

IMPLEMENTATION OF CROSS-ZONAL INTRADAY CAPACITY PRICING

IMPLEMENTAREA PRETULUI CAPACITATII IN TRANZACTIONAREA INTRAZILNICA TRANSFRONTALIERA

Andrei MICLEA¹, Ionut JDERU²

***Abstract:** This paper is describing how the cross-zonal intraday capacity pricing will be implemented across the pan-European level by applying a market coupling mechanism between the bidding zones, which means that a price for the intraday cross-zonal capacity can be determined. It is specified how the cross-zonal intraday capacity pricing was proposed, the solution that was selected and a short description of the implemented solution and the current status of development.*

Keywords: ACER, IDA, SIDC, SDAC, CACM, TSO, NRA, XBID

***Rezumat:** Lucrarea de fata descrie modul in care preturile capacitatii intrazilnice interzonale vor fi implementate pe baza unei metodologii unice la nivel european. Sunt prezentate optiunile identificate si solutiile adoptate pentru implementare, precum si stadiul actual si perspectivele al proiectului.*

Cuvinte cheie: ACER, IDA, SIDC, SDAC, CACM, OTS, NRA, XBID;

1. Introduction

The first requirement for the Intraday cross-zonal capacity pricing is mentioned in Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management (CACM), Article 55 (Pricing of intraday capacity) [1]:

1. Once applied, the single methodology for pricing intraday cross-zonal capacity will reflect market congestion and will be based on actual orders.
2. Prior to the approval of the single methodology for pricing intraday cross-zonal capacity, Transport and System Operators (TSOs) may propose an intraday cross-zonal capacity allocation mechanism with reliable pricing for

¹ Specialist I, OPCOM S.A. e-mail: amiclea@opcom.ro

² Specialist II, OPCOM S.A. e-mail: ijderu@opcom.ro

approval by the regulatory authorities of the relevant Member States. This mechanism will ensure that the price of intraday cross-zonal capacity is available to the market participants at the time of matching the orders.

3. All TSOs had to develop a proposal for a single methodology for pricing intraday cross-zonal capacity in 24 months.

4. No charges, such as imbalance fees or additional fees, will be applied to intraday cross-zonal capacity except for the pricing.

Because the Article 55 stipulates that TSOs may propose an intraday cross-zonal capacity allocation mechanism with reliable pricing for approval by the regulatory authorities of the relevant Member States, on 10 August 2017 they finished a document called Cross-zonal Intraday Capacity Pricing Methodology – Explanatory note[2].

All the models proposed in the methodology by all the TSOs had the next technical requirements:

- Compatibility with continuous matching
- Reflects congestion if capacity is scarce
- Is based on actual orders
- Capacity price is made available at the time of matching the orders
- Additional charges or fees does not exist

The single intraday coupling which precedes the pricing, is based on continuous matching. The continuous matching mechanism poses a challenge in terms of finding a good pricing model. Determination of an intraday cross-zonal capacity price, reflecting scarcity, was very difficult in continuous markets since intraday cross-zonal capacity could be subject to a price mainly when cross-zonal capacity is no longer available.

While intraday cross-zonal capacity remains available, there is no bottleneck, and the use of remaining intraday cross-zonal capacity does not yield any economic benefit (the price of the capacity is theoretically zero).

When intraday cross-zonal capacity has been fully used by the trades and is no more available, the execution of an additional trade using marginal capacity would yield an economic benefit; but no cross-zonal trade is possible any longer, so that the pricing of the capacity is not possible.

In continuous markets, the potential scarcity value of intraday cross-zonal capacity is captured by the first trade using the capacity with the highest/lowest price at that moment (i.e. the quickest market participants and not the ones which value the capacity the most) because of the FCFS (first come first served) principle.

Possible models: to find the best possible model to price intraday cross-zonal capacity, several pricing models were contemplated. Their suitability for the Methodology is briefly discussed below as well as additional clarifications provided for the chosen one, the so-called “hybrid model”. The following subsection further elaborates on the justification of the chosen model.

a) Implicit continuous trading only

The continuous trading, being understood to be the XBID solution in its current status does not embed any feature related to intraday cross-zonal capacity pricing: in essence, this model always sets the intraday cross-zonal capacity price to zero and therefore cannot be considered with its current features as a possible model to be evaluated.

