CACM Annual Report 2024

ALL NEMO COMMITTEE

in coordination with entsoe

ALL NEMO COMMITTEE

CACM
Annual Report 2024

Table of Contents

Letter to stakeholders

Dear Stakeholders, NRAs, Commission and ACER,

Looking back to – and reflecting on – 2024, it cannot pass unnoticed that it was yet another year of transition and transformation, where projects already initiated were successfully brought to completion, while new foundations were being laid.

In the year when the integrated **day-ahead market coupling** celebrated its **10th anniversary,** auctions were also introduced in the Intraday timeframe in June 2024, with the **launch of EU-wide Intraday Auctions (IDAs)** to complement the existing intraday continuous market. Thanks to the collaborative efforts of both NEMOs and TSOs, IDAs have attained a consistent **success rate of 98 %**, proof of the high standards maintained in securing reliability, robustness and efficiency of market coupling operations. This is particularly important considering that IDAs represent a completely new market segment, with tight operational timings.

Numbers speak for themselves. In 2024 the day-ahead market reached a total of 1 840 TWh of traded volume, an 8.5 % increase compared to 2023, with 11.8 billion EUR of average economic surplus per session. The continuous market has also grown apace. This represents the fifth consecutive increase in annual market volumes since SIDC market go-live in June 2018. The size of the coupled market grew, from 57 TWh in 2019, to 207.5 TWh, representing over 208 million trades plus 46.6 TWh in IDAs.

NEMOs have also contributed towards the development and implementation of the Terms, Conditions and Methodologies established by CACM. I would like to stress the good cooperation between ACER and the NEMO Committee in these processes.

In 2024, NEMOs, in cooperation with TSOs, started to work on the deliverables around co-optimisation, as expected in the new version of the Algorithm methodology. As regards the day-ahead products methodology, after the corresponding consultation and formal submission, the updated methodology, incorporating updates for the 15 min implementation in SDAC, was published by ACER and swiftly implemented by NEMOs. The intraday products methodology followed the same process, some months later.

Now that market integration in the EU is already complete, both for SDAC and SIDC, efforts are concentrated on further improving the market to the benefit of market participants and European society as a whole. A case in point is the complete rollout of 15-minute products in SIDC, which will coincide with the go-live of 15-minute products in SDAC. The overall rollout of 15-minute products in both timeframes refines market operations by enhancing precision, improving the integration of renewable energy sources and increasing overall efficiency and flexibility. By enabling better adaptation to fluctuations in energy supply and demand, it will support more accurate pricing and scheduling, delivering significant benefits to market participants.

In terms of extensions, in 2024 a new NEMO became operational in SDAC and SIDC. With the entry of BRM the NEMO family keeps growing. Furthermore, several power exchanges joined in 2024, as NEMO Committee observers.

Going further, preparatory work is on-going for integration of the Energy Community countries into the coupled EU markets. In January 2025, NEMOs delivered a major milestone towards this so far unprecedented extension, submitting a proposal for the Market Coupling Operations Integration Plan (MCO IP) to ACER.

In our efforts to constantly improve and adapt to market needs and to the energy landscape reality, it is essential that any proposal we bring is not only justified but also properly consulted. The Electricity Market Design Reform (EMD), which was adopted in June 2024, acknowledged the well-functioning European Electricity Spot Market. The sealed agreement has preserved the role of NEMOs in jointly managing the integrated day-ahead and intraday markets in a coordinated manner, based on multilateral and decentralised cooperation.

As we are about to embark on the revision of the Capacity Allocation and Congestion Management (CACM) Regulation, it is important to reflect on the role this EU rulebook plays in enabling NEMOs to successfully operate the Market Coupling. Being one of the key pillars of EMD, NEMOs remain consolidated and committed to further developing the internal electricity market.

Maintaining open and transparent dialogue is fundamental in the way we interact with stakeholders. For a second year in a row, NEMOs held their **NEMO Committee Annual Conference**, a key event which is already growing to become a tradition. This gathering was a great opportunity to exchange views, experiences and a chance for mutual learning.

Furthermore, our engagement with market participants and TSOs is all-year-round via the Market Coupling Consultative group (MCCG), which has established itself as the format where market developments are discussed and presented in depth, with questions asked and addressed in a spirit of openness.

Traditions and well-working practices would be of no significance without a vision and a forward-looking approach. Our **Annual Work Programme 2025** highlights not only what we are working on, but also what lies ahead. Undoubtedly, the revision of CACM is in the spotlight and will remain so throughout 2025. Among other things, progress is being made with the study and the R&D assessment of market requirements for co-optimisation, according to the timeline of the ACER decision no 11/2024.

We thank you for your continued trust and for a fruitful cooperation! We are convinced that our work is an essential contribution to the European welfare and we remain committed to continuing this mission of further developing the European Electricity Market.

Rafael Gómez-Elvira González
Chairman of the All NEMO Committee

Regulatory framework

Annex I to the ACER Decision 04/2020 on the Algorithm Methodology of 30 January 2020 (hereinafter referred to as Algorithm Methodology), amended by ACER Decision 11/2024, provides the regulatory framework obligations for this CACM Annual Report. It includes the methodology for the price coupling algorithm, the continuous trading matching and the intraday auction algorithm also incorporating a common set of requirements in accordance with Article 37(5) of the Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management (CACM).

The reporting obligations to comply with CACM Annual Report are listed in the Algorithm Methodology. This report is elaborated in cooperation with TSOs and is structured in the following manner, for both SDAC and SIDC:

1. Operations report, consisting of:

a) Report on incidents

According to article 4(19) and 5(17) of the Algorithm Methodology, it provides a list of incidents in the operation of the relevant algorithm and the application of back-up and fall-back procedures. It includes an explanation for their occurrence, as well as remedies applied or anticipated to prevent their recurrence;

b) Report on the decisions on requests for change

According to article 19(11) of the Algorithm Methodology, it indicates the decision for each request for change, the criteria and the principles behind such decision as well as the assessment report as required under article 17(12) of the Algorithm Methodology; and

c) Report on the application of corrective measures

According to article 12(13) of the Algorithm Methodology, it indicates the corrective measure applied, the reasons for applying it and provides additional information on plans for future measures to address these problems.

2. Report on the outcome of the monitoring of the algorithm performance

According to article 8(3) of the Algorithm Methodology, it contains the items listed in Annex 3 and Annex 4 to the Algorithm Methodology, all cases of performance deterioration or non-compliance with an implemented functionality, an analysis on the usage of each product and its impact on algorithm performance (for SDAC only), a description of the reasons for these occurrences and remedies or future improvements (as referred to in article 5 of Annex 3 and article 5 of Annex 4 to the Algorithm Methodology) and a presentation of the conclusions made in cooperation with the relevant stakeholder fora.

3. Scalability report

According to article 9(4) of the Algorithm Methodology, it provides the outcome of the assessment of the estimated level of scalability for the coming years and an explanation as to whether this level meets adequate scalability requirements. This section also includes the assessment of the effective usage, anticipated usage and usage range. Finally, it provides the prospective projects scoped as part of research and development with estimated workloads. Starting from 2025 (relevant to CACM Annual Report 2024) the scalability Report will be published separately from the CACM Annual Report by the end of September each year.

4. Report on research and development activities

According to article 11(8) of the Algorithm Methodology, it provides the status of the research and development activity and the planning of the future research and development activity, including an estimation of the identified workload and the associated budget.

In addition, article 20(3) of the Algorithm Methodology sets the obligation to publish all the above-mentioned reports.

NEMOs & NEMO Committee

NEMOs are the Nominated Electricity Market Operators designated by the competent national authorities to run the Day Ahead and Intraday markets according to CACM. Currently there are 17 NEMOs designated for both DA and ID, with the exception of ETPA and EXAA (designated only for the Day Ahead market).

The All NEMO Committee is the body established by NEMOs to facilitate their cooperation in the delivery of common European tasks. It manages the delivery of the Terms, Conditions and Methodologies expected under CACM (the so called MCO Plan, and relevant Methodologies), the contractual framework among NEMOs and with TSOs and ensures NEMO representation, stakeholder's involvement and legal compliance.

Following withdrawal of NASDAQ's designation in late 2023, as of 2024 it is no longer part of the cooperation.

NEMO Committee Activities

Reporting

Publication of CACM Cost Report 2023, CACM Annual Report 2023 and CACM Annual Report 2023 Infographic.

Communication

On 19th September 2024 NEMO Committee held its 2nd Annual Conference in Athens where the CACM Annual Report 2023 was presented.

NEMO representation

Preparation and representation of NEMO positions in public and institutional fora (including among others the Florence Forum, Market European Stakeholde Committee (MESC), the Market Coupling Consultative Group (MCCG), the Pentalateral Coordination Group, Electricity Market Integration Forum (EMIF), together with European Commission, ACER and NRAs.

Methodologies

In late 2023, following a relevant public consultation, all NEMOs submitted to ACER their proposed amendments to the Algorithm methodology related to Co-Optimisation, based also on the updated common set of requirements from the TSOs. The amended Algorithm methodology was adopted pursuant to ACER Decision 11–2024.

On 26 April 2024, all NEMOs submitted to ACER a proposal for amending the terms and conditions for the SDAC products reflecting all the required amendments for the incorporation of the 15 minutes (15') market time unit ("MTU") products in SDAC as of January 2025. The introduction of the 15' MTU in SDAC, impacting the performance of the SDAC algorithm, necessitated the introduction of improvements and modifications for the products and order types available in SDAC. Based on the proposal, ACER issued Decision 13–2024 whereby it amended the Day-ahead product methodology. In 2024 the NEMOs also worked on preparing updated SIDC Products Methodology mainly on the IDAs section reflecting the introduction of the 15 min MTU as for the SDAC Products Methodology.

The MCO IP proposal was formally submitted by the NEMO Committee to ACER on 31st January 2025.

Results of Consultations

- In late 2023 NEMOs cooperating within the SDAC opened a coordinated consultation, related to the potential removal of the so-called Second Auctions. The results of the consultation were published in late February 2024.

Further info about NEMOs and the NEMO Committee can be found at www.nemo-committee.eu.

Figure 01

- Public consultation on amendments to SDAC Products Methodology due to the introduction of 15-min MTU products in SDAC was opened in early February 2024 and closed in March 2024.
- Public Consultation on amendments to SIDC Products Methodology on reflecting harmonisation of terms and conditions on the IDAs section of the SIDC was opened in late May 2024 and lasted until July 2024.

Published

- Information package about IDA
- Updated EUPHEMIA Public Description
- NEMO Committee position on ACER welfare study on expected benefits of co-optimisation in the day-ahead electricity market
- Joint statement welcoming the new Demand Response Network code

Survey on Co-Optimisation:

In the context of their continuing cooperation with Market Particiants, of NEMOs and TSOs, in cooperation with ENTSO-E, conducted an informal survey among market participants regarding the possible future use of co-optimised balancing capacity and energy products in SDAC. Following the survey, a Co-optimisation workshop was held.

Further Tasks

SDAC 15-min MTU preparations are ongoing for introduction of 15-min MTU in the Single Day-ahead Market Coupling in 2025 with a Big Bang Approach.

Newsletter

With close to 1000 subscribers, All NEMO Committee newsletter has been a reflection of the latest developments of the NEMO activities in SDAC and SIDC on a quarterly basis since September 2021.

You can subscribe to the newsletter on All NEMO Committee website here.

NEMO Committee ANNUAL PROGRAMME 2025

In 2024 the NEMO Committee Annual Work Programme was published setting out the tasks and objectives to be fulfilled by the Committee and its taskforces for 2025.

LinkedIn account

Since its launch in April 2023, the NEMO Committee LinkedIn Professional network has been constantly growing, highlighting NEMO Committee activities and important topics.

NEMO Committee 2nd Annual Conference

On 19 September 2024 the NEMO Committee held its second Annual Conference. The high-level discussion forum addressed the challenges and prospects of the European internal electricity market and the extensions beyond the EU. The event gave a glimpse into the strong cooperation and commitment of the NEMOs to implement EU regulations.

More details about the event can be found here.

Market Coupling Consultative Group (MCCG)

MCCG serves as a key platform for engaging market participants in discussions on the design, development, implementation, and operation of the Single Day-Ahead and Intraday Coupling. It fosters open dialogue and collaboration between NEMOs, TSOs, and market participants, ensuring continuous progress in market integration.

Since its establishment in 2022, MCCG has held regular meetings to address various market developments. In 2024, three meetings took place — on February 26, June 27, and November 8. Meeting agendas, presentation materials, and minutes are available on the NEMO Committee and ENTSO-E websites.

Each full-day MCCG meeting follows a structured format, with dedicated sessions focused on MCSC, SDAC, and SIDC topics. The implementation of agreed action points is closely monitored to ensure alignment with market developments.

Key topics discussed in 2024 included:

- Intraday Auctions in SIDC
- The 15-minute Market Time Unit (MTU) in SDAC and SIDC
- Operational timings and fallback processes

Given the interactive nature of MCCG meetings, participants' questions and insights are captured in real-time and subsequently reflected in the published meeting minutes.

ENTSO-E

40 TSOs operating one of the world's largest interconnected grids

- ENTSO-E is the association for the **cooperation** of the European transmission system operators (TSOs).
- 40 member TSOs, representing 36 countries and serving over 500 million citizens, responsible for the **secure and coordinated operation** of Europe's electricity system.
- ENTSO-E is also the **common voice of TSOs in Europe.**
- ENTSO-E **serves the interests of society by optimising social welfare** in its dimensions of safety, economy, environment, and performance.

For more Information, please check Member Companies.

Figure 02

Executive summary

Single Day-Ahead Coupling

High level market data

The SDAC covered a large proportion of the EU, including 27 Countries. The average economic surplus increased by 7.8 % with respect to 2023 and was, on average, around 11.8 B€ per session. The traded volumes increased with respect to the previous year by almost the 8 % amounting to 1 840 TWh with clearing prices reduced with respect to the previous year, resulting between 60 €/MWh and 110 €/MWh for most of the countries, with the exception of a few bidding zones in Nordic Countries, which show annual average prices ranging from 20 to 50 €/MWh.

Operations report

In 2024, the SDAC operations continued to show great reliability and the number of incidents resulted in line with the ones registered in the previous years, mainly concentrated on cases of low severity, related to technical issues belonging to local NEMO or TSO systems. The most critical incidents in SDAC were two events leading to a partial decoupling in June and July 2024. The incidents were also due to a local IT issue. Many RfCs went live: among others, several products and MNA extensions and the go-live of Nordic Flow- Based. There has been no need to trigger corrective measures.

Performance Monitoring report

The SDAC algorithm continues to perform well. The usage of products shows a moderate increase with respect to 2023 (+18 %), the Time To First Solution (TTFS) remains, on average, well below the 17 minutes allowed for algorithm running, equal to 2.3 minutes. Optimality and Repeatability continued to perform well. The individual impact of products study indicates that no product on its own seems to have a disproportionate key impact on performance.

R&D report

Throughout 2024, key areas of focus included finalising the implementation of the 15-minute Market Time Unit (MTU), scalability improvements, and exploratory research on future algorithmic adaptations. These efforts are crucial for ensuring the readiness and robustness of Euphemia to meet evolving market requirements and regulatory standards.

Single Intraday Coupling

High level market data

Trading in the SIDC continuous market continues to show steady growth and 2024 is yet another record year. The coupled SIDC volume continuously grew to 207.48 TWh traded – representing 208 million trades. Annual mean price per bidding-zone ranged from 22.29 €/MWh to 112.57 €/MWh. The SIDC currently couples the intraday markets of 25 countries. The SIDC handles orders and transmission capacity from 34 bidding zones and 56 borders where market participants are trading on platforms of 15 NEMOs.

Intraday Auctions (IDAs) were implemented across Europe on 13 June 2024, complementing the continuous trading in SIDC. In the three daily auctions, a total of 46.6 TWh, averaging daily at 244 GWh, has been traded in 2024. The SIDC\IDAs are available in all the same market areas as for the SIDC/CT.

