ACER director
Mr. Alberto Pototschnig

and
representatives of NRAs

NEMO COMMITTEE

1st August 2019

SUBJECT: SUBMISSION OF NEMO METHODOLOGIES PROPOSALS

Dear ACER Director, NRAs representatives,

I am writing to you on behalf of all NEMOs in execution of ACER Decisions 08/2018 and 01/2019 in accordance to Articles 37 and 55 of CACM (Commission Regulation (EU) 2015/1222).

All NEMOs, in cooperation with all TSOs, launched on 3rd June 2019 a public consultation on Algorithm Methodology review, including algorithm change control and algorithm monitoring, plus SIDC requirements annex amendment for supporting ID auctions, plus SIDC product methodology. This consultation closed on 2nd July 2019.
After the finalisation of the consultation, the comments received were evaluated and the final versions of the mentioned proposals were prepared and approved by all NEMOs and all TSOs. Hereby, the NEMO Committee is submitting these proposals to ACER and all NRAs for revision and approval, on behalf of all NEMOs, and in parallel each NEMO may submit the abovementioned proposals to the corresponding NRA(s).

This submission comprises the following documents: The Algorithm Methodology (AM), the common set of requirements for the continuous trading matching and the intraday auction algorithms (annex 2), the Algorithm Monitoring Methodologies (AMM) for SDAC and SIDC respectively (annexes 3 and 4), the proposal for products that can be taken into account by NEMOs in the intraday coupling process and the evaluation of responses to the public consultation.

Please, don't hesitate to come back to us should you need any clarification or additional information. The proposals submitted are crucial for the successful development of the MCO function and therefore we are interested to cooperate with ACER and NRAs in order to find the best way forward

Yours sincerely,

Cosimo Campidoglio
NEMO Committee Chairman¨

On behalf of all designated NEMOs: CROPEX, EPEX SPOT, EXAA, GME, HENEX, HUPX, IBEX, NASDAQ, EMCO, OKTE, OMIE, OPCOM, OTE, SEMOpx, BSP and TGE.

Appendixes: Appendix A. Changes introduced in the proposals after the public consultation
Appendix B. List of documents submitted

Appendix A. Changes introduced in the proposals after the public consultation

The changes introduced in the proposals after the public consultation can be classified in three main categories:

1. **Changes in response to the feedback obtained in the public consultation**
   In AM Article 5(20), the interruption of cross-zonal allocation in continuous SIDC in advance of the auction GCT has been increased, in order to address the needs of TSOs belonging to the CORE region.
   AM Articles 6(4) and 6(5) have been added in order to clarify the steps to be followed in case intraday cross-zonal capacity is not provided for IDAs and the case in which an IDA is not able to allocate the intraday cross-zonal capacity.
   AM article 6(6) and the Annex 2 to the Algorithm Methodology, article 6(1)(a)(i) have been modified in order to allow for an earlier implementation of the MTU requirement in IDAs.

2. **Clarifications on concepts**
   AM article 2(2)(l) improved definition of First "OK" solution.
   AM article 12 (8) has been amended in order to detail who shall be affected by the corrective measures listed under article 12(5)(c).

3. **Slight rewording of paragraphs**
   AM article 13 aligns the terminology used. "Evaluation" term has been replaced by "assessment" term.
   AM articles 13, 17, 18, 19 and 20 contain several minor wording amendments as well as fixing.
   AM article 19 fixes some wrong references and article 20 adds the resources constraints as a reason for not accepting one request for change.

Appendix B. List of documents submitted

- Evaluation of responses to the public consultation abovementioned, provided as "Answers_to_Feedback_on_Public_Consultation_AMs.pdf" document

- Algorithm Methodology, hereinafter referred as AM:
  - Clean version "AM_document_clean.pdf"
  - Version showing changes "AM_document_with_comments.pdf"

- Algorithm monitoring methodologies for SDAC and SIDC, respectively corresponding to the annexes 3 and 4 of the Algorithm Methodology:
  - Clean version "AMM_SDAC_document.pdf"
  - Clean version "AMM_SIDC_document.pdf"

- Annex 2 to the Algorithm Methodology, containing the Common set of requirements for the continuous trading matching and the intraday auction algorithms:
  - Clean version: "SIDC_requirements_clean.pdf"
  - Version showing changes "SIDC_requirements_with_comments.pdf"

- Proposal for products that can be taken into account by NEMOs in intraday coupling process:
  - Clean version: "Products Proposal_ID_clean.pdf"
  - Version showing changes: "Products Proposal_ID_with_comments.pdf"

The documents that are new are provided in a clean version only. When documents have been amended from a previous existing version approved by ACER, two versions are provided: one clean version and one "commented" version.

Methodology for the price coupling algorithm and the continuous trading matching algorithm

also incorporating a common set of requirements in accordance with Article 37(5) of the Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management

01 August 2019

16th July 2019

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Annex 1 to the Algorithm methodology: Common set of requirements for the price coupling algorithm
Annex 2 to the Algorithm methodology: Common set of requirements for the continuous single intraday coupling and the intraday auction algorithms

Annex 3 to the Algorithm methodology: Methodology for monitoring the performance and usage of the price coupling algorithm

Annex 4 to the Algorithm methodology: Methodology for monitoring the performance and usage of the continuous trading matching algorithm

Whereas

(1) This document establishes the methodology for the price coupling algorithm and for the continuous trading matching algorithm ('algorithm methodology') in accordance with Article 37(5) of Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management ('CACM Regulation'). It incorporates, as annexes, a common set of requirements for the price coupling algorithm ('DA algorithm requirements') and for the continuous trading matching algorithm ('ID algorithm requirements') in accordance with Article 37 of the CACM Regulation, and common set of principles and indicators for their respective monitoring.

(2) This document also establishes the methodology for the algorithm applied in the Intra Day Auctions (IDAs) established compliant to ACER's decisions 01/2019 to comply with the requirement for the pricing of capacity in the Single Intra Day Coupling set forth in CACM Article 55. As a consequence, the common set of requirements for the IDAs are included in the ID algorithm requirements Annex. As a further consequence, while by Single Day Ahead Coupling (SDAC) it is meant the day ahead session of market coupling, by Single Intra Day Coupling (SIDC) it is meant both the continuous trading session and the Intraday Auction session.

(3) In order to be able to support the same set of products and functionalities while assuring at the same time an efficient use of resources in terms of implementation costs and time to delivery of new functionalities, as well as benefit from algorithm development evolutions, the same price coupling algorithm used for SDAC shall be used also for Intra Day auctions. As a consequence, in this methodology whenever ID auction algorithm is referred to, it is meant to refer to the same price coupling algorithm used for the SDAC. The proposed timeline for the implementation of the IDAs is based on the above assumption.

(4) This Algorithm methodology takes into account the general objectives of capacity allocation and congestion management described in Article 3 of the CACM Regulation as set out below in paragraphs (3) to (14).

(5) The Algorithm methodology promotes effective competition in the generation, trading and supply of electricity (Article 3(a) of the CACM Regulation) as it establishes a level playing field for competition among all market participants through an objective function which maximises the economic surplus and transparent conditions to participate in the price coupling and continuous trading matching.

(6) The Algorithm methodology ensures that the cross-zonal capacity is allocated in a way that maximizes economic surplus and thus contributes to ensuring optimal use of the transmission infrastructure (Article 3(b) of the CACM Regulation).

(7) The Algorithm methodology ensures that cross zonal trading within the SDAC and SIDC respects the cross-zonal capacities and allocation constraints provided by coordinated capacity calculators and thereby ensures that operational security is not endangered by the operation of SDAC and SIDC (Article 3(c) of the CACM Regulation).

(8) The Algorithm methodology facilitates both the coordinated net transmission capacity approach as well as flow-based approach and thereby supports the optimisation of the calculation of cross-zonal capacity (Article 3(d) of the CACM Regulation). As regards the allocation of cross-zonal capacity, the Algorithm methodology promotes implicit allocation of cross-zonal capacity, which is considered as more efficient

than explicit allocation of cross-zonal capacity and allows for the usage of explicit cross-zonal capacity allocation.

(9) The Algorithm methodology ensures fair and non-discriminatory treatment of TSOs, NEMOs and market participants (Article 3(e) of the CACM Regulation). The non-discriminatory treatment of TSOs and NEMOs is achieved by allowing an open access to participation in SDAC and SIDC to all NEMOs and TSOs and by allowing both to define their requirements in relation to the development and operation of SDAC and SIDC. Non-discriminatory treatment of market participants is achieved through the support of different products that meet the market participants' needs. Moreover, the matching of their orders is based on an objective function, which maximises the economic surplus. The Algorithm methodology has no impact on the non-discriminatory treatment of the Agency and regulatory authorities.

(10) The Algorithm methodology ensures and enhances transparency and reliability of information (Article 3(f) of the CACM Regulation) through transparent management of the algorithms' development and operation. This is achieved via transparent rules for monitoring and managing the algorithm performance, the corrective measures and the requests for changes to the algorithms. Transparency and reliability is also achieved through the requirements on regular reporting, the publication of documents related to these processes and the disclosure to the interested public of information needed to monitor the functioning of the algorithms.

(11) The Algorithm methodology contributes to an efficient long-term operation and development of the electricity transmission system and electricity sector in the Union (Article 3(g) of the CACM Regulation) as it ensures that all electricity markets and networks in the EU and other eligible third countries can participate in the SDAC and SIDC. This provides for an environment in which these markets can operate efficiently, where the cheapest generation can meet the highest demand and where efficient signals for the operation and development of the electricity sector are provided for.

(12) The algorithms apply clear rules for the price formation, which do not allow for discrimination among market participants. Therefore, the Algorithm methodology respects the need for a fair and orderly market and a fair and orderly price formation (Article 3(h) of the CACM Regulation) by ensuring that the algorithms always maximise the economic surplus and that their outcome is repeatable and scalable to the extent needed to support the extension of SDAC and SIDC to the whole EU and other eligible third countries.

(13) The Algorithm methodology supports the creation of a level playing field for NEMOs (Article 3(i) of the CACM Regulation) as it allows the participation by more than one NEMO in one bidding zone and provides equal opportunities for all NEMOs to compete with their services, with the exception of the national legal monopoly, in accordance with Article 5 of the CACM Regulation. The Algorithm methodology also ensures that the needs of NEMOs to customise the products for their customers are treated equally and in a non-discriminatory way, while taking into account the impact of those needs on the algorithm performance.

(14) The Algorithm methodology ensures non-discriminatory access to cross-zonal capacity (Article 3(j) of the CACM Regulation) as it ensures the application of implicit capacity allocation which allocates cross-zonal capacities to market participants' orders in a way which maximises the economic surplus at a specific point of time.

(15) The Algorithm methodology should provide assurance that the price coupling algorithm and the continuous trading matching algorithm are able to find for all days a solution that is compliant with the concept of market coupling and implicit capacity allocation in the permitted time. The Algorithm methodology should provide an objective framework to monitor and communicate on the operational performance, as well as to ensure stakeholders' understanding of the functioning of the algorithm.

(16) Changes to the price coupling algorithm and continuous trading matching algorithm should be managed in an open, transparent and non-discriminatory way by seeking stakeholder input, where relevant. These changes should provide assurance that the algorithm performance is maintained at adequate levels and over a reasonable period of time in the future, assuming plausible market growth and development. To achieve this, individual NEMO's or TSO's requests should be supported to the extent

that they do not harm any Party or include measures to mitigate any harm in a way that ensures non-discrimination.

(17) While the existing day-ahead ('DA') and intraday ('ID') algorithm solutions support all existing requirements and all individual products established in the products that can be taken into account by NEMOs in the single day-ahead coupling and single intraday coupling ('DA and ID products'), such support may not be achievable in a situation where the SDAC and SIDC are extended to many additional bidding zones and where the usage of products is greatly increased. In such a situation, the algorithm should support at least a combination of products, which does not significantly restrict the needs of market participants and requirements specified in a way that enables TSOs to perform their duties pursuant to CACM Regulation. A specific set of articles for deciding on requests for changes and corrective measures are included to provide clarity regarding such limitations to products or requirements.

(18) In order to address all the requirements of the CACM Regulation, the existing DA and ID algorithm solutions require further research and development on the IT solution supporting the algorithm operation and the algorithm design, aiming to maintain adequate performance of the algorithm. All NEMOs should regularly inform the regulatory authorities and other stakeholders about the expected outcome of the research and development process, in order to allow for adapting their own operational processes to the newly developed solutions.

(19) The price coupling algorithm needs to support the products (and requirements) ranging across more than one market time unit ('MTU') and often having the all-or-nothing acceptance criterion. This requires complex combinatorial calculations to compute a number of alternative (CACM Regulation compliant) solutions. In order to allow the algorithm to provide the results within the time limit specified by all TSOs in accordance with Articles 48(1) and 59(4) of the CACM Regulation, the algorithm may not have enough time to search for all feasible solutions in order to find an optimal solution, which maximises the economic surplus. In that respect, the requirement to maximise the economic surplus for SDAC or SIDC should be understood as the requirement to find the highest possible economic surplus among all the feasible solutions found by the algorithm within the time constraints. This may, in specific cases, have an impact on the requirement to respect the need for a fair and orderly price formation in accordance with Article 3(h) of the CACM Regulation. Since the maximisation of the economic surplus (i.e. optimal solution) is considered as the best guarantee to fulfil this requirement, all NEMOs should minimise the degree to which the solution found within the time constraints deviates from the optimal solution.

(20) According to Article 38(1)(e) of the CACM Regulation, the price coupling algorithm must be repeatable, which means that it must consistently produce the same results during the repeated execution with identical inputs. However, since the solution found by the price coupling algorithm is time dependent, the repeatability can only be ensured within the same conditions, i.e. on the same specific configuration of hardware and software and the same number of algorithm iterations. Furthermore, the application of a concept of full repeatability in a "multi-threading" approach, as the one implemented in the price coupling algorithm in order to maximise its scalability and its ability to find more and better solutions given the constraints recalled in whereas (19), would drastically reduce such benefits. For this reason, the repeatability of the price coupling algorithm in operations should be adequate to accommodate the objectives of the CACM Regulation, meaning that the differences between alternate runs of the algorithm on the same input data, given the same specific configuration of hardware and software and the same number of algorithm iterations, respect the conditions defined in the Article 3(4)(b) of the Annex 3. At the same time, NEMOs should be able to fully replicate on dedicated instances of the algorithm the outcome of specific sessions under the request of ACER or of one or more NRAs.

(21) According to Article 51(1)(e) of the CACM Regulation, the continuous trading matching algorithm must be aim to maximise the economic surplus and repeatable. Since the matching of orders in the continuous trading matching algorithm is based on their price and submission time, the continuous trading matching algorithm does imply no optimization feature on the welfare and does not contain any element of randomness. Therefore, the continuous trading matching algorithm is by default maximizing

welfare and repeatable. For this reason, the monitoring of continuous trading matching algorithm's optimality and repeatability is not necessary.

(22) According to Articles 38(1)(e) and 51(1)(e) of the CACM Regulation, the algorithms must be scalable. This means that they must be able to accommodate an enlargement of the SDAC and SIDC to new bidding zones (and new NEMOs), as well as the enlargement of the use of DA and ID products and an enlargement of the algorithm requirements. However, unlimited scalability is (i) not feasible, since any configuration of hardware and software is subject to technical constraints that can become limiting under extreme conditions, (ii) not efficient, since it entails costs, which are not proportionate to the results that can be achieved and (iii) not needed, since the dimensions of the market coupling are not infinite in terms of geographical scope, number of NEMOs, products and requirements. Hence, the scalability should be adequate to accommodate the objectives of the CACM Regulation.

(23) With regard to additional bidding zones, the completion of a fully functioning and interconnected internal energy market makes the extension of market coupling to all eligible bidding zones and NEMOs the highest priority objective. Thus, at the time of the adoption of this methodology, the algorithm should support all eligible bidding zones and NEMOs as well as the existing requirements of TSOs and existing DA and ID products. However, as the number of eligible bidding zones and NEMOs will increase in the future (e.g. due to extension to third countries), the algorithms should be continuously upgraded to accommodate all additional bidding zones (and NEMOs) eligible to participate in the SDAC and SIDC as well as the additional requirements from TSOs that may arise from the development of capacity calculation methodologies in capacity calculation regions.

(24) The implementation and management of the SDAC and/or SIDC algorithms according to the CACM Regulation requirements in terms of security of operation as well as of adequate performance, trigger different activities in charge of all NEMOs and all TSOs. Such activities are the monitoring on a structured basis of the algorithm performance and of the usage of the functionalities therein supported, an efficient planning of the modifications to be implemented to the algorithms in the mid-long term, together with the establishment of a research and development process aimed at improving the SDAC and/or SIDC algorithm performance.

(25) In the framework of monitoring of the algorithm performance, if due to unexpected evolution, the performance of the algorithm deteriorates, all NEMOs and all TSOs should apply corrective measures to restore the performance. These measures should be timely communicated to stakeholders. An efficient and transparent governance is crucial for this process.

(26) The future evolution of the algorithms in terms of their scalability requires changes to the algorithms' functionalities or to the usage of already existing functionalities. To accommodate these changes, all NEMOs should cooperate with all TSOs where these changes affect TSOs' algorithms' requirements or algorithms' performance and communicate these changes to stakeholders in a timely manner. An efficient and transparent governance is crucial for this process.

