ACER Decision on Algorithm methodology: Annex IIa

(for information only)

Annex 1 to the Algorithm methodology:

Common set of requirements for the price coupling algorithm

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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 price coupling algorithm (hereinafter referred to as "DA 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").¶

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;"*¶

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*.¶

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 shall 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.¶

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.*¶

According to Article 37(4) "*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 was prepared in cooperation between all TSOs and all NEMOs and was consulted upon together to ensure efficient assessment of their content by market participants.¶

In accordance with Article 37(5) of the CACM Regulation the all NEMOs' proposal for the Algorithm Proposal, incorporating the TSOs' and NEMOs' DA and ID Algorithm Requirements and taking into account the comments from the consultation, has been 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.¶

This Proposal is complemented by the back up and fallback procedures that are referred in the proposal for the back-up methodology. The clearing prices will be calculated taking into account the harmonized maximum and minimum clearing prices Proposal for Single Day Ahead Coupling.¶

The timeline for the implementation of the Initial and Future DA requirements and Other DA Functionalities mentioned in this document is settled in the Algorithm Proposal, Article 5.¶

TITLE 1¶

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DA price coupling algorithm requirements

1. Requirements on functionalities and performance

	State		Owner	
	Initial Requirements	Future Requirements	TSOs	NEMOs
1.1 General requirements.				
a) For each bidding zone, the price coupling algorithm shall be able to:				
(i) facilitate orders for several Market Time Units (hereafter referred as "MTUs"), such as 15 minutes, 30 minutes and hourly;		X	X	X
(ii) support the products as defined in the DA Products;	X			X
(iii) facilitate configurations with more than one NEMO for a given bidding zone or a scheduling area in accordance to the multiple NEMO arrangement as referred to in Article 45 of the CACM regulation;	X		X	X
(iv) support multiple scheduling areas within a bidding zone as requested by TSOs;	X		X	
(v) allocate cross-zonal capacities on a bidding zone border with one or multiple TSOs on one or both sides of the concerned bidding zone border.	X		X	
b) The price coupling algorithm shall aim at maximising the economic surplus for SDAC for the next trading day, consistent with time limitations, conditions and requirements established by NEMOs and TSOs.	X		X	X
c) The price coupling algorithm shall provide for a fair and orderly price formation in accordance with Article 3(h) of the CACM Regulation.	X			X
d) The price coupling algorithm shall support multiple bidding zones within a country and shall be scalable to cover all bidding zones eligible for participating in SDAC.	X		X	X
e) In case the price coupling algorithm finds solutions with equal social welfare, it shall apply deterministic rules in order to define prices and net positions for each bidding zone.	X		X	X
f) The price coupling algorithm shall be reliable, thus able to find a solution within the allowed time limit, including the potential to extend the calculation time in case the allowed calculation time is exceeded.	X		X	X

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g) The price coupling algorithm shall be able for each MTU to provide the net position per NEMO trading hub and the input for the calculation of the scheduled exchanges between bidding zones or scheduling areas.	X		X	X
h) The price coupling algorithm shall be able to calculate the scheduled exchanges between bidding zones or scheduling areas.	X		X	
i) For each bidding zone, the result from the application of the price coupling algorithm shall be one price and one net position for each MTU. For the bidding zones containing several TSOs separating their scope in different scheduling areas, the net position for each MTU shall be calculated for each scheduling area. For scheduling areas where more than one NEMO operates, the net position for each MTU shall be calculated for each NEMO trading hub.	X		X	X
j) For each bidding zone, the result from application of the price coupling algorithm shall be one price and one net position for each MTU. For the bidding zones containing several TSOs separating their scope in different scheduling areas, the net position for each MTU shall be calculated for each scheduling area.	X		X	
k) The integrity of the price coupling algorithm and the data it processes shall be properly secured from unauthorized access;	X		X	X
1.2 Qualitative requirements with precision and price ranges				
a) The price coupling algorithm shall ensure:				
(i) equal treatment of orders coming from all NEMOs in accordance with Article 3(e) of the CACM Regulaiton; and	X		X	X
(ii) provide all orders of market participants non-discriminatory access to cross zonal capacity in accordance with Article 3(j) of the CACM Regulation.				
b) In case of tie rules (between two or more orders) and for branching decisions (if any), deterministic rules shall be implemented. Such choices shall be logged.	X		X	X
c) The price coupling algorithm shall allow for partial decoupling.	X		X	X
d) The price coupling algorithm shall automatically support leap years, i.e. 366 days in a year.	X		X	X
e) The price coupling algorithm shall support 23, 24 or 25 hours for a trading day.	X		X	X
f) The calculation process of the price coupling algorithm, including prices and scheduled exchanges resulting from this calculation process, shall be transparent, auditable, and explainable. This requirement applies also to all deterministic rules and applied algorithm heuristics and occurrence rate of these rules and heuristics.	X		X	X
g) The price coupling algorithm source code shall be well structured and well documented.	X			X

