

European Network of Transmission System Operators for Electricity

Cross-zonal Intraday Capacity Pricing Methodology - Explanatory note

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Disclaimer

This explanatory document is submitted by all TSOs to all NRAs for information and clarification purposes only accompanying the "All TSOs' proposal for cross-zonal intraday capacity pricing methodology in accordance with Article 55 of Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management".



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I. Introduction

1. Purpose and Structure of the Methodology

Article 55 of Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management (hereinafter referred to as "CACM Regulation") requires that by 24 months after the entry into force of CACM Regulation, all Transmission System Operators ("TSOs") propose a single methodology for pricing intraday cross-zonal capacity (hereinafter referred to as the "CZIDCP Methodology" or "Methodology") to all National Regulatory Authorities ("NRAs") for approval pursuant to Article 9(6)(j) of CACM Regulation. According to Article 9(9) of CACM Regulation the CZIDCP Methodology proposal needs to be submitted to ACER as well, who may issue an opinion on the proposal only if requested by the NRAs. According to Article 12 of CACM Regulation the CZIDCP Methodology proposal shall be submitted to consultation by the stakeholders, including the relevant authorities of each Member State, at Union level. The consultation shall last for a period of not less than one month.

This document is an explanatory note accompanying the CZIDCP Methodology and describing the technical background which forms the basis for the all TSOs CZIDCP Methodology. The document is structured as follows:

The legal requirements for the CZIDCP Methodology and their implications are presented in Chapter 2. Chapter 3 provides an explanation of some definitions introduced in the proposal. Chapter 4 describes the ID continuous market. Chapter 5 reflects on the methodology for intraday cross-zonal capacity pricing. Chapter 6 gives the design topics for the Hybrid Model. Chapter 7 provides the detailed process of the proposed Intra Day Auction (hereinafter referred to as "IDA"). Chapter 8 stresses the implementation prerequisites and Chapter 9 gives the implementation plan. Where relevant, examples are provided to better illustrate the application of the methodology.

The CZIDCP Methodology applies solely to the single methodology for pricing intraday cross-zonal capacity ("IDCZC") applied by all TSOs. Intraday trading and pricing within a bidding zone is outside the scope of this proposal, as is complementary regional auctions in line with Article 63 of the CACM Regulation, or any intraday cross-zonal capacity allocation mechanism with reliable pricing that may be proposed by some TSOs prior to the approval of the CZIDCP Methodology pursuant to Article 55 (2) of CACM Regulation. This proposal does not reflect on possible implications regarding the impact on the intraday cross-zonal capacity calculation methodology for relevant CCRs. These aspects are regulated and defined by other legal provisions and methodologies.

Capitalized terms used in this document are understood as defined in CACM Regulation, Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity (hereafter referred to as "Regulation (EC) No 714/2009"), Commission Regulation (EU) 543/2013 and the CZIDCP Methodology proposal (hereinafter referred to as the "Proposal").

2. Challenges for the pricing of the intraday cross-zonal capacity

Following challenges and risks have been identified during the drafting of the Proposal:

- CACM Regulation defines requirements for CZIDCP Methodology which seem sometimes conflicting with the principles of the Single Intraday Coupling (hereinafter "SIDC"). For example, pursuant to Article 55 (1) of the CACM Regulation, CZIDCP Methodology shall reflect scarcity ("shall reflect market congestion"), which may be challenging in a continuous allocation (see further details in §V.4.a) "Difficulties to price the intraday capacity with continuous allocation");
- There is no harmonized intraday cross-zonal capacity calculation/recalculation timing across Europe at the time of preparing the present methodology. Each CCR has indeed to perform intraday cross-



zonal capacity calculation according to its methodology based on relevant inputs, which can lead to specific timing issues during day ahead and intraday: as intraday cross-zonal capacity is an input of the intraday capacity pricing (see further details in §V.4.c)2 "Intraday cross-zonal capacity made available to the IDA"), the use of different timings across the different CCR makes it challenging to determine common timing of the CZIDCP process. Furthermore these methodologies have not been finalised at the time of the drafting of this CZIDCP Methodology;

- The definition of CZIDCP Methodology timings (especially IDA timing) reveals potential conflicts between market interests (related to market operation timing) and operational timing constraints for TSOs (e.g. related to calculation of intraday cross-zonal capacity). This issue is further detailed in §V.7 "Elements affecting the timing of the IDA processes";
- The development of CZIDCP Methodology is conditioned by several intraday related methodologies, such as: intraday cross-zonal gate opening and intraday cross-zonal gate closure times proposal as well as capacity calculation methodologies, which have not been approved or developed at the time of the drafting of the CZIDCP Methodology. This means that the Methodology relies on the content of the relevant methodologies in their current stage of the development, and not on an approved version;
- The incompleteness of execution of the prerequisites underpinning the Methodology (i.e. of the related methodologies referred to above and /or lack of full knowledge) do not free TSOs and NEMOs from their responsibilities stemming from Article 55 of CACM.

3. Reference documents

#	Name	Description
1	All TSOs' proposal for IDCZGOT and IDCZGCT	All TSOs' proposal for intraday cross-zonal gate opening and gate closure times in accordance with Article 59 of Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management, dated 16.12.2016
2	Outcome of ENTSO-EIntradaycapacitypricingworkshop,20.05.2015	Outcome from ENTSO-E Intraday capacity pricing workshop, 20.05.2015 (shared with NRAs and NEMOs)
3	ENTSO-E Intraday capacity stakeholder Workshop, 22.02.2016	Material from ENTSO-E Intraday capacity stakeholder Workshop, 22.02.2016 (slideshows, and other supporting documents, minutes)
4	Requirements for the continuous trading matching algorithm	Proposal for a common set of requirements for the continuous trading matching algorithm by NEMOs pursuant to CACM Regulation, dated 14.02.2017
5	Proposal for harmonised maximum and minimum prices for SIDC	Proposal for harmonised maximum and minimum clearing prices for Single Intra Day Coupling by NEMOs pursuant to CACM Regulation, dated 14.02.2017
6	Proposal for products for SIDC	Proposal for products that can be taken into account by NEMOs in single day ahead and intraday coupling process pursuant to CACM Regulation, dated 14.02.2017

This explanatory note makes use of the following documents:

Table 1: Reference documents



II. Requirements and Common Criteria for Intraday Capacity Pricing

1. Legal framework

a) CACM Regulation

The legal requirements for the CZIDCP Methodology are set out by Article 55 of CACM Regulation as follows:

"1. Once applied, the single methodology for pricing intraday cross-zonal capacity developed in accordance with Article 55 (3) shall reflect market congestion and shall be based on actual orders.

2. Prior to the approval of the single methodology for pricing intraday cross-zonal capacity set out in paragraph 3, TSOs may propose an intraday cross-zonal capacity allocation mechanism with reliable pricing consistent with the requirements of paragraph 1 for approval by the regulatory authorities of the relevant Member States. This mechanism shall ensure that the price of intraday cross-zonal capacity is available to the market participants at the time of matching the orders.

3. By 24 months after the entry into force of this Regulation, all TSOs shall develop a proposal for a single methodology for pricing intraday cross-zonal capacity. The proposal shall be subject to consultation in accordance with Article 12.

4. No charges, such as imbalance fees or additional fees, shall be applied to intraday cross-zonal capacity except for the pricing in accordance with paragraphs 1, 2 and 3."

These requirements are completed by the **Recital 22** of CACM Regulation, which states:

"Reliable pricing of transmission capacity should be introduced for the intraday market time-frame, reflecting congestion if capacity is scarce."

The **Recital 13** of CACM Regulation sets general requirements for allocation of capacity in the day-ahead and intraday timeframes:

"Capacity should be allocated in the day-ahead and intraday market time-frames using implicit allocation methods, in particular methods which allocate electricity and capacity together. In the case of single day-ahead coupling, this method should be implicit auction and in the case of single intraday coupling it should be continuous implicit allocation. The method of implicit auction should rely on effective and timely interfaces between TSOs, power exchanges and a series of other parties to ensure capacity is allocated and congestion managed in an efficient manner."

