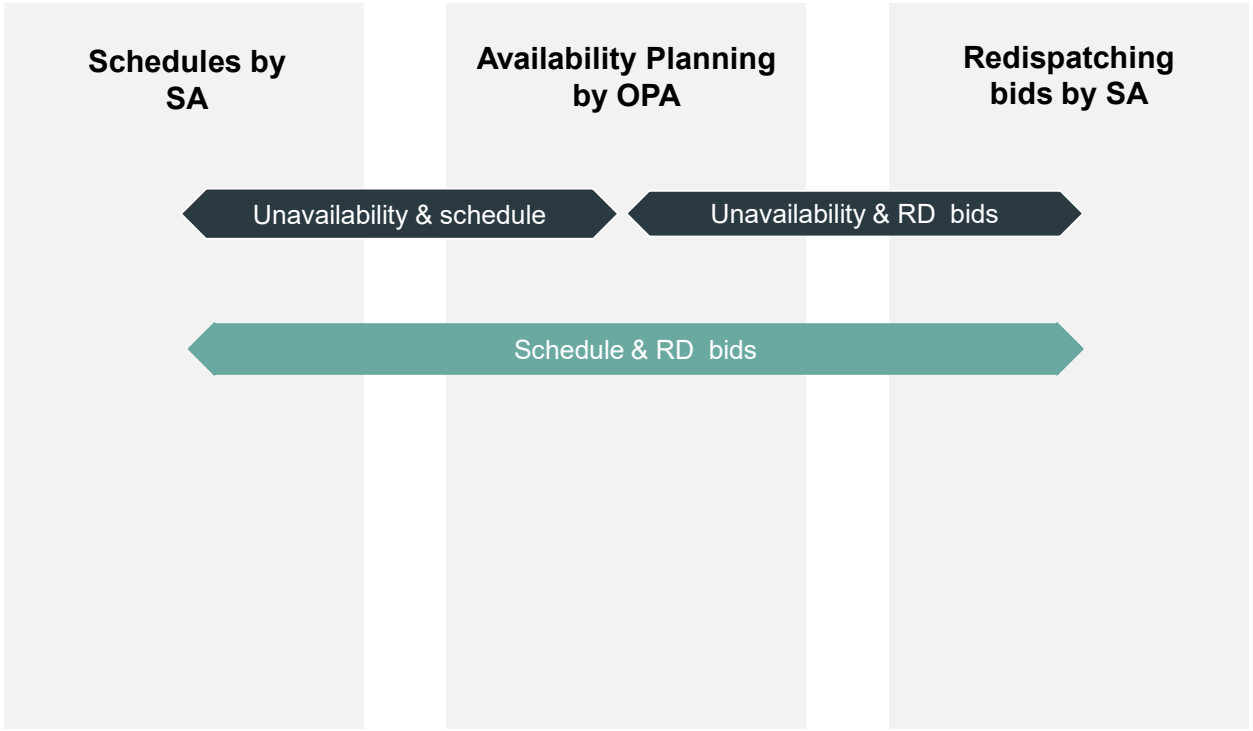
Why cross checks?

To support the SA, OPA to give correct data

To make sure that Elia has solutions in real-time

As from phase 2, Data are received from different entities (SA, OPA, BSP), if they are not **coherent** ➔ issue in real-time : which one is correct?

High level overview of Cross-checks



Cross-checks - Summary

Crosscheck between				Check	Consequence of Inconsistency
Data 1	from	Data 2	from		
Outage planning status	OPA	Schedule	SA	Outage planning status and schedules are coherent	• Notification to SA / OPA • Inconsistency penalty (50/50 for SA/OPA)
Outage planning status	OPA	Schedule and RD bids	SA	Outage planning status, schedules and RD bids are coherent in case of Forced Outage	• Notification to SA/OPA
Outage planning status	OPA	RD bid	SA	Provision of (at least one) RD bids is coherent with outage planning status	• Notification to SA / OPA • Inconsistency penalty in case no RD bids are provided while status is available (except if not technically feasible)
Schedule	SA	RD bids	SA	In case of amendment of schedule, RD bids must be updated	• Notification to SA
Schedule	SA	Technical Pmin/Pmax		P_min, techn <= Schedule <= Pmax,techn (the constraint regarding Pmin tech is relaxed if there is a shutdown or start-up going on over maximum 2 days)	• Notification to SA • Inconsistency penalty

