Proposal for a common set of requirements for the continuous trading matching algorithm

14 February 2016

1. Background

1. This document is a common proposal developed by all Transmission System Operators (hereafter referred to as "TSOs") and Nominated Electricity Market Operators (hereafter referred to as "NEMOs") for a common set of requirements for the continuous trading matching algorithm (hereinafter referred to as "ID Algorithm Requirements") in accordance with article 37 of Commission Regulation (EU) 2015/1222 establishing a guideline on capacity allocation and congestion management (hereafter referred to as the "CACM Regulation").

2. For the purpose of this proposal, terms used in this document have the meaning of the definitions included in Article 2 of the CACM Regulation and Regulation 543/2013.

3. According to Article 37: "1. By eight months after the entry into force of this Regulation: (a) all TSOs shall jointly provide all NEMOs with a proposal for a common set of requirements for efficient capacity allocation to enable the development of the price coupling algorithm and of the continuous trading matching algorithm. These requirements shall specify functionalities and performance, including deadlines for the delivery of single day-ahead and intraday coupling results and details of the cross-zonal capacity and allocation constraints to be respected;"

4. In addition to the above common proposal for the TSOs Algorithm Requirements, article 37 of the CACM Regulation requires that "all NEMOs shall jointly propose a common set of requirements for efficient matching to enable the development of the price coupling algorithm and of the continuous trading matching algorithm" (hereinafter referred to as "NEMOs Algorithm Requirements") within the same deadline.

5. When both proposals are prepared and after the deadline of eight months, all Nominated Electricity Market Operator (hereafter referred to as "NEMO") and all TSOs will cooperate to finalise the sets of the TSOs and NEMOs Algorithm Requirements. Based on the above two sets of requirements, TSOs and NEMOs Algorithm Requirements, "all NEMOs shall develop a proposal for the algorithm in accordance with these requirements. This proposal shall indicate the time limit for the submission of received orders by NEMOs required to perform the MCO functions in accordance with Article 7(1)(b)." This NEMOs proposal for the algorithm shall be prepared no later than three months after the submission of the TSOs and NEMOs Algorithm Requirements.

6. In accordance with Article 37(3) of the CACM Regulation the NEMOs proposal for the algorithm "shall be submitted to all TSOs. If additional time is required to prepare this proposal, all NEMOs shall work together supported by all TSOs for a period of not more than two months to ensure that the proposal complies with paragraphs 1 and 2.

7. According to paragraph 4 of Article 37 "The proposals referred to in paragraphs 1 and 2 shall be subject to consultation in accordance with Article 12". The consultation on all proposals, i.e. TSOs and NEMOs algorithm requirements and the NEMOs proposal for the algorithms shall be prepared in cooperation between all TSOs and all NEMOs and be consulted upon together to ensure efficient assessment of their content by market participants.

8. The all NEMOs proposal for the algorithm developed based on the TSOs and NEMOs algorithm requirements and taking into account the comments from the consultation shall be submitted to the regulatory authorities for approval no later than 18 months after the entry into force of the CACM Regulation, i.e.14 February 2017.

9. The current set of ID Algorithm Requirements is based on the current coupling solutions, either implemented or under development and updated or amended where seen appropriate by the TSOs

and/or NEMOs.

10. Future evolution of capacity calculation methodologies in accordance with the CACM regulation may require additional input parameters, e.g. remedial action variables. In this case, all TSOs shall send a request for amendments of the algorithm to the NEMOs and later on for all NRAs' approval. An assessment of the additional algorithm functionalities shall take place at the latest when the proposal for the capacity calculation methodology in every capacity calculation region (CCR) in accordance with the CACM Regulation is being developed by the TSOs. All TSOs and all NEMOs shall cooperate to propose any amendments if deemed necessary when the above proposals for the capacity calculation methodology is submitted for approval to the national regulatory authorities (ten months after the approval of the all TSOs CCR Proposal).

11. Decisions of the NEMO Committee in this proposal refers to decisions of All NEMOs coordinated via the NEMO Committee.