Moreover, Article 14 of CACM Regulation defines the Capacity calculation time-frames:

"1. All TSOs shall calculate cross-zonal capacity for at least the following time-frames:

(a) day-ahead, for the day-ahead market;

(b) intraday, for the intraday market.

2. For the day-ahead market time-frame, individual values for cross-zonal capacity for each day-ahead market time unit shall be calculated. For the intraday market time-frame, individual values for cross-zonal capacity for each remaining intraday market time unit shall be calculated.

3. For the day-ahead market time-frame, the capacity calculation shall be based on the latest available information. The information update for the day-ahead market time-frame shall not start before 15:00 market time two days before the day of delivery.

4. All TSOs in each capacity calculation region shall ensure that cross-zonal capacity is recalculated within the intraday market time-frame based on the latest available information. The frequency of this recalculation shall take into consideration efficiency and operational security."



The Article 20 (2) defines the modalities for definition of the intraday capacity calculation methodologies:

"No later than 10 months after the approval of the proposal for a capacity calculation region in accordance with Article 15(1), all TSOs in each capacity calculation region shall submit a proposal for a common coordinated capacity calculation methodology within the respective region. The proposal shall be subject to consultation in accordance with Article 12. The proposal for the capacity calculation methodology within regions pursuant to this paragraph in capacity calculation regions based on the 'North-West Europe' ('NWE') and 'Central Eastern Europe' ('CEE') as defined in points (b), and (d) of point 3.2 of Annex I to Regulation (EC) No 714/2009 as well as in regions referred to in paragraph 3 and 4, shall be complemented with a common framework for coordination."

The Article 21 (2) of CACM Regulation refines the requirements for the intraday capacity calculation methodologies:

"For the intraday capacity calculation time-frame, the capacity calculation methodology shall also state the frequency at which capacity will be reassessed in accordance with Article 14(4), giving reasons for the chosen frequency."

The **Article 58** (1) of CACM Regulation defines the timing for provision of input data for the single intraday coupling process:

"Each coordinated capacity calculator shall ensure that cross-zonal capacity and allocation constraints are provided to the relevant NEMOs no later than 15 minutes before the intraday cross-zonal gate opening time."

b) Other Regulations

The Article 11 (1) and Article 11 (2) of Commission Regulation (EU) 2015/543 of 14 June 2013 on submission and publication of data in electricity markets and amending Annex I to Regulation (EC) No 714/2009 of the European Parliament and of the Council (hereinafter the "Transparency Regulation") provide with requirements on information relating to the estimation and offer of cross zonal capacities:

"1. For their control areas TSOs or, if applicable, transmission capacity allocators, shall calculate and provide the following information to the ENTSO for Electricity sufficiently in advance of the allocation process:

(a) the forecasted and offered capacity (MW) per direction between bidding zones in case of coordinated net transmission capacity based capacity allocation; or

(b) the relevant flow based parameters in case of flow based capacity allocation.

TSOs or, if applicable, transmission capacity allocators shall be considered as the primary owners of the information they calculate and provide.

2. The information laid down in paragraph 1(a) shall be published as set out in the Annex."

The Annex of Transparency Regulation refines the publication of the information referred to in Article 11 (2) of Transparency Regulation for intraday timeframe:

"One hour before the first intra-day allocation and then real-time, for each market time unit"

2. Interpretation

The CZIDCP Methodology complies with the requirements set out in Article 55 of CACM Regulation and also serves the general objectives of the CACM Regulation.

In particular, the mechanism proposed in the CZIDCP Methodology allows for the calculation of a price for the intraday cross-zonal capacity which:



- is compliant with the concepts of the single intraday coupling;
- reflects congestion if capacity is scarce at the moment of auction;
- is based on actual orders; this point is interpreted to mean that the CZIDCP Methodology shall be based on orders that have been submitted for intraday trade by market participants to the NEMOs;
- is made available to the market participants at the time of matching the orders; this point is interpreted to mean that the market participants should know the price of the intraday cross-zonal capacity at the moment of the matching of their orders during the execution of continuous matching session of the single intraday coupling;
- is not complemented by additional charges or fees in accordance with Article 55 (4) of CACM Regulation.

With regards to the general requirements of CACM Regulation for allocation of capacity in the intraday timeframes, the IDA defined by the CZIDCP Methodology uses an implicit allocation mechanism.

III. Definitions

Article 2 of the CZIDCP Methodology introduces a number of definitions. Below some newly introduced definitions are explained.

1. First Auction Hour (FAH)

The definition of FAH is introduced in order to refer to the first hour for which market time units (hereinafter referred to as "MTUs") get allocated within the respective IDA.

For a given delivery day, IDA are performing an allocation on a delivery period covering MTUs from FAH until end of the day.

2. Intraday Auction (IDA)

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.

IDAs form the basis of the proposed CZIDCP Methodology, as further described in Chapter §Error! Reference source not found. "Error! Reference source not found.").

IV. Description of the intraday continuous market

1. Functioning of the intraday continuous market

a) General principles

The intraday continuous market is operated by NEMOs and allows a participant at any point in time during the trading session to buy and sell energy in any open MTU, by submitting orders.

The matching of the orders submitted by the participants consists of creating a trade, based on purchase and a sale orders with compatible execution characteristics.

The execution of orders is based on the so called "First Come First Served" (hereinafter referred to as the "FCFS") principle: the NEMOs process the orders in the order of their receipt. Trade occurs whenever a new order—that is either a purchase order with a price that is equal or greater than the best sale order at the time or a sale order with a price that is equal or smaller than the best purchase order at the time—is submitted.



Orders are first executed according to their price. Then, for identical prices, the order matched first is the one that has been submitted earlier. The price of matched trades depends on prices of the last matched orders for each trade (or each group of trades which are matched simultaneously). This results in a non-uniform price for each MTU, which implies a set of matched trades with individual prices for each MTU. After a matching of trades, other matching prices will result from the remaining orders that are still not matched.

Intraday continuous markets can run locally (i.e. on a si

ngle bidding zone), or coupled (i.e. by matching orders from different bidding zones until the cross zonal capacity defined between these bidding zones is exhausted).

Furthermore, the intraday allocation mechanisms are executed based on different MTU resolution depending on the product that is being accommodated.

b) Single intraday coupling solution (XBID solution)

NEMOs proposed to NRAs in the "All NEMO proposal for the Market Coupling Operator (MCO) Plan" that the delivery of the intraday market coupling MCOFunction, in accordance with Article 36 (4) of the CACM Regulation, shall be based on the XBID solution. Adoption by NEMOs of the XBID solution as the basis for the intraday MCO Function shall be contingent on agreement with TSOs (and NRAs where relevant).

The XBID solution means the solution (system, procedures, contract, etc.) to be implemented by the NEMOs and TSOs within the XBID Project for the single intraday coupling according to the principles set forth in the CACM Regulation.

2. Allocation of cross-border capacity in intraday continuous market

a) Implicit continuous allocation

In order to allow for the implicit continuous allocation under the SIDC, a capacity management module has to be implemented to continually allocate intraday cross-zonal capacity for trades between orders from different bidding zones.

Implicit allocation allows part of the set of bids from one bidding zone to become visible to traders in other bidding zones, which make these bids tradable, up to the volume of intraday cross-zonal capacity made available on the capacity management module platform by the TSOs (or when capacity is netted due to a trade in the opposite direction):

- If no capacity is available between two neighboring bidding zones (or insufficient capacity), no orders are visible from one bidding zone to the other;
- When capacity is made available between two neighboring bidding zones, a trade may be defined from the source bidding zone to the sink bidding zone, depending on the prices of the orders: for this trade, the cheapest sell orders in source bidding zone are traded (or "matched") with the most expensive buy orders in sink bidding zone for each direction ("cross-border matching"). Cross-border matching happens if no better trade is possible in the same bidding zone given the prices of available orders in this bidding zone (i.e. cross-border matching is not prioritized over local matching, but only happens depending on prices and available cross-border capacity), and stops when all available capacity is used (or if there is still capacity but all tradable orders have been matched).