(27) In order to assess the impact on performance of the SDAC and/or SIDC algorithm of any requested or uninstructed change in the usage of its functionalities, all NEMOs and all TSOs should define usage scenarios for each of those functionalities which usage could varies on a daily basis (such as orders submitted by market participants for each type of product supported by the algorithm, or the value of the ATC daily auctioned on the market by the TSOs or the value and number of daily flow base constraints defined by TSOs for each relevant bidding zone borders, as described in Scheduled Exchanges Calculation Methodology, Article 5, 1, iv). Such scenario and their applications are defined in the Annexes 3 and 4 relative to the monitoring of the price coupling algorithm and continuous trading matching algorithm.

(28) The concept of Effective Usage refers to actual value of usage of these functionalities over a past period. This is the basis for the monitoring of usage of requirements and the performance of the algorithm.

(29) The concept of Anticipated Usage refers to the future value of the usage of these functionalities, when assessing expected variation of the performance of the algorithm due to implementation of requests for change or to the expected growth of their usage. The Anticipated Usage is based on the application of standard growth rates to the Effective Usage for functionalities already applied or on information

provided by the requesting Party in the case of a request for change introducing new usage of functionalities. This is the basis for assessing the impact on performance induced by requests for change as well as for the periodic assessment of adequate scalability against anticipated growth of the usage of functionalities.

(30) The concept of Usage Range refers for each functionality to the maximum estimated usage of such functionality supported by the algorithm consistent with adequate levels of scalability. The individual Usage Ranges of the functionalities are jointly estimated on the basis of their Anticipated Usage. Considering that the joint usage of many functionalities affects performance, the Usage Range does not represent any maximum allowed or reserved level of usage of the single functionalities, rather indicates a prudential measure of individual usage consistent with overall adequate performance and indicates potential area of application of corrective measures in case overall performance is reducing below predefined thresholds.

(31) The development and operation of the price coupling algorithm and the continuous trading matching algorithm require close cooperation between all NEMOs and all TSOs as part of the day-to-day management of the single day-ahead and intraday coupling pursuant to Article 10 of the CACM Regulation. For this purpose, NEMOs and TSOs should collaborate in the processes for managing the algorithm performance, in the processes leading to a change in the algorithms, as well as in the development of the underlying rules governing these processes.

(32) The development and operation of the algorithms require highly transparent processes. For this reason, all NEMOs should publish in a timely manner all relevant information and reports having an impact on the algorithm operation, management, performance and future evolution. Moreover, all NEMOs should ensure that the interested public is able to understand the functioning of the algorithm and therefore publish and continuously update a detailed description of the price coupling algorithm and of the continuous trading matching algorithm.

The future evolution of various terms and condition or methodologies developed by TSOs or NEMOs in accordance with the CACM Regulation may require some additional changes to the algorithms. In such a case, all TSOs and all NEMOs should update the DA and ID algorithm requirements and subsequently all NEMOs should update the Algorithm methodology and submit it to all regulatory authorities for approval.

(33) The indicators set forth in the Algorithm monitoring methodology annexes are meant to provide an objective basis for the management of all the activities related to the management of the SDCA/SIDC coupling and for the information to stakeholders and institutions, as far as both operations and development are involved.

(34) The usage indicators set forth in the Algorithm monitoring methodology annexes are meant to support the day to day management of the SDCA/SIDC referred to in CACM Article 10. They provide the information on evolution of the effective usage of the DA/ID algorithms over an historical batch and so are the basis for application of corrective measures. These indicators are published in the yearly monitoring report and constitute the basis for periodic reporting from NEMOs and TSOs to the institutions in the relevant Fora.

(35) The performance indicators set forth in the Algorithm Market Monitoring Methodology Annexes are meant to measure the properties of the algorithm in terms of compliance with the CACM requirements of optimality, repeatability and scalability. They provide the information on evolution of the actual performance of the DA/ID algorithms over the same historical batch of the usage indicators, as a consequence of the growth of the latter. These indicators are published in the yearly monitoring report and constitute the basis for periodic reporting from NEMOs and TSOs to the institutions in the relevant Fora, together with the usage indicators.

(36) The performance indicators set forth in the Algorithm monitoring methodology annexes are also meant to measure the capability of the algorithm to support in the medium and long term anticipated market growth and extension of requirements, thus providing the basis for the decisions on the long term development of the DA/ID algorithms. They measure the impact on performance of any requests for change, assessed on a past and future batches. In order to ensure adequate transparency on the process of

development of the DA/ID algorithms, these indicators are published in the yearly scalability report and in the yearly research and development report.

(37) In particular, the performance indicators on scalability set forth in the Algorithm monitoring methodology annexes are also meant to provide the basis for the impact assessment of requests for change including, but not limited to, those for corrective measures on the reliability of algorithm's operation. They measure the impact of such changes on calculation time on both an historical batch and a future batch, based on the anticipated usage of SDCA/SIDC requirements, in order to assess the risk that the requests for change are expected to have on: (i) in the short term the reliability of operation of the existing version of the algorithms (ii) in the medium or long term, the necessity of triggering or revising the research and development activity in order to be able to support the request for change, or (iii) the likelihood that the proposed corrective measures are sufficient to restore adequate reliability of operation.

TITLE 1
General provisions

Article 1

Subject matter and scope

1. This Algorithm methodology determines the single day-ahead price coupling algorithm, the single intraday continuous trading matching algorithm and the ID auction algorithm in accordance with Article 37 of the CACM Regulation. The Algorithm methodology incorporates the DA and ID algorithm requirements (as per Annex 1 and Annex 2).
2. This Algorithm methodology set forth principles for the submission, evaluation, decision and implementation of requests for change related to the SDAC and/or SIDC algorithms incorporated and detailed in the change control procedures defined in the relevant operational agreements among all NEMOs, and/or or between all NEMOs and all TSOs in the day-ahead and intraday framework.
3. The Algorithm methodology incorporates the Algorithm monitoring methodology for DA and ID (as per Annex 3 and Annex 4)
4. The following provisions and related decisions of all NEMOs shall apply subject to applicable laws and regulations.

Article 2

Definitions and interpretation

1. The terms used in this Algorithm methodology shall have the meaning given to them in Article 2 of Regulation (EC) No 714/2009, in Article 2 of Regulation (EU) No 543/2013, in Article 2 of the CACM Regulation, in Article 2 of Directive 2009/72/EC, in Article 3 of Regulation (EU) 2017/1485, with the exception of the definition of 'scheduling area', and in the Market Coupling Operator ('MCO') Plan.
2. In addition, the following definitions shall apply:

a) **Algorithm monitoring methodology**: means a methodology developed jointly by all NEMOs in coordination with all TSOs in order to assess the performance of the price coupling algorithm and of the continuous trading matching algorithm.
b) **Algorithm performance**: means the ability of the price coupling algorithm and the continuous trading matching algorithm to (i) ensure reliability of the process to find solutions, (ii) maximise economic surplus, and (iii) ensure an adequate level of repeatability and scalability.
c) **Algorithm service provider**: the subject in charge of providing new versions of the algorithm as identified in the relevant operational agreements among all NEMOs, in the day-ahead and intraday framework.
d) **Assessment Body:** the body in charge for the technical assessment of the request for change, as identified in the relevant operational agreements among all NEMOs, between all NEMOs and all TSOs, and among all TSOs, in the day-ahead and intraday framework.
e) **Back-up methodology**: means the methodology developed in accordance with Article 36(3) of the CACM Regulation and approved in accordance with Article 9 of the CACM Regulation, including any amendments, which have been approved in accordance with that Article 9.
f) **Change control procedure:** means a procedure, annexed to the relevant DA and ID operational agreements developed according to the principles reported in the present methodology in order to manage requests for change to the price coupling algorithm, to the continuous trading matching algorithm and the ID auction algorithm.
g) **Corrective measure**: means a last resort measure taken by all NEMOs and all TSOs in case of performance degradation of the price coupling algorithm or of the continuous trading matching algorithm with the aim to restore their adequate performance.
h) **Decision Body**: the body in charge of activities described in Article 20, as identified in the relevant operational agreements among all NEMOs, between all NEMOs and all TSOs, and among all TSOs, in the day-ahead and intraday framework.
i) **Existing DA algorithm solution**: means the algorithm which has been developed and implemented by some NEMOs for the day-ahead market coupling within the day-ahead coupling project pre-existing the CACM Regulation in accordance with the MCO Plan.
j) **Existing ID algorithm solution**: means the algorithm, which has been developed and implemented by some NEMOs for the intraday market coupling within the intraday coupling project pre-existing the CACM Regulation in accordance with the MCO Plan.
k) **Fallback Methodology**: means the methodology developed for robust and timely fallback procedures to ensure efficient, transparent and non-discriminatory capacity allocation in the event that the single day-ahead coupling process is unable to produce results, in accordance with Article 44 of the CACM Regulation and approved in accordance with Article 9 of the CACM Regulation, including any amendments, which have been approved in accordance with that Article 9.
l) **First "OK" solution:** when referring to the price coupling algorithm, it means the first solution found that satisfies all input constraints up to a pre-defined numerical tolerance level.
m) **Functionality**: means any market or network feature or design element embodied in the systems, communications and procedures that support the price coupling algorithm or the continuous trading matching algorithm in accordance with the DA and ID algorithm requirements.
n) **Future Requirements**: means requirements proposed according to Article 37 of the CACM Regulation, which are needed to extend further the functionalities of the price coupling algorithm and of the continuous matching algorithm.
o) **Go-live Date**: means, with respect to each request for change, the date within a specific Go-live Window on which such request for change is to be implemented in operation
p) **Go-live Window**: single temporal slot reflecting the unit of partition of a calendar year, where different phases of requests for change management shall be implemented according to indications provided in Article 16. The number of Go-live Windows in a given year will be established periodically according to the relevant DA or ID change control procedure. Each individual Go-live Window may determine the period during which: (i) requests for change may be submitted; (ii) the assessment process of requests for change will take place; or (iii) the request for change will go-live.
q) **IDA**: intraday auction as defined in Annex I article 2(1)(b) from ACER decision 1/2019 on the Methodology for pricing intraday cross-zonal capacity.

r) **Initial Requirements**: means requirements proposed according to Article 37 of the CACM Regulation, which need to be implemented at the beginning of the operation of the price coupling algorithm and of the continuous trading matching algorithm.

s) **MCO Plan**: means the plan on joint performance of market coupling operator functions developed in accordance with Article 7(3) of the CACM Regulation and approved in accordance with Article 9 of the CACM Regulation, including any amendments, which have been approved in accordance with that Article 9.

t) **Methodology for calculating scheduled exchanges**: means the methodology developed in accordance with Articles 43(1) and 56(1) of the CACM Regulation and approved in accordance with Article 9 of the CACM Regulation, including any amendments, which have been approved in accordance with that Article 9.

u) **NEMO Trading Hub**: means a virtual trading point collecting all orders received by a NEMO with delivery in a specific scheduling area.

v) **Originator**: any Party submitting a request for change. The request for change may be submitted by any individual Party or a working group comprising of any two or more parties, in each case in accordance with the relevant change control procedure for the DA or ID contractual framework.

w) **Paradoxically Rejected Order**: means any sell/buy order covering multiple MTUs, which, although its order price is lower/higher than the average market clearing price for all the MTUs included in the order, are nonetheless rejected by the price coupling algorithm on the grounds that, if they had been accepted, the average market clearing price in the respective MTUs would have either decreased/increased below/above their order price or the economic surplus calculated by the price coupling algorithm would have decreased.

x) **Party**: any NEMO or TSO.

y) **DA products, ID products and IDA products**: means the products that can be taken into account in the single day-ahead, intraday coupling or intraday auction, respectively, developed in accordance with Articles 40(1), 53(1) of the CACM Regulation and approved in accordance with Article 9 of the CACM Regulation, including any amendments, which have been approved in accordance with that Article 9.

z) **Request for change**: means a formal request by one or more NEMO(s) or TSO(s) for any modification to the price coupling algorithm, the continuous trading matching algorithm and the intraday auction algorithm or to its usage.

aa) **Scheduling area**: means a scheduling area according to Article 3(2)(91) of the Regulation (EU) 2017/1485 with at least one NEMO trading hub.

bb) **Scheduled exchange between NEMO trading hubs**: means an electricity transfer scheduled between NEMO trading hubs within or between scheduling areas or bidding zones.

cc) **Usage:** quantitative indication of the average usage of a functionality over a predefined time range. Such information is needed whenever the usage of such functionality is dependent to decisions of market participants (e.g. number of orders of a specific product) or a TSO (e.g. hourly value of ATC, number and value of PTDFs). Specific definition of Effective Usage, Anticipated Usage and Usage Range are provided in Article 7. .

3. Unless the context requires otherwise or unless specified otherwise:

a) the singular indicates the plural and vice versa;

b) the table of contents and headings are inserted for convenience only and do not affect the interpretation of this Algorithm methodology; and

c) any reference to legislation, regulations, directives, decisions, orders, instruments, codes or any other enactment shall include any modification, extension or re-enactment thereof when in force.

TITLE 2
Algorithms

Article 3

Algorithm requirements

1. The algorithm requirements comprise a common set of requirements proposed by all TSOs, a common set of requirements proposed by all NEMOs and a common set of requirements jointly proposed by both all TSOs and all NEMOs, in line with Article 37 (1) of the CACM Regulation.
2. The common set of requirements for the price coupling algorithm, the continuous trading matching algorithm and the intraday auction algorithm are set out in Annex 1, Annex 2 TITLE 1 and Annex 2 TITLE 2, respectively, of this Algorithm methodology.
3. All NEMOs shall maintain the functionalities (following their implementation) to be compliant with the requirements that are set out in Annex 1 and Annex 2 of this Algorithm methodology.
4. The price coupling algorithm, the continuous trading matching algorithm and the intraday auction algorithm shall support the requirements for the calculation of scheduled exchanges between bidding zones and between scheduling areas as well as scheduled exchanges between NEMO trading hubs in accordance with the methodology for calculating scheduled exchanges for the day-ahead, intraday timeframe and respectively intraday auction timeframe.
5. The price coupling algorithm and the continuous trading matching algorithm shall support all DA, ID and IDAs products and all requirements defined in Annex 1, Annex 2 TITLE 1 and Annex 2 TITLE 2 to this Algorithm methodology. However, if such support leads to a deterioration of the algorithm performance, all NEMOs may apply, through the procedures for corrective measure and/or change requests:

    a) limitations to specific products or their usage in specific bidding zones; and/or
    b) limitations to specific algorithm requirements or their usage, if these requirements are specified in a way that excessively impacts the algorithm performance.

    When applying those limitations, all NEMOs shall respect the rules referred to in Article 12 of this Algorithm methodology.
6. All NEMOs shall ensure that the price coupling algorithm produces the results set out in Article 39(2) of the CACM Regulation while fulfilling the requirements referred to in Article 38(1) and Article 40(2) of the CACM Regulation:

    a) The price coupling algorithm shall aim at maximising the economic surplus for all biding zones participating in the SDAC for the next trading day while respecting cross-zonal capacity and allocation constraints within the maximum calculation time. The price coupling algorithm shall facilitate efficient price formation by using the marginal price principle according to which all accepted orders have the same price per bidding zone and per MTU;
    b) The price coupling algorithm shall be repeatable, which means that the outcome of alternate executions of the algorithm on the same hardware and software and their configuration after the same number of iterations shall respect the conditions set forth in Article 3(4)(b) of Annex 3. All NEMOs shall be able to fully replicate the results of the price coupling algorithm for a specific historic delivery day if requested by any regulatory authority or the Agency pursuant to their monitoring duties in accordance with Article 82(1) of CACM Regulation;
    c) The price coupling algorithm shall be scalable, thus ensuring that it can support in a non-discriminatory way all bidding zones and all NEMOs eligible to participate in the SDAC at any time, all DA algorithm requirements and all products set out in the DA products, as well as their reasonable usage based on anticipated and Effective Usage;

d) The price coupling algorithm shall be able to accommodate orders resulting from products covering one MTU and multiple MTUs;
e) The price coupling algorithm shall be reliable, which means that it shall be able to find at least one solution within the time limit as set out in the operational procedure and timings; and
f) The price coupling algorithm shall provide for a fair and orderly price formation as required by Article 3(h) of the CACM Regulation.

7. All NEMOs shall ensure that the continuous trading matching algorithm produces the results set out in Article 52(1) of the CACM Regulation while fulfilling the requirements of Article 51(1) and Article 53(3) of the CACM Regulation:

a) The continuous trading matching algorithm shall aim at maximising economic surplus for the SIDC per trade for the intraday market time-frame by allocating cross-zonal capacity to orders, which can be matched in accordance with their price and submission time, while respecting the cross-zonal capacity and allocation constraints;
b) The continuous trading matching algorithm shall be repeatable, which means that for a given (i) set of orders, their associated submission time and cross-zonal capacities and allocation constraints for a specified delivery date and (ii) an adequate and suitable storage and computational capacity of the algorithm and related IT assets, the same results originally obtained for the indicated delivery date can be reproduced;
c) The continuous trading matching algorithm shall be scalable, thus ensuring that it can support in a non-discriminatory way all bidding zones and all NEMOs eligible to participate in the SIDC at any time, all ID algorithm requirements and all products set out in the ID products, as well as their reasonable usage based on anticipated and Effective Usage; and
d) The continuous trading matching algorithm shall be able to accommodate orders covering one MTU and multiple MTUs.

8. All NEMOs shall ensure that the intraday auction algorithm produces the results and fulfils the requirements defined for SDAC algorithm in the previous paragraph 6 plus the requirements defined in TITLE 2 of Annex 2. In case of discrepancy, TITLE 2 of Annex 2 shall prevail.