Operations report

For SIDC continuous, 35 RfCs were implemented in 2024, the most noticeable being the implementation of 15 min MTU in several BZs and borders and the go-live of BRM in Romania and ETPA in Germany. Through 2024, the operation of the systems remained stable, and their performance was unaffected by the significant increase in orders and trades. SIDC\CT experienced 24 incidents in total, of which 2 incidents of severity 4 were not visible to market participants. There were two incidents of Severity 1, on 21 May and on 28 August, that led to a Market Halt with 64 minutes and 20 minutes of unexpected outage of the SDAC\CT operation respectively.

For SIDC/IDA, 10 RfCs were also implemented after the go-live. SIDC\IDA experienced 50 incidents in total, of which 20 incidents were not visible to market participants. Only 4 incidents were related to the MCO function. Despite the number of incidents, IDA success rate during 2024 was 97.7 %.

Performance Monitoring report

For SIDC continuous, the analysis of monthly values regarding executed orders and matched trades continues, also through 2024, to show steady increase. The daily values, in terms of processing time for orders/trades and order book update also continues to show stability. The "Total matched – hours to delivery" indicator shows that still more than 50 % of the traded volume is matched in the last two hours before gate closure, which is set one hour before delivery.

Good performance recorded also in the SIDC-auctions segment of the market, after the first six months from the go-live of the IDAs, with high value of the optimality computed via the optimality gap indicator, having less than 5 k€ of final gap in most of the sessions considering that in average the economic surplus for the three IDAs are 167 M€, 19 M€ and 5 M€ respectively, per session.

R&D report

The R&D focus in 2024 was mainly on the principal functional extension of the SIDC functionalities, namely finalisation of Intraday Auctions, further analysis of Flow-Based Allocation as well as on improvement of performance to level up with the higher utilisation of the trading platform. In 2024, optimisation and improvements in the central functionalities of REMIT reporting for continuous market were implemented.

Single Day-Ahead Coupling

SDAC main features

NEMO requirements

- MNA in Romania (BRM go-live in November 2024)
- Block products (simple, linked, exclusive)
- PUN & merit orders
- Complex Orders and Scalable Complex Orders
- Aggregated MTUs orders (curves)

TSO requirements

- ATC and Flow based (PTDF constraints)
- Network constraints: Ramping, losses

CACM requirements

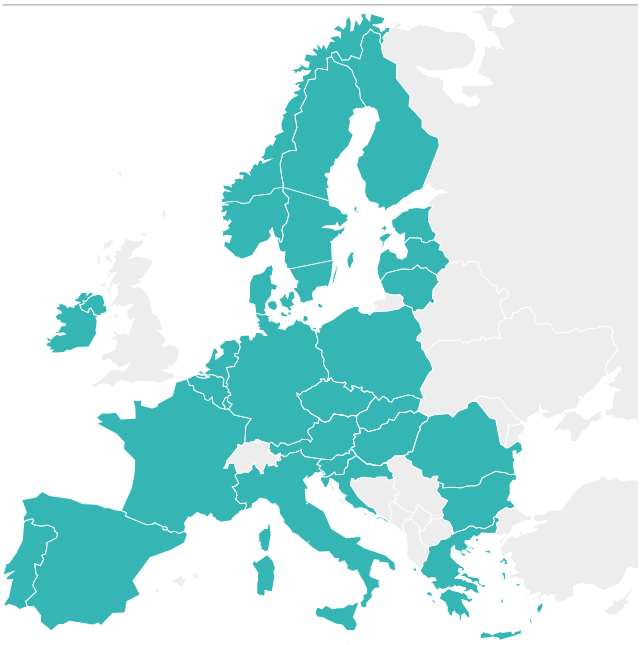
- Adequate optimality
- Adequate scalability
- Adequate repeatability
- MNA
- MTU: 60 min

Systems release(s)

- PMB 13.0 and Euphemia 11.3 implemented on 11th of September 2024

Geographical scope

PT, ES, FR, IT, DE, BE, NL, LUX, IE*, NI*, AT, SI, HR, BG, GR, PL, LT, LV, EE, FI, SE, DK, NO, HU, CZ, SK, RO



SDAC members (operational*)
* SEM bidding zone: operation in isolation

Figure 03

High level market data

In 2024, the SDAC covered most of the EU, in a fully integrated Pan-European day-ahead power market.

The coupling topology included 27 Countries, 77 bidding zones (including virtual Bidding Zones), 30 TSOs and 16 operational NEMOs.

- The economic surplus managed by the algorithm increased by 7.8% with respect to 2023 and was, on average, around 11.8B€ per session. The traded volumes of the coupling have increased from 1696 TWh in 2023 to 1840 TWh in 2024 (+8.5%).
- After the increase experienced in 2022, the clearing prices further decreased significantly compared to the previous year, with average prices between 60 €/MWh and 110 €/MWh for the majority of the countries, with the exception of a few bidding zones in Nordic Countries, with an annual average price between 20 and 50 €/MWh.

Price indexes are computed excluding hourly prices in bidding zones with no traded volume on a daily basis. Yearly prices are computed as simple averages of hourly prices.

Traded volumes are computed based on selling and purchase volumes in each bidding zone.

Traded volumes (TWh)

Table 01

Annual	Daily average	Daily minimum	Daily maximum
1839.71	5.05	4.19	6.08

Clearing prices – annual mean (€/MWh)

Table 02

Hourly minimum	Hourly maximum
-500	1750

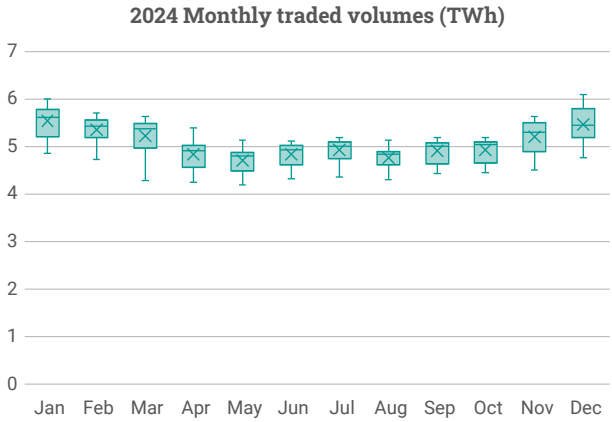


Figure 04

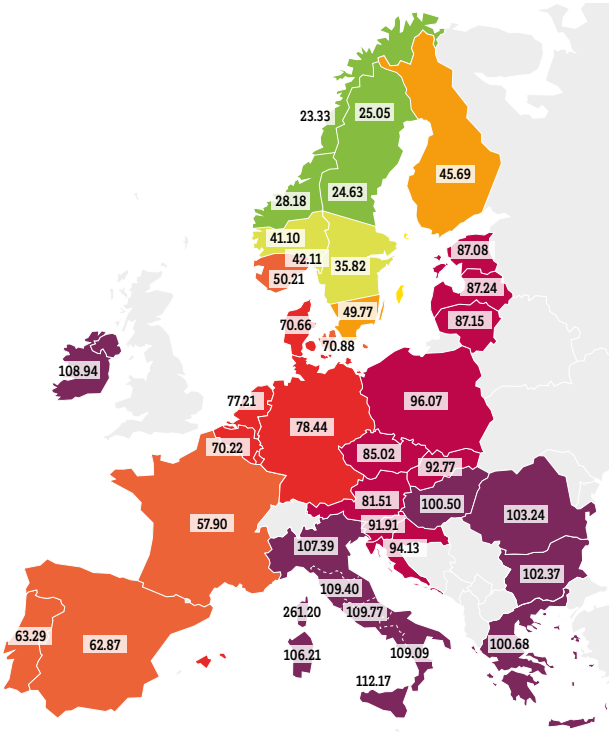


Figure 05

Operations report

In this section, 2024 SDAC operational events are reported, including: the incidents, requests for changes and corrective measures.

"During 2024:
– Several products and MNA extensions went live
– Two partial decoupling events occurred, due to local issues."

Incidents

As for the past year reports, incidents in SDAC are classified according to severity and causes, which is similar but not identical to the relevant classification applied for SIDC, given the differences in the two technical solutions.

The incidents in 2024, result in line with the ones registered in the previous years, mainly concentrated on cases of low severity.

- Relating to severity, the most critical incidents in SDAC were two events leading to a partial decoupling, which occurred on 25/06/2024 and 24/07/2024. The incidents were not caused by the SDAC algorithm or procedures, which performed as expected, but by internal technical issues from different NEMOs. More details are provided in a dedicated paragraph on "Partial Decoupling incidents in 2024".
- The majority of the incidents were visible to market participants but only in two cases the message of risk of decoupling was sent, with no actual decoupling taking place due to the issues being solved. A share of 26 % of incidents were of low-severity and not even visible to market participants.
- All the incidents fell in the category "Non-MCO", mainly related to technical issues belonging to NEMO local trading systems.

Requests for change (RfC)

RfCs for SDAC are classified per type of requirement. The same classification is used in SDAC and SIDC, despite the differences of the two technical solutions.

- Many important RfCs went live in 2024, in particular:
  - MNA extension on the Spanish-French border on 28/02
  - MNA extension on the Austria-Slovenia border on 16/04
  - RfC for Nordic Flow- Based topology on 29/10
  - Implementation of MNA in Romania on 19/11
- Product extensions:
  - Introduction of Step-wise Curves in Italian BZs (following the removal of PUN Orders starting from December 31st 2024).
  - Introduction of Curtailable Blocks in OTE Trading Hub.
  - Introduction of a parent block of a linked family as part of an exclusive group in EPEX SPOT and EMCO Trading Hub(s).
  - Additionally, one system release for PMB and EUPHEMIA went live on 11/09.

Corrective measure (CM)

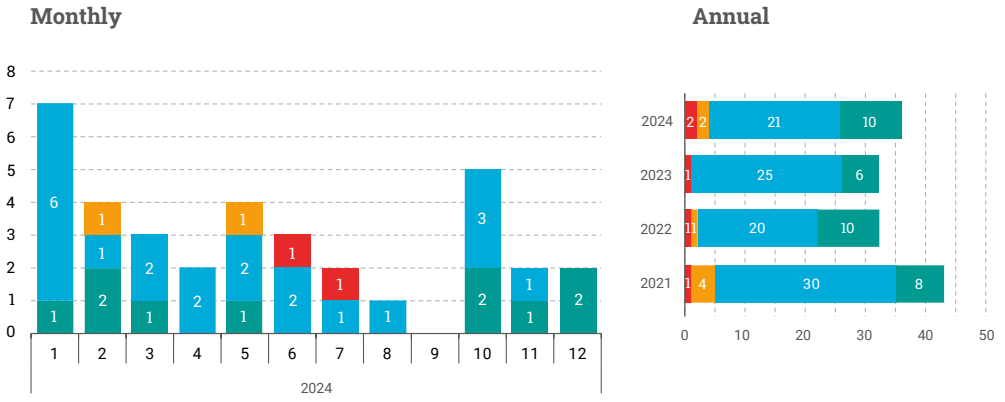
In 2024, no corrective measures were triggered.

Detailed operation report

More information can be found in detailed Excel-file Operations Report reported at the NEMO Committee website at the publications section.

Incidents

Severity



Severity 1
Incidents that led to decoupling

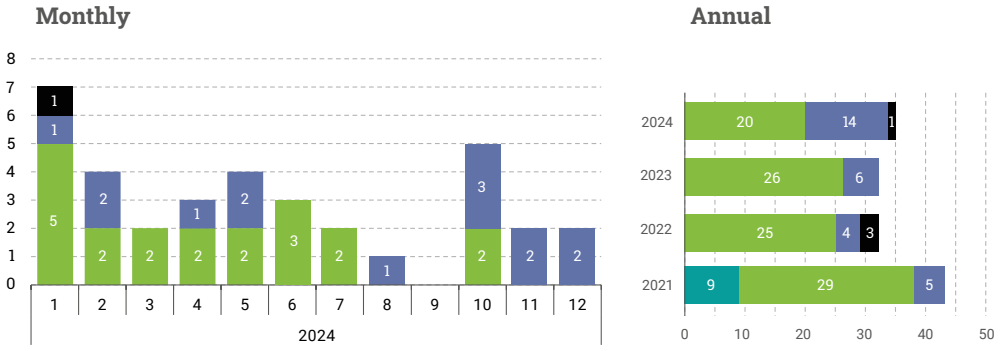
Severity 2
Incidents where message of risk of decoupling was sent

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 participants

Figure 06

Causes[1]



Other
Human error
Unusual process
Interface issue
System bug
Configuration
Non-MCO: local trading
Non-MCO: transmission of capacity
Non-MCO: Other

Figure 07

Partial Decoupling incident 25th of June 2024

On June 25, 2024, an incident took place for delivery date June 26, 2024, in the Single Day Ahead Market Coupling process that led to a partial decoupling of some areas.

The partial decoupling event was due to a local issue at EPEX SPOT which prevented this NEMO to provide its order books for the CORE area and for the Nordic area before the partial decoupling deadline (13:05), as foreseen by the SDAC market coupling procedures. Due to this event and in line with the Nordic-Baltic regional fallback methodology and procedures, the order book from Nord Pool for the Nordic area was also decoupled, in order to execute a regional coupling for the Nordic and the Baltic countries.

The impacted interconnectors were:

- NO2–NL (Norway 2–Netherlands (NorNed)
- NO2–DE (Norway 2–Germany (NordLink)
- DK1–NL (Denmark 1–Netherlands (COBRA Cable)
- DK1–DE (Denmark 1–Germany)
- DK2–DE (Denmark 2–Germany)

Following declaration of the partial decoupling and in line with the fallback procedures, shadow auctions were run by JAO for the above-listed interconnectors and the results were sent to the market participants.

The SDAC parties that remained coupled followed the normal procedures and the final results were published at 14:09 CEST.

For the Nordic and Baltic bidding areas, regional fallback coupling auctions were successfully completed at 17:40 CEST.

For the EPEX SPOT CORE bidding areas, local fallback auctions were completed at 15:06 CEST.

The MCSC initiated an in-depth investigation to identify lessons learned to mitigate the risk of similar incidents in the future.

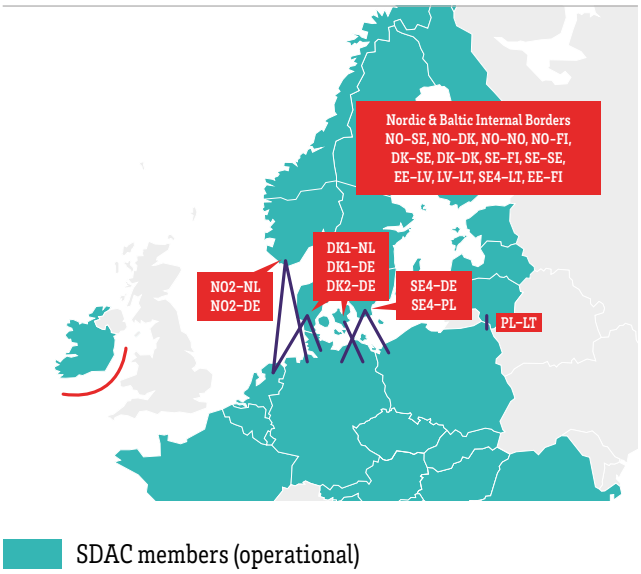


Figure 08

Lessons learned

- Coupling operational procedures and regional procedures were reviewed by NEMOs and TSOs with the aim of improving the communication process during an incident.
- SDAC parties also acknowledge that deeper understanding of the specific decoupling scenarios would help in handling these situations more quickly and therefore it is planned to increase the awareness on these fallback procedures and scenarios.
- The common coupling system and the operational process for performing the partial decoupling worked as expected and ensured the coupling of the remaining European market areas and NEMOs within SDAC.
- The SDAC procedures in place to manage a partial decoupling, have been properly applied and have proven to be successful in retaining the coupling among the bidding zones not involved in the issue.
- In addition, NEMOs and TSOs are continuing to investigate the generic robustness of the operational processes and procedures at different levels (European, regional, and local) and their consistency for specific types of incidents. This generic investigation is not specifically related to this incident.

Investigation report

The full investigation report was published on 26th July 2024.

Partial Decoupling incident of 24th of July 2024

On July 24, 2024, an incident took place for delivery date July 25, 2024, in the Day Ahead Market Coupling process that led to a partial decoupling of the Czech Republic.