2. Terminology

1. The term Bidding Zone is equivalent to the term Market Area most often used in IDM.
2. The term Scheduling Area is equivalent to the term Delivery Area most often used in IDM.
3. 'NEMO Trading hub' shall be defined as 'the set of orders submitted by the market participants to a specific NEMO within a Bidding Zone.
4. Cross-Zonal Flows are Scheduled flows between adjacent Bidding Zones.

3. Approach

The table below sets out the ID Algorithm Requirements. Each requirement has been classified according to the following criteria:

1. **State:**
   a. Initial Requirement: a requirement that must be complied with at the point the SIDC first commences operation. Such requirements are normally already incorporated into the XBID solution.
   b. Future Requirement: a requirement that must be complied with at a point after the SIDC first commences operation. Such requirements shall need to be properly specified and implemented via a Change Request. Some Future Requirements may already be under development within XBID.

2. **Owner:** owner of the requirement (TSOs, NEMOs, or joint TSOs and NEMOs) with meaning as defined in the Algorithm Proposal

3. **Nature**:
   a. MCO Function: a requirement that relates to the joint responsibility of NEMOs to carry out MCO functions in accordance with Article 7(2).
   b. Scheduled Exchange Calculation ("SEC") Function: a requirement that relates to the joint responsibility of TSOs to calculate and publish scheduled exchanges on borders between bidding zones in accordance with Article 8(2)(g), where such requirement shall be supported by the ID Algorithm (i.e., the SOB and/or CMM). In many cases these requirements are not yet specified ("Future") and it may be that the calculations will be performed outside the ID Algorithm – e.g., as a separate post-matching process, or a local/regional process. The solution shall be agreed between the relevant NEMOs and TSOs.

4. Continuous trading matching algorithm requirements

Title 1: General requirements

1. **Overall**

Requirement	State		Owner		Nature	
	Initial requirement	Future requirement	TSO	NEMO	MCO Function	SEC Function
a. The algorithm shall support the continuous matching of orders as well as the continuous allocation of intraday interconnection capacity.	X		X	X	X	
b. The algorithm shall ensure equal treatment of orders coming from all NEMOs and from explicit capacity requests.	X			X	X	
c. For each bidding zone the algorithm shall be able to:						
i. The algorithm must support at least the order types included in the Intraday Product Proposal;	X		X	X	X	
ii. The algorithm shall support non-standard products to the extent this is technically feasible and approved by the competent regulatory authorities;		X	X	X	X	
iii. facilitate different MTUs which shall be configurable in each bidding zone;	X		X	X	X	
iv. facilitate configurations with more than one NEMO for a given bidding zone, meaning matching of orders between multiple NEMOs in one bidding zone and between multiple bidding zones;	X		X	X	X	
v. support multiple scheduling areas within a bidding zone as requested by TSOs;	X		X			X
vi. allocate cross-zonal capacities on a bidding zone border with multiple TSOs on one or both sides of the concerned bidding zone border.	X		X	X	X	
d. Intraday Gate Opening Time (GOT) and Gate Closure Time (GCT) shall be configurable for each bidding zone border	X		X	X	X	
e. The algorithm shall aim to ensure that economic surplus is maximised, where applicable.	X		X	X	X	
f. The algorithm shall be able to deal with one or multiple bidding zones within a country and shall be scalable to cover all Europe.	X		X	X	X	
g. The algorithm shall be able to provide the net positions and cross zonal flows for each bidding zone.	X		X			X
h. For each bidding zone the result from application of the algorithm shall be for each MTU calculate one net position and, where applicable, net positions for each scheduling area and each NEMO trading hub.	X		X			X
i. The algorithm must ensure/support respect of the proprietary rights and the anonymity of the data (orders, etc..) and information submitted and accessed by the parties in their use of the system.	X		X	X	X	

State		Owner		Nature	
Initial requirement	Future requirement	TSO	NEMO	MCO Function	SEC Function

j. The integrity of the algorithm and the data it processes shall be properly secured from unauthorized access.

X		X	X	X	

k. The algorithm needs to provide the all necessary information for the Cross-NEMOs settlement and shipping.

X			X	X	

l. Problem in one area, one border or for one NEMO shall not, as far as possible, prevent trading in the other areas, borders or for other NEMOs.