Orders of all NEMOs are collected in a shared order book and matched locally or at cross-border level without any discrimination and in continuous manner (this applies irrespective of the number of NEMOs per bidding zone). In case of a cross-border matching, the interface between the shared order book and the capacity management module allows for automatic allocation of the corresponding cross-border capacity to the cross-border trades according to the FCFS principle.



The implicit continuous allocation mechanisms are executed based on different MTU resolution (60 min, 30 min, 15 min) depending on the arrangements on the relevant bidding zone borders.

b) Explicit allocation

In addition to implicit allocation under SIDC, and according to the modalities defined in Article 64 of CACM Regulation, the intraday cross-zonal capacity may be allocated on an explicit basis if the relevant NRAs approve a derogation from the European target model.

In this case, the capacity management module shall allow allocating the intraday cross-zonal capacity both in an implicit and explicit way without discrimination and still according to the FCFS principle.

V. Background of the methodology for intraday cross-zonal capacity pricing

This section explains the background of pricing intraday cross-zonal capacity in accordance with the Methodology: the goals underpinning the Methodology as well justification for the chosen pricing model used in the Methodology, the so-called "hybrid model" and its elements .

1. Objectives of the CZIDCP Methodology

The CZIDCP Methodology is a methodology to be implemented at the European level that should fulfill following objectives:

b) Reveal scarcity

Efficient intraday cross-zonal capacity pricing is needed in order to reveal the value of cross-zonal capacity when it is scarce.

This might happen when new intraday cross-zonal capacity becomes available due to the initial intraday cross-zonal capacity calculation, or because of changes, like significant grid outages, outages of large power plants or consumption units having an impact on the intraday market.

Especially, intraday cross-zonal capacity can be calculated more accurately, based on assumptions closer to real-time, where uncertainties and margins are reduced compared with the day-ahead capacity calculations. The new assumptions taken into account in the intraday timeframe might be results from the day-ahead market, updated wind/solar/temperature forecasts and adjustments due to unscheduled outages.

Thus, the main idea of the Methodology is to price capacity released by the intraday cross-zonal capacity calculation methodology, being either before the start of the continuous intraday market, or during its execution. The intraday cross-zonal pricing only reflects a situation at a specific moment in time and gives a price for each MTU.

Thus, intraday cross-zonal capacity pricing needs to be as consistent as possible with timings of recalculation of cross-zonal capacities as set in the different CCRs within the intraday timeframe to work most effectively.

Finally, additional operational complexity due to the intraday cross-zonal capacity pricing should be kept low in order to ensure smooth operation of the intraday market and foster liquidity.

c) Signal for investment

As intraday cross-zonal capacity pricing reveals scarcity at a particular moment in time, it will give a signal on how valuable the cross-zonal capacity is for the electric system. A high price of the intraday cross-zonal capacity could indicate a need to invest in additional cross-zonal capacity if this high price difference between



two market areas is structural and will be maintained in the future taking into account changes in load, generation and grid topology.

d) Efficient functioning of the intraday market

In a single intraday market running only with free cross-zonal capacity allocated in a continuous FCFS manner, the cross-border capacity is allocated to the quickest market participants with the highest price at that moment, but not necessary the ones which value it the most during the timeframe of the ID market. The economic goal to bring together supply and demand in an optimal manner for the intraday cross-zonal capacity would then be jeopardized.

In addition, the pricing of cross zonal capacity in the intraday timeframe also allows creating a remuneration of the offered cross border capacity across all timeframes (it is currently priced in all other timeframes, i.e. long term and day ahead). Therefore, the implementation of an intraday cross-zonal capacity pricing methodology shall contribute to a fair and non-discriminatory competition between market participants in the single intraday market.

2. Challeges linked to pricing cross-zonal capacity in the continuous markets

The single intraday coupling which preceeds the pricing, is based on continuos matching. The continuous matching mechanism poses a challenge in terms of finding a good pricing model, however. Determination of an intraday cross-zonal capacity price, reflecting scarcity, is very difficult in continuous markets since intraday cross-zonal capacity could be subject to a price¹ 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 principle.

3. 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 3. 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 at the moment: 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.

¹ More details are given in the "Report on intraday capacity pricing" from PMI consulting assigned by Ofgem, dated 17.10.2014.



This doesn't ensure an efficient pricing of the intraday market (as outlined in §Error! Reference source not found. "Error! Reference source not found.") 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 is available or not but no price is given for the commodity.

b) Implicit continuous trading with pricing

Key features

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 as²:

- "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 boundaries³ 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,
 - A first variant consists in decreasing the price (eventually to zero) if there is unused capacity prior to Gate Closure ("Move to zero price");
 - 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");
- "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;
- "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 analyzed.

² Further details about such models can be found in the "Report on intraday capacity pricing" from PMI consulting assigned by Ofgem, dated 17.10.2014, "Options for Intraday Capacity Pricing" from Baringa assigned by Ofgem, dated 21.10.2014, report from Universität Duisburg Essen assigned by Ofgem, dated July 2014, and "Preliminary report on intraday capacity pricing by Yves Langer and Olaf Islei", dated September 2014. ³ The boundaries of the profile are the prices when intraday cross-zonal capacity is fully used in a given direction. Fixed

³ The boundaries of the profile are the prices when intraday cross-zonal capacity is fully used in a given direction. Fixed boundaries therefore mean fixed price boundaries.



General assessment

Pros	Cons
 Price scaling Pricing is done during the execution of continuous allocation Market participants know the pricing scheme ex ante 	 Inefficient allocation in cases where the "boundary" prices differentiate from the bidding zone price differential (as capacity would remain unused in case of too high price boundary, or not allocated to those who value it the most in case of too low price boundary) Parameters used can only approximate the value of the intraday cross-zonal capacity Complex process to set the parameters (price boundary) and to review at regular moments New complexity on the continuous allocation algorithm Compatibility with different capacity calculation methodologies (e.g. flow-based to be assessed)
<u>Congestion forecast during trading</u> <u>session</u> • Same as for price scaling	• Cases where capacity has been priced although the interconnection is not congested
 Ex-post calculation No need to change the continuous matching algorithm being currently developed by XBID project 	 Price is not known ex-ante as such market parties cannot take it into account in their bidding. Necessity to define a price in each bidding zone based on matched orders. It needs to be defined how the price can be defined given the different types of products that can be traded in continuous trading.

Table 2: General assessment of continuous trading with pricing

Fulfilment of CACM requirements

The assessment of continuous trading with pricing model types shows that it is not possible to fulfill criteria of CACM Regulation, as shown in the table below:

Requirement	Assessment	
Compatibility with continuous	This model implies that the matching algorithm being currently	
matching	developed for the first GO-LIVE of SIDC implementation by	
	XBID project has to be significantly changed	
Reflects congestion if capacity is scarce	Only with "ex-post calculation of capacity price"	
	Not in all cases with other types of model	
Is based on actual orders	Only with "ex-post calculation of capacity price"	
	Not in all cases with other types of model	
Capacity price is made available at the	No with "ex-post calculation of capacity price" variant	
time of matching the orders	Yes in the other variants but the price does not reflect the real	
	willingness to pay of market parties	
Isn't complemented by additional	Yes	
charges or fees		
Conclusion	Not compliant with CACM requirements for CZIDCP	

Table 3: Fulfilment of CACM requirements by continuous trading with pricing



c) Implicit auction only model

Key features

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:

- 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)⁴;
- 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)⁵.

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.

General assessment

IDAs allows for determining a unique price for a particular moment in each bidding zone and thus a clear and unique intraday cross-zonal capacity price. However there is no guarantee that this scarcity is maintained nor that the same intraday cross-zonal capacity price is obtained if further IDAs are held for the same delivery period.

However, the intrinsic drawback of implicit auction only model is that it is not a continuous allocation method and as such not in line with European target model nor the SIDC solution indicated in CACM:

⁴ Under flow-based approach, bidding zones will have the same price if no critical network element is congested.

⁵ Under flow-based approach, bidding zones might get different prices when one or more critical network element are congested.