The incident was caused by local issues at the OTE Local Trading System (LTS) preventing the order books from OTE to be submitted before the operational deadline of partial decoupling. Hence, a partial decoupling from SDAC was declared, and OTE-CZ was decoupled, at 13:05 CEST, in line with the relevant procedures.

The robust organisation of market coupling worked as expected and ensured the coupling of the remaining parts of the SDAC topology with adapted capacity for the internal core borders.

Indeed, as the partial decoupling involved a bidding zone located within a flow-based region, an additional fallback procedure had to be applied in order to allocate the capacity of the non-decoupled Core CCR internal borders with ATC instead of using flow-based parameters.

The final SDAC market coupling results were published around 14:15 CEST.

Lessons Learned

- Regarding the local issue that triggered the partial decoupling, OTE and their IT provider implemented further deployment testing of third-party hardware/ software updates.

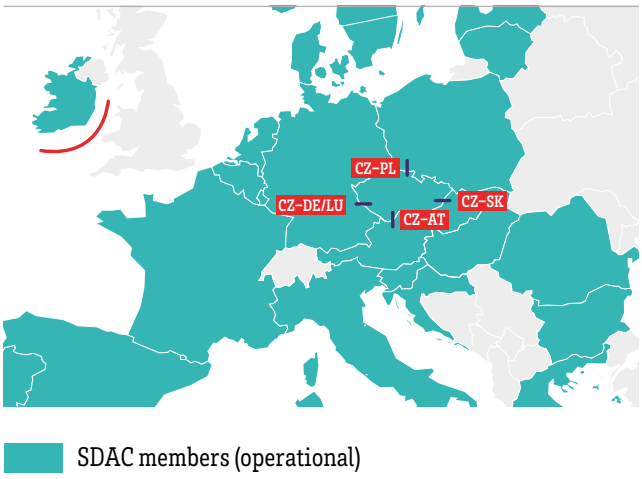


Figure 09

- In terms of operational procedures, these were followed correctly, and the communication was performed in line with them, using the agreed messages.
- The common market coupling system worked as expected and ensured the coupling of the remaining European market areas within SDAC.
- NEMOs and TSOs are always working on trying to improve the robustness of the processes and procedures to reduce the risk for such kind of incident.

Investigation Report

The full investigation report was published on 15th of August 2024.

Request for change (RfCs)[2]

Figure 10

Table 03

Requirement	Name	Go-live Date*	Reason according to AM article 14.1	Initiator/ Owner Details
Other	Decrease of second auction low threshold to −500 in SVK	31/01/2024	N/A	NEMOs
MNA extension	MNA on Spain-French border	28/02/2024	a, g	NEMOs/TSOs
Network topology	Change of ATC line configuration for ALDE-ALBE FR-DE and DE-NL	28/02/2024	g	TSOs
Network topology	Decommissioning of the Belgian Allocation constraint	28/02/2024	g	TSOs
MNA extension	MNA on Austria-Slovenia border	16/04/2024	a, g	NEMOs/TSOs
Other	BSP serviced by EPEX	16/04/2024	N/A	NEMOs/TSOs
Product Extension	Introduction of curtailable blocks in OTE market	13/06/2024	d	NEMOs
Other	EPEX + BSP After Care in SDAC	10/07/2024	N/A	NEMOs
Product Extension	Sanity check adjustment between CO_4 and CO_2 block orders	11/09/2024	d	NEMOs
Product Extension	Change in the overall limit of C02 block orders submitted on EPEX SPOT NEMO trading hubs and introduction of CO_4 exclusive blocks to be parents to CO_2 linked families	11/09/2024	d	NEMOs
Product Extension	Parent block of a linked family part of an exclusive group in EMCO trading system	11/09/2024	d	NEMOs
System release	E11.3 & PMB 13.0	11/09/2024	e, f	NEMOs/TSOs
Flow -based	Nordic FB MC RfC for SDAC	29/10/2024	g	TSOs
Network topology	Lowering of the ramping limit to 300 MW for SE4-PL (SwePol link)	29/10/2024	g	TSOs
MNA extension	Implementation of Multi-NEMO arrangement and BRM as a NEMO in Romania	19/11/2024	a, g	NEMOs
Other	Change to Nord Pool EMCO Virtual Borker(s) in the PMB	19/11/2024	N/A	NEMOs
Product Extension	Introduction of stepwise curves in GME's bidding areas	31/12/2024	d	NEMOs
Product Extension	Discontinuation of PUN MOs and introduction of new products in GME	31/12/2024	d	NEMOs
Network topology	Activation of Curtailment Sharing in Italian bidding zones	31/12/2024	g	TSOs

Performance monitoring report

During 2024 the performance of the SDAC continued to be positive, in which the performance has been better than previous years despite that the usage of products has increased on average.

- The usage of products, on average, shows an increase with respect to 2023 (+18 %).
- The Time To First Solution (TTFS) kept reducing with respect to the previous year (–8.5 %) – thus amounting to 2.26 minutes in average.
- Optimality and Repeatability continued to show good performances, as shown in previous years.

For performance monitoring, the indicators considered are listed in the draft Annex 3 of the AM approved by ACER with decision 4/2020. The chapter addresses the past four years spanning from 2021 to 2024 in order to allow for a better appreciation of trends and seasonality.

The daily values for these indicators were considered as well as the maximum, minimum and average values observed throughout the year 2024. These are reported in tables in the following pages and compared with the average values of the past three years. When relevant, monthly values are also reported in separate graphs, with evidence of the main events which took place within the timeline of the graphs.

Notes on the calculation of these indicators are included at the end of the report as Annex 2 and further details are provided in the Monitoring Procedure published on the NC website.

"The performance of the SDAC algorithm continued to be highly reliable, ensuring yearly average TTFS of 2.26 mins well below the maximum 17 mins allowed."

Usage indicators

- In 2023, we observe an increase in the average values for **product usage** for most of the products (pages 25–28) with respect to 2021, with the exception of the complex orders (-34 %), partially replaced by scalable complex orders and of supply merit orders (-4 %). For the other products the increase in 2024 with respect to 2023 is concentrated in the increase on the "total number of demand merit orders" (+103.4 %), "total number of steps at bidding zone level" (+21.4 %), "total number of PUN orders" (+15.1 %), and "total number of block orders" (+9.7 %).
- Among the indicators related to **network constraints** usage (page 29), it shows the major changes made in 2021 with the implementation of the LTA, that allowed to significantly reduce the number of FB-PTDF constraints compared, to be later increased by the go-live of the Core FB-PTDF in June 2022 and later the go-live of Nordic FB-PTDF at the end of October 2024. Although Nordic FB-TDF increase impacted only in the last quarter of the year, its effect is significant in the total number of flow-based PTDF constraints (+22.5 %).
- The analysis of time series shows a seasonal effect in the usage of different kind of orders, with an increase during the winter period. This is particularly evident when observing the trend of the total number of blocks orders (page 25).

Performance data

- The analysis of TTFS (Time To First Solution) shows a reduction w.r.t. the previous year (–8.5 %) and the performance of the SDAC algorithm continued to show high reliability, with a yearly average of 2.26 mins for the TTFS. Also, in the most challenging sessions, the TTFS never exceeded 7.52 min. Such data shows that the algorithm was able to absorb the increase in the number of flow-based PTDF constraints that were a consequence of Nordic FB implementation in 2024 as well as the usage increase of the majority of the products in 2024.
- The economic surplus indicators show good quality of solutions, negligible changes in the overall economic surplus for either first to final solution found in the standard 17 mins and for final solution to the one after extended calculation time. Increment of economic surplus with respect to the first OK solution is slightly decreasing than in previous years and as well as the economic surplus gain after increasing allowed calculation time by 10 minutes.
- Without using deterministic time in the calculation, the level of repeatability in 2024, measured by the frequency indicator per delivery day, is always higher than 98.21 %, and the impact of differences over the relevant values, whenever present, proved to be negligible with an average annual value around 0.25 %. These values are slightly lower than 2023, and the most notable difference is the reduction in the number of sessions in which 100 % repeatability is reached.
- The level or repeatability with the deterministic time activated is, as expected, equal to 100 %.

Output indicators

- The average economic surplus shows an increase of about 7.8 % compared to 2023, amounting to an average economic surplus equal to 11.8 B€ per session.
- Curve orders are responsible for the majority of the traded volumes, followed by PUN orders, merit orders, block orders and complex orders. The most significant increase in the energy matched is coming from the curves (+12 %).
- The time spent on the different phases of the algorithm calculation process was in line with the values from the previous years,

Usage indicators MRC/SDAC

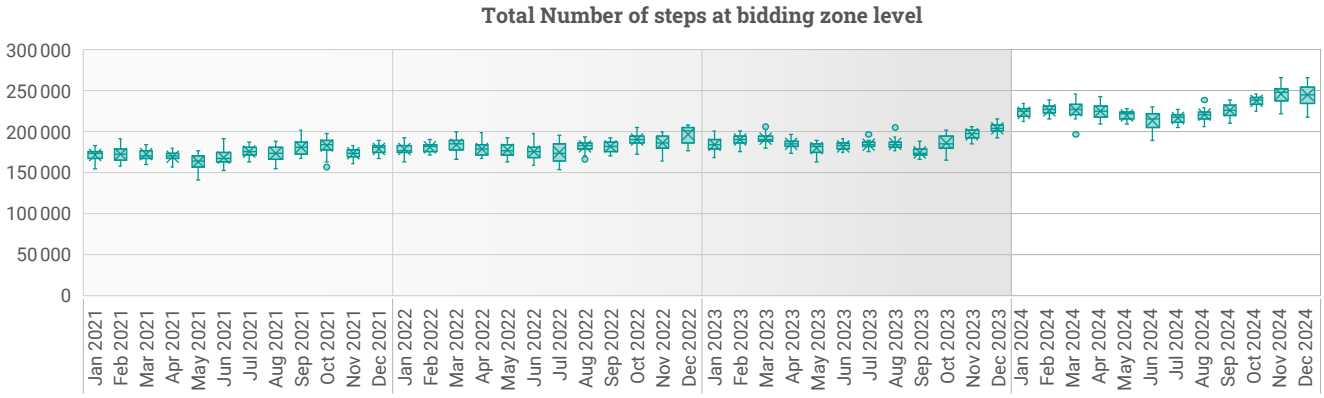
Table 04

Usage indicators Indicators to describe the Usage of SDAC products (Annex 3 of AM Article 10)	2021** MRC/SDAC Avg	2022** SDAC Avg	2023** SDAC Avg	2024** SDAC Avg	2024** SDAC Min	2024** SDAC Max
Total number of steps at bidding zone level*	173 392	182 216	186 818	226 854	188 969	265 951
Total number of block orders	3 745	4 076	4 401	4 828	3 573	6 347
Total number of block order exclusive groups	114	135	158	171	129	213
Total number of linked families	35	43	57	52	34	78
Total number of complex orders	80	81	57	53	43	63
Total number of scalable complex orders	0	0	19	21	14	28
Total number of demand merit orders	651	687	832	1 692	905	2 749
Total number of supply merit orders	44 029	43 341	40 744	42 342	39 035	44 972
Total number of PUN orders	10 085	13 823	21 279	24 485	21 552	26 330

* 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.

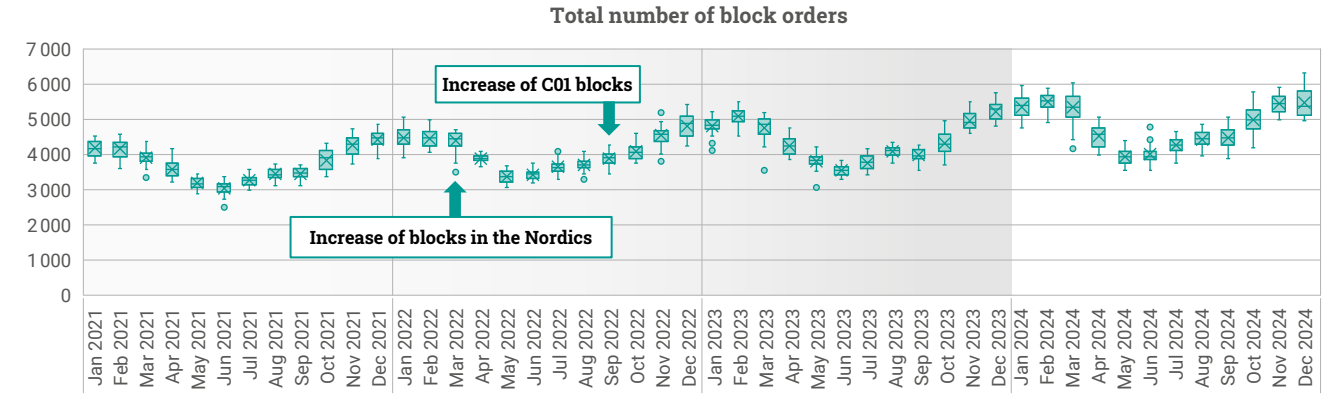
** The reported values are calculated excluding the days of Decoupling – one occurrence in each of the years 2021, 2022, 2023 and 2024.

MRC/SDAC[3]



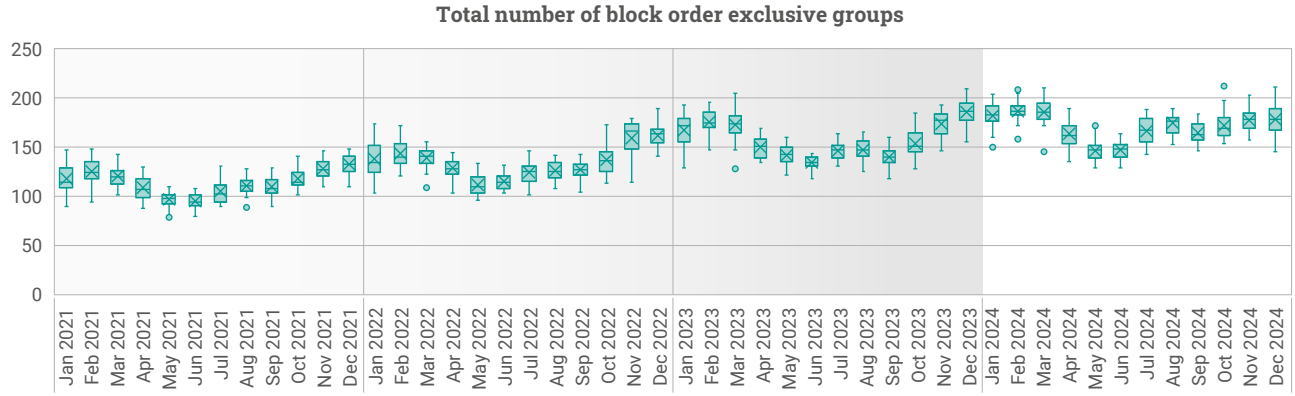
Weak seasonal variation, with significant average increase w.r.t. 2023 (+21.4 %).

Figure 11



Marked seasonal variation, with an increase of the average annual level in 2024 w.r.t. 2023 (+9.7 %).

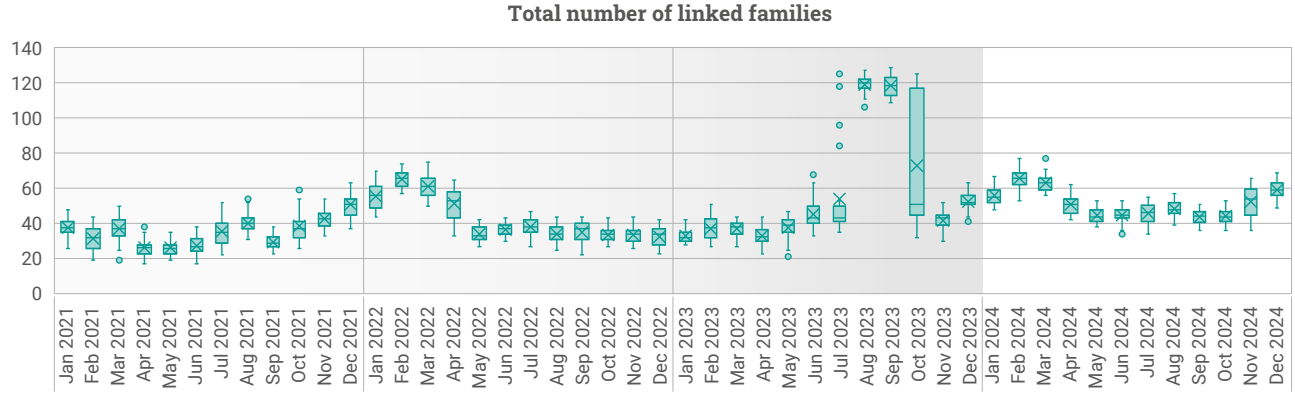
Figure 12



After significant increase in 2023 w.r.t. 2022 of around +17 %, from 2023 to 2024 the growth trend continues but at a lower rate of +8.3 % average increase.