X		X	X	X	

m. The algorithm must support but not to be limited to:
  i. Receive the available capacity information in real time
  ii. Request capacity when pairs of matchable orders are identified

X		X	X	X	

n. Algorithm must support Transaction cancellation functionalities: the system must be able also to initiate the required actions on the capacity allocation side and interaction with the NEMOs.
  i. In case a cross-border trade is involved in the transaction cancellation, the algorithm shall request capacity in the opposite direction.
  ii. The system must support deadline for transaction cancellation to be initiated.

X			X	X	

o. The algorithm shall match orders according to price, time priority and, for cross-border trades, allocation constraints and available capacity. The configuration of the matching rules must support but not to be limited to the following matching rules.
  i. Automatic matching process meaning buy and sell orders with crossed prices. The matcher will match the orders at the price of the passive order i.e. the one already in the order book.
  ii. When an order is updated or entered, the algorithm checks if it can be executed.
  iii. A buy (sell) order can be matched if
    - On the opposite side, there is a sell (buy) order with an inferior (superior) or equal price.
    - If there are several orders on the sell (buy) side fulfilling a), the order with best price is executed first and if the aggressor order is not fully executed, then the second best price order is executed etc.
    - If there are several orders on the sell (buy) side fulfilling a) and with the same price, the order with the oldest timestamp is executed first and if the aggressor order is not fully executed, then the second oldest is executed etc.
    - The matching price of a transaction take into account the harmonised max and min prices of bidding zones
  In case of partial execution of an order, the unexecuted part remains in the book (except otherwise specified by the order type) as an order with the quantity equal to the unexecuted quantity - the price of the remaining part of order is the one entered initially by the trader except

X			X	X	

	State		Owner		Nature	
	Initial requirement	Future requirement	TSO	NEMO	MCO Function	SEC Function

otherwise specified by the order type.

p. The orders are all centralised in a consolidated order book that is used to generate the local views, considering the relevant allocation constraints and available capacity between the areas.

	State		Owner		Nature	
p	X			X	X	

q. All incoming orders and explicit capacity requests are queued in the same queue. The algorithm shall guarantee a first come first serve principle. Only one matching and/or capacity allocation event can occur at the same time.

	State		Owner		Nature	
q	X		X	X	X	

r. The algorithm supports increase and decrease of capacity. When the capacity available increased due to netting, capacity publication or update, it may lead to a crossed order book. The algorithm must include a mechanism to solve this situation (pair matching or auction).

	State		Owner		Nature	
r	X		X	X	X	

s. The algorithm must calculate local view of order books based on available orders and capacities. The configuration of the local views must support but not to be limited to the following rules:
- The local view of area bidding zone corresponds to the orders that the market participants of the bidding zone can trade
- The available capacity corresponds to the maximum flow between two areas (unless Flow Base cross-border capacity mechanisms are defined and implemented) taking all allocation constraints into consideration.
- For building the same local view, the same capacity can only be considered once.
- Construction of the local view must take into account price limits set per bidding zone

	State		Owner		Nature	
s	X			X	X	

t. The algorithm must prevent that NEMOs have the information to calculate the local view based on the order books from other NEMOs and capacities.

	State		Owner		Nature	
t	X			X	X	

u. Capacity and order book updates are used to create updated local views. Local view updates are continuously broadcasted to the connected NEMOs in a non-discriminatory manner.

	State		Owner		Nature	
u	X		X	X		

v. The algorithm must be able to cross-match the different order types in the Product Description within one and between multiple Bidding Zones, respecting the capacity and order restrictions.

	State		Owner		Nature	
v		X		X	X	

2. Qualitative requirements with precision and price ranges

a. The algorithm shall provide all market participants non-discriminatory access to cross-zonal capacity in accordance with Article 3 of CACM.

	State		Owner		Nature	
a	X		X	X	X	

b. The algorithm shall aim to ensure that in case there are matching opportunities the matching shall always take place taking into account the intraday cross-border GCT.

	State		Owner		Nature	
b	X		X	X	X	

c. The algorithm shall be able to reproduce the same results with the same input data coming in exactly identical sequence and timing.