Pros

- Efficient pricing of intraday cross-zonal capacity through IDAs at a particular moment in time
- Pooling of Liquidity in IDAs
- IDAs are beneficial for smaller market participants (e.g. resources, market power)

Cons

• Not in line with the continuous allocation model set forth as the European target model in CACM or the SIDC model

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 Table 4: General assessment of implicit only model

Fulfilment of CACM requirements

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

However, the assessment of implicit auction only model shows that most of the criteria of CACM Regulation applicable to the CZIDCP Methodology are fulfilled, as shown in the table below:

Requirement	Assessment	
Compatibility with continuous matching	No, as SIDC requires continuous matching sessions	
Reflects congestion if capacity is scarce	Yes, but only at the moment of the auction	
Is based on actual orders	Yes The market participants have to submit their actual orders which reveals an actual price of the intraday cross-zonal capacity (cf. "pay-as-clear" approach)	
Capacity price is made available at the time of matching the orders	Yes Even if there would be no continuous allocation, the capacity price is revealed at the time of running the auction (i.e. when orders are matched)	
Isn't complemented by additional charges or fees	Yes The price of the intraday cross-zonal capacity is entirely based on the market outcome	
Conclusion	Not compliant with CACM requirements for CZIDCP	

Table 5: Fulfilment of CACM requirements by implicit only model

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 multiple 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 pay-as-cleared under implicit auction and pay-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.

General assessment

The differences with the implicit auction only model are indicated in bold in the table below:

Pros		Cons	
•	In line with implementation of SIDC Efficient pricing of intraday cross-zonal capacity through IDAs Pooling of Liquidity in IDAs IDAs are beneficial for smaller market participants (e.g. resources, market power) Can be implemented without fundamental review of the algorithm of the XBID solution	•	No continuous intraday cross-zonal capacities pricing scheme (i.e. during continuous matching sessions) but scarcity is priced during auctions Continuous matching is not open to trade all MTU at all times; the tradable MTU can be split into different sessions limited to a sub set of MTU; or if all MTU are open to continuous matching trade must be halted prior to an IDA as capacity cannot be given to both trading platforms simultaneously

 Table 6: General assessment of hybrid model

Fulfilment of CACM requirements

The assessment against criteria of CACM Regulation applicable to the CZIDCP Methodology is the same as for implicit auction only model, except that it now complies with continuous matching:

Requirement	Assessment	
Compatibility with continuous	Yes	
matching		
Reflects congestion if capacity is scarce	Yes but only at the moment of the auction.	
Is based on actual orders	Yes	
	The market participants have to submit their actual orders which	
	reveals an actual price of the intraday cross-zonal capacity (cf.	
	"pay-as-clear" approach)	
Capacity price is made available at the	Yes	
time of matching the orders		
Isn't complemented by additional	Yes	
charges or fees	The price of the intraday cross-zonal capacity is entirely based	
	on the market outcome	
Conclusion Compliant with CACM requirements for CZIDCP		
Table 7: Fulfilm	nent of CACM requirements by hybrid model	

Tuble 7. Puljument of CACM requirements by hybrid mode

4. Choice of Hybrid Model for intraday capacity pricing

a) Difficulties to price the intraday capacity with continuous allocation



As outlined in the previous section, implementation of a CZIDCP Methodology in continuous allocation raises several issues, mainly the impossibility to reflect properly the congestion and to contribute to the efficient functioning of the intraday market. Finally, a pricing mechanism within the continuous matching sessions might negatively affect speed/cost of implementation and overall robustness of the EU-wide solution (XBID).

b) Hybrid Model as an efficient capacity pricing mechanism

The choice of the present CZIDCP Methodology has focused on the best combination of the compatibility against the following requirements:

- "Implicit continuous allocation";
- CACM Regulation requirements on capacity pricing: establishing efficient pricing and reflecting market congestion, based on actual orders.

This leads to the conclusions that only the hybrid model satisfies all the constraints and requirements, and especially CACM compliance. Neither continuous trading nor implicit auctions can alone fulfil all CACM requirements.

The hybrid model is the most suitable intraday cross zonal capacity pricing method to ensure compliance with CACM Regulation, while allowing also the execution of continuous trading and respecting an IDCZCT of 60 minutes before delivery (pursuant to the version of the IDCZCT proposal from TSOs at the time of this CZIDCP Methodology). Additionally, no major objection was raised as the hybrid model was presented by the TSOs to the stakeholders at the different workshops (cf. reminder of previous works in §0 "5. Previous work from all TSOs and stakeholders' involvement"). Especially, no objections were raised from NRAs present at these workshops.

Benefits of the hybrid model in pricing intraday cross-zonal capacity are listed below with regards to the following topics:

Compliance with CACM Regulation

- Allows for implementation of SIDC as continuous matching;
- Pricing based on orders submitted from market participants ("actual orders" requirement from CACM);
- Capacity pricing made available to the market participants at the time of matching the orders;
- Pricing reflects market congestion at the moment of the auction;
- Maximization of economic surplus (implicit allocation).

Ease of Implementation

- Straightforward (implicit auctions independent from continuous matching, and no need to significantly review the algorithm of the continuous matching algorithm);
- Practical and feasible (use of an existing and proven concept);
- Cost-efficiency (possibility to take advantage of existing systems for implicit auctions);
- Reasonable time to make familiar to the market participants.

Efficient intraday cross-zonal capacity pricing

• Efficient pricing of capacity through auctions:

By introducing IDA before starting the continuous trading, intraday cross-zonal capacity can be allocated to the market participants that values it most and not just on a first-come first-served basis (cf. pay-as-cleared bidding).



The IDAs yield a reference intraday cross-zonal capacity price for the MTUs traded in the upcoming continuous matching session, with the assumption that the intraday cross-zonal capacity assessed by TSOs is first offered through IDAs (see §V.4.c)2 "Intraday cross-zonal capacity made available to the IDA").

This reference price reflects the situation at the time of execution of the IDA.

• Uniform pricing methodology:

An intraday auction price applies uniformly to all parties. Thus, all market actors receive/pay the same uniform price on their sales/purchases. This allows market participants to express their "willingness to pay" (this depends in practice on the effective pricing/bidding strategy for each market participant).

- Fair and transparent price formation thanks to a unique price in each bidding zone, no distortions under the condition that all available intraday cross-zonal capacity is made available at each IDA;
- Pooling of liquidity (implicit auction) which contributes to a relevant pricing;
- Optimal matching of supply and demand.

Robust and future-proof European solution

- High performance and reliability: IDA exists as a robust solution. Computation of a continuous matching algorithm embedding additional complex pricing rules has to be developed, and has thus an element of unknown added complexity and vulnerability. This is why the introduction of IDA is not seen as a threat to the overall reliability of operation of the intraday market;
- The combination implicit auction and continuous matching sessions is repeatable and scalable;
- Can be combined with XBID Solution (can be developed as a complement that doesn't have to be included directly in the continuous implicit coupling algorithm);
- Remuneration of the offered cross border capacity allocation across all timeframes.

Fulfilment of market parties' needs

- Intraday cross-zonal capacity is not priced if not scarce at the moment of the auction;
- Possibility to adjust positions close to real time during continuous matching sessions;
- Pricing of intraday cross-zonal capacity is known by market participants at the time of continuous matching;
- Simplicity and ease of use (implicit auction) although it requires market participant to enter their bids in the two systems taking into account different allocation algorithms paid as bid for continuous trading and paid as cleared for IDA;
- Transparency.

Level playing field

Accessibility for all market participants (small generators, RES, demand side): IDAs are beneficial for smaller market participants as well (standardized trading times are beneficial to small players without sophisticated trading departments operating 24/7 and easier to monitor).

c) Characteristics of the hybrid model selected as the best compromise by TSOs

Characteristics of the hybrid model can be refined regarding the MTUs covered by each IDA, and the continuous matching sessions.

Firstly, TSOs consider that MTUs allocated by each IDA shall always cover remaining period until the end of the delivery day: each IDA allows for pricing of all remaining MTUs, which means that each IDA covers MTUs from a given FAH until the end of the delivery day. This allows market participants to adjust their



position for all the remaining MTUs of the delivery day at each IDA (including for block bids since no split of the blocks is needed). This feature is of benefit especially for smaller market participants who not necessarily need to have a 24/7 desk.