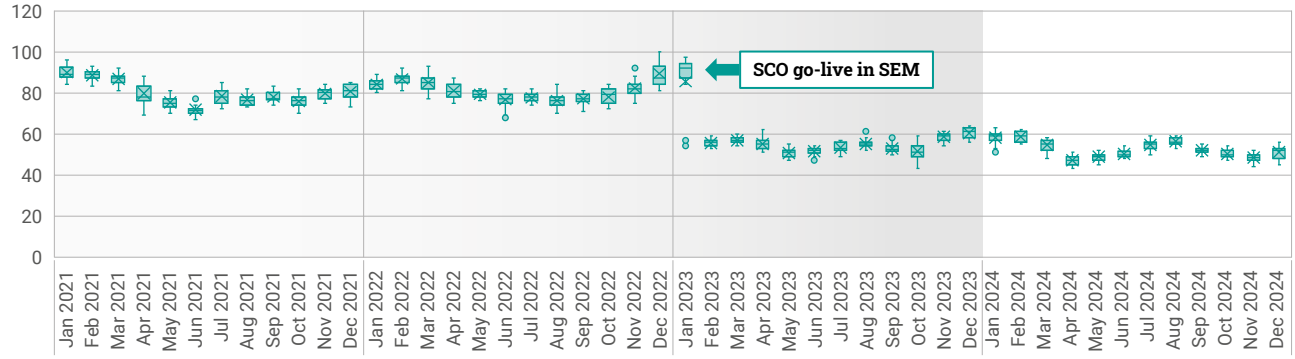
Figure 13

MRC/SDAC[3]



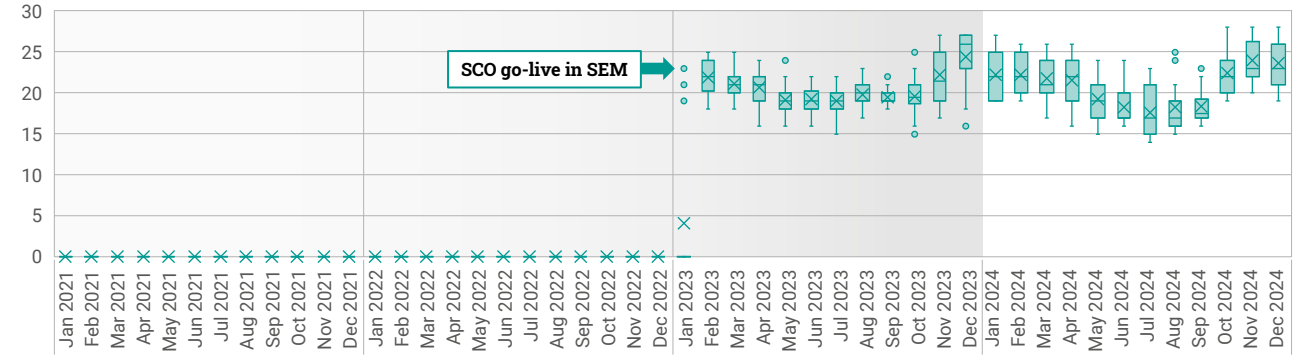
After significant increase in summer of 2023 and later return levels in last quarter of 2023, in 2024 the average number of linked families has been reduced w.r.t. 2023 (-9.3 %).

Figure 14



Usage remained stable in 2024 w.r.t 2023.

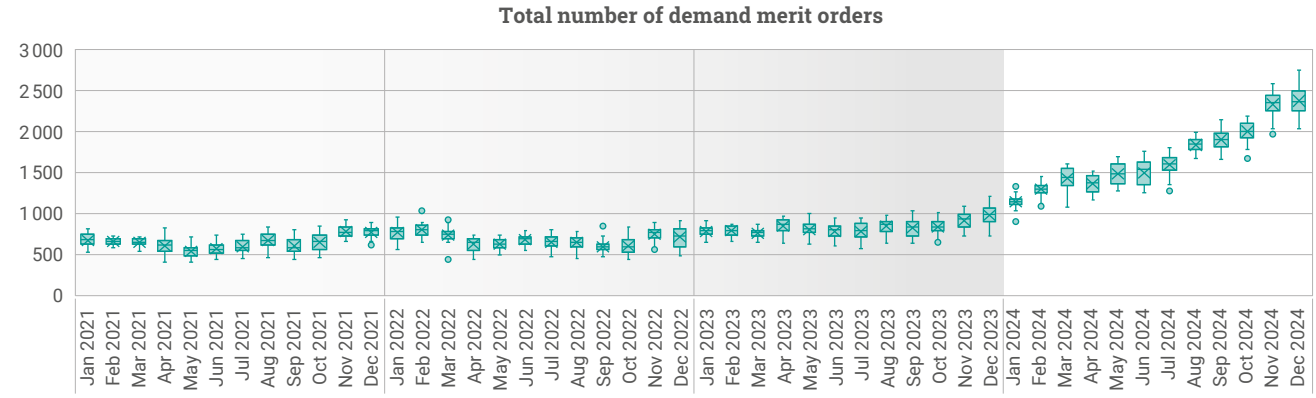
Figure 15



Usage started in January 2023. Usage remained stable in 2024 w.r.t 2023.

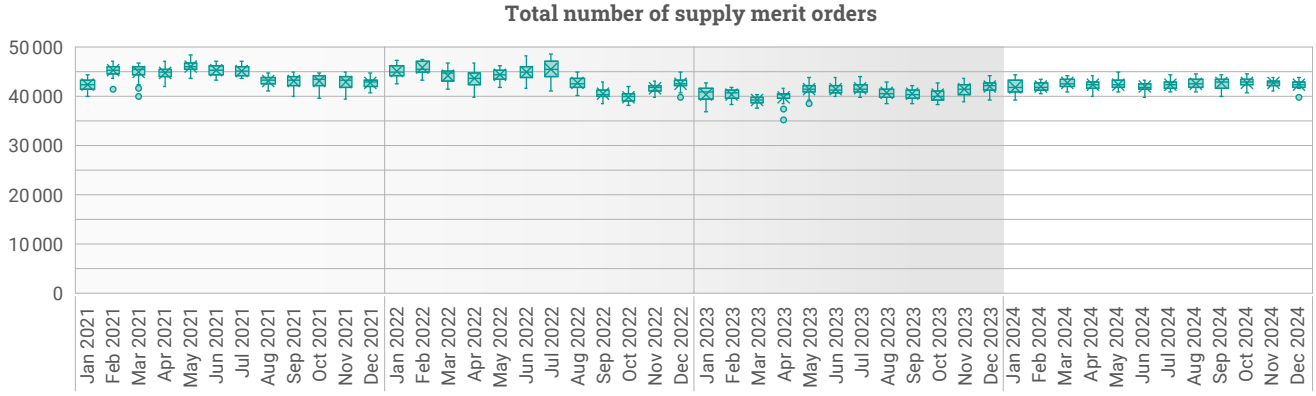
Figure 16

MRC/SDAC[3]



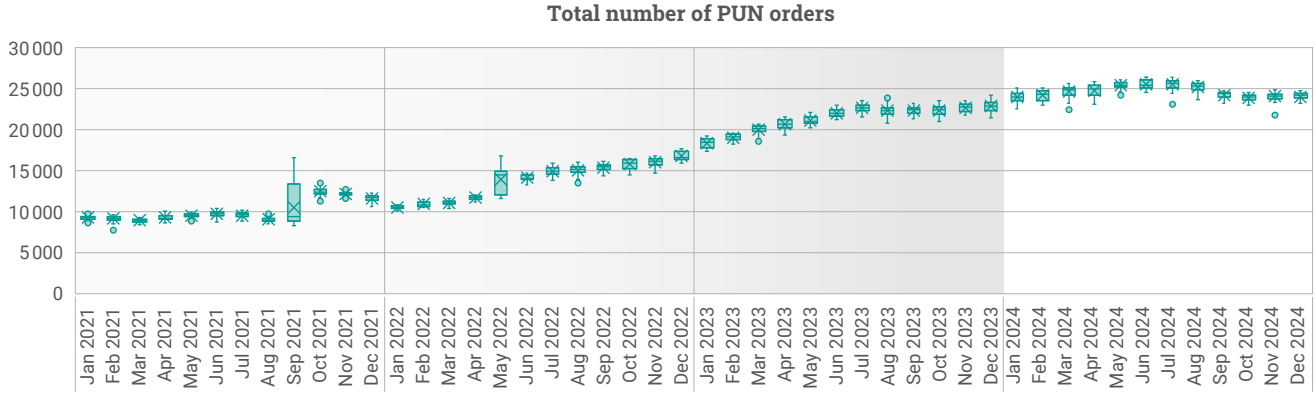
Significant increase of the average usage w.r.t. 2023 (+103.4 %).

Figure 17



Similar usage w.r.t 2023, with a subtle increase (+3,9 %).

Figure 18



Significant increase of the average usage w.r.t 2023 (+15.1 %).

Figure 19

MRC/SDAC[3]

Table 05

Usage indicators	2021* MRC/ SDAC Avg	2022* SDAC Avg	2023* SDAC	2024* SDAC Avg	2024* SDAC Min	2024* SDAC Max
2) Indicators to describe geographical extension of the SDAC (Annex 3 of AM Article 11)						
Number of bidding zones	58.1	61.6	61	63.8	61	77
Total number of flow-based bidding zones	7	11	14	19.4	14	45
Number of scheduling areas	61.1	64.6	64	66.8	64	80
Number of NEMO Trading Hubs	95.9	99.4	97	102.7	97	130
3) Indicators to describe the network constraints (Annex 3 of AM Article 12)						
Total number of bidding zone lines	80.2	88.2	88	90.9	88	105
Total number of flow-based PTDF constraints	1 337.6	1 896.0	2 785.2	3 410.8	768	6 350
Total number of scheduling area lines	90.2	98.8	99	101.9	99	116
Total number of NEMO Trading Hub lines	207.8	224.8	222	233.3	222	278

* The reported values are calculated excluding the days of Decoupling.

MRC/SDAC[3]

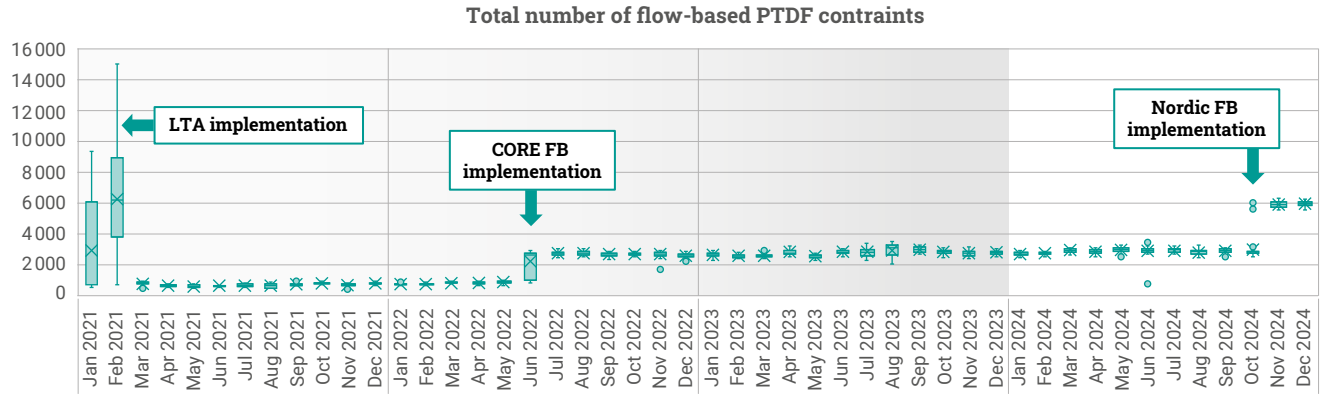


Figure 20

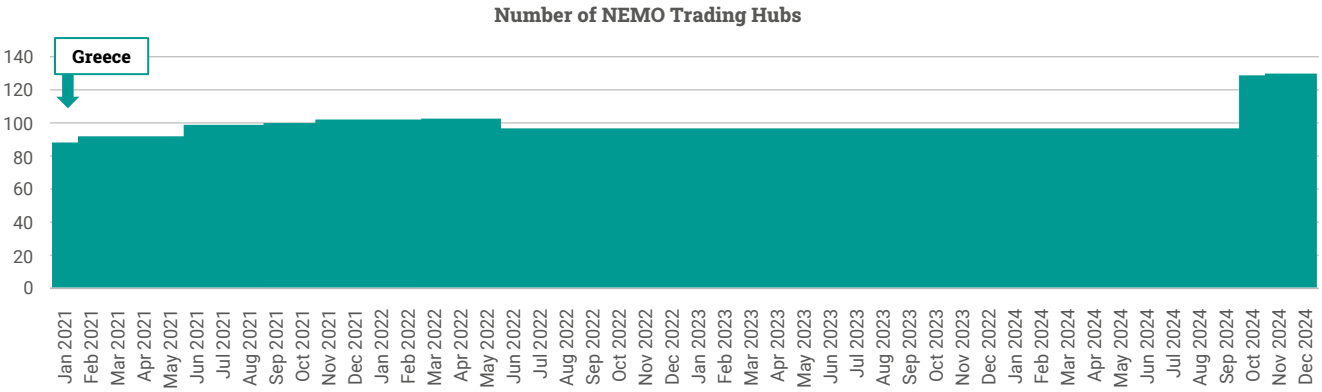


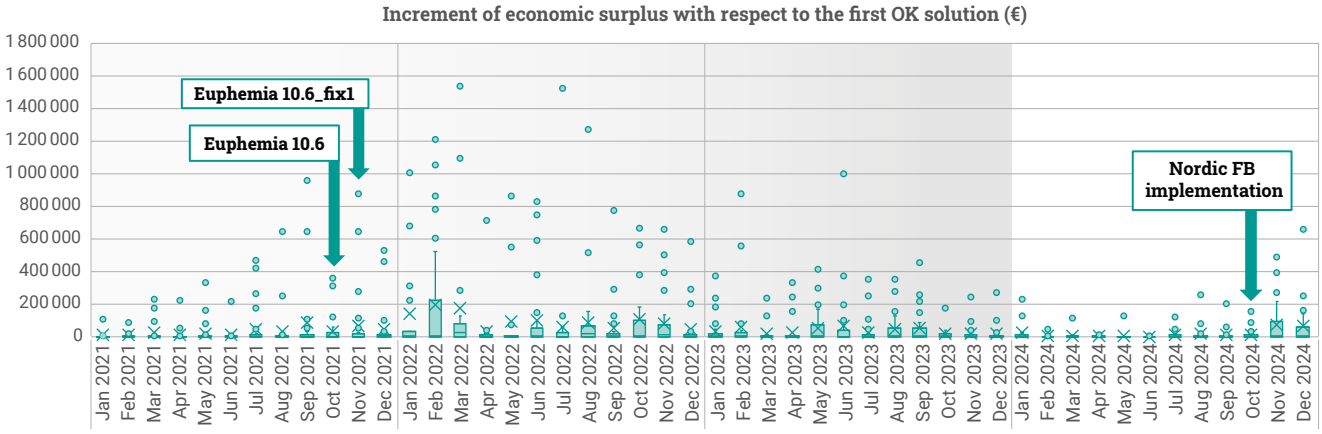
Figure 21

Performance indicators[4]