Article 4

Price coupling algorithm

1. The price coupling algorithm shall produce at least the following results simultaneously for each MTU:

a) a single clearing price for each bidding zone and MTU in EUR/MWh;
b) a single net position for each bidding zone and each MTU;
c) the matched volumes of each bidding zone for each relevant MTU;
d) the scheduled exchanges between bidding zones (in case of DC interconnectors separately for each of them) and between scheduling areas as well as scheduled exchanges between NEMO trading hubs for each relevant MTU;
e) the information which enables the execution status of orders to be determined; and
f) the acceptance ratio for each block as defined in the DA products.

2. The price coupling algorithm shall calculate scheduled exchanges between bidding zones and between scheduling areas as well as scheduled exchanges between NEMO trading hubs in accordance with the methodology for calculating scheduled exchanges for the day-ahead timeframe.

3. For the purpose of calculating scheduled exchanges, the price coupling algorithm shall calculate the net positions as follows:

a) for the bidding zones consisting of more than one scheduling area, the net position for each MTU will be calculated for each scheduling area; and

b) for the scheduling areas where more than one NEMO operates, the net position for each MTU will be calculated for each NEMO trading hub.

4. To find a solution, the price coupling algorithm shall evaluate different combinations of block orders and complex orders and try to find values for the remaining variables that fulfil the market and network requirements expressed as constraints in the optimisation problem. Every evaluated combination is a node.

5. In order to ensure reliability of operation, the price coupling algorithm shall first aim to find a first solution compliant with the input constraints. In order to maximise the economic surplus, it shall then seek to find new solutions with higher economic surplus by exploring new nodes until the overall optimal solution is found and verified in the process of maximising the economic surplus or until the time limit referred to in paragraph 6 has been reached. In case the price coupling algorithm finds two or more solutions with the same value of economic surplus, it shall select the one that maximises the traded volume.

6. Under normal operations, all NEMOs shall execute the price coupling algorithm using the time limit stopping criterion, which shall be equal to the maximum calculation time established in the operational procedure and timings referred to in paragraph 16 .

7. The price coupling algorithm shall perform checks on every solution found to validate that all the market and network requirements, expressed as constraints in the optimisation problem, are respected within a tolerance which shall be agreed between NEMOs and TSOs. The last solution found that is fulfilling this condition shall be the result of the execution of the price coupling algorithm.

8. Orders used in the price coupling algorithm shall be anonymous and processed in a non-discriminatory way. There shall be no identification of the originating market participant or NEMOs.

9. A single execution of the price coupling algorithm operated by the coordinator shall calculate the results for all NEMO trading hubs participating in the SDAC.

10. The input data to the price coupling algorithm referred to in Article 39(1) of the CACM Regulation shall be available to any authorised operator, who is entitled to perform the price coupling calculation in parallel.

11. Under normal operations, all NEMOs shall submit orders to the MCO function systems by the time defined in the operational procedure or otherwise back-up procedures shall be applied as set out in the backup methodology.

12. Under normal operations, all NEMOs performing the MCO functions shall provide (i) all TSOs, all coordinated capacity calculators and all NEMOs with the results of the SDAC referred to in paragraph 1(a),(b),(c) and (d) above; and (ii) all NEMOs with the results specified in paragraph 1 above, by 13:00 market time day-ahead and anyway not later than 15:30 market time day-ahead.

13. All NEMOs shall provide TSOs with the scheduled exchanges between bidding zones and between scheduling areas as referred to in paragraph (2) above, calculated in accordance with the methodology for calculating scheduled exchanges for the day-ahead timeframe.

14. All NEMOs shall ensure that the price coupling algorithm meets the algorithm requirements as follows:

    a) by 1 August 2018, the price coupling algorithm shall be able to support:

        (i) all initial requirements, set out in Annex 1 to this Algorithm methodology, except the requirement referred to in point (b) of this paragraph;
        (ii) the requirement of maximisation of the economic surplus as referred to in Article 3(6)(a) ; and
        (iii) the requirement on delivery of results as referred to in paragraph 1.

    b) by 1 May 2019, the price coupling algorithm shall be able to support:

        (i) the requirement for the operation of multiple NEMOs in a bidding zone;
        (ii) the requirement of scalability as referred to in Article 3(6)(c) ; and

(iii) the requirement for the calculation of scheduled exchanges as referred to in paragraph 2.

c) by 1 February 2020, the price coupling algorithm shall be able to support the requirement of adequate repeatability referred to in Article 3(6)(b) ; and
d) by 1 August 2022, the price coupling algorithm shall be able to support all future requirements set out in Annex 1 to this Algorithm methodology.

15. In the case of amendments of the methodology for the calculation of scheduled exchanges for day-ahead timeframe changes are required in the calculation of scheduled exchanges, the delivery of the functionality for the calculation of scheduled exchanges shall be postponed until 12 months after the approval of the methodology for the calculation of scheduled exchanges for the day-ahead timeframe.

16. All NEMOs and all TSOs shall jointly establish the operational procedures and timings for the price coupling algorithm to comply with Article 48 of the CACM Regulation. These operational procedures and timings shall define the modalities for coordinating the operation of the SDAC market between NEMOs and TSOs both in ordinary and non-ordinary conditions and shall detail all relevant actions to be taken together with relevant subjects, timings and processes. These operational procedures and timings shall make reference to the Back-up methodology developed in accordance with Article 36(3) of the CACM Regulation.

17. Every year, all NEMOs shall provide all regulatory authorities with a report on incidents in the operation of the price coupling algorithm and the application of back-up and fallback procedures in accordance with the Back-up methodology and fallback methodology. The report shall provide at least a list of incidents in the operation of the price coupling algorithm and the application of back-up and fallback procedures, including the reasoning of their occurrence and applied or anticipated remedies to prevent them in the future.

18. All NEMOs shall create and maintain a document with the detailed description of the price coupling algorithm, including the description of calculation of scheduled exchanges in accordance with the methodology for calculating scheduled exchanges for the day-ahead timeframe. This document shall be published and kept updated with every new version of the price coupling algorithm. The document shall be publicly available by all NEMOs on a public webpage.

Article 5

Continuous trading matching algorithm

1. All NEMOs, as part of their MCO function, shall ensure that the continuous trading matching algorithm produces at least the following results:

a) the execution status of orders and prices per trade;
b) a single net position for each bidding zone participating in the SIDC and each MTU; and
c) the scheduled exchanges between bidding zones (in case of DC interconnectors separately for each of them) and between scheduling areas as well as scheduled exchanges between NEMO trading hubs for each relevant MTU.

2. The continuous trading matching algorithm shall comprise a shared order book (‘SOB’) module and a capacity management module (‘CMM’). The SOB module shall manage order entry, order management and order matching, while the capacity management module shall manage and allocate cross-zonal capacities and allocation constraints.

3. The continuous trading matching algorithm shall enable all NEMOs to connect to the SOB module. All NEMOs shall enter orders into the SOB module through local trading solutions. All valid orders entered in time in the local trading solution shall automatically enter the SOB module. Market participants are not entitled to access the SOB module directly.

4. The continuous trading matching algorithm shall calculate the scheduled exchanges between bidding zones and between scheduling areas as well as scheduled exchanges between NEMO trading hubs in accordance with the methodology for calculating scheduled exchanges for the intraday timeframe. This functionality shall be implemented by all NEMOs, together with all TSOs, through the shipping module.

5. Matching of orders shall be performed within the SOB module, irrespectively of the scheduling areas through which the orders were entered, including from the same area. The SOB module shall maintain a consolidated order book for all contracts based on the available cross-zonal capacities and allocation constraints.

6. The CMM shall provide information on the currently available cross-zonal capacities and allocation constraints. When cross-zonal matching is performed, the required cross-zonal capacities shall be implicitly allocated in the CMM.

7. Market participants requesting explicit access to cross-zonal capacity in accordance with Article 64 of the CACM Regulation and subject to regulatory approval shall directly access the CMM for explicit cross-zonal capacity allocation.

8. The SOB module shall determine the local view of all orders that can be matched in a selected scheduling area.

9. The SOB module shall apply deterministic matching procedures. Orders shall be matched in the SOB module on the price-time-priority principle:

    a) Price: orders shall be executed at the best price. This means that the best buy order, i.e. the order with the highest price, shall be executed against the best sell order, i.e. the order with the lowest price, first.
    b) Time: when an order is entered into the SOB, it shall be assigned a timestamp. This timestamp is used to prioritise orders with the same price. At the same price, orders with earlier timestamps shall be executed with a higher priority than orders with a later timestamp.

10. The trade execution price for a newly entered order that is matched shall be the order price of the best order which is already in the SOB:

    a) If a newly entered buy order is matched against an existing sell order, the price of the sell order shall become the trade execution price.
    b) If a newly entered sell order is matched against an existing buy order, the price of the buy order shall become the trade execution price.

11. Where a possible cross-zonal trade is identified in the SOB module, a request for implicit allocation of cross-zonal capacity shall be submitted to the CMM. Requests for implicit capacity allocation shall be queued along with requests for explicit capacity allocation, and cross-zonal capacity shall be allocated on a first-come-first serve basis respecting also allocation constraints. If the necessary cross-zonal capacity is not available, the cross-zonal trade shall not be matched.

12. CMM shall not discriminate between implicit capacity allocation for matching of single-time-unit products (e.g. hourly, half-hourly and quarter-hourly), implicit capacity allocation for matching of user-defined blocks and explicit capacity allocation to explicit capacity allocation requests. These requests from both implicit continuous matching and explicit allocation shall all be treated in the CMM on a first-come-first served basis.

13. NEMOs shall provide TSOs with the scheduled exchanges between bidding zones and between scheduling areas as referred to in paragraph 4 above and in accordance with the methodology for calculating of scheduled exchanges for the intraday timeframe.

14. All NEMOs shall ensure that the continuous trading matching algorithm meets the algorithm requirements as follows:

    a) By 1 August 2018 the continuous trading matching algorithm shall be able to support:

(i) all requirements defined in Annex 2 identified with deadline "IDC 1" to this Algorithm methodology;
(ii) the requirement of maximisation of economic surplus as referred to in Article 3(7)(a) ;
(iii) the requirement for the operation of multiple NEMOs in a bidding zone;
(iv) the requirement of scalability as referred to in Article 3(7)(c) ;
(v) the requirement of adequate repeatability as referred to in Article 3(7)(b) ;
(vi) the requirement on delivery of results as referred to in paragraph 1; and
(vii) the requirements for the calculation of schedule exchanges as referred to in paragraph 4;

b) By 1 August 2019 the continuous trading matching algorithm shall be updated with the complete functionality of enhanced preferred shipper;
c) by end 2021, the continuous trading matching algorithm shall be able to support all requirements identified with deadline "IDA 1" set out in TITLE 1 of Annex 2 to this Algorithm methodology
d) By 1 August 2023, the continuous trading matching algorithm shall be able to support all requirements identified with deadline "IDC 2" set out in Annex 2 to this Algorithm methodology.

15. In the case of amendments of the calculation of scheduled exchanges for the intraday timeframe requires changes in the calculation of scheduled exchanges, the delivery of the functionality for the calculation of scheduled exchanges shall be postponed until 12 months after the approval of the methodology for calculating scheduled exchanges for the intraday timeframe.

16. All NEMOs and all TSOs shall jointly establish the operational procedures and timings for the continuous trading matching algorithm to comply with Article 60 of the CACM Regulation. These operational procedures and timings shall define the modalities for coordinating the operation of the SIDC market between NEMOs and TSOs both in ordinary and non-ordinary conditions and shall detail all relevant actions to be taken together with relevant subjects, timings and processes. These operational procedures and timings shall make reference to the Back-up methodology developed in accordance with Article 36(3) of the CACM Regulation.

17. Every year, all NEMOs shall provide all regulatory authorities with a report on incidents in the operation of the continuous trading matching algorithm and the application of back-up and fallback procedures in accordance with the Back-up methodology and fallback methodology. The report shall provide at least a list of incidents in the operation of the continuous trading matching algorithm and the application of back-up procedures, including the reasoning of their occurrence and applied or anticipated remedies to prevent them in the future.

18. All NEMOs shall create and maintain a document with the detailed description of the continuous trading matching algorithm, including the description of calculation of scheduled exchanges in accordance with the methodology for calculating scheduled exchanges for the intraday timeframe. This document shall be published and kept updated with every new version of the continuous trading matching algorithm. The document shall be publicly available by all NEMOs on public webpage.

19. Under normal operations, in order to avoid double allocation of cross zonal capacity, the cross zonal allocation in continuous SIDC shall be interrupted starting no later than the GCT of the IDAs and shall remain interrupted until the end of the IDA process as referring in Article 6(2).

20. Where so required by relevant regulation, interruption of cross zonal allocation in continuous SIDC may be anticipated no more than 15 minutes before the GCT of the IDAs. The 15 minutes for the interruption of cross zonal allocation in continuous SIDC can be further extended by a maximum of 15 minutes to comply with regulatory requirements in case there is an obligation of publication of available capacity prior the IDA.

Article 6

Intraday auction algorithm

1. The ID auction algorithm shall respect the same provisions defined in article 4 and shall apply with the exceptions defined in this article in the following paragraphs:
2. The results of the SIDC intraday auction referred to in Article 4(1)(a), (b), (c) and (d);, shall be made available allowing at least 30 minutes of cross-zonal continuous trading for any given MTU after the publication of the auction results as stated in Annex 1, article 4, paragraph 8 from ACER 01/2019.
3. Under normal circumstances, the SIDC intraday auction process shall be completed 30 minutes after the GCT of the relevant IDA.
4. In case the TSOs are not able to provide the intraday cross-zonal capacity to an IDA, such capacity, when it becomes available, shall be allocated through the continuous SIDC, as stated in Annex 1, article 4, paragraph 6 from ACER 01/2019
5. In case an IDA is not able to allocate intraday cross-zonal capacity, such capacity shall be subsequently offered and allocated through the continuous SIDC, as stated in Annex 1, article 4, paragraph 7 from ACER 01/2019
6. All NEMOs shall ensure that the ID auction algorithm meets the algorithm requirements as follows:
   a) by end 2021, the ID auction algorithm shall be able to support:

      (i) all requirements identified with deadline "IDA 1", set out in TITLE 2 of Annex 2 to this Algorithm methodology, except the requirement referred to in point (b) of this paragraph;
      (ii) the requirement of maximisation of the economic surplus as referred to in Article 3(6)(a);
      (iii) the requirement on delivery of results as referred to in paragraph 1.
      (iv) the requirement for the operation of multiple NEMOs in a bidding zone;
      (v) the requirement of scalability as referred to in Article 3(6)(c); and
      (vi) the requirement for the calculation of scheduled exchanges as referred to in paragraph 2; and
      (vii) the requirement of adequate repeatability referred to in Article 3(6)(b).

   b) by 1 August 2023, the ID auction algorithm shall be able to support all requirements identified with deadline "IDA 2" set out in TITLE 2 of Annex 2 to this Algorithm methodology.
   c) by end of 2021, only hourly time resolution shall be implemented in operation. Further MTU products shall be implemented in operation when also implemented into the price coupling algorithm.
   d) Requirements identified with deadline "IDA 1B" set out in TITLE 2 of Annex 2 to this Algorithm methodology may be implemented before the deadline defined in previous letter b) but the implementation date shall not be before the 1 August 2022, which is the deadline defined for this requirement in the price coupling algorithm in SDAC scope.
   e) by end of 2021, pure NTC approach shall be implemented in operation. Flow based approach shall be implemented in operation for those regions where cross-zonal capacity is calculated following Flow based methodology no later than when continuous trading matching algorithm is adapted to support flow-based allocation. The evolution of flow-based approach for auctions prior to the implementation of the full flow-based solution is subject to further technical evaluation.

TITLE 3
Algorithm performance management

Article 7

Calculation of Effective Usage, Anticipated Usage and Usage Range

1. All NEMOs in cooperation with all TSOs shall ensure that for each of all those functionalities of the SDAC/SIDC algorithm which daily Usage can vary from one day to another according to definition provided in Article 2, is associated a quantification of the Effective Usage and the Anticipated Usage. Such definitions shall provide the basis for the quantification of the Usage Range, the assessment of the impact on performance of any request for change according to the principles described in the following Article 13 and for the monitoring of the evolution of the performance of the SDAC/SIDC algorithm according to the provisions set forth in Article 8.
2. Effective Usage of a functionality is equal to the mean of its actual usage observed over a predefined set of historical sessions. Its calculation shall be performed according to Article 2(3)(a) of Annex 3 and Article 2(3)(a) of Annex 4, based on the following principles:
    a) The predefined set of historical sessions to be considered shall be equal for all functionalities.
    b) The computation of the Effective Usage shall reflect the observed historical growth trend in the assessment process and the application of corrective measures.
3. The Anticipated Usage of a functionality is its expected Effective Usage over a predefined set of future sessions. Its calculation shall be performed according Article 2(3)(d) of Annex 3 and Article 2(3)(c) of Annex 4, based on the following principles:
    a) The predefined set of historical sessions to be considered shall be equal for all the functionalities and wide enough to avoid the influence of seasonal effects.
    b) In case of existing functionalities already used in bidding zones or on the borders subject to assessment, the Anticipated Usage shall be derived from the Effective Usage where relevant according to a growth rate associated to the functionality. In other cases, all the necessary information for the calculation of the Anticipated Usage should be provided by the Assessment Body.
    c) In case of new functionalities or functionalities not already being used in bidding zones, scheduling areas, NEMO trading hubs or on the borders between them that are subject to assessment, the Anticipated Usage shall be communicated by the Originator in its request for change.
4. The Usage Range of a functionality is the maximum estimated usage of that functionality supported by the algorithm consistent with an adequate level of performance according to the indicators defined in the Article 9 of Annex 3 and Article 8 of Annex 4. The Usage Range of each functionality shall be jointly estimated in a single simulation scenario with the purpose of calculating in a single step the individual Usage Range of all the functionalities, each based on its Anticipated Usage. Usage Range may reflect limits included in the agreements with the relevant Algorithm service providers.
5. All NEMOs and all TSOs shall review when relevant, and at least annually, the Usage Range of any functionality impacting the algorithm performance on the basis of the estimated level of scalability indicated in the scalability report described in Article 9.