Detailed process and applicable penalty will be defined later

Checks outage planning status & Schedules

Rules

OPA status	Schedules
Available	0-X MW
Unavailable	0 MW
Testing	0-X MW

Cross-checks

OPA status	Schedules	Rules	Action Elia
Unavailable	X MW >0	Inconsistency penalty (50/50 for SA/OPA) Schedule valid, base line = X MW	Notification to SA / OPA of inconsistency

Checks outage planning status, Schedules & RD bids in case of forced outage in intraday

Rules

OPA status	Schedules	RD bids	Action Elia
Unavailable due to FO	0 MW	No bids available	Notification to SA, BSP, OPA

Cross-checks if rules not correct

Rules	Actions Elia
All received information are still valid even if inconsistency	Notification of inconsistence

See also Outage Planning Agent and Scheduling Agent

Checks outage planning status & RD bids

Rules

OPA status	RD bids
Available	At least one RD bid in one direction
Unavailable	No RD bids
Testing	No RD bids

Cross-checks if rules not correct

OPA status	RD bids	Rules	Action Elia
Available	No RD bids (except if not technically feasible)	Inconsistency penalty	Inconsistency penalty Notification to SA/OPA
Unavailable / Testing	With RD bids	Incoherence but valid bids	Notification to SA / OPA

Checks schedules & redispatching bids

Rules

When amendment of schedule -> RD bids volume must be updated

Cross-checks if rules not correct

Event	Redispatching bids	Action Elia
Amendment of valid schedule	Not updated after 15 min	Notification to SA to update bids due to changes in schedules

Checks Pmin Pmax & Schedules

Rules

P_min, techn <= Schedule <= Pmax,techn ; the constraint regarding Pmin tech is relaxed if there is a shutdown or start-up going on over maximum 2 days

Checks if rules not correct

Schedules	Rules	Action Elia
<Pmin_tech	If start up / shut down, accepted	OK
	If not start up / shut down, rejected	Not ok, Notification & accept but report for penalty
X >Pmax_tech	Inconsistency penalty rejected	Not ok, Notification but accept but report for penalty

New congestion indicator - CRI

The goal of the CRI is to avoid BAL actions by Elia that would aggravate a congestion issue.

The CRI is used as a **filter** on activations of energy of contracted and non-contracted aFRR/mFRR .

The CRI represents the congestion risks in a Belgium electrical zone and is determined :

- For a direction: incremental, decremental or both
- For a specific duration
- With 3 levels: Low, Medium (with a MW cap) & High

Due to freedom of dispatch in ID, CRI cannot block Intraday Schedule Amendment (>< present Red zones: external stakeholders are forbidden to change generation schedules due to a congestion)

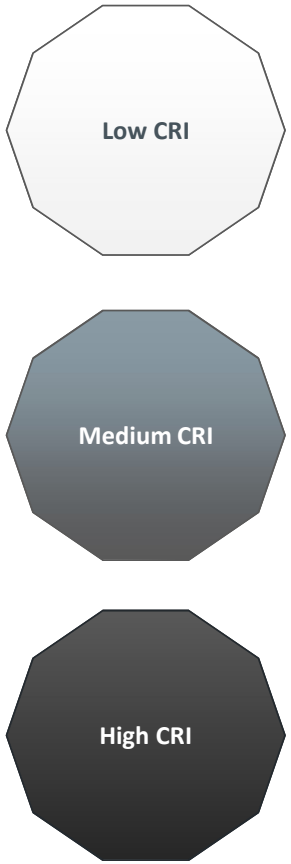
Congestion Risk Indicator (CRI)

The Congestion Risk Indicator (CRI) represents the congestion risks in a zone and is determined

… for a direction	Incremental Decremental Both incremental and decremental
… for a specific duration	Start hour – End hour
… for a geographic zone	Zones determined by NCC: • 380kV • Langerbrugge West • Langerbrugge East • Schaerbeek • Merksem • Liège • Stalen • Ruien • Hainaut West • Hainaut East

Is there (a risk for) an overload in N-1 that cannot be solved by a topological modification?