Table 06

Performance	2021 MRC/SDAC Avg	2022 SDAC Avg	2023 SDAC	2024 SDAC Avg	2024 SDAC Min	2024 SDAC Max
1) Ability to maximise economic surplus (Annex 3 of AM Art. 7)						
(a) Increment of economic surplus with respect to the first OK solution (%)	0.000407 %	0.001021 %	0.000351 %	0.000177 %	0 %	0.005412 %
(b) Economic surplus gain after increasing allowed calculation time by 10 minutes (%)	0.000092 %	0.000011 %	0.000007 %	0.000002 %	–0.000929 %	0.001584 %
2. Algorithm repeatability without deterministic time						
(a) Algorithm repeatability without deterministic time. Repeatability frequency indicator, measured as number of equal values over total values for the relevant results (%) [bigger is better]	99.86 %	99.88 %	99.89 %	99.82 %	98.21 %	100 %
(b) Algorithm repeatability without deterministic time. 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]	0.17 %	0.17 %	0.19 %	0.25 %	0 %	6.52 %
(b) Algorithm repeatability with deterministic time. Repeatability frequency indicator, measured as number of equal values over total values for the relevant results (%) [bigger is better]	100 %	100 %	100 %	100 %	100 %	100 %
(b) Algorithm repeatability with deterministic time. 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 %	0 %	0 %	0 %	0 %	0 %
3) Algorithm scalability (Annex 3 of AM Art. 9) TTFS (min)	3.78	2.56	2.47	2.26	1.02	7.52

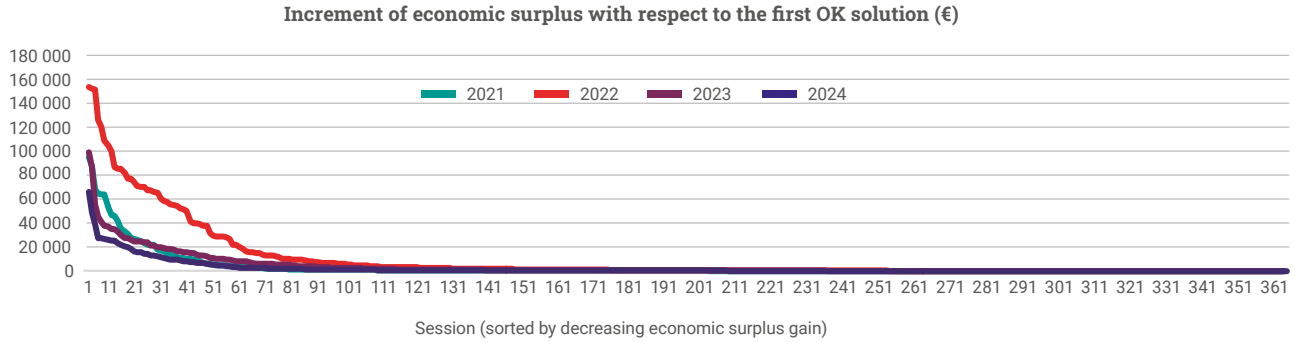
Ability to maximise the economic surplus [3,5]



Increment of economic surplus with respect to the first OK solution: maximum increase around 1.56 M€ over 11 755 M€ average daily economic surplus in 2024.

Negative axis is not shown due to the absence of negative values.

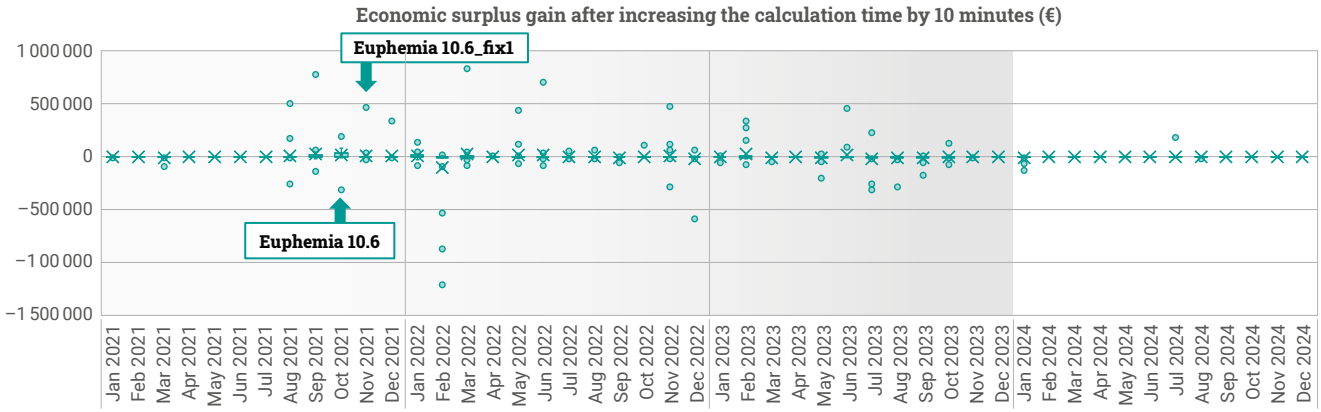
Figure 22



Duration curve shows the Increment of economic surplus with respect to the first OK solution in descending order of magnitude, rather than chronologically.

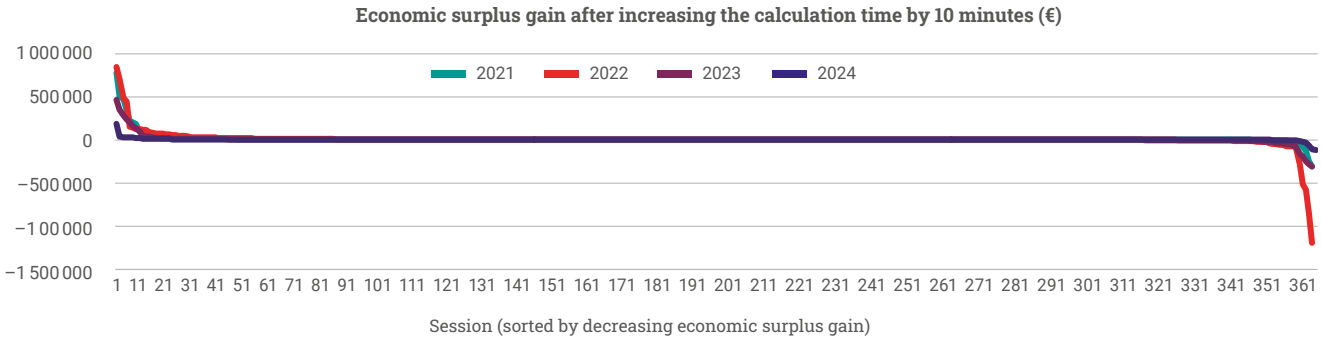
Figure 23

Ability to maximise the economic surplus [3,5]



Economic surplus gain after increasing the calculation time by 10 minutes: maximum/minimum gain ranges between +840 k€ and –120 k€ over 11 755 M€ average daily economic surplus in 2024.

Figure 24



Duration curve shows the Economic surplus gain after increasing the calculation time by 10 minutes ordered in descending order of magnitude, rather than chronologically.

Figure 25

Algorithm scalability (min) [3,5]

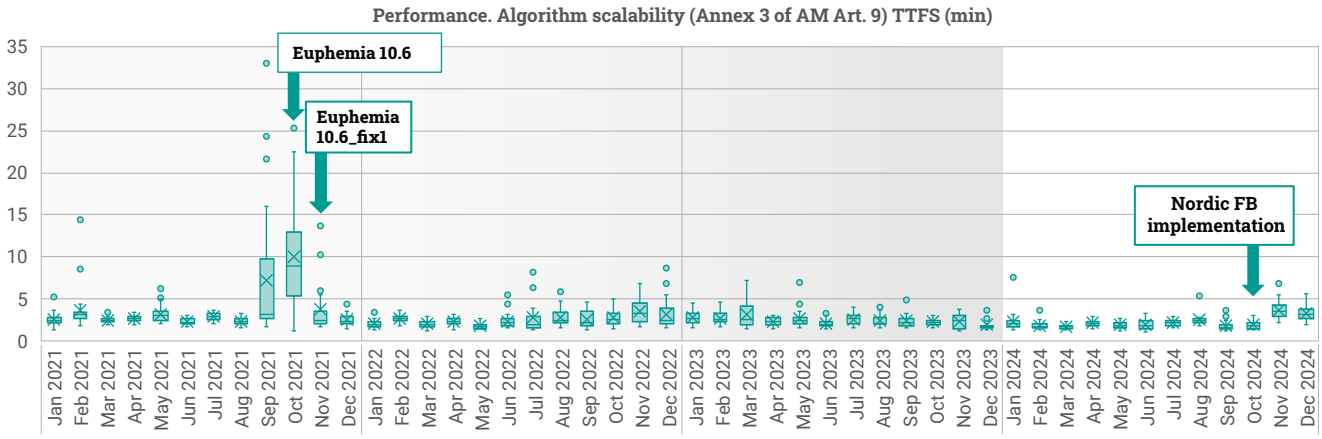


Figure 26

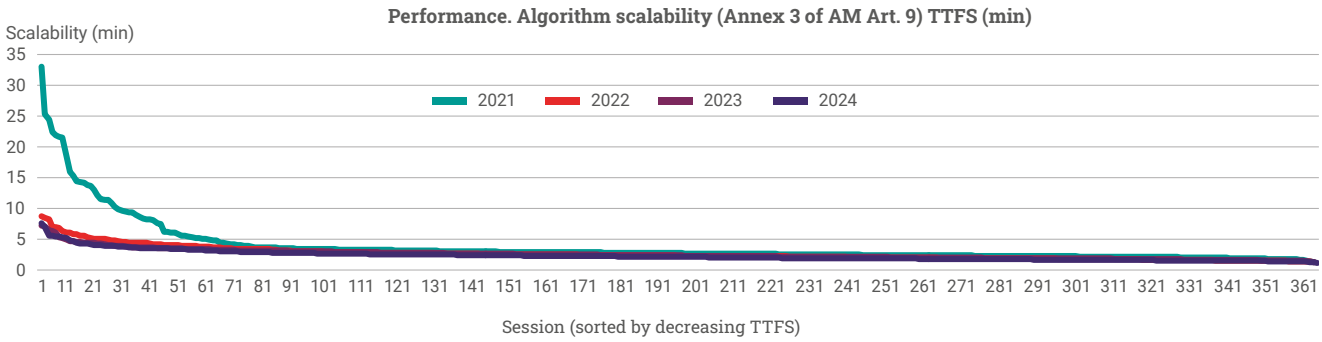


Figure 27

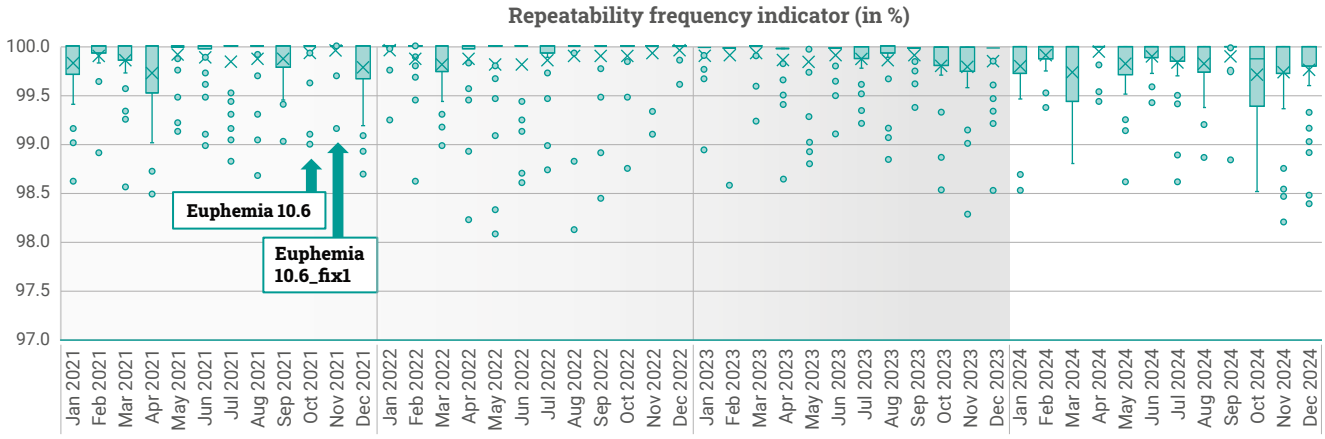
In September–early October 2021 we observed an increase in the TTFS due to the increase of PUN links.

PUN links are not PUN orders, but data that are created by the Algorithm to solve the problem. In particular, PUN links are caused by more orders at the same level of price: the more orders that are present at the same price, the more links are created for solving Euphemia. **Price level of the orders depends on the offers of Market Participants.**

In order to solve the issue, **a change in Euphemia (fix version)**, consisting in removing the PUN links constraints, was implemented and the TTFS was reduced again.

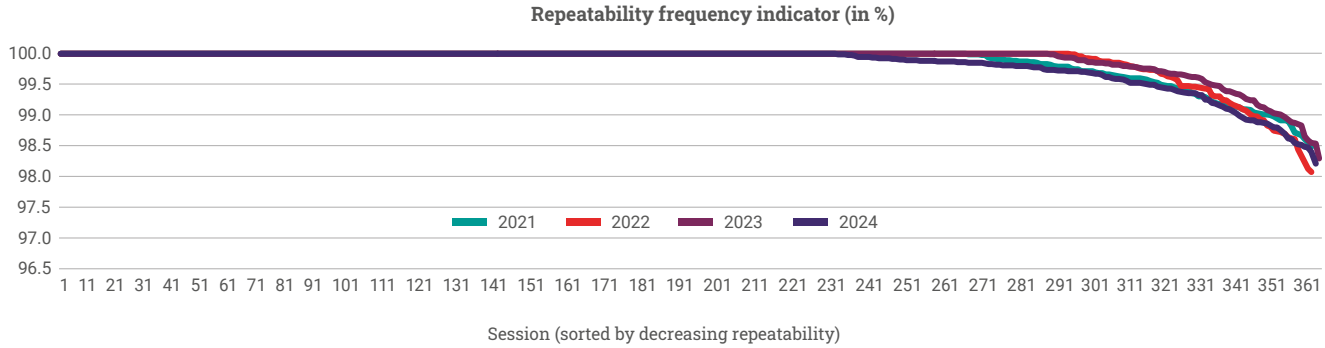
In 2024, the behavior is similar to 2023 and aligned with the values observed in 2022.

Algorithm repeatability without deterministic time [3,4]



Repeatability frequency indicator: high level of repeatability, which, in 2024, is always higher than 98.21 %.

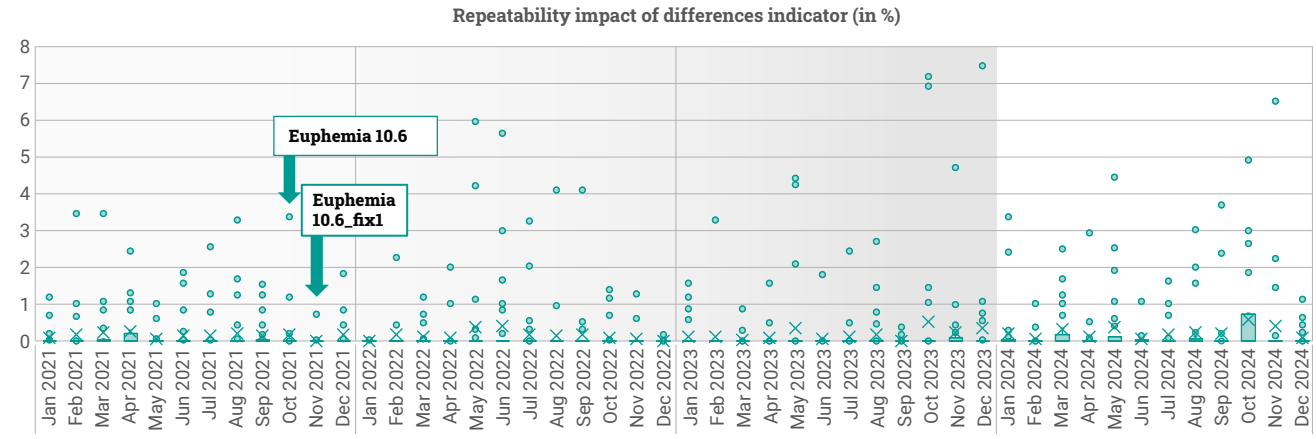
Figure 28



Duration curve shows the Repeatability frequency indicator ordered in descending order of magnitude, rather than chronologically. The number of sessions reaching 100 % value for repeatability frequency in 2024 is lower than the value obtained in 2023, caused by the strictness of tolerances used for the calculation of this indicator . See details in the Annexes.

