ACER
European Union Agency for the Cooperation of Energy Regulators

European Network of Transmission System Operators for Electricity

entsoe

~~All TSOs' proposal for a~~ ACER Decision on the Methodology for Calculating Scheduled Exchanges resulting from single day-ahead coupling: Annex I

Methodology for Calculating Scheduled Exchanges resulting from single day-ahead coupling in accordance with Article 43 of the Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management

~~xx/xx~~09/2024~~XX~~ 25 September 2024

Contents

All Transmission System Operators taking into account the following:

Whereas

1. This document provides the methodology for calculating Scheduled Exchanges resulting from the single day ahead coupling (hereafter referred to as "SDAC") in accordance with Article 43 of Commission Regulation (EU) 2015/1222 establishing a guideline on Capacity Allocation and Congestion Management (hereafter referred to as "CACM Regulation"). This methodology is hereafter referred to as "DA SEC Methodology". The document is based on all Transmission System Operators (hereafter referred to as "TSOs") proposal of 20 December 20224 April 2024, as amended and approved by ACER.

2. The DA SEC Methodology takes into account the objectives and principles set out in the CACM Regulation, and is consistent with other methodologies based on the CACM Regulation. The goal of the CACM Regulation is the coordination and harmonisation of capacity calculation and allocation in the day-ahead and intraday cross-border markets.

3. The DA SEC Methodology, in line with Article 45 of CACM Regulation, accommodates situations where there are more than one Nominated Electricity Market Operator (hereafter referred to as "NEMO") designated and/or offering day-ahead trading services in a particular geographic area. In addition, according to Article 4(1) of CACM Regulation, multiple NEMOs can be designated to perform the SDAC in a Member State. For each NEMO, a NEMO trading hub is assigned. Where multiple NEMOs operate within a geographic area, some multi-NEMO arrangements require multiple NEMO trading hubs within that geographic area.

4. The DA SEC Methodology considers situations where the bidding zone is equal to the scheduling area, as well as where there are multiple scheduling areas within a bidding zone.

5. The DA SEC Methodology provides for the calculation of Scheduled Exchanges between bidding zones, scheduling areas and NEMO trading hubs.

6. The DA Scheduled Exchanges calculation is integrated in the SDAC calculation in accordance with the methodology for the price coupling algorithm and the continuous trading matching algorithm in accordance with Article 37(5) of the CACM Regulation (hereafter referred to as "algorithm methodology"), and consequently performed by the Market Coupling Operator function (hereafter referred to as "MCO function"). NEMOs are responsible for operating the MCO function, and therefore acts as the entities with the task of calculating Scheduled Exchanges (the Scheduled Exchange Calculator). The DA SEC Methodology provides the necessary framework for the Scheduled Exchanges Calculator to calculate the Scheduled Exchanges resulting from SDAC pursuant to Article 49 of CACM Regulation.

7. The DA Scheduled Exchanges CalculationcalculationCalculation is an integral part of the price coupling algorithm algorithm and thereby contributes to the total computation time. Before aligning the DA MTUday-ahead Market Time Unit (MTU) with the respective imbalance settlement period, the price coupling algorithm needs to have its' performance improved to cope with the increased amount of data in the limited time

available for calculation. Further the performance needs improvements in the DA Scheduled Exchanges calculation process help to reduce the total computation time needed by the price coupling algorithm.

A back-up mode ofbackup method for calculating DA Scheduled Exchanges Calculation will be activated if the price coupling algorithm algorithm takes too long to find a solution. Since the quadratic part of the objective function for DA Scheduled Exchanges Calculation is what calculation can cause calculation time to be slow, the back upbackup method will use an objective function that is a Taylor expansion on the quadratic part based on reference flows, making it linear and easier to solve. The reference flows are the values found by the market clearing algorithm which respect all requirements but are not based on SEC methodology.

8. The requirements on information exchange between the NEMOs, TSOs and the Scheduled Exchange Calculator stem from the algorithm methodology.

