

CACM Annual Report 2018



Index

Letter to stakeholders

Legal framework

Executive summary

Chapter 1: SDAC

Background
Operations report
Performance Monitoring report
Scalability report
R&D report

Chapter 2: SIDC

Background
Operations report
Performance Monitoring report
Scalability report
R&D report

Annexes

Annex 1: Monitoring parameters
Annex 2: Notes

Please, check the All NEMO Committee and ENTSO-E websites where you can find further background information on SDAC and SIDC as well as a glossary with clarifications about the acronyms used in this report.

Letter to stakeholders

Dear Stakeholders, NRAs, ACER and Commission,

You're handling the first issue of the CACM Yearly Report, drafted by All NEMOs in cooperation with All TSOs. For us, this is not just a compliance action towards the provisions included in CACM and Algorithm methodology, rather it is a tangible proof of our belief that transparency and stakeholders' involvement is key to support an effective EU market integration.

The 2018 report is just the first issue and aims to address 2018 for the past and 2019 for the future scenarios, due to evolving regulatory framework and IT processes to produce data. This report will set the basis for the next annual report which will address 2017-2019 for the past and 2020-2022 for the future scenarios. For the next years to come we target anticipating publication to June and to improve the quantity and quality of information provided and of its presentation.

From a practical perspective, this report is based on two main chapters, respectively dedicated to SDAC and SIDC, mirroring each other in order to support a synoptical reading of them. The goal is more to highlight the structural differences between the two projects, related to their inherent differences in market design, rather than suggest an often misleading comparison of values.

“Transparency and stakeholders' involvement is key to support an effective EU market integration”

Besides, it must be understood that the geographical and chronological scope for both markets is different due to the ongoing integration process of the European Electricity market, so there will be some asymmetries:

- ***Geographical scope:*** *The day-ahead market is close to full integration, with a full coupling expected in 2020 between the MRC and 4MMC areas which have had operational singularities during 2018 and 2019. As for the SIDC, the incipient creation of the intraday continuous market, means that this report applies to the 14 countries that went live in the 1st wave although 7 more countries have joined the operations on 19th November 2019.*
- ***Chronological scope:*** *We start this comparative in 2018, however SIDC starting point is June 2018, that is when it started operations.*



In their turn, each of the two chapters include four paragraphs, which delivers in one consistent approach all the reporting obligations stemming from the Algorithm methodology (AM) in force, adopted by ACER Decision 08/2018, dated 26 July 2018. However, the performance monitoring indicators have been prepared taking into consideration the proposal submitted on 31st July 2019 by NEMOs, still under evaluation by ACER whose decision is expected in January 2020. Therefore, the sections on performance monitoring have to be considered an early implementation exercise.

The CACM Annual Report 2018 makes a thorough compilation that goes from actual operations (requests for changes implemented, potential incidents, potential application of corrective measure), to monitoring of actual performance (including analysis of inputs and outputs of the coupling process), to analysis of expected scalability (capability to retain adequate performance in the expected near future), to conclude with R&D (processes in place to preserve in the long term adequate performance in a context of growing complexity).

“The CACM Annual Report 2018 makes a thorough compilation”

We sincerely hope that this first exercise meets your expectations and we commit together with All TSOs to keep on working with all the Stakeholders, NRAs, ACER and the Commission in achieving a fully integrated, well-functioning, efficient and transparent European Electricity Market. In future editions, this report will evolve and grow in content once all the data extraction functionalities and other processes are implemented. In order to make this evolution happen, NEMOs and TSOs will continue their co-operation with the relevant institutions and stakeholders.

Cosimo Campidoglio

Chairman of the All NEMO Committee



Legal framework

The legal framework for the Annual Report is in Annex I of the ACER Decision 08/2018 on Algorithm Methodology of 26th July 2018 in accordance to Article 37 of Commission Regulation (EU)2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management. Throughout its articles it describes the obligation to report regularly on different aspects that altogether conform the first CACM Annual report which is elaborated with the cooperation of the TSOs and can be compiled and classified in the following chapters for both, SDAC and SIDC:

OPERATIONS REPORT

- **Incidents (Art. 4.18 and 5.18):** Lists of incidents in the operation of the algorithm and the application of back-up and fallback procedures, the reasoning of their occurrence and applied or anticipated remedies to prevent them in the future.
- **Request for change (Art. 12.7):** provides all the relevant information on the process followed.
- **Corrective measures (Art. 8.11):** informs of the corrective methods applied and the reason for it and gives additional info on future planned measures to address the problem.

PERFORMANCE MONITORING REPORT (ART. 6.6):

reports on algorithm performance indicators, relevant usage indicators, relevant output indicators, thresholds; value of parameters ; cases of performance deterioration and description of the reasons.

SCALABILITY REPORT (ART. 7.7):

assesses the estimated level of scalability for the following years and of the Estimated Usage, Anticipated Usage and Usage Range. Perspective projects scoped for the activity with the related estimated workload.

R&D REPORT (ART. 4.19 AND 5.19):

Describes the status of the R&D activity and the planning of the future R&D activity, including an estimation of the identified workload and the associated budget.

Furthermore, Art. 13 of the Algorithm Methodology establish the obligation to publish the reports mentioned in previous slide.

Finally, this report sets the basis for compliance with Art. 37.6 of CACM: “No later than two years after the approval of the proposal in accordance with paragraph 5, all TSOs and all NEMOs shall review the operation of the price coupling algorithm and continuous trading matching algorithm and submit the report to the Agency”.

Executive summary

SDAC

Single Day-Ahead Coupling

OPERATIONS

During 2018, SDAC operations confirmed its reliability. The number of operational incidents proved limited, with no decoupling and still keeping a majority of cases not visible to market participants, i.e. without impact on them. At the same time, no corrective measures has been triggered, following the moderate level of usage of products and requirements and the overall adequate level of performance (see following bullet). Finally many requests for change have gone live, the most relevant being changes to the geographical scope (with inclusion of the Single Electricity Market on the island of Ireland (SEM) since 1/10/2018), in the network topology (with the DE-AT split always on 1/10/2018) and the go-live of the 10.2 release of Euphemia entailing multi-threading improvements, more frequent checks against time limit to avoid late termination, enhanced strategy to sequence activation of the different threads and other technical improvements.

PERFORMANCE MONITORING

During 2018 the usage of products remained generally stable, despite seasonal fluctuations, while a significant increase has been recorded in the number of PTDFs used in the CWE areas following the DE-AT border split. These changes induced a major impact on the Time To First Solution (TTFS), which – after the go >>>

“During 2018, SDAC operations confirmed its reliability.”

live of the mentioned requests for change on 01/10/2018 – increased by nearly 30%. Notwithstanding, the performance of the SDAC algorithm confirmed highly reliable, ensuring yearly average TTFS of 3.4 mins, well below the maximum 12 mins allowed and never higher than 9 mins. The performance of the algorithm proved adequate also in terms of optimality and repeatability.

SCALABILITY

For the years 2019-2021, the demand for scalability is expected to increase significantly, due to many Requests for Change expected to go-live during these years already included in the Roadmap (the several MNA projects, ...), plus an exogenous trend of growth in the usage of products. Such estimate does not take into account the potential impact of some relevant RfCs (Nordic Flow Based, Core Flow based, 15/30 mins products), for which proper data sets and specifications are still missing. The results confirm good reliability, despite deterioration of TTFS, but raises challenges on the future scalability as the trade off between new demand for scalability (flow-based, 15 min MTU) and the prospects for improving the algorithm capability (five more minutes for calculation time, new releases) cannot still be assessed.

“The performance of the SDAC algorithm confirmed highly reliable, ensuring yearly average TTFS of 3.4 mins, well below the maximum 12 mins allowed.”

R&D

In order to preserve an adequate level of performance in the future, a vast R&D Programme has been approved by NEMOs and TSOs in the SDAC JSC starting in 2019, including the assessment of potential benefits expected from hardware improvement (different IT architecture), software improvement (different treatment of the heuristics embedded in Euphemia) and market design (changes in the treatment of Complex Orders and Flow based). NEMOs shall report on the related activities in the 2019 CACM report



Executive summary



Single Intraday Coupling

OPERATIONS

The operation of SIDC started in June 2018 in the countries of the so called “first wave”. Throughout the first months of operation a considerable amount of RfCs was implemented or planned in order to guarantee the smooth functioning of the market as well as to prepare the systems for the second wave. The number and severity of incidents registered in 2018 was kept at a reasonable level, with a fast reduction after the first month of operation and did not hamper the well functioning of the SIDC especially considering the fact that this is a new and complex market covering many parties.

PERFORMANCE MONITORING

In 2018, important efforts were put in launching the safe operation of SIDC with a good level of performance. Furthermore, at that moment, the Algorithm Monitoring Methodology (proposed Annex 4 to the AM) was not available which means that performance monitoring indicators were not yet defined nor the capability to extract all the relevant data was implemented. For these reasons, some indicators cannot be assessed for 2018. This is a limitation to the first annual report that will be fixed in next year’s report.

“Throughout the first months of operation a considerable amount of RfCs was implemented or planned in order to guarantee the smooth functioning of the market.”

SCALABILITY

The scalability needs for the period 2019-2021 are very much linked to the second wave of SIDC, i.e. the expansion of operations to 7 additional countries.

R&D

There was no R&D programme for SIDC as such in 2018 for the same reasons listed in the performance monitoring part and also due to the fact that the necessary technical developments are delivered by the provider of the central systems itself without direct participation from NEMOs and TSOs.



SDAC

Single Day-Ahead Coupling



Background Assumption

NEMO requirements

- Block products (simple, linked, exclusive)
- Pun & merit orders
- Complex Orders
- Aggregated MTUs orders (curves)

TSO requirements

- ATC and Flow based (PTDF constraints)
- Intuitive flow-based
- Network constraints: Ramping, losses, minimum stable flows...

CACM requirements

- Adequate optimality
- Adequate scalability
- Adequate repeatability
- MNA
- MTU: 60 min

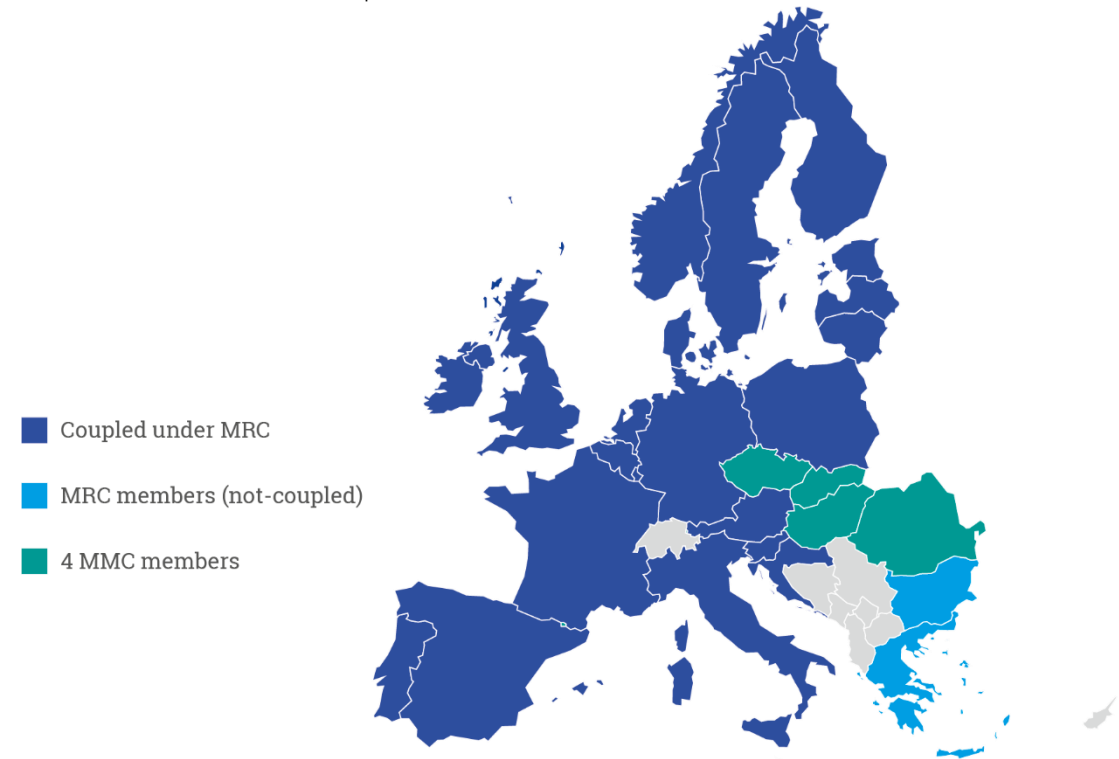
Systems release(s)

- Euphemia 10.1 (until 05/06/2018)
- Euphemia 10.2 (from 06/06/2018)
- PMB 9.0.1 (until 02/04/2019)

Geographical scope

- SDAC: MRC (PT, ES, FR, IT, DE, BE, NL, LU, UK, IE, AT, SI, HR, BG*, GR*, PL, LT, LV, EE, FI, SE, DK, NO) and 4MMC (HU, CZ, SK, RO)

*MRC member not coupled



Operations report

In this section, operational events occurred to SDAC in 2018 are reported, including: the incidents occurred, requests for changes decided upon and corrective measures applied. Such events are separately reported for both MRC and 4MMC regions, at the level of the two whole coupled areas and not at NEMO, TSO or country level.

INCIDENTS

Incidents are classified according to two criteria (severity and causes), with a classification in SDAC which is similar but not identical to those applied in SIDC due to the specificities of the two technical solutions.

- The summary of incidents shows that the SDAC operation in 2018 was smooth and reliable for market participants.
- As regards severity, the most critical incidents in SDAC are those that lead to a decoupling. In 2018 there was no decoupling incident and 60% of the incidents were not visible to market participants in MRC while in 4MMC the share of incidents not visible to the market participants was 75%. The most frequent cause for incidents in MRC was “Other” (73%), meaning incidents which don’t fall under the joint responsibility of NEMOs and TSOs, but are mainly related with technical

issues belonging to local NEMO or TSO systems. In 4MMC, interface issues was the incident cause with higher occurrence.

REQUESTS FOR CHANGE (RfC)

RfCs are classified per type of requirement, with the same classification being applied in SDAC and SIDC despite the specificities of the two technical solutions.

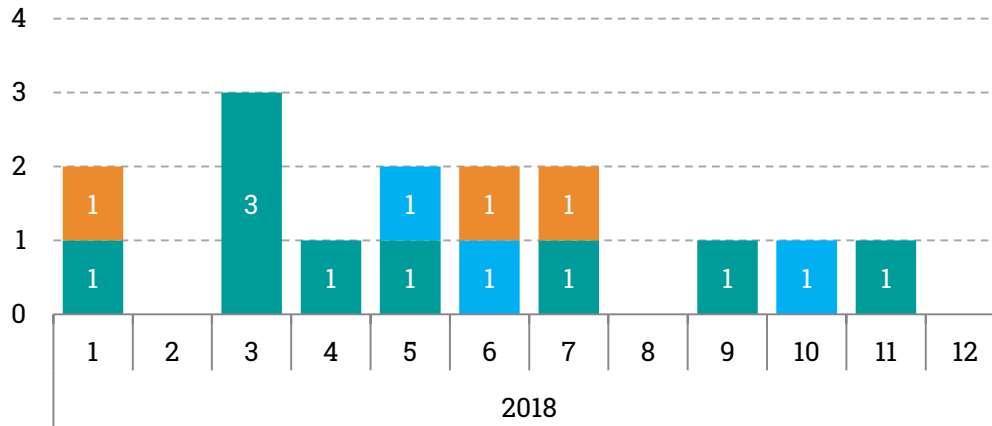
- The most important RfCs implemented in 2018 were the inclusion of the Irish market since 01/10/2018, the DE-AT split also on 01/10/2018 and the go-live of the 10.2 release of Euphemia on 06/06/2018.
- The implementation of RfCs follows an exhaustive testing and approval process based on agreed criteria.

CORRECTIVE MEASURE (CM)

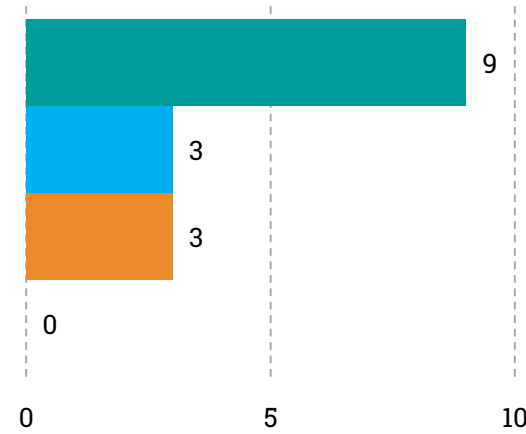
No CM has been applied in SDAC during 2018, as no relevant performance deteriorations has been recorded during the year.