This does not ensure an efficient pricing of the intraday market and doesn't take into account the "willingness to pay" for the intraday cross-zonal capacity of all market participant interested to acquire cross- zonal capacity for a specific MTU. Moreover, no information is given about the value of the scarcity of the intraday cross-zonal capacity in this case. Cross-zonal capacity is available or not but no price is given for the commodity.

b) Implicit continuous trading with pricing

This model consists in embedding the pricing of intraday cross-zonal capacity within the intraday continuous allocation, depending on the allocation time. This can be done through different main variants, such as:

A. "Price scaling" based on share of allocated cross-zonal capacity compared to maximum available intraday cross-zonal capacity, with a price profile that is fixed in advance (with fixed boundaries based on outcome of day-ahead market for example). The price determination follows the profile, which consists of a "dead band" where the price is zero up to a given value, and then followed by a linear increase of the capacity price depending on the increase of the allocated capacity up to the available intraday cross-zonal capacity,

- 1) A first variant consists in decreasing the price (eventually to zero) if there is unused capacity prior to Gate Closure ("Move to zero price");
- 2) Another variant consists in making the price profile dynamic (including the definition of its boundaries) so that it can adjust based on the rate at which capacity is allocated ("Dynamic pricing");
- 3) "Congestion forecast during trading session" also uses a price profile, which depends both on the share of allocated capacity compared to the available intraday cross-zonal capacity and on the time before gate closure time;

B. Ex-post calculation" of capacity price: the scarcity is assessed once the intraday trading session is closed. If all the available intraday cross-zonal capacity has been allocated, then the capacity price is calculated as the difference between the two bidding zones prices. Several possible choices exist to define the price in each bidding zone, which is derived from the price of matched orders. In such cases, the possibility to define a price through the matching of actual orders in a discrete fixing performed ex-post remains to be further analysed.

This model is not compliant with CACM requirements for Cross-zonal Intraday Capacity Pricing Methodology.

c) **Implicit auction only model**

During certain periods throughout the day, implicit auction trading sessions are held at European level to allocate the available intraday cross-zonal capacity at all bidding zone borders by applying a market coupling mechanism between the bidding zones, which means that:

1) The same price is obtained in adjacent bidding zones when there is still free cross-zonal capacity after the implicit auction has been run (null capacity price);

2) Or two different prices are obtained in adjacent bidding zones in the event of congestion on the corresponding bidding zone border (capacity price is then equal to the difference in prices between the two zones).

The term “IDA” refers to implicit intraday auction trading sessions held at pan-European level to allocate the available intraday cross-zonal capacity at all bidding zone borders by applying a market coupling mechanism between the bidding zones, which means that a price for the intraday cross-zonal capacity can be determined.

These implicit auction trading sessions allow therefore to determine a price for the intraday cross-zonal capacity that reflects scarcity and are referred to as IDA. Several IDA can be held for a given delivery day but each IDA will reflect scarcity at the moment of the auction.

The determination of the results is done in a different way for an implicit auction compared to implicit continuous matching: IDA apply the pay-as-cleared mechanism while pay-as-bid is used in implicit continuous matching.

Under a pay-as-cleared pricing scheme each seller receives the market clearing price and each buyer pays the market clearing price.

Under pay-as-bid, sellers (resp. buyers) receive (resp. pay) the price of their bid. Pay-as-cleared incentivizes participants to reveal their actual preferences in terms of prices and volumes, contrary to continuous market in which the activity of a trader is visible to everyone (anonymously) in the shared order book, meaning that the traders may use/reveal dynamically the information in a way that suits their interests given the other visible orders.

The results of IDA, and thus the resulting intraday cross-zonal capacity pricing, are therefore based on actual orders of market participants, which reveals an actual price at the moment of the auction.

The implicit auction only model is not considered as compliant with CACM Regulation, as it does not allow implementing the SIDC as defined in the CACM Regulation.