Figure 29

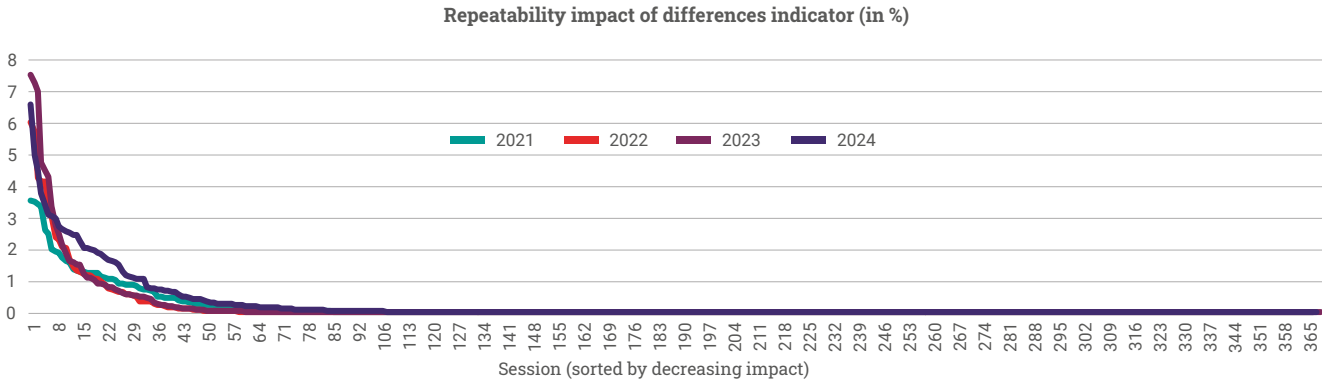
Algorithm repeatability without deterministic time [3,4]



Repeatability impact of differences indicator: the impact of differences over the relevant values, whenever present, proved to be negligible.

In 2024 behaviour is similar to 2023.

Figure 30



Duration curve shows the Repeatability impact of differences indicator ordered in descending order of magnitude, rather than chronologically.

Figure 31

Output indicators

MRC/SDAC

Table 07

Output indicators	2021* MRC/SDAC Avg	2022* SDAC Avg	2023* SDAC Avg	2024* SDAC Avg	2024* SDAC Min	2024* SDAC Max
1) Indicators on the maximisation of economic surplus (Annex 3 of AM Article 13)						
Maximisation of the first economic surplus						
Economic surplus of first OK solution (M€)	8 528.200	9 904.509	10 908.781	11 755.454	9 284.940	14 852.139
Economic surplus of the final solution (M€)	8 528.234	9 904.607	10 908.819	11 755.476	9 284.941	14 852.326
2) Indicators to describe the status of orders (Annex 3 of AM Article 14)						
Evolution of number of matched orders						
Total number of matched blocks	742	808	875	1 098.3	477	1 754
Total number of matched complex orders	31	42	13	6.8	0	42
Total number of matched scalable complex orders	0	0	6	6.6	0	21
Total number of matched non-PUN merit orders	33 421	32 883	32 542	35 224	30 885	38 962
Total number of matched PUN orders	7 184	11 354	16 936	19 635	16 711	22 533
Total matched volume from curves (MWh)	5 917 323	5 707 128	6 001 375	6 728 770	5 638 694	8 068 991
Total matched volume from blocks (MWh)	343 177	398 544	363 438	349 632	176 445	8 068 991
Total matched volume from complex orders (MWh)	114 367	210 601	62 762	45 661	0	346 413
Total matched volume from scalable complex orders (MWh)	0	0	36 600	41 008	0	93 849
Total matched volume from (non-PUN) merit orders (MWh)	733 778	730 972	691 978	701 125	499 321	934 778
Total matched volume from PUN orders (MWh)	783 501	776 821	751 039	758 490	497 097	1 007 789
Paradoxically rejected orders						
Number of PRBs in the final solution	11.4	13.0	7.5	8.3	0	41
Number of PRMICs in the final solution	1.0	2.1	1.5	1.4	0	13
Maximum Delta P in the final solution	10.2	41.7	14.9	13.1	0	166.6
Maximum Delta MIC in the final solution	2.2	6.1	3.3	3.6	0	49.1
PRB utility loss in the final solution (k€)	50.687	129.859	46.123	45.1	0	569.7
PRMIC utility loss in the final solution (k€)	11.542	50.669	23.610	24.0	0	902.3
Volume of PRBs in the final solution (MWh)	13 021	12 704	10 127	10 299.9	0	58 178.7
Volume of PRMICs in the final solution (MWh)	5 143	10 955	6 897.64	4 826.8	0	37 319.6

Table 07

Output indicators	2021* MRC/SDAC Avg	2022* SDAC Avg	2023* SDAC Avg	2024* SDAC Avg	2024* SDAC Min	2024* SDAC Max
Indicators on the evolution of the use of network constraints along the time						
Number of periods for ATC/DC lines with flows at full capacity	856	1 059	1 127	1 265.2	1 019	1 876
3) IT calculation process (Annex 3 of AM Article 15)						
Time spent in every phase of the algorithm calculation process						
TTFS (s)	227.2	153.6	148.3	135.8	71.9	451.3
Input data reading time (s)*	11.9	10.4	9.3	13.4	5.3	66.5
Input data delivery day creation (s)*	12.8	23.1	30.0	14.1	9.2	23.5
Time to solve the root node for the master computer (s)*	50.4	15.0	17.2	10.6	3.9	17.5
Time to solve the root node for the job that found first solution (s)*	45.2	3.49	5.6	6.5	1.9	28.5
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****	2.6	2.4	3.1	3.2	1	14
Total number of nodes in the master branch and bound tree**	444	405	565.2	579.6	48	4 527

* The reported values are calculated excluding the days of Decoupling
** 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.
**** This number includes the first solution

Performance monitoring report: analysis on the usage of each product and its impact on algorithm performance

In this section, the individual impact on performance of each product is assessed, as stated in article 8.3.a) of the Algorithm methodology approved by ACER in January 2020.

Methodology

The analysis is performed for all the products included in the DA product methodology, apart from Stepwise Curves and Simple Blocks (which are deemed being the least impacting way to implement requirement explicitly mentioned in CACM) and merit orders (which are considered basically equivalent to stepwise curves in terms of performance impact). The analysis is performed against a historical dataset from Q4 2024.

Conversion of products

In order to assess the individual impact on performance, the remaining products have been replaced by the most similar alternative product, following specific conversion rules.

- **Piecewise curves:** converted into stepwise curves. For each non-vertical piecewise curve segment, one stepwise curve segment is created with price at the middle of min and max price of the given source piecewise segment. In case source segment is stepwise (e.g. having STEPWISE or HYBRID source curve) it is kept as it is. Vertical segments needed for the construction of the stepwise curve may be added or amended.

- **Smart Blocks:** converted into simple blocks.
  - Linked families where all members have the same sign (all buy or sell) are converted into a single block that aggregates all their energy at the price of the family parent block. Linked families with mixed members (buy and sell) are discarded.
  - Exclusive groups are converted by picking the most promising block of the blocks forming the exclusive group, maintaining its MAR and price.
  - Flexible blocks are replaced by a simple block in the period in which they would provide the greatest welfare according to the published results.

- **MIC/MP and load gradient orders (BO + curves):** converted into Simple Blocks plus Stepwise curves.
  - All suborders' steps below the variable term are converted into profiled block orders with minimum acceptance ratio equal to 1 and whose price will be the variable term plus the contribution of the fixed term over the sum of all offered volume.
  - Remaining steps shall be integrated into the single curve.

- **MIC/MP and load gradient orders** (Scalable MIC/MP): converted into Scalable Complex Orders. The variable term from the complex order and their impact on the acceptance of the order is incorporated to the fixed term of the Scalable Complex Order.

- **MIC/MP and load gradient orders and Scalable Complex orders** is an extension of scenario "MIC/MP and load gradient orders (BO + curves)" in which Scalable Complex Orders are also replaced too by BO and curves:
  - Power for the block order is the greatest of the first step power or the minimum acceptance power from the Scalable Complex Order. Price of the block is calculated using the contribution of price of the SCOs steps weighted by its power and the contribution of the FT distributed among all power that is assigned to the block.
  - Remaining steps shall be integrated into the single curve.

- **PUN orders:** converted into Demand Merit Orders by changing their type.

- **PUN and merit orders:** converted into stepwise curves. All PUN and merit orders offered at the same price are merged in a single step in the stepwise curve.

Conversion of products drawbacks

Due to the nature of the requirements these conversion rules are not able to convert all the requirements from the original product into requirements from remaining products.

The conversions done in this study may not reflect a realistic behaviour of market participants in case one product is replaced by another one. For instance, one stepwise order may be split in several stepwise orders by a market participant in order to reflect their needs.

It should be noted that such an approach is overestimating the impact on performance, as the conversion eliminates not only the individual impact of each product but also the combined effect linked to the interaction with the remaining products. For such a reason, it should also be noted that the estimated impact of the different scenarios cannot be accumulated.

Results

First, the gains of a product replacement measured in seconds are in the order of few tens of seconds. Furthermore, repeated runs of the same input data may return small differences values for the time to first solution (TTFS), in the order of few seconds, even when the same machine and configuration is used.

Second, the impact on individual sessions is not evenly distributed. It has been observed that although the average behaviour may be negative, there may exist a few sessions that are not single outliers and its value has a different sign.

Third, it has been observed that the impact on TTFS may depend on the internal parameters of the simulation. The selection of values for internal parameters of CPLEX and heuristics in EUPHEMIA is done pursuing a good behaviour in a wide variety of cases, covering adequate performance in average and being able to deal with problematic cases too. If one kind of product is removed, then the values of parameters should be reassessed against the full set of data scenarios used for the acceptance of new EUPHEMIA releases.

Fourth, the Q4 of 2024 has been selected, which contains many of the most challenging sessions of the year. Although the size of the sample used for input data has been extended from the initial 1 month selected for 2019 study to 3 months from 2020 study, data still show counter intuitive behaviours in some scenarios when using normal configuration. We observed counter-intuitive behaviours such as in piecewise conversion into stepwise when using normal configuration (+61.4 % in TTFS).

Fifth, the comparison of impact from this study with the outcome from R&D activities may be indicating that the size of the input data for the sessions used in an impact of products on algorithm performance study is more relevant than the size of the sample (in number of sessions) used for the study.

Sixth, it should be reminded also the drawbacks due to the conversions of products applied that have been already explained in a previous slide.

In conclusion, the main findings of the study seems to be:

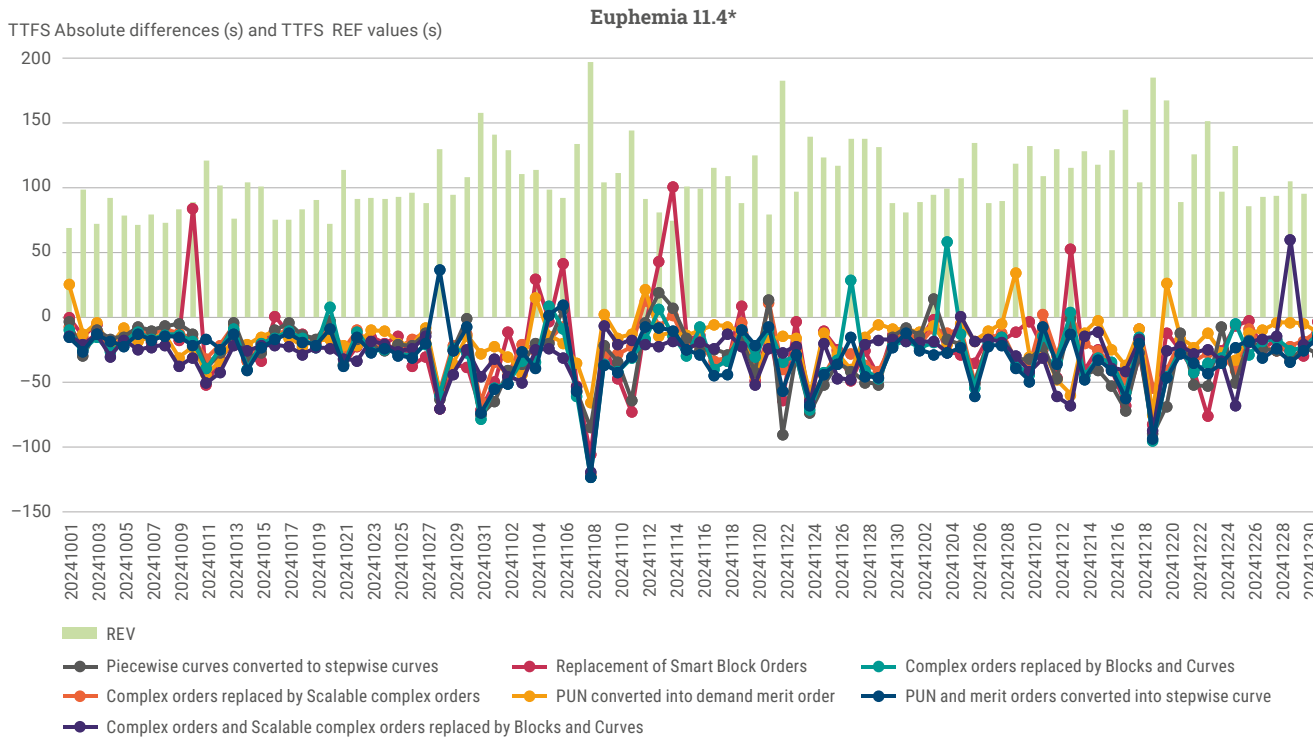
The outcome is heavily dependent on the methodology used [replacement of products, length in number of sessions of the batch, selection of internal parameters of the algorithm, size of the input data for each one of the sessions contained in the batch, ...]

Given the chosen methodology, no product seems to have a standalone key impact on performance.

As a **final remark**, all these observations suggest reconsidering the approach to be followed to assess the impact of each product on algorithm performance. It should be noted than in the scope of this study only products were taken into account, while other requirements, such as flow-based also have a significant impact, as shall be reflected in the scalability report. NEMOs defend that in case corrective measures need to be applied, the decision should be accompanied with a study analysing the impact on prices.

		Reference Scenario											
		Actual values		Impact on performance*			Assumptions for the simulation						
	Products	Orders submitted (#)	Traded volumes (GWh)	AVG TTFS(s) E11.3	ΔTTFS (s) E11.3	ΔTTFS (%) E11.3	# of steps at BZ level	# of Block orders	# of Smart Block Orders	# of MIC/ MP and load gradient orders	# of Scalable MIC/MP and load gradient orders	# PUN and Merit Orders	# of PUN Orders
Reference	Reference scenario			107.7	–	–	242 382	5 317	2,866	50	23	68 666	23 873
Scenarios in which products are replaced	Stepwise Curves	242 382	6 912	Not estimated				–	–	–		–	–
	Piecewise Curves			79.8	–27.8	–25.9 %	224 790	5 317	2 866	50	23	68 666	23 873
	Merit orders	5 317	394	Not estimated			–	–	–	–	–	–	–
	Block Orders	4 854	355	Not estimated			–	–	–	–	–	–	–
	Smart Block Orders (exclusive groups + linked blocks)	2 866	Not available	85.4	–22.2	–20.7 %	242 382	2 645	0	50	23	68 666	23 873
	MIC/MP and load gradient orders (that are converted into BO and curves)	50	76	81.0	–26.7	–24.8 %	243 953	5 366	2 866	0	23	68 666	23 873
	MIC/MP and load gradient orders (that are converted in to Scalable Complex Orders)	50	76	84.2	–23.5	–21.8 %	242 382	5 317	2 866	0	73	68 666	23 873
	MIC/MP and load gradient orders and Scalable Complex Orders (that are converted into BO and curves)	73	120	79.0	–28.7	–26.6 %	245 146	5 390	2 866	0	0	68 666	23 873
	PUN Orders	23 873	746	90.1	–17.5	–16.3 %	242 382	5 317	2 866	50	23	68 426	0
	PUN and Merit Orders	68 666	1 445	75.5	–28.3	–26.2 %	261 582	5 317	2 866	50	23	0	0

Figure 32



* Calculated with respect the reference scenario. The values of the impact (ΔTTFS) report AVG (TTFS from scenario replacing the product X) compared against AVG (TTFS from REF scenario). A negative value means that when the product is replaced, the TTFS is shorter than in the reference scenario.
All the scenarios, except for the one in which piecewise curves are converted in stepwise curves, are calculated using default configuration (the one used in production).
For the scenario in which piecewise curves are converted in stepwise curves, different internal parameters have been used, as suggested by the algorithm provider (these are different than the default configuration).