Article 8

Monitoring algorithm performance

1. All NEMOs, in coordination with all TSOs, shall monitor the performance of the price coupling algorithm and the continuous trading matching algorithm and their compliance with the CACM Regulation and this methodology. This monitoring shall be based on the principles set out in this Article.
2. The monitoring of SDAC and/or SIDC algorithm performance shall be based on the indicators and the principles described in the Algorithm monitoring methodology included in Annex 3 and Annex 4 to this methodology. The principles and implementing details included in Annex 3 and Annex 4 shall be further detailed in the operational procedures attached to the relevant DA and ID Operational Agreements.
3. The Algorithm monitoring methodology reported in Annex 3 and Annex 4 shall include at least:
    a) the relevant indicators to monitor the SDAC and/or SIDC algorithm's performance, which shall include at least:
        (i) with reference only to the price coupling algorithm, indicators on the ability to maximise the economic surplus;
        (ii) with reference only to the price coupling algorithm, the indicators to monitor the algorithm repeatability;
        (iii) the indicators to monitor the algorithm scalability.
    b) The relevant indicators to monitor the usage of the algorithm requirements;
    c) the relevant indicators to monitor the output produced by the algorithm;
    d) the relevant thresholds (including critical thresholds) to identify performance deteriorations.
4. The algorithm performance shall be measured against the criteria specified in previous paragraphs and further elaborated in the Article 3(4) of Annex 3 and Article 3(4) of Annex 4. In case all NEMOs detect an unanticipated degradation of the algorithms' performance below the thresholds referred to in Article 3(4)(c) of Annex 3 and Article 3(4)(a) of Annex 4 or a non-compliance with an implemented functionality is detected according to Article 3(4)(c) of Annex 3 and Article 3(4)(a) of Annex 4, all NEMOs and TSOs shall:
    a) promptly inform all regulatory authorities;
    b) investigate to the fullest extent possible and share its findings with relevant stakeholder fora organised in accordance with Article 11 of the CACM Regulation;
    c) evaluate any potential improvement of the algorithm performance, to be introduced following a request for change or following research and development activity as described in Article 11;
    d) communicate to all regulatory authorities the solution identified, supported by relevant documentation; and
    e) eventually, whenever the conditions described in Article 12(1) apply, initiate the request for change process described in Article 12 .
5. All NEMOs in coordination with all TSOs shall jointly develop and publish a yearly report on the outcome of the monitoring of the algorithm performance, which should contain at least: (i) all items listed in paragraph 3 of this Article; (ii) the value of the relevant parameters referred to in Article 2(4) of Annex 3 and Article 2(4) of Annex 4 for the calculation of the indicators and their thresholds, together with the value of the thresholds (iii) all cases of performance deterioration or non-compliance with an implemented functionality; (iv) a description of the reasons of these occurrences and the used or suggested remedies or future improvements, according to Article 5 of Annex 3 for SDAC and Article 5 of Annex 4 for SIDC; and (v) a presentation of the conclusions made in cooperation with the relevant stakeholder fora organised in accordance with Article 11 of the CACM Regulation.

Article 9

Scalability report

1. All NEMOs and all TSOs shall assess the usage of any functionality by any NEMO or TSO that impacts the algorithm performance up to an upper bound defined by the Usage Range taking into account the requirement of adequate scalability. The Usage Range shall take as basis the Anticipated Usage and shall assess the usage beyond it.
2. When the algorithm supports a specific functionality, the Effective Usage and the Anticipated Usage of the functionality shall serve as the basis for future assumptions related to the impact on the algorithm performance of this functionality (including the testing of other requests for change).
3. All NEMOs shall estimate each year for the following years the level of scalability, according to Article 5 of Annex 3 and Article 5 of Annex 4, on the basis of at least the following information related to the received requests for change and research and development activities:
    a) the extension of the SDAC and SIDC to additional bidding zones and/or NEMOs;
    b) the implementation of operation of multiple NEMOs within a bidding zone or a scheduling area;
    c) the extension of the usage of products and requirements to additional bidding zones and/or NEMO trading hubs; and
    d) the anticipated results from the activity of research and development.
4. All NEMOs shall develop, in cooperation with all TSOs, publish and send to all regulatory authorities a yearly scalability report including at least:
    a) the outcome of the assessment of the estimated level of scalability for the following years and whether this level meets the adequate scalability, including the assessment of the Effective Usage, Anticipated Usage and Usage Range; and
    b) the perspective projects scoped for the research and development activity with the related estimated workload.

Article 10

Roadmap for planning of changes

1. In order to support a timely and consistent development of the SDAC and SIDC algorithms, every year all NEMOs and all TSOs shall agree on a multi-year roadmap incorporating all requests for change issued, related to, among others:
    a) new releases of the SDAC/SIDC algorithm;
    b) outcomes of the research and development activity under following Article 11;
    c) amendments of requirements of the SDAC/SIDC algorithm;
    d) major amendments in the usage of existing functionalities;
    e) Future requirements as defined in the Annex 1 and 2 of the current methodology.

    This roadmap shall be updated at the end of each year and shall include requests for change with expected Go-live Date at least within next 24 months.
2. According to the roadmap, all NEMOs and all TSOs shall elaborate a feasible calendar for the implementation in production of each request for change;
3. In order to include a change request in the roadmap, the Originator shall prepare and submit to the relevant Assessment Body the related requests for change, which shall include at least information under Article 15(3), letters a), b), c), d), e), i), j), k) and l).

4. The requests for change issued according to this Article shall have a specific priority according to Article 17(7), under the condition that the complete set of information requested under Article 15(3) is received within maximum timeline requested under Article 16(7).
5. The specific priority mentioned in the previous paragraph shall not be considered by the Assessment Body in case the request for change:
    a) is only submitted to the Assessment Body at the moment that its expected Go-live Date lies within the first 12 months of the roadmap and;
    b) is postponed to a Go-live Date in a Go-live Window different from the one indicated as outcome of the assessment process by explicit request of the Originator.

Article 11

Research and Development activities

1. All NEMOs and all TSOs shall perform continuous research and development activities to allow for incremental improvement of the performance of the price coupling algorithm in order to ensure adequate scalability as referred to in Article 3(6)(c) and in order to monitor and preserve the fairness of the price formation according to the principles laid out in Article 3(6)(f)and to develop new functionalities.
2. All NEMOs and all TSOs shall perform continuous research and development activities to allow for incremental improvement of the performance of the continuous trading matching algorithm in order to ensure adequate scalability, according to the principles laid out in Article 3(7)(c) and to develop new functionalities.
3. At the end of every year, all NEMOs and all TSOs shall elaborate a research and development program for the next year. The program shall indicate at least the technical solutions subject to research and development, their qualitative expected impact on CACM compliance, the timeline for prototyping and the estimated cost for prototyping. All NEMOs and all TSOs shall agree on the program.
4. The yearly research and development program shall have up to two iterations, depending on the needs of request and development activities.
5. According to the research and development program, all NEMOs and all TSOs shall elaborate a feasible calendar for the implementation of type IV requests for change, as defined in Article 14(2)(d), including an estimation of the identified workload;
6. At the beginning of each iteration, new requests for change can be added and the planning is subject to be changed.
7. The algorithm provider might be required to create algorithm prototypes in order to implement the list of type IV requests for change elaborated by all NEMOs and all TSOs, if the Decision Body considers it necessary.
8. Algorithm provider is entitled to suggest to all NEMOs and all TSOs ideas for exploring different configuration or strategies for the type IV request for change.
9. Assessment of type IV request for changes shall be carried out according to Article 6 of Annex 3 and Article 6 of Annex 4 that measure the performance of the algorithm, its scalability and its reproducibility.
10. If the outcome of the research and development is positive and improves beyond the thresholds defined in Article 6(3) of Annex 3 and Article 6(3) of Annex 4 for accepting the algorithm prototype, then a type I, II or III request for change might be issued for implementing the prototyped changes
11. Every year, all NEMOs and all TSOs shall provide all regulatory authorities with a report on research and development activities on the algorithm. All NEMOs shall consult the draft report with the relevant

stakeholder forums organised in accordance with Article 11 of the CACM Regulation, before submitting it to all regulatory authorities. The report shall provide at least:

a) the status of the research and development activity in relation to the earlier agreed all NEMOs' approaches and targets; and
b) the planning of the future research and development activity, including an estimation of the identified workload and the associated budget.

Article 12

Corrective measures

1. In case all NEMOs detect an unanticipated degradation of the algorithms' performance below the thresholds referred to in Article 3(4)(c) of Annex 3 and Article 3(4) of Annex 4, due to an overall Effective Usage higher than the Usage Range, according to Article 3(3) of Annex 3 and Article 3(3) of Annex 4, all NEMOs and all TSOs may decide to apply specific corrective measures with the aim to maintain adequate performance of the SDAC and/or SIDC algorithms.
2. Any NEMO(s) and/or TSO(s) may initiate a proposal for the application of a corrective measure. The proposal shall be submitted to all NEMOs by a request for change in accordance with Article 13.
3. All NEMOs and all TSOs shall jointly evaluate and decide on any requests for change proposing the application of corrective measures in an objective and non-discriminatory manner in accordance with the principles defined in Article 17 and Article 20.
4. The corrective measures referred to in paragraph 1 may be applied only for a limited time period to solve unanticipated impacts on the algorithm performance. After the deadlines referred to in Article 4(14)(d) and Article 5(14)(c), the application of a corrective measure shall be limited to six months and an extension of it shall not be possible.
5. The corrective measures referred to in paragraph 1 shall be limited to:
    a) limitations to combinations of products that NEMOs are allowed to use;
    b) limitations to the algorithm requirements; and
    c) limitations on the usage of products or requirements based on Usage Range; and
    d) changes in parameters related to the operation of the SDAC and/or SIDC algorithm, or to the thresholds described in Article 2(4) of Annex 3 and Article 2(4) of Annex 4 or in the relevant DA and/or ID change control procedures.
6. Corrective measures referred to in paragraph 5(c) may be applied only if other corrective measures prove to be infeasible or insufficient for restoring the algorithm performance.
7. In case all NEMOs and all TSOs apply a corrective measure to limit the usage of products or requirements whose Effective Usage turns out to be higher than the Usage Range pursuant to paragraph 5(c) , they shall limit the usage of these functionalities according to the sharing rules that shall be defined in the relevant change control procedure.
8. Without prejudice to what set out in previous paragraph, sharing rules shall ensure a reasonable limitation on the usage of involved products or requirements to all bidding zones and/or scheduling areas and/or NEMO trading hubs. The adoption of sharing rules shall restore a value of the overall Effective Usage compatible with the Usage Range and thus an adequate level of SDAC/SIDC algorithm performance. In particular, the sharing rules reported in the relevant change control procedures shall introduce a limitation on the overall usage of the involved product or requirement equal to the excess of overall Effective Usage compared to the overall Usage Range, increased by a safeguard parameter. Such reduction shall be applied on a proportional basis to the Parties using that product or requirement.

9. In case of application, all NEMOs and all TSOs shall implement measures to ensure their compliance with these agreed limitations. In case any NEMO(s) or TSO(s) breaches such limitations and fails to take timely measures, each NEMO shall report such events to the competent regulatory authority.
10. Any corrective measure shall guarantee non-discriminatory principles among market participants and NEMOs.
11. All NEMOs shall announce publicly any introduction or discontinuation of a corrective measure at least seven calendar days before its introduction or discontinuation and maintain an up-to-date publicly accessible list of currently applied corrective measures.
12. No later than four weeks after the introduction of a corrective measure, all NEMOs shall publish a report indicating the corrective measure applied and the reasons for applying it. After the discontinuation of a corrective measure, the report shall be updated with additional information on the future measures planned by all NEMOs to address the problems that have caused the application of a corrective measure.

TITLE 4
Algorithm change management

Article 13

Principles and criteria for requests for change management

1. All NEMOs and all TSOs shall jointly manage all requests for change to the price coupling algorithm's or continuous trading matching algorithm's functionalities and usage of the SDAC algorithm or SIDC algorithm, according to the principles set out in this Article.
2. Any approved change to the SDAC algorithm or SIDC algorithm and any changes to the MCO function systems, including any modifications needed to meet future requirements, shall be implemented according to a request for change, which shall require an assessment of its feasibility and of its impact on the relevant algorithm's performance.
3. As a basis principle, a decision on requests of change shall be made jointly by all NEMOs and all TSOs. The related provisions concerning the decision making shall be provided in the operational contracts among the Parties, with the possibility for a simplified process if deemed relevant and efficient by all NEMOs and all TSOs. All NEMOs in coordination with all TSOs shall ensure that the assessment of all requests for change is conducted by the relevant Assessment Body and the decision taken by the relevant Decision Body, according to provisions established in the relevant procedures attached to the operational contracts among the Parties.
4. The Originators submitting a request for change shall include a preliminary assessment of feasibility and the expected impact on the relevant algorithm's performance, with the aim of demonstrating that the request for change will induce only a proportionate and controlled impact on the relevant algorithm's performance and will avoid significant harm to any other functionality already included in the relevant algorithm.
5. The Assessment Body shall conduct assessments of all requests for change in an objective and non-discriminatory manner. In order to ensure objectivity of the assessment process, all requests for change must be submitted according to a standard format and shall be assessed according to a standard procedure, as described in this methodology and as further detailed in the relevant Change control procedures.
6. When evaluating a request for change, the Assessment Body shall take into account any impact of a request for change on the performance of the MCO function, systems and processes. The impact of a request for change on the relevant algorithm's performance, existing functionalities, adjacent systems and processes shall be evaluated based on the Anticipated Usage of the new functionality, together with

the Effective Usage of existing functionalities, in order to ensure its technical feasibility and consistency with the performance criteria set forth in Annex 3 and 4.

7. The Decision Body may reject any request for change which induces an impact on the relevant algorithm's performance which is not proportionate and/or controlled or where the Decision Body reasonably considers that the request for change could cause significant harm to another functionality of the relevant algorithm.
8. Requests for change shall be compatible with the algorithm requirements after they have been implemented in accordance with the deadlines specified in Article 4(14)and Article 5(14).
9. All NEMOs, in coordination with all TSOs, shall jointly ensure transparency of the request for change process by publishing in due time all information relevant to the evaluation of the request for change as more particularly described in Article 24.

Article 14

Request for change

1. The purpose of a request for change subject to the provisions of the following Articles may include any one or more (in any combination) of the following:
   a) Compliance with any legal and/or regulatory requirement;
   b) Bug fixes and incomplete algorithm requirements;
   c) Application of corrective measures pursuant to Article 12;
   d) Implementation of modifications that affect the performance of the SDAC algorithm and/or SIDC algorithm, including those modifications arising from the research and development activity as described in Article 11;
   e) Introduction/removal/modification of an algorithm requirement requested by NEMOs and/or TSOs, including products and network elements;
   f) Implementation of a new release of the SDAC algorithm and/or SIDC algorithm, including those arising from research and development activity carried out pursuant to Article 11;
   g) Modification of the topology not requiring changes in the algorithm requirements, but limited to the addition or removal of network elements (e.g. the addition or removal of bidding zone borders, scheduling areas, interconnectors between bidding zones or scheduling areas or PTDFs) or NEMO trading hubs;
   h) Change in configuration of the parameters of the SDAC algorithm and/or SIDC algorithm used to set the internal numerical tolerances or heuristics applied;
   i) Hardware update, including but not limited to machine upgrades and firmware updates;
   j) Such other purposes as the NEMOs and TSOs may determine pursuant to the terms of the relevant change control procedure.
2. Requests for change shall be classified, depending on the expected impact of the requested change on the SDAC algorithm and/or SIDC algorithm performance and on the market participants, into one of the following categories:
   a) **Non-notifiable change (type I):** is a change either not directly affecting the MCO function assets, and not causing a detriment to the performance of the relevant algorithm and not relevant to market participants. Such changes are not included in the public list of all requests for change described in Article 24.
   b) **Fast-track change (type II):** is a change that needs to be implemented with urgency. This type includes bug fixes and the application of corrective measures.
   c) **Standard change (type III):** is a change that has a potential detrimental impact on the performance of the relevant algorithm and/or market participants. Any request for change not being of type I, type II or type IV shall be considered as type III.
   d) **Research and Development change (type IV):** is a change aimed at activating the research and development analysis on the specific functionality involved. The assessment is carried out in the

test framework according to the relevant research and development agreement with the service provider, hence the management of such request for change is carried out according to a dedicated process as more particularly described in Article 11.

3. In derogation from general provisions under Article 16 and Article 20, requests for change of type I and type II (as defined in the previous paragraph) shall be assessed by the Assessment Body on a continuous basis (i.e. without the periodic assessment in a given Go-live Window). Decisions on requests for change of type I shall be taken directly by the Assessment Body and assessment shall be completed within 1 month from the issuing date and notified to the relevant Decision Body. In derogation from general provisions under Article 15, Article 16, Article 17 and Article 20 relevant change control procedures may specify separate process for assessment and approval of change of type II (as defined in the previous paragraph) related to bug fix.