MRC

Monthly



Annual



Severity 1

Incidents that lead to decoupling

Severity 2

Incidents where message of risk of decoupling was sent

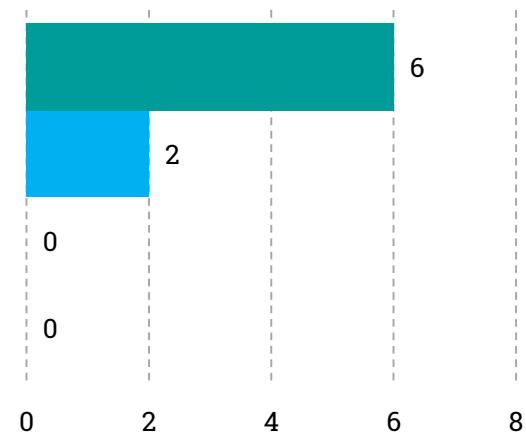
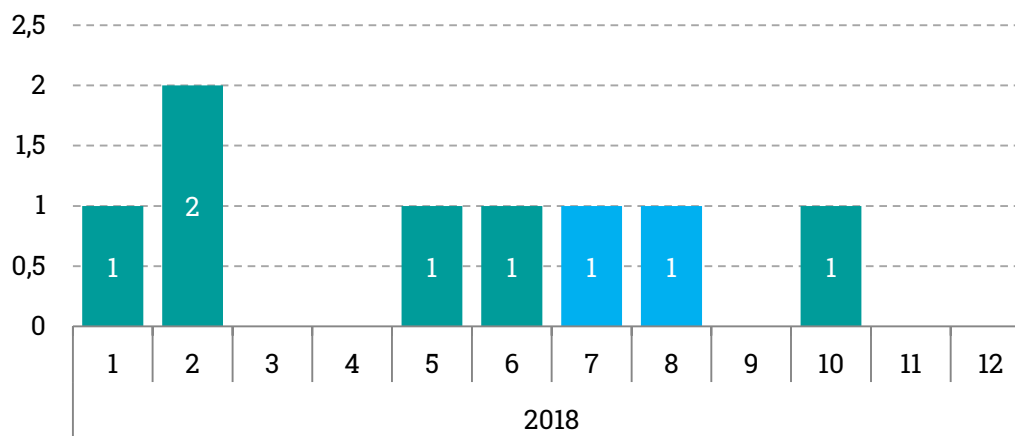
Severity 3

Incidents that were visible to market participants but risk of partial decoupling message was not sent

Severity 4

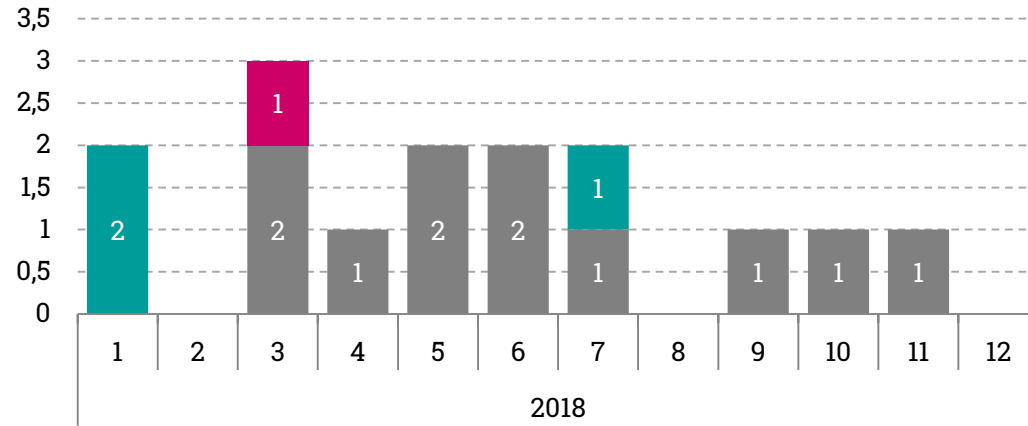
Incidents that were not visible to market participant

4MMC

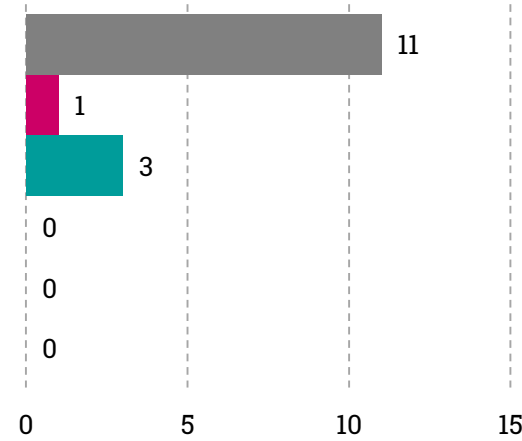


MRC

Monthly



Annual



Other

Human error

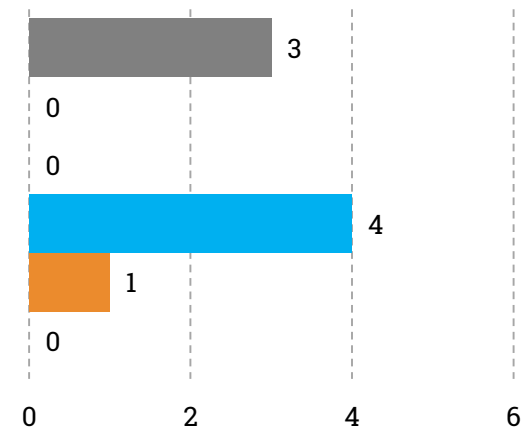
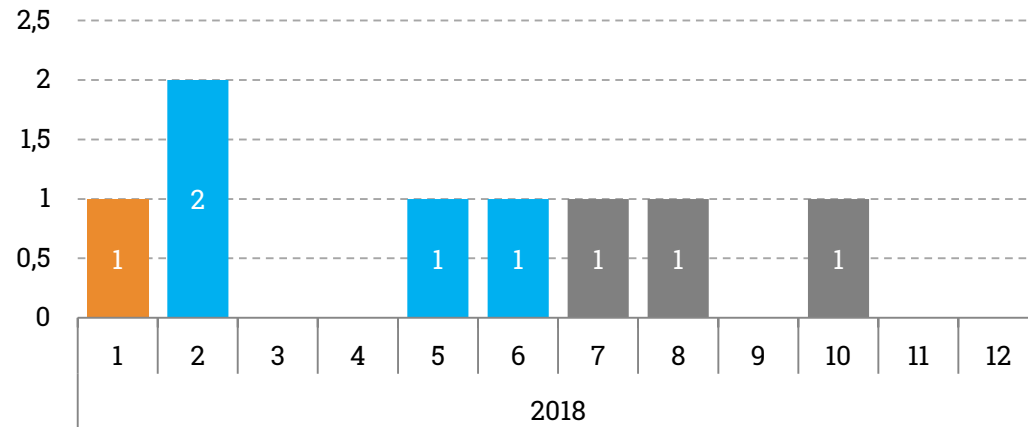
Unusual process

Interface issue

System bug

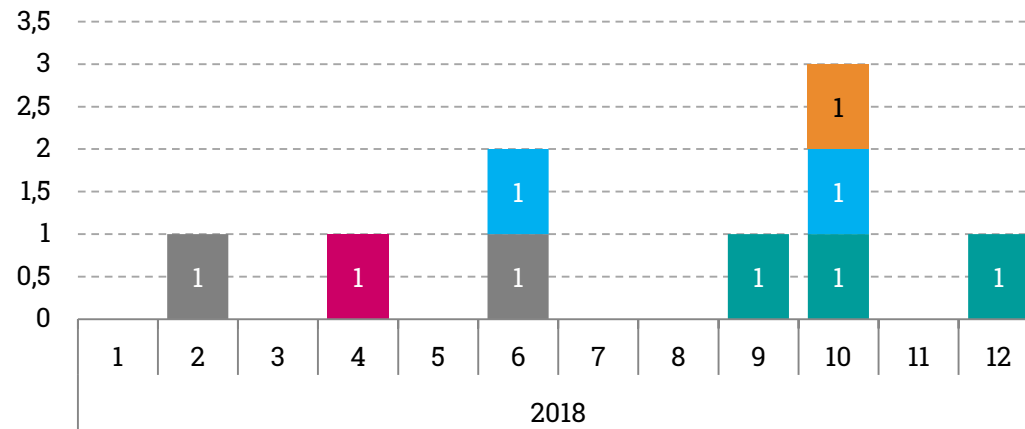
Configuration

4MMC

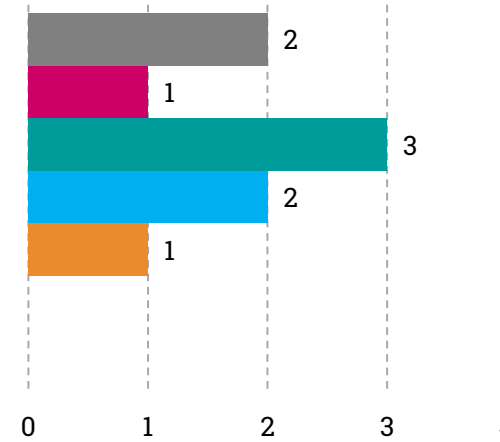


MRC

Monthly



Annual



Other

System Release

Network topology

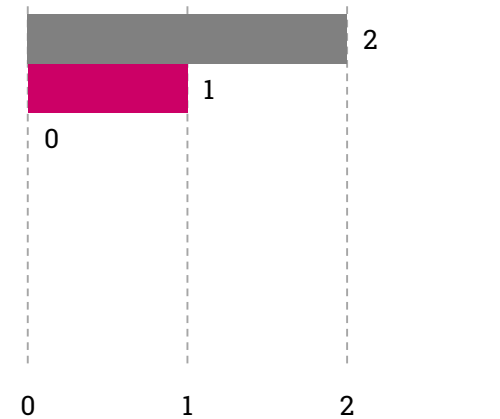
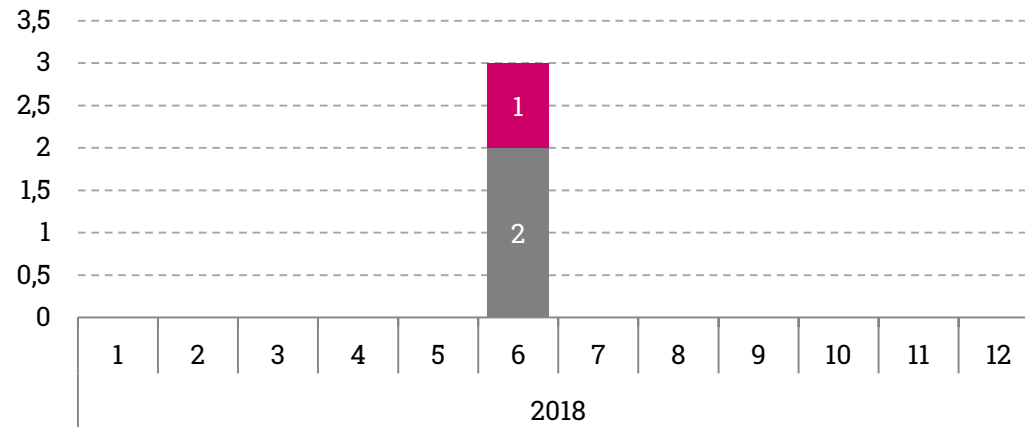
Graphical extension

Products extension

MNA implementation

Flow based

4MMC



MRC

| Requirement | Specific | GO Live Date | Reason | Initiator/Owner | Details | Outcome/date |
|------------------------|--|--------------|--------|-----------------|----------------------|-----------------------|
| Geographical extension | Irish market SI-HR coupling | Q4 2018 | CACM | NEMOs/TSOs | | Go-live on 01/10/2018 |
| | | Q2 2018 | CACM | NEMOs/TSOs | | Go-live on 19/06/2018 |
| Network topology | DE-AT split Change Italian zones Cost coefficient Slov | Q4 2018 | Other | TSOs | | Go-live on 01/10/2018 |
| | | Q4 2018 | Other | TSO | | Go-live on 31/12/2018 |
| | | Q3 2018 | Other | TSO | | Go-live on 18/09/2018 |
| System release | Euphemia 10.2 | Q2 2018 | CACM | NEMOs | General improvements | Go-live on 06/06/2018 |
| Products extension | Complex order in Irish market | Q4 2018 | CACM | NEMO | | Go-live on 01/10/2018 |
| Other | BSP Second auction IC time change | Q2 2018 | Other | NEMO | | Go-live on 19/06/2018 |
| | | Q1 2018 | | NEMOs/TSOs | | Go-live on 28/02/2018 |

4MMC

| Requirement | Specific | GO Live Date | Reason | Initiator/Owner | Details | Outcome/date |
|----------------|---|--------------|--------|-----------------|---------|-----------------------|
| System release | Implementation of the Euphemia release 10.2 | 05/06/2018 | Other | NEMOs | | Go-live on 05/06/2018 |
| Other | Update of procedures | 05/06/2018 | Other | NEMOs | | Go-live on 19/06/2018 |
| Other | Update of procedure | 20/06/2018 | Other | NEMOs | | Go-live on 20/06/2018 |

Performance monitoring report

For performance monitoring, the indicators listed in the draft annex 3 of the AM (currently under review by ACER) have been considered, therefore please check that annex for clarifications on the terms and concepts mentioned in this chapter. In order to compute these indicators all the sessions (days) of year 2018 were considered. The maximum, minimum and average values observed throughout the year are reported in the following slides. When relevant, monthly values are also reported.

In particular usage of inputs to the algorithm and output of the algorithm in 2018 are computed separately for MRC and 4MMC Regions, which can be summed in order to anticipate the future scenarios of full SDAC, to provide a measure of the relative dimension of the two systems. The algorithm performance indicators are calculated only on MRC perimeter because performance indicators cannot be summed up and the most challenging one is currently MRC, due to its greater scope and complexity.

Notes on the calculation of these indicators are included at the end of the report as Annex 2.

USAGE INDICATORS

- The data in the table show the actual level of usage of inputs to the algorithm in 2018 separately for MRC and 4MMC Regions. They confirm the greater dimension and complexity of MRC with respect to number and type of both orders used and network constraints.
- The usage of products remained generally stable, with a moderate increase throughout the year on the number of some products, while a significant increase has been recorded in the number of PTDFs used in the CWE areas (+400%) following the DE-AT border split.
- Analysis of time series show a general seasonality effect in the usage of different kind of orders, increasing during winter time. In 2018 this also reflect the effect of go-live in October '18 of DE/AT split and of the coupling of the Irish market, which together increased not only the number of zones and NEMOs, but also the usage of complex order and blocks and especially increased by 5 times the number of PTDFs used, in order to support the inclusion of the LTA (Long Term Allocation) requirement from TSOs

PERFORMANCE DATA

- The analysis of TTFS shows a sensitive increase after the go-live of the Irish market coupling and DE/AT border split on 1/10/2018. Notwithstanding, the performance of the SDAC algorithm confirmed highly reliable, ensuring yearly average TTFS of 3.4 mins (in MRC perimeter) against the maximum 12 mins allowed and always lower than 9 mins (approached only 4 times).
- The welfare indicators show good quality of solutions, with negligible changes of the overall welfare both from first to final solution found in the standard 12 mins and from final solution to the one after extended calculation time. Furthermore towards the end of the year it can be observed an increase in both indicators, apparently inversely related with the level of usage of requirements. This suggesting that as usages increase, so should the time allocated to the Algorithm.

- The provided indicators show also an adequate level of repeatability, over 97.82% of repeatability level per delivery day in MRC cloud, when considering equal values over the total number of relevant values on two consecutive executions of the algorithm in the same machine and comparing the latest
- common solution found. Almost a half of the sessions in MRC proved to be fully repeatable on the relevant values.

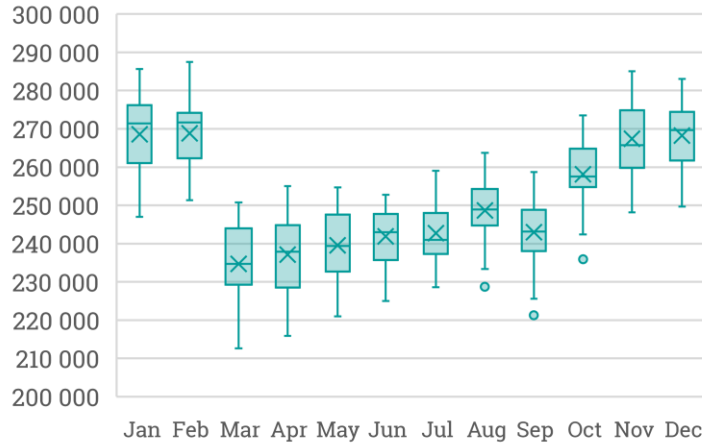
OUTPUT INDICATORS

- Data shows the welfare contribution of the MRC scope to average 8.7 B€ daily. This is complemented with a more modest daily contribution of 92 M€ for 4MMC.
- Euphemia TTFS is spent mostly on branching, i.e. exploring the branch & bound tree of fill/kill decisions for block and complex orders.
- The majority of traded volumes comes from curves, followed by merit orders, block orders and complex orders.