9. Net positions and clearing prices are fixed by the results from the SDAC. Furthermore, cross-zonal capacities and allocation constraints have already been taken into account by the price coupling algorithm. Cross-zonal capacities and allocation constraints are therefore not impacted by the calculated Scheduled Exchanges.

10. In line with Article 9(9) of CACM Regulation, the DA SEC Methodology includes a timescale for the implementation of the Methodology.

11. This DA SEC Methodology fulfils the objectives stated in Article 3 of the CACM Regulation as follows:
    - Article 3(a) of CACM Regulation aims at promoting effective competition in the generation, trading and supply of electricity.
        - The DA SEC Methodology, as it is derived from the results of SDAC, does not impact competition in generation, trading and supply of electricity.

    - Article 3(b) of CACM Regulation aims at ensuring optimal use of the transmission infrastructure.
        - The Scheduled Exchanges resulting from the DA SEC Methodology are derived from the results of SDAC i.e. they are based upon:
            - Net positions of bidding zones, scheduling areas and NEMO trading hubs;
            - Scheduled Exchanges into and out of individual HVDC interconnectors (difference in Scheduled Exchanges in/out reflecting losses where applicable).

    - Article 3(c) of CACM Regulation aims at ensuring operational security.
        - The information provided by the Scheduled Exchange Calculator to all TSOs resulting from the SDAC will duly respect all constraints defined by TSOs in order to maintain operational security. Cross-zonal capacities and allocation constraints are not impacted by the calculation of Scheduled Exchanges and have no influence on operational security.

    - Article 3(d) of CACM Regulation aims at optimising the calculation and allocation of cross-zonal capacity.
        - Scheduled Exchanges resulting from SDAC does not modify, but only duly reflect the results of the SDAC session.

- Article 3(e) of CACM Regulation aims at ensuring fair and non-discriminatory treatment of TSOs, NEMOs, the Agency, regulatory authorities and market participants.
    - The DA SEC Methodology is fair, transparent and based on the results of SDAC.

- Article 3(f) of CACM Regulation aims at ensuring and enhancing the transparency and reliability of information.
    - The DA SEC Methodology comprises a step-wise, top-down approach (from bidding zone, to scheduling area and to NEMO trading hub) for the calculation of Scheduled Exchanges which ensures and enhances the transparency and reliability of the DA SEC Methodology.

- Article 3(g) of CACM Regulation aims at contributing to the efficient long-term operation and development of the electricity transmission system and electricity sector in the Union.
    - The DA SEC Methodology shows clear cross-Network Code thinking in order to contribute to the efficient development of the common European day-ahead market. The DA SEC Methodology, through its construction facilitates the efficient long-term operation and development of the European transmission system.

- Article 3(h) of CACM Regulation aims at respecting the need for a fair and orderly market and fair and orderly price formation.
    - The DA SEC Methodology does not interfere with or compromise the anonymity of the market participants as it has no influence on the results of SDAC.

- Article 3(i) of CACM Regulation aims at creating a level playing field for NEMOs.
    - The DA SEC Methodology creates a level playing field for NEMOs as it has no influence on the results of SDAC. Additionally, the DA SEC Methodology supports multiple NEMOs within a bidding zone or scheduling area.

- Article 3(j) of CACM Regulation aims at providing non-discriminatory access to cross-zonal capacity.
    - The DA SEC Methodology does not interfere with the provision nor allocation of cross-zonal capacity.

12. ~~The~~ TSOs~~, which intend to calculate scheduled exchanges resulting from single day-ahead coupling, assessed current and foreseen applications of results of DA SEC and concluded that~~ use the results of DA SEC~~,~~ calculated according to this DA SEC Methodology ~~may be used only,~~ for:
    a) shipping;
    b) financial settlement between NEMOs;
    c) as initial setting of HVDC(s);
    d) intraday capacity calculation in Coordinated Net Transmission Capacity (cNTC) CCRs~~,~~; and
    e) congestion income distribution in cNTC CCRs.