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h) The price coupling algorithm shall support negative prices for each bidding zone.	X			X
i) The price coupling algorithm shall be able to round calculated prices and volumes according to bidding zone specific ticks and rounding rules.	X		X	X
1.3 Performance				
a) The price coupling algorithm shall be robust and reliable and it shall be resilient to pretested data configurations such as, but not limited to, non-crossing of bids and offer curves, orders' curtailment, maximum and minimum prices, price and volume indeterminacy.	X		X	X
b) The price coupling algorithm shall always produce a unique result, i.e. price and volume indeterminacy shall be resolved.	X		X	X
c) The price coupling algorithm shall use reliable IT technology, e.g. reliable third party software.	X		X	X
d) The price coupling algorithm shall be available at all times when required.	X		X	X
e) The price coupling algorithm shall be adequatly scalable when the number of bidding zones increases. The price coupling algorithm shall cope with new markets that need to be incorporated in the price coupling, either corresponding to geographical extensions, or with additional NEMOs in existing bidding zones.	X		X	X
f) Price taking orders are buy (respectively sell) limit orders submitted at the maximum (respectively minimum) prices. The failure to accept these price taking orders corresponds to a curtailment situation: (i) In case of over-supply, not all price taking supply orders can be accepted (ii) In case of under-supply, not all price taking demand orders can be accepted Curtailment can be partially mitigated by exporting excess energy or importing deficit energy. In case more than one bidding zones faces a curtailment situation, when the curtailment of one increase, the curtailment of the other will decrease. Per bidding zone, it should be possible to either: (i) Prevent sharing of curtailment: the local curtailments remain local; no support is received or provided to the adjacent bidding zone (ii) Share curtailment: the difference in relative (percentage) curtailment between the different bidding zones is minimized	X		X	X

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The option of sharing curtailment in point (ii) above also applies in case of an application of flow-based approach, where sharing curtailments may be at the cost of the economic surplus.

The price coupling algorithm shall provide a mechanism that allows for a sharing of curtailment between bidding zones in a flow-based capacity allocation.

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2. Requirements related to cross-zonal capacities

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2.1 The price coupling algorithm shall be able for each MTU to:

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a) allow setting cross-zonal capacity value for each bidding zone border in accordance with the CACM Regulation in case coordinated net transmission capacity is applied;	X		X	
b) constrain scheduled exchanges to the respective cross-zonal capacity value for each bidding zone border for each direction, in case the coordinated net transmission capacity approach is applied;	X		X	
c) where applicable, allow TSOs setting a default value for cross-zonal capacity for each bidding zone border and for each 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 ATC), 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	
e) allow to define a positive and a negative limit to the net position for each bidding zone;		X	X	
f) process flow-based parameters, if provided at the defined MTU, when allocating cross-zonal capacities for each bidding zone border;	X		X	
g) allow definition and application of the following flow-based parameters for each network element of a given bidding zone for the flow-based approach:				
(i) power transfer distribution factor (PTDF) as defined in Regulation (EU) 543/2013; and	X		X	
(ii) available margin on critical network element as refered to in Regulation (EU) 543/2013;	X		X	
h) ensure that the PTDF matrix multiplied by the net position is less than or equal to the available margins for each critical network element;	X		X	
i) receive the flow-based parameters as:				