It is also possible to have a pricing of the intraday cross-zonal capacity for a given MTU at different points in time:

- Initial IDA defines the initial price reflecting the scarcity situation at the moment of the auction;
- Depending on the outcome of the next capacity calculations during intraday timeframe, if any, additional intraday cross-zonal capacity can be offered, and thus priced, for this MTU; this applies especially for MTUs close to the end of the delivery day.

Secondly, TSOs consider that a continuous matching session shall open after the publication of the each IDA results and cover the MTUs not traded in the forthcoming IDA: as a consequence, there is no need to stop the continuous matching during each IDA; but simply start continuous matching for the MTUs of the latest IDA when IDA results are ready. This choice is seen as a good balance between pricing updated intraday cross-zonal capacity and having the possibility of performing continuous matching. On the other hand in a design with only one single continuous matching session spanning all MTUs until the end of the day, new additional cross-zonal capacity might be used in the continuous matching before being priced in an IDA, and there would be a need to stop this continuous matching session to hold an IDA, which would bring an additional complexity on the processes, from TSOs', NEMOs' and market participants' point of view.

The characteristic of the hybrid model selected by the TSOs as the best compromise are summarized in the following table:

Choice	Rationale
MTUs allocated by each IDA shall always cover remaining period until the end of the delivery day	 Allows market participants are able for adjusting their position for all the remaining MTUs "Incremental" pricing of the intraday cross-zonal capacity for a given MTU
A continuous matching session shall open after the publication of each IDA results and cover the MTUs not traded in the forthcoming IDA	 No need to stop the continuous matching during each IDA Intraday cross-zonal capacity is first priced through an IDA

 Table 8: Characteristics of the hybrid model

5. Previous work from all TSOs and stakeholders' involvement

The different models considered in this document and the choice of hybrid model for pricing the intraday cross-zonal capacity are in line with the previous work done by all TSOs and shared with stakeholders through several ENTSO-E workshops:

Outcome of ENTSO-E Intraday capacity pricing workshop, 20.05.2015 [2]

- Recommendation to develop a hybrid solution which combines both implicit auctions and implicit continuous matching sessions;
- Presentation of eight different hybrid models;

ENTSO-E Intraday capacity stakeholder Workshop, 22.02.2016 [3]

- Neither continuous matching nor implicit auctions can fulfil alone all CACM requirements;
- Recommendation to develop hybrid models;
- Design features of hybrid models.



VI. Elements of methodology for intraday cross-zonal capacity pricing

This section provides explanation on the key elements of the pricing intraday cross-zonal capacity as in the Proposal for CZIDCP Methodology (Articles 3, 4, 5 and 6) that is based on the hydbrid model.

1. Steps of the IDA

The execution of each IDAa key element of the Methodologyconsists of following steps:

- 1. All TSOs in the relevant Capacity Calculation Regions calculate the intraday cross-zonal capacity pursuant to relevant capacity calculation methodology;
- 2. All TSOs make available to NEMOs and publish the intraday cross-zonal capacity to be used in the IDA;
- 3. The bidding period for the IDA opens (this step can be executed before the two previous ones but no later than the next one);
- 4. All TSOs make available and publish the final value of intraday cross-zonal capacity to be used in the IDA, along with possible allocation constraints, this value is transferred to the NEMOs;
- 5. The bidding period for the IDA closes, which launch the calculation of the IDA results;
- 6. After the calculation of the IDA results, the IDA results are first to be validated by TSOs (against the intraday cross-zonal capacity and allocation constraints they submitted) and NEMOs (against the orders they submitted) before they can be published (including intraday cross-zonal capacity price), settled and shipped;
- 7. The remaining intraday cross-zonal capacity is made available for the subsequent continuous matching (or "CM") session for the MTUs covered in the IDPA.

The different steps are summarized below, and further discussed in the next chapters:



Figure 1: Steps of the IDA

2. Intraday cross-zonal capacity made available to the IDA

a) Initial intraday cross-zonal capacity

Each IDA will allocate cross-zonal capacity based on the latest intraday cross-zonal capacity calculation.

In order to efficiently reflect its level of congestion, all the available intraday cross zonal capacity for a given MTU at the moment when the final value of capacity is transmitted to IDA (see below) shall be offered through this IDA. If some volume of intraday cross-zonal capacity was not allocated at borders where a price difference exists, this would induce a reduction of the total social welfare.

This means that the initial intraday cross-zonal capacity calculated for a given MTU shall first be allocated by an IDA so that it can be priced in a feasible manner. The remaining intraday cross-zonal capacity that is left after the execution of the IDA shall then be allocated in the continuous matching session for this MTU.

This principle is illustrated by the figure below:





Figure 2: Use of intraday cross-zonal capacity by IDA and continuous matching

The IDA will therefore price the intraday cross-zonal capacity calculated by the TSOs, and before it is made available to the continuous matching session if feasible. The intraday cross-zonal capacity is only allocated through continuous matching for the MTU which are not allocated anymore in a subsequent IDA. This ensures that a relevant intraday cross-zonal capacity price is determined for this MTU before the start of CM session.

b) Update of intraday cross-zonal capacity

Moreover, with regards to the intraday cross-zonal capacity calculation, Articles 14 (1), (2) and (4) of CACM Regulation require the TSOs to assess intraday cross-zonal capacities not only in day ahead timeframe (before the start of Intraday Cross Zonal Gate Opening), but also within the intraday timeframe where relevant. It is also explicitly required to take into account the latest available information for these calculations. Since the capacity calculation is dependent on the forecast of net positions taken into account in the base case, there is an opportunity for the TSOs to refine the capacity calculation for the remaining MTUs that are still not made available for continuous matching and lower the level of uncertainties, with therefore a higher probability of determining additional cross-zonal capacities with a new recalculation.

As for the initial intraday cross-zonal capacity, any additional intraday cross-zonal capacity for a given MTU (obtained by a capacity reassessment, when relevant) shall first be allocated by an IDA so that it can be priced if feasible.

Concretely, for late MTUs, intraday cross-zonal capacity can be calculated several times, which may lead to a new capacity pricing through an IDA if feasible. Since the frequency of intraday cross-zonal capacity calculation is entirely dependent of the corresponding methodologies that are established at the different CCRs, the feasibility of this principle for which coherence of the timings of recalculation in the different CCRs is essential is still to be confirmed at an EU level. Such a procedure is illustrated by the figure below:



Figure 3: Intraday cross-zonal capacity recalculations between IDA



However, situations can occur where the intraday cross-zonal capacity of a given MTU is updated, where this MTU is no longer traded in any upcoming IDA, but still be available during the execution of the continuous matching session. This can happen due to:

- Real time events impacting the intraday cross-zonal capacity (typically on a HVDC interconnector, or any other relevant grid element limiting the cross-zonal capacity, or new input information for grid security reasons). These events can lead to a decrease or an increase of the intraday cross-zonal capacity;
- Discrepancies between the timing of European IDA, and the timing of intraday cross-zonal capacity calculation, which is determined by the different CCRs. This point constitutes a real challenge for implementation of CZIDCP Methodology and each intraday cross-zonal capacity calculation methodology.

In such cases leading to additional intraday cross-zonal capacity to become available for MTUs which will no longer be traded in subsequent IDA, this additional capacity should not be withheld from the continuous matching session. In cases where new capacity calculations result in a reduced capacity, the new capacity information should likewise be uploaded to the continuous trading session.

The IDA results will thus reflect the market situation at the moment IDA is executed, including the bidding strategy of market participants at this point in time. This means that market participants should be aware that intraday cross zonal capacity and IDA prices might vary between different IDAs. Recalculation of cross zonal ID capacity can result in more (or less) intraday cross zonal capacity being available in the subsequent IDAs made for a given MTU.

c) Transmission of final value for each IDA

Finally, the final value of intraday cross-zonal capacity (as well as possible allocation constraints associated) for each IDA shall be transferred to the NEMOs no later than a minimum duration before the start of the calculation of the results of this IDA.

