# Annex 3 to the Algorithm methodology:

## All NEMOs proposal for amendment to

# Algorithm monitoring methodology for single dayaheadday-ahead coupling

## 23 November 2023

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# TITLE 1

## General provisions

### Article 1
### General specifications

1. This Annex elaborates the principles for the required indicators monitoring the SDAC algorithm. More specifically, it is referred to by the following Articles in the Algorithm methodology:

   a) Article 7: Calculation of effective usage, anticipated usage and usage range, using the defined data sets and the scalability indicator for calculating the usage range;

   b) Article 8: Monitoring algorithm performance;

   c) Article 9: Scalability report;

   d) Article 11: Research and development activities;

   e) Article 12: Corrective measures; and

   f) Article 18: Impact assessment methodology for SDAC and IDA algorithms, for the assessment of requests for change.

2. The principles and processes described in this methodology shall be further developed and detailed within the algorithm monitoring procedures in the DA framework.

3. 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.

4. ~~In this Algorithm monitoring methodology, any reference to SDAC algorithm directs to the same algorithm solution used for the co-optimised allocation of cross-zonal capacities for the exchange of balancing capacity or sharing of reserves (also "co-optimisation", in accordance with Article 40(1) of Commission Regulation (EU) 2017/2195 of 23/11/2017 establishing a guideline on electricity balancing).~~

### Article 2
### Data sets for indicators

Being 'M' the month and 'Y' the year in which the assessment is done, the indicators shall be calculated with a daily granularity over different temporal sets of delivery days. Specifically:

   a) ~~the~~The recent historical set shall comprise the delivery days of the previous K (K<13) months, starting from the Kth month ('M') 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;

   b) ~~the~~The rolling historical set shall comprise the previous year's delivery 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~~The whole year historical set will comprise the previous full ~~years'~~year's delivery days (Y-1), 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~~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~~; and~~.

e) ~~the~~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.

# TITLE 2

## Application of ~~Indicators~~indicators for the SDAC algorithm

### Article 3
### Monitoring of operations and reporting

1. For monitoring and reporting the evolution of the SDAC algorithm, the performance indicators described under Title 3, 4 and 5 shall be used.

2. The usage indicators under Title 4 shall be monitored by comparing the effective usage of their functionality in the recent historical set pursuant to Article 2(a) for all days against the usage range of the same functionality, which ~~was~~is calculated pursuant to Article 5(3).

3. The economic surplus indicator pursuant to Article 7 and the repeatability indicator pursuant to Article 8 shall be monitored by assessing the values of the recent historical set pursuant to Article 2(c).

4. For monitoring the scalability, the values of the recent historical set pursuant to Article 2(a) shall be assessed against the thresholds of the scalability indicator pursuant to Article 9(2).

5. For reporting purposes, the indicators referred to under Title 3, 4 and 5 shall use the rolling historical set pursuant to Article 2(b).

6. For reporting purposes, an average of values may be applied.

### Article 4
### Request for ~~Change~~change impact assessment

1. The request for change impact assessment ~~should~~shall assess the impact on scalability by a request for change.

2. The assessment of the scalability indicator shall be performed for:

a) ~~the~~The historical scenario: using as inputs the actual usage of all the existing functionalities as recorded over the whole year historical set under Article 2(c) and the anticipated usage of the functionality under assessment calculated over the near future set under Article 2(d) and applying the relevant thresholds in accordance with Article 9(2~~);~~).

b) ~~the~~The near future scenario: using as inputs the anticipated usage of all the functionalities calculated on the near future set under Article 2(d) and using the relevant thresholds in accordance with Article 9(2).

## Article 5
### Scalability assessment

1. The scalability assessment ~~should~~shall assess the impact of the long-term anticipated growth on the SDAC algorithm scalability, considering the expected increase of usage of functionalities.
2. The relevant thresholds pursuant to Article 9(2) shall be applied on the values resulting from simulation of the SDAC algorithm including the anticipated usage of all functionalities on:

   a) the near future set pursuant to Article 2(d~~)~~); and
   b) the distant future set pursuant to Article 2(e).

3. The usage range shall be calculated as the maximum usage of the functionalities supported by the SDAC algorithm resulting from paragraph 2(b).