In conclusion this model is not compliant with CACM requirements for Cross-zonal Intraday Capacity Pricing Methodology.

This implies that, ideally, the implicit auction only model should be complemented by continuous matching sessions so that it does not contradict the implementation of the SIDC as outlined in the CACM Regulation.

d) Hybrid model

Key features:

- Intraday cross-zonal capacity is priced through IDAs;
- Initial IDA is executed in day ahead timeframe and covers all the MTUs of the delivery day;
 - Further IDAs are executed in intraday timeframe and cover each a subset of all the MTUs of the delivery day: different options can then be introduced, depending whether
 - there is an overlap between the MTUs covered by each IDA (i.e. all IDAs cover all MTUs until the end of the day);
 - or there is no overlap between the MTUs covered by each IDA;
 - Continuous matching sessions are run between the IDAs, with different options:
 - Either a continuous matching session opens after the publication of the each IDA results and covers the MTUs not traded in the forthcoming IDA;
 - Or one single continuous matching session is executed; it opens after the publication of the first IDA results and covers all the MTUs until the end of the delivery day;
 - Given the fact that bids are paid-as-cleared under implicit auction and paid-as-bid under implicit continuous market participants need to enter their bids for both types of markets separately. This implies a different bidding strategy for market participants as such bids entered in one system cannot be transposed to the other.

The assessment against criteria of CACM Regulation applicable to the Cross-zonal Intraday Capacity Pricing Methodology is the same as for implicit auction only model, except that it now complies with continuous matching.

This model is compliant with CACM requirements for Cross-zonal Intraday Capacity Pricing Methodology.

2. Intraday Auction (IDA)

As it was mentioned in the Cross-zonal Intraday Capacity Pricing Methodology – Explanatory note[2], The term “IDA” refers to implicit intraday auction trading sessions held at pan-European level to allocate the available intraday cross-zonal capacity at all bidding zone borders by applying a market coupling mechanism between the bidding zones, which means that a price for the intraday cross-zonal capacity can be determined.

On 24 January 2019 Agency for the Cooperation of Energy Regulators (ACER) published the Methodology for pricing intraday cross-zonal capacity[3] and on 30 January 2020 published the Methodology for the price coupling algorithm, the continuous trading matching algorithm and the intraday auction

algorithm[4] in which the requirements for the implicit intraday auction trading sessions are described.

The requirements for this market are divided into the following categories:

- Legal requirements
- General requirements
- Qualitative requirements with precision and price ranges
- Performance requirements

Each category will further be described using only the most important requirement.

2.1. Legal requirements

In order to be able to support the same set of products and functionalities while assuring at the same time an efficient use of resources in terms of implementation costs and time to delivery of new functionalities, as well as benefit from the Single Day Ahead Coupled (SDAC) algorithm's development evolution, the same algorithm used for SDAC should be used also for IDAs.

Any IDA auction should ensure that the cross-zonal capacity is allocated in a way that aims to maximise the economic surplus and thus contributes to ensuring optimal use of the transmission infrastructure and also facilitates both the coordinated net transmission capacity approach as well as flow-based approach and thereby supports the optimisation of the calculation of cross-zonal capacity. As regards the allocation of cross-zonal capacity, the Algorithm methodology promotes implicit allocation of cross-zonal capacity, which is considered as more efficient than explicit allocation of cross-zonal capacity and allows for the usage of explicit cross-zonal capacity allocation.

Also, it should ensure a fair and non-discriminatory treatment of TSOs, Nominated Electricity Market Operators (NEMOs) and market participants. The non-discriminatory treatment of TSOs and NEMOs is achieved by allowing an open access to participation in SDAC and SIDC to all NEMOs and TSOs and by allowing both to define their requirements in relation to the development and operation of SDAC and SIDC. Non-discriminatory treatment of market participants is achieved through their equal access to the SDAC and SIDC regardless of their origin or chosen NEMO in Member States with multiple NEMOs. Moreover, the matching of their orders is based on an objective function, which maximises the economic surplus.