Figure 33


1+x+y+2a+21
1lim h-->0
x=0 xn
(1+x+y+2a)-(3a+3g+x)
5+x+k+2a+21
E=mc2
1+x+y+2a
45-4a-3
+11,00,00

R&D report

The SDAC R&D program within Euphemia Lab continues to drive significant advancements in market coupling algorithm development. Since the beginning of Euphemia Lab in 2019, the program has been central to introducing new methods and features into Euphemia releases, ensuring the algorithm remains at the forefront of both regulatory compliance and market needs. Across the most recent two iterations of Euphemia Lab throughout 2024, core initiatives have included finalising 15-minute Market Time Unit (MTU) capabilities, improving solver and fallback scalability, exploring potential future adaptations under CACM requirements as well as investigating more disruptive research streams to keep Euphemia robust in increasingly dynamic market conditions.

Key Developments and Achievements in 2024

A critical focus has been the readiness of the 15-minute MTU environment, with around 14 percent of each iteration's resources allocated to performance assessments and fallback procedure finalisation. This work included not only validating the performance and stability in 15-minute data batches but also ensuring that the new fallback logic mitigates the risk of decoupling when larger data set or unexpected constraints arise. Additionally, performance gains were achieved by the implementation of a bidirectional flow avoidance mechanism, enhanced configurations, and other improvements coming from the other tracks. Final thorough simulation runs were carried out for both SDAC and SIDC IDA, confirming that 15-minute products can be seamlessly accompanied by existing hourly and half-hourly products.

A wide range of reliability and performance upgrades was covered within the Generic Improvements category, consuming around 40 percent of effort in each iteration. This category entailed the investigation of new heuristics that could improve the process of complex order reinsertion, ultimately enhancing performance – which was also the primary objective of the removal of obsolete variables in the flow-based model. The Generic Improvements also encompassed the investigation of the new HVDC line type, which allows for lighter modeling of virtual bidding zones, and HVDC reversal avoidance mechanism. Both these HVDC topics are part of fine-tuning Euphemia's modeling, which makes results consistently robust under CACM expansions. Another topic under this category involved the update of Adequacy Patch module, which addresses rare curtailment events, ensuring robust CACM operation under 15' MTU expansions.

"Final thorough simulation runs were carried out for both SDAC and SIDC IDA, confirming that 15-minute products can be seamlessly accompanied by existing hourly and half-hourly products."

Around 16 percent of each iteration's scope was devoted to Core Software Improvements. In particular, solver improvements were implemented, including parallelisation and feature tuning, as well as feature assessment for scalability. This allowed faster and more robust solutions under growing complexity (e.g. 15' MTU), meeting CACM performance expectations. Concurrently, solver repeatability was improved to comply with the CACM repeatability requirement under increasing complexity of the algorithm. Furthermore, multiple types of improved branching strategies were conceptually explored, creating a basis for future work in the next iterations intended to enhance performance and minimize the optimality gap. To meet CACM performance expectations under the planned expansions, logging feasible solutions before solving volume problems in post-processing was introduced to secure fallback in case of errors during the volume problems post-processing. Other notable accomplishment as a part of the Core Software Improvements included the JSON refinements, which resulted in stabilising large data exchanges.

The stream Future of the Algorithm addresses advanced or forward-looking requirements, such as storage orders, advanced hybrid coupling, or co-optimisation frameworks. The ambition is to keep Euphemia both adaptable and competitive as the industry embraces new resources like storage systems or evolving hybrid coupling configurations. Time spent in this research phase has produced prototype features that can be trialed in test environments, gradually maturing toward industrial release.

These steps ensure that Euphemia remains well-positioned to integrate new technologies without compromising its established performance benchmarks, a necessity for evolving regulatory and market landscapes. Regarding the exploration on co-optimisation frameworks, during Iteration 11 the co-optimisation was explored formally under the scope of that iteration, whereas during Iteration 12, the co-optimisation topic was taken as a separate topic outside of the Iteration 12 with separate budget spent given the substantially increased work-load on that topic during that time.

R&D programme for the price coupling algorithm: budget share per topic

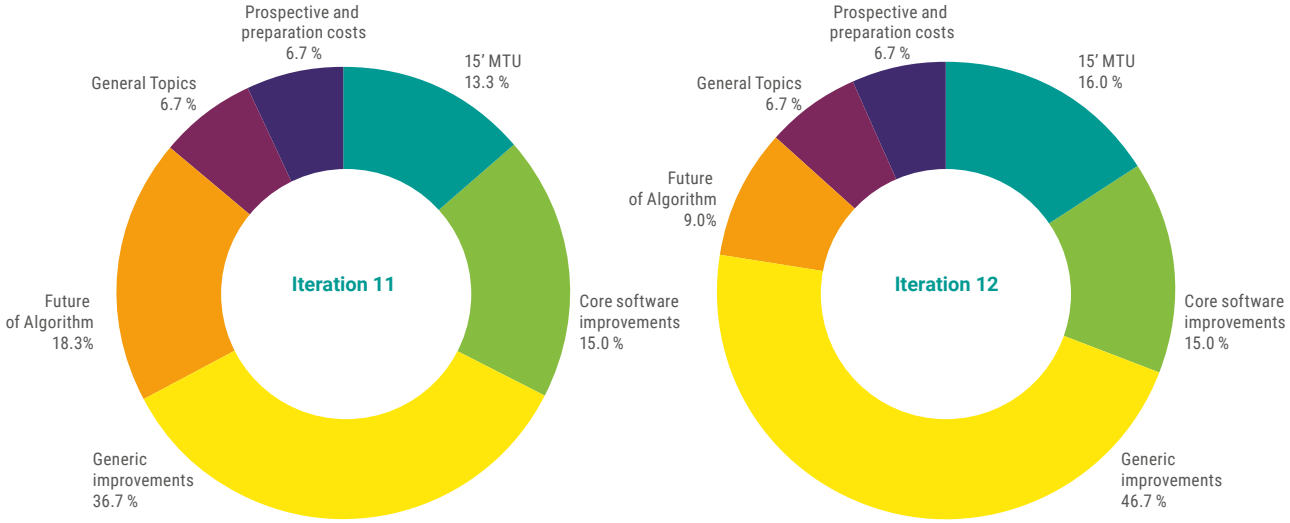


Figure 34

For both Iterations 11 and 12, the largest share of the budget was dedicated to Generic improvements containing multiple topics as detailed in the following tables. Comparing the share of 'Future of the Algorithm' between the two iterations, it is important to note that while in Iteration 11 the R&D on Co-optimisation was part of 'Future of the Algorithm', during Iteration 12 this topic was taken separately outside of Iteration 12 due to extensively increased work-load. The total cost for both iterations is 858 000 €, plus added costs for cloud testing of 65 815 €, the cost for R&D on Co-optimisation separated during Iteration 12 is 186 275 €.

R&D programme for the price coupling algorithm – ITERATION 11 (1/2)

R&D topic	Description	Iteration #*	Share of Iteration workload and budget	Share of both iterations worklwoad and budget
15' MTU	Follow-ups to ensure full 15' MTU readiness in SDAC and SIDC: • Final performance tests on new 15' MTU data batches • Numerical and robustness improvements (volume problems, curve handling) • Additional tuning & fallback options if decoupling risk is detected	11	13.33 %	6.67 %
Core software improvements	Solver improvements • Solver parallelisation and feature tuning • Solver feature assessment for scalability (branching, pre-processing)	11	13.33 %	6.67 %
	• JSON improvements for large-scale messaging	11	5.00 %	2.50 %

*The Iteration 10 is presented in the 2023 CACM Annual report; Iteration 11 and 12 took place from April 2024 until March 2025.

R&D programme for the price coupling algorithm – ITERATION 11 (2/2)

R&D topic	Description	Iteration #*	Share of Iteration workload and budget	Share of both iterations worklwoad and budget
Generic Improvements	New heuristics (primal price checks, reverse local search, always branch down etc.)	11	13.33 %	6.67 %
	Basis sharing for complex order reinsertion	11	6.67 %	3.33 %
	Adequacy patch revision	11	5.00 %	2.50 %
	New HVDC line type	11	1.67 %	0.83 %
	HVDC reversal avoidance mechanism	11	10.00 %	5.00 %
Future of Algorithm	Storage orders	11	18.33 %	9.17 %
	Core Advanced Hybrid Coupling	11		
	Explorations on Co-optimisation frameworks	11		
General Topics	Large-scale batch analysesCreation of new solver and algorithm configurations when required	11	6,67 %	3,33 %
Prospective and preparation costs	Wrap up prototype iteration 11	11	6,67 %	3,33 %

* The Iteration 10 is presented in the 2023 CACM Annual report; Iteration 11 and 12 took place from April 2024 until March 2025.

Table 08

	CACM compliance	Outcome and impact on CACM compliance	Implementation in production (forecast)
	15′ MTU implementation	Performance improvements resulting from the new bidirectional flow avoidance mechanism, improved configurations, and other improvements coming from the other tracks.	E11.4 and following releases
	Scalability improvement	Allows faster, more robust solutions under growing complexity (e.g. 15′ MTU), meeting CACM performance expectations.	E12.0 and following releases

Table 08

	CACM compliance	Outcome and impact on CACM compliance	Implementation in production (forecast)
	Scalability improvement	Enhances performance by investigating new heuristics and improving the process of complex order reinsertion; fine-tunes Euphemia's modeling (HVDC) so results stay robust under CACM expansions; stabilizes large data exchange (JSON).	E 11.4 and following releases (Basis sharing for complex order reinsertion); E12.0 and following releases (JSON improvements); To be further investigated (other tracks)
	N/A	Ensures Euphemia can adapt to major expansions (new product types, large-scale coupling). Lays groundwork for future CACM amendments.	To be further investigated
	N/A	Ensures new and existing features are tested against latest test batches. Analyse performance gains achieved due to improved algorithms, modelling, or configurations.	N/A
	N/A	Integrated successful adaptations from the iteration into the Euphemia prototype, ensuring readiness for future tests and implementations.	N/A

R&D programme for the price coupling algorithm – ITERATION 12 (1/2)

R&D topic	Description	Iteration #*	Share of Iteration workload and budget	Share of both iterations workload and budget
15 ´ MTU	Follow-ups to ensure full 15' MTU readiness in SDAC: • Final performance checks on new 15' data sets • Extra numerical/robustness improvements • Advanced performance monitoring after go-live • Fallback logic if decoupling risk arises (corrective measures)	12	16.00 %	8.00 %
Core software improvements	Solver repeatability	12	3.33 %	1.67 %
	Improved branching (conceptual design)	12	6.67 %	3.33 %
	Logging feasible solutions before solving volume problems	12	6.67 %	3.33 %
Generic Improvements	New heuristics follow-ups (primal price checks, reverse local search)	12	6.67 %	3.33 %
	Adequacy Patch revision	12	6.67 %	5.00 %
	HVDC line type	12	6.67 %	3.33 %
	HVDC reversal avoidance mechanism	12	10.00 %	1.67 %
	Negative RAM handling	12	6.67 %	3.33 %
	Removal of flow variables in Flow-based	12	3.33 %	1.67 %

* The Iteration 10 is presented in the 2023 CACM Annual report; Iteration 11 and 12 took place from April 2024 until March 2025.

R&D programme for the price coupling algorithm – ITERATION 12 (2/2)

R&D topic	Description	Iteration #*	Share of Iteration workload and budget	Share of both iterations workload and budget
Future of the algorithm	Core Advanced Hybrid Coupling	12	5.67 %	2.83 %
	Storage Orders	12	3.33 %	1.67 %
General Topics	Large-scale batch analyses, creation of new solver and algorithm configurations when required	12	6.67 %	3.33 %
Prospective and preparation costs	Wrap up prototype iteration 12	12	6.67 %	3.33 %

* Iteration 10 is presented in the 2023 CACM Annual report; Iteration 11 and 12 took place from April 2024 until March 2025.

Table 09

	CACM compliance	Outcome and impact on CACM compliance	Implementation in production (forecast)
	15′ MTU implementation	Reinforces reliability at 15′ MTU granularity, lowering incident risk at go-live.	E 12.0 and following releases
	Scalability improvement	Helps maintain or reduce TTFS under increasing complexity (15′ MTU, advanced hybrid coupling). Logging solutions secures fallback if volume post-processing fails, meeting CACM performance expectations.	E 12.0 and following releases
	Scalability improvement/ Flow-based in SIDC IDA	Raises performance headroom by implementing new heuristics and removing obsolete variables in flow-based. Refines HVDC modeling (fallback & reversal logic). Updated Adequacy Patch addresses rare curtailment events, ensuring robust CACM operation under 15′ MTU expansions. Handling of negative RAM is needed for the introduction of flow-based in SIDC IDA meeting CACM requirements.	To be further investigated

Table 09

	CACM compliance	Outcome and impact on CACM compliance	Implementation in production (forecast)
	N/A	Ensures Euphemia can adapt to major expansions (new products, large-scale coupling), laying groundwork for potential future CACM amendments or advanced market features.	To be further investigated
	N/A	Ensures new and existing features are tested against latest test batches. Analyse performance gains achieved due to improved algorithms or modelling.	N/A
	N/A	Integrated successful adaptations from the iteration into the Euphemia prototype, ensuring readiness for future tests and implementations.	N/A

Future Plans

For 2025, the intention is to build on the achievements attained for integrating 15-minute MTU, further pushing the boundaries of innovation and adaptability through the ongoing efforts to enhance scalability, improve performance, and integrate new concepts. Core advanced hybrid coupling simulations are scheduled to further align Euphemia with future expansions in cross-zonal capacity usage ensuring stable and reliable algorithm performance. In addition, advancing the performance of polarity reversal avoidance mechanism is a significant objective for the future of the algorithm, since the avoidance mechanism has had a considerable impact on the performance due to optimising HVDC cable tolerance of continuous use.

A key priority will also be to facilitate the introduction of storage order products within Euphemia to enable the market to benefit from storage assets while also supporting the renewable energy-based electricity system. During 2025, efforts will additionally focus on exploring a viable method for including Italy North into the Core region, meeting the CACM requirements. As part of Euphemia Lab, the solely SIDC IDA topic of handling negative RAM will continue to be investigated, facilitating the implementation of flow-based in SIDC IDA.

Part of the extended roadmap for the "2030 Future of the Algorithm" involves follow-up studies on co-optimisation frameworks, which will continue as a separate topic with separately allocated budget outside the iterations with extensive efforts dedicated to this topic. Furthermore, research on new Phase-Shifting Transformer (PST) approaches relevant for more complex network flows will be carried out.

With further exploration of the specific areas (key of them outlined above) and sustained risk management efforts, the SDAC market coupling systems are well-prepared to handle upcoming challenges and opportunities. The combined budget for the efforts in iterations 11 and 12 was 858 000 €, together with the co-optimisation topic separated during iteration 12 it was in total 1 044 275 € and including also cloud testing the overall budget reaches 1 110 090 €, reflecting the commitment of Euphemia Lab to deliver robust and scalable market coupling solutions.