Article 15

Submission of requests for change

1. Any one or more of the NEMOs and/or TSOs are entitled to submit to all other NEMOs at any time a request for change with respect to the price coupling algorithm or continuous trading matching algorithm and/or to the MCO function systems.
2. The Originators shall submit every request for change to the Assessment Body according to the principles more particularly described in Article 14 and in a format corresponding to the template annexed to the relevant DA and the ID change control procedures.
3. The request for change shall include, where relevant, the following information to be considered as complete:
    a) Aim of the request for change, according to Article 14, plus the general description of the request for change.
    b) Originators;
    c) Issuing date;
    d) Expected go-live date;
    e) Indication of the type of request for change according to Article 14(2);
    f) Fully specified technical requirement;
    g) Anticipated Usage of the functionality;
    h) Estimated impact on algorithm performance, following principles set in Article 13(4);
    i) Estimated effect on other processes or systems;
    j) Risk assessment
    k) Bidding zones, scheduling areas or NEMO trading hubs affected by the implementation of the request for change.
    l) Specify the cost categorization in accordance with Article 80(2) of the CACM Regulation.
4. In any case where a request for change is in contemplation of compliance with a request or instruction from one or more NRAs and the assessment under paragraph (3) h) above indicates a possible adverse impact on algorithm performance as a result of such change, the Originators shall enclose with the request for change written evidence of the approval from the relevant NRAs regarding the preliminary report previously communicated by the Originating Party to the relevant NRAs. Such preliminary report shall include the description of the purpose of the request for change, its high level implementing features and rationale and an initial assessment of the impact of the requested changes on algorithm performance.
5. The Assessment Body can decide at any moment to contact the Originators with the purpose of requesting additional information on the request for change. Originators are always entitled to receive all relevant information from the Assessment Body regarding the status of their request for change.

6. A request for change may be submitted at any time, provided that the timing requirements according to Article 16 and the criteria described according to Article 13 are fulfilled, also taking into account provisions under Article 10.
7. Any NEMO(s) or TSO(s) may join a request for change submitted by the Originators. The Originators and the NEMO(s) or TSO(s) joining the request for change may decide jointly to modify the submitted request for change.
8. Requests for change that aim to improve the algorithm performance shall be deemed to be to the benefit of all NEMOs and/or all TSOs and those NEMOs and/or TSOs shall be entitled to define such requests for change as a common proposal of all NEMOs and/or all TSOs.
9. The associated costs of any request for change shall be treated in accordance with Article 80 of the CACM Regulation.

Article 16

Timing for management of request for changes

1. The assessment on of requests for change shall be carried out periodically by the Assessment Body in different evaluation timeframes, named Go-live Windows, based on the expected Go-live Date of the request for change.
2. The periodic assessment of a request for change with an expected Go-live Date within a specific Go-live Window shall include all requests for change with an expected Go-live Date within the same Go-live Window in such a manner as to allow a cumulative impact assessment tests.
3. Each DA and/or ID change control procedure shall define the number of Go-live Windows in each calendar year. Additional Go-live Windows can be introduced by the Assessment Body as a new ad-hoc Go-live Window or by increasing the frequency of regular Go-live Windows. The Go-live Windows shall be at least two in a calendar year.
4. Originators shall send each request for change to the Assessment Body by no later than the end of the second Go-Live Window prior to the Go-live Window during which the Go-live Date of such request for change is expected to occur.
5. In derogation from the previous paragraph, the Assessment Body shall carry out the assessment of requests for change type II ("fast-track"), due to their exceptional urgency, within the same Go-live Window of their submission if the level of criticality allows resulted in satisfactory timing of implementation or in a separate additional Go-live Window for quicker implementation. In the first case, the requests for change can be collectively tested and shall be prioritized according to a principle of urgency by applying prioritization rules set out in Article 17 (7), to be justified by the Assessment Body, while in case of a dedicated Go-live Window the Assessment Body shall implement an individual assessment of the request for change.
6. The assessment process of requests for change and the relative decision shall be concluded within the Go-live Window antecedent the one of the Go-live Date. In particular, the decision process shall be reserved at least one month out of the overall Go-live Window. In case of preliminary consultation under following Article 20(8) or escalation process under following Article 21 the time for the decision process shall be extended, even beyond the duration of the Go-live Window, up to the conclusion of the relative consultation or escalation processes.
7. Originators can submit to the Assessment Body their requests for change before the minimum timing set out in previous paragraph 4. In such a case the requests for change can be considered validly received even if they are not reporting all information under Article 15(3), provided that:
    a) an indication of the possible options being under discussion and the order of magnitude of new products or network elements or constraints to be added to the algorithm should be provided;

b) the missing information is provided to the Assessment Body by the end of the minimum timing set out in previous paragraph 4;

8. Requests for change included in the roadmap process described under previous Article 10:

a) shall be managed according to Article 17;
b) shall be "preliminary" assessed by the Assessment Body by the end of the next Go-live Window following its presentation in Article 17 (3).
c) shall be finally assessed by the Assessment Body within the Go-live Window antecedent the one of the Go-live Date according to previous paragraph 6;
d) shall receive specific priority according to Article 17(7), provided that final information referred to under paragraph 6 is received by the beginning of the second Go-Live Window antecedent the one of the expected Go-live Date.

Article 17

Assessment of requests for change

1. The Assessment Body shall evaluate any request for change in an objective and non-discriminatory manner and shall issue an assessment report for each submitted request for change.

2. In case of a request for change referred to a development of the SDAC and/or SIDC algorithm, the Algorithm service provider may be involved in the technical assessment set out in following paragraph 3. It is further allowed to reject the requests for change in case of unfeasibility or to request amendments in order to include additional requirements for solving interferences with other existing requirements.

3. The Assessment Body shall, directly or in coordination with other bodies under the relevant operational agreements and/or with the Algorithm service provider or third party suppliers, assess for each request for change:

a) Correct indication of the type of request for change according to categorization set out in Article 14(2);
b) Originator of the request for change and impacted parties;
c) Potential prioritization criteria to be applied according to Article 17;
d) Impact assessment on the SDAC and/or SIDC algorithm performance as set out, respectively, in following Article 18 and Article 19.
e) Whether or not development is required in the algorithm for the request for change in accordance with following paragraph 13;
f) Assignment of the assessment window and the Go-live Window according to timings described in the previous Article 16;

4. In case the verification in paragraph 3(a) proves that categorization of the request for change is not correct, the Assessment Body shall:

a) assign the correct categorization of the request for change according to Article 14(2);
b) apply the relevant assessment process in terms of timing and actions according to the relevant DA or ID change control procedure
c) timely inform the Originator(s) of the modification occurred

5. The impact assessment of the requests for change with expected Go-live Dates within the same Go-live Window shall first be considered in combination.

6. In case the outcome of the combined impact assessment breaches the acceptance criteria described in Article 18 for the SDAC algorithm and in Article 19 for the SIDC algorithm, the Assessment Body shall carry out a second assessment based on individual impact assessments enclosed to the request for change according to Article 15(3).

7. In case multiple requests for change have been received with expected Go-live Dates within the same Go-live Window, the following prioritization shall apply:

    i. requests for change type II ("fast-track") according to previous Article 14(2)(b);
    ii. requests for change received according to Article 10;
    iii. other requests for change;

8. In case several requests for change have the same priority according to previous paragraph (7), the following sub-prioritization shall apply:

    i. requests for change extending the SDAC and SIDC to all bidding zones, improving the SDAC and SIDC between existing bidding zones also through a modification of interconnections, amending TSOs configurations, and extending the SDAC and SIDC to all NEMOs eligible to participate in the SDAC and SIDC;
    ii. requests for change modifying the parameters for the usage of products or requirements used in the algorithm, including among others the modification of the Usage Range, the modification of the topology of bidding zones, scheduling areas or NEMO trading hubs different from those reported in point iii, the modification of the number of PTDFs;
    iii. requests for change extending the set of products or requirements used in one or more bidding zones, scheduling areas or NEMO trading hubs;
    iv. requests for change modifying the requirements included in this Algorithm methodology and/or the list of products included in the products methodologies.
    v. requests for change from previous Go-live Windows postponed by the Originating Party not received according to Article 10.

9. In case several requests for change have the same priority according to previous paragraph (8), the following sub-prioritization shall apply:

    a) requests for change from previous Go-live Windows postponed by the Decision Body;
    b) requests for change assessed in a preliminary impact assessment with a positive outcome according to previous Article 16(8)(b);
    c) other requests for change.

10. The costs for assessment of requests for change shall be borne in shares according to CACM sharing keys.

11. In case the requests for change involves simultaneously more than one of the principles referred to in paragraph 7, 8 or 9 above, the requests for change shall be assessed on a case-by-case basis depending on the specific nature of the request. Once the assessment process is concluded all NEMOs in coordination with all TSOs shall take the final decision on the request for change according to the outcome of consultation and, if needed, to a new technical assessment.

12. The outcomes of the assessment on requests for change shall be included in an assessment report, containing all the relevant information on the process followed, including at least the following information:

    a) Description of the requests for change, including all information from previous Article 15(3);
    b) Proposal of prioritization of the requests for change with arguments when requests for change combination breaches the performance criteria referred to in paragraph 6;
    c) Results of impact assessment with reduced group of requests for change if case b) occurs.

13. In case the request for change requires developments to be done in the Algorithm, under previous paragraph 3(e), the Assessment Body, after alignment with the relevant Algorithm service provider, shall in derogation to Article 16:

    a) Evaluate the Go-live Date of the request for change, taking into account the time necessary for the estimated development required for the request for change.
    b) Send the request for change (including timing and costs) to the Decision Body for approval to initiate the development. The decision body may decide to amend, postpone or reject the development start upon consideration of resources constraints.

c) Coordinate the follow up of the developments required for the request for change with NEMOs and the relevant Algorithm service provider to ensure a correct and timely implementation by the foreseen Go-live Window.
d) Perform the impact assessment of the request for change within the respective Go-live Window (combined with the impact assessments of other requests for change for such Go-live Window) once the developments have been completed, after which the request for change will follow the normal process of this methodology.

14. For the decision to go-live of request for changes, all assessments for request for change, the version of the respective algorithm that shall be used in the assessment process shall be the same than the one that is expected to be used in the implementation in production of the request for change.

Article 18

Impact assessment methodology for SDAC algorithm

1. The impact on the performance of the price coupling algorithm of a request for change, in isolation or in combination, shall be assessed by monitoring the scalability indicator under Article 9 of Annex 3 before and after the change.
2. To be accepted, a request for change shall fulfil a set of criteria defined in Article 4(3) of Annex 3.
3. The impact on algorithmic performance shall comprise at least two scenarios: a historical-like scenario described under Article 4(2)(a) of Annex 3, and a future scenario, described under Article 4(2)(b) of Annex 3.
4. To accurately reflect the operational conditions of the SDAC, the tests shall be performed using the algorithm version that will be in production at the date the request for change is expected to go live. Shall the Go-live Date of the change be delayed; a new performance assessment may be required if the new expected Go-live Date occurs in a different Go-live Window.

Article 19

Impact assessment methodology for SIDC algorithm

1. The impact on the performance of the continuous trading matching algorithm of a request for change, in isolation or in combination, shall be assessed by monitoring the scalability indicator under Article 8 of Annex 4 before and after the change.
2. To be accepted, a request for change shall fulfil a set of criteria defined in Article 4(3) of Annex 4.
3. The impact on algorithmic performance shall comprise at least two scenarios: a historical scenario as described under Article 4(2)(a) of Annex 4 and a future scenario as described under Article 4(2)(b) of Annex 4.
4. The selection by the decisional body of the applicable scenarios will be made on a case-by-case basis dependent on the nature of the changes to be evaluated.
5. To accurately reflect the operational conditions of the SIDC, the tests shall be performed using the algorithm version that will be in production at the date the request for change is expected to go live. Shall the Go-live Date of the change be delayed; a new performance assessment may be required if the new expected Go-live Date occurs in a different Go-live Window.

Article 20

Decision-making and implementation of requests for change

1. The decisions by all NEMOs and all TSOs shall be justified by the assessment report referred to in Article 17(12) and the objectives set out in Articles 3 and 37 of the CACM Regulation.
2. The relevant Decision Body shall decide on the request for change based on the principles from Article 13(3).
3. The Decision Body shall indicate for each assessed request for change one of the following possible decisions:
    a) Accepted: the request for change is ready to be used in production and the request for change shall be implemented within six months;
    b) Rejected: the implementation of the request for change is not compatible with security of operation and adequate performance criteria or resources constraints;
    c) Postponed: the implementation of the request for change could be compatible to security of operation and adequate performance criteria, but it is necessary to postpone the Go-live Date or due to resources constraints;
    d) Amended: the request for change as submitted is not fully compatible with an implementation compliant with security of operation and adequate performance criteria, but could be so compatible and therefore is accepted provided that appropriate amendments of it are carried out or due to resources constraints.
4. In case of a request for change of type I as referred to in Article 14(2)(c) above, formal approval and implementation shall be taken within 30 days.
5. In case of a request for change of type III as referred to in Article 14(2)(c) above, and provided that the combined impact assessment under Article 17(3) of all the requests for change within a particular Go-Live Window has a positive outcome, all requests for change in such Go-Live Window shall be approved. The Decision Body might nevertheless decide to carry out a case-by case qualitative assessment on individual requests for change considered in the combined impact assessment in case they collectively induce an excessive variation on algorithm performance, even though this is below the combined acceptance criteria.
6. In case of a requests for change of type III as referred to in Article 14(2)(c) above, if the combined impact assessment of all the requests for change under Article 17(3) has a negative outcome, depending on the assessment of algorithm performance with respect to the individual request for change, the relevant Parties can:
    i. request the issuing Party to amend the request for change;
    ii. postpone its anticipated go live;
    iii. propose a modification of the criteria to assess market performance under Article 18 and Article 19, in case they are deemed no longer suited to properly assess algorithm performance. In such a case all NEMOs and all TSOs shall issue a revised proposal in accordance with Article 9(13) of the CACM Regulation within 30 days;
    iv. trigger an escalation to the arbitral tribunal in accordance with Article 21.
7. In case the actions taken by the Parties pursuant to Article 20(6) are not sufficient to change the combined impact assessment of all the requests for change under Article 17(3), the Decision Body shall approve only those requests for change with individual positive impact assessment outcomes, in order of priority according to previous Article 17(7).
8. The Decision Body may decide to consult a “preliminary decision” on a Request for change type III prior to taking a final decision. Such consultation shall be carried out only in exceptional cases, such as – but not limited to - significant changes on the market design, or if the request for change triggers an

amendment of a methodology under Article 9 of CACM Regulation. Once the consultation process is concluded, the Decision Body shall consider the outcome of such process in order to express the final decision on the requests for change.

9. The decision on a request for change shall follow timing set out in Article 16 (6). Such timing shall apply also to the preliminary decision indicated in previous paragraph 7.
10. In case the Decision Body activates the consultation process according to previous paragraph 8, timing on final decision indicated in paragraph 9 shall be considered only once the consultation is concluded.
11. The voting rule that applies for decisions on requests for change will be defined in the relevant DA and ID operational agreements.
12. Any decision will be timely communicated by the Assessment Body to the Originating Party.
13. After the decision on the request for change, all NEMOs jointly in coordination with all TSOs shall issue a public evaluation report indicating the decision, the reason for the decision, the principles behind the decision and the assessment report as referred to in Article 17(12), in order to ensure transparency on the change request process.
14. The Decision Making Body shall base the decisions under previous paragraph 3 also on the relevant information about time, costs for implementations and budget constraints

Article 21

Escalation process

1. Decision Body may decide to refer their decision to an independent arbitral tribunal for a binding decision.
2. Any NEMO(s) and/or TSO(s) is entitled to challenge a decision by Decision Body by requesting a referral to an independent arbitral tribunal for a binding decision following the relevant procedures established in the contractual framework.
3. The NEMO(s) and/or TSO(s) requesting a referral to an independent arbitral tribunal shall do so by written request to the highest Decision Body where all TSOs and all NEMOs are represented.
4. The Decision Body and the requestor of the referral shall first meet in good faith to try to resolve the dispute within 14 days. The referral of the decision to the independent arbitral tribunal will be triggered only as a last resort measure in case internal ways to avoid the referral do not succeed.
5. If the dispute is not solved, the Decision Body and the requestor of the referral shall submit all the relevant materials for the dispute to the independent arbitral tribunal established in accordance with Article 22 without undue delay.
6. The relevant DA and/or ID change control procedure shall stablish the appropriate penalties in order to prevent an abusive usage of escalation process. The cost sharing of the arbitral tribunal cost will implicitly prevent the unjustified use of the escalation process.
7. In case a request of change of regulatory nature is not compatible with secure operation and adequate performance criteria and thus should be rejected by the Decision Body, the matter shall be escalated to ACER/all NRAs

Article 22

Establishment of arbitral tribunal

1. The independent arbitral tribunal shall take a decision on a request for change only if the decision is delegated by Decision Body.
2. The independent arbitral tribunal shall consist of 5 members whereof one is appointed chair and other is appointed as vice-chair in order to act as a replacement of the chair when necessary and additional 3 alternates already designated in a reserve list with the purpose of replacing existing 5 members when required. The members shall be considered experts by all NEMOs and all TSOs based on sufficient evidence of academic and professional competence in at least one of the following areas:
    a) Optimization Algorithms
    b) European electricity market regulation and operation
    c) Law and Economics
3. Regarding previous paragraph 2, in the designation of chair members it shall be assured, at any time, that at least 3 members of the arbitral tribunal are experts in algorithm optimization.
4. The members in the independent arbitral tribunal shall be appointed jointly by all NEMOs and all TSOs following a public call for candidates. Each member is appointed for an initial period of 3 years, renewable. However, all NEMOs and all TSOs may decide to terminate at any moment the appointment of the arbitral tribunal or any of its members. Each member shall be regarded as independent from the parties by all NEMOs and all TSOs. As a general rule, the members of the arbitral tribunal shall not belong to the staff of any NEMO or TSO and they shall not have worked either as staff or hired consultant in any NEMO or TSO at least in the previous 2 years, and shall be prevented from working with any NEMO or TSO either as staff or hired consultant in the next 2 years. Nevertheless, if a particular decision may create a conflict of interest for a given member, the chair of the arbitral tribunal will decide whether to replace or not the relevant member by an alternate in this particular case. The consideration of a potential conflict of interest concerning a particular member may be declared by the concerned member itself or may be requested by any NEMO or TSO.
5. According to decisions from All NEMOS and All TSOs, the cost of the arbitral tribunal may include.
    a) a component to guarantee the availability of the members
    b) a component related to the individual decisions to be taken
6. In order to prevent a potential abuse of the right to appeal decisions made, the costs under previous paragraph b) may include a share to be paid by the requestor of the referral that will be established in the relevant procedure. All other costs under previous paragraphs a) and b) shall be considered as a common cost. In the case of referral of a decision by all NEMOs and all TSOs, the corresponding cost of the arbitral tribunal shall be considered as a joint common cost.
7. The arbitral tribunal may be used also for only TSOs or only NEMOs dispute. In such a case, only all TSOs or only all NEMOs respectively shall pay the cost of the decision requested to the arbitral tribunal.
8. Confidentiality clause: the members of the Arbitral tribunal shall not disclose any information concerning the cases that are addressed to them.