Article 1 – Subject matter and scope

1. The DA SEC Methodology lays down the requirements to calculate Scheduled Exchanges resulting from SDAC, the input information required from all NEMOs for the calculation, the calculation process, the description of the required equations and the information that shall be notified to relevant NEMOs, central counter parties, shipping agents and TSOs.

2. This DA SEC Methodology shall apply to the TSOs listed in Annex 1.

3. The scope of the DA SEC Methodology does not extend to the assignment of roles and responsibilities of the specific parties. Also, the governance framework for specific roles or responsibilities is out of scope of the DA SEC Methodology.

Article 2 – Definitions and interpretation

1. For the purposes of this DA SEC Methodology, terms used shall have the meaning of the definitions included in Article 2 of CACM Regulation, Article 2 of Regulation (EU) 2019/943, Commission Regulations (EU) 543/2013 and (EU) 1227/2011 as well as Article 3 of Commission Regulation (EU) 2017/1485 establishing a guideline on electricity transmission system operation (hereafter referred to as "SO Regulation"), with the exception of the definition of 'scheduling area'.

2. In addition, in the DA SEC Methodology, the following definitions shall apply:

   a) 'NEMO trading hub' means 'a virtual trading point collecting all orders received by a NEMO with delivery in a specific scheduling area', as defined in the algorithm methodology;
   b) 'Net position per scheduling area' means 'netted sum of the external commercial trade scheduled per scheduling area for all NEMO trading hubs';
   c) 'Net position per NEMO trading hub' means 'netted sum of internal and external commercial trade schedules for each market time unit for a single NEMO trading hub';
   d) 'Scheduling area' means a scheduling area according to Article 3(2)(91) of the SO Regulation with at least one NEMO trading hub;
   e) 'Scheduled Exchanges between NEMO trading hubs' means 'electricity transfer scheduled between NEMO trading hubs operating within or between scheduling areas or bidding zones', as defined in the algorithm methodology; and
   f) 'Net Financial Exposure' shall have the meaning set forth in Article 6(2) of this DA SEC Methodology.

3. The term 'Scheduled Exchange' is defined in Article 2(32) of CACM Regulation. For the purposes of the DA SEC Methodology, the term 'geographic area' means both scheduling area and bidding zone. The notion of 'NEMO trading hub' is required in order to ensure proper functioning of post market coupling processes under market settlement regimes where multiple NEMOs are active in a bidding zone or scheduling area in accordance with the requirements contained within Article 45 of CACM Regulation.

4. The virtual bidding zones, set forth in Requirement 2.1.k of Annex I to the algorithm methodology, shall fall under this methodology. These virtual bidding zones may be accompanied by virtual scheduling areas and virtual NEMO trading hubs to ensure proper modelling of the functionality.

5. In this DA SEC Methodology, unless the context requires otherwise:
   a) the terms used apply in the context of the SDAC;
   b) the table of contents and headings are inserted for convenience only and do not affect the interpretation of this methodology; and
   c) any reference to legislation, regulations, directive, order, instrument, code or any other enactment shall include any modification, extension or re-enactment of it then in force.

Article 3 – General principles for the Scheduled Exchanges Calculation

1. The Scheduled Exchange Calculator shall calculate Scheduled Exchanges between bidding zones, scheduling areas and NEMO trading hubs as defined in this methodology.

2. The DA Scheduled Exchanges calculation is integrated in the SDAC in accordance with the algorithm methodology, and consequently performed by the MCO function. NEMOs are responsible for operating the MCO function~~,~~ and will therefore perform the task of calculating Scheduled Exchanges as the Scheduled Exchange Calculator in accordance with the algorithm methodology.

3. The Scheduled Exchange Calculator shall use the following input information for the Scheduled Exchanges calculation, as described in Articles 4, 5 and 6 of this DA SEC Methodology, pursuant to the algorithm methodology and Article 43(2) of CACM Regulation, resulting from the SDAC, for each market time unit:
   a) net position per bidding zone;
   b) net position per scheduling area;
   c) net position per NEMO trading hub; and
   d) a single clearing price for each bidding zone in EUR/MWh.