3. Bidding to the IDA

a) Tradable MTUs

The MTUs that are covered in each IDA are always comprised in a time interval which:

- Starts at the FAH of this IDA;
- Ends at the last hour of the delivery day (i.e. 24:00).

For each bidding zone border, resolution of MTUs to be allocated in the IDA shall be consistent with the resolution of the MTUs that are usually traded cross-border in intraday timeframe for these bidding zones.

b) Products and liquidity

A lack of liquidity in IDA might lead to wrong intraday cross-zonal capacity price signals. This point is linked to:

- Timing of IDA: moment where the concentration of the liquidity can be maximized;
- Bidding zone borders included: from this perspective, defining specific timing per bidding zone border or regions seems less relevant in order to implement a uniform CZIDCP Methodology across Europe maximizing the liquidity;
- Intraday cross-zonal capacity available for IDA: all available intraday cross-zonal capacity shall be allocated in the IDAs if feasible;
- Products included: to be determined by NEMOs.



4. Price of intraday cross-zonal capacity

a) Calculation

The IDA determines a single clearing price for each bidding zone in a following way:

- a) If all intraday cross-zonal capacity has been allocated by the IDA, the intraday cross-zonal capacity is priced at the value corresponding to the difference between the clearing price of each bidding zone. To establish the clearing price for each bidding zone, available bids and orders shall be matched within the IDA mechanism and the price shall be established by using a pay-as-cleared approach;
- b) If not all intraday cross-zonal capacity has been allocated by the IDA, the intraday cross-zonal capacity is priced at zero.

The previous statements are made with the assumption that the intraday cross-zonal capacities to be allocated in the IDA are modelled in a coordinated net transmission capacity approach. With a flow-based approach, the statement needs to be slightly adapted, in the sense that the availability of the cross-zonal capacity is conditioned by one or several critical network elements at a CCR level (instead of a cross-zonal capacity at a bidding zone border level):

- 1. If the power flow capabilities of one critical network element are fully used by the allocation performed in the IDA, then differences exist between the clearing price of the bidding zones of the CCR;
- 2. If not, then the clearing price of the bidding zones of the CCR are the same.

Another refinement to be made is related to the possible allocation constraints defined by TSOs to be taken into account in the calculation of IDA results, in the sense that such constraints can limit the amount of intraday cross-zonal capacity that is allocated in an IDA (before the intraday cross-zonal capacity itself).

The price of intraday cross-zonal capacity shall be calculated shortly after the bidding period of the IDA closes so that, for a given MTU, it is available to the market participants before the start of continuous matching session, i.e. the time of matching the orders.

b) Robustness

The intraday cross-zonal capacity price determined by a given IDA will reflect the market situation at the moment of this IDA is executed.

This means, in certain cases, that a price may be assessed for intraday cross-zonal capacity (since it is congested at the moment of the IDA execution), while in a later moment this cross zonal capacity can be priced at a different value, for example it may be zero (if not congested anymore when more ID capacity is made available and not used).

5. Interactions with the single intraday coupling

c) Processes

After each IDA, the remaining intraday cross-zonal capacity shall be determined for each MTU of the subsequent continuous matching session: this remaining intraday cross-zonal capacity shall be transferred from the systems in charge of IDA to the systems in charge of executing the continuous matching sessions.

It has to be noted that same systems could be in charge of the execution of IDA and continuous matching, but this does not have to be necessary as such: this point is to be further assessed during the implementation phase. However if the systems are different the transfer from one system towards the other will become more complex and automation may be not possible.

This operation shall be run as smooth as possible in the most efficient way in order to avoid any delay of the continuous matching session: the intraday cross-zonal capacity to be allocated in the continuous matching



session is indeed a prerequisite to start this continuous matching session. Following topics have to be managed:

- Systems used for IDA and continuous matching: different systems can bring additional complexity to transfer data from IDA to continuous matching;
- Operational processes needed between IDA and continuous matching, among which:
 - Validation of the results of IDA, that needs to be performed by TSOs and NEMOs (cf. execution of the day ahead implicit allocation);
 - Clearing, settlement and shipping of results of IDA;
 - Determination of intraday cross-zonal capacity made available to the continuous matching.

The intraday cross-zonal capacity made available to the continuous matching shall be based on the outcome of the IDA.

d) Bidding and products

There is no any automatic transfer of bids/offer from market participants from IDA (pay-as-cleared mechanism) towards continuous matching (pay-as-bid mechanism). This means that the type of products to be traded within IDA are not directly linked with the ones traded during continuous matching session.

Market parties should be aware that it is their responsibility to place their offers separately in the IDA and the continuous matching sessions, as summarized below:



Figure 4: Bidding periods for IDA and continuous matching

Finally, it is underlined that there is no obligation for the market participants to submit offers in both mechanisms (IDA and continuous matching) for a given MTU.

e) Pricing

The IDA price results are used to price the intraday cross-zonal capacity, but are not reused in the subsequent continuous matching sessions: this means that the remaining intraday cross-zonal capacity will be allocated without capacity pricing in the subsequent continuous matching sessions.

6. Interaction with explicit allocation

There is no interaction between CZIDCP Methodology and explicit allocations that could be introduced pursuant to CACM Regulation on relevant borders in the sense that an explicit allocation is performed, when relevant, in parallel of implicit allocation during the execution of continuous matching sessions but no explicit auction is included in the CZIDCP Methodology.

Moreover, IDAs are implicit only auctions allocating all available intraday cross-zonal capacity, and only the remaining intraday cross-zonal capacity is offered in the SIDC continuous trading session (including continuous explicit allocation, when relevant).

7. Elements affecting the timing of the IDA processes



When designing the CZIDCP Methodology, a number of elements impact the timing of the IDA processes.

a) Operational processes from TSOs

The definition of the timing of IDA is impacted by several operational processes from TSOs, which outputs condition the start of each IDA.

Before the start of IDA, TSOs need to perform following tasks:

- For the initial IDA, security analysis and intraday cross-zonal capacity calculations following the results of the day ahead market. These security analyses may make use of the Common Grid Model established in the day ahead timeframe which is made available at the end of the afternoon;
- For later IDAs, intraday cross-zonal capacity calculation, which is performed according to the methodology defined per Capacity Calculation Region. This calculation will depend on the output of security analysis that makes use of the Common Grid Model established in the day ahead timeframe.

This means that the determination of the timing of the first IDA shall be such that all TSOs can perform the above-mentioned tasks. However, this may be difficult since:

- The timing of the IDAs shall be uniformly defined across Europe in order to provide for a market coupling mechanism across CCRs, which means that the first IDA shall be set so that all TSOs can execute their processes;
- The timing of each ex-ante process from TSOs is defined at a CCR level or at a lower level.

Additionally, the number of intraday cross-zonal capacity reassessment can also have an impact on the number of IDAs, knowing that intraday cross-zonal capacity shall first be allocated by an IDA if feasible so that it can be priced. However, it is intrinsically not possible to guarantee that all intraday cross-zonal capacity methodologies per CCR offer the same timing and number of intraday reassessments.

b) Stakes for the market participants

From market participants' perspective, the stakes considered by TSOs when defining the time and number of IDA are the following:

- Same time across Europe: each proposed IDA shall be executed according to the same timing in order to price the intraday cross-zonal capacity at the same time across Europe, in the same way that each MTU should be allocated in a continuous way during a minimum common continuous matching session window where orders across Europe can be matched;
- Required minimum duration for continuous matching sessions: the implementation of CZIDCP Methodology shall be compliant with SIDC and shall thus allow for at least a minimum continuous matching session window for each MTU (once the results from IDA are known).

Besides this, the number of IDAs may be considered: a good balance should be found between a high number of IDA (high complexity, too much discretization of the continuous matching, cost efficiency) and very few IDA (no possibility to update the pricing, inefficient allocation).

c) SIDC

Each IDA shall be executed so that its results are determined before the bidding period for the continuous matching starts.