Article 23

Arbitral tribunal procedure for decision

1. All procedures set by the arbitral tribunal shall be in English.

2. Any NEMO and TSO may submit information to the arbitral tribunal and will provides the experts with such assistance and documents as the arbitral tribunal reasonably requires for the purpose of reaching a decision.
3. Each Party shall with reasonable promptness supply each other with all information and give each other access to all documentation as the other Party reasonably requires to make a submission.
4. The arbitral tribunal shall prepare a written decision within the deadline required, under simple majority, by all NEMOs and all TSOs. This deadline shall not be shorter than fifteen working days after all the relevant documentation has been received by the arbitral tribunal.
5. The arbitral tribunal will make a decision by consensus or by simple majority of the members represented.
6. To the extent not provided for in this article, the arbitral tribunal may determine such other procedures to assist with the conduct of the deliberation as is considered just or appropriate. Any instruction of professional advisers to assist him in reaching the determination shall require prior approval of all NEMOs and all TSOs.
7. The decision of the arbitral tribunal will be final and binding upon all NEMOs and all TSOs.
8. All NEMOs in coordination with all TSOs shall implement the decisions according to previous paragraph 7.

TITLE 5
Transparency and reporting

Article 24

Publications and reporting

1. All NEMOs shall publish and maintain a set of documents to be formally updated and consulted with the relevant stakeholder fora, organised in accordance with Article 11 of the CACM Regulation.
2. All NEMOs shall publish, continuously update and consult in the relevant stakeholder fora the following draft documents:
    a) the public description of the price coupling algorithm as referred to under Article 4(17);
    b) the public description of the continuous trading matching algorithm as referred to under Article 5(18).
3. All NEMOs shall develop and publish with the relevant periodicity the following reports:
    a) the report on incidents in the operation of the price coupling algorithm and the continuous trading matching algorithm and on the application of back-up and fallback procedures in accordance with the Back-up methodology and fallback methodology and in accordance with Article 4(18) and Article 5(18);
    b) the report on research and development activities in accordance with Article 11(11);
    c) the reports on the outcome of the monitoring of the algorithm performance in accordance with Article 8 ;
    d) the report on scalability in accordance with Article 9(4);
    e) the report on the application of corrective measures in accordance with Article 12(12); and
    f) the reports on the decisions on requests for change in accordance with Article 20(13).
4. All NEMOs shall publish and maintain a continuously updated record of the currently and historically applied corrective measures.
5. All NEMOs in coordination with all TSOs shall publish at least one month in advance the date of the yearly workshop with stakeholders and institutions on the requests for change Roadmap under Article 10.
6. All NEMOs shall publish, pursuant to Article 62(2) of the CACM Regulation:
    a) the aggregated volumes of all trades made per contract per bidding zone – two values are requested, sell volumes and buy volumes;
    b) the volume-weighted average intraday prices per contract and bidding zone[1]; and
    c) the volume-weighted average intraday prices per contract and bidding zone that took place during the last trading hour[2].

    The information shall be published no later than 12:00 on the day following the trading day.

[1] For the calculation of this indicator, all trades where either the seller, the buyer or both are located in the relevant bidding zone are to be considered and weighed equally.
[2] See footnote 1

Article 25

Access to data by regulatory authorities

1. The regulatory authorities or relevant authorities primarily responsible for monitoring NEMOs in accordance with Article 82(1) of the CACM Regulation shall have the power to request from the respective NEMOs all information and data used in the monitoring of the algorithm performance, historical input data used by the algorithms in calculating SDAC and SIDC results. They shall provide access to this information and data to other regulatory authorities and the Agency.
2. NEMOs shall also make the source code of the algorithms auditable by third parties mandated by the regulatory authorities and/or the Agency, subject to non-disclosure agreement and in coherence with contractual agreements with the relevant third parties.
3. The regulatory authorities or relevant authorities primarily responsible for monitoring NEMOs in accordance with Article 82(1) of the CACM Regulation shall have the power to request from the respective NEMOs the simulation of the algorithm results, respecting adequate repeatability pursuant to Article 3(6)(b) and Article 3(7)(b)) of this methodology. They shall provide access to this possibility to other regulatory authorities and the Agency.

TITLE 6
Final provisions

Article 26

Language

The reference language for this Algorithm methodology shall be English. For the avoidance of doubt, where NEMOs need to translate this Algorithm methodology into the national language(s) of a relevant national regulatory authority, in the event of inconsistencies between the English version published by the NEMOs in accordance with Article 9(14) of the CACM Regulation and any version in another language, the relevant NEMOs shall be obliged to dispel any inconsistencies by providing a revised translation of this Algorithm methodology to the relevant national regulatory authorities.

Annex 2 to the Algorithm Methodology: Common set of requirements for the continuous trading matching and the intraday auction algorithms

Background

Agency for the Cooperation of Energy Regulators (hereafter referred to as the "ACER") on 26 July 2018 has adopted decision No 08/2018 on the methodology and the common set of requirements for the price coupling algorithm and the continuous trading matching algorithm, developed pursuant to Article 37 of Regulation (EU) 2015/1222 (hereafter referred to as the "CACM Regulation"), among which also the Annex III (Annex 2 to the Algorithm methodology) - Common set of requirements for the continuous trading matching algorithm.

On 24 January 2019, ACER has adopted decision No 01/2019, establishing a single methodology for pricing intraday cross-zonal capacity. Article 6 of this methodology requires that all Transmission System Operators (hereafter referred to as "TSOs") shall update and complement the common set of requirements for efficient capacity allocation to enable the development of the algorithm for the IDAs in accordance with Article 37(1)(a) of the CACM Regulation and provide it to all NEMOs.

This document is a common proposal developed by all TSOs as amendment of a common set of requirements continuous trading matching algorithm (hereinafter referred to as "TSOs Algorithm Requirements") in accordance with article 37 of CACM Regulation.

Approved by all TSOs, the amended TSOs Algorithm Requirements, update and replace the Common set of requirements for the continuous trading matching algorithm adopted by ACER decision No 08/2018 of 26 July 2018.

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.

According to CACM Regulation 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, according to Article 9(13): "TSOs or NEMOs responsible for developing a proposal for terms and conditions or methodologies or regulatory authorities responsible for their adoption in accordance with paragraphs 6, 7 and 8, may request amendments of these terms and conditions or methodologies. The proposals for amendment to the terms and conditions or methodologies shall be submitted to consultation in accordance with the procedure set out in Article 12 and approved in accordance with the procedure set out in this Article."

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, 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.

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 will 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.

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 will be submitted to the regulatory authorities for approval.

The original set of TSOs Algorithm Requirements was based on the current coupling solutions at that time, either implemented or under development and updated or amended where seen appropriate by the TSOs. This first amendment is due to Decision No 01/2019 of the Agency for the Cooperation of Energy Regulators of 25 January 2019 Establishing a Single Methodology for Pricing Cross Zonal Capacity (hereafter referred to as "IDCZCP Decision"). 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 will send a request for amendments of the algorithm to the NEMOs and later on for all NRAs' approval.

For avoidenance of doubt, TSOs do not intend to amend price coupling algorithm requirement with this amendment, however in case this amendment would lead to necessity of amending the price coupling algorithm requirements, the latter shall be prepared jointly by NEMOs and TSOs.

Disclaimer: Requirements where NEMOs are the only owner – are kept for efficiency of cooperation among TSOs and NEMOs and are not part of the amended TSO requirements.

Impact on the objectives of CACM Regulation and implementation timeline

Impact on the objectives of CACM Regulation

The TSOs Algorithm Requirements take into account the general objectives of capacity allocation and congestion management cooperation described in Article 3 of the CACM Regulation. The TSOs Algorithm Requirements aim in particular at ensuring optimal use of the transmission infrastructure, optimizing the calculation and allocation of cross - zonal capacity and ensuring fair and non-discriminatory treatment of TSOs, NEMOs and all market participants. For this reason (enhancing competition and fair treatment), the algorithm should for example facilitate trading with multiple NEMOs and thus, contribute to a level playing field for NEMOs. The algorithm should also allow participation by more than one TSO on one or both sides of a bidding zone border. Further, in order to ensure transparency and reliability of information, it is crucial that the algorithm documentation including information on the source code is well structured and well documented and made available to all involved parties and stakeholders. The algorithm should also respect the need for a fair and orderly market and fair and orderly price formation.

The NEMOs proposal for the algorithm to be prepared in cooperation with all TSOs should contain a detailed explanation of the impact of the algorithm and its requirements to the objectives of the CACM Regulation. TSOs are willing to cooperate with the NEMOs for the development of this assessment.

Implementation timeline

TSOs aim at the earliest possible implementation of the continuous trading matching algorithm and ID auction keeping in mind the differences between the various Member States and regions/CCRs. The

NEMOs proposal for the algorithm to be prepared in cooperation with all TSOs should allow for an early but stepwise alignment of existing solutions and application of the single intraday coupling at a regional level and later on at EU level. In particular, TSOs and NEMOs will jointly assess which functionalities are necessary at first stage of implementing IDCZCP Decision, and which can be implemented at later stages taking into account complexity of implementation and benefits for market participants.

TITLE 1

Requirements for continuous single intraday coupling algorithm

1 Requirements on functionalities and performance

	Owner		State
	TSO	NEMO	Requirement Deadline
1.1 General requirements			
a) The continuous trading matching algorithm shall support the continuous matching of orders as well as the continuous allocation of intraday cross-zonal capacity.	X	X	IDC 1
b) The continuous trading matching algorithm shall ensure equal treatment of orders coming from all NEMOs and from requests for explicit capacity allocation.		X	IDC 1
c) For each bidding zone, the continuous trading matching algorithm shall be able to:			
(i) support at least the order types included in the ID products;		X	IDC 1
(ii) support non-standard products (all products besides quarter hourly, half hourly and hourly) to the extent this is technically feasible and approved by the competent regulatory authorities;	X	X	IDC 2
(iii) facilitate different market time units (MTUs) which shall be configurable in each bidding zone;	X	X	IDC 1
(iv) 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 57 of the CACM regulation;	X	X	IDC 1
(v) support multiple scheduling areas within a bidding zone as requested by TSOs;	X		IDC 1
(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	IDC 1
d) Intraday cross-zonal gate opening and intraday cross-zonal gate closure times (IDCZGT) shall be configurable for each bidding zone border.	X	X	IDC 1
e) The continuous trading matching algorithm shall aim to ensure that economic surplus is maximised, where applicable.	X	X	IDC 1

f) The continuous trading matching algorithm shall support one or multiple bidding zones within a country and shall be scalable to cover all bidding zones eligible for participating in SIDC.	X	X	IDC 1
g) The continuous trading matching algorithm shall be able to provide the net positions considering bidding zone borders included in SIDC and scheduled exchanges between bidding zones.	X		IDC 1
h) For each bidding zone the result from application of the continuous trading matching 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		IDC 1
i) The continuous trading matching algorithm must ensure the 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	IDC 1
j) The integrity of the continuous trading matching algorithm and the data it processes shall be properly secured from unauthorized access.	X	X	IDC 1
k) The continuous trading matching algorithm needs to provide all necessary information for the cross-NEMOs settlement and shipping.		X	IDC 1
l) Problems in one area, on one border or for one NEMO shall not, as far as possible, prevent trading in the other areas, on the other borders or for the other NEMOs.	X	X	IDC 1
m) The continuous trading matching algorithm must support, but not be limited to: (i) receive the available cross-zonal capacity information in real time; (ii) request cross-zonal capacity when pairs of matchable orders are identified.	X	X	IDC 1
n) The continuous trading matching algorithm must support transaction cancellation functionalities. The system must be able 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 continuous trading matching algorithm shall request cross-zonal capacity in the opposite direction; (ii) The system must support to define a deadline for transaction cancellation.		X	IDC 1
o) The continuous trading matching algorithm shall match orders according to price, time priority and, for cross-border trades, available cross-zonal capacity and allocation constraints. The configuration of the matching rules must support, but not 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 continuous trading matching algorithm checks if it can be matched; (iii) A buy (sell) order can be matched if: • there is an order by a trading counterpart with an inferior sell (superior buy) price or equal price; • there are several orders on the sell (buy) side fulfilling the first criterion the order with best price is matched first and if the aggressor order is not fully matched, then the second best price order is matched etc.;		X	IDC 1

• there are several orders with the same price on the sell (buy) side fulfilling the first criterion, the order with the oldest timestamp is matched first and if the aggressor order is not fully matched, then the second oldest is matched etc.; • the matching respects the cross-zonal capacity and allocation constraints; • the matching price is within the harmonised maximum and minimum clearing prices for SIDC. In case of partial matching of an order, the non-matched part remains in the book (except otherwise specified by the order type) as an order with the quantity equal to the non-matched quantity - the price of the remaining part of order is the one entered initially by the trader except 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 cross-zonal capacity and allocation constraints.		X	IDC 1
q) All incoming orders and explicit capacity requests are queued in the same queue. The continuous trading matching algorithm shall guarantee a first come first serve principle. Only one matching and/or cross-zonal capacity allocation event can occur at the same time.	X	X	IDC 1
r) The continuous trading matching algorithm supports increase and decrease of capacity. When the capacity available increases due to netting, capacity publication or update, it may lead to a crossed order book. The continuous trading matching algorithm must include a mechanism to solve this situation (pair matching or auction).	X	X	IDC 1
s) The continuous trading matching algorithm must calculate local views of order books based on available orders and capacities. The configuration of the local views must support, but not be limited to the following rules: (i) The local view of a bidding zone corresponds to the orders that the market participants of the bidding zone can trade; (ii) The available capacity corresponds to the maximum flow between two bidding zones (unless flow-based cross-border capacity mechanisms are defined and implemented) taking all allocation constraints into consideration; (iii) For building the same local view, the same capacity can only be considered once; (iv) Construction of the local view must take into account the harmonised maximum and minimum clearing prices for SIDC;		X	IDC 1
t) The continuous trading matching algorithm must prevent that NEMOs have the information to calculate the local view based on the order books from other NEMOs and capacities.		X	IDC 1
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.	X	X	IDC 1
v) The continuous trading matching algorithm must allow, as part of SIDC, to cross-match the different order types of the ID products within one and between multiple bidding zones, respecting the capacity and order restrictions.		X	IDC 1

1.2 Qualitative requirements with precision and price ranges			
a) The continuous trading matching algorithm shall provide all market participants non-discriminatory access to cross-zonal capacity in accordance with Article 3(j) of the CACM Regulation.	X	X	IDC 1
b) The continuous trading matching algorithm shall aim to ensure that in case there are matching opportunities the matching shall always take place taking into account the IDCZGT.		X	IDC 1
c) The continuous trading matching algorithm shall be able to reproduce the same results with the same input data coming in exactly identical sequence and timing.	X	X	IDC 1
d) The continuous trading matching algorithm shall support 23, 24 or 25 hours for a trading day.	X	X	IDC 1
e) The continuous trading matching algorithm shall support automatically the leap years, i.e. 366 days in a year.	X	X	IDC 1
f) The matching process of the continuous trading matching 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 continuous trading matching algorithm heuristics, if any, and occurrence rate of these rules and heuristics.	X	X	IDC 1
g) The continuous trading matching algorithm shall be well structured and well documented. A description of the continuous trading matching algorithm should be made publicly available, and should be kept up to date. The documentation shall be written in English.	X	X	IDC 1
h) The continuous trading matching algorithm shall support negative prices as well as prices with different price boundaries.		X	IDC 1
i) The continuous trading matching algorithm shall be able to deliver prices and volumes according to globally configurable ticks and, in case rounding is required, specific rounding rules.	X	X	IDC 1
1.3 Other functionalities related to cross-zonal capacity allocation			
a) The continuous trading matching algorithm shall be able to match both implicit (NEMOs) and explicit capacity allocation requests.	X	X	IDC 1
b) The continuous trading matching algorithm shall be able to calculate for each MTU the scheduled exchanges between bidding zones.	X	X	IDC 1
c) The continuous trading matching algorithm shall be able to calculate for each MTU the scheduled exchanges between scheduling areas.	X		IDC 1
d) Once allocated by the continuous trading matching algorithm, the capacity is firm (cannot be changed by TSOs).		X	IDC 1
e) Cross-zonal capacity shall be allocated to either energy transactions or explicit requests, at zero price for market participants.	X	X	IDC 1
f) .	X	X	IDC 1
g) The continuous trading algorithm shall (i) support switchover to auction mode where ID auction (IDAs) requirements apply to allocation of cross zonal capacity;	X	X	IDA 1