4. The DA SEC Methodology shall be based on a step-wise calculation of DA Scheduled Exchanges:

   i. The Scheduled Exchange calculation shall be performed per market time unit;
   ii. The Scheduled Exchange Calculator shall calculate respective Scheduled Exchanges stepwise for the three different levels (bidding zones, scheduling areas and NEMO trading hubs);
   iii. Each subsequent step shall take as a constraint the output from the previous step;
   iv. The calculation of the DA Scheduled Exchanges between bidding zones shall follow the principles described in Article 4 of this DA SEC Methodology;
   v. The calculation of the Scheduled Exchanges between scheduling areas shall follow the principles described in Article 5 of this DA SEC Methodology;
   vi. The calculation of Scheduled Exchanges between NEMO trading hubs shall follow the principles described in Article 6 of this DA SEC Methodology; and
   vii. Scheduled Exchanges shall always be calculated for a specific direction i.e. Scheduled Exchange from/to.

5. For cross border HVDC interconnectors within a capacity calculation region (hereafter referred to as "CCR") applying the flow-based approach and where the impact of an exchange over the HVDC interconnector is considered during flow-based capacity allocation, the Scheduled Exchanges over the respective bidding zone border may differ from the flow based net positions of the virtual hub used to model the HVDC interconnector to ensure optimal solution in accordance with this DA SEC Methodology. This allows, if configured as such, a calculation based only on net positions of the scheduling area and bidding zone, a set of constraints and Scheduled Exchanges on relevant bidding zone borders, as for other AC interconnectors.

6. For a bidding zone with multiple scheduling areas, the Scheduled Exchanges between bidding zones shall be calculated by the Scheduled Exchange Calculator and the sum of the Scheduled Exchanges on the scheduling areas' borders corresponding to this bidding zone border shall equal the Scheduled Exchange on this bidding zone border.

Article 4 – Calculation of Scheduled Exchanges between bidding zones

1. The Scheduled Exchange Calculator shall calculate the Scheduled Exchanges between bidding zones based on bidding zone net positions according to Article 3 of this DA SEC Methodology.

2. Bidding zone borders in the calculation in this Article consist of the set of bidding zone borders and, where relevant, individual HVDC interconnectors considered in the SDAC.

3. When considering the ~~Coordinated Net Transmission Capacity (hereafter referred to as "CNTC")~~cNTC approach, where a price difference exists between two bidding zones either the available capacity has been fully used or another allocation constraint (e.g. ramping constraint) was active. Hence, the Scheduled Exchange between bidding zones shall respect the active allocation constraint.

4. When the allocation of cross-border capacities is based on bidding zone net positions (e.g. flow-based approach), or in case of indeterminacies[1], several routes could be possible. The optimisation of the Scheduled Exchanges between bidding zones shall therefore aim to minimise the costs associated with the Scheduled Exchanges between the involved bidding zones taking into account the principles in Article 3(4) of this DA SEC Methodology. For this minimisation, the Scheduled Exchanges between involved bidding zones shall be used as a set of variables to minimise the target function following:

$$\min\left(\sum_{i=1}^{n} lc_i * flow\_bzb_{i,h} + \sum_{i=1}^{n} qc_i * flow\_bzb_{i,h}^2\right)$$

With:

- lc_i = linear cost coefficient associated to bidding zone border i
- qc_i = quadratic cost coefficient associated to bidding zone border i

[1] In case there is no congestion between two or more bidding zones applying a ~~CNTC~~cNTC approach (i.e. no allocation constraint was active and the bidding zone prices are equal), then multiple routes are available.