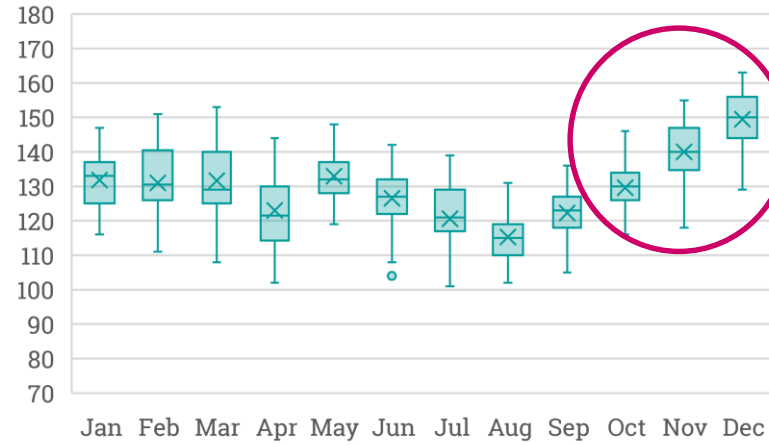
| Usage indicators | Year 2018 | | | | | |
|---|-----------|---------|---------|--------|--------|--------|
| | MRC | | | 4MMC | | |
| | Avg | Min | Max | Avg | Min | Max |
| 1) Indicators to describe the Usage of SDAC products (Proposed Annex 3 of AM Article 10) | | | | | | |
| Number of points in curve orders at bidding zone level* | 251 459 | 212 646 | 287 453 | 27 932 | 21 961 | 32 064 |
| Total number of steps at bidding zone level* | 146 278 | 116 902 | 186 151 | 14 517 | 11 401 | 16 912 |
| Total number of block orders | 4 265 | 3 245 | 5 219 | 172 | 91 | 267 |
| Total number of block order exclusive groups | 129 | 101 | 163 | 3.4 | 0 | 8 |
| Total number of linked families | 52 | 22 | 90 | 2.8 | 0 | 8 |
| Total number of complex orders | 91 | 73 | 113 | 0 | 0 | 0 |
| Total number of demand merit orders | 781 | 456 | 1 230 | 0 | 0 | 0 |
| Total number of supply merit orders | 38 486 | 34 301 | 44 213 | 0 | 0 | 0 |
| Total number of PUN orders | 5 065 | 3 694 | 6 371 | 0 | 0 | 0 |

* This figure is the sum of number of points or steps of the aggregated bid curves or stepwise curves in all bidding zones in all 24 hours of the day respectively.

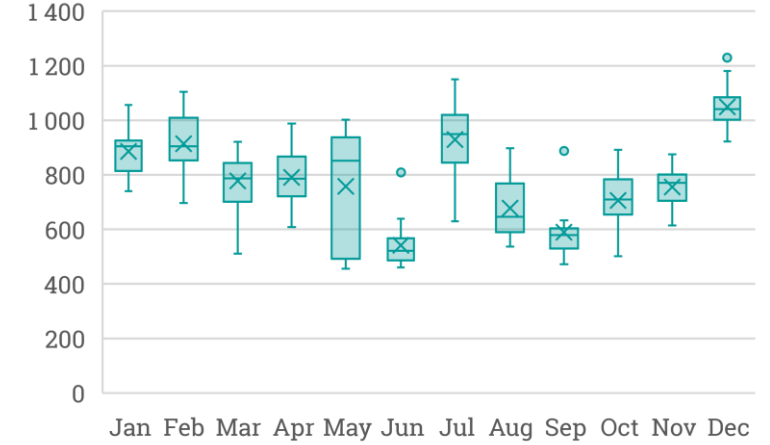
Number of points in curve orders at bidding zone level



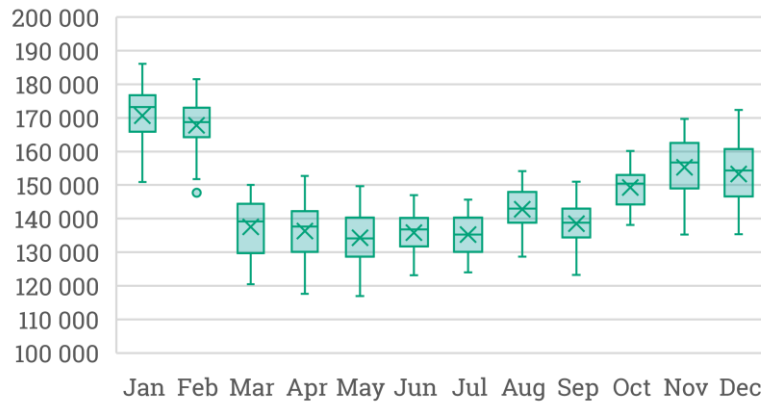
Total number of block order exclusive groups



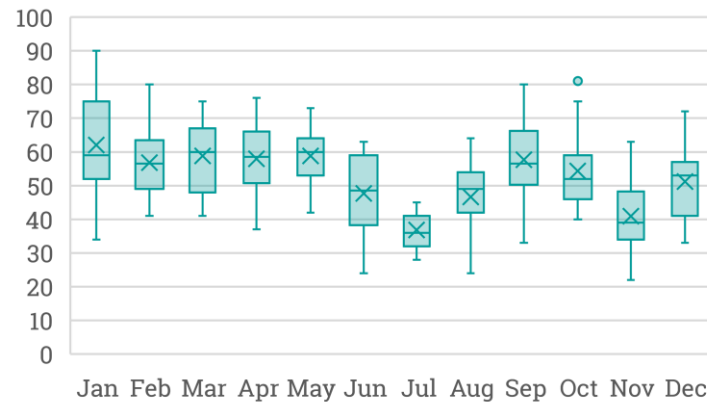
Total number of demand merit orders



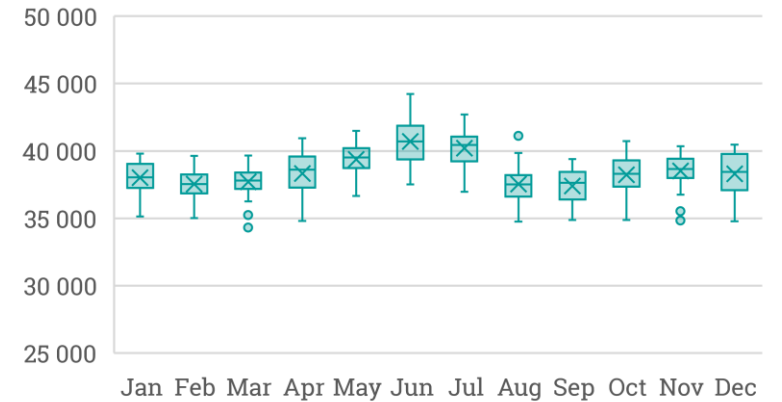
Total number of steps at bidding zone level



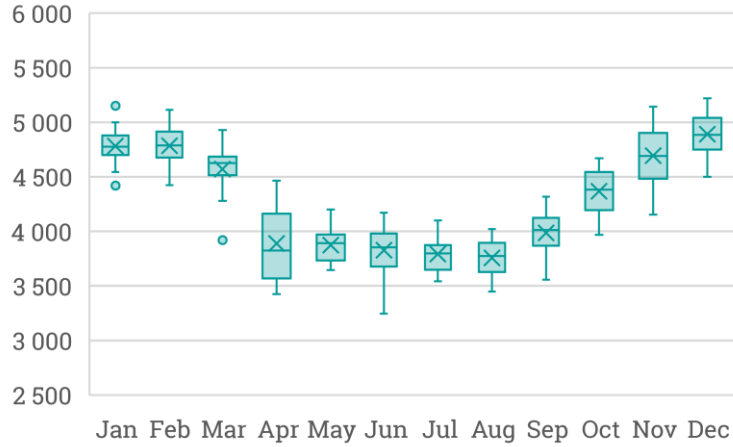
Total number of linked families



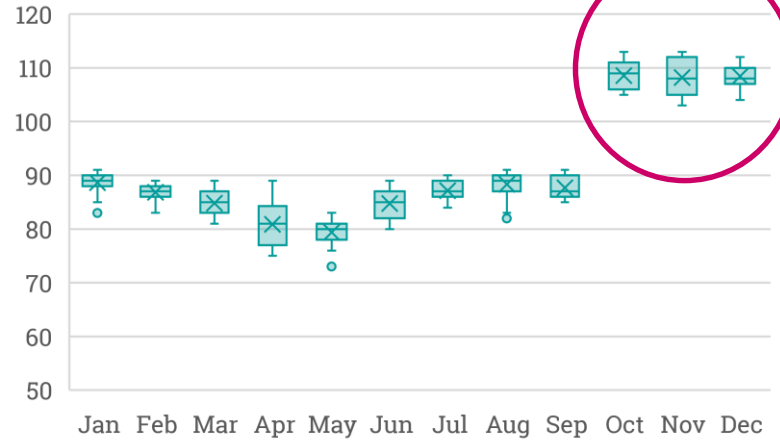
Total number of supply merit orders



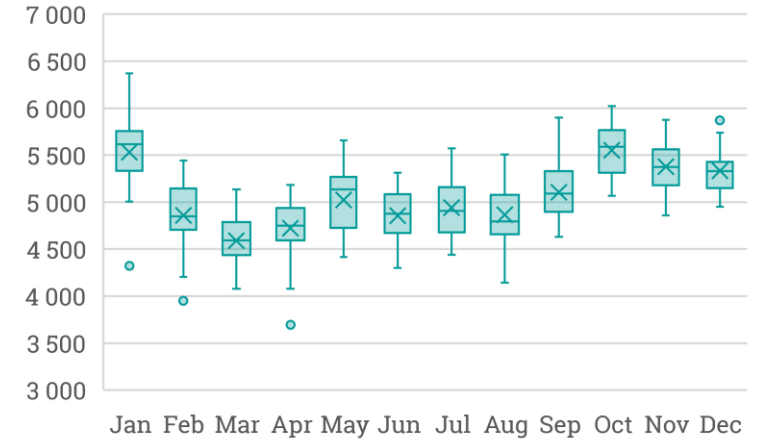
Total number of block orders



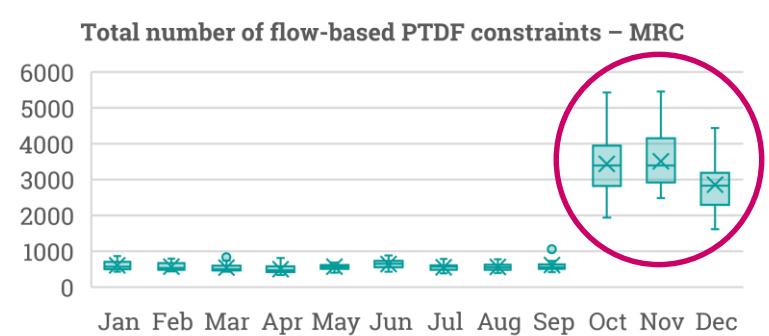
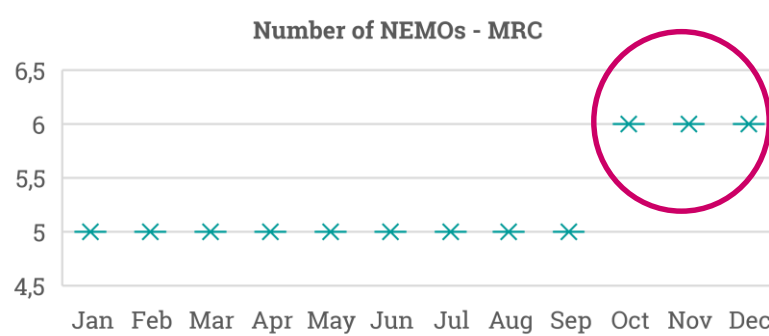
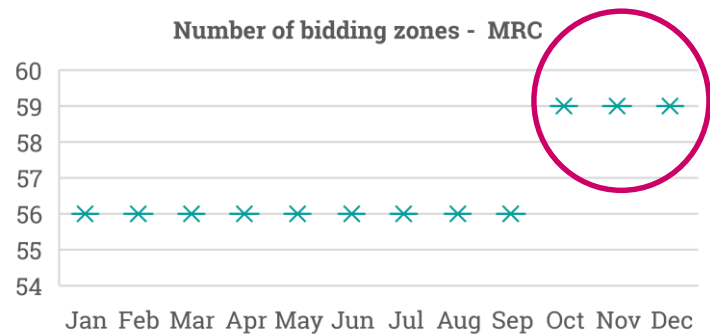
Total number of complex orders



Total number of PUN orders

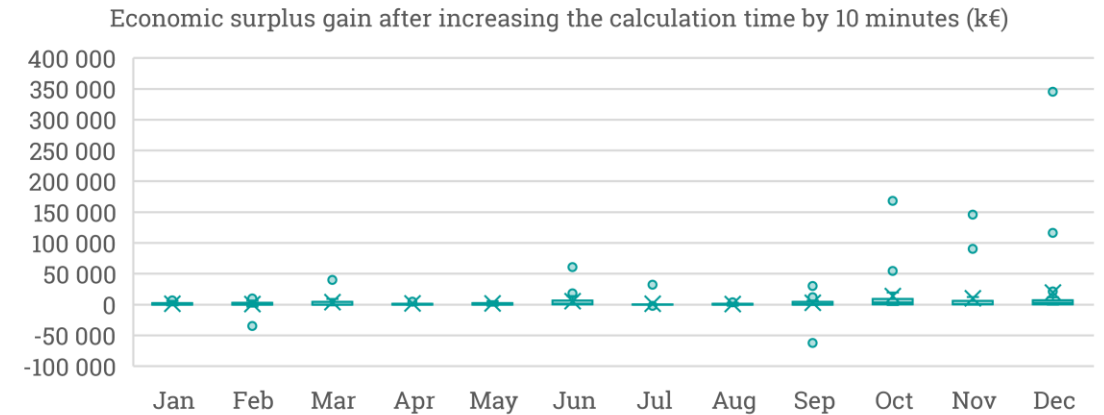
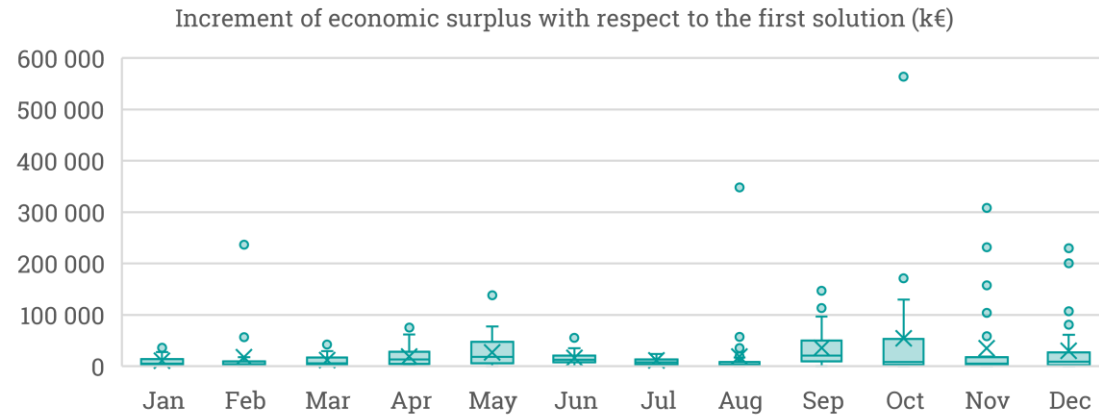


| Usage indicators | | Year 2018 | | | | | |
|---|---|-----------|-----|-------|------|-----|-----|
| | | MRC | | | 4MMC | | |
| | | Avg | Min | Max | Avg | Min | Max |
| 2) Indicators to describe geographical extension of the SDAC (Proposed Annex 3 of AM Article 11) | Number of bidding zones | 57 | 56 | 59 | 4 | 4 | 4 |
| | Total number of flow-based bidding zones | 4.2 | 4 | 5 | 0 | 0 | 0 |
| | Number of scheduling areas | 57 | 56 | 59 | 4 | 4 | 4 |
| | Number of NEMO Trading Hubs | 57 | 56 | 59 | 4 | 4 | 4 |
| 3) Indicators to describe the network constraints (Proposed Annex 3 of AM Article 12) | Number of NEMOs | 5.2 | 5 | 6 | 4 | 4 | 4 |
| | Total number of bidding zone lines | 74 | 72 | 77 | 3 | 3 | 3 |
| | Total number of flow-based PTFD constraints | 1 256 | 342 | 5 454 | 0 | 0 | 0 |
| | Total number of scheduling area lines | 74 | 72 | 77 | 3 | 3 | 3 |
| | Total number of NEMO Trading Hub lines | 74 | 72 | 77 | 3 | 3 | 3 |