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(i) "zero balanced" meaning that the available margin on critical network elements applies from zero exchanges and that pre-existing exchanges are transmitted aside; or

(ii) "not zero balanced" meaning that the available margin on critical network elements applies from pre-existing exchanges;

j) allow the coexistence of both flow-based and coordinated net transmission capacity approaches within the coupled regions, i.e. hybrid coupling;

k) allow the use of virtual bidding zones to model how the critical network elements of a CCR applying the flow-based approach are impacted by cross-zonal exchanges on HVDC interconnectors within a CCR or by cross-zonal exchanges on bidding zone borders outside the CRR that are applying the coordinated net transmission capacity approach.

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

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3. Requirements related to allocation constraints

3.1 The price coupling algorithm shall be able to:

a) constrain the increase/decrease of scheduled exchanges over one direct current (DC) interconnector and/or a combination of DC 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;

b) constrain the increase/decrease of scheduled exchanges over one DC interconnector and/or a combination of DC 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 taking into account the nominations of long term capacity allocations, i.e. physical transmission rights, where applicable. The constraint shall be handled on a single DC interconnector and multiple DC interconnectors in combination;

c) constrain the 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

d) incorporate losses functionality on interconnector(s) between bidding zones during capacity allocation, and activate this functionality during allocation, if requested by the owner(s) of the relevant interconnector after the approval by the relevant NRAs.

3.2 The price coupling algorithm shall allow to set a minimum price difference between adjacent bidding zones when a DC interconnector

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standard hybrid coupling, where the algorithm is able to accomodate coordinated net transmission capacity approach and flow based approach on different bidding zone borders coexist within different capacity calculation regions and where the mutual impact of cross-zonal capacity allocation between two capacity calculation regions these borders is taken into account in capacity calculation and not within the price coupling algorithm; and, where cross-zonal capacity values and Flowflow-based parameters coexist implying that TSOs shall reserve margins ex-ante.

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is used for electricity exchange. For this requirement, the price coupling algorithm shall model the costs incurred for each MWh passing through a DC interconnector as a "flow tariff". The "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 scheduled exchange shall be set to zero. If there is a scheduled exchange, the price difference shall equal the "flow tariff", unless there is a congestion. Once the price difference exceeds the "flow tariff", the congestion income becomes positive. This functionality shall be incorporated in the price coupling algorithm and activated during allocation if requested by the owner(s) of the interconnector after approval by the relevant NRAs.

3.3 The price coupling algorithm shall allow for adverse scheduled exchanges, i.e. scheduled exchanges from higher price bidding zone to lower price bidding zone, if this leads to an increase in overall economic surplus.

3.4 The price coupling algorithm shall enforce intuitive scheduled exchange in flow-based areas, i.e. scheduled exchange from lower price bidding zone to higher price bidding zone, where requested by the relevant party for a bidding zone border.

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The Algorithmprice coupling algorithm shall enforce intuitive Scheduled Flowscheduled exchange in Flow-based areas, i.e. Scheduled Flowscheduled exchange from lower price bidding zone to higher price bidding zone, where requested by the relevant party for a bidding zone border.
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4. Requirements related to balance constraints

4.1 For overall balance of all bidding zones, the price coupling algorithm shall ensure that the sum of unrounded net positions and transmission losses, where applicable, of all bidding zones shall be zero.

4.2 For overall balance of a bidding zone, the price coupling algorithm shall ensure for each bidding zone the sum of unrounded net position and transmission losses, where applicable, shall be equal to the sum of import and export of this bidding zone resulting from the day ahead capacity allocation.