3 levels:



Unlimited flexibility for actions as no forecasted constraint

(No MW cap for actions)

Limited flexibility for actions in the direction of the constraint

(MW cap for actions > 0 MW)

No flexibility for actions in the direction of the constraint

(MW cap for actions = 0 MW)

Processes linked with CRI

Scope of iCAROS

1.	**ZONE DETERMINATION** Process to define the electrical zones subject to a level of CRI	Around once a year
2.	**LEVEL DETERMINATION** Process to define level of CRI (high, medium, low)	Once in DA Around 3 times in ID
3.	**FILTER OF BALANCING BIDS** Process to filter BAL bids based on the level of the zone	Close to real time

Scope of MARI

Determination of zones

Annual process

Determination of the zones

Approach:

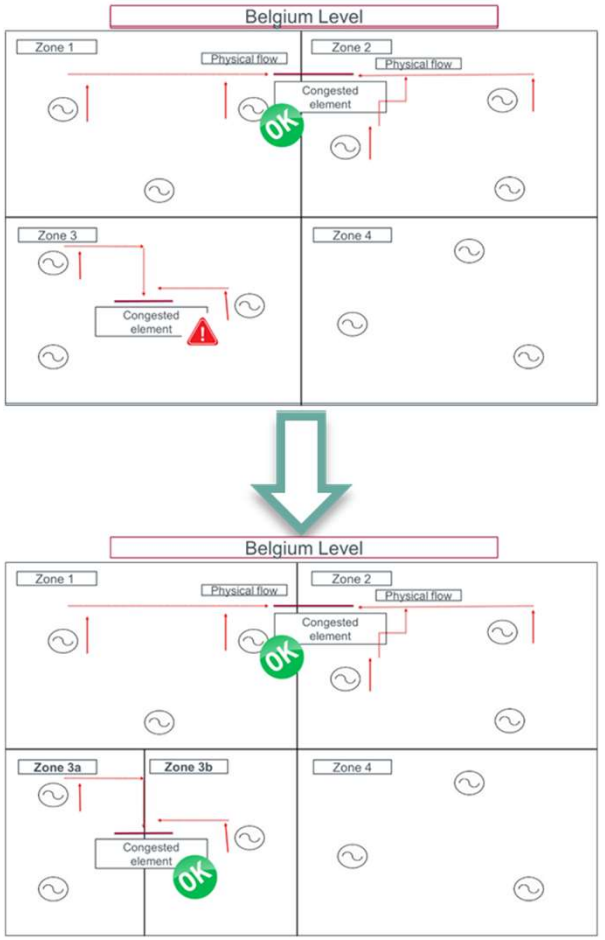
- Lines with a congestion risk are cross-electrical zone lines
- Inside a zone: copper plate hypothesis.

Concretely:

Once a year (or via a trigger), analysis of relevant congested lines based on historical values:

- Re-organization of one/multiple zones if a structural congested line is inside a zone.
- Determination of CNE* and Contingencies* via min PTDF
- Determination of a realistic MW threshold between medium and low CRI by zone

The determination of zones should allow Elia to filter out balancing bids that have relevant impact on congested elements



* Same concepts but different elements than Flow-Based

Determination of CRI level

Day ahead and Intraday process

Determination level

Determination if a risk of congestion in a zone filters out an activation of contracted and non-contracted aFRR/mFRR

High level process:

1. Global security analysis based on latest schedules: including optimization of the grid for the base case.
2. Zonal security analysis: virtual increase/decrease of production to determine a MW cap using GSK to distribute this increase/decrease in the zone.

ZONE	CRI Incre	CRI Decre	MW cap I	MW cap D
1	MEDIUM	LOW	**150 MW**	/
2	HIGH	LOW	**0 MW**	/
3	LOW	MEDIUM	/	**- 75 MW**
4	MEDIUM	HIGH	**50 MW**	**0 MW**