European Network of
Transmission System Operators
for Electricity

entsoe

Proposal for mFRR and RR Standard Products – supporting document

- draft 7 -

Working Group Ancillary Services

30 March 2016

This report is a draft report which represents the status of the discussion within ENTSO-E. It emphasizes that the choice of standard products is related to other market design decisions. Some of them are given in the report but must not be seen as necessarily comprehensive.
ENTSO-E welcomes stakeholders' reactions on any part of this report. They will be taken into account to progressively close options and converge towards a fully consistent proposal.

1. Contents

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2. abstract

Operating system, including performing balancing at the lower cost and the best security of supply level is one of the targets of the third energy package. A prerequisite of a European wide competitive balancing energy market is the definition of rules and criterions to compare the BSP and the balancing energy bids to each other.

The Network Code on Electricity Balancing written by ENTSOE in the playing field of the Framework guidelines defined by ACER requires that standard balancing energy and balancing capacity products have to be defined no later than one year after the entry into force of the network code. The early definition of these products will allow both TSOs and BSPs to consider them in their relevant processes in order to be prepared for the introduction of regional initiatives for promoting the exchange of balancing energy bids.

Starting from the actual situation where European TSOs use hundred of products which are usually close to each other but not really comparable, a subgroup of the Working Group Ancillary Services has defined a first set of standard products to fulfil the network code requirement. The inputs considered for this first draft are: (i) the network code electricity balancing, (ii) the Framework Guidelines, (iii) the Key policy issue paper, and (iv) the network code load frequency control and reserves. From these inputs, the subgroup studied or highlighted many technical points in terms of physical and financial consequences for TSOs, BSPs and BRPs. For each of them, we tried to exhaustively identify the different options and provide a conclusion or a recommendation for the definition of standard products.

The draft proposed in this report is finally composed of manual products (aFRR products will come later, due to additional technical studies needed) which mainly differ on the full activation time, the minimum delivery period and the activation process. ENTSOE remind the historical evolution of standard products either in terms on number or characteristics. Indeed initially there were 9 manually activated products (activation time from 5 minutes up to 30 minutes ; minimum delivery period from 0 minutes to 30 minutes ; activation based on predefined timestamp – so called scheduled based - or at any timestamp – so called direct activated based). Across the past months, ENTSOE has taken into account ACER, EC and stakeholder remarks in order to improve its definition and reach the most acceptable compromise solution. The products proposal has been completed after an assessment of the products with the TSO needs (included in this report). It concluded that this first draft of products is quite reasonable satisfactory for the majority TSOs to cover quite all their system imbalance.

At this point in time, products are adequate enough to ENTSOE members for a first draft. Therefore this supporting document details the approach from ENTSOE to discuss this first set of standard products with stakeholders, before launching a public consultation and submitting the proposal to ACER, as requested by the draft NCEB. Nonetheless, these technical values are only the first step in the way of processes definition for mutualisation and common activation of bids. Other processes are still to be defined like the algorithms to put in place in the Common Merit Order (CMO) lists, etc. One of the main drivers of product definition was to keep them as simple as possible, what shall enable ENTSOE to define simple algorithms to compare them and construct clear and straightforward CMO lists used for the activation. Finally, we should keep in mind that the Network Code on EB allows and promotes the periodic revision of products. Therefore, depending on learning process from pilot projects, feedback from stakeholders, future ENTSOE definition of processes, the products could be reviewed at any point in time, whereas every time it will be needed or at least once a year according to Network Code on Electricity Balancing.

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3. Introduction

In the scope of Framework Guidelines on Electricity Balancing written by ACER and published on ACER website, September 12th 2012 on the one hand and the draft Network Code on Electricity Balancing on the other hand, all Transmission System Operators have one year after entry into force of the Network Code to define a set of standard products to be used by TSO for balancing the systems.

Indeed ACER promotes the harmonisation of balancing energy products used by TSO, which is a first step before the creation of a wide balancing market. Such a European market will be the corner stone of an increased competition and reduction of balancing cost among E.U. A standard product finally consists of a balancing energy (or capacity) bid with characteristics predefined and which should be used to solve most of the capacity needs and power imbalances met in Europe.

In accordance with balancing guidelines, the target for definition of standard products should be reached close to end of year 2018 subject to entry into force of the NC on balancing expected early 2017. As such a process could be very long due: (i) the number of TSO involved, (ii) large differences between TSO to operate their system, (iii) necessary feedback or approval from Balancing Services Providers and National Regulatory Authorities, ENTSO-E Working Group Ancillary Services started to work on this issue with a target to deliver to ACER a first set of standard products as soon as possible.

ENTSOE also highlight that tight differences which could be seen insignificant in the products could be explained by ongoing discussions and definition of pricing and algorithm principles (for instance definition of direct activated or block products).

4. Glossary

Definition used in this paper mainly come from LFCR and NCEB codes. They are reminded below for clear understanding:

Guidelines Electricity Balancing

Activation Optimisation Function means the role to operate the algorithm applied for the optimisation of the activation of Balancing Energy bids within a Coordinated Balancing Area.

Allocated Volume means an energy volume physically injected or withdrawn from the system and attributed to a Balance Responsible Party, for the calculation of the Imbalance of that Balance Responsible Party.

Balance Responsible Party means a market-related entity or its chosen representative responsible for its Imbalances.

Balancing Capacity means the contracted Reserve Capacity.

Balancing Energy means energy used by TSOs to perform Balancing.

Balancing Market means the entirety of institutional, commercial and operational arrangements that establish market-based management of the function of Balancing within the framework of the European Network Codes.

Balancing Services means either or both Balancing Capacity and Balancing Energy.

Balancing Service Provider means a Market Participant providing Balancing Services to its Connecting TSO, or in case of the TSO-BSP Model, to its Contracting TSO.

Common Merit Order List means a list of Balancing Energy bids sorted in order of their bid prices, used for the activation of Balancing Energy bids within a Coordinated Balancing Area.

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Connecting TSO means the TSO which operates the Responsibility Area in which Balancing Service Providers and Balance Responsible Parties shall be compliant with the terms and conditions related to Balancing.

Deactivation Period means the time period for ramping, from full delivery or withdrawal back to a set point.

Delivery Period means a time period of delivery during which the Balancing Service Provider delivers the full requested change of power in-feed or withdrawals to the system.

Divisibility means the possibility for the TSO to use only part of the Balancing Energy bids or Balancing Capacity bids offered by the Balancing Service Provider, either in terms of power activation or time duration.

Exchange of Balancing Energy means the process of instructing the activation of Balancing Energy bids for the delivery of Balancing Energy by a TSO in a different Responsibility Area or Scheduling Area when appropriate, than the one in which the activated Balancing Service Provider is connected.

Exchange of Balancing Services means either or both Exchange of Balancing Capacity and Exchange of Balancing Energy.

Full Activation Time means the time period between the activation request by TSO and the corresponding full activation of the concerned product.

Imbalance Adjustment means an energy volume representing the Balancing Energy from a Balancing Service Provider and applied by the Connecting TSO for an Imbalance Settlement Period to the concerned Balance Responsible Parties, for the calculation of the Imbalance of these Balance Responsible Parties.

Mode of Activation means the implementation of activation of Balancing Energy bids, manual or automatic, depending on whether Balancing Energy is triggered manually by an operator or automatically by means of a closed-loop regulator.

Preparation Period means the time duration between the request by the TSO and start of the energy delivery.

Requesting TSO means the TSO that requests Balancing Energy.

Specific Product means a product different from a Standard Product.

Standard Product means a harmonised Balancing product defined by all TSOs for the Exchange of Balancing Services.

Validity Period means the time period when the Balancing Energy bid offered by the Balancing Service Provider can be activated, whereas all the characteristics of the product are respected. The Validity Period is defined by a beginning time and an ending time.

System Operation Guidelines

Time to Restore Frequency means the maximum expected time after the occurrence of an imbalance smaller than or equal to the Reference Incident in which the System Frequency returns to the Frequency Restoration Range for Synchronous Areas with only one LFC Area; for Synchronous Areas with more than one LFC Area the Time to Restore Frequency is the maximum expected time after the occurrence of an imbalance of an LFC Area within which the imbalance is compensated; and

Virtual Tie-Line means an additional input of the controllers of the involved areas that has the same effect as a measuring value of a physical Tie-Line and allows exchange of electric energy between the respective areas.

Automatic FRR means FRR that can be activated by an automatic control device;

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Frequency Restoration Reserves (FRR) means the Active Power Reserves activated to restore System Frequency to the Nominal Frequency and for Synchronous Area consisting of more than one LFC Area power balance to the scheduled value;

Replacement Reserves (RR) means the reserves used to restore/support the required level of FRR to be prepared for additional system imbalances. This category includes operating reserves with activation time from Time to Restore Frequency up to hours;

Precisions, additional definitions

Minimum delivery period
means the minimum time period where the Balancing Service Provider could be requested by the TSO to physically deliver the full requested change of power in-feed or withdrawals to the system**.**

Maximum delivery period
means the maximum time period where the Balancing Service Provider could be requested by the TSO to physically deliver the full requested change of power in-feed or withdrawals to the system**.**

Minimum delivery period and maximum delivery period are defined by the TSOs as standard products characteristics. Most important points agreed are:

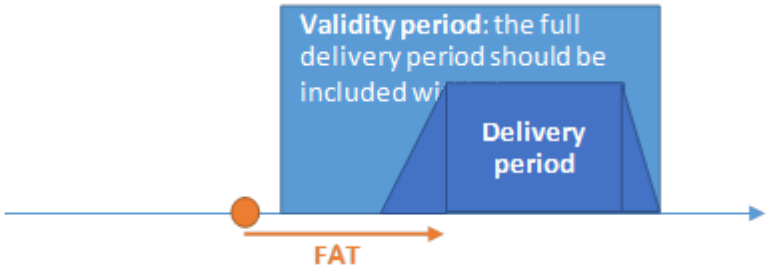
(i) that min/max values are defined by TSOs as a standard characteristic, to allow comparable products and price ranking activation principle ;

(ii) that min/max delivery period refer to physical delivery;

(iii) that the exact duration of the product will be defined by the TSO when the bid will requested for an activation. Requested duration will obviously be between min and max.

Full delivery period
refers to the time period starts at the beginning of the ramping period and ends at the end of the deactivation period. Both **ramping periods** are defined by the standard product**.**

Validity period
is a time period defined by the BSP by a beginning and an ending time. The validity period reflects the time period where the BSP could provide balancing energy through this bid, and should therefore be at least the full delivery period of the bid.



5. Inputs and reasoning for products

Inputs from Guildelines Electricity Balancing

Targets
The network code on Electricity Balancing promotes the introduction of standard products in order to enhance competition between BSPs. Such a principle means that the majority of BSPs should be able to participate, should they be from conventional units, renewable units, demand side or other. From TSO side, a wide and competitive market should be reached to cover the TSO balancing needs.

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The article 31.6 summarizes this requirement in: "*Standard Products for Balancing Capacity and Standard Products for Balancing Energy for Frequency Restoration Reserves and Replacement Reserves shall:*

(a) ensure efficient standardisation and foster cross-border competition, liquidity and avoid undue market fragmentation;

(b) facilitate the participation of demand facility owners, third parties and owners of power generating facilities from renewable energy sources as well as owners of storage elements as balancing service providers;

(c) satisfy the needs of TSOs in order to ensure operational security and efficiently fulfil frequency Quality Target Parameters and reserve capacity requirements pursuant to [Article 19 frequency Quality Target Parameters, Article 46 FRR Dimensioning and Article 48 RR Dimensioning of the Regulation on Load-Frequency control and reserves].

Conclusion

- ENTSOE defines the standard products in accordance with TSO needs and in order to respect LFCR network code, in line with Article 31.6.c.
- Proposal of standard product is from TSO point of view, also in line with articles 31.6a and 31.6.c but should be discussed in detail with stakeholders in order to receive their feedback and proposals for possible improvement

Shapes of products

Balancing Energy is energy produced by a BSP, activated by manual or automatic order from the TSO for the purpose of system balancing. Balancing Energy can be provided by units or assets which were contracted for Balancing Capacity as well as other units.