(ii) support switch back from auction mode to continuous trading mode where continuous trading requirements apply to allocation of cross zonal capacity; (iii) make available for the TSOs the allocation results on the different borders when suspension occurs; (iv) allow setting priority level of AAC files in the same manner as for NTC files, depending on the sender of the AAC file; (v) allow automatization of halting and unhalting of allocation of cross-zonal capacities on continuous trading basis; (vi) allow for automatization of switchover to allocation of cross-zonal capacities into IDAs; (vii) allow for automatization of switch back from IDAs to allocation of cross-zonal capacities to continuous trading mode; (viii) ensure no double allocation of capacity; (ix) allow for the timings of all process steps to be configurable;..			
h) TSOs shall receive the allocation results on the different borders when suspension occurs.		X	IDA 1
i) The algorithm shall allow setting priority level of AAC files depending on the sender of the file the same as it happens with NTC files.	X	X	IDA 1
j) The countinous trading algorithm shall allow automatization of halting and unhalting of allocation cross-zonal capacities on continuous trading basis.	X	X	IDA 1
k) The continuous trading shall allow for automatization of switchover to allocation of cross-zonal capacities into IDAs, avoiding double allocation of capacity.	X	X	IDA 1
l) Times when suspension, switchover and reactivation into/from IDAs shall allow for automatization and shall be configurable, avoiding double allocation of capacity.	X	X	IDA 1
m) Timeout time shall be configurable.	X	X	IDA 1
n) The continuous trading matching algorithm shall support the possibility of continuous matching of orders during the IDA without continuous allocation of intraday cross-zonal capacity.	X	X	IDA 1
o) The continuous trading algorithm and ID auction shall be aligned in relevant aspects in order to avoid inconsistencies that would endanger proper functioning of single intraday coupling, including but not limited to: (i) the losses functionality shall be aligned in relevant aspects; (ii) there shall be no case when cross zonal capacity is allocated by continuous trading algorithm and by ID auction algorithm at the same time.	X	X	IDA 1

p) The continuous trading algorithm and ID auction algorithm shall support updating relevant data[1]: (i) Upon switchover into IDAs – the continuous trading algorithm shall allow processes for sending of capacity data and other relevant input data to the auction (ii) Upon switch back from IDAs the continuous trading algorithm shall allow processes for updating the cross-zonal capacities and other results accordingly.	X	X	IDA 1
q)	X	X	IDA 1
r) 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	IDC 1
s) Once IDAs are combined with continuous trading, the continuous trading matching algorithm shall include the necessary mechanisms for: (i) allowing the operational integration with the auctions taking into account the intraday cross-zonal gate opening and closure times; (ii) allowing the incorporation of the auctions' results to the continuous trading, in terms of cross-zonal capacity.	X	X	IDA 1
1.4 Performance			
a) The continuous trading matching algorithm shall produce and log performance indicators with minimum level of those indicators in order to monitor its performance. This shall include, among others, the statistics related to the usage of different products with regard to their impact on continuous trading matching algorithm performance and in relation to particular products. These measurements should include for every bidding zone the number and volume of bids per product and the number and volume of accepted bids per product.		X	IDC 1
b) All TSOs and NEMOs shall develop performance indicators in order to monitor the performance of the continuous trading matching algorithm.	X	X	IDC 1

2 Requirements related to cross-zonal capacities

2.1 The continuous trading matching algorithm shall be able for each MTU to:

a) allow TSOs to set constant cross-zonal capacity and allocation constraints for each bidding zone border in case coordinated net transmission capacity is applied. This cross-zonal capacity value may also be a very high value;	X		IDC 2
b) constrain scheduled exchanges 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 approach is applied;	X		IDC 1

[1] *The design of cooperation between continuous trading algorithm and ID auction algorithm, e.g. wherether switchover/switch are performed automatically or manually, are relevant data trasferred directly or via IT sytems of TSOs/CCCs, possible validation, are out of scope of these requirements. The possible approaches will be assessed, and finally NEMOs and TSOs will agree on the best solution for implementation.*

c) where applicable, allow 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		IDC 2
d) constrain, where appropriate, an aggregated set of cross-zonal interconnectors with one global cross-zonal transmission capacity limit (cumulative net transmission capacity), 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		IDC 2
e) allow the processing of flow-based parameters, if provided at the defined MTU, when allocating cross-zonal capacities for each bidding zone border;	X		IDC 2
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		IDC 2
(i) power transfer distribution factor (PTDF) as defined in Regulation (EU) 543/2013; and	X		IDC 2
(ii) available margin on critical network element as refered to in Regulation (EU) 543/2013;	X		IDC 2
g) ensure that the PTDF matrix multiplied by the net position is less than or equal to the available margin for each critical network element;	X		IDC 2
h) allow the reception of the flow-based parameters as:	X		IDC 2
(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	X		IDC 2
(ii) “not zero balanced“ meaning that the available margin on critical network elements applies from pre-existing exchanges;	X		IDC 2
i) allow the coexistence of both flow-based and coordinated net transmission capacity approaches within the coupled regions, i.e. hybrid coupling;	X		IDC 2
j) 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;	X		IDC 2
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 continuous trading matching algorithm shall match the relevant orders with the aim of maximizing economic surplus;	X	X	IDC 2
l) allow configuring the moment when the cross-zonal capacity update is applied or becomes effective;	X		IDC 1
m) enable to halt/unhalt one bidding zone, one border, one instrument, and 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	IDC 1
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		IDC 1

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 trades moving the clearing point towards the flow-based domain.	X		IDC 2
2.2 Multiple flow-based approaches, i.e. plain, intuitive, bilaterally intuitive, may be used for different capacity calculation regions.	X		IDC 2

3 Requirements related to allocation constraints

3.1 The continuous trading matching algorithm shall allow 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. The constraint shall take into account the nominations of capacity allocations, i.e. physical transmission rights, day-ahead scheduled exchanges, and auction SIDC scheduled exchanges, where applicable. The constraint shall be handled on a single DC interconnector and multiple DC interconnectors in combination (i.e. ramping); b) 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 c) incorporate losses on interconnector(s) between bidding zones during capacity allocation, if requested by the owner(s) of the relevant interconnector after approval by the relevant NRAs.	X		IDC 2
3.2 For the DC interconnectors, the scheduled exchanges 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.	X		IDC 2
3.3 The continuous trading matching algorithm shall allow to set a minimum price difference between adjacent bidding zones when a DC interconnector is used for power exchange. For this requirement, the continuous trading matching algorithm shall model the costs incurred for each MWh passing through a DC interconnector as a “flow tariff”. 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 scheduled exchanges will be set to zero. If there is a scheduled exchange, the price difference will 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 continuous trading matching algorithm if requested by the owner(s) of the interconnector after approval by relevant NRAs.	X		IDC 2
3.4 The continuous trading matching algorithm shall allow for adverse scheduled exchanges, i.e. scheduled exchanges from higher price bidding zone to lower price bidding zone.	X		IDC 2

3.5	The continuous trading matching 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.	X		IDC 2

4 Requirements on continuous trading matching algorithm output for the delivery of single intraday coupling results

4.1	Regarding the quantities for each MTU the output of the continuous trading matching algorithm shall be:			
	a) 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;	X	X	IDC 1
	b) where applicable, the rounded and unrounded net position for each NEMO trading hub in bidding zones with several NEMOs shall be provided;		X	IDC 1
	c) the execution status of orders and prices per trade;		X	IDC 1
	d) number and volume of matched block orders for each bidding zone;		X	IDC 2
4.2	For each relevant MTU, the continuous trading matching algorithm shall provide scheduled exchanges resulting from intraday market coupling in the form of:			
	a) scheduled exchanges between scheduling areas;	X		IDC 1
	b) scheduled exchanges between bidding zones;	X		IDC 1
	c) scheduled exchanges between NEMO trading hubs;		X	IDC 1
	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.			
4.3	Regarding the calculation results, the output of the continuous trading matching algorithm shall be the output necessary for monitoring in accordance with Article 82(2) and (4) of the CACM Regulation.	X	X	IDC 2
4.4	The continuous trading matching 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 continuous trading matching algorithm.	X	X	IDC 2
4.5	The continuous trading matching 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	IDC 1
4.6	The continuous trading matching 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 a particular MTU.	X	X	IDC 1

5 Currency

5.1	The continuous trading matching 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	IDC 1

TITLE 2

Requirements for single intraday coupling auctions in accordance with methodology for intraday capacity pricing

6. Requirements on functionalities and performance

6.1. General requirements

	Owner		State
	TSOs	NEMOs	Requirement deadline
a) For each bidding zone, the ID auction 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	IDA 1B
(ii) support the products as defined in the IDAs section of the All NEMOs' methodology for products ;		X	IDA 1
(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	IDA 1
(iv) support multiple scheduling areas within a bidding zone as requested by TSOs;	X		IDA 1
(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		IDA 1
b) The ID auction algorithm shall aim at maximising the economic surplus of the SIDC auction for the market time units, are part of the delivery period of the auction, consistent with time limitations, conditions and requirements established by NEMOs and TSOs;	X	X	IDA 1
c) The ID auction algorithm shall provide for a fair and orderly price formation in accordance with Article 3(h) of the CACM Regulation;		X	IDA 1
d) The ID auction algorithm shall support multiple bidding zones within a country and shall be scalable to cover all bidding zones eligible for participating in SIDC;	X	X	IDA 1
e) In case the ID auction 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	IDA 1

f) The ID auction 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	IDA 1
g) The ID auction 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	IDA 1
h) The ID auction algorithm shall be able to calculate the scheduled exchanges between bidding zones or scheduling areas;	X		IDA 1
i) For each bidding zone, the result from the application of the ID auction 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	IDA 1
j) The integrity of the ID auction algorithm and the data it processes shall be properly secured from unauthorized access;	X	X	IDA 1
k) Intraday auction cross-zonal gate opening and intraday cross-zonal gate closure times (IDCZGT) shall be configurable.	X	X	IDA 1
6.2. Qualitative requirements with precision and price ranges			
a) The ID auction algorithm shall ensure: (i) equal treatment of orders coming from all NEMOs in accordance with Article 3(e) of the CACM Regulaiton; and (ii) provide all orders of market participants non-discriminatory access to cross zonal capacity in accordance with Article 3(j) of the CACM Regulation;	X	X	IDA 1
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	IDA 1
c) The ID auction algorithm shall allow for partial coupling;	X	X	IDA 1
d) The ID auction algorithm shall automatically support leap years, i.e. 366 days in a year;	X	X	IDA 1
e) The ID auction algorithm shall automatically support daylight saving clock changes;	X	X	IDA 1
f) The ID auction algorithm shall support MTUs from first auction MTU till end of day for a given auction;	X	X	IDA 1
g) The calculation process of the ID auction 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	IDA 1

h) The price coupling algorithm source code shall be well structured and well documented;		X	IDA 1
i) The ID auction algorithm shall support negative prices for each bidding zone;		X	IDA 1
j) The ID auction algorithm shall be able to round calculated prices and volumes according to bidding zone specific ticks and rounding rules.	X	X	IDA 1
6.3. Performance			
a) The ID auction 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	IDA 1
b) The ID auction algorithm shall always produce a unique result, i.e. price and volume indeterminacy shall be resolved;	X	X	IDA 1
c) The ID auction algorithm shall use reliable IT technology, e.g. reliable third party software;	X	X	IDA 1
d) The ID auction algorithm shall be available at all times when required;	X	X	IDA 1
e) The ID auction algorithm shall be adequatly scalable when the number of bidding zones increases. The ID auction 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	IDA 1
7. Requirements related to cross-zonal capacities			
7.1. The ID auction algorithm shall be able for each MTU to:			
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		IDA 1
b) constrain scheduled exchanges to the respective cross-zonal capacity value for each bidding zone border for each direction, including capacity allocated under previous timeframes , in case the coordinated net transmission capacity approach is applied;	X		IDA 1
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		IDA 1
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		IDA 1

e) allow to define a positive and a negative limit to the net position for each bidding zone;	X		IDA 2
f) process flow-based parameters, if provided at the defined MTU, when allocating cross-zonal capacities for each bidding zone border;	X		IDA 1
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		IDA 1
(ii) available margin on critical network element as refered to in Regulation (EU) 543/2013;	X		IDA 1
h) ensure that the PTDF matrix multiplied by the net position from the current IDA is less than or equal to the available margins for each critical network element adjusted for already existing exchanges;	X		IDA 1
i) receive the flow-based parameters as:			
(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	X		IDA 2
(ii) "not zero balanced" meaning that the available margin on critical network elements applies from pre-existing exchanges;	X		IDA 1
j) allow the coexistence of both flow-based and coordinated net transmission capacity approaches within the coupled regions, i.e. hybrid coupling;	X		IDA 1
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.	X		IDA 1
7.2. Multiple flow-based approaches, i.e. plain and bilaterally intuitive, may be used for different capacity calculation regions.	X		IDA 1
8. Requirements related to allocation constraints			
8.1. The ID auction 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 before first auction MTU and the first auction MTU;	X		IDA 1
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 before first auction MTU and the first auction MTU taking into account the results of previous allocation including nominations of long term capacity allocations, i.e. physical	X		IDA 2

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 between MTUs;	X		IDA 1
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.	X		IDA 1
8.2. The ID auction algorithm shall allow to set a minimum price difference between adjacent bidding zones when a DC interconnector 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.	X		IDA 1
8.3. The ID auction 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.	X		IDA 1
8.4. The ID auction 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.	X		IDA 1

9. Requirements related to balance constraints

9.1. 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.	X		IDA 1
9.2. For overall balance of a bidding zone, the ID auction 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 intraday capacity allocation.	X		IDA 1

10. Requirements on algorithm output and deadlines for the delivery of auction SIDC results

10.1. Regarding the prices for each MTU the output of the ID auction algorithm shall be:			
a) rounded and unrounded price in Euros for each bidding zone;	X	X	IDA 1
b) shadow prices of critical network elements as needed for flow-based capacity allocation; and	X		IDA 1
c) regional reference prices, in a network in which the cross-zonal capacity constraints are relaxed, e.g. Nordic region.	X	X	IDA 1
10.2. Regarding the quantities for each relevant MTU, the output of the ID auction algorithm shall be:			
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	IDA 1
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	IDA 1
c) the information which enables the execution status of orders to be determined;		X	IDA 1
d) number and volume of accepted block orders for each bidding zone and paradoxically rejected orders, if any;		X	IDA 1
e) scheduled exchanges into and out of individual relevant DC network elements (difference in scheduled exchanges in/out reflecting losses where applicable);	X		IDA 1
f) scheduled exchanges on relevant bidding zone borders (scheduled exchanges in/out reflecting losses where applicable);	X		IDA 1
g) scheduled exchanges on relevant scheduling area borders (scheduled exchanges in/out reflecting losses where applicable);	X		IDA 1
h) available margin on critical network elements or the remaining allowable scheduled exchange on the network element in case of flow-based approach.	X		IDA 2
10.3. For each relevant MTU the ID auction algorithm shall provide scheduled exchanges resulting from SIDC auctions in the form of:			
a) bilateral and multilateral scheduled exchanges between scheduling areas;	X		IDA 1
b) bilateral and multilateral scheduled exchanges between bidding zones; and	X		IDA 1
c) bilateral and multilateral scheduled exchanges between NEMO trading hubs;	X	X	IDA 1

and pursuant to the methodology for calculating scheduled exchanges reulting from day ahead. This is to support the scheduled exchanges calculation and/or multi-NEMO arrangements function[2].			
10.4. Regarding the calculation results, the output of the ID auction algorithm shall be:			
a) the overall economic surplus and economic surplus for each bidding zone; and	X	X	IDA 1
b) the output necessary for monitoring in accordance with Article 82(2) and (4) of the CACM Regulation.	X	X	IDA 1
10.5. The ID auction 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	IDA 1
10.6. The ID auction 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		IDA 1
10.7. The ID auction algorithm shall be capable of finding results within the agreed time limit that is established in the operational procedure of the Algorithm methodology.	X	X	IDA 1
10.8. The ID auction 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		IDA 1

11. Currency

11.1. The ID auction algorithm shall for auctions under the SIDC arrangements 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	IDA 1

[2] *The ID Auction 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 a particular MTU.*

Annex 3

Methodology for monitoring the performance and usage of the price coupling algorithm

in accordance with Article 8 of the Algorithm Methodology

31st May 2019

Summary

TITLE 1 - General provisions

Article 1

Subject matter and scope

1. This algorithm monitoring methodology elaborates the principles and sets forth the indicators for:
   a) monitoring the performance of the price coupling algorithm, as set out in Article 7 of the Algorithm Methodology;
   b) monitoring the usage of the price coupling algorithm, as set out in Article 7 of the Algorithm Methodology;
   c) monitoring the output produced by the price coupling algorithm, as set out in Article 7 of the Algorithm Methodology;

2. The principles and processes described in this methodology shall be further developed and detailed within the algorithm monitoring procedures defined in the relevant operational agreements among all NEMOs, between all NEMOs and all TSOs, and among TSOs, in the day-ahead framework.