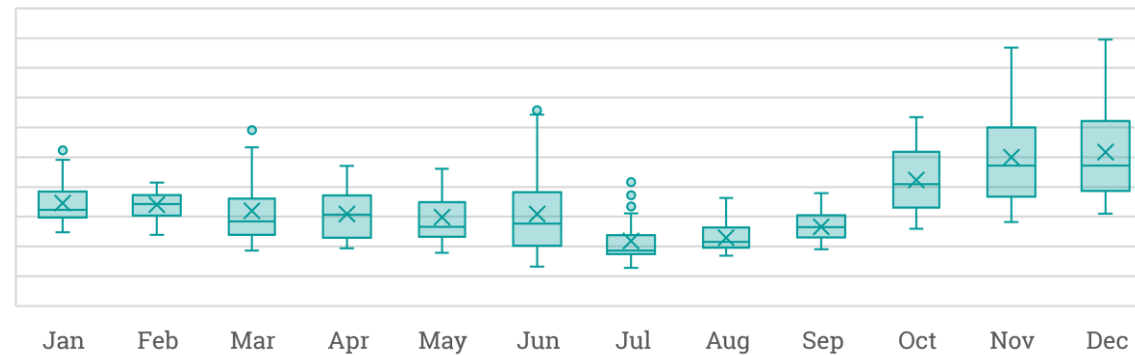


| Performance | | Year 2018 | | |
|---|---|-----------|------------|-----------|
| | | MRC | | |
| | | Avg | Min | Max |
| 1) Ability to maximise economic surplus (Proposed Annex 3 of AM Art. 7) | (a) Increment of economic surplus with respect to the first OK solution (%) | 0.000280% | 0.000000% | 0.006500% |
| | (b) Economic surplus gain after increasing allowed calculation time by 10 minutes (%) | 0.000062% | -0.000714% | 0.003974% |
| 2.a) Algorithm repeatability. Repeatability frequency indicator, measured as number of equal values over total values for the relevant results (%) [bigger is better] | | 99.70% | 97.82% | 100% |
| 2.b) Algorithm repeatability. Repeatability impact of differences indicator, measured as average of the contributions of the sums of absolute values of differences over the sum of the absolute values, for all the relevant results (%) [lower is better] | | 0.54% | 0% | 5.49% |
| 3) Algorithm scalability (Proposed Annex 3 of AM Art. 9) TTFS (min) | | 3.39 | 1.27 | 8.90 |

Ability to maximise the economic surplus (k€)

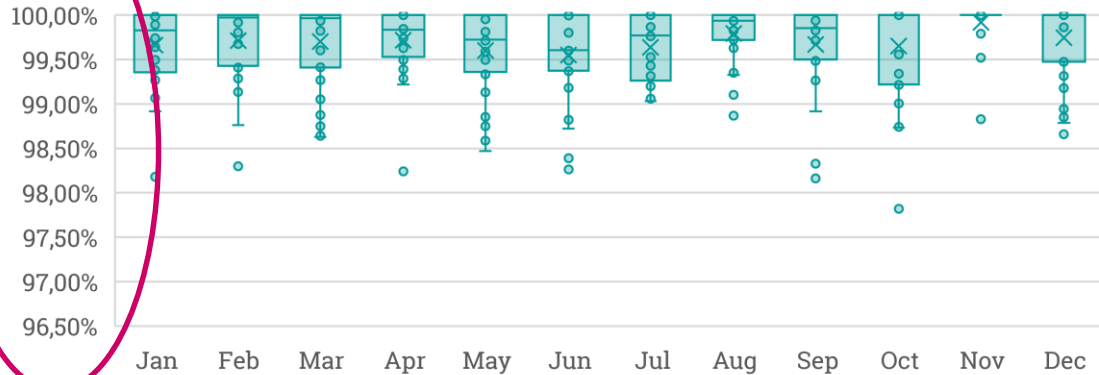


Algorithm scalability (min)

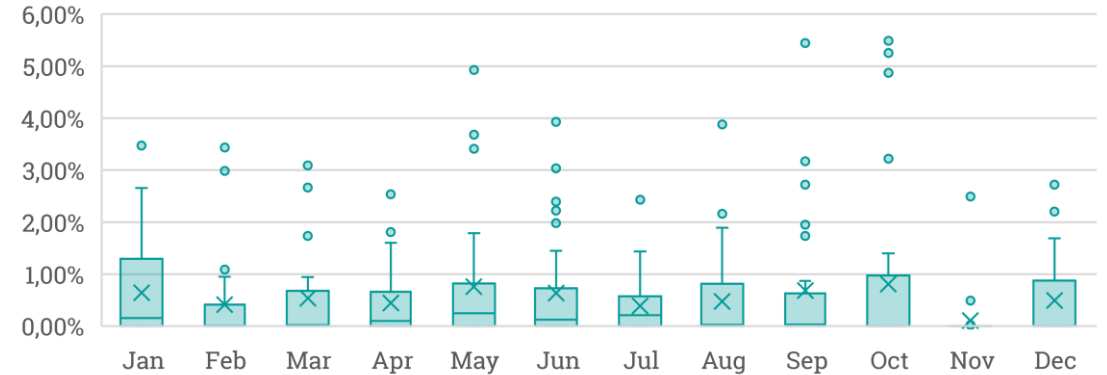


Algorithm repeatability

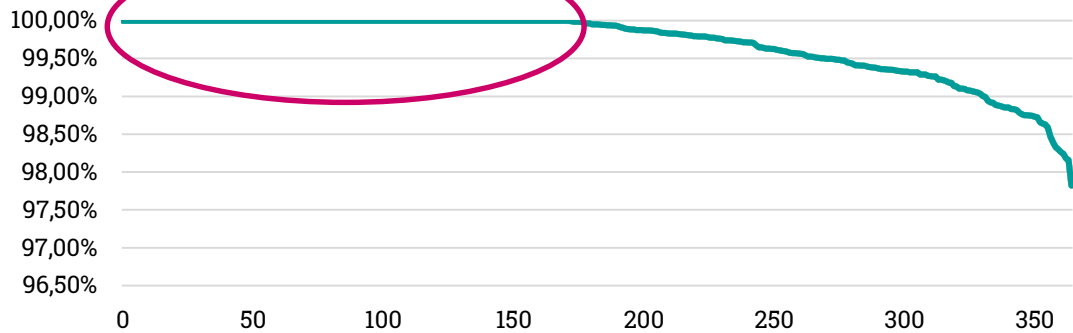
Repeatability frequency indicator



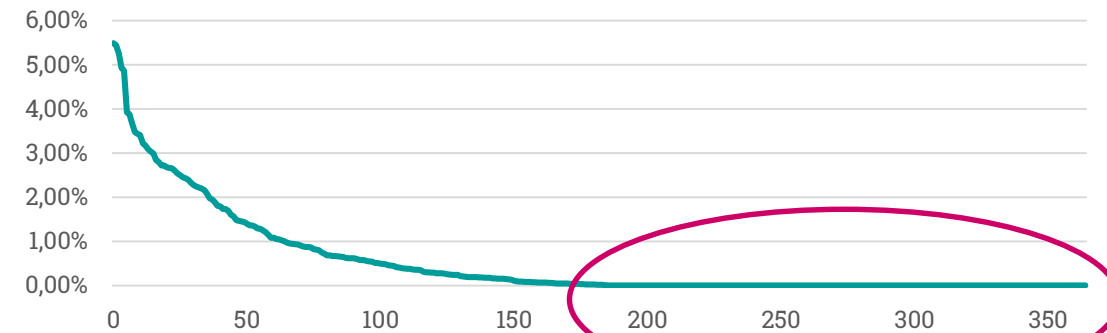
Repeatability impact of differences indicator



Repeatability frequency indicator



Repeatability impact of differences indicator



| Output indicators | | Year 2018 | | |
|---|--|--------------------------------------|-----------|------------|
| | | Avg | Min | Max |
| Maximization of the first economic surplus | Economic surplus of first OK solution (M€) | 8 689.352 | 6 620.911 | 11 202.909 |
| | Economic surplus of the final solution (M€) | 8 689.376 | 6 620.919 | 11 202.914 |
| Evolution of number of matched orders | Total number of matched blocks | 661 | 312 | 1 310 |
| | Total number of matched complex orders | 24 | 0 | 61 |
| | Total number of matched non-PUN merit orders | 30 505 | 23 870 | 36 107 |
| | Total number of matched PUN orders | 3 270 | 2,482 | 4 090 |
| | Total matched volume from curves (MWh) | 5 748 521 | 4 353 570 | 7 450 242 |
| | Total matched volume from blocks (MWh) | 321 327 | 191 392 | 485 469 |
| | Total matched volume from complex orders (MWh) | 150 012 | 773 | 360 887 |
| | Total matched volume from (non-PUN) merit orders (MWh) | 753 386 | 542 159 | 952 441 |
| | Total matched volume from PUN orders (MWh) | 799 350 | 542 070 | 987 055 |
| | Paradoxically rejected orders | Number of PRBs in the final solution | 21 | 3 |
| Number of PRMICs in the final solution | | 1 | 0 | 6 |
| Maximum Delta P in the final solution | | 5 | 0 | 42 |
| Maximum Delta MIC in the final solution | | 1 | 0 | 22 |
| PRB utility loss in the final solution (k€) | | 30.077 | 0.128 | 288.491 |
| PRMIC utility loss in the final solution (k€) | | 4.690 | 0 | 182.568 |
| Volume of PRBs in the final solution (MWh) | | 26 488 | 1 304 | 128 893 |
| Volume of PRMICs in the final solution (MWh) | | 4 343 | 0 | 39 796 |

1)
Indicators on the maximisation of economic surplus (Proposed Annex of AM 3 Article 13)

| Output indicators | | Year 2018 | | |
|---|--|--------------------------------------|---------|---------|
| | | Avg | Min | Max |
| Maximisation of the first economic surplus | Economic surplus of first OK solution (M€) | 92.485 | 49.200 | 135.220 |
| | Economic surplus of the final solution (M€) | 92.485 | 49.200 | 135.220 |
| Evolution of number of matched orders | Total number of matched blocks | 115 | 43 | 231 |
| | Total number of matched complex orders | 0 | 0 | 0 |
| | Total number of matched non-PUN merit orders | 0 | 0 | 0 |
| | Total number of matched PUN orders | 0 | 0 | 0 |
| | Total matched volume from curves (MWh) | 324 737 | 269 164 | 402 593 |
| | Total matched volume from blocks (MWh) | 35 289 | 12 281 | 69 320 |
| | Total matched volume from complex orders (MWh) | 0 | 0 | 0 |
| | Total matched volume from (non-PUN) merit orders (MWh) | 0 | 0 | 0 |
| | Total matched volume from PUN orders (MWh) | 0 | 0 | 0 |
| | Paradoxically rejected orders | Number of PRBs in the final solution | 1 | 0 |
| Number of PRMICs in the final solution | | 0 | 0 | 0 |
| Maximum Delta P in the final solution | | 1 | 0 | 19 |
| Maximum Delta MIC in the final solution | | 0 | 0 | 0 |
| PRB utility loss in the final solution (k€) | | 4.531 | 0 | 134.691 |
| PRMIC utility loss in the final solution (k€) | | 0 | 0 | 0 |
| Volume of PRBs in the final solution (MWh) | | 1 793 | 0 | 20 603 |
| Volume of PRMICs in the final solution (MWh) | | 0 | 0 | 0 |

1)
Indicators on the maximisation of economic surplus (Proposed Annex of AM 3 Article 13)

| Output indicators | | Year 2018 | | | | | | |
|--|--|--|---------------|------|-------|-----|-----|-------|
| | | MRC | | | 4MMC | | | |
| | | Avg | min | max | Avg | min | max | |
| 2) IT calculation process (Proposed Annex 3 of AM Article 14) | Time spent in every phase of the algorithm calculation process | TTFS (s) | 203.7 | 76.5 | 537.1 | 2.6 | 1.8 | 35.0 |
| | | Input data reading time (s)* | 12.9 | 5.0 | 28.0 | 0.8 | 0.0 | 1.9 |
| | | Input data delivery day creation (s)* | Not available | | | | | |
| | | Time to solve the root node for the master computer (s)* | 22.3 | 4.0 | 101.5 | 0.5 | 0.0 | 1.1 |
| | | Time to solve the root node for the job that found first solution (s)* | 27.5 | 6.0 | 101.5 | 0.4 | 0.0 | 1.1 |
| | | Number of successive improvements of the solution in the given timeframe <i>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 SDAC algorithm</i> | 3.9 | 1 | 9 | 1.3 | 1 | 4 |
| | | Total number of nodes in the master branch and bound tree | 1 557 | 83 | 3 940 | 15 | 0** | 2 027 |

* Some time measurements in the calculation are overlapping (parallel processes).

** Zero nodes in the master branch can happen when the root node directly resolves to an optimal solution.

Scalability report

In this section, the scalability of the SDAC is assessed, simulating the evolution of the scalability indicator in reaction to expected evolution of newly expected requests for change (included in the roadmap) and of the exogenous usage of requirements, for the situation in 3 years (2021), as they were expected at the end 2018, using the latest available version of the SDAC Algorithm (Euphemia 10.4).⁶⁾

ROADMAP

The Roadmap anticipates the impact of RfCs expected to go live during 2020, including among others the go live of the several expected MNA projects (Nordic, Polish, Baltic), the merge of MRC and 4MMC regions (for full detail see “Roadmap of RfCs included in scalability study ” in the following slides).

This assessment could not consider the go live of CORE and Nordic flow based, which are expected to go live by end of 2020/beginning 2021 (due to the lack of final network topology data), as well as the 15/30 min MTU implementation, expected to go live on 2021 (due to the need of finalizing the “cross matching” technical requirements needed to handle both products and cross border capacities with

different MTUs, deriving from the chance for individual TSOs to apply for un-harmonised derogations).⁷⁾

ANTICIPATED USAGE

The expected usage of products and requirements reflects the actual usage recorded in 2018 and projected 2021 usage by applying the historical growth of usage of each product/requirement projected in the future (ranging between 0 and 65%, for full detail see slide on anticipated usage).

SCALABILITY INDICATOR

The resulting value of the scalability indicator confirms also for 2019 and 2021 the good performances of Euphemia already registered in 2018, ensuring that a first valid solution for these years is found in less than 12 mins in 99% of the cases and always in less than 17 min. Extension of calculation time to 17 min, agreed with TSOs to go live from April 2020, shall provide further margins to cope with growing requirements.

Absent any change in the SDAC algorithm, such increase in usage of products is estimated to increase the TTFS to 5.5 mins (+62%), still below the critical thresholds identified in the AM as the one preserving reliable operation and ensuring RfCs acceptance. Such estimate does not take into account the potential impact of Nordic and Core Flow based, for which the needed detailed information related to the network topology are not yet available, and of the requirement to support 15/30 min products, for which still are missing both datasets reflecting the scenarios for local derogations and requirement to handle the consequent cross matching functionalities for unharmonised MTUs among products and cross border capacities.

Further improvements expected from the next algorithm releases and further 5 mins time allowed for calculation, recently agreed among NEMOs and TSOs, should provide further tools for managing the impact from these RfCs, together with the outcome the R&D programme mentioned below.