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5. Requirements on algorithm output and deadlines for the delivery of SDAC results

5.1 Regarding the prices for each MTU the output of the price coupling algorithm shall be:

a) rounded and unrounded price in Euros for each bidding zone;

b) shadow prices of critical network elements as needed for flow-based capacity allocation; and

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c) regional reference prices, in a network in which the cross-zonal capacity constraints are relaxed, e.g. Nordic region.	X		X	X	Deleted: …onal capacity constraints are relaxed, - ….g. ... [3]
5.2 Regarding the quantities for each relevant MTU, the output of the price coupling algorithm shall be:					Deleted: Algorithm
a) rounded and unrounded net position for each bidding zone, which is defined as the difference between accepted supply and demand orders within a bidding zone, where rounding shall follow the rounding rules defined for each bidding zone;	X		X	X	Deleted: matched
b) where there are multiple NEMOs within a bidding zone and scheduling area, the rounded and unrounded net position for each NEMO trading hub in a bidding zone;	X		X	X	Deleted: W…ere there are multiple NEMOs within a bidding zone and schedul ... [4] Deleted: X
c) the information which enables the execution status of orders to be determined;	X			X	
d) number and volume of accepted block orders for each bidding zone and paradoxically rejected orders, if any;	X			X	Deleted: matched
e) scheduled exchanges into and out of individual relevant DC network elements (difference in scheduled exchanges in/out reflecting losses where applicable);	X		X		Deleted: Scheduled Flow…cheduled exchanges into and out of individual Relevant …elevant DC Network …etwork Elements elements (difference in Scheduled Flow ... [5]
f) scheduled exchanges on relevant bidding zone borders (scheduled exchanges in/out reflecting losses where applicable);	X		X		Deleted: Scheduled Flow…cheduled exchanges on Relevant relevant Bidding …idding Zone …one borders (Scheduled ... [6]
g) scheduled exchanges on relevant scheduling area borders (scheduled exchanges in/out reflecting losses where applicable);	X		X		Deleted: Scheduled Flow…cheduled exchanges on Relevant relevant Scheduling …cheduling Area …rea borders (Scheduled Flow ... [7]
h) available margin on critical network elements or the remaining allowable scheduled exchange on the network element in case of flow-based approach.		X	X		Deleted: remaining available margin (RAM)…or the remaining allowable Scheduled Flow…cheduled exchange on the network element under …n case of FB …low-based capacity alloca ... [8]
5.3 For each relevant MTU, the price coupling algorithm shall provide scheduled exchanges resulting from day ahead market coupling in the form of:					Deleted: Where required, regarding the quantities f…or each relevant MTU, with the output of the Algorithmprice coupling algorithm,…the price coupling algorithm a process which shall not interfere with the market coupling results calculation, …hall provide Scheduled Flow…cheduled exchanges,…resulting from day ahead market coupling, ... [9]
a) bilateral and multilateral scheduled exchanges between scheduling areas;	X		X		Deleted: Bilateral …ilateral and Multilateral …ultilateral Scheduled Flow…cheduled exchanges between Scheduling scheduling Areas…reas with at least one NEMO hub ... [10]
b) bilateral and multilateral scheduled exchanges between bidding zones; and	X		X		Deleted: Bilateral …ilateral and Multilateral …ultilateral Scheduled Flow…cheduled exchanges between Bidding …idding Zones…ones; and /or ... [11]
c) bilateral and multilateral scheduled exchanges between NEMO trading hubs;	X		X	X	Deleted: Bilateral …ilateral and Multilateral …ultilateral Scheduled Flow…cheduled exchanges between NEMO trading hubs;: ... [12]
and pursuant to the methodology for calculating scheduled exchanges. This is to support the scheduled exchanges calculation and/or multi-NEMO arrangements function.					Deleted: Methodology …ethodology for calculation …alculating of …cheduled exchanges resulting from market coupling ... [13]
5.4 Regarding the calculation results, the output of the price coupling algorithm shall be:					Deleted: Algorithm
a) the overall economic surplus and economic surplus for each bidding zone; and	X		X	X	