- $flow\_bzb_{i,h}$ = Scheduled Exchange on bidding zone border i for market time unit h
- n = total number of bidding zone borders and individual HVDC interconnectors considered in the optimization

5. In caseUnder the default calculation method of the Scheduled Exchanges between bidding zones, as described in Art.Article 4(4) is unable to find), a solution shall be found by the time limit stopping criterion, defined in the operational procedure in accordance with the algorithm methodology pursuant to Article 37(5) of the CACM Regulation. If a solution cannot be found by the time limit stopping criterion, and thereby inducing the risk of a decoupling, a backup modecalculation method for the calculation of Scheduled Exchanges between bidding zones shall automatically be triggered. InIf the backup modecalculation method is triggered, the complexity of the optimisation problem is toshall be reduced by using a linearized target function, while still maintaining a solution within the feasible domain of the original problem. In this context, a first-order Taylor approximation isshall be used to estimate the quadratic terms within the original target function by leveraging reference flows. These reference flows are derived from the solutions to previously addressed volume indeterminacy problems. Consequently, in such case, instead of using the target function described in Art. Article 4(4)), the following linear objective function shall be used:

$$\min\left(\sum_{i=1}^{n} lc_i * flow\_bzb_{i,h} + \sum_{i=1}^{n} 2qc_i * flow\_bzb_{i,h}^{ref} * (flow\_bzb_{i,h} - flow\_bzb_{i,h}^{ref})\right)$$

With:

- lc_i = linear cost coefficient associated to bidding zone border i
- qc_i = quadratic cost coefficient associated to bidding zone border i
- $flow\_bzb_{i,h}$ = Scheduled Exchange on bidding zone border i for market time unit h
- $flow\_bzb_{i,h}^{ref}$ = Reference Scheduled Exchange on bidding zone border i for market time unit h, around which the first order Taylor approximation is computed.
- n = total number of bidding zone borders and individual HVDC interconnectors considered in the optimization

6. The costs coefficients (both linear and quadratic) associated to each bidding zone border are provided as an input by TSOs. The cost coefficients are fixed for a given market topology (set of bidding zone borders) and do not change per market time unit. The cost coefficients are determined in such a way that following objectives are met:

   i. Uniqueness by introducing a quadratic term per bidding zone border in the target function.

   ii. Shortest path rule to avoid loops and to ensure a minimization of transits between bidding zones by setting of the linear cost coefficient.

   iii. Prioritisation rule to prioritise certain path (set of bidding zone borders) for exchanges between two bidding zones to avoid path of the flow which will reduce economic efficiency.

   iv. For HVDC interconnectors, which apply losses in the SDAC, the linear cost coefficient shall be set to a high value to avoid undue scheduling through the interconnector.

   v. For a given bidding zone, in case a bidding zone border has a significantly higher or lower thermal capacity than the other bidding zone borders, then the quadratic cost coefficient of this

bidding zone border shall be set appropriately (i.e. bidding zone borders which have a limited installed capacity will set a higher quadratic cost coefficient)).

7. The cost coefficients are determined in such a way that the optimisation avoids creating high differences between Scheduled Exchange values it calculates, especially on a given bidding zone's borders, while respecting the objectives set forth in Article 4(56). Hence, the ratio between the different cost coefficients on each bidding zone border is more important than the exact value of the cost coefficient.

8. CCRs shall set the same cost coefficients (linear and quadratic) for all borders within the CCR, unless this approach breaches the objectives set forth in Article 4(56).

9. TSOs and NEMOs shall review the cost coefficients used in the SDAC regularly. Additionally, when a new bidding zone border is added to the SDAC or when a CCR implements either CNTCcNTC of flow-based, the cost coefficients on all bidding zone borders of the CCR bidding zone borders to neighbouring CCR(s) shall be reviewed to ensure compliancy with the requirements set forth in previous Articles. National Regulatory Authorities (NRAs) shall be informed of the changes.

10. The calculated Scheduled Exchanges between bidding zones shall be consistent with the bidding zones' net positions according to Article 3 of this DA SEC Methodology.