	State		Owner		Nature	
c	X		X	X	X	

	State		Owner		Nature	
	Initial requirement	Future requirement	TSO	NEMO	MCO Function	SEC Function
d. The algorithm shall be able to deal automatically and easily with day-light savings related to winter and summer time changes, i.e. algorithm supports 23, 24 or 25 hours for a trading day.	X		X	X	X	
e. The algorithm shall be able to deal automatically and easily with leap years, i.e. 366 days in in a year.	X		X	X	X	
f. The matching process of the algorithm, including prices and allocated capacities resulting from this calculation process, has to be transparent, auditable, and explainable. This requirement applies also to all the deterministic rules and applied algorithm heuristics, if any, and occurrence rate of these rules and heuristics.	X		X	X	X	
g. The algorithm source code shall be well structured and well documented. A description of the algorithm should be made publicly available, and should be kept up to date. The documentation shall be written in English.	X		X	X	X	
h. The algorithm shall be able to deal with negative prices as well as with different price boundaries.	X		X	X	X	
i. The algorithm shall be able to deliver prices and volumes according to bidding zone or/and Scheduling area specific ticks and, in case rounding is required, rounding rules	X		X	X	X	

3. Other functionalities related to cross-zonal capacity allocation

	State		Owner		Nature	
	Initial requirement	Future requirement	TSO	NEMO	MCO Function	SEC Function
a. The algorithm shall be able to match both implicit (NEMOs) and explicit capacity allocation requests.	X		X	X	X	
b. The algorithm shall be able to calculate for each MTU the scheduled exchanges between adjacent bidding zones.	X		X	X	X	
c. The algorithm shall be able to calculate for each MTU the scheduled exchanges for each scheduling area	X		X			X
d. Once allocated by the algorithm, the capacity is firm (cannot be changed by TSOs).	X			X	X	
e. Cross-zonal capacity shall be allocated to either energy transactions or explicit requests, at zero price for market participants.	X		X	X	X	
f. All incoming orders and explicit capacity requests are treated in a non-discriminatory fashion (e.g. single queue). The system must implement first come first serve principle. Only one matching event can be executed at the same time.	X		X	X	X	
g. Algorithm shall allow for non-zero pricing of intraday capacity in accordance with Article 55 of CACM Regulation, where the pricing intraday cross-zonal capacity shall reflect market congestion and shall be based on actual orders and proposal for methodology shall be developed by all TSOs by August 2017.		X	X		X	

	State		Owner		Nature	
	Initial requirement	Future requirement	TSO	NEMO	MCO Function	SEC Function
h. For the execution of complementary regional auctions, it shall be possible to stop continuous trading within and between relevant bidding zones for a limited period of time before the intraday cross-zonal gate closure time, which shall not exceed the minimum time required to hold the auction and in any case 10 minutes.	X		X	X	X	

4. Performance

	State		Owner		Nature	
	Initial requirement	Future requirement	TSO	NEMO	MCO Function	SEC Function
a. Algorithm shall produce and log performance indicators in order to monitor its performance, which include among others report on number of and the frequency of unmatched feasible trades and their volumes		X	X	X	X	
b. All TSOs and NEMOs shall develop performance indicators in order to monitor the performance of the algorithm. These performance indicators shall be made publically available	X		X	X	X	

Title 2: Requirements related to Cross-zonal capacities

	State		Owner		Nature	
	Initial requirement	Future requirement	TSO	NEMO	MCO Function	SEC Function
1. The algorithm shall be able for each MTU to:						
a. allow TSOs to set constant cross-zonal capacity and ramping values for each bidding zone border in accordance with CACM Regulation in case coordinated net transmission capacity is applied; this cross-zonal capacity value may also be a very high value;		X	X		X	
b. constrain cross-zonal flows to the respective cross-zonal capacity value for each bidding zone border for each cross-zonal flow directions, in case the coordinated net transmission capacity (CNTC) approach is applied;	X		X		X	
c. where applicable, allow setting a default value for cross-zonal capacity for each bidding zone border and for each flow direction in case coordinated net transmission capacity approach is applied;		X	X			
d. constrain, where appropriate, an aggregated set of cross-zonal interconnectors with one global cross-zonal transmission capacity limit (cumulative NTC), i.e. a general boundary constraint. This constraint shall be applicable also to a predefined set of bidding zone borders in order to limit for example the net position of a bidding zone(s);		X	X		X	
e. process flow-based parameters, if provided at the defined MTU, when allocating cross-zonal capacities for each bidding zone border;		X	X		X	
f. allow definition and application of the following flow-based parameters for each network element of a given bidding zone for flow-based approach;		X	X		X	