Roadmap of RfCs included in scalability study

| Requirement | Specific | GO Live Date | Reason | Initiator/Owner | Details | Outcome/date |
|---------------------|---|--------------|--------|-----------------|--|-----------------------|
| Network topology | COBRA cable | 02/07/2019 | TSO | TSOs | Inclusion of a new DK1-NL line in MRC topology | Go-live on 16/04/2019 |
| Multi-NEMO | CWE MNA | 02/07/2019 | CACM | NEMOs/TSOs | Introduction of multi-NEMO framework in CWE region | Go-live on 02/07/2019 |
| Multi-NEMO | Nordic MNA | 10/03/2020 | CACM | NEMOs/TSOs | Introduction of multi-NEMO framework in the Nordic region | |
| Multi-NEMO | Baltic MNA | 2020 | CACM | NEMOs/TSOs | Introduction of multi-NEMO framework in the Baltic region | |
| Multi-NEMO | Polish MNA | Q1/ Q2 2020 | CACM | NEMOs/TSOs | Introduction of multi-NEMO framework in Poland | |
| Network topology | ElecLink cable | 01/10/2019 | TSO | TSOs | Introduction of a new FR-GB line | Go-live on 01/10/2019 |
| Network topology | DE-AT-PL-4M Coupling | Q3/2020 | TSO | TSOs | Implementation of DE-AT-PL-4M NTC coupling | |
| Network topology | Additional Bidding zone on Italian market for Montenegro connection | Unknown | CACM | Unknown | Additional BZ | |
| Usage | Cropex new blocks | Unkown | CACM | | Introduction of profile blocks and linked blocks for CROPEX in the HR bidding area | |
| Multi-NEMO | Multi-NEMO capability | E10.3 | CACM | NEMOs/TSOs | Capability to model multiple NEMOs in bidding zones Implementation of SEC functionality | Go-live on 03/04/2019 |
| Network requirement | Support of parallel ATC lines | E10.4 | TSO | TSOs | Capability of the algorithm to support the definitions of multiple line between the same pair of bidding zones | |

Roadmap of RfCs **not included** in scalability study (1/3)

| Requirement | Specific | GO Live Date | Reason | Initiator/Owner | Details |
|------------------------|--|--|---------------------|-----------------|--|
| Multi-NEMO | NASDAQ in MRC | 19/11/2019 | CACM | NEMOs | Entrance of NASDAQ in MRC coupling |
| Network requirement | Interconnector ramping | Unknown (not part of CACM future requirements) | TSO | NEMOs/TSOs | Implementation of "minute by minute" ramping |
| Network requirement | Bounded net positions in Belgium | 01/10/2019 (E10.4 go-live) | TSO | TSOs | Possibility to limit in import or export the net position of the Belgian bidding zone (BZ), per period |
| HMMCP | Harmonisation of Maximum and Minimum clearing prices (HMMCP) | 01.07.2019 DEFERRED | HMMCP | NEMOs/TSOs | Implementation of a dynamic maximum price definition in MRC |
| Brexit | Hard Brexit Enduring Solution | 31/10/2019 | Other | NEMOs/TSOs | Removal of Great Britain bidding zones & interconnections from MRC coupling in case of hard Brexit |
| Network topology | IFA2 | 01/03/2020 | TSO | TSOs | Introduction of a new FR-GB line |
| Network topology | ALEGrO cable introduction | Q4/2020 | TSO | TSOs | Implementation of an HVDC line between Belgium (BE) and Germany (Amprion scheduling area) using a 'evolved hybrid flow-based' modeling |
| Network topology | CORE FB | Q4/2020 | CACM/ Core CCR | NEMOs/TSOs | Implementation of FB Capacity Calculation in the CORE region |
| Network topology | Nordic FB | Q2/2021 | CACM/ Nordic CCR | TSOs | Implementation of (plain) FB coupling for the Nordic region |
| Geographical extension | Introduction of the Greek market | 01/10/2020 | CACM | NEMOs | Insert Greek BZ and market orders within MRC |
| Geographical extension | Coupling of the Greek market | 01/10/2020 | CACM | TSOs | Connect the Greek BZ with Italy |

Roadmap of RfCs not included in scalability study (2/3)

| Requirement | Specific | GO Live Date | Reason | Initiator/Owner | Details |
|------------------|--|---------------------------|--------|-----------------|--|
| System release | Implementation of 15-min MTU for MRC areas | 01.01.2021 or 01.08.2022? | CACM | NEMOs/TSOs | According to ACER decision 08/2018, date is 1.08.2022 According to ACER's decision of 24.04.2018, by 01.01.2021, MTU shall be implemented on each border as equal to the shortest common ISP of the corresponding bidding zones |
| System release | Activation of full reproducibility functionality | ALM Art. 4 (14) 1.02.2020 | CACM | NEMOs | The algorithm shall be fully reproducible, i.e. allow obtaining identical solutions in case of rerun |
| Network topology | VikingLink cable introduction | Q4/2022 | TSO | TSOs | New cable between Denmark and UK |
| Network topology | Coupling of Bulgaria with the Greek market | Unknown | TSO | TSOs | Addition of a new interconnection between Greece and Bulgaria, effectively coupling Bulgaria (for now operated in MRC but isolated) |
| Network topology | Losses on Skagerrak cable | 2019? | TSO | TSOs | Implementation of loss-factor on DK1-NO2 area connection. Cable between Norway and Jutland/Denmark. |
| Network topology | New cable NordLink | Q1/2020 | TSO | TSOs | New cable 1,400 MW between Germany and Norway |
| Network topology | New cable North Sea Link | Q1/2021 | TSO | TSOs | New cable 1,400 MW between Norway and Great Britain |
| Network topology | New interconnection between Slovenia and Hungary | Q4/2022 | TSO | TSOs | New AC cable between SI and HU |
| Network topology | New cable between Poland and Lithuania | by 2025 | TSO | TSOs | New (undersea) HVDC line between PL and LT areas |
| Network topology | New cable HansaPowerBridge | by 2025 | TSO | TSOs | New (undersea) HVDC line between DE (50Hertz) and SE4 (SVK) |
| Network topology | New cable FAB link | 2022 | TSO | TSOs | New France-Alderney-Britain cable |
| Network topology | New interconnection between SK and HU | by end of 2020 | TSO | TSOs | New interconnection between SK and HU MAVIR: For now, this is to our knowledge not considered as part of CORE FB data |

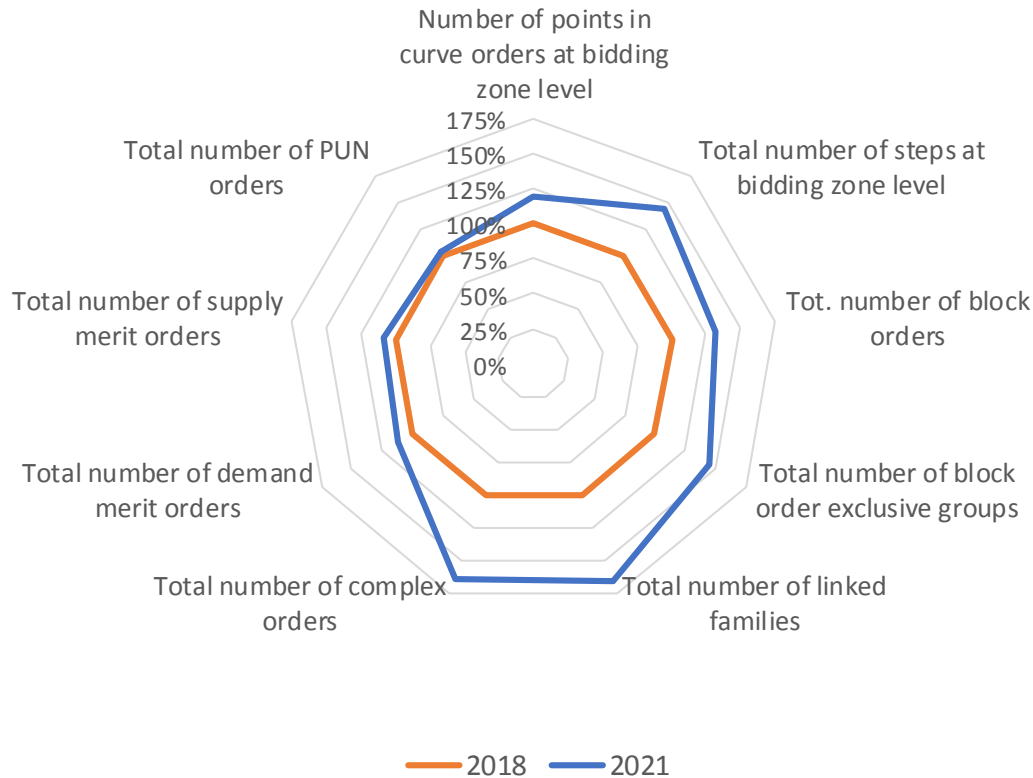
Roadmap of RfCs not included in scalability study (3/3)

| Requirement | Specific | GO Live Date | Reason | Initiator/Owner | Details |
|-----------------------|---|--|--------|-----------------|---|
| Network topology | Flow-based in region IT-North | Unknown | CACM | TSOs | Flow-based approach to be applied on IT-North according to art 20.3 of CACM |
| Network topology | ES-FR capacity increase | by 2025 | TSO | TSOs | Increase in ATC capacity between Spain and France (both senses), from 2 800 MW to 5 000 MW (+2 200MW increase) |
| Network topology | FR-IT capacity increase | 2020 | TSO | TSOs | Increase in ATC capacity with +1 200MW between France and Italy |
| Network requirement | Interconnector ramping | Unknown (not part of CACM future requirements) | TSO | TSOs | Implementation of "minute by minute" ramping |
| Network requirement | Limitation of BZ net positions | E10.4 | TSO | TSOs | Possibility to limit in import or export the net position of the Belgian bidding zone (BZ), per period |
| Network requirement | Evolved Flow-Based | Already available but not in operation yet | TSO | TSOs | Implementation of 'evolved flow-based' capability via the implementation of virtual areas |
| Order requirements | Order crossmatch under heterogeneous MTUs | Already available but not in operation yet | CACM | NEMOs | Allow for the definition of orders under heterogeneous Market Time Units ("MTUs"), such as 15 minutes, 30 minutes and hourly. The algorithm shall be able to cross-match these products. MTUs shall be configurable per bidding zone. |
| Network requirement | Network allocation under heterogeneous MTUs | E10.5/? | CACM | NEMOs/TSOs | Allow for the definition of heterogeneous MTU network allocations. The MTU shall be defined per interconnection (i.e. inter-BZ line). The corresponding BZs shall have their markets designed for the support of such property |
| Network requirement | Advanced hybrid coupling | Unknown | TSO | TSOs | The Algorithm shall be able for each MTU to facilitate the Advanced hybrid coupling, where realised cross-zonal capacity transactions are taken into account in the margin of the Flow-based critical branches (using virtual bidding areas). |
| Algorithm requirement | Full algorithm reproducibility | Available in E10.4 (prototype) but not foreseen in operation yet | CACM | NEMOs | The algorithm shall be fully reproducible, i.e. allow obtaining identical solutions in case of rerun |
| Algorithm requirement | Scalability | Continuous improvement | CACM | NEMOs | The algorithm shall be able to cope with the complexity of MRC coupling whatever the geographical extension / network change / competition aspects |

| Usage indicators | Years | | |
|--|--|-------------------------|---------|
| | 2018 (Y) | 2021 (Y+3) | |
| 1) Indicators to describe the Usage of SDAC products (Proposed Annex 3 of AM Article 10) | Number of points in curve orders at bidding zone level | 279 392 | 332 775 |
| | Total number of steps at bidding zone level | 160 796 | 231 700 |
| | Tot. number of block orders | 4 438 | 5 821 |
| | Total number of block order exclusive groups | 133 | 193 |
| | Total number of linked families | 55 | 91 |
| | Total number of complex orders | 91 | 149 |
| | Total number of demand merit orders | 781 | 872 |
| | Total number of supply merit orders | 38 487 | 42 004 |
| | Total number of PUN orders | 5 065 | 5 253 |
| | 2) Indicators to describe geographical extension of the SDAC (Proposed Annex 3 of AM Article 11) | Number of bidding zones | 61 |
| Total number of flow-based bidding zones | | 4 | 5 |
| Number of scheduling areas | | 61 | 64 |
| Number of NEMO Trading Hubs | | 61 | 107 |
| Number of NEMOs | | 9 | 12 |
| 3) Indicators to describe the network constraints (Proposed Annex 3 of AM Article 12) | Total number of bidding zone lines | 77 | 88 |
| | Total number of flow-based PTDF constraints | 1 256 | 3 564 |
| | Total number of scheduling area lines | 77 | 99 |
| | Total number of NEMO Trading Hub lines | 77 | 269 |

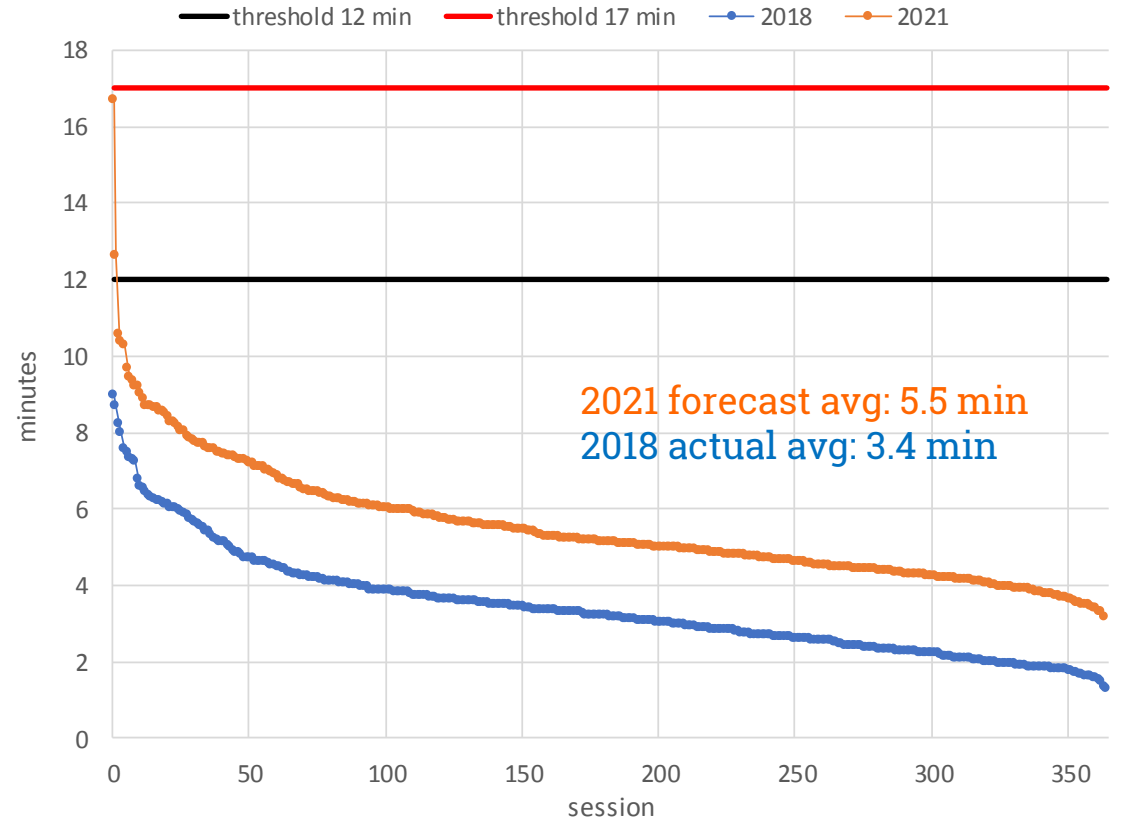
Algorithm scalability

Usage as percentage of 2018 usage



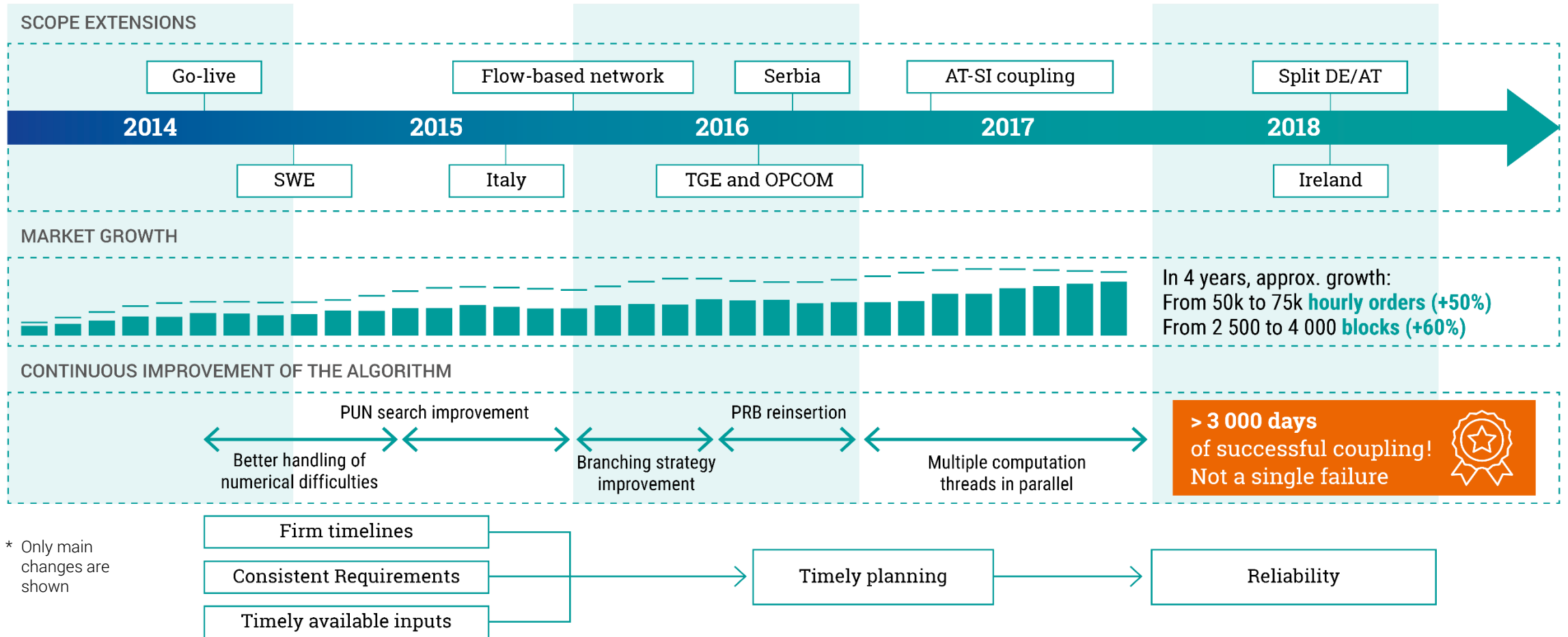
Distribution of TTFs (min)

Scalability assessment - duration curves



R&D report

Background: Past evolutions of Euphemia*



R&D PROGRAMME FOR THE PRICE COUPLING ALGORITHM

The R&D programme for the price coupling algorithm has been approved and initiated in 2019, so it will be included in next report.