The shape of the standard product is defined in Network Code Electricity Balancing article 29.5 as follow: "*The list of Standard Products for Balancing Capacity and Standard Products for Balancing Energy shall define at least the following standard characteristics of a bid by a fixed value or an appropriate range:*

(a) Preparation Period;

(b) Ramping Period;

(c) Full Activation Time;

(d) minimum and maximum quantity;

(e) Deactivation Period;

(f) minimum and maximum duration of Delivery Period;

(g) Validity Period; and

(h) Mode of Activation."

This could be illustrated by the hereafter figure.

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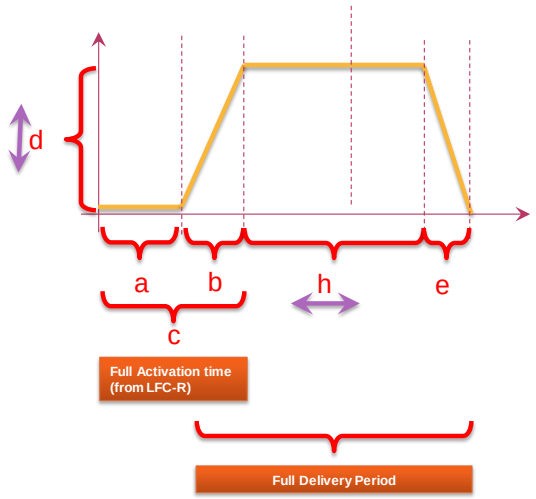
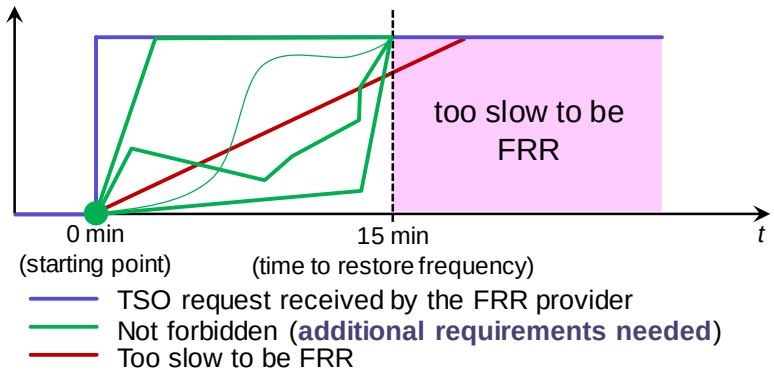


The target of standard product definition will be to harmonise values for the above mentioned parameters in order to allow the products to be price or cost ranked (the ranking method – price or cost – will be defined later on, during definition of algorithm principles, according to requirement from article 66.1.d of NCEB: "*No later than one year after the entry into force of this Network Code, all TSOs shall jointly define principles for each of the algorithms applied for the following functions: .../... (d) Activation Optimisation Function.*"

Inputs System Operation guidelines

The system operation guidelines merge several draft network codes written over past years by ENTSOE. Among these codes, Network Code Frequency Control and Reserve one provides many requirement to be respected in order to manage the system while respecting frequency quality targets and is considered as an input to design the standard products. Indeed the products shall be used in order to restore system frequency and energy exchange after a fixed time period following an expected or unexpected event. This time target is called Time To Restore Frequency (TTRF). The direct consequence for product is: all products with a Full Activation Time lower than Time ToRestore Frequency are called Frequency Restoration Reserve products.



In the first ENTSOE version of this network code, the time to restore frequency was defined per synchronous area, as reminded below:

time to restore frequency, depending on synchronous area, according to LFCR code – version 2013

Continental Europe	Great Britain	Ireland	Nordic
15 minutes	10 minutes	20 minutes	15 minutes

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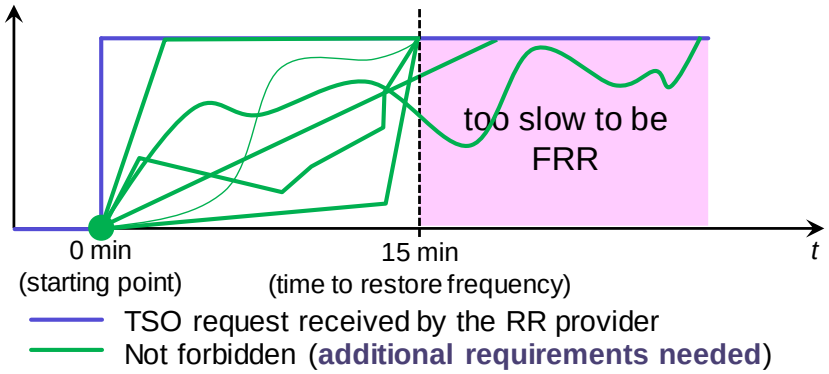
Across discussions between ENTSOE, ACER and EC this table has been submitted to discussion and evolutions. The expected target is now to define a harmonised **TTRF in Europe and to reach the value of 15 minutes**. Indeed an harmonised TTRF will lead to define less standard products and therefore allow for a more liquid market.

In addition to this requirement for full activation time of mFRR products in each synchronous area, we highlight that some TSOs use Replacement Reserve process. Therefore, to comply with these TSO needs and processes, ENTSOE has to define RR products. For RR products, all Full Activation TimesTime are accepted.



Minimum requirements

- At least 1 product with a Full Activation Time which reflect the Time to Restore Frequency : 15'
- At least 1 RR product

This list is a minimum requirement and does not exclude additional products definition. The reason for this is that TSOs should have the right to power balance their system with the most relevant and economically efficient products . For instance fast mFRR balancing energy products may be cheaper (due to local energy mix) than balancing reserve and/or balancing energy aFRR products that otherwise would be needed. Moreover independently of the product name, and the related FAT, the TSO should respect the Time To restore Frequency (TTRF) to recover the Control Block imbalance. It means that any processing time for identification of TSOs power needs, Activation Optimisation Function, or TSO to BSP activation order emission should be considered in the overall process.

In case a TSO uses a combination of aFRR and mFRR to respect TTRF, one mFRR 15 minutes FAT standard product is not enough. There should be at least two products and one of them should have a faster FAT than 15 minutes. If only one mFRR standard product is defined, then the FAT of this product should be lower than 15 minutes to take into account the necessary processing time

Minimum requirement

- at least one standard product should have a FAT lower than 15 minutes.

Technical aspects for products

Blocks and physical products

ENTSOE proposes to make a difference between two approaches for products definition which mainly have consequences on expected power, energy delivery by balancing services providers and impact on settlement with balancing service providers, balancing responsible parties and between TSOs.

On the one hand there are the so called physical products. The expected delivery of a physical product is characterized by values of finite ramps either when starting or stopping. The consequences of a physical product for TSOs, due to the consideration of ramping, is that the settled energy both between the TSO and the BSP and between the TSOs is done according to ramp-up and ramp-down rates. The duration of

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ramping period could be either defined by BSP (as long as it is lower than full activation time) when offering the bids and therefore reflecting its ramping characteristic, or predefined ex ante for instance by the calculation of an average value, which do not necessarily correspond to all individual BSP capabilities (but for instance to the expected average ramping capability of the BSPs). In the former case there is a clear incentive to the BSPs to deliver power based on the BSP-declared ramp, whereas in the latter case there is the incentive to deliver power based on the ex-ante defined ramp.

On the other hand, there are block products. In opposition to physical products, the settled products does not includes ramps and the product is therefore designed with infinite ramps rates. Consequences of such products for TSOs are that the settlement between TSOs is done according to infinite up and down ramp, whatever the real delivered product is. There may or may not be additional physical reaction requirements (will be verified during pre-qualification). It is a clear incentive to deliver power very close to the block product defined in order to avoid unsettled balancing energy provided on the one side, and imbalances on the other side. Consequently block products seems to be most attractive for fast ramping units or demand, while there is no settlement an imbalance adjustment of ramps.

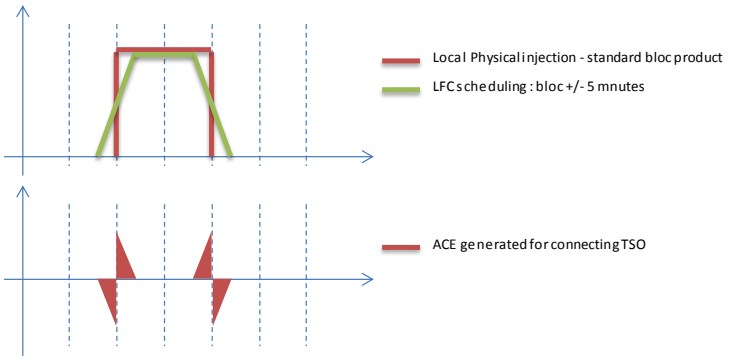
Physical or block products are distinguished by:

- the way the energy delivery is settled (taking into account declared or predefined ramps – infinite is also included in the latter). For physical product, the settlement may impact the imbalance settlement period prior and after the delivery period, meaning more ISPs than for block products. Indeed in the latter case only the ISPs containing delivery period are affected by settlement,
- and by the physical exchange between the TSOs (that is the adjustments in the secondary controllers). The difference is indeed in the incentive given to BSPs for their ramp up/ramp down behaviour.

ramping

ENTSOE welcomes inputs, advantages / disadvantages for each method and expect stakeholders to provide their opinion on this topic.

Whatever the final shape of the product will be, we can highlight that the closer the BSP physical delivery will be from the cross border exchange, the better it will be for the connecting TSO. Indeed if this equality is not verified, then it will generate ACE for the connecting TSO as presented in the picture below. The cross border exchange on the LFC controllers of the TSOs and the actual physical delivery of the BSPs should be near, therefore this can be achieved either by bringing the nearer the physical shape to the LFC controller XB exchange or the XB exchange of the LFC controller to the actual physical delivery.



We can assume that the settlement principle to BSP and BRP will impact the physical delivery of the BSP (when BSPs are flexible enough to react based on a signal curve). For instance, if we settle physical products, then the BSP will be fostered to provide balancing energy linked with this settled energy. Therefore it is interesting for TSOs that local physical delivery is close to XB exchange shape. Moreover it is more comfortable for the TSO to have BSP physical delivery close to cross border exchange shape.

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Indeed in such a case, whatever the origin of the bid is (local or from abroad), the injected or withdrawn power profile will be identical. Note that to verify equality (or near equality) between these parameters, we can bring nearer physical shape to XB exchange, or XB exchange to physical shape.

To minimize the volumes of ACE generated by difference between XB exchange and local physical shape, we should seek for ramps symmetrical from both part of ISP boundary.

Direct activated and scheduled products

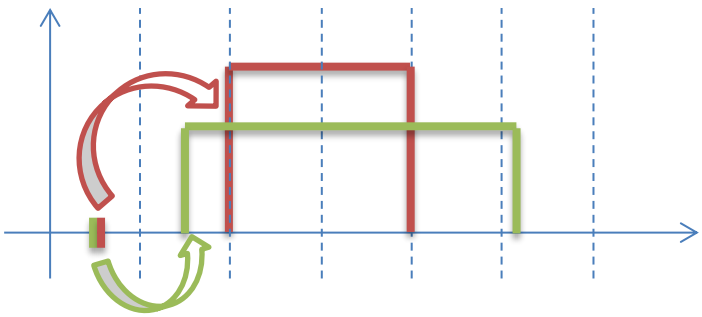
A schedule-based activation is a standard product which is exchanged via a schedule change:

- as part of the set point (In fact, when operating a virtual tie line not the SETPOINT Pset is adapted (this would imply a change of schedules according to the respective confirmation rules (see Policy 2), but a virtual measuring value Preal* is introduced and added to the other physical measuring values on the boundary of the control block) of the load frequency controller of the LFC area in case of exchange of Balancing Energy between LFC areas (called "virtual tie line")
- as part of the set point of the HVDC controller in case of exchange between non-synchronous areas
- or based on the scheduling time period through scheduling process of LFC controllers of relevant LFC areas

The main characteristic of a schedule product is that beginning and ending of the activation period should be based on the scheduling time interval (can be scheduled for the duration of one or more time periods until it does not interfere with cross zonal intraday as defined in paragraph 3.3.2), currently defined in Europe to 1 hour or 15 minutes depending on TSO and borders. This kind of product is in this way similar to market products.

A direct activation is a standard product that is activated and deactivated (means requested from TSO to BSP) at any point in time. Such a product can be activated and exchanged between TSO very close to real time (depending on technical characteristics of the product) because it does not need to be activated through a scheduling process.

Clarifying these definitions, it is important to remember that the supply and demand balance is a continuous real time process and, depending on the imbalance event to cover, can be forecasted (e.g. consequent evolution of load within an imbalance settlement period) or not (e.g. generation unit tripping). Transmission System Operators have different needs, and either scheduled products or directly activated products or both are currently used. (aFRR and) mFRR should be activated through a fast scheduling process in order to restore frequency, while RR could be activated with a slower method.



Moreover, it should be noted that the scheduling time period for exchange of balancing energy bids should be as short as possible in order to activate products which are as close as possible to the TSO needs.

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Direct activation product

- at least one direct activated manual product is needed since some TSOs balance their system with a combination of aFRR and mFRR products. All TSOs should be able to respect LFCR requirements with these products

Links between bids

During the discussions held within the ENTSO-E subgroup, it has been highlighted that it would be beneficial to allow proposing bids which are linked together. The possibility of linking bids means that a bid could be activated (or not activated) only if another have been previously activated (or not activated) or that the activation of two bids is mutually exclusive at the same period (only one can be activated).

The link between bids is pushed to allow:

- To clearly include the starting cost or allow the management of power limits of a generation unit when needed (e.g. price of bid "1" is 70 €/MWh and include a starting cost of 1000 € while price of bid "2" is only 50 €/MWh. There is no starting cost, only energy but the use of this bid is submitted to the previous activation of bid "1").
- To allow BSP to manage energy constraint when offering their bids (e.g. for a bid able to deliver 100 MWh, BSP could offer bid "1" at 400 MW during 15 minutes or bid "2" at 200 MW during 30 minutes. BSP do not ex ante know which one of these bids is the more convenient for the TSO, linking bids together allow to offer all flexibility)
- The first one is a limitation in time, e.g. bid B from 13:00 – 13:15 is only available, if bid A from 12:45 – 13:00 was not activated. These bids are interesting for technologies which have a small storage, e.g. water power plants or demand side response

The links between bids finally allow BSPs to offer more flexibility, maximise the opportunity to be activated by fitting with TSO needs, reduce costs of balancing and contribute to an efficient and competitive balancing market. TSO also find an interest because it could potentially increase the volume of available bids in one CMO, therefore system security could be better ensured at a lower cost due to the increased competition between BSPs.

Linking bids mainly consists of three simple links which are:

A. If bid "1" is activated, then bid "2" is unavailable (exclusive choice between bid "1" & "2")
B. If bid "1" is activated, then bid "2" is available (bid "2" submitted to activation of bid "1").
C. If bid "1" is activated, then bid "2" should be activated (necessary activation of 2 bids in one shot)

Cases A & B could be applied to link the bids in terms of power. Case C is only a temporal link between bids (time sequence in activation of balancing energy bids).

The following restrictions as defined for links between bids:

- The links between bids should not be allowed for aFRR bid. Indeed, as explained in the paragraph above the link between bids allow the management of power limits and energy constraints, while the aFRR consists of bids which should be divisible (no power constraint) and activated for long duration (e.g. up to 24 hours a day). Therefore there is no reason to allow the linking of bids for aFRR.
- The temporal links between bids should not be allowed in those CMOL which use a simple merit order activation principle.

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- The temporal linked between bids (type C) could be allowed only for those CMOL which use a discrete clearing selection principle with activation duration based on multiple of bids duration (e.g. activation for 1 hour, based on fifteen minutes bids).

- In order to simplify the selection of bids algorithm principles, the links between bids of several CMOs will not be allowed, at least at the entry into force of the products. Depending of needs, easiness to implement and benefits, this proposal could be reconsidered in ongoing proposal for evolution of standard products and algorithms.

- Links are only allowed for those bids which can be activated in the time interval between two intraday cross zonal gate closure time, and not between bids which could overlap with intraday. Indeed the selection process of bids only refers to the bids offered for the next balancing period (i.e. after intraday GCT until the next one) and no links between several periods will be considered for simplicity reasons.

- At this point in time, there is no reason to limit the number of links for one bid with others.. Nevertheless, this point could be submitted to evolution in case TSOs identify that the number of link between bids affects too much the complexity of the selection process and the clearing time duration of the clearing algorithm.

Links

- Kinds of links could be exclusivity, necessary joint activation, or availability under condition
- Temporal links (case C) between bids are only allowed for clearing process bids selection.

6. Characteristics - General features

This chapter is composed of general features which are valid and generic for all products, and characteristics only valid for the proposed product

Minimum bid size

is proposed to be set at a maximum of 1 MW.

minimum bid size

- a bidder should offer a bid with at least the minimum bid size,

Maximum bid size

is proposed to be set at 9999 MW. In a way, it reflects the absence of value but allow IT teams to define something when programming algorithms.

Maximum bid size

- a bidder should not offer a bid larger than 9999 MW
- bids should be interger values (not decimal)

The addition of preparation time and ramping period results in the full activation time.

Ramping period, preparation time and full activation are complementary values. Therefore, when defining two of these values, the entire timing of the product is clear and defined. For manually activated standard products (mFRR and RR), only the full activation time will be defined as a requirement by TSOs. When

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offering flexibility, each BSP will be entitled to split this time duration into a preparation period and a ramping period.

The full activation time will be verified for prequalification of bids, while preparation periods and ramping will be required for information but not necessary used.

Full Activation Time, preparation period and ramping period

- Full activation time will be defined for each standard product, with a variety of values in order to give the opportunity for participation to a large number of BSP
- Admissible preparation time and ramping period will be defined by each TSO and used for both prequalification and bid submission process

Location of the bid

means, from common merit order side, to be aware where the bid is located. Indeed, the bid selection algorithm will need to comply with operational security limits and more specifically the cross zonal capacities and possibly internal constraints. Therefore the minimum information required for the location value is the bidding zone. In addition, we noted that some bidding zone are wide and include many TSOs, therefore we propose to complete the location information with connecting TSO name. Moreover, depending on the design of the local market (number of bidding zones, central dispatch versus self dispatch, portfolio bidding …) additional information may be needed and requested by the Connecting TSO in order to efficiently balance its system and clear local network congestions.

location

- should consist at least of bidding zone and the Connecting TSO. Information is to be completed by the BSP when offering the bid
- the TSO may require additional information in order to perform local security calculation for grid constraint management and precise local activation when needed

Price

of the bid is defined by the BSP while respecting the terms and conditions defined in the COBA. The price could be positive or negative.

Divisibility of bids

Management of the system balance with automatic FRR usually leads to activate partially the bids in order to solve the imbalance with the highest accuracy as possible. The consequence is automatic activated bids (i.e. aFRR) should be divisible. It is requested by the TSO and it is necessary if a BSP wants to offer such a bid. Such a requirement should not raise concerns from BSP side due to the behaviour of installed load frequency controller's regulations.

On the other side for manual activated bids, even if TSO are still interested to activate only a part of the bid, BSP are not always in the position to deliver a partial bid (e.g. a single generation unit is often able to be stopped or deliver nominal power, but nothing else. It could be in the absence of adequate regulation process or due to the machine itself). Therefore, in order to collect as much bids as possible and increase competition between BSPs, TSOs can only foster BSP to offer divisible bids but not make this mandatory for manually activated bids.

divisibility

- bids could be marked as divisible by BSP when offering the flexibility at GCT.
- divisibility is not mandatory, but divisible bids offered by BSP maximise the opportunities to be activated.

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Minimum and maximum Delivery period duration

of the bid is a standard characteristic defined by TSOs in order to request that BSPs should be able to deliver energy, at least (resp. up to) equal to the Minimum (resp. maximum) Delivery period, meaning that no BSP unable to provide balancing energy for a duration of at least (resp. up to) the minimum (resp.maximum) delivery period is entitled to propose a bid. TSO will request an activation within the range minimum delivery period - maximum delivery period.

Minimum delivery period

- is the lower standard characteristic define as the time limit for the BSP to be able to provide energy and the TSO to request balancing energy
- will be defined per standard product

Maximum delivery period

- is the upper standard characteristic define as the time limit for the BSP to be able to provide energy and the TSO to request balancing energy
- will be defined per standard product

In addition of the definition themselves, ENTSOE worked on the values of minimum and maximum delivery periods. The following lines describes how did we proceed to conclude on this topic. Main inputs for definition of duration are (i) ISP duration; (ii) XZGCT; (iii) balancing principle (interaction BRPs / TSO).
As a principle is to avoid overlap with intraday, duration of balancing product has to be aligned with min GCT of ID to make product compatible. This is a minimum requirement for products duration. The balancing network code and CACM network code require IDCZGCT: GCT for balancing is not before the id GCT (60mins) and before real time. At the moment Shortest IDCZGCT is 45mins. Therefore if we stay with current situation, we conclude that longer products (highest value for max delivery period) should not exceed 45mins if such a product should be used across entire Europe (meaning mFRR).In addition to this requirement for a limit regarding delivery period, we discussed the possibility to develop products which fits with maximum number of TSO needs. We identified 3 options…

- Define several products to cover different needs (e.g. one product with 15-30 minutes delivery period and one product with 30-45 minutes duration delivery period). This first option hashave the disadvantage to increase the number of products (not compliant with ACER request nor with development of liquid European wide market), and is therefore not suitable for a European implementation
- Define only one product with a very wide range of delivery period (e.g. 0-45 minutes) to cover all TSOs needs. This options leads BSPs to offer very flexible bids which are not available everywhere in Europe (e.g. depending on energy mix). It is finally counterproductive and against developing liquid market. Moreover these products could be too flexible for some TSOs which do not require the full range of delivery. In such a case it will unduly increase local procurement cost and the balancing GCT would unnecessarily far from real-time (potentially impacting local ID markets). This solution to cover all balancing needs seems not relevant as well.
- Define only one product with a range which covers needs of majority of TSOs. It will lead to define some specific products if needed. This is the compromise found by ENTSOE to define the minimum and maximum duration.

We should also consider the ISP duration to define the minimum and maximum delivery period. At this point in time and even if a Cost Benfit Analysis is still pending on this topic, ENTSOE assumed (for the definition of standard products) that the ISP duration will be 15 minutes.

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By this we define the duration of scheduled standard products to be equal to ISP duration.

Regarding direct activated product, we firstly assumed that a direct activated product will ever stop at the end of an ISP boundary. Indeed such an assumption allow the TSO to activate scheduled balancing energy bids after the activation of a direct activated product, or let the BRP balance the system in intraday. Once we defined the maximum delivery period we focused on the minimum value. We propose to define the minimum delivery period of the Direct Activated standard products with the same value as the Full activation time. This principle leads to define standard direct activated products which last between one ISP duration (assumption ISP is 15 minutes), and up to ISP duration added of product FAT.

Values for delivery period

- product with 15 minutes FAT could last between 0 and 30 minutes. The final range for activation time is still under discussion.
- product with 10 minutes FAT could last between 10 and 25 minutes The final range for activation time is still under discussion.
- product with 5 minutes FAT could last between 5 and 20 minutes The final range for activation time is still under discussion.
- do stakeholder share the delivery period definition principle and the final result? Otherwise, what are the proposed methods and expected values from stakeholder point of view to cover the largest number of TSO needs?

7. Behind the products characteristics

It has been discussed that the definition of products characteristics were not sufficient to define the standard products. Indeed the settlement, imbalance settlement and algorithms principles were required at least for discussion to understand the overall process and provide the level playing field for stakeholders. This paragraph focus on these topics.

Settlement of balancing energy bids overlapping several ISPs (for direct activated products)

We consider balancing energy from only one product. The issue of how to deal with balancing energy from different products will be treated after an agreement is reached on how to price balancing energy from one product, because pricing of multiple (bid) products significantly increases complexity. As the topic is focused on settlement of balancing energy, the use of multiple Merit Order Lists or affecting more bidding interval is out of scope of this memo. Bids valid for many hours are included, as they can be seen as a series of bids for consecutive ISPs.

Balancing service providers (BSP) offer their willingness to inject or withdraw power or energy on request by the system operator, and to settle the resulting balancing energy with the connecting system operator (TSO). BSP's announce this willingness by placing balancing energy bids to their connecting TSO.

A balancing energy bid is an option offered by the BSP to the TSO to a transaction in balancing energy between BSP and TSO. Balancing energy reflects relative injection or withdrawal (NCGL EB ART 56, 2 (c)), which means that in principle balancing energy bids are impartial to the kind of material resources used by a BSP. The BSP expresses in its bid prices (ART 32; 5 (a), SD - € /MWh) the price that the BSP (at least) wishes to receive in case of relative injection, or at most wishes to pay in case of relative withdrawal, for the balancing energy activated by the TSO from this balancing energy bid. Balancing energy bids become firm at balancing energy gate closure time (ART 35, 3); this means that the bid parameters, including bid price, cannot be changed anymore by the BSP.

The option thus gives the TSO the right to activate balancing power or energy from the BSP, in a specific direction, up to a certain volume of power or energy, and on activation, the obligation (ART 56, 3) to settle

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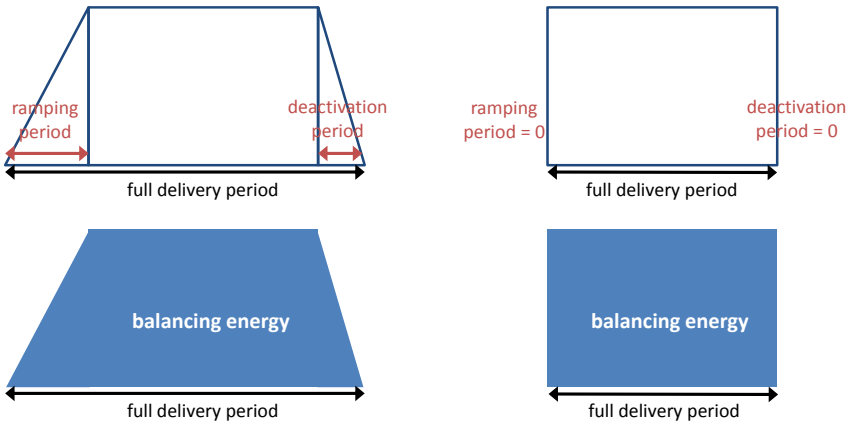
the ensuing balancing energy per ISP (ART 56, 2) with the BSP. The option also gives the TSO the obligation to adjust, on activation of the bid, the activated balancing energy volume on the imbalance of the concerned BRP (ART 60), which is outside the scope of this memo.

As previously detailed in this document, the full delivery period contain the delivery period and defined ramps as well, as reminded by the pictures below.

According to the defined standard product, the full delivery period starts at the end of the preparation period (after activation), and thus at the beginning of the ramping period. The full delivery period ends at the end of the deactivation period.

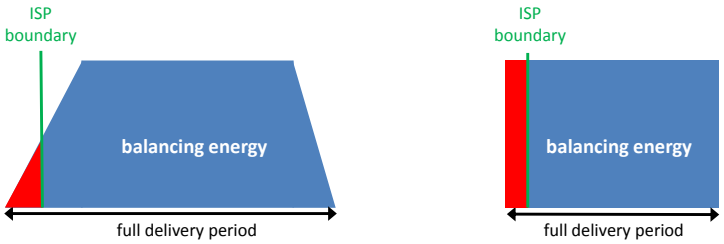


Balancing energy from standard products left with, a defined ramping period and a deactivation period right w/o ramping period and deactivation period.

Note that:

- All balancing energy from an activated standard product is delivered within the full delivery period.
- No balancing energy is delivered outside the full delivery period.
- The volume of balancing energy can be geometrically determined.

The position of start and end of the full delivery period determine in which ISPs the energy from this bid is delivered, and therefore with which ISPs the delivery has an overlap. The definition of overlap may require more detailed attention at a later stage (resolution of temporal overlap of full delivery period and ISP, in minutes or seconds, or resolution of volumetric overlap as in minimal required volume of balancing energy in kWh/ISP).



Application of minimum requirements to the definition of balancing energy; red area is **not** balancing energy

Balancing energy settlement prices

In pay as bid, separate balancing energy settlement prices may apply within an ISP, one per bid.

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Note that:

- The bid price of a balancing energy bid is a BSP determined property of all balancing energy activated from that bid.
- Balancing energy is settled by the TSO with the BSP per ISP against a TSO determined settlement price for that ISP.

Under marginal pricing (which is the default requested pricing method set by the guidelines electricity balancing), bid prices of all balancing energy per ISP contribute to setting a marginal price for that ISP, regardless of when it was activated, and all this balancing energy is settled against that marginal price for that ISP, regardless of when it was activated.

As a consequence this marginal price for balancing energy for an ISP is therefore fixed only when no longer balancing energy bids can be activated that contribute balancing energy to that ISP.

Options for marginal pricing for balancing energy

Note : In the following, the reference to the ramping period is when this is requested by the TSO and it would constitute a product characteristic (e.g. in case of physical product)

Option 1: all is balancing energy

Define all energy delivered within the defined profile of a standard product as balancing energy, and treat it as such according to the GL/NC EB.

Option 2: Distinguish non-balancing energy as a result of activation of a standard product

.

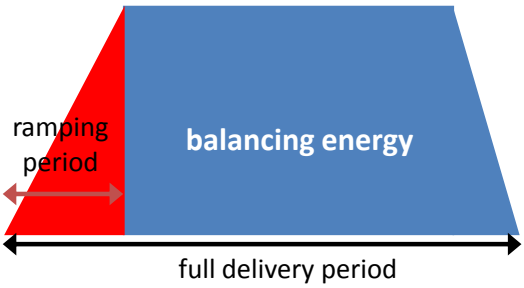

Figure 5: Distinguishing energy delivery during ramping period (red) as not balancing energy (red)

Energy delivered during the ramping and deactivation periods are not balancing energy, but an unintentional by-product of the balancing action. GL/NC EB thus does not give an unambiguous answer on how to treat the ramping and deactivation periods, which is one of the issues in this memo. By not being designated balancing energy these volumes do not contribute to price setting, nor do they need to be settled as balancing energy under pay as clear marginal pricing. In fact by not designating this as balancing energy it is out of scope of NC/EL EB. On the other hand this solution may require improved definitions for standard products.

Pricing and settlement ramps

If not all energy that is delivered as a result of the activation of a bid, is defined as balancing energy (as described in Option 2 above), it is necessary to define if and how this energy should be priced and settled. Three options are considered here, but there will also be other possibilities.

Option 2.a The energy is not settled

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This is not a logical option as long as the ramping and deactivation periods are defined in the product. The BSPs would then be required to deliver the energy, but not be paid for it. They would of course need to include their costs for ramping and deactivation in their bid prices. Still their actual behavior would depend on the relation between their costs and the expected price for balancing energy, and thus become unpredictable.

Option 2.b Settlement according to the balancing energy price

The prevailing balancing energy price is used. This is straight forward in all situations where this price is higher than the bid prices of the bids that are ramping or deactivating. Whenever these bid prices are higher, the BSPs will receive a price that is lower than their bid price, and therefore potentially their cost. Especially high cost BSPs would need to take into account that they may lose money during these periods, and take that into account when preparing their bids. So although there is a risk, it can be controlled by the parties who face this risk.

- For the TSO there is no risk, as it never pays more than it receives. It is therefore not necessary to design a solution to handle the excess revenues to the TSO.
- Apart from the fact that the ramping and deactivating bids do not contribute to price setting, this approach is also close to the intentions of the GL/NC EB because of the use of the marginal pricing principle

Option 2.c Settlement according to the bid price

Using the bid price implies that the Pay As Bid (PAB) principle is used for the ramping and deactivation periods. The advantage of this is that the risks for the BSPs is reduced. They will never lose money during ramping and deactivation, provided their bid prices is at least equal to their cost.

There are disadvantages to this approach:

The TSO may have additional costs (depending on how the imbalance price is determined), because some bids will get paid more than the balancing energy price. If the imbalance price is equal to the BE price, the TSO will have a loss that needs to be compensated in some way. This can be done, but increases complexity.

The PAB principle is not favored in the GL/NC EB.

Option 3 Redefine the ramps

"Redefining the ramps" means to convert the ramping and deactivation periods into rectangles with half the duration and the same volume. This is an obvious solution in the case of scheduled products when the ramps are symmetrical around the start and the end of the ISP, because this will convert the physical delivery into a block within one ISP. The principle is illustrated in the following figure:

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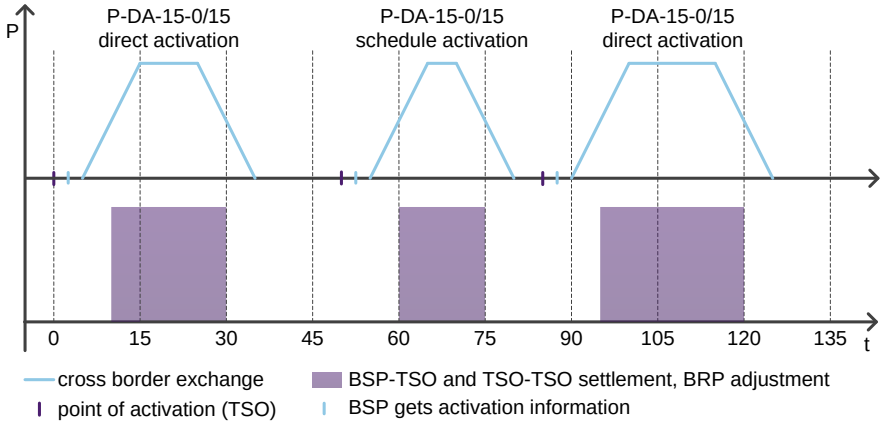

figure : Redefinition of ramps, three examples (from Memo "Combination of a direct and schedule activated product")

The centre figure shows the results for a scheduled product. When the ramp does not cross an ISP border, the redefinition of the ramp has no effect on settlement.

It is proposed that the imbalance of the BRP is calculated on the basis of the original ramp. The result of this is that the BRP is compensated for the expected ramp. If the BSP is also BRP, it will have an incentive to follow the ramp. However, the price it receives may be different from the price in the ISP the energy is delivered if the ramp crosses an ISP border.

This option can be considered in to versions

Option 3a Redefine the ramps - with BRP adjustment

Position of BRP is adjusted (Imbalance Adjustment) only in the requested delivery period, which means that there will be no adjustment in ISPs in which BSPs only ramps up and down and which not coincide with delivery period.

Option 3b Redefine the ramps – with BRP adjustment

Position of BRP is adjusted (Imbalance Adjustment) in all ISPs which coincide with full delivery period. Which means that delivery of energy during ramping and deactivation period is also taken into account in adjusted BRP position (see Figure 7 below).

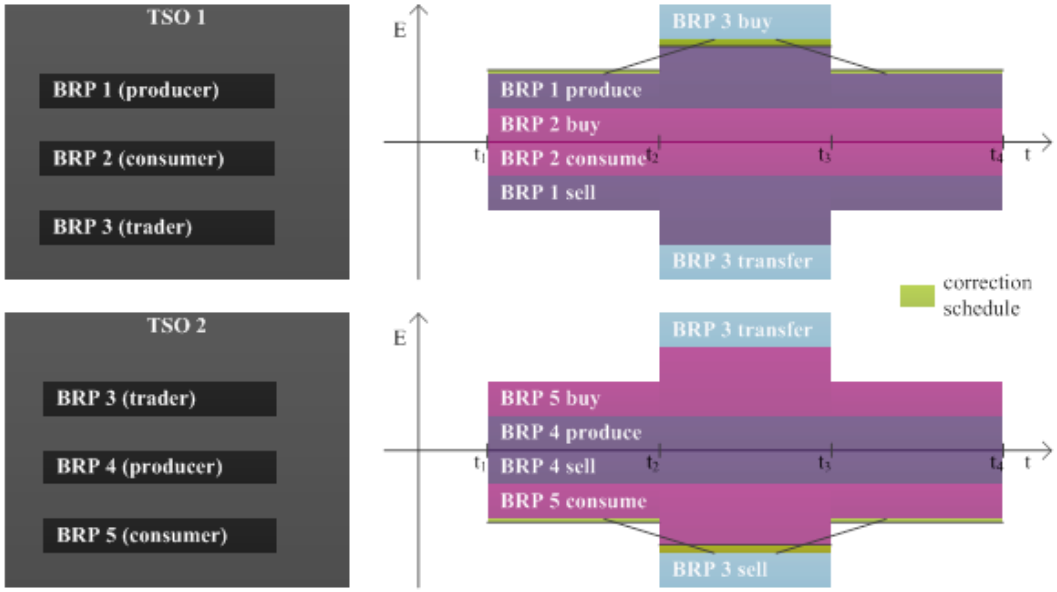

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Figure 7: Adjustment of BRPs position after bid activation

Comparison, ranking of scenarios
The following table gives an overview over the alternatives.

Table 1: Overview over choice for ramp settlement

Option		**Ramp price setting**	**Ramp settlement price**	**comments**
1	All delivered energy is balancing energy	yes	BE price	In this case the ramp is settled at the BE price by definition
2a	Ramps not settled	no	0	
2b	Ramps settled according to balancing energy price	no	BE price	For option 2 there are choices for the pricing of BE
2c	Ramps settled according to bid price		Bid price	
3a	Redefinition of ramps	depending	BE price	
3b		depending	BE price	

The alternatives are compared with respect to the following criteria:

Easy to understand and apply: with respect to transparency and incentives for BSPs to participate in the market, it is an advantage that the approach is easy to understand.

1 means that BSPs shall be able to understand and develop the method easily and the results (BE prices) can be easily explained and implemented by TSOs.…

0 means that BSPs need more time to understand and develop the method and resulting pricing, but they can be applied in a reasonable time

Simple calculation of balancing energy: related to the above. A simple calculation of the balancing energy also increases transparency. It is questionable if this is very important, the main difference between the options is between calculating the volume of a rectangle versus a triangle.

0 means that BSPs need more time to understand the calculation and develop the method, but they can be applied in a reasonable time.

1 means that BSPs shall be able to understand the calculation and develop the method easily.

BSP incentive to deliver required profile: if the options incentivizes the BSP to deliver defined profile, it is probably more predictable what will be delivered. It must also be assumed that the profiles are defined with the intention to get the product profiles. From that perspective, it is important that the settlement approach gives the correct incentive.

1 means that BSPs are strongly incentivized to allocate energy to the ISP according to the ramp request by the settlement rules

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0 means that there are not strong market signals regarding allocation of ramping energy to ISPs.

-1 means that that BSPs are incentivized not to allocate energy to the ISP according to the ramp request, they will try to activate cheapest way (i.e.: very close to the ISP bounder), which will cause unexpected volumes.

BSP risk: if the BSP is paid at least its bid price, it should have no other risk than its own ability to deliver. If it may be paid less or not at all, it faces a risk. To compensate for that, it must increase its bid price, but there will be an uncertainty.

1 means that there is no need to BSPs to include additional risk components in bid price, because they will get at least the bid price or more.

0 means that there is no need to BSPs to include additional risk components in bid price, because they will get the bid price.

-1 means that BSPs have to take into account the unpaid transportation and this cost will be appear in the bid price.

High price contagion to several ISPs: if an activated bid is price setting in several ISPs, the activation of one high priced bid that delivers energy in several ISPs also results in a high price in the other ISPs. This is seen as a disadvantage by many. However, ENTSO-E also emphasizes that the market should face the "full cost of balancing". From that perspective, suppressing a high price of balancing energy in ISPs where high priced energy is actually delivered is negative. The table uses the first perspective, but the second perspective should be kept in mind.

1 means that bid price only affects ISP of the delivery period.

0 means that price may affect 1 or 2 ISPs depending on the moment of activation (see Figure 6 above)

-1 means that bid price may affect marginal price in all ISPs where bid delivers energy and can be the highest bid price; which leads a higher price of the given ISP.

Always a defined price to settle balancing energy: when the ramps are not price setting, but are paid the balancing energy price in the relevant ISP, there is a certain risk that there is no price defined, if no other balancing actions have been taken.

1 means that price to settle balancing energy and ramping energy is always defined (either as BE price or as a bid price).

-1 means that in some cases energy price needed to settle ramping energy may be not defined (in case no other balancing action in the given ISP).

Compliance with "priced as cleared" principle: GL BE strongly advocates this principle, and it must therefore be seen as an advantage that this principle is used, even when delivered energy is defined as "non-balancing energy".

1 means that option is in line with this principle, BE (**marginal**) price is settlement price of ramping.

0 means that ramping period does not settled.

-1 means that option is not in line with this principle, **bid** price is settlement price of ramping.

Effect on TSO financial position: approaches that lead to additional revenues and/or deficits for the TSO need additional measures to compensate for this, which is complicating.

1 means that there is no effect and TSO is always financially neutral;

0 means that option may affects TSO financial position depending on the moment of activation and consequently ISP in which ramping energy will be settled (see Figure 6 above)

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-1 means that option will affects the financial position of TSO (may get surplus or deficit, depending on bid and BE price).;

Number of ISPs impacted: approaches that impact several consecutive ISP receive lower notes. Indeed the higher ISP number are impacted, the more complex it will be for settlement and for market players. This argument has been collected from a stakeholders feedback.

1 if number of affected ISPs is 1;

-1: if number of affected ISPs is 3 ;

0 if number of affected ISPs is 2,

An evaluation of the options using these criteria is given in the following table

Based on these scenarios, we performed an assessment of the different cases, with an objective to rank the pricing strategies based on the most objective criterion. These criterion are based on the code itself and reflect the potential for balancing market integration.

	OPTION 1	**OPTION 2a**	**OPTION 2b**	**OPTION 2c**	**OPTION 3a**	**OPTION 3b**
Easy to understand and apply (straightforward)	1	1	0	0	0	0
Simple calculation of balancing energy	0	1	0	0	1	1
BSP incentive to deliver required profile or volumes per ISP	1	-1	0	1	0	1
BSP risk	1	-1	0	1	0	1
High price contagion to several ISPs	-1	1	1	1	0	0
Always a defined price to settle balancing energy	1	1	-1	1	1	1
Compliance with "priced as cleared" principle in GL BE	1	0	1	-1	1	1
Effect on TSO financial position	1	1	1	-1	0	0
Number of ISP impacted (assumption ISP 15 minutes, product duration 15 minutes, ramps +/- 5 minutes) Lower is better	3, score -1	1, score 1	3, score -1	3, score -1	1/2*, score 0	1/2*, score 0
TOTAL score	4	4	1	1	3	5

** Depending of the moment of activation (see Figure 6 above)*

This assessment leads ENTSOE to exclude principle based on option 2b, 2c, 3a in case products overlap several ISPs (independently of the block/physical products)

Settlement principle for bids overlapping several ISPs

- ENTSOE proposition is exclude principle based on option 2b, 2c, 3a
- Do stakeholders (mainly BSPs) share this proposal, the pro/cons and ENTSOE position ?

Settlement of balancing energy bids within a COBA, correlation with imbalance

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settlement price scheme

Context

System Operations Guideline requires each (TSO of a) LFC block/area to regulate the ACE towards zero within TTRF. This means that regulating the ACE towards zero is a local responsibility of the TSO (per LFC block/area). The intention is however that the TSOs assist each other by exchanging reserve capacity and energy bids. The following paper discusses some of the consequences of having cross-border (XB) pricing Vs Local pricing mechanisms, in a combination with XB activations. This section first deals with TSO-BRP settlement and then TSO-BSP settlement.

- When the term XB imbalance price is used, it means that in the case of no congestions or specific products between two areas, the imbalance price is identical.
- A local imbalance price means that even though there is no congestion or specific products between two areas, the imbalance price can be different.

In case of congestion or specific products, a local imbalance price will remain necessary.
Furthermore, the following relevant paragraphs of the ENTSO-E Network Code on Electricity Balancing as submitted to the EC by ACER (Version 3.0, 6th of August 2014) are explicitly considered during the assessment; Article 24 § 2, Article 55 § 1, Article 64 § 3 and 4.

Local *Vs XB* imbalance pricing (TSO-BRP settlement)

Given the above fragments of the NC EB, the imbalance price should reflect the cost of the TSO to restore the balance in the LFC block/area (cfr. Art 55 § 1(a),(b)). If the imbalance price is high (normally due to a high initial imbalance leading to the use of a high amount of balancing services by the TSO), this will give an incentive to the BRP to reduce the imbalances caused by its portfolio (cfr. Art 55 § 1(c),(e),(f)). In the table below, the consequences of using a local imbalance price or a XB imbalance price and the impact on the targets put forward by the NC EB are described.

Consequence if Local Imbalance Price is used	Consequence if XB Imbalance Price
• **No cross-LFC bock/area balancing behaviour of BRPs** If the producer in area A identifies that the same MWh can be produced cheaper in area B, then the producer will not be incentivized to shift the position from area A to area B (due to the exposure to potentially different imbalance prices), thereby not exhibiting cross-LFC block/area balancing behaviour. On the other hand, not producing from the cheapest units might reduce welfare.	• **Cross-LFC block/area balancing behaviour of BRPs** BRP's that are active in more LFC blocks/areas can change production program across LFC blocks/areas, without the risk of being exposed to different imbalance prices. If the producer in area A identifies that the same MWh can be produced cheaper in area B, then the producer might shift the position from area A to area B, without the TSO being informed. So the BRPs are not incentivized to only be balanced within a LFC block/area. This goes against the targeted behaviour in the NC EB as mentioned in Art. 55 § 1 (a),(c),(e),(f) and the LFC block/area requirements of the System Operations guideline.
• **No use of non-allocated XB capacity**	• **Use of non-allocated XB capacity** When XB imbalance pricing is used, BRPs that balance their portfolio across LFC blocks/areas due to the behaviour as explained above can create flows across the interconnections that result in a non-compliant use of interconnection capacity.

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• **Shift of imbalances from LFC blocks/areas with high imbalance prices to LFC blocks/areas with low prices** If the imbalance price is consistently higher in area A, a BRP that is active in more LFC blocks/areas will try to move the imbalance away from this area. This could increase the imbalance in neighbouring areas where imbalance prices are lower (and as a consequence increase the imbalance and the price). This behaviour is preferred if imbalance prices are high due to high energy prices/balancing need, but a distortion if the imbalance price is high due to various mark-up's added to the imbalance price.	• **No shift of imbalances from LFC blocks/areas with high imbalance prices to LFC blocks/areas with low prices**
• **Less extensive harmonisation of balancing processes required** Easier extendibility since this also works between regions of which the balancing processes/activation strategies are not identical.	• **Extensive harmonisation of balancing processes required** When the cooperating TSOs have different activation strategies (e.g. different settings aFRR controller or different strategies for activation of mFRR, different usage of aFRR or mFRR) the activations of one TSO could push the imbalance price upwards for all cooperating TSOs if a XB price is used. This goes against the targeted behaviour in the NC EB as mentioned in Art. 55 § 1 (a),(b),(c). This can even lead to a reaction of the BRPs in one LFC block/area that challenges the balancing actions by a TSO in another LFC block/area (when balancing processes differ). This goes against the targeted behaviour in the NC EB as mentioned in Art. 55 § 1 (c),(e),(f). To avoid this, the activation strategies of the TSOs should either be extensively harmonized or for example a local pricing scheme can be used.
• **Level playing field BRPs** Level playing field on LFC block/area level.	• **Level playing field BRPs** Level playing field on COBA level.

Table 2: Impact of a local versus XB imbalance price

From a market point of view, XB imbalance pricing can allow the most economically efficient system (attracting balancing energy where costs for offering balancing energy are the lowest) on the conditions that there is no congestion, no specific products, less local responsibilities for the TSO, a level playing field between producers and no difference in the activation strategies of cooperating TSOs.

If the above conditions cannot be met within or between COBAs additional measures will need to be taken to avoid the undesired effects of XB pricing as explained in the table.

An example could be the use of a local imbalance pricing mechanism, which will be able to provide the appropriate local price signals to incentivize BRPs to be balanced on a LFC block level and reflect the local need of/attract balancing energy/flexibility while exchanging bids within/between COBAs to ensure that the activation of balancing energy is performed at the lowest possible (if no congestions, specific products) cost.

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Local *Vs XB energy* pricing (TSO-BSP settlement) combined with local imbalance pricing (TSO-BRP settlement)

If a local imbalance pricing mechanism would be used and the imbalance price is coupled to the price paid for balancing energy (cfr. NC BE Art. 24 § 2 (e), Art. 55 §1 (b), Art. 64 §3-4), a local balancing energy pricing system (under the assumption that a pay-as-cleared mechanism for balancing energy is applied) could also be needed.

The consequences of a local and XB balancing energy price (when combined with a local imbalance price) are discussed in the table below.

Consequences for Local TSO-BSP settlement Price (with local TSO-BRP settlement)	Consequences for XBorder TSO-BSP settlement Price (with local TSO-BRP settlement)
• **Costs for balancing energy settlement are reflected/covered by the imbalance price settlement**	• **Costs for balancing energy settlement are not reflected/covered by the imbalance price settlement (*)** The costs for balancing actions by the TSO would not be reflected in the imbalance price and therefore not be recovered via the imbalance settlement from the BRPs. This "gap" might be quite large (since the local IP would always be ≤ XB balancing energy settlement price so the "gap" would cumulate for every quarter-hour where the local IP < XB balancing energy settlement price) and this gap might be even more important if several TSOs with different activation strategies (usage of aFRR/mFRR) are cooperating. Other mechanisms than local pricing might be able to recover the costs for balancing energy, but will not be able to correctly reflect the costs for balancing energy in the imbalance price settlement. This goes against the targeted behaviour in the NC EB as mentioned in Art. 55 § 1 (a),(b) and Art. 64 §3-4.
• **No additional components to the imbalance pricing mechanism needed**	• **Can lead to complex local imbalance pricing mechanisms (*)** The combination of a local imbalance pricing mechanism with a XB balancing energy pricing mechanism might lead to the need of additional components for the local imbalance pricing mechanism such as "imbalance price floors" to be able to be compliant to the NC EB requirement as mentioned in Art. 64 §3-4.
• **Incentive to BSPs to deliver the requested balancing services to the connecting TSO** In case of non-delivery of local bids (used by the connecting TSO) the increase of the balancing energy settlement price will lead to an increase in imbalance price and in case of non-delivery of exporting bids (used by the receiving TSO), the increase of the balancing energy settlement price is not ensured (the non-delivery of the BSP increases	• **No incentive to BSPs to deliver the requested balancing services to the connection TSO(*)** A XB balancing energy settlement price cannot ensure incentives to the BSPs to deliver the requested energy solely via the TSO-BRP settlement. When a BSP does not deliver, this will always increase the XB balancing energy settlement price (since the next bid will be activated) for this BSP. When local imbalance

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the balancing need of the connecting TSO which leads to exporting bids becoming local bids, and therefore the BSP will receive the, lower, connecting TSO balancing energy price instead of the, higher, receiving TSO balancing energy price). Therefore, the combination of the TSO-BSP and TSO-BRP settlement could solely provide an incentive to deliver.	pricing is applied, this might not penalize/de-incentivize a BSP for such behaviour. Therefore, a combination of local imbalance pricing with XB- balancing energy pricing does not provide an appropriate incentive to deliver to the BSPs (without any additional measures). This goes against the targeted behaviour in the NC EB as mentioned in Art. 55 § 1 (f),(i)
• **Level playing field BSPs** Level playing field on LFC block level.	• **Level playing field BSPs** Level playing field on COBA level.
• **BSPs in same LFC block/area could receive a different price for balancing energy depending on mechanism** Certain local pricing mechanisms might result in a different TSO-BSP settlement price for BSPs of one LFC block/Area. If a marginal pricing regime is applied, and balancing energy that is exported is settled differently (at a higher price) than balancing energy that is activated to restore local imbalance, the BSP might speculate in their bid price, and increase it to a level, where they believe they will be cross boarder activated, and thus be able to obtain the higher marginal price (thereby accepting the risk of no longer being selected). This might reduce the expected reductions in price when going from a pay-as-bid scheme to a pay-as-cleared-scheme. This method might be opposed or found less transparent by BSPs, and the bidding behaviour of some BSPs might lean towards the one used in a pay as bid regime. This could also be solved by applying a different local pricing scheme. This needs further investigation.	• **BSPs in same LFC block/area always receive same price for balancing energy**
(*) These issues could also be avoided with the use of XB imbalance settlement, the underlying assumption for the above discussion, was however how TSO-BSP settlement shall be done, if only local TSO-BRP settlements are performed.	

Table 3: Impact of local versus XB balancing energy price in combination with a local imbalance price

Working conclusion

A strong link between BRP and BSP settlement is needed (cfr. extracts NC EB). If not the BSP can be incentivized to submit extreme high bid pricing, without the risk of being imposed to high imbalance prices, and this shall be avoided.

If XB marginal pricing is applied towards BSP's, then most likely also XB imbalance pricing shall be applied towards BRP's. TSO's having same balancing and activation philosophy can benefit from applying XB TSO-BRP settlement and XB TSO-BSP settlement, as this is a simple solution, where BSPs and BRPs can more easily compete on a level playing field. However, in such a design solutions have to be found to avoid cross-LFC block/area balancing behavior of BRPs, avoid the use of non-allocated XB capacity and to give the right incentives to the BRPs to be locally balanced (cfr. **Error! Reference source not found.**).

Since XB TSO-BRP settlement has some important drawbacks (cfr. **Error! Reference source not found.**) in a context of local (per LFC block/area) regulation quality responsibilities and the cooperation of TSOs

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that apply different activation processes (which are specific to the balancing environment and not comparable with DA/ID electricity markets), local imbalance pricing (combined with local balancing energy pricing, cfr. **Error! Reference source not found.**) can resolve these drawbacks, but might reduce the level playing field between BRPs/BSPs of different LFC blocks/areas.

In the case of congestions and specific products, local prices will always have to be applied.

Summary
Table below gives a summary of the impact of the different combinations on several important assessment criteria.

Incentive for BSP to provide the bid

This criterion evaluates whether the combination of imbalance settlement and balancing energy settlement provides an appropriate incentive to the BSP to offer bids.

An appropriate incentive is a balanced one (score 0);

not too high (score -1) to draw most flexibility out of the market whereas not too low (score -1) to ensure a sufficient amount of bids to be offered to the TSO to restore the remaining imbalance.

Incentive for BSP to deliver the bid

This criterion evaluates whether the BSP has an incentive to deliver the bid, under the assumption that there are no additional incentives next to TSO-BSP and TSO-BRP settlement and a BRP-BSP relation and arrangements exist. Under these assumptions, the BSP has an incentive to deliver a bid when requested by the TSO when not delivering can result in less net gain/income for the BSP than delivering the bid. Or in other words, if delivering the bid would not result in less net gain/income than not delivering the bid. More information can also be found in Table 2.

Incentive for BRP to help the control area/block to be balanced

This criterion evaluates whether the BRP is incentivized to be balanced or help the system to restore its balance on a control area/block basis (score 1) or on a COBA basis (score -1). Given the local responsibilities of the TSOs to restore the system balance on a LFC area/block basis and the different activation strategies used by the TSOs, an incentive on a COBA basis might result in counterproductive behavior of the BRPs. More information can also be found in Table 1.

Risk of use of non-allocated XB capacity

Methods that have an increased risk of use of non-allocated XB capacity receive a score of -1.

More information can also be found in Table 1.

Impact on cost distribution

Combinations that could create a large difference in the total TSO-BSP settlement and the total TSO-BRP settlement receive a score of -1 since the difference (surplus or deficit) would need to be redistributed to the appropriate entities. More information can also be found in Table 2.

Ability of TSO to reflect costs for balancing energy in the imbalance price

Combinations that allow the imbalance settlement price to reflect the costs for restoring the balance in the system receive a 1. More information can also be found in Table 2.

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Fair competition between BSPs

Combinations that allow a fair competition between BSPs of the same LFC block/area receive a -1 whereas combinations that allow a fair competition between BSPs of the same COBA receive a 1.

Straightforward

Combinations that allow a straightforward link between the TSO-BSP settlement and the TSO-BRP settlement receive a 1.

Assessement of the proposed methods

	XB ISprice XB Settlement	**XB ISprice Local Settlement**	**Local ISprice XB Settlement**	**Local ISprice Local Settlement**
Incentive for BSP to provide the bid	0	-1	-1	0
Incentive for BSP to deliver the bid	0	1	-1	0
Incentive for BRP to help the control area/block to be balanced	-1	-1	1	1
Affects financial position of TSO (may get surplus or deficit, depending on consistency with Imabalance settlement price)	1	-1	-1	1
Fair competition between BSPs	1	-1	1	-1
Straightforward	1	-1	-1	1
Risk of use of non-allocated XB capacity	-1	-1	1	1
Ability of TSO to reflect costs for balancing energy in the imbalance price	1	-1	-1	1
Total Score	2	-6	-2	4

This assessment leads ENTSOE to exclude the combination of a XB imbalance settlement price combined with a local balancing energy settlement price. The other three possible combinations need further investigation and discussionGeographic area for settlement of activated balancing energy bids

Geographic area for settlement of activated balancing energy bids

- ENTSOE proposes to exclude the combination of a XB imbalance settlement price combined with a local balancing energy settlement price.
- ENTSOE invites stakeholders to share insights on the remaining three possible combinations.

8. standard products

We propose to name the products as follow: P-[DA/Sch]-[FAT]-[Min delivery], where [DA/Sch] means a direct activated or scheduled product; FAT is the full activation time in minutes; Min delivery is the minimum delivery period in minutes. As an example P-DA-15-15 is a direct activated product with a full activation time of 15 minutes and minimum delivery period of 15 minutes;

Initial set of standard products (January 2015) - global view of all products and reason behind

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	P-DA-15-15	P-DA-20-10	P-DA-10-10	P-DA-5-5	P-DA-3-3	P-SCH-15-0	P-SCH-30-15	P-SCH-15-15	P-SCH-x-y
FAT	15	20	10	5	3	15	30	15	x
Min delivery	15	10	10	5	3	0	15	15	y
divisibility	Optional	Optional	Optional	Optional	Optional	Optional	Optional	Optional	Optional

P-DA-15-15
We need a direct activated mFRR product, with a full activation time equal to 15 minutes (time to restore frequency in Continental Europe). Duration is proposed to be at least 15' (unless use link between bids), in relation with slowest common denominator of ISP in Europe (therefore, we will be able to activate such a bid within an ISP).

P-DA-20-10
We need a direct activated mFRR(Ireland) / RR(CE) product, with a full activation time equal to 20 minutes (time to restore frequency in Ireland). Duration is proposed to be at least 10' (unless use link between bids), in relation with TSO needs.

P-DA-10-10
We need a direct activated mFRR(UK) product, with a full activation time equal to 10 minutes (time to restore frequency in UK). Duration is proposed to be at least 10' (unless use link between bids), in relation with TSO needs related to small area, relative low stability and fast balance variation. Also the Nordic system requires fast mFRR products due to its strong dependence on mFRR. It does not mean than this product will not be used by other members.

P-DA-5-5
We need a direct activated mFRRproduct, with a full activation time equal to 5 minutes. Duration is proposed to be at least 5' (unless use link between bids), in relation with TSO needs to cover short and fast imbalances.

P-DA-3-3
We need a direct activated mFRR product, with a full activation time equal to 3 minutes. Duration is proposed to be at least 3' (unless use link between bids), in relation with TSO needs to cover short and fast imbalances.

P-SCH-15-0
We need a scheduled mFRR(Continental Europe) energy product, with a full activation time equal to 15 minutes (time to restore frequency in Continental Europe). Duration is proposed to be 0', meaning that the product could in some cases physically reach the requested power and decrease immediately after. Exchanges between TSOs and settlement are only based on 15' scheduling. Duration in relation with slowest common denominator of ISP met in Europe (therefore, we will be able to activate such a bid within an ISP).

P-SCH-30-15
We need a scheduled RR product with a full activation time equal to 30 minutes (seems to be sufficient to cover BSP technical abilities and TSO needs). Standard duration is proposed to be 15' and could be extended by BSP by using links between bids. Such product will be activated only based on 15' scheduling process.

P-SCH-15-15
We need a scheduled RR product with a full activation time equal to 15 minutes (seems to be sufficient to cover BSP technical abilities and TSO needs). Standard duration is proposed to be 15' and could be

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extended by BSP by using links between bids. Such product will be activated only based on 15' scheduling process.

P-DA-x-y
TSOs propose this product for discussion in order to make BSP in the position to offer flexibilities not compatible with other standard products. It means that TSOs do not require specific values neither for Full Activation Time nor minimum delivery period. These values will be completed and defined by the BSP at gate closure time when offering the bid to the connecting TSO. Consequences in selection algorithms are that products are not so similar and difficultly comparable between each other. Therefore fair competition between BSPs and selection of bids by TSOs (algorithms) will be an important challenge for this product.

Evolution of the list of standard products

Liquidity, harmonised features and European potential
The first ENTSOE thoughts led to propose a list of 9 standard products. This list has been discussed with ACER, stakeholders and EC as well. Many of the involved parties considered that the number of standard products was too important to develop liquidity on each product. Moreover ENTSOE surveys to investigate on the possible use of standard products by TSOs leads to show that a limited number of the proposed standard products could be used by a majority of TSOs in Europe. It means that a few of the proposed products have a European potential for use and exchange, which in a way is not in line with the expectations of the network code.

Standard products

- should be as limited as possible
- should be as define as possible to allow products to be comparable within a CMOL
- should seek for European potential use

System operation guidelines evolutions and inputs
Other inputs linked with Load Frequency Control and Reserves and then System Operation guidelines have been considered. First ACER expects that TTRF will be harmonised to 15 minutes in Europe, which leads to remove some of the products defined to comply with synchronous area requirements.

Standard versus specific products
There is an inherent contradiction in some of the requirement of the network code and the needs of the TSOs: we need to cover most of power needs with the most reduced number of standard products. We have pointed out that the TSOs have different needs based on the physical characteristics of their systems. Combining this with the requirement to have few Standard Products and to let Standard Products cover the majority share of the TSO needs leads to inconsistencies. We can look at two available options:

1) Keep the present Standard Products. This satisfies the perceived intention of the NC EB, but the number of products is assumed higher than what is preferred by ACER. Moreover, the requirement that all products should be used in all CoBAs is impractical and unnecessarily expensive, as it will require significant IT development for products that will not be used in several CoBAs.

2) Reduce the number of Standard Products. This will satisfy the "limited number of products" requirement, and reduce the inadvertent effects of the "all products in all CoBAs" requirement. But then the Standard Products will not cover the major share of the TSOs' balancing needs in all regions.

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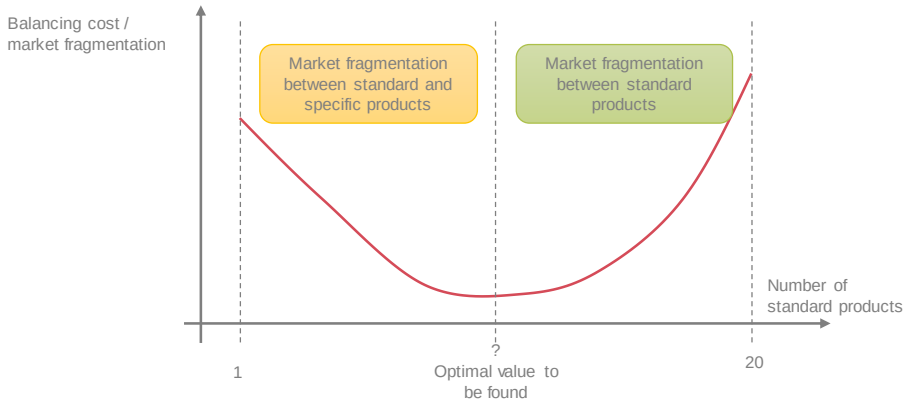
ENTSO-E analysed the possible reduction of the number of Standard Products. We agree with ACER that reducing the number of Standard Products reduces market fragmentation (between Standard Products). Nonetheless we identified that the reduction of products could be better for market liquidity and BSP competition up to a threshold … Indeed if we reduce drastically the number of Standard Products, several TSOs will not be able to cover all needs with Standard Products and will need to define specifics ones (it might become necessary for TSOs to shift some of the FRR to potentially more expensive aFRR to cover its needs). In this latter case the market fragmentation (specific / standard) will increase, and the cost of balancing as well. This description of an extreme case allows us to qualitatively illustrate that there is an optimal number of Standard Products to avoid market fragmentation. Both standard/specific and between standard fragmentation could be avoided with the relevant number of products.



The three requirements to the Standard Products are therefore not compatible, and at least one of them should be relaxed. One reason for the complication is that, as mentioned before, mFRR covers a small share of the total balancing needs in some regions (e.g. CWE), while it is the dominating process in the Nordic region and the UK. Obviously, there is a need for a broader range of products when manual balancing is the only or main process than when it covers only a small share of the total needs.

Streamlining the 15 minutes products
Justification for streamlining of products

In order to reduce the number of standard products and obtain additional market liquidity, we investigated the merging of the DA and SCH 15 minutes FAT products into one product (or the combination of two products in 1 CMOL).

A combination of direct and schedule activation in one CMO has the following **advantages**:

- **Prevents fragmentation of markets and therefore increases liquidity in remaining markets**: BSPs do not have to choose between different CMOs and with a single BEGCT, the same bid can be used for both processes
- **Reduces number of standard products:** in line with target for streamlining standard products and in accordance with feedback from ACER
- **Enables cooperation between TSOs either using mainly direct or mainly schedule activated products**

One **disadvantage** of combining direct and scheduled activation might be that depending on the pricing method, the prices for two different products with different requirements are linked. By this the price for schedule activation might be too high for example. One solution to overcome this problem might be to have two different prices, one for schedule activation and one for direct activation..

Methodology for activating combined direct and scheduled activated products

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One of the key challenges is to develop a methodology for activating combined direct and schedule activated products from 1 CMOL.

We assume in this investigation that there is only one product, for which it is possible to do a schedule (SCH) and a direct activation (DA). By this assumption, an optimisation between two CMOLs is avoided and the same gate closure time can be used. As mentioned above, different prices for direct and schedule activation could be applied if such a mechanism was required to differentiate the price of DA and SCH.

Given that in this circumstance there is only one product with bids in one CMOL, two high-level options are available regarding the order in which each process (DA and SCH) is performed:

1) DA is activated first with SCH activation possible afterwards using remaining bids
2) SCH is activated first with DA activation possible afterwards using remaining bids

The first question to be answered therefore is as follows:

Question 1: What order of activation provides the highest fulfillment of TSO needs and increases social welfare?

We investigate and describe further these two options for combining schedule and direct activation in order to understand the potential advantages and disadvantages of each solution. It should be noted that many variations of these two options are possible, particularly with regard to varying the minimum and maximum delivery periods in each scenario. This initial assessment therefore will not decide on the definitive solution for merging the SCH and DA 15 minute FAT products. Instead we will consider different advantages and disadvantages of the two concepts and highlight if any solutions can be ruled out. Further work will then be done to develop the most advantageous concepts.

One consideration which potentially will impact the preferred order of activation is the interaction of each CMOL with multiple ISPs. It is therefore preferred at this stage to also consider for the two activation options if the energy is mainly delivered in the same ISP as the one which the CMOL refers to, and also when this is not the case.

Question 2: How does the order of activation affect the number of ISPs over which a CMOL is valid?

Developing the concepts

Both concepts have the following common features:

a) Gate closure time: The balancing energy gate closure time is common for the SCH and DA bids.

b) Schedule only or schedule and direct activation: In both concepts a BSP can submit a bid marked as:

a) SA only
b) SA and DA

We offer this flexibility to BSPs as it may be possible for a BSP (for uncontracted bids only. contracted bids will be DA or SA or combination, in accordance with TSO requirements) to place only bids for schedule activations. For instance, let's assume that a BSP has a power plant with a capacity of 100 MW. This BSP sold 100 MW from 13:00–13:15, 50 MW from 13:15-13:30 and 100 MW from 13:30-13:45 on the intraday market. Therefore, only a scheduled activation of 50 MW would be possible from 13:15 to 13:30.

c) AOF: Both options use an activation optimization function (AOF) for direct and schedule activations.

i) **SCH AOF**: a market clearing - optimization - algorithm minimises the costs (maximises the social welfare) by satisfying the total balancing needs submitted to the AOF by the TSOs, i.e. the overall system costs for the ISP. It is also possible to net the TSO needs. Additionally, in

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the schedule activation there is simultaneous consideration of transmission capacity which leads to more efficient utilization of it.

ii) **DA AOF:** algorithm must work according to the first come first serve principle. That means the AOF minimizes only the cost for one TSO for the given balancing need, under the assumption that no netting is performed in the case of direct activation, since a direct activation is always done immediately.

iii) **Minimum and Maximum delivery period**: It is assumed in developing these concepts that the delivery period for SCH activation remains fixed at 15 minutes (both minimum and maximum), For the diagrams in this document the DA product is also given with a delivery period of 15 minutes for simplicity. There is any number of variations on how the rules could be set for DA or SCH with regard to delivery period and therefore we propose that further work will be done on this area to develop the concepts which are preferred.

Some of the other key considerations to take into account in relation to the solutions are:

- Validity of the CMOL: Which and how many CMOLs are available for activation at the same time
- The FAT and Validity period (possible delivery period)
- Bid firmness: it is related to the time the BSP must have the balancing energy bid available
- ATC usage and handling: when the transmission capacity is free to be used for direct activation and when for schedule activation

OPTION 1: DA followed by SCH

High-level process

The process is described in the following and illustrated in **Error! Reference source not found.**:

1. BSPs submit their balancing energy bids
2. ATCs for affected ISPs submitted
3. TSOs submit their balancing needs to be met by DA
4. The AOF calculates which bids are activated according to the first come first serve principle.
5. Each time a TSO uses the CMO for DA, ATC capacity and merit order list are updated.

Steps 3-5 are repeated on a continuous basis until the end of the validity period of the DA.

6. At the end of the validity period of the CMOL, the remaining balancing energy bids marked SA or both SA and DA, and the remaining ATC are submitted to the CMO for SA. Moreover TSOs submit their balancing needs to be met by SA.
7. A market clearing process – optimization function – runs considering the CMO with SA.
8. The results are: activated balancing energy bids, satisfied TSO balancing needs and remaining ATC to be used for the subsequent DA

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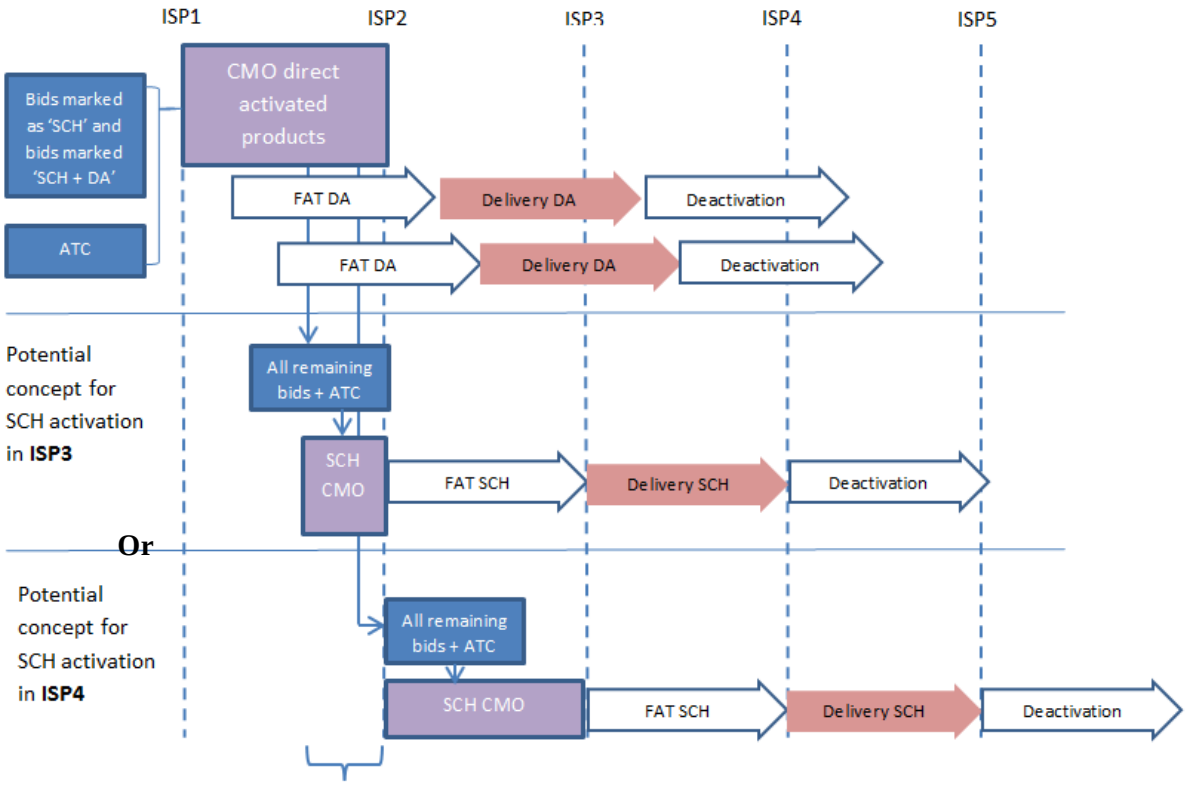

Figure 1: illustration of the high level process of option 1 with 2 potential concepts for SCH activation depending on whether process is designed with delivery in ISP3 or 4 preferred

OPTION 2

High-level process

The process is described in the following:

1. BSPs submit their balancing energy bids
2. TSOs submit their balancing needs to be met by SA
3. ATC for affected ISPs submitted
4. A market clearing process – optimization function – runs considering the CMO with SA.
5. The results are: activated balancing energy bids, satisfied TSO balancing needs and remaining ATC to be used for the subsequent DA
6. The remaining balancing energy bids marked as both SA and DA, and the remaining ATC are submitted to the CMO for DA
7. TSO balancing needs that must be met by DA can use the CMO for DA
8. Each time a TSO uses the CMO for DA, ATC capacity and CMO are updated

The process is illustrated in **Error! Reference source not found.**.

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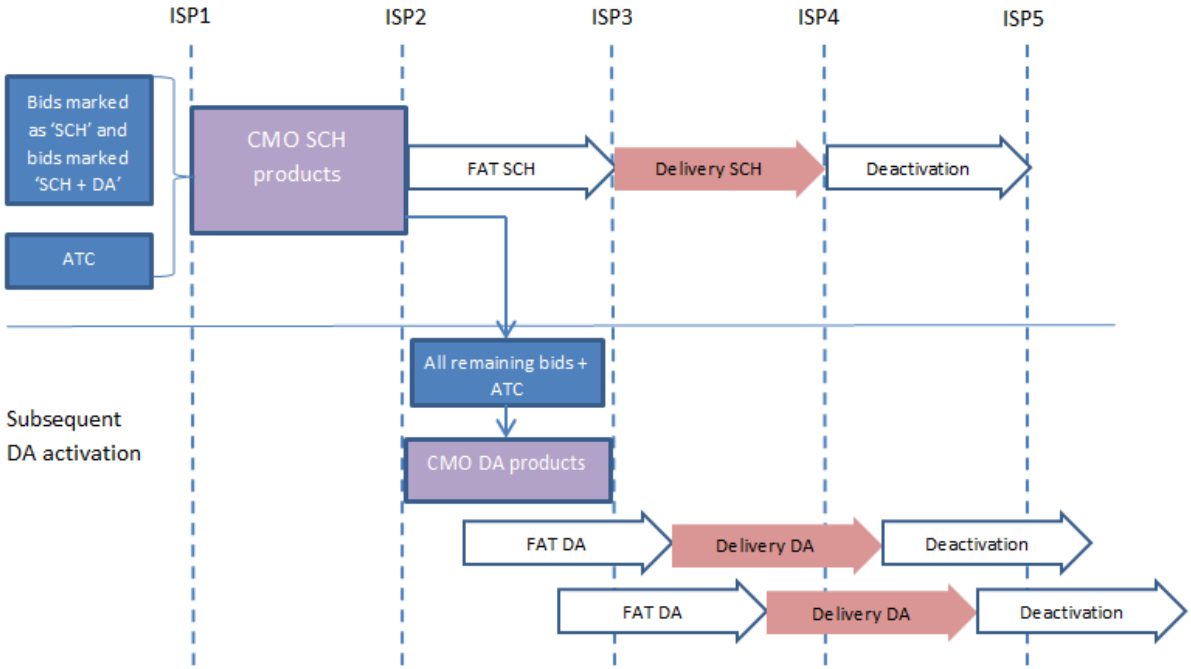

Figure 2: Overview of Option 2, Scheduled activations from CMOL taking place with remaining bids to be activated via DA

Evaluation of Concepts

The two questions we wish to answer are as follows:

Question 1: What order of activation provides the highest fulfillment of TSO needs and increases social welfare?

Question 2: How does the order of activation affect the number of ISPs over which a bid is activated?

To answer Question 1 there is a number of criteria which need to be taken into account to understand what the TSOs actually need and therefore which option may be preferred. These criteria can therefore be scored against for the two different options.

The first set of criteria can be summarized under the headline "**Maximizing flexibility**". It is important for TSOs that any product which combines DA and SCH activation allows the flexibility in activation that TSOs need to operate the system in real-time.

- ***Incentives for BSPs to bid for direct activation***: It is desirable that BSPs that technically are able to do direct activation also bid for direct activation, instead of bidding for schedule activation only, which would reduce the flexibility for the TSO. This criterion tries to quantify the incentive for a BSP to place a bid for both direct and schedule activation.
    - Option 2 could provide benefits, since schedule activation is used first and direct activation is used afterwards. By this it is guaranteed that the more costly bids will be used for direct activation which will incentivize BSPs. Option 2 would therefore score higher.
- ***Avoid usage of DA bids for schedule activation (keep flexible bids as long as possible to face unexpected imbalances)***: With this criterion it is considered that in the case of Option 2 it may be that a bid which can be directly activated is used for schedule activation, since it is cheaper than a bid which can only be schedule activated. Then this bid is not available for direct activation afterwards. By running the scheduled process first, flexibility for DA may be removed from the CMOL.

- Option 1 gets better scores, since bids are used for direct activation first.

The following criteria can be summarized under the heading "**reduce costs**". TSOs are expected to optimize use of balancing energy and as a result, increase social welfare. The ability of each concept to enable this to happen is therefore important to consider.

- ***Maximize the benefits of netting by increasing the amount of schedule activations***: With this criterion it is considered that more schedule activations are beneficial since netting can be used. The more netting that is used, activation of energy can be avoided and subsequent activation will have higher liquidity remaining in the CMOL. This should reduce overall costs and increase social welfare.
  - Option 2 gets better scores since the first process to take place in the CMOL is netting of TSO needs, allowing the maximum number of bids to remain in the CMOL for all other activation needs (both SCH and DA) at the lowest cost possible
- ***Reduce risk of counter activations***: With this criterion it is considered if the risk of counter activations due to e.g. long delivery periods is reduced/increased and by this costs are increased/reduced.
  - Options with short or flexible delivery periods are more advantageous for this criterion – this will be investigate further as part of the development of these concepts and subsequent work of maximum and minimum delivery periods

The following criteria aims to address **Question 2: How does the order of activation affect the number of ISPs over which a CMOL is valid?** For some TSOs it is preferred that balancing energy is limited to delivery in as few ISPs as possible. We therefore consider the validity of each CMOL below

- ***Energy deliver in the valid ISP of the CMOL***: This criterion tries to evaluate if the energy is mainly delivered in the same ISP as the one which the CMOL refers to.
  - This criterion will depend on the defined maximum delivery periods for the products and therefore should also be investigated further. By limiting maximum delivery periods it may be possible to reduce the ISPs for which a product is activated.
  - For Option 1 this will depend on the ISP for which the SCH process is subsequently run, as illustrated in Figure 1.
    - Where the SCH process is absorbed into the end of ISP1 (and overlaps with the period in which the DA process is running for that CMOL), the delivery of the SCH product will be in ISP3, whilst the DA activation will deliver in ISP2 and 3.
    - Where the SCH process takes place in the next ISP and therefore only delivers in ISP4, no overlap will exist. The one CMOL will therefore allow delivery in 3 ISPs (DA in ISP 2 & 3, SCH in ISP 4)
  - For Option 2 the DA activation will be delivered in 2 ISPs; 1 of which overlaps with the SCH activation.
  - Both Options therefore score evenly given the potential to have the CMOL valid for 2 ISPs only.

We could therefore conclude that given the importance of this characteristic, a mechanism such as that where one CMOL can be activated in ISP2&3 by DA and ISP 4 by SCH is unlikely to be preferred. Any further investigation into Option 1 should consider the concept where the SCH process is absorbed into the end of ISP1

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Given the above, it is therefore important to consider the fulfillment of a fundamental TSO need – **DA process can run at all times**. TSOs would prefer this to ensure that the DA product can be activated in case of a sudden loss of generation

- For Option 1 it would appear that there is a period in which the same CMOL would still be undergoing the DA process when the SCH process would need to begin. Given the optimization function of the SCH process (with netting of needs) this could take a number of minutes. During this process it would be extremely difficult to perform this optimization if bids were still being picked on a first comes first basis for DA. The DA process would likely need to be paused for the period of time during which the SCH process is running.
- For Option 2 the SCH process finishes and can immediately be followed by the DA process. This reduces the risk of there being periods of time in which TSOs cannot activate DA.
- Option 2 would therefore score higher for this criterion, though given the uncertainty of process times for either option, even this option will not score the maximum

It is important also to consider the **compliance of each concept with the requirements of the network code**.

- Compliance with NG EB: With this criterion it is considered if the variation of an option is compliant to NG EB.
    - Variation of options which don`t foresee that the BSP can be fully activated get worse scores.
    - Both options appear to allow BSPs to deliver Standard products and therefore should score evenly

Criteria which are not considered for evaluation but which have been discussed

Simultaneous use of ATC by DA and SCH: It is a problem that the calculation time of the AOF for schedule activation might be longer than the AOF for direct activation. By this there is a time period in which no direct activation can be done, since the AOF for schedule activation is running with fixed ATC values in this time period. If a direct activation would be done in this time period this would have an influence on the ATC values considered in the AOF for schedule activation. This is a problem affecting both options.

Efficient usage of ATC: With this criterion it is considered whether Option 1 or Option 2 lead to a more efficient usage of ATC. Since no approach to deal with this criterion could be found, this criterion is not considered for evaluation.

Flexibility of delivery period: With this criterion it is considered, how much the respective TSO can influence the shape of the delivered balancing energy. The flexibility of delivery period can be further investigated as part of the development of the concepts for the combined DA and SCH product. It is intended this criterion is investigated more in full in due course.

Summary

A summary of the outputs of the above criterion is given below. It should however be noted that ENTSO-E intends to further assess the two options in more detail with regard to delivery periods as well potential cross-border exchanges.

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	Option 1	Option 2
Maximizing flexibility		
incentives for BSPs to bid direct activation	0	1
avoid usage of direct activated bids for schedule activation (keep flexible bids as long as possible to face unexpected imbalances)	1	-1
Reduce costs		
Maximise the benefits of netting (of TSO power needs)	-1	1
Others		
Delivered energy in the main ISP (energy mainly provided in the ISP where the CMOL refers to)	0	0
Possible to activate DA product at all times	-1	0
Compliance with NCEB	1	1
Total score	0	2

CONCLUSION

- Based on this table, Option 2 (Scheduled followed by Directly Activated) seems to be the most promising concept
- With regard to the question regarding the number of ISPs for which each CMOL is valid, both Options appear equal. Adjustment of the min and max delivery times however could provide more advantageous solutions (it may be possible to adjust activation so both DA and SCH apply for 1 ISP only)
- ENTSO-E would propose to work further investigating min and max delivery times and XB exchanges and the impact these could have on the potential for Options 1 & 2.

Consequences

The above detailed requirements leads to remove some standard products:

- P-DA-x-y is removed for a lack of characteristics standardisation ("x" and "y" were free to be defined by the BSP)
- P-DA-20-10 is removed due to harmonisation of TTRF
- P-DA-3-3 is removed due to specificity of the need (local)
- P-DA-15-15 and P-SCH-15-15 products are merged according to the previous mentioned solution

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Latest draft set of standard products, proposed for discussion

	P-DA/SCH -15-15/30	P-DA-10-10/25	P-DA-5-5/15*	P-SCH-30-15
FAT	15	10	5	30
Min delivery	15 => 0 ?	10	5	15
Max delivery	30	25	20	15
Temporal divisibility	yes	yes	yes	No
Temporal link (case C)	no	no	no	yes
Activation principle	Continuous process AND clearing	Continuous process	Continuous process	Clearing
ramps	Tbc	tbc	tbc	no
Bid size	Integer, from 1 MW up to 9999 MW			

* note that P-DA-5-5/15 standard product does not present a European potential for exchange. Nevertheless ENTSOE internal investigation for potential use of this product showed that many neighbouring TSOs which do not use aFRR at the moment expressed their interest for such a product, and that there is a regional market for such a product. At this point in time ENTSOE would like to keep this product as standard due to (regional) potential benefits to define standardized characteristics and exchange such a product locally. However, many TSOs did not expressed their interest for such product (in competition with aFRR in some areas) and not all ENTSOE TSOs will implement this product, submitted to the application of the article xx.x of the Balancing guidelines.

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