11. The Scheduled Exchange Calculator shall respect the allocation constraints in the SDAC.

Article 5 – Calculation of Scheduled Exchanges between scheduling areas

1. After the calculation of the Scheduled Exchanges between bidding zones, the Scheduled Exchange Calculator can calculate the Scheduled Exchanges between scheduling areas, where appropriate. In case scheduling areas are equal to bidding zones, Scheduled Exchanges between two bidding zones are equal to the Scheduled Exchanges between two scheduling areas.

2. Calculation of Scheduled Exchanges between scheduling areas is only performed between scheduling areas where at least one NEMO operates.

3. If there is more than one scheduling area within a bidding zone, then:
   a) The Scheduled Exchange Calculator shall calculate the Scheduled Exchanges between the scheduling areas using the scheduling areas' net positions according to Article 3 of this DA SEC Methodology.
   b) For the calculation of Scheduled Exchanges between scheduling areas the same optimisation approach shall be applied as for the Scheduled Exchanges between bidding zones following:

$$\min\left(\sum_{i=1}^{n} lc_i * flow\_sab_{i,h} + \sum_{i=1}^{n} qc_i * flow\_sab_{i,h}^2\right)$$

With:

- lc_i = linear cost coefficient associated to scheduling area border i

- qc_i = quadratic cost coefficient associated to scheduling area border i
- $flow\_sab_{i,h}$ = Scheduled Exchange on scheduling area border i and market time unit h
- n = number of scheduling area borders considered in the optimization

c) If there are multiple scheduling areas on one (or both) side(s) of the bidding zone border, then the Scheduled Exchanges between the scheduling areas, over the bidding zone border, shall be attributed to each scheduling area border proportionally to the installed thermal capacity of the interconnectors on each scheduling area border, following:

$$\boldsymbol{flow\_sab_{i,h} = \frac{TC\_sab_i}{TC\_bzb_{,k}}\ flow\_bzb_{k,h}}$$

With:

- $flow\_sab_{i,h}$ = Scheduled Exchange on scheduling area border i and market time unit h
- TC_sab_i = Thermal capacity installed on scheduling area border i
- TC_bzb_k = Thermal capacity installed on bidding zone border k of which scheduling area border i is a part of
- $flow\_bzb_{k,h}$ = Scheduled Exchange on bidding zone border k and market time unit h

4. The linear and quadratic cost coefficients for the scheduling area borders within the same bidding zone border shall be equal.

5. The calculated Scheduled Exchanges between scheduling areas shall be consistent with the scheduling areas' net positions according to Article 3 of this DA SEC Methodology.

Article 6 – Calculation of Scheduled Exchanges between NEMO trading hubs

1. The Scheduled Exchange Calculator shall calculate the Scheduled Exchanges between NEMO trading hubs based on NEMO trading hubs' net positions according to Article 3 of this DA SEC Methodology.

2. The calculation of Scheduled Exchanges between NEMO trading hubs aims at minimizing the Net Financial Exposure (hereinafter referred to as "NFE") between the central counter parties associated to each NEMO (hereinafter referred to as "CCP"). The NFE between two CCPs A and B depends on the Scheduled Exchanges between the NEMO trading hubs of their corresponding NEMO as follows:

$$NFE_{A|B} = \sum_{t \in T} \sum_{(n1,n2) \in L_{A,B}} \left[p^t_{n_2} \cdot \left(1 - loss_{n1,n2}\right) \cdot flow^t_{n_1,n_2} - p^t_{n_1} \cdot \left(1 - loss_{n2,n1}\right) \cdot flow^t_{n_2,n_1}\right]$$

with:

- A, B being two different CCPs

- $L_{A,B} = \{(n_1, n_2) \in L^d | \ ccp(n_1) = A \text{ and } ccp(n_2) = B\}$ being the set of all lines linking NEMO trading hubs of NEMO corresponding to CCP A and NEMO trading hubs of NEMO corresponding to CCP B.
- L^d is the set of all directed lines connecting NEMO Trading Hubs.
- $ccp(n)$ is a function returning the CCP corresponding to NEMO trading hub n
- p_n^t is the clearing price for bidding zone applying on NTH n at market time unit t
- $flow_{n_1,n_2}^t$ is the Scheduled Exchange from NEMO trading hub $n_1$to NEMO trading hub n_2 for market time unit t
- $loss_{n1,n2}$ is the loss associated to the network constraint underlying scheduled exchange, or 0 if no such constraint exists
- t is the market time unit and T is the set of all market time units