In future editions, the activities, the outcome and the budget of the R&D programme will be reported.



Background Assumption

NEMO requirements

- MTU: 15, 30, 60 mins
- Regular orders
- Linked orders
- Iceberg Orders

TSO requirements

- ATC (including possibility to set a global constrain for set of cross-zonal interconnectors)
- Ramping constraints
- Explicit capacity requests

CACM requirements

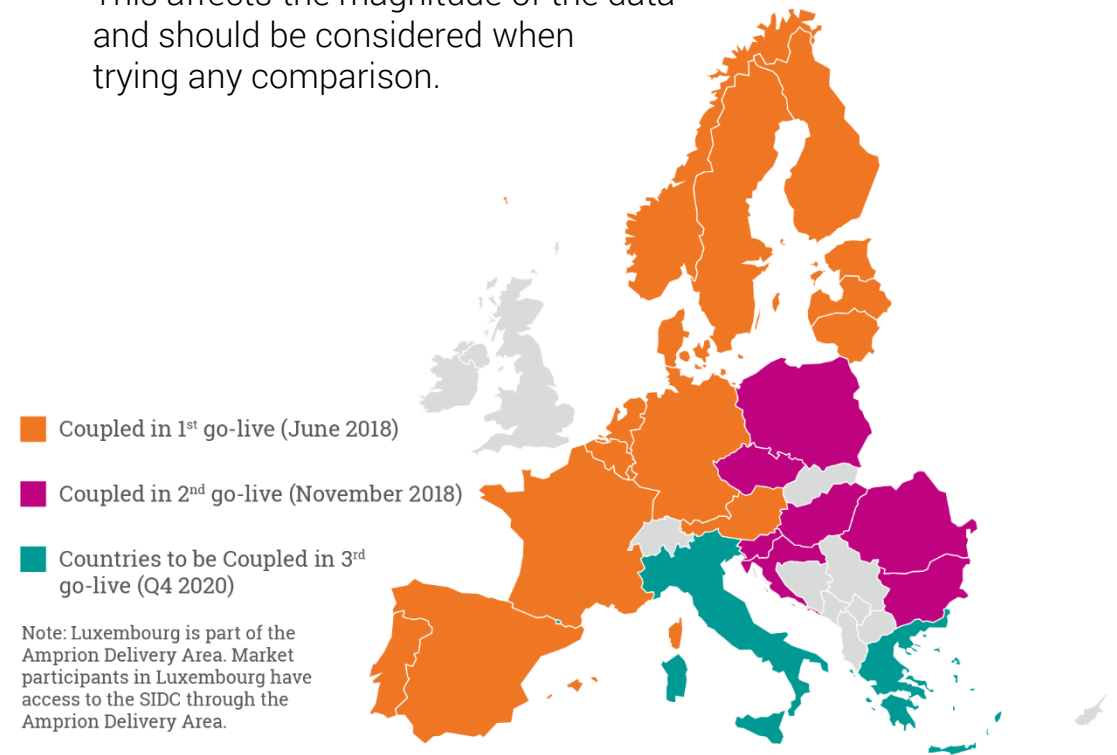
- Adequate scalability
- MNA
- MTU: 15-60 mins

Systems release(s)

- 1.4.10.1 until 27/08/2018
- 1.4.10.5 until 24/10/2018
- 1.4.10.5.1 until 29/10/2018
- 1.5.8 until 31/12/2018

Geographical scope

- First wave (PT, ES, FR, DE, BE, NL, AT, LT, LV, EE, FI, SE, DK, NO)
- In 2018, SIDC operations started in June. This affects the magnitude of the data and should be considered when trying any comparison.



Operations report

In this section, operational events occurred in SIDC during 2018 are reported, including: the incidents occurred, requests for changes decided upon and corrective measures applied. Such events are reported for so called “First wave” coupled area and not at NEMO, TSO or country level.

INCIDENTS

They are classified according to two criteria (severity and causes), with a classification in SIDC which is similar but not identical to those applied in SDAC due to the specificities of the two technical solutions.

- In 2018 SIDC operations experienced some issues, which are linked to the launch of a new and complex market, as shown by the drastic reduction of incidents after the first month of operation.
- The most critical incidents in SIDC (those that lead to stop trading) in 2018 happened only twice, in the month of September, and for an aggregated duration no longer than 46 minutes.
- The most frequent cause of incidents has been “other” minor cases.

REQUESTS FOR CHANGE (RfC)

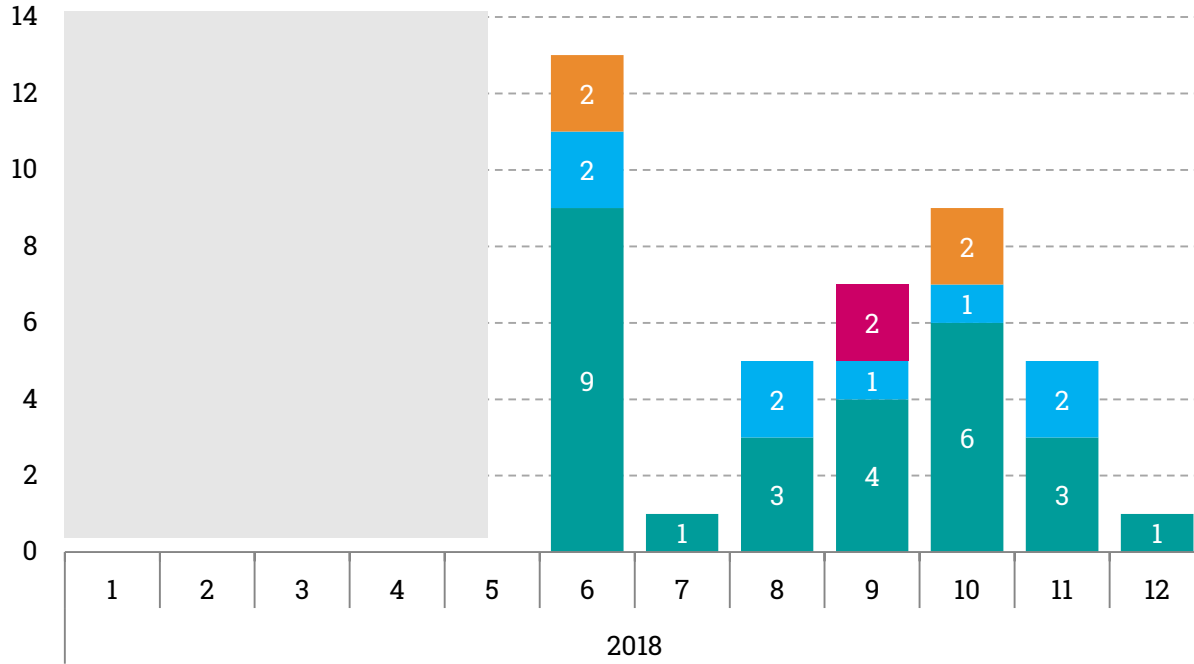
RfCs are classified per type of requirement, with the same classification being applied in SDAC and SIDC despite the specificities of the two technical solutions.

- Limited number of RfCs has been implemented during 2018, in line with the new launch of the project and the short duration of the operations.
- The majority of RfCs concentrated in small fixings in the first months of operations and in the launch of new releases in August and October providing functional improvements (including improvements in GUI and error messages).
- The most important RfC implemented in 2018 was the DE-AT split on 01/10/2018.

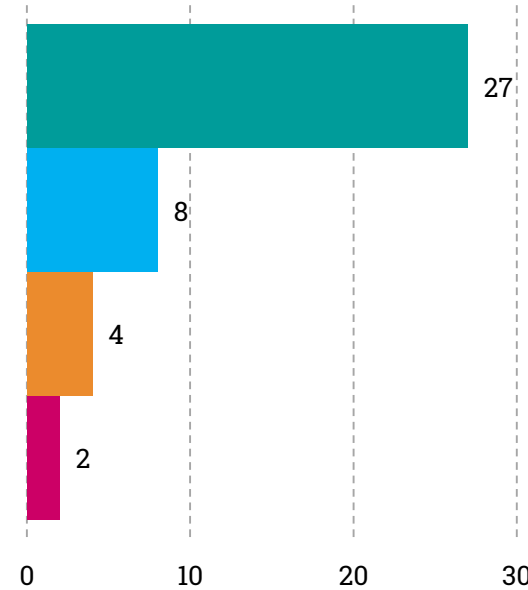
CORRECTIVE MEASURE

- No CM has been applied in SDAC during 2018, as no relevant performance deteriorations has been recorded during the year.

Monthly



Annual



Severity 1

Incidents that lead to stopping ID trading

Severity 2

Incidents that lead to closing interconnector(s)/area(s)

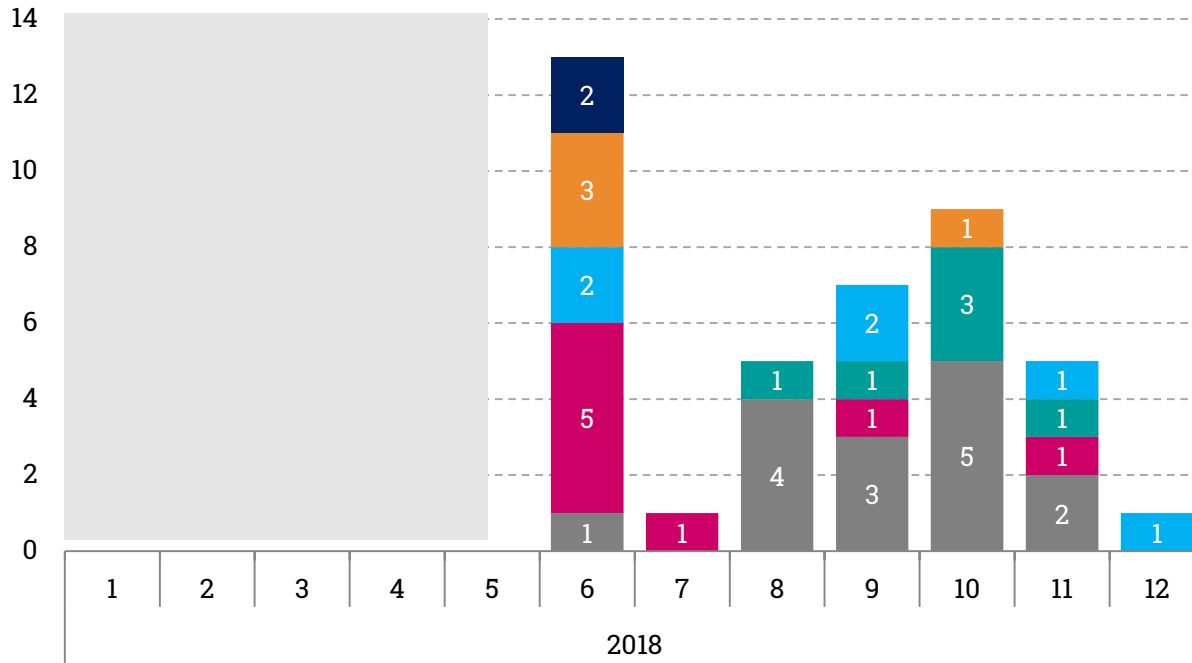
Severity 3

Incidents that were visible to participants

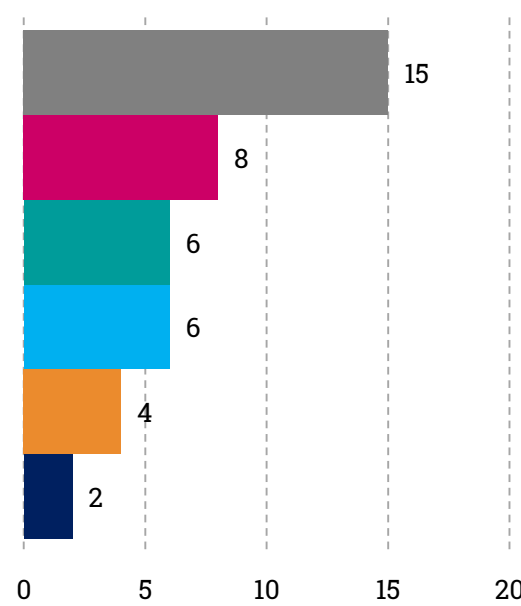
Severity 4

Incidents that caused the breach of a critical deadline or any other major incident

Monthly

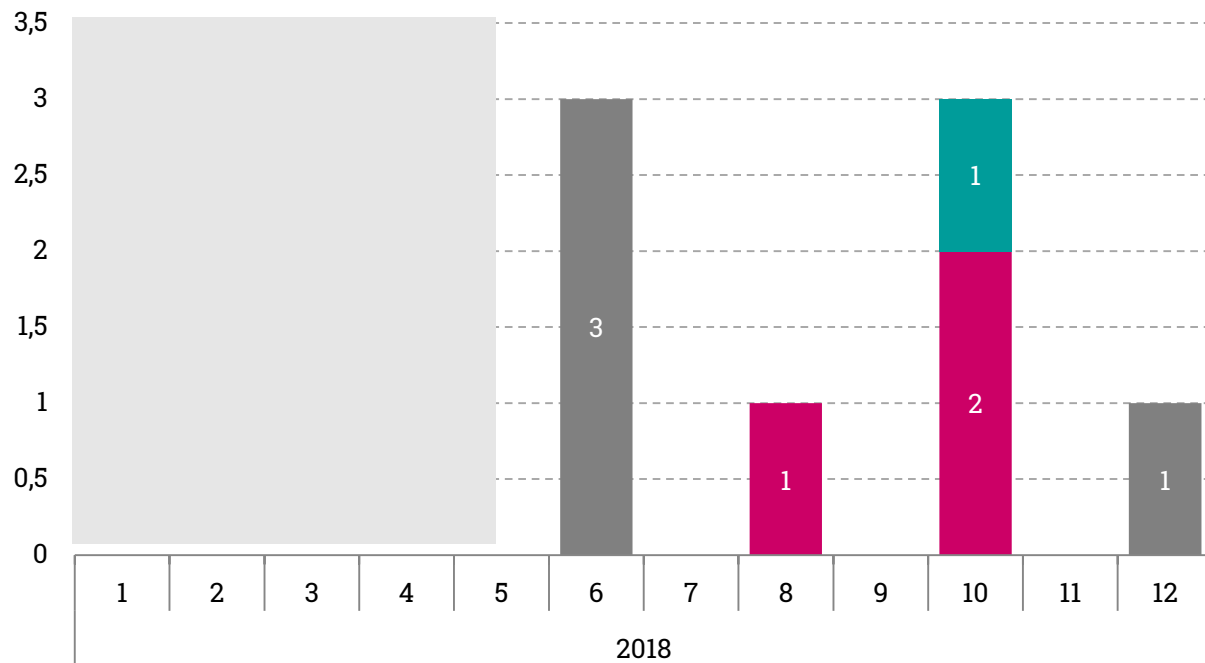


Annual

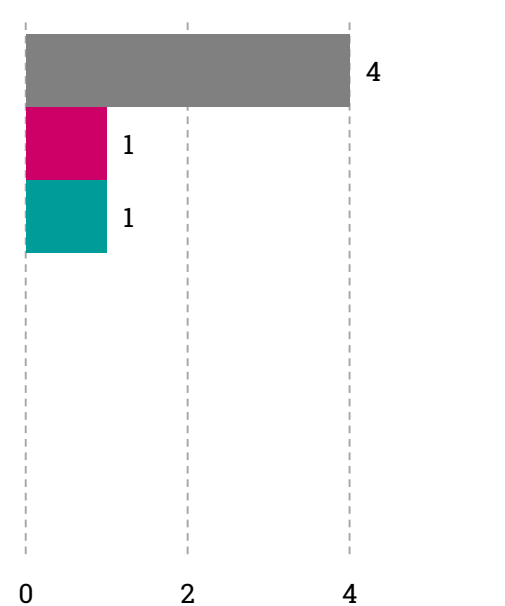


- Other
- Human error
- Unusual process
- Interface issue
- System bug
- Configuration

Monthly



Annual



Other

System Release

Network topology

Graphical extension

Products extension

MNA implementation

Flow based

| Requirement | Specific | GO Live Date | Reason | Initiator/Owner | Details | Outcome |
|------------------|--|---------------|--------------------|-----------------|---|----------|
| Network topology | Germany-Austria split | October 2018 | Regulatory request | NEMOs/TSOs | | Approved |
| System release | Release 1.4.10.5 | August 2018 | Other | NEMOs/TSOs | Code fix | Approved |
| | Release 1.4.10.5.1 | October 2018 | Other | NEMO/TSO | Code fix | Approved |
| | Release 1.5.8 | October 2018 | Other | NEMO/TSO | Various usability improvements and code fixes | Approved |
| Other | Spain - Morocco Interconnector inactivated | June 2018 | Other | NEMO/TSO | Configuration update (notification) | Approved |
| | AMPRION-APG capacity publish offset change | June 2018 | Other | NEMO/TSO | Configuration update (notification) | Approved |
| | New Balancing Group for TTG* in Capacity Management Module | June 2018 | Other | NEMO/TSO | Configuration update (notification) | Approved |
| | Explicit access for TTG-TTN* | December 2018 | Other | TSO | Configuration update (notification) | Approved |

* TTG: TenneT TSO GmbH ; TTN: TenneT TSO NL

Performance monitoring report

For performance monitoring, the indicators listed in the draft annex 4 of the AM (currently under review by ACER) have been considered. In order to compute these indicators all the days of year 2018 were considered, starting from the go-live in June. The maximum, minimum and average values observed throughout the year are reported in the following slides. When relevant, monthly values are also reported.