## Article 6
### Research and ~~Development~~development assessment

1. The research and development assessment ~~should~~shall ensure the capability of the SDAC algorithm to support in the medium and long term the anticipated market growth and the extension of requirements and shall use all performance indicators defined under Title 3.
2. The performance indicators shall be calculated with the usage range of all the functionalities when simulating the run of the SDAC algorithm on the distant future set pursuant to Article 2(e) and shall be assessed as follows:

   a) ~~for~~For the scalability indicator, the relevant thresholds in accordance with Article 9(2) shall be used~~;~~.
   b) ~~for~~For the economic surplus indicator pursuant to Article 7 and the repeatability indicator pursuant to Article 8, the obtained values shall be assessed against the rolling historical set pursuant to Article 2(b).

# TITLE 3

# Indicators on SDAC algorithm performance

## Article 7
### Indicators on SDAC algorithm's ability to ~~maximize~~maximise economic surplus

The indicators to monitor the ability of the SDAC algorithm to ~~maximize~~maximise the economic surplus are:

1. **Economic surplus gain with respect to the first solution** – This indicator is the difference between the economic surplus of the accepted solution and the economic surplus of the first solution found. This indicator is not valid for comparing two different versions of the SDAC algorithm. It should be used only as an indicative of the improvements of the solutions after the first one is found.
2. **Economic surplus gain after increasing the calculation time by T minutes** – This indicator measures the gain in the economic surplus if the same delivery day is run again on a hardware with the same ~~min~~minimum requirements as the one used for delivering results, giving the SDAC algorithm T minutes

more. to find a solution. This indicator needs to be calculated ex- post SDAC algorithm calculation, in a different process.

## Article 8
### Indicators on SDAC algorithm repeatability

The indicators to monitor algorithm repeatability reflect the differences of clearing prices and accepted quantities for different orders over the relevant MTUs and bidding zones between two runs of the SDAC algorithm. Potential differences shall be calculated while using the same inputs, configuration of hardware and software and at the same number of iterations and comparing the last common solutions in both runs.

## Article 9
### Indicators on SDAC ~~Algorithm~~algorithm scalability

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

2. The scalability indicator pursuant to paragraph 1 shall be based on data sets in accordance with Article 2 and be assessed against the following thresholds (the 'x', 'y' and '~~y'~~z' values shall be set in the algorithm monitoring procedure):

   a) ~~in~~In x% of the cases the indicator shall be lower than y minutes~~, and~~.
   b) ~~its~~Its average value shall be smaller than z minutes~~;~~.

# TITLE 4

## Indicators on the SDAC 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 DA product type, per bidding zone over time, and the corresponding total volume:

   a) **Total number of steps at bidding zone level** – This indicator counts the total number of steps in the aggregated price-per-volume- curves for each bidding zone and MTU from all orders of all NEMO ~~Trading Hubs~~trading hubs. A step is a segment made of two consecutive curve points of the price-per-volume- curve with different quantities. One single value is provided per delivery day.
   b) **Total number of block orders** – This indicator counts the total number of block orders per delivery day and bidding zone.
   c) **Total number of block order exclusive groups** – This indicator counts the total number of exclusive groups existing for the block orders per delivery day.

d) **Total number of linked families** – This indicator counts the total number of families of linked block orders per delivery day.

e) **Total number of complex orders** – This indicator counts the total number of complex orders per delivery day and bidding zone.

f) **Total number of scalable complex orders** – This indicator counts the total number of scalable complex orders per delivery day and bidding zone.

g) **Total number of demand merit orders** – This indicator counts the total number of demand merit orders per delivery 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 delivery day and bidding zone.

i) **Total number of PUN orders** – This indicator counts the total number of PUN orders per delivery day and bidding zone. That means the number of unique PUN prices regarding the input data.

2. ~~Indicators on the evolution of the number of submitted orders of each SBCP type in the co-optimisation, per bidding zone over time, and the corresponding total volume:~~

   a) ~~Having the Bidding Guide and Bidding Structure for the co-optimization defined, this section will be updated with the list of products following the same rules that the ones that set the list of indicators for DA:~~
      i. ~~Aggregated price-per-volume-curves for each bidding zone and MTU shall be provided as one single value per delivery day.~~
      ii. ~~Different product types different than aggregated price-per-volume-curves shall be counted as the total per delivery day and bidding zone. If different sub-types exist, there will be reported.~~
      iii. ~~Product aggregation in groups or families shall be counted as the total per delivery day.~~