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		State		Owner		Nature	
		Initial requirement	Future requirement	TSO	NEMO	MCO Function	SEC Function
i. power transfer distribution factor (PTDF) as the contribution of 1 MW of a net position change to the power flow over the network element; and			X	X		X	
ii. remaining available margin (RAM) or the remaining allowable power flow (AMF) on the network element.			X	X		X	
g. ensure that PTDF multiplied by net position is less than or equal to RAM for each network element and net positions concerned by the flow-based parameters for flow-based approach;			X	X		X	
h. receive the flow-based parameters as: i. "zero balanced" meaning that the remaining available margin of critical branches applies from zero exchanges and that pre-existing exchanges are transmitted aside; or ii. "not zero balanced" meaning that the remaining available margin of critical branches applies from pre-existing exchanges;			X	X		X	
i. allow the coexistence of both flow-based and coordinated net transmission capacity approaches within the coupled regions, i.e. hybrid coupling;			X	X		X	
j. facilitate the following hybrid couplings: i. standard hybrid coupling, where cross-zonal capacity values and flow-based parameters coexist implying that TSOs shall reserve margins ex-ante on flow-based critical branches; and ii. advanced hybrid coupling, where realized cross-zonal capacity transactions are taken into account in the margin of the flow-based critical branches.			X	X		X	
k. facilitate change of cross-zonal capacity values or flow-based parameters, which among other things might be a consequence of netting, capacity publication or update of capacity value or flow-based parameter. In such a case, if a crossed order book is produced, the algorithm shall match the relevant orders with the aim of maximizing economic surplus.			X	X		X	
l. allow for configuring the moment when the update is applied or become effective once the cross-zonal capacity is updated;		X		X		X	
m. enable to halt/unhalt one bidding zone, one border, one instrument, one NEMO. In case of halting of one bidding zone, one instrument and one NEMO, all the relevant orders will be halted or inactivated.		X		X	X	X	
n. handle situations for relevant bidding zone borders where the calculated cross-zonal capacity value applying coordinated net transmission capacity approach is less than the current level of exchange so that no more capacity is allocated in the direction of this exchange until level of exchange is below the calculated cross zonal capacity value; and		X		X		X	
o. handle situations for relevant bidding zone borders where for continuous intraday trading applying flow-based approach an initial market clearing point is outside flow-based domain by allowing only			X	X		X	

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trades moving the clearing point towards the flow-based domain.

2. Multiple flow based approaches, i.e. plain, intuitive, bilaterally intuitive, may be used for different capacity calculation regions.

Title 3: Requirements related to allocation constraints

a. The algorithm shall be able to:
   i. for direct current (DC) interconnectors constrain increase/decrease of flows over one interconnector and/or a combination of interconnectors from a MTU to the following MTU or between the last MTU from the day before and the first MTU of the following day. The constraint shall take into account the nominations of long term capacity allocations, i.e. physical transmission rights, and day-ahead cross-zonal flow, where applicable. The constraint shall be handled on a single DC interconnector and multiple DC interconnectors in combination (i.e. ramping)
   ii. constrain increase/decrease of net positions of a single bidding zone from a MTU to the following MTU within a day or between the last MTU from the day before and the first MTU of the following day; and
   iii. incorporate losses on interconnector(s) between bidding zones during capacity allocation, if requested by the owner(s) of the interconnector after approval by relevant NRAs
b. For the DC interconnectors the flow shall not be below the minimum stable flow (MSF), other than at zero. The MSF will be given for the DC interconnector, if requested by the owner(s) of the interconnectors after approval by relevant NRAs. The capacity allocation shall take into account the nominations of long term cross-zonal capacity and day ahead cross-zonal capacity, where applicable. The constraints shall be handled on a DC interconnector-by-DC interconnector, multiple DC interconnectors and on a net position (regional) basis.
c. The algorithm shall allow to set a minimum price difference between adjacent bidding zones when DC interconnector is used for power exchange. For this requirement, the algorithm shall model the costs incurred for each MWh passing through a DC interconnector as a "flow tariffs". This "flow tariff" shall be treated as a threshold for the price between the bidding zones connected by the DC interconnector. If the price difference between the relevant bidding zones is less than the "flow tariff" the flow will be set to zero. If there is a flow the price difference will equal the "flow tariff", unless there is a congestion. Once the price difference exceeds the "flow tariff" the congestion