3. For each market time unit t, Scheduled Exchanges between NEMO trading hubs ($flow_{n,n'}^t$) are found in such a way to minimize sum of absolute net financial exposures (NFE) between all CCP pairs, and sum of scheduled exchanges between NEMO trading hubs and maximum volume (weighted by α parameter):

$$\min\left(\overbrace{\sum_{c\in CCP}\sum_{c'\in CCP\setminus\{c\}}|NFE_{c|c'}|}^{\text{Absolute Exposures}} + \alpha\left(\overbrace{\sum_{t\in T}\sum_{(n,n')\in NTH^2}|flow_{n,n'}^t|}^{\text{Scheduled Exchanges}} + \overbrace{\sum_{t\in T}\sum_{sa\in SA}\max_{(n,n')\in NTH(sa)^2}|flows_{n,n'}^t|}^{\text{Max Volumes}}\right)\right),$$

subject to constraints:

$\overline{\boldsymbol{flows}}^{\boldsymbol{t}}_{\boldsymbol{sa_1},\boldsymbol{sa_2}} = \sum_{(\boldsymbol{n},\boldsymbol{n'})\in\boldsymbol{L^d}\mid\boldsymbol{SA}(\boldsymbol{n})=\boldsymbol{sa_1},\boldsymbol{SA}(\boldsymbol{n'})=\boldsymbol{sa_2}} \boldsymbol{flow}^{\boldsymbol{t}}_{\boldsymbol{n},\boldsymbol{n'}}$	**for** $\forall \boldsymbol{sa_1} \in \mathbf{SA}, \forall \boldsymbol{sa_2} \in \mathbf{SA} \setminus \{\boldsymbol{sa_1}\}, \forall \mathbf{t} \in \mathbf{T}$	(1)
$\overline{NP}_n^t = \sum_{l^-=(n,n')\in L^d} flow_{l^-}^t - \sum_{l^+=(n',n)\in L^d} flow_{l^+}^t$	for $\forall n \in NTH, \forall n'$ $\in$ NTH $\setminus \{n\}, \forall$t $\in$ T	(2)

with:

- NTH is the set of all NEMO trading hubs
- CCP is the set of all the CCPs, i.e. CCP $= \{ccp(n), \forall n \in \text{NTH}\}$)
- c is a CCP, c′ is another CCP (different than CCP c)
- NTH(*sa*) is the set of NEMO trading hubs in the scheduling area *sa*.
- SA(n) is the function returning the scheduling area associated to NEMO trading hub *n*

- α is a numeric parameter in €/MW which ensures that financial exposures are minimized before volume terms and at the same time guarantees algorithmic stability. The valid range of values is:
  - $0 < \alpha \leq \frac{0.01}{4}$ €/MW
- $\overline{flows}_{sa_1,sa_2}$ is the scheduled exchange from scheduling area sa_1 to scheduling area sa_2
- $\overline{NP}_n$ is the net position of NTH n
- $flow_l^{t-}$ and $flow_l^{t+}$ are respectively the flow from NTH n to NTH n', and NTH n' to NTH n at market time unit t.

The three terms in the "linear" objective function have the following meaning in particular order:

- minimization of the total sum of absolute Net Financial Exposures (Linear)
- minimization of total exchange volumes, to guarantee that loop flows are penalized (Linear)
- minimization of max volumes (Linear), to guarantee that unequally distributed flows are penalized, given that previous terms above hold.

The last two terms are given a lower priority than minimization of NFE by the α parameter.

Constraint (1) ensures that the sum of all inter-NTH exchanges associated to an exchange between two scheduling areas is balanced.