3. ~~Indicators on the evolution of the number of submitted orders for the linked DA products and SBCPs in the co-optimisation, per bidding zone over time, and the corresponding total volume for the market:~~

   a) ~~Having the Bidding Guide and Bidding Structure for the co-optimization defined, this section will be updated with the list of products following the same rules that the ones that set the list of indicators for DA:~~
      i. ~~Aggregated price-per-volume-curves for each bidding zone and MTU shall be provided as one single value per delivery day.~~
      ii. ~~Different product types different than aggregated price-per-volume-curves shall be counted as the total per delivery day and bidding zone. If different sub-types exist, there will be reported.~~
      iii. ~~Product aggregation in groups or families shall be counted as the total per delivery day.~~

## Article 11
### Indicators to describe the geographical extension of the SDAC

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 delivery 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 columns of the PTDF matrixes that exist per delivery day.

c) **Number of scheduling areas** – Total number of scheduling areas. This indicator is obtained by counting all the scheduling areas existing per delivery day.

d) **Number of NEMO ~~Trading Hub~~trading hubs** – Total number of NEMO ~~Trading Hub~~trading hubs per delivery day.

e) **Number of NEMOs** – Total number of different NEMOs in the delivery day. One NEMO may be operating several NEMO ~~Trading Hub~~trading hubs, each one in a different bidding zone and scheduling area.

f) ~~**Number of bidding zones where co-optimisation is used** – Total number of different bidding zones in which a combination of DA products and SBCPs is used under the co-optimisation process.~~

## Article 12
### Indicators to describe the network constraints

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 delivery 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~~trading hub lines** – This indicator counts the total number of lines between NEMO ~~Trading Hub~~trading hubs.

# TITLE 5

## Indicators on the SDAC algorithm output

## Article 13
### Indicators to describe the output of ~~maximization~~maximisation of economic surplus

Indicators on the ~~maximization~~maximisation of economic surplus:

a) **Economic surplus of the first solution found** – This indicator is obtained as provided by the SDAC algorithm, querying the utility of the solution that the SDAC algorithm classifies for the DA surplus as the first solution per delivery day.

~~a)~~b) **Economic surplus of the final solution** – This indicator is obtained as provided by the SDAC algorithm, querying the utility of the solution that the SDAC algorithm classifies for the DA ~~and BC market~~ surplus as the ~~first~~accepted solution per delivery day.

b) ~~**Economic surplus of the final solution** – This indicator is obtained as provided by the SDAC algorithm, querying the utility of the solution that the SDAC algorithm classifies for the DA and BC market surplus as the accepted solution per delivery day.~~

c) ~~**Economic surplus of the first solution found for the DA market under the co-optimisation** – This indicator is obtained as provided by the SDAC algorithm, querying the utility of the solution that the SDAC algorithm classifies for the DA market surplus as the first solution per delivery day.~~

d) ~~**Economic surplus of the final solution for the DA market under the co-optimisation** – This indicator is obtained as provided by the co-optimisation algorithm, querying the utility of the solution that the co-optimisation algorithm classifies as the accepted solution per delivery day.~~

e) ~~**Economic surplus of the first solution found for the BC market under the co-optimisation** – This indicator is obtained as provided by the SDAC algorithm, querying the utility of the solution that the SDAC algorithm classifies for the BC market surplus as the first solution per delivery day.~~

f) ~~**Economic surplus of the final solution found for the BC market under the co-optimisation** – This indicator is obtained as provided by the SDAC algorithm, querying the utility of the solution that the SDAC algorithm classifies for the BC market surplus as the accepted solution per delivery day.~~

## Article 14
### Indicators to describe the status of orders

1. Indicators on the evolution of the number of matched orders and paradoxically rejected orders of each DA product type over time, and the corresponding total volume for the set of DA products:

   a) **Total number of matched blocks** – This indicator counts the total number of matched blocks per delivery day and bidding zone.

   b) **Total number of matched complex orders** – This indicator counts the total number of matched complex orders per delivery day and bidding zone.

   c) **Total number of matched scalable complex orders** – This indicator counts the total number of matched scalable complex orders per delivery day and bidding zone.

   d) **Total number of matched non-PUN merit orders** – This indicator counts the total number of matched merit orders (non-PUN merit orders) per delivery day and bidding zone. It ~~will be~~is calculated as the count of non-PUN merit orders whose matching quantity is greater than 0.

   e) **Total number of matched PUN orders** – This indicator counts the total number of matched PUN orders per delivery day and bidding zone. That means the number of unique PUN prices regarding the input data. It ~~will be~~is calculated as the count of PUN orders whose matching quantity is greater than 0.