b) the output necessary for monitoring in accordance with Article 82(2) and (4) of the CACM Regulation.	X		X	X
5.5 The price coupling algorithm shall provide NEMOs and TSOs with information necessary to comply with the monitoring pursuant to Regulation (EU) 1227/2011, where such information can be obtained only from the price coupling algorithm.	X		X	X
5.6 The price coupling algorithm shall be able to implement a change of bidding zone configurations following the change control procedure referred to in Article 9 of the Algorithm methodology.	X		X	
5.7 The price coupling algorithm shall be capable of finding results normally within the time limit that is established in the operational procedure referred to in Article 4(15) of the Algorithm methodology.	X		X	X
5.8 The price coupling algorithm shall be able to deliver the volume of matched orders and not-matched orders of each NEMO for bidding zones or scheduling areas if requested by the relevant TSOs.	X		X	

6. Currency

6.1 The price coupling algorithm shall for SDAC 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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Whereas

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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;"*

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.*

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 shall 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.

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.*

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In accordance with Article 37(5) of the CACM Regulation the all NEMOs' proposal for the Algorithm Proposal, incorporating the TSOs' and NEMOs' DA and ID Algorithm Requirements and taking into account the comments from the consultation, has been 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.[A1]

This Proposal is complemented by the back up and fallback procedures that are referred in the proposal for the back-up methodology. The clearing prices will be calculated taking into account the harmonized maximum and minimum clearing prices Proposal for Single Day Ahead Coupling.[A2]

The timeline for the implementation of the Initial and Future DA requirements and Other DA Functionalities mentioned in this document is settled in the Algorithm Proposal, Article 5.[A3]

TITLE 1

General provision

Article 1

Definitions

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, definitions included in Section 2 of MCO Plan and the definitions included in Article 2 of the Algorithm Proposal.

In addition, hereafter following definition applies:

Algorithm: means the price coupling algorithm**.**

Article 2

Approach

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

State:

Initial Requirement: a requirement that must be complied with at the point the Single Day-Ahead Coupling (SDAC) first commences operation. Such requirements are normally already incorporated into the already agreed solution for price coupling algorithm.

Future Requirement: a requirement that must be complied with at a point after the SDAC first commences operation, as further specified in the timeline for implementation of the price coupling algorithm. Such requirements shall need to be properly specified and implemented via a Request for Change (which shall include technical feasibility and performance impact assessment).[A4]

Owner: owner of the requirement of a given functionality (TSOs, NEMOs, or joint TSOs and NEMOs) with meaning as defined in the MCO Plan.[A5]

Nature:

MCO Function: a requirement that relates to the joint responsibility of NEMOs to carry out MCO functions in accordance with Article 7(2) of the CACM Regulation.

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) of the CACM Regulation, where such requirement shall be supported by the price coupling algorithm. In many cases these requirements are not yet specified ("Future") and it may be that the calculations will be performed outside the price coupling 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[A6].[A7]

	advanced hybrid coupling, where the algorithm is able to accomodate coordinated net transmission capacity approach and flow based approach on different bidding zone borders coexist within different capacity calculation regions and where the mutual impact of cross-zonal capacity allocation between two capacity calculation regionsthese borders is taken into account within the price coupling algorithmThe price coupling algorithm Algorithm shall be able for each MTU to facilitate the Aadvanced hybrid coupling, where realized cross-zonal capacity transactionsscheduled exchanges over bidding zone borders with coordinated net transmission capacity approach are taken into account in the available margin on critical network elements of the Fflow-based critical branchescapacity calculation regions (using virtual bidding areaszones).		X	X

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