Links exist therefore between timing of IDA and intraday cross-zonal gate opening and closing times (see next paragraph).



d) Regulation

CACM Regulation

Article 59 (1) of CACM Regulation defines intraday cross-zonal gate opening time (hereafter referred to as "IDCZGOT") and intraday cross-zonal gate closure time (hereafter referred to as "IDCZGCT").

The CACM Regulation defines the IDCZGOT as "the point in time when cross-zonal capacity between bidding zones is released for a given market time unit and a given bidding zone border". As further detailed in [1], IDCZGOT is the point in time when cross-zonal capacity allocation for the intraday timeframe is possible for the first time. All TSOs have currently proposed to set a single IDCZGOT at 22:00 market time day ahead, with the option to choose an earlier intraday cross-zonal gate opening time at a CCR level.

This therefore means that the calculation of the first IDA results shall not start after the IDCZGOT. In case of different IDCZGOT, and still assuming a uniform timing of the IDAs across Europe, this would result in a challenging situation since the calculation of the first IDA results should then occur before the first IDCZGOT in time. This would be furthermore a time constraint in contradiction with the ones coming from the operational processes from TSOs (cf. previous paragraph).

Requirements of CACM Regulation related to the SIDC also state that the final value of intraday cross-zonal capacity shall be transferred to NEMOs no later than 15 minutes before the IDCZGOT. Thus, the final value of intraday cross-zonal capacity (as well as possible allocation constraints associated) for each IDA shall be transferred to the NEMOs no later than 15 minutes before the start of the calculation of the results of this IDA, as shown in the figure below:



Figure 5: transmission of the final value of intraday cross-zonal capacity to the NEMOs

On the other hand, the CACM Regulation defines the IDCZGCT as "the point in time when cross-zonal capacity allocation is no longer permitted". As further detailed in [1], all TSOs have currently proposed to set a single IDCZGCT at 60 minutes before the start of the relevant MTU.

This therefore means that both intraday cross-zonal capacity pricing and start of continuous allocation shall start at the latest at IDCZGOT and end before IDCZGCT.

Transparency Regulation

According to the Transparency Regulation, all TSOs shall make available the calculated cross-zonal IDA capacities for publication no later than 60 minutes prior to the execution of this IDA. This is not understood as a requirement for a fixed value, meaning that it could be updated also after this 60 minutes lead time when relevant. Thus, the only requirement for a fixed value is the one coming from the CACM Regulation regarding the transmission of the final value to be allocated both in IDA and continuous matching sessions.

8. Bidding zone borders included/geographical scope (pan-European/regional)

The CZIDCP Methodology applies to all European bidding zone borders.



However, there might be situations that require addressing intraday capacity pricing through implicit auctions at the regional level.

Article 5 of the Proposal has been introduced to address these situations. The idea behind the Article is to enable additional intraday cross-zonal implicit auctions as part of regional implementation of this CZIDCP proposal. Relevant TSOs may propose and relevant NRAs to approve them. These additional auctions shall respect principles of the Proposal, and should be aligned with updates of cross-zonal capacities if operationally feasible.

Pursuant to Article 63 of CACM Regulation, complementary regional intraday auctions may be introduced on relevant borders. These complementary regional auctions may be introduced separately without linking them to intraday capacity pricing methodology. These complementary regional intraday auctions may propose a different methodology for pricing intraday cross-zonal capacity than this CZIDCP Methodology, which shall nevertheless meet the principles provided for in Article 55 (1) of CACM Regulation.

Pursuant to Article 55 (2) of CACM Regulation, TSOs may propose an intraday cross-zonal capacity allocation mechanism with reliable pricing consistent with the requirements of Article 55 (1) of CACM Regulation prior to the approval of the CZIDCP Methodology. Based on this it is possible to make a proposal of such regional mechanism before all NRAs approve the CZIDCP Methodology.

In addition to situations invoked above in Articles 63 and 55 of the CACM Regulation, it is further considered necessary to allow additional intraday cross-zonal auctions as part of the regional implementation of this CZIDCP proposal. It is stressed however that in case implemented, these auctions are always additional and allowing their implementation in special regional circumstances shall not contravene the Pan-European solution prescribed by the Proposal.

9. Fallback

In line with CACM Regulation⁶, no fallback procedure for IDA is defined.

The case where the calculation of the intraday cross-zonal capacity is delayed only in some CCRs should not lead to postponement of the IDA. Procedures to deal with such cases shall be further define in the implementation phase.

In case an IDA can't be executed for given MTUs, the corresponding intraday cross-zonal capacity will be allocated in the continuous matching session and not priced.

10. Systems and Algorithm

The concept of IDA is quite different from the implicit continuous allocation, which raise the question whether same systems should necessary be used for IDA and continuous matching. This question shall be closed during the implementation of the CZIDCP Methodology, however a first assessment is given below when opting for different systems for IDA and continuous matching:

- As for pros, there is the possibility to reuse PCR&XBID systems, without needing to change them in depth since only an interface would be needed (to be assessed during the implementation phase);
- As for cons, this solution might lead to additional complexity when switching from IDA to continuous matching.

Opting for same systems for IDA and continuous matching might have the advantage to simplify the transfers of information from IDA to continuous matching but would never allow full automation since market

⁶ Contrary to the single day ahead coupling, for which the CACM Regulation requires the establishment for fallback procedures according to Article 44, no requirements of this kind are given to the SIDC.



participants would still need to enter their bids in both systems since the clearing algorithm is different in an auction versus continuous matching. If this one system should be XBID it would imply a significant amount of development on the current solution, which is currently not prepared for CZIDCP (it has been agreed to not be in scope for the first go-live). In such an option, it would be thus important to establish a formal involvement of XBID project in the implementation of CZIDCP Methodology.

NEMO's input is needed in order to assess this point further.

It can be noted that the implementation of the intraday cross-zonal capacity pricing is part of the future requirements for the continuous trading matching algorithm in their current version (see [7]), pursuant to Article 37 of CACM Regulation.

11. Detailed process of the initially proposed IDAs

11.1 Timing and number

The introduction of two IDA, one in day ahead timeframe and one in intraday timeframe, is seen as a compromise between sufficient frequency and implementation challenges, especially due to timing constraints (see §V.7 "Elements affecting the timing of the IDA processes"). The number of IDA could be changed in the future based on approved CCR methodologies regarding intraday cross-zonal capacity calculation methodologies – including recalculation moments, initial feedback from stakeholders on the consultation of CZIDCP Methodology, implementation of CACM Regulation methodologies, experience from TSOs, market participants' needs, or NRAs guidance (scalable solution).

The first IDA shall perform the pricing of the initial intraday cross-zonal capacity assessed before the start of continuous intraday market. Therefore, it shall be executed at the IDCZGOT at the latest and its timing shall allow all TSOs to perform their intraday cross-zonal capacity calculations (cf. §V.7.a) "Operational processes from TSOs"). However, the timing of this process is not known at the time of this present CZIDCP Methodology and depends on the future methodologies regarding ID capacity calculations to be established at a CCR level.

As a first indicative proposal, it is therefore suggested that the IDA1 is executed at the latest possible time which is 22.00, market time day ahead (i.e. the calculation of its results starts at 22.00, market time day ahead). The results of the IDA1 shall be available at the latest at 22.30, market time day ahead, which grants that at least 30 min is available for the continuous matching for market participants before the IDCZGCT of the first tradable MTU. This is shown below:



Figure 6: minimum duration of continuous matching after IDA

It has to be noted that in the current proposal for IDCZGOT it is technically possible to define optionally IDCZGOT before 22:00 market time day ahead (cf. §V.7.d) "Regulation").

The number of IDA after the IDA1 shall be based on a compromise between sufficient frequency and implementation challenges: frequent IDA are conditioned by frequent intraday cross-zonal capacity assessment: as stated above, this depends on the future methodologies to be established at a CCR level which are still not known. On the other hand, there shall be at least one IDA to allow for updating the information impacting the intraday market (i.e. update of intraday cross-zonal capacity).