   f) **Total matched volume from curves** – This indicator aggregates the total matched volume from supply and demand curves. It ~~will be~~is calculated as the sum of all ~~"market time unit"~~MTU-weighted unrounded volume matched at each relevant MTU and bidding zones for supply and demand curves.

   g) **Total matched volume from blocks** – This indicator aggregates the total matched volume from blocks. It ~~will be~~is calculated as sum of all ~~"market time unit"~~MTU-weighted unrounded volume matched at each relevant MTU and bidding zones from blocks.

   h) **Total matched volume from complex orders** – This indicator aggregates the total matched volume from complex orders. It ~~will be~~is calculated as sum of all unrounded volume matched at each relevant MTU and bidding zones from complex orders.

i) **Total matched volume from scalable complex orders** – This indicator aggregates the total matched volume from scalable complex orders. It ~~will be~~is calculated as sum of all unrounded volume matched at each relevant MTU and bidding zones from scalable complex orders.

j) **Total matched volume from (non-PUN) merit orders** – This indicator aggregates the total matched volume from (non-PUN) merit orders. It ~~will be~~is calculated as sum of all unrounded volume matched at each relevant MTU and bidding zones from (non-PUN) merit orders.

k) **Total matched volume from PUN orders** – This indicator ~~aggregated~~aggregates the total matched volume from PUN orders. It ~~will be~~is calculated as sum of all unrounded volume matched at each relevant MTU and bidding zones from PUN orders.

2. Indicators on paradoxically rejected orders for the set of DA products~~-~~:

a) **Number of PRBs in the final solution** – This indicator counts the total number of Paradoxically Rejected Blocks (PRBs) in the accepted solution per delivery day and bidding zone.

b) **Number of PRMICs in the final solution** – This indicator counts the total number of Paradoxically Rejected ~~MICs~~Minimum Income Conditions (PRMICs) ~~of the~~ complex orders and scalable complex orders in the accepted solution per delivery day and bidding zone.

c) **Maximum Delta ~~P~~Parameter in the final solution** – This indicator reports the maximum Delta ~~P~~Parameter of the blocks for the accepted solution per delivery day.

d) **Maximum Delta MIC in the final solution** – This indicator reports the maximum Delta MIC of the complex orders and scalable complex orders for the accepted solution per delivery day.

e) **PRB utility loss in the final solution** – This indicator reports the utility (economic surplus) loss due to ~~paradoxically rejected blocks~~PRBs per delivery day.

f) **PRMIC utility loss in the final solution** – This indicator reports the utility (economic surplus) loss due to paradoxically rejected MICs and Maximum Payment Conditions (MPCs~~)~~ ~~of the~~ complex orders and scalable complex orders per delivery day.

g) **Volume of PRBs in the final solution** – This indicator sums the volume of all the ~~Paradoxically Rejected Blocks (PRBs)~~PRBs in the accepted solution per delivery day and bidding zone.

h) **Volume of PRMICs in the final solution** – This indicator sums the volume of all the ~~Paradoxically Rejected MICs (~~PRMICs~~)~~ ~~of the~~ complex orders and scalable complex orders in the accepted solution per delivery day and bidding zone.

3. ~~Indicators on the evolution of number of matched orders and paradoxically rejected orders of each SBCP product type over time, and the corresponding total volume in the set of SBCPs in the co-optimisation:~~

a) ~~Having the Bidding Guide and Bidding Structure for the co-optimization defined, this section will be updated with the set of indicators following the same rules as the ones for DA market.~~

4. ~~Indicators on paradoxically rejected orders in the set of SBCPs in the co-optimisation:~~

a) ~~Having the Bidding Guide and Bidding Structure for the co-optimization defined, this section will be updated with the set of indicators following the same rules as the ones for DA market.~~

~~5.~~3. Indicators on the evolution of the use of network constraints ~~along the~~over 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~~direction. A line is considered fully ~~utilized~~utilised when the energy flow is equal to its capacity.

## Article 15
## Indicators to describe the IT calculation process

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 SDAC algorithm requires in order to read all the data needed for a delivery day from the ~~SQL~~ database. Different methods exist for the calculation of this indicator~~:~~.

b) **Input data delivery day creation** – This indicator measures the amount of time the SDAC algorithm requires in order to create a delivery 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~~led to the first OK solution found. This time ~~will~~does not include the time to read the input data and create the solver models. It ~~will~~does neither include the time spent in the master ~~computers~~computer's 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 optimisation process limited by the amount of time available for running the SDAC 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.