The ongoing development of the R&D program Euphemia Lab underscores its dedication to innovation and excellence. Moving forward, Euphemia Lab will continue to pioneer advancements, ensuring the algorithm remains at the forefront of market coupling systems. Through continuous research and development, the program seeks to sustain high performance levels, adapt to new market demands, and support the transition to a high-renewables energy system, ensuring robust and efficient market operations for the future.

The R&D plan in a nutshell: How it works

With the approval of CACM and the related methodologies, further challenging requirements have been introduced in terms of dimension (a wider geographical scope, going together with a higher usage of products, more complex network topology), market design (MNA, new demanding network constraints, 15 minutes MTU,...) and algorithm performance (optimality, scalability and repeatability).

To be ahead of the change and keep on ensuring the best level of performance even in the new demanding environments, NEMOs and TSOs launched in 2019 a forward-looking R&D program "Euphemia Lab", aimed at increasing both the scalability of Euphemia and the quality of the solutions in terms of economic surplus as well as ensuring the repeatability of the solutions, meeting CACM requirements.

Euphemia Lab conducts its research in systematically defined iterations that address three areas: hardware, software and market design. While some changes are incremental — refinements that smoothly integrate into existing code, others — like storage orders or advanced HVDC expansions — can be disruptive enough to require broader re-engineering and prolonged pilot testing.

From the overall timeline perspective, a period of six to twelve months is usually required to integrate, test, and validate newly proven concepts. This timeframe ensures that time-to-first-solution, optimality gap, and solution repeatability remain within operationally acceptable ranges.

Changes that may significantly impact market participant behavior or require methodology updates undergo additional scrutiny and stakeholder engagement. By organising development in this structured manner, Euphemia Lab remains poised to manage immediate enhancements – such as 15-minute MTU expansions – while also planning for next-generation features that the European electricity markets will likely need in the coming years. This iterative approach has effectively balanced short-term operational stability with the ongoing innovations required to keep Euphemia at the leading edge of market coupling solutions.

Single Intraday Coupling

SIDC CT main features

NEMO requirements

- MTU: 15, 30, 60 mins without cross-matching
- Regular orders
- Linked orders
- Iceberg Orders
- User Defined Blocks

TSO requirements

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

CACM requirements

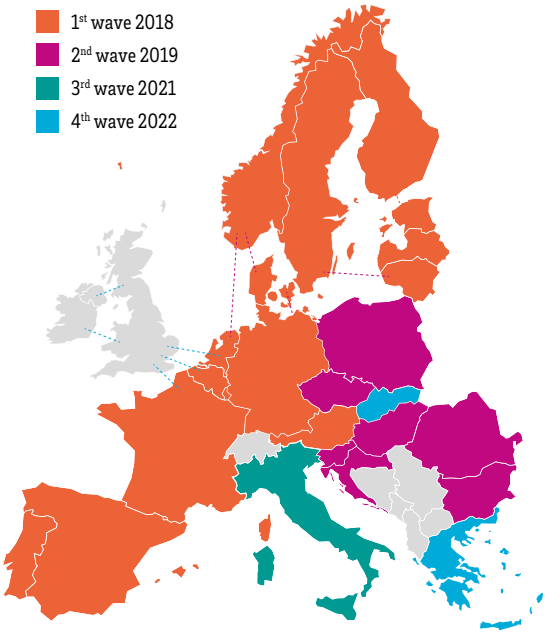
- Adequate scalability
- MNA
- MTU: 15–60 mins

Systems release(s)

- Deployment of XBID version 4.0, 16th of May 2024.
- Release R4.0.30 deployed on 5th of June 2024.

Geographical scope

- 5th wave (concerning inclusion of ETPA in SIDC, Continuous Trading)
- 6th wave (concerning inclusion of BRM in SIDC, Continuous Trading)



Note: Luxemburg is part of the Amprion Delivery Area. Market participants in Luxemburg have access to the SIDC through the Amprion Delivery Area.

Figure 35

SIDC IDAs features

NEMO requirements

- Block Orders (simple, linked, exclusive)
- Merit Orders
- Aggregated MTUs orders (curves)

TSO requirements

- ATC
- Network constraints: Ramping

CACM requirements

- Adequate optimality
- Adequate scalability
- Adequate repeatability
- MNA
- MTU: 60 min, 30 min, 15 min
  - › gradual introduction of 15 min products in 2024
  - › Introduction of 15 min products in all SIDC BZs to be completed in 2025 together with SDAC big-bang approach (Greece)

Systems release(s) IDA

- Deployment of several systems to implement IDAs on 16th of May 2024
- PMB 13.0 and Euphemia 11.3 implemented from 11th of September 2024

Geographical scope

- As per 06/2024 big-bang approach: Austria, Belgium, Bulgaria, Germany, Netherlands, Romania (running in isolated mode), Slovakia, Slovenia, Denmark, Sweden, Finland, Croatia, Hungary, Poland, Czech Republic, Estonia, Latvia, Lithuania + Norway, France, Italy, Spain, Portugal, Greece

SDAC members (operational*)
* SEM bidding zone: operation in isolation

Figure 36

High level market data

SIDC Continuous

Through more than six years, since the go- live in 2018, the trading in the SIDC continuous market has shown steady growth. 2024 shows increasing growth and another record year with more than 5 281 million orders handled by the market coupling.

The coupled SIDC continuous-trading grew to 207.49 TWh traded – representing more than 208 million trades. In 2023 the relevant traded volume was 166.45 TWh.

The SIDC couples the continuous intraday markets of 25 countries. The SIDC/CT systems handle orders and transmission capacity from 34 bidding zones and 57 borders. Market participants are now trading on platforms of 15 NEMOs after the successful go-live also of Bursa Romana de Marfuri's (BRM) operation in Romania since 22 May 2024.

"The coupled SIDC continuous trading grew to 207.5 TWh traded – representing more than 208 million matched trades"

The operation of the systems remained stable and their performance unaffected by the significant increase in number of orders executed per day and number of trades matched. Number of incidents that were visible to the market remains low and the amount of unexpected downtime at a minimum.

The annual average clearing price was about 79 €/MWh for hourly contracts and 70 €/MWh and 91 €/MWh for half- and quarter-hourly contracts, respectively. Block contracts tend to be traded with lower average price just below 70 €/MWh. Average price on hourly and half-hourly traded in the last hour before delivery is slightly higher while for quarter-hour and blocks the average price is lower than the average price overall.

Annual mean price per bidding-zone in the SIDC\CT ranged from 22.29 €/MWh to 112.57 €/MWh. Price range across the market area converged compared to the 2023 mean price levels per bidding zone.

TRADED VOLUMES – SIDC/CT (GWh)

Table 10

Annual	Daily average	Daily minimum	Daily maximum
207 486	566.9	379.0	974.2

Yearly prices are computed as volume-weighted average prices of all trades per contract per bidding zone.

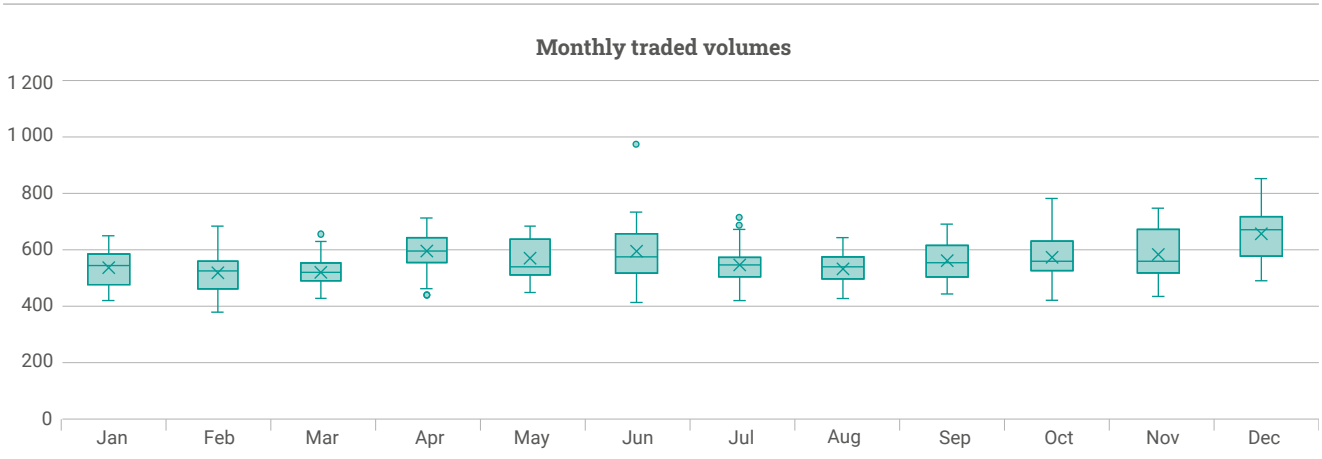


Figure 37

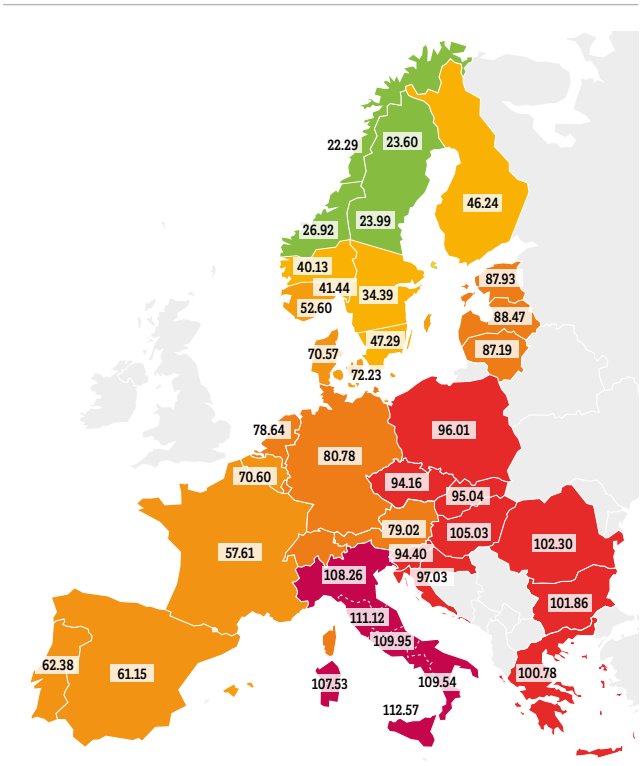


Figure 38

SIDC IDAs

Intraday Auctions (IDAs) were implemented across Europe on 13 June 2024, complementing the continuous trading in SIDC. IDAs take place as three European-wide auctions at 15:00 (D-1), 22:00 (D-1), and 10:00 (D).

The SIDC\IDAs are available in all the same market areas as for the SIDC/CT, coupling 25 countries – 34 bidding zones and 57 borders.

In the three daily auctions, a total of 46.6 TWh has been traded in 2024. A daily average of 244 GWh traded, IDA1 with the highest average of 126 GWh per delivery day, IDA 2 with 88 GWh and IDA3 with an average volume of almost 30 GWh.

The annual average prices in the three IDA auctions were mostly aligned, with higher prices in the continental/south Europe, ranging between 70 and 130 €/MWh, east Europe between 100 and 160 €/MWh with the exception of Romania, running in isolated mode up to Q1 2025, with prices around 0 €/MWh, due to the technical prices computed by the algorithm due to the very poor liquidity in the area; lower prices in the Nordic countries around –15 €/MWh and 45 €/MWh.

TRADED VOLUMES – SIDC/IDAs (GWh)

Table 11

IDA	Annual	Daily average	Daily minimum	Daily maximum
IDA 1	23 922.45	125.91	91.49	180.32
IDA 2	16 904.86	88.51	57.24	180.64
IDA 3	5 788.67	29.69	13.52	45.58

Yearly prices are computed as volume-weighted average prices of all trades per contract per bidding zone.

"A total of 46.6 TWh was traded in 2024 in the three Intraday Auctions after the implementation on 13 June."

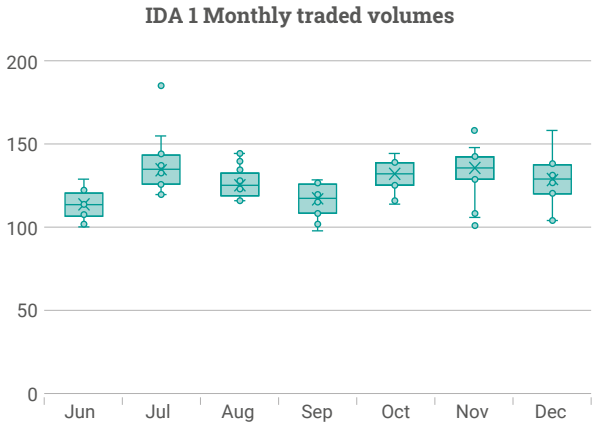


Figure 39

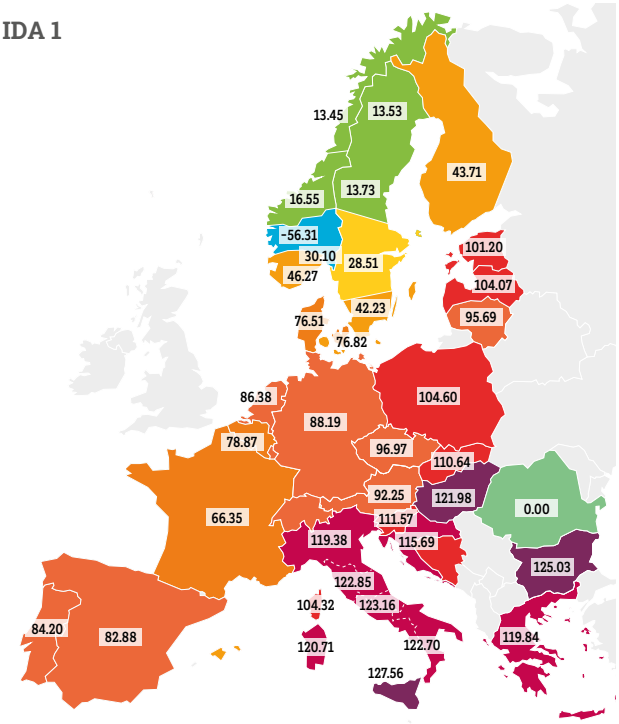


Figure 40

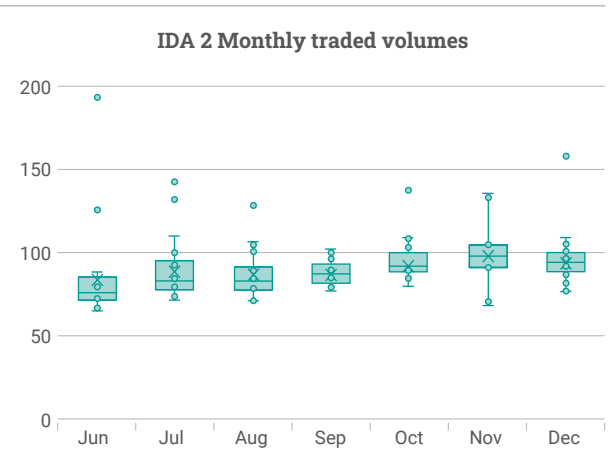


Figure 41

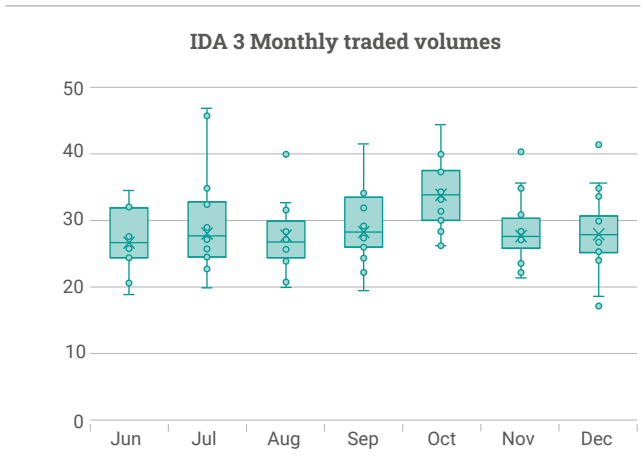


Figure 42