State		Owner		Nature	
Initial requirement	Future requirement	TSO	NEMO	MCO Function	SEC Function
	X	X		X	
X		X		X	
X		X		X	
X		X		X	

income becomes positive. This functionality shall be incorporated in the algorithm if requested by the owner(s) of the interconnector after approval by relevant NRAs.

d. The algorithm shall allow for adverse flows, i.e. flows from higher price bidding zone to lower price bidding zone

e. The algorithm shall aim to minimize the number of bidding zone borders on the path between the matched orders and allow for route prioritisation by the use of interconnector specific cost coefficients.

Title 4: Requirements on algorithm output and deadlines for the delivery of single intraday coupling results

a. Regarding the quantities for each MTU the output of the algorithm shall be:
   i. rounded and unrounded net position for each bidding zone, which is defined as the difference between matched supply and demand orders within a bidding zone, where rounding shall follow the rounding rules defined for each bidding zone. Where applicable, the rounded and unrounded net position for each NEMO trading hub in bidding zones with several NEMOs shall be provided;
   ii. number and volume of matched block orders for each bidding zone and paradoxically rejected orders, if any;

b. Where required regarding the quantities for each relevant MTU, with the output of the algorithm, an ex-post process which shall not interfere with the market coupling results calculation, shall provide scheduled exchanges, resulting from intraday market coupling, in the form of:
   i. Scheduled Exchanges between Scheduling Areas
   ii. Scheduled Exchanges between Bidding Zones
   iii. Scheduled Exchanges between NEMO trading hubs and pursuant to the Methodology for calculation of scheduled exchanges resulting from market coupling. This is to support the scheduled exchanges calculation and/or multi-NEMO arrangements function

c. Regarding the calculation results the output of the algorithm shall be:
   i. overall economic surplus and economic surplus for each bidding area; and
   ii. output necessary for monitoring in accordance with Article 82(2) and (4) of CACM Regulation

Section	Initial requirement	Future requirement	TSO	NEMO	MCO Function	SEC Function
income becomes positive...						
d. adverse flows		X	X		X	
e. minimize bidding zone borders		X	X			X
Title 4						
a. quantities for each MTU						
a.i. rounded and unrounded net position	X		X	X	X	
a.ii. number and volume of matched block orders		X	X		X	
b. ex-post process scheduled exchanges	X		X			X
c. calculation results						
c.i. overall economic surplus		X	X	X	X	
c.ii. output for monitoring		X	X		X	

		State		Owner		Nature	
		Initial requirement	Future requirement	TSO	NEMO	MCO Function	SEC Function
d.	The algorithm shall provide NEMOS and TSOs with information necessary to comply with monitoring of REMIT regulation where the algorithm is the only feasible source.		X	X		X	
e.	The algorithm shall respect the agreed cross-zonal GOT and GCT in accordance with the all TSOs proposal in accordance with Article 59 of the CACM Regulation.	X		X	X	X	
f.	The algorithm shall be able to implement a change of bidding zone configurations no later than 4 weeks after a TSO notifies a change subject to the change request procedure.	X		X	X	X	
g.	The algorithm shall be capable of providing results in order for all post coupling processes to be initiated in 5 minutes after Gate Closure Time of particular MTU.	X		X	X	X	

Title 5: Currency

		State		Owner		Nature	
a.	The algorithm shall only accept matching in Euro, i.e. all input and output currency data shall be in Euros. This should not prevent local currency orders and settlements.	X			X	X	

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