Notes on the calculation of these indicators are included at the end of the report as Annex 2.

USAGE INDICATORS

- For 2018 many of the data cannot be provided due to the nature of the centralised system and will be provided for future data after the related functionalities are implemented. The available data represent the already extensive network topology covered (24 market areas), despite the limited number of active NEMOs (3) and the product types available (4).
- The analysis of monthly values regarding total order transactions per month shows an upward trend from 9.0 to 17.7 M.

PERFORMANCE INDICATORS ⁹⁾

- The analysis of daily values, in terms of processing time, shows a stability in the values for the lower percentiles in the indicators and an increment of the variations in the values for high percentiles.
- Only in October, an SLA threshold was breached, and this happened only once: Order Execution time reached 7,082 milliseconds of the percentile 99.5% on 15 October. This shows the good quality of the solution and the stability on the response times.

OUTPUT INDICATORS

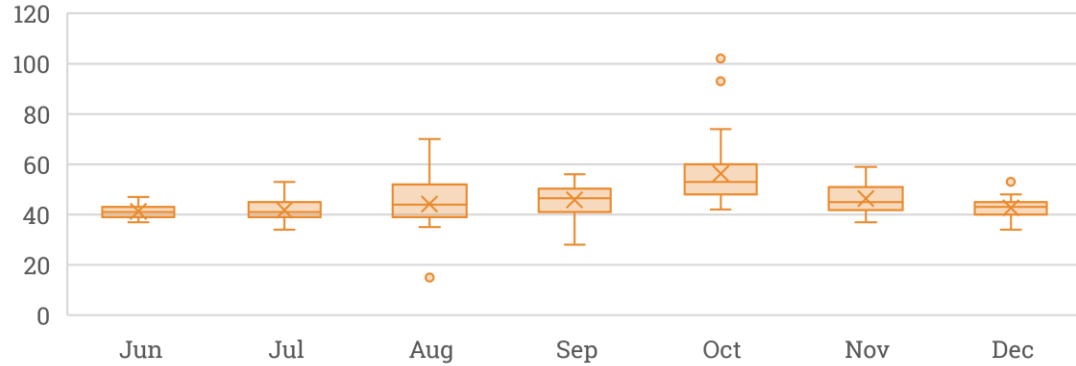
- For 2018 limited data can be provided, more data will be provided in future reports after the indicators extraction functionality is implemented.

| Usage indicators | | Year 2018 | | |
|--|--|---------------|-----|-----|
| | | Avg | min | max |
| 1) Indicators to describe the Usage of products (Proposed Annex 4 of AM Article 9) | Total number of products | 4 | 4 | 4 |
| | Total number of daily submitted order per product and per bidding zone | Not available | | |
| | Total daily submitted order volume per bidding zone | | | |
| | Total number of explicit capacity allocation request | | | |
| 2) Indicators to describe the geographical extension (Proposed Annex 4 of AM Article 10) | Total number of NEMOs | 3 | 3 | 3 |
| | Total number of delivery areas | 27 | 27 | 27 |
| | Total number of market areas | 24 | 24 | 24 |
| | Total number of interconnectors | 48 | 48 | 48 |
| | Total number of borders | 36 | 36 | 36 |
| 3) Indicators to describe Network constraints (Proposed Annex 4 of AM Article 11) | Total number of occurrences of ramping constraints on interconnector level | Not available | | |
| | Total number of occurrence of Biding Zone net position ramping constraints | | | |
| | Total number of occurrence of Biding Zone net position volume constraints | | | |

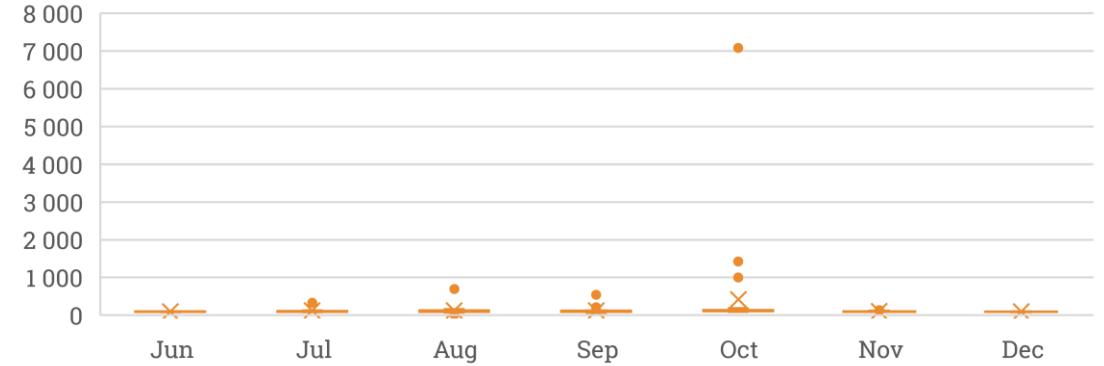
| Performance | | Year 2018 | | | |
|--|---|---|--------------|--------------|-------|
| | | Avg | min | max | |
| Algorithm scalability (Proposed Annex 4 of AM Art. 8) | (a) Time for the execution of an order (milliseconds) ⁽¹⁰⁾ | Percentile 1 normally 95% | 46 | 15 | 102 |
| | | Percentile 2 normally 99,5% | 157 | 15 | 7 082 |
| | | Percentile 3 degraded 93% ⁽¹⁰⁾ | 40 | 15 | 73 |
| | | Percentile 4 degraded 96,5% ⁽¹⁰⁾ | 55 | 15 | 515 |
| | (b) Rate of executed orders (number per day) | 451 760 | 186 286 | 733 937 | |
| | (c) Time for the execution of a trade ⁽¹⁰⁾ | Equal to (a) | Equal to (a) | Equal to (a) | |
| | (d) Rate of executed trade (number per hour) | 38 607 | 20 702 | 64 105 | |
| | (e) Time for generation of post coupling files (milliseconds) | 7 375 | 1 385 | 38 000 | |
| | (f) Time for processing an order book update (milliseconds) | Percentile 1 normally 95% | 72 | 18 | 112 |
| | | Percentile 2 normally 99,5% | 128 | 18 | 200 |
| Percentile 3 degrade 93% | | 66 | 18 | 112 | |
| Percentile 4 degrade 96,5% | | 79 | 18 | 113 | |

Time for the execution of an order/trade (millisec)

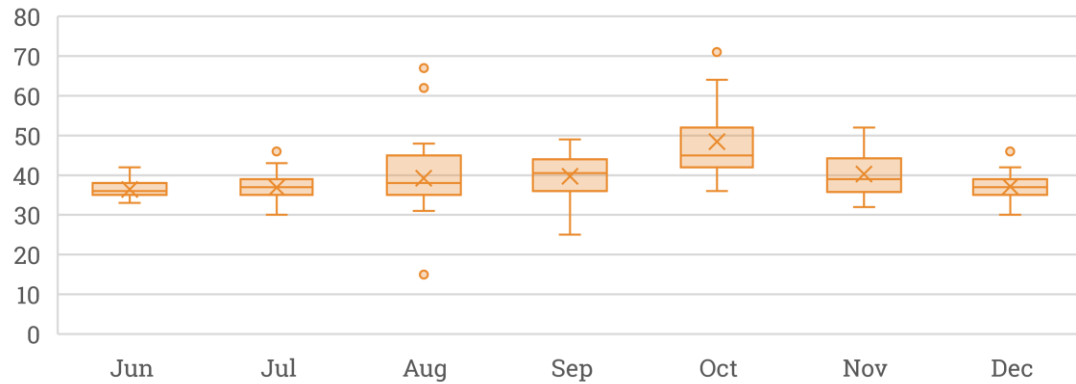
Percentile 1 normally 95%



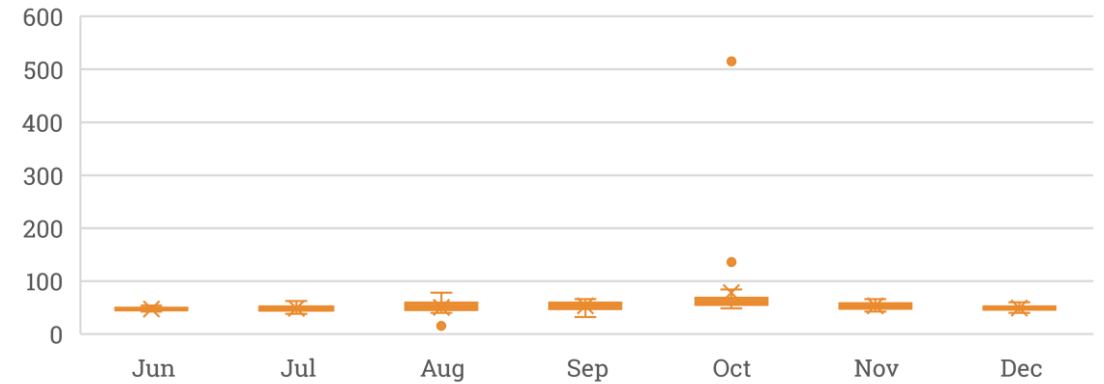
Percentile 2 normally 99,5%



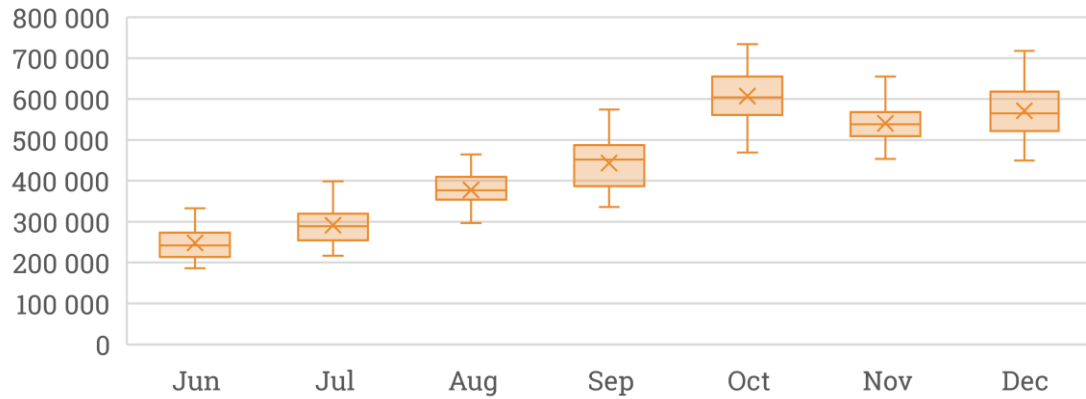
Percentile 3 degrade 93%



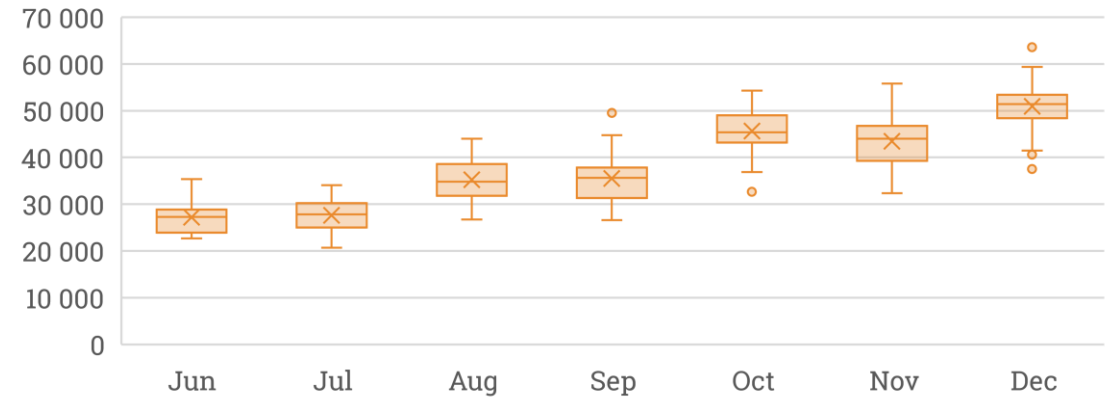
Percentile 4 degrade 96,5%



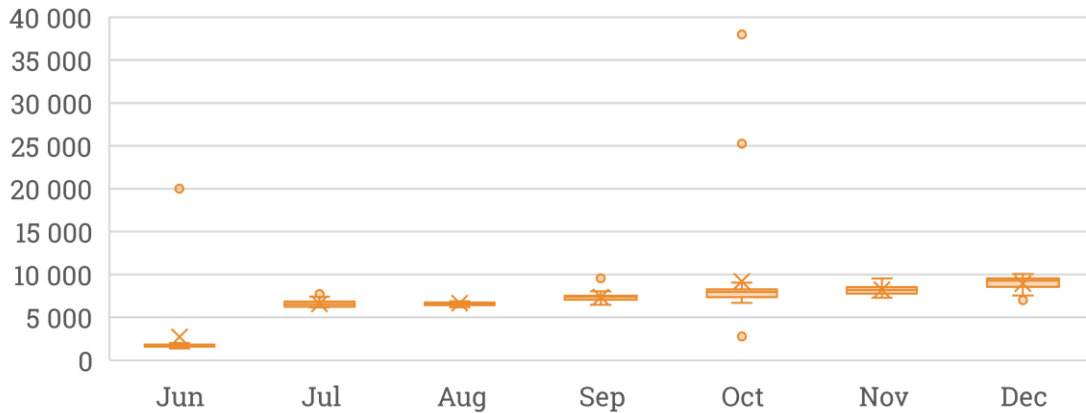
Rate of executed orders (number per day)



Rate of executed trade (number per hour)

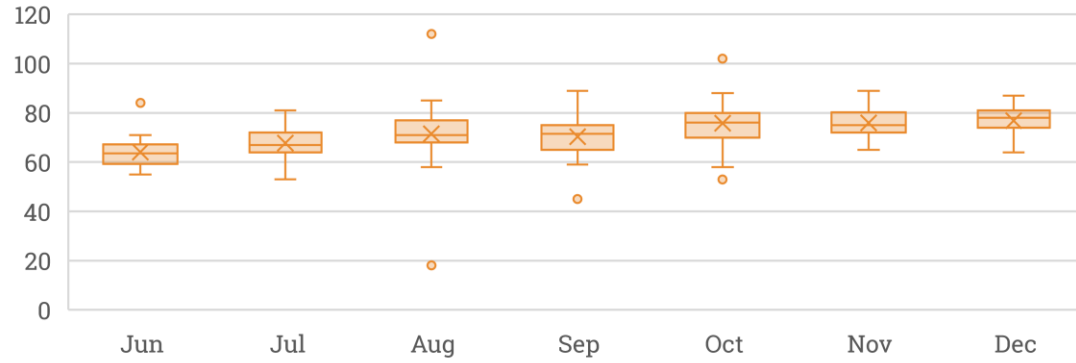


Time for generation of post coupling files (millisec)

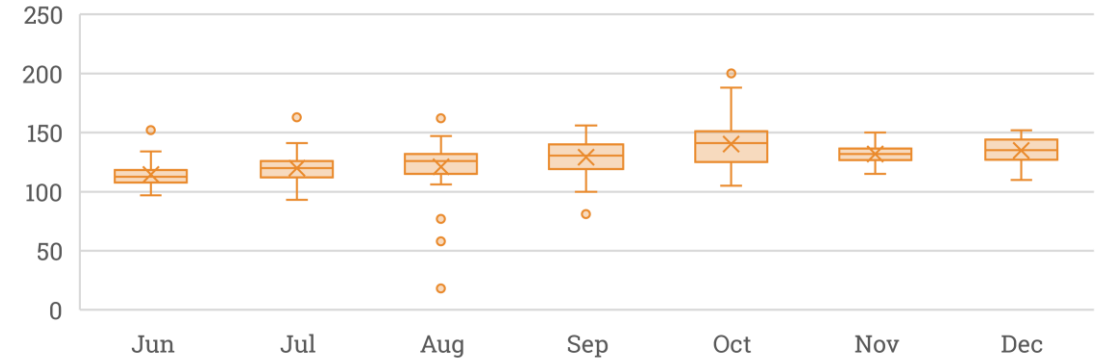


Time for processing an order book update (millisec)