3. All NEMOs and all TSOs shall ensure the update of the present Annex.

Article 2

Type, Purposes and Use Cases for indicators calculation

1. The indicators addressed in this Annex shall belong to different categories:
   a) usage indicators envisaged in TITLE 4 shall quantify the average daily usage of a functionality and shall constitute the input of the price coupling algorithm. They shall be the basis for the quantification of effective usage, anticipated usage and usage range, and definition of dataset;
   b) output indicators envisaged in TITLE 5 shall qualify the outcome of the price coupling algorithm and the algorithm computation process;
   c) performance indicators envisaged in TITLE 3 shall measure the properties of the price coupling algorithm in terms of compliance with the CACM requirements of optimality (Article 7), repeatability (Article 8) and scalability (Article 9).

2. The indicator referred to in previous paragraph 1 shall be meant to support different purposes:
   a) Monitoring of operations: monitoring the evolution of the actual performance of the price coupling algorithm (Article 3);
   b) Request for change impact assessment: assessing the impact of request for change or of corrective measures, as described in the Algorithm Methodology (Article 4);
   c) Scalability assessment: assessing the impact of the long term anticipated growth on the price coupling algorithm scalability (Article 5), considering also the usage of other functionalities of the algorithm whose use is expected to be increased;
   d) Research and development assessment: ensure the capability of the price coupling algorithm to support in the medium and long term anticipated market growth and extension of requirements (Article 6).

3. The indicators under paragraph 1 above shall be calculated with a daily granularity over different temporal sets of trading days in order to build the scenarios to address the purposes described in paragraph 2 above. Specifically:

a) The recent historical set shall comprise the trading days of the previous K months, starting from the Kth month before the assessment (M-K) up to the previous month (M-1) and may exclude for practical reasons the days on which a Daylight Saving Time change occurs and/or any days on which a partial/total decoupling occurs. The K value shall be defined in the operational procedures attached to the relevant operational agreement;
b) The rolling historical set shall comprise the previous year's trading days, starting from the 13th month before the assessment (M-13) up to the previous month (M-1) and may exclude for practical reasons the days on which a Daylight Saving Time change occurs and/or any days on which a partial/total decoupling occurs;
c) The whole year historical set will comprise the previous full years' trading days, counting only complete years, and may exclude for practical reasons the days on which a Daylight Saving Time change occurs and/or any day on which a partial/total decoupling occurs;
d) The near future set for the indicator calculation shall be defined by reference to the projected growth of the whole year historical set for the following year (Y+1) and taking into account all the forward-looking system information expected at the time of evaluation;
e) The distant future set for the indicator calculation shall be defined by reference to the projected growth for of the whole year historical set for the following three years (Y+3) and taking into account all the forward-looking system information expected at the time of evaluation.

4. Unless specified otherwise, all the values that are defined as parameters in this methodology, shall be defined in the operational procedures of the relevant operational agreements and their value will be shared in the public reports.

TITLE 2 - Indicators calculation and thresholds for price coupling algorithm

Article 3

Monitoring of operations

1. For Monitoring purposes under Article 2(2)(a) the following indicators shall be used:

   a) the usage indicators defined under TITLE 4 (and as referenced under Article 2(1)(a),
   b) the output indicators defined under TITLE 5 (and as referenced under Article 2(1)(b),
   c) the performance indicators defined under TITLE 3 (and as referenced under Article 2(1)(c).

2. The indicators referred to under paragraph 1 shall be calculated as their actual values as recorded in the rolling historical set under Article 2(3)(b) and, for reporting purposes, as the mean of the respective actual values over the rolling historical set under Article 2(3)(b).

3. The usage indicators under paragraph 1(a) shall be assessed against the following threshold comparing the effective usage of the functionality calculated over the recent historical set of trading days under Article 2(3)(a) against the corresponding usage range, as calculated under following Article 5(4).

4. The performance indicators under previous paragraph 1(c), calculated as their actual values as recorded in the recent historical set under Article 2(3)(a), shall be assessed over the following thresholds:

   a) economic surplus indicator under Article 7: the obtained values shall be assessed against the historical values, calculated as their actual values as recorded in the rolling historical set under Article 2(3)(b);
   b) repeatability indicator under Article 8: the obtained values shall be assessed against the historical values, calculated as their actual values as recorded in the rolling historical set under Article 2(3)(b);
   c) scalability indicator under Article 9: in x% of the cases the obtained values shall be lower than y minutes and its average value shall be smaller than z minutes.

Article 4

Request for Change impact assessment

1. For the request for change impact assessment purpose under Article 2(2)(b), the scalability indicator defined under TITLE 3 Article 9 and recalled under Article 2(1)(c) shall be used.
2. The scalability indicator under paragraph 1 shall be calculated simulating the run of the price coupling algorithm over two different scenarios:
   a) historical scenario: using as inputs the actual usage of all the existing functionalities as recorded over the historical set under Article 2(3)(c) and the anticipated usage of the functionality under assessment calculated over the near future set under Article 2(3)(d);
   b) near future scenario: using as inputs the anticipated usage of all the functionalities calculated on the near future set under Article 2(3)(d).
3. The scalability indicator under paragraph 2 shall be assessed against the following thresholds:
   a) In x% of the cases the indicators under previous paragraph 2(a) shall be lower than y minutes, and its average value shall be smaller than z minutes;
   b) In x% of the cases the indicators under previous paragraph 2(b) shall be lower than y minutes.

Article 5

Scalability assessment

1. For scalability assessment purposes under Article 2(2)(c) the scalability indicator defined under TITLE 3 Article 9 shall be used.
2. The scalability indicator under paragraph 1 shall be calculated simulating the run of the price coupling algorithm over two different scenarios:
   a) a near future scenario: using as inputs the anticipated usage of all the functionalities calculated over the near future set under Article 2(3)(d).
   b) a distant future scenario: using as inputs the increasing values of the anticipated usage of all the functionalities calculated on the distant future set under Article 2(3)(e).
3. The scalability indicator described under previous paragraph 2 shall be assessed against the following thresholds:
   a) in x% of the cases the indicators under previous paragraph 2(a) shall be lower than y minutes and its average value shall be smaller than z minutes.
   b) in x% of the cases the indicators under previous paragraph 2(b) shall be lower than y minutes and its average value shall be smaller than z minutes.
4. The usage range shall be calculated as the maximum usage of the functionalities supported by the price coupling algorithm adopted in previous paragraph 2(b) and complying with the threshold under paragraph 3(b).

Article 6

Research and Development assessment

1. For the research and development purposes under Article 2(2)(d), all performance indicators defined under TITLE 3 shall be used.
2. The performance indicators shall be calculated simulating the run of the price coupling algorithm using as inputs the usage range of all the functionalities calculated on the distant future set defined in Article 2(3)(e).
3. The performance values calculated under paragraph 2, shall be assessed against the following thresholds:
   a) economic surplus indicator under Article 7: the obtained values shall be assessed against the historical values, calculated as their actual values as recorded in the rolling historical set under Article 2(3)(b)
   b) repeatability indicator under Article 8: the repeatability indicators obtained values shall be assessed against the historical values for repeatability indicators calculated as the values as recorded in the rolling historical set under Article 2(3)(b)
   c) scalability indicator under Article 9: in x% of the cases the obtained values shall be lower than y minutes and its average value shall be smaller than z minutes.

TITLE 3 - Indicators on price coupling algorithm performance

Article 7

Indicators on algorithm's ability to maximize economic surplus

1. The economic surplus is the sum of the consumer and producer surpluses plus the congestion income attributable to flows between bidding zones. Indicators to monitor the ability of the price coupling algorithm to maximize the economic surplus are:
   a) **Increment of economic surplus with respect to the first OK solution** – This indicator is the difference between the economic surplus of the accepted solution and the economic surplus of the first OK solution found. This indicator is not valid for comparing two different versions of the price coupling algorithm. It should be used only as an indicative of the improvements of the solutions after first one is found. The existence of big outliers may indicate either the capacity of the price coupling algorithm to explore remote areas in the "Branch & Bound" process or a big change produced by the input data, for instance in situations with low liquidity that produces big impact after small changes in orders acceptance.
2. Indicators on the loss of economic surplus due to limited calculation time with respect to extended calculation time;
   a) **Economic surplus gain after increasing calculation time in X minutes** – This indicator measures the gain in the economic surplus if the same trading day is run again in a similar machine than the used for published results, giving the price coupling algorithm T minutes more. This indicator needs to be calculated ex post price coupling algorithm calculation, in a different process.

Article 8

Indicators on price coupling algorithm repeatability

1. The indicators to monitor algorithm repeatability includes the indicators on the differences in the same relevant outputs from the price coupling algorithm due to repeated calculations on the same specific configuration of hardware and software and at the same iteration.
2. With reference to previous paragraph 1:
   a) the relevant variables mentioned in are: clearing prices, net positions, and products output from the price coupling algorithm;
   b) the weights shall be established in the Algorithm Market Monitoring Procedure attached to the relevant operational agreement.
   c) the difference between clearing prices is calculated as the average, over the relevant MTUs and the zones, of the absolute value difference between same MTUs zonal clearing prices, weighted by the related net positions;
   d) the difference between net positions is calculated as the average, over the relevant MTUs, the zones and the MTUs, of the absolute value difference between zonal net positions for each MTU;
   e) the difference between individual bids/offers is calculated as the average, over the relevant MTUs and the orders, of the absolute value difference between accepted quantity of each product output from the price coupling algorithm.

Article 9

Indicators on Algorithm scalability

1. The indicator to monitor the algorithm scalability is the **Time to first solution.**
   a) This indicator measures the time spent since the algorithm starts until the first “OK” solution is found. It considers the time required for reading input data from database, the creation of the model for the optimization problems and the resolution until the first “OK” solution has been found.

TITLE 4 - Indicators on the price coupling algorithm usage

Article 10

Indicators to describe the usage of SDAC products

1. Indicators on the evolution of the number of submitted orders of each product type per bidding zone over time, and the corresponding total volume;

   a) **Number of points in curve orders at bidding zone level** – Total number of points in curves at bidding zone level, after the curves from NEMO Trading Hubs have been aggregated. One single value is provided per trading day. This indicator is calculated in the aggregation step by the price coupling algorithm.
   b) **Total number of steps at bidding zone level** – This indicator counts the total number of steps in the curves at bidding zone level, after the curves from NEMO Trading Hubs have been aggregated. A step is a segment made of two curve points with the same price but different quantities, followed by another segment in which the point not shared with the previously mentioned segment has a different price. One single value is provided per trading day.
   c) **Total number of block orders** – This indicator counts the total number of block orders per trading day and bidding zone.
   d) **Total number of block order exclusive groups** – This indicator counts the total number of exclusive groups existing for the block orders per trading day.
   e) **Total number of linked families** – This indicator counts the total number of families of linked block orders per trading day.
   f) **Total number of complex orders** – This indicator counts the total number of complex orders per trading day and bidding zone.
   g) **Total number of demand merit orders** – This indicator counts the total number of demand merit orders per trading day and bidding zone. These merit orders are not the PUN orders.
   h) **Total number of supply merit orders** – This indicator counts the total number of supply merit orders per trading day and bidding zone.
   i) **Total number of PUN orders** – This indicator counts the total number of PUN orders per trading day and bidding zone. That means the number of unique PUN prices regarding the input data.

Article 11

Indicators to describe the geographical extension of the SDAC

2. Indicators on the evolution of the number of bidding zones;

   a) **Number of bidding zones** – Total number of bidding zones. This indicator is obtained by counting all the bidding zones existing per trading day.
   b) **Total number of flow-based bidding zones** – This indicator counts the total number of bidding zones in which there is flow based topology. This indicator is calculated by counting the number of PTDF matrixes that exist per trading day.
   c) **Number of scheduling areas** – Total number of scheduling areas. This indicator is obtained by counting all the scheduling areas existing per trading day.
   d) **Number of NEMO Trading Hubs** – Total number of NEMO Trading Hubs per trading day.
   e) **Number of NEMOs** – Total number of different NEMOs in the trading day. One NEMO may be operating several NEMO Trading Hubs, each one in a different bidding zone and scheduling area.

Article 12

Indicators to describe the network constraints

1. Indicators on the evolution of the use of network constraints are:
    a) **Total number of bidding zone lines** – This indicator counts the total number of lines between bidding zones.
    b) **Total number of flow-based PTDF constraints** – This indicator counts the total number of PTDF constraints existing for all the flow-based bidding zones per trading day. It is the same as the number of rows in the PTDF matrixes.
    c) **Total number of scheduling area lines** – This indicator counts the total number of lines between scheduling areas.
    d) **Total number of NEMO Trading Hub lines** – This indicator counts the total number of lines between NEMO Trading Hubs.

TITLE 5 - Indicators on the price coupling algorithm output

Article 13

Indicators to describe the output of maximization of economic surplus

1. Indicators on the maximization of economic surplus:
   a) **Economic surplus of the first OK solution found -** is the market surplus, calculated Due to price coupling algorithm works floating-point format numbers, the precision of the calculations is limited. Quality of the solution is the quality in term of tolerances, using as value the worst level of tolerance achieved among all the checks applied to the constraints. A solution is considered "OK" when there exists an acceptance tolerance problem in all the constraints up to a maximum value known as the technical limit. Price coupling algorithm provides the utility of each one of the solutions that improve the previously solutions found. This indicator can be obtained querying the utility of the first solution found with quality "OK"
   b) **Economic surplus of the final solution -** This indicator is obtained as provided by the price coupling algorithm, querying the utility of the solution that the price coupling algorithm classifies as the accepted solution per trading day.

2. Indicators on the evolution of number of matched orders and paradoxically rejected orders of each product type over time, and the corresponding total volume;
   a) **Total number of matched blocks** – This indicator counts the total number of matched blocks per trading day and bidding zone.
   b) **Total number of matched complex orders** – This indicator counts the total number of matched complex orders per trading day and bidding zone.
   c) **Total number of matched non-PUN merit orders** – This indicator counts the total number of matched merit orders (non-PUN merit orders) per trading day and bidding zone. It will be calculated as the count of non-PUN merit orders whose matching quantity is greater than 0.
   d) **Total number of matched PUN orders** – This indicator counts the total number of matched PUN orders per trading day and bidding zone. That means the number of unique PUN prices regarding the input data. It will be calculated as the count of PUN orders whose matching quantity is greater than 0.
   e) **Total matched volume from curves** – This indicator aggregates the total matched volume from supply and demand curves. It will be calculated as the sum of all "market time unit"-weighted unrounded volume matched at each relevant MTU and bidding zones for supply and demand curves.
   f) **Total matched volume from blocks** – This indicator aggregates the total matched volume from blocks. It will be calculated as sum of all "market time unit"-weighted unrounded volume matched at each relevant MTU and bidding zones from blocks.
   g) **Total matched volume from complex orders** – This indicator aggregated the total matched volume from complex orders. It will be calculated as sum of all unrounded volume matched at each relevant MTU and bidding zones from complex orders.
   h) **Total matched volume from (non-PUN) merit orders** – This indicator aggregates the total matched volume from (non-PUN) merit orders. It will be calculated as sum of all unrounded volume matched at each relevant MTU and bidding zones from (non-PUN) merit orders.
   i) **Total matched volume from PUN orders** – This indicator aggregated the total matched volume from PUN orders. It will be calculated as sum of all unrounded volume matched at each relevant MTU and bidding zones from PUN orders

3. Indicators on paradoxically rejected orders
   a) **Number of PRBs in the final solution** – This indicator counts the total number of Paradoxically Rejected Blocks (PRBs) in the accepted solution per trading day and bidding zone.
   b) **Number of PRMICs in the final solution** – This indicator counts the total number of Paradoxically Rejected MICs (PRMICs) in the accepted solution per trading day and bidding zone.

c) **Maximum Delta P in the final solution** – This indicator reports the maximum delta P of the blocks for the accepted solution per trading day.
d) **Maximum Delta MIC in the final solution** – This indicator reports the maximum Delta MIC of the blocks for the accepted solution per trading day.
e) **PRB utility loss in the final solution** – This indicator reports the utility (economic surplus) loss due to paradoxically rejected blocks per trading day.
f) **PRMIC utility loss in the final solution** – This indicator reports the utility (economic surplus) loss due to paradoxically rejected MICs and MPCs per trading day.
g) **Volume of PRBs in the final solution** – This indicator sums the volume of all the Paradoxically Rejected Blocks (PRBs) in the accepted solution per trading day and bidding zone.
h) **Volume of PRMICs in the final solution** – This indicator sums the volume of all the Paradoxically Rejected MICs (PRMICs) in the accepted solution per trading day and bidding zone.

4. Indicators on the evolution of the use of network constraints along the time;

a) **Number of periods for ATC/DC lines with flows at full capacity** – Total number of periods for which ATC/DC lines are utilized at full capacity in one of their directions. We consider a line fully utilized when the energy flow is equal to capacity.

Article 14

Indicators to describe the IT calculation process

5. Indicators on the time spent in every phase of the algorithm calculation process are:

a) **Input data reading time** – This indicator measures the time the price coupling algorithm requires in order to read all the data needed for a trading day from the SQL database. Different methods exist for the calculation of this indicator:
b) **Input data trading day creation** – This indicator measures the amount of time the price coupling algorithm requires in order to create a trading day from the data read from the database.
c) **Time to solve the root node for the master computer** – This indicator measures the amount of time to solve the root node for the master tree.
d) **Time to solve the root node for the job that found first solution** – This indicator measures the amount of time to solve the first node of the job that lead to the first OK solution found. This time will not include the time to read the input data and create the solver models. It will neither include the time spent in the master computers root node.
e) **Number of successive improvements of the solution in the given timeframe** – This indicator measures the number of OK solutions that improve a previously found solution during the optimization process limited by the amount of time available for running the price coupling algorithm.
f) **Total number of nodes in the master branch and bound tree** – This indicator measures the number of nodes processed in the master branch and bound tree.