Also, it should be provided an assurance that the SDAC and SIDC algorithms are able to find for all days a solution that is compliant with the concept of market coupling and implicit capacity allocation within the permitted time.

The algorithms must be scalable. This means that they must be able to accommodate an enlargement of the SDAC and SIDC to new bidding zones (and new NEMOs), as well as the increased usage of the products and the implementation of the algorithm requirements. However, an unlimited scalability is not feasible, since any configuration of hardware and software is subject to technical constraints that can

become limiting under extreme conditions. Hence, the scalability should be adequate to accommodate the objectives of the CACM Regulation.

2.2. General requirements

For each bidding zone, the IDA algorithm will be able to:

- Facilitate orders for several Market Time Units ('MTUs'), such as quarter-hourly, half-hourly and hourly;
- support the products as defined in the IDA products;
- facilitate configurations with more than one NEMO for a given bidding zone or a scheduling area in accordance to the multiple NEMO arrangement;
- support multiple scheduling areas within a bidding zone as requested by TSOs;
- allocate cross-zonal capacities on a bidding zone border with one or multiple TSOs on one or both sides of the concerned bidding zone border.

The IDA algorithm will aim at maximising the economic surplus of the SIDC auction for all market time units that are part of the delivery period of the IDA, consistent with time limitations, conditions and requirements established by NEMOs and TSOs.

The IDA algorithm will provide for a fair and orderly price formation and will support multiple bidding zones within a country and will be scalable to cover all bidding zones eligible for participating in SIDC.

2.3. Qualitative requirements with precision and price ranges

The IDA algorithm will ensure:

- equal treatment of orders coming from all NEMOs in accordance with Article 3(e) of the CACM Regulation; and
- provide all orders of market participants non-discriminatory access to cross zonal capacity in accordance with Article 3(j) of the CACM Regulation.

In case of tie rules (between two or more orders) and for branching decisions (if any), deterministic rules will be implemented. Such choices will be logged and will allow for partial coupling, in order to deliver the auctions results, even if some inputs from a market or a delivery area are missing.

The IDA algorithm will automatically support leap years, i.e. 366 days in a year and will automatically support daylight saving clock changes.

2.4. Performance requirements

The IDA algorithm will be robust and reliable and it will be resilient to pretested data configurations such as, but not limited to, non-crossing of bids and offer curves, orders' curtailment, maximum and minimum prices, price and volume indeterminacy and will always produce a unique result, i.e. price and volume indeterminacy will be resolved.

The IDA algorithm will use reliable IT technology, e.g. reliable third-party software will always be available when required.

2.5. Fundamentals of intraday cross-zonal capacity pricing

The pricing mechanism for cross-zonal capacity in the intraday timeframe will be based on intraday auctions, which will be part of the single intraday coupling (i.e. auction SIDC) and will complement the continuous SIDC and will be established by allocating the available cross-zonal capacity for the respective MTUs by IDAs using the marginal pricing principle.

The established price of intraday cross-zonal capacity will reflect the market situation at the time of the allocation. The IDAs will respect cross-zonal capacity and allocation constraints.

The intraday cross-zonal gate opening and closure times for each MTU are defined according to the terms and conditions for intraday cross-zonal gate opening and intraday cross-zonal gate closure.

2.6. Timing of IDAs

1. One IDA will be held on the day D-1 for all MTUs of the delivery day D, i.e. from the first auction MTU starting at 00:00 until the end of the delivery day D, with a deadline for bid submission at 15:00 market time D-1.

2. One IDA will be held on the day D-1 for all MTUs of the delivery day D, i.e. from the first auction MTU starting at 00:00 until the end of the delivery day D, with a deadline for bid submission at 22:00 market time D-1.

3. One IDA will be held on the delivery day D for all remaining MTUs of the delivery day D, i.e. from the first auction MTU starting at 12:00 until the end of the delivery day D, with a deadline for bid submission at 10:00 market time D.

For Romania, the next calendar shall apply for a normal trading day, the extension to 30 minutes before and after the IDA is not considered:

- 9:40 – 10:20 AM CET The last IDA for all the remaining MTU from 12:00 CET until the end of delivery for the current trading day.