Constraint (2) ensures that the sum of exchanges entering/leaving an NTH is balanced with its related net position.

Article 7 – Information provided by the Scheduled Exchange Calculator

1. The Scheduled Exchange Calculator shall provide the following information pursuant to the algorithm methodology and Articles 43(2) and 49(2) of CACM Regulation, resulting from the SDAC, to relevant NEMOs, central counter parties, shipping agents and TSOs, for each market time unit:
   a) Net position per bidding zone;
   b) Net position per scheduling area;
   c) Net position per NEMO trading hub;
   d) Scheduled Exchanges for each bidding zone border, between each scheduling areas and between each NEMO trading hubs; and
   e) Where relevant, Scheduled Exchanges into and out of individual relevant HVDC interconnectors (difference in Scheduled Exchanges in/out reflecting losses where appliable).); and
   f) Calculation method - either default calculation method according to Article 4(4) or backup calculation method according to Article 4(5).

2. The information listed in Article 7(1)(d) and 7(1)(e) is required to ensure a coherent calculation of Scheduled Exchanges between different CCRs and to ensure the implementation of arrangements pursuant Article 45 of CACM Regulation.

3. The Scheduled Exchange Calculator shall notify the results of the DA Scheduled Exchanges Calculation by 13:01 under normal operation, and will endeavour to deliver these ahead of the

intraday gate opening time so that the day-ahead post-coupling processes can be completed. If there are issues ascertaining the market coupling results, the Schedule Exchange Calculator shall notify the results no later than 15:30 market time day-ahead.

Article 8 – Implementation of the DA SEC Methodology

1. Upon approval of this methodology for calculating scheduled exchanges resulting from single day-ahead coupling, each TSO shall publish it on the internet in accordance with Article 9(14) of the CACM Regulation.
2. The TSOs shall implement the DA SEC Methodology no later than three months after its approval.
3. Notwithstanding paragraph 2 of this Article, the TSOs shall apply Articles 4(5), 7(1)(f) and 7(3) in the DA SEC Methodology as of the go-live of the 15-minute MTU in SDAC in accordance with Articles 8(2) and 8(4) of Regulation (EU) 2019/943.

Article 9 – Language

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

ANNEX 1

List of TSOs subject to the approved DA SEC methodology:

- APG – Austrian Power Grid AG
- Elia – Elia System Operator S.A
- ESO – Electroenergien Sistemen Operator EAD
- HOPS - Croatian Transmission System Operator Ltd
- ČEPS - ČEPS, a.s.
- Energinet – Energinet
- Elering – Elering AS
- Fingrid – Fingrid OyJ
- Kraftnät Åland Ab
- RTE - Réseau de Transport d'Electricité, S.A
- Amprion – Amprion GmbH
- Baltic Cable AB
- TransnetBW -TransnetBW GmbH
- TenneT GER – TenneT TSO GmbH
- 50Hertz – 50Hertz Transmission GmbH
- IPTO – Independent Power Transmission Operator S.A.

- MAVIR ZRt. - MAVIR Magyar Villamosenergia-ipari Átviteli Rendszerirányító Zártkörűen Működő Részvénytársaság ZRt.
- EirGrid – EirGrid plc
- Terna – Terna SpA
- Augstsprieguma tïkls - AS Augstsprieguma tïkls
- LITGRID – LITGRID AB
- CREOS Luxembourg – CREOS Luxembourg S.A.
- TenneT TSO – TenneT TSO B.V.
- PSE – PSE S.A.
- REN - Rede Eléctrica Nacional, S.A.
- Transelectrica - C.N. Transelectrica S.A.
- SEPS - Slovenská elektrizačná prenosovú sústava, a.s.
- Statnett SF
- ELES – ELES, d.o.o.
- REE - Red Eléctrica de España S.A.U.
- Svenska kraftnät - Affärsverket Svenska Kraftnät
- SONI System Operator for Northern Ireland Ltd.