As a first indicative proposal, it is therefore suggested that one IDA is also executed within the intraday timeframe. As the unique IDA within the intraday timeframe, IDA2 shall cover at least half of the total tradable hours, which means that the FAH for IDA2 shall be 12:00, intraday market time. Moreover, the IDA2 is executed at 10.00, market time intraday (i.e. the calculation of its results starts at 10.00, market time intraday, which grants that at least 30 min is available for the continuous matching before the IDCZGCT of the first tradable MTU.

This means that each IDA shall be executed within 30 minutes: this is the maximum duration between the moment when bidding period is closed, and the moment when remaining capacity is made available to continuous matching.

The characteristics of the two suggested IDA are summarized below:

IDA	Execution time	Delivery period	Publication of resultsRemainingcapacityavailable to CM
IDA1	22.00, market time day ahead	from 00:00 to 24:00 of the day D (FAH is 00:00)	no later than 22.30, market time day ahead
IDA2	10.00, market time intraday	from 12:00 to 24:00 of the day D (FAH is 12:00)	and no later than 10.30, market time intraday
	Ta	ble 9: Indicative IDA timings	

After the IDA1 is operated and its results are published, the hours 00:00 to 12:00 of the day D become tradable in the first continuous matching (CM1), while the hours from 12:00 to 24:00 of the day D become tradable in the second continuous matching (CM2) after the publication of the results of IDA2.

The following graph represents the process sequence of CZIDCP Methodology with IDA1 and IDA2 during day ahead and intraday timeframes:



Figure 7: Process sequence of CZIDCP through day ahead and intraday timeframes

The table below details the timings and tradable hours of each IDA and the subsequent session of continuous matching of the SIDC:





Figure 8: Timings of CZIDCP and continuous matching sessions

11.2 Bidding time

The bids of market participants can be submitted to the IDA until the closing of the bidding period of this IDA (calculation of IDA results are then performed and take time during which bidding is no more possible). A distinction can be made between:

- The moments when the bidding period of an IDA is opened and closed;
- The moment when the initial value of intraday cross-zonal capacity to be allocated to this IDA is published. This depends on the intraday cross-zonal capacity calculation methodologies designed in each relevant CCR, however an indicative timing is proposed below;
- The moment when the final value of intraday cross-zonal capacity to be allocated to this IDA is firm. This moment corresponds to the latest moment when the value of intraday cross-zonal capacity to be allocated to this IDA can be changed. This moment has to be set uniformly in order to grant a uniform execution of the IDA (it is not possible that this moment is different for some borders).

The indicative timings for bidding of each IDA are the following:



IDA	Bidding opening/closing	Initial value of intraday cross-zonal capacity	Final value of intraday cross-zonal capacity
IDA1	No later than 21.00, market time day ahead 22.00, market time day ahead	21.00, market time day ahead	21.45, market time day ahead
IDA2	No later than 09.00, market time intraday 10.00, market time intraday	09.00, market time intraday	09.45, market time intraday

Table 10: Indicative IDA bidding timings

12. Implementation prerequisites

The effective implementation of the CZIDCP Methodology is conditioned by following prerequisites:

12.1 Compatibility with CACM Regulation

a) Implementation of SIDC

XBID Solution is currently not prepared for implementation of CZIDCP Methodology for the initial go-live, since it has been agreed to not be in scope of the initial XBID solution.

ICDP Methodology and other functionalities required by CACM Regulation are in the process of being designed and will be implemented only after initial go-live of XBID Solution.

Given that future requirements like CZIDCP Methodology⁷ can have a considerable impact on the current systems, it is important to establish a formal involvement of XBID Solution in the ongoing discussions with external stakeholders.

b) Definition of intraday cross-zonal gate opening time

The definition of IDCZGOT pursuant to Art. 59 (1) of CACM Regulation will impact the possible timing of IDA. Especially, different IDCZGOT represent a significant challenge when trying to define a uniform timing of IDAs (cf. §V.7.d) "Regulation").

c) Definition of intraday cross-zonal gate closing time

The definition of IDCZGCT pursuant to Art. 59 (1) of CACM Regulation will impact the possible timing of IDA (cf. §V.7.d) "Regulation").

d) Implementation of intraday cross-zonal capacity calculation methodologies per CCR

Timing of IDAs ought to be aligned with intraday cross-zonal capacity recalculations, which depend on CCR methodologies still to be developed and implemented, pursuant to Art. 21 of CACM Regulation. This represents a challenge as the timing of CCR methodologies development and implantation is not necessary uniformed (in addition to the fact that the process timing may also be different, as outlined in §V.7.a) "Operational processes from TSOs").

In addition, CZIDCP Methodology may have to be reassessed as part of the flow-based development of intraday cross-zonal capacity calculation methodologies. This shall include the possibility to have different intraday cross-zonal capacity modeling (i.e. (C)NTC or flow-based) between IDA and continuous matching.

12.2 Process and technical issues regarding practical implementation of the IDCP Methodology

⁷ The possibility for the algorithm to allow for pricing of intraday capacity is identified as a "future requirement" of the continuous trading matching algorithm, see [4].



Once the CZIDCP Methodology has been approved and its implementation has began the following topics have to be further detailed in practice (list is not exhaustive):

- Definition of processes, among which:
 - Validation of IDA results by TSOs and NEMOs;
 - Determination of intraday cross-zonal capacity made available to the continuous matching by TSOs, pursuant to IDA results. This topic shall deal with the possibility to have different intraday cross-zonal capacity modeling (i.e. (C)NTC or flow-based) between IDA and continuous matching;
 - Fallback/backup procedures regarding the transmission of cross-zonal capacity to be priced in IDA: for example, a default value of zero could be defined so that the IDA can still be executed in case of fallback for the capacity calculation of concerned CCRs, this point is associated with the question of cases leading to cancellation of IDAs;
- Specification of systems and algorithms used for CZIDCP implementation, in coordination with NEMOs:
 - Finalization of SIDC algorithm requirements (see [4]), as the case may be;
 - Choice of a system/algorithm, especially assessment if existing systems (PCR, XBID) can be reused and updated, or if new systems are needed;
- Settlement and shipping processes of IDA results have to be designed with NEMOs.

12.3 Summary

The table below details the prerequisites needed to implement each step of the IDA process given the elements presented in the previous chapters:

IDA Step	Prerequisites
Publish IDCZC	Intraday cross-zonal capacity calculation methodology per CCR
Bidding opening	Definition of intraday cross-zonal gate opening time
	Intraday cross-zonal capacity calculation methodology per CCR
Final IDCZC	Intraday cross-zonal capacity calculation methodology per CCR
Bidding closing	Definition of intraday cross-zonal gate closing time
IDA results	Choice of systems, algorithm and operation of the IDA
Clearing & settlement	
Remaining IDCZC for	Implementation of SIDC
СМ	Update of SIDC systems and procedures
	Table 11: Implementation prerequisite for each step of the IDA

13. Implementation plan

Following main phases are identified towards implementation of the CZIDCP Methodology:

Implementation phase	Description	
Adoption of CZIDCP	Following initial submission of CZIDCP Methodology, NRAs have to	
Methodology	approve it pursuant to CACM Regulation	
Final review of CZIDCP	A final review of the CZIDCP Methodology is needed when all	
Methodology	methodologies that serve as prerequisite are approved (e.g. capacity	
	calculation methodologies, IDCZGOT/IDCZGCT).	
	The review of the CZIDCP Methodology shall include a review of its	
	implementation plan to better evaluate its duration.	



Elaboration of an	NEMOs and TSOs shall together elaborate a common implementation	
implementation plan for	plan, including a time plan within 6 months upon approval of the CZIDCP	
CZIDCP Methodology by	methodology and once the preconditions and prerequisites are met.	
TSOs and NEMOs	The planning of the implementation shall also be coordinated with regards	
	to deployment and updates of the XBID Solution.	
Implementation of CZIDCP	Specify the design with the NEMOs regarding especially:	
Methodology with the	• System/algorithm;	
NEMOs	• IDA Processes.	
	Then the specified design shall be implemented	

Table 12: Implementation phases for CZIDCP Methodology

The implementation plan shall be reviewed upon completion of all prerequisites identified for CZIDCP Methodology.