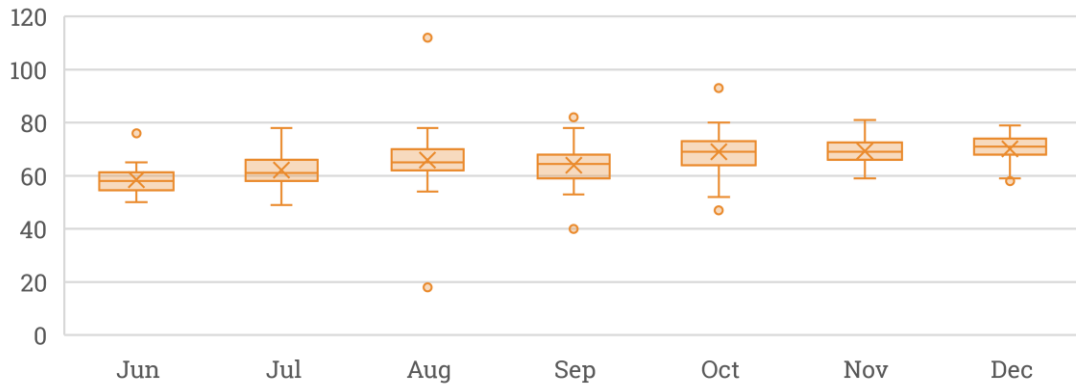
Percentile 1 normally 95%



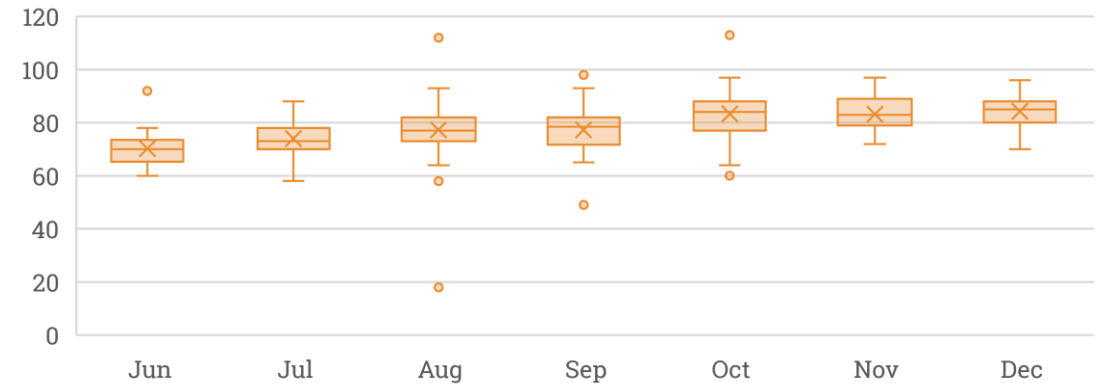
Percentile 2 normally 99,5%



Percentile 3 degrade 93%



Percentile 4 degrade 96,5%



| Output indicators | | Year 2018 | | | |
|---|---|---|---------------|-------|-------|
| | | Avg | min | max | |
| Indicators on the maximisation of economic surplus (Proposed Annex 4 of AM Article 12) | Number of matched orders of each contract | Total matched volume | Not available | | |
| | | Total matched volumes – hours to delivery | | | |
| | | Total number of trades per contracts | | | |
| | | Total number of trades per contract – hours to delivery | | | |
| | Number of explicit capacity allocation | Total number of daily explicit capacity allocations | 3 254 | 1 049 | 9 983 |
| | Prices | Volume-Weighted Average Intraday Prices | Not available | | |
| | | Volume-Weighted Average Intraday Prices – last trading hour | | | |
| | | Bid-Ask Spread | | | |
| | Capacities | ATC utilisation rate | Not available | | |
| | NET positions | NET positions | | | |

Scalability report

Due to Go-live mid 2018 there is no historical data available to measure the scalability of the system. To solve this, during the project different stress tests were executed to explore the behaviour of the system along different stress test scenarios. The stress tests always represent a busy hour of the day and the 100% of the results must respect the agreed SLA (service level agreement) regarding time indicators.

Along different releases, stress tests included realistic tests scenarios which represented different distribution of orders along different mix of products, variations along different combinations of base load, number, duration and quantity of rate of orders per second which are sent to the system. The stress tests included a realistic topology, including changes foreseen in the road map and the anticipated growth.

The stress tests were performed using the latest available version of the SDIC algorithm and they did not cover the performance impact of some future RfCs that it may be impossible to measure or model in advance.

All stress tests were passed.

| Requirement | Specific | GO Live Date | Reason | Initiator/Owner | Details | Outcome |
|------------------|---|------------------------|--------|-----------------|---|--------------------------------------|
| Network topology | Cobra Interconnector (DK1-NL) | September 2019 | Other | NEMOs/TSOs | Configuration update | Approved for development and testing |
| | 2 nd wave | Q4 2019 | CACM | NEMOs/TSOs | Configuration update | Approved for development and testing |
| System releases | R2.0 | Q4 2019 | Other | NEMOs/TSOs | Enhanced shipper, Orderbook depth, Usability** improvements | Approved for development and testing |
| Other | Harmonisation of Intraday Cross-Zonal Gate Opening Time | Jan 2019 + other waves | CACM | TSOs | Configuration update | Approved for development and testing |
| | NEMO access to Capacity Management Module | April 2019 | Other | NEMOs/TSOs | Configuration update | Approved for development and testing |
| | Max/min capacity for NO3-NO4 | January 2019 | Other | TSOs | Configuration update (notification) | Approved for development and testing |
| | Usability improvements** | NA | Other | NEMOs/TSOs | System development | Included to assessment |

* List of RfCs placed in 2018 for future implementation.

** As the number of RfCs related to usability improvement is high, it is covered by this generic reference at least until they are implemented. When the RfC is implemented, more detailed information will be listed.

R&D report

The discussions on R&D programme for the continuous trading matching algorithm started in 2019, so it will be included in next report.

In future editions, the activities, the outcome and the budget of the R&D programme will be reported.



Annexes



| Indicator | Parameter | Description | Value | Purpose | Proposed Annex 3 of AM |
|---------------|-----------|---|---------------------------------------|---|---|
| | K | Number of months which define the recent historical set | 3 | Definition of recent historical set | Art. 2(3)(a) |
| Scalability | X% | Minimum percentage of cases which have to comply with the scalability indicator threshold | 1. 97% of cases; 2. 100% of cases. | <ul style="list-style-type: none"> - Monitoring purpose - RfC assessment for the past scenario - RfC assessment for the future scenario - Scalability assessment for the near future scenario - Scalability assessment for distant future scenario - Research and development | Art. 3(4)(c)- Art. 4(3)(a) - Art. 4(3)(b) - Art. 5(3)(a) - Art. 5(3)(b) - Art. 6(3)(c) |
| | y | Threshold for scalability indicator on the indicator values distribution | 1. 12 min; 2. 21.6 min. | <ul style="list-style-type: none"> - Monitoring purpose - RfC assessment for the past scenario - RfC assessment for the future scenario - Scalability assessment for the near future scenario - Scalability assessment for distant future scenario - Research and development | Art. 3(4)(c)- Art. 4(3)(a)- Art. 4(3)(b)- Art. 5(3)(a)- Art. 5(3)(b)- Art. 6(3)(c) |
| | Z | Threshold for scalability indicator on the average value | ∞ | <ul style="list-style-type: none"> - Monitoring purpose - RfC assessment for the past scenario - Scalability assessment for the near future scenario - Scalability assessment for distant future scenario - Research and development | Art. 3(4)(c)- Art. 4(3)(a)- Art. 5(3)(a)- Art. 5(3)(b)- Art. 6(3)(c) |
| | X | Time extension for first OK-solution calculation | 10 min | | Art. 7(2)(a) |
| Repeatability | pi | Weight for the different component of the repeatability indicator | 1 | <ul style="list-style-type: none"> - Clearing prices - Products output | Art. 8(2)(b) |

| Parameter | Value | Scope | Proposed Annex 4 of AM |
|-----------|--------------------|---|--|
| K | 3 | Number of months which define the recent historical set | Art. 2(3)(a) |
| t | n.a. ⁸⁾ | Scalability threshold as defined in the service agreement with the service provider | Art. 3(4)(a)- Art.4(3)(a)- Art.4(3)(b)- Art.5(3)(a)- Art.5(3)(a)- Art.6(3)(a) |
| X% | n.a. ⁸⁾ | Minimum percentage of cases which have to comply with the scalability indicator threshold t | Art.6(3)(a) |

- 1) **Incidents causes.** “Unusual process” category involves any unattended procedures that may cause delays; “Interface issues” is related with mistakes in the format of offers/results; “System bug” involves problems with common systems; “Configuration” is related with topological configuration; “Human error” is related with incidents caused by an external party (e.g. market participant); “Other” involves any other cause, typically related with technical issues belonging to local NEMO/TSO systems.
- 2) **Requests for change.** “Geographical extension” category involves any RfC including in the SDAC new MSs; “Network topology” category involves any RfC modifying the topology of the existing MSs (for example by splitting existing BZs, removing BZs, adding or eliminating cables, ...); “Flow based” category involves any RfC introducing or modifying the flow based methodology in one or more BZs; “MNA implementation” category involves any RfC introducing MNA in one or more BZs; “product extension” category involves any RfC extending the usage of existing products in further BZs; “System release” category involves any RfC introducing the usage of a new version of one or more MCO system; “other” category involves any RfC non included in the previous categories, among which especially related to procedural changes. When a single RfC impacts more than one category among those reported in the graphs, they are conventionally counted for the number of categories impacted. Typical is the example of the “Geographical extension” RfCs, which, by definition, are impacting also product extension to different BZs. Note that the Non-notifiable changes are not included in the list provided. These changes are 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.
- 3) **Box plot.** The monthly trend of the indicators is reported through “box and whisker” chart (or box blot). The chart shows the distribution of data into quartiles, highlighting the median, mean and outliers. The boxes have lines extending vertically called “whiskers” which indicate variability outside the upper and lower quartiles, and any point outside those lines or whiskers is considered an outlier. The reported charts show the mean markers (X symbol) and the quartile calculation uses the exclusive median

method (i.e. The median is excluded from the calculation if the number of values in the data is odd)

4) Performance indicators.

- 1) **Ability to maximise the welfare indicator.** The first indicator illustrates the economic improvements realised in production, from the first valid solution find (corresponding to the TTFS solution) and the finally chosen solution. The second indicator shows foregone economic surplus improvements, identifying the incremental welfare which would have derived from prolonging calculation time by 10 minutes after the maximum allowed time (currently 12 minutes). The minimum value observed for the economic surplus gain after increasing allowed calculation time by 10 minutes is negative (-0.000714%) because the corresponding version of Euphemia was not fully repeatable.
- 2) **Repeatability indicator:** The versions of the SDAC algorithm used in 2018 didn't support yet fully repeatability. A session is repeatable if Euphemia returns, for each iteration, the same value for all the relevant variables in both runs when comparing solutions with the same solution id. Comparison is made on the latest common solution over two consecutive runs of production input data in a production like machine. This machine fulfils the minimum requirements set for machines used in production. Comparisons are done considering 6 decimal places precision (1e-6 tolerance). Two indicators are provided to assess the adequate repeatability level, please note that they are not included in the proposed Annex 3 of Algorithm Methodology. One measures what is the proportion of the values equal with respect the total number of indicators, the other indicator measures the average impact on the relevant results when differences exist.

- 5) **Ability to maximise the welfare indicator.** The indicator on foregone welfare due to limiting calculation shows for some sessions the economic surplus decreases with the time extensions. This effect reflects the non full repeatability of the SDAC Algorithm in 2018.
- 6) **Scalability report.** This indicator for SDAC applies the standard scalability indicator (TTFS) and relative thresholds currently applied to approve RfCs (97% of solutions with TTFS<12 min, 100% of solutions with TTFS<21,6 min) to future scenarios (namely the near future scenario representing Y+1, namely 2019, and distant future scenario representing Y+3, namely 2021), which includes anticipated growth of historical usages and anticipated Requests for Changes. The simulations are calculated using the latest available version of the SDAC algorithm, which means that by construction this indicator under-estimate the future level of scalability, as it cannot consider the expected impact of the future releases of the SDAC algorithm which will be used in production in Y+1 and Y+3. Furthermore it may be impossible to model the impact of some RfCs, whenever they request new releases of the algorithm or network data not already modelled at the time of the simulation.
- 7) **Unharmonised derogations.** According to article 8.2 of Regulation (EU) 2019/943, SDAC and SIDC shall implement MTUs aligned with the Imbalance Settlement Period (ISP), which according to Article 8.4 shall be 15 mins since 01/01/2021, with possibility for derogations until 31/12/2024. This shall induce a significant increase in the demand for scalability, due to the quadruplication of the size of the market (from 24 to 96 MTUs). Furthermore according to article x of Balancing Regulation, TSOs may apply for a derogation to this term up to 2025 and, in case different MTUs temporarily apply on two sides of a border, the cross border capacity should be allocated on the longer MTU of the two. Hence, depending on local TSOs' applications for derogations and NRAs' decisions, this could lead to a stepwise implementation of 15 mins MTU throughout the EU, with different products durations being traded in different BZs and with cross-border capacity being allocated on different MTUs on the different borders of a same BZs. This would require the SDAC algorithm to incorporate a new functionality in order to support the so called "cross matching" of products with different MTUs but also of net positions and

cross border flows with different MTUs, which is not existing at the moment and which can be expected to prove even more demanding in terms of scalability.

- 8) **SIDC.** Technical operation of SIDC is fully regulated by the Master Service Agreement (MSA) between NEMOs and the XBID system vendor. MSA's contractual arrangements stipulate that the vendor is a sole party having access to the XBID technical components as e.g. XBID databases. Hence, the data which are included in this report are mainly based on the technical regular reports provided by vendor to SIDC parties. This also implies that all request on the extension of the reporting obligation (including the existing reporting obligations which are not implemented yet), and which require extension of XBID source data provided by the vendor, are subject of the change management process and release management process stipulated with the vendor. It shall be also noted that MSA set outs principles of confidentiality which, among others, applies to the provisions of the Service Level Agreement regulating e.g. availability and performance of XBID system. Based on the confidentially principles, the details may be shared with SIDC stakeholders (NRAs, ACER, EC) but cannot be revealed to a general public.

9) SIDC Performance indicators

- 1) **Ability to maximise the welfare indicator:** As set out in the Title 3, Article 7 of the Annex 4 of the Methodology for monitoring the performance and usage of the continuous trading matching algorithm, the indicators on the continuous trading matching algorithm's ability to maximize economic surplus are not relevant for the continuous trading matching algorithm.
- 2) **Repeatability indicator:** As set out in the Title 1, Article 2, Paragraph 1c of the Annex 4 of the Methodology for monitoring the performance and usage of the continuous trading matching algorithm, the continuous trading matching algorithm is by design optimal and repeatable. For this reason, the monitoring of the continuous trading matching algorithm's optimality and repeatability is not necessary.

10) SIDC Performance indicators

- 1) As of today, there is no separate value for the execution of a trade and for execution of an order. The parameter includes together order and trade execution (trades executions are a subset of order executions in the existing reporting). Consequently, the values used would be those for the time for the execution of an order (indicator a).
- 2) The degraded percentile values are the percentiles that apply when the agreed rates of orders per second, transactions and total number of orders in specified time windows are breached, this means the SLA's timings apply to these degraded percentiles instead.

Disclaimer

The data source of this report has been provided by SDAC and SIDC respectively.

The All NEMO Committee accept no responsibility or liability for any consequences arising from the use of the data contained in this document.

Imprint

Publisher: All NEMO Committee

Publishing date: December 2019

For questions, comments or clarifications: secretariat@nemo-committee.eu

TEID # TAK # EYXAPICTO # DANKE # PALDIES # GRAZIE # KITOS # DAN
JE # OBRIGADO # KÖSZÖNÖM # TACK # THANK
YOU # ĐAKUJEM # TĀNAN # TEID DZIEKUJE # GRACIAS # MERCI # MULTUMESC # BJAOTAPPA
BI HVALA GO
PĀIBH MAITH AGAT # AČIŪ # DĚKUJI VĀM # TĀNAN

ALL
NEMO
COMMITTEE