- 2:40 – 3:20 PM CET The first IDA for the next delivery day.

- 3:00 PM CET Opening a new trading day: order submitting and trading for the available contracts associated with the next delivery day in continuous intraday trading.

- 9:40 – 10:20 PM CET The second IDA for the next delivery day.

2.7. Design of IDAs

The IDAs will price the cross-zonal capacity for all relevant MTUs on the relevant bidding zone borders. All TSOs competent on the bidding zone borders participating in a specific IDA will provide to the relevant NEMOs the cross-zonal

capacity and allocation constraints as an input for the relevant IDA. The cross-zonal capacity and allocation constraints will be provided to the respective NEMOs before the deadline for bid submission of the relevant IDA.

The IDAs will be organised as implicit auctions where collected orders will be matched, and cross-zonal capacity will be allocated simultaneously for different bidding zones. IDAs will take into account all valid orders submitted for the respective auctions and determine a clearing price for the relevant bidding zones based on matched orders.

Cross-zonal capacity will not be allocated to an IDA and continuous trading at the same time. For this purpose, the cross-zonal trade and cross-zonal capacity allocation within the continuous SIDC will be temporarily suspended and during this suspension all the available cross-zonal capacity will be allocated through the IDA. The suspension period will be limited to the time needed to transfer cross-zonal capacity between the continuous SIDC and the auction SIDC to run the IDA algorithm and to verify the results for allocated cross-zonal capacities. IDAs will not have an impact on the continuous SIDC within bidding zones, for at least those bidding zones where more than one NEMO operates.

The duration of an IDA will be determined by its start, which is the deadline for bid submission, and by its termination, which is the publication of auction results. In case the TSOs are not able to provide the intraday cross-zonal capacity to an IDA, such capacity, when it becomes available, will be allocated through the continuous SIDC. In case that an IDA is not able to allocate intraday cross-zonal capacity, such capacity will be subsequently offered and allocated through the continuous SIDC.

The IDAs will be implemented on all the bidding zone borders eligible to participate in the SIDC. This obligation will apply to bidding zone borders regardless of whether they are already participating in the continuous SIDC or not.

In order to accommodate IDAs, the cross-zonal capacity allocation within the continuous SIDC will be suspended for a limited period during which the cross-zonal capacities will not be allocated through the continuous SIDC. This period for suspension will not be longer than 40 minutes and will consist of:

- the suspension before the deadline for bid submissions of each IDA. This suspension won't be longer than 20 minutes and allow maximum of 5 minutes for recalculating and/or updating of cross-zonal capacities, which will be published no later than 15 minutes before the deadline for bid submissions for each IDA;
- the suspension after the deadline for bid submissions of each IDA, which won't be longer than 20 minutes and allow for the calculation of auction results, verification of results and the recalculation and/or update of cross-zonal capacities for the continuous SIDC.

If all NEMOs and/or all TSOs identify during the testing of IDAs, that they are not able to implement IDAs within the time constraints, they may start the

implementation of IDAs with extended time constraints which are 30 minutes for suspension before the deadline for bid submissions of each IDA and 30 minutes for the suspension after the deadline for bid submissions of each IDA. These extended time constraints may be applied for up to maximum 12 months starting from the implementation date of IDAs and won't affect the deadline for publication of cross-zonal capacities.

3. Conclusions

The chosen model that is compliant with CACM requirements for Cross-zonal Intraday Capacity Pricing Methodology is the Hybrid model in which the Intraday cross-zonal capacity is priced through IDAs.

The same algorithm used for SDAC should be used also for IDAs.

The intraday auctions concept will be additional to the continuous intraday market, which will remain. Orders and trades in the intraday auctions are not related to orders and trades either in the day-ahead market or in the continuous intraday market.

There will be three auctions for a delivery day and for the period in which the IDA is held, the continuous intraday capacity will be suspended and will be used into IDA.

The IDA project is a part of the SIDC project, and the first intra-day auction is expected to be held on the 1st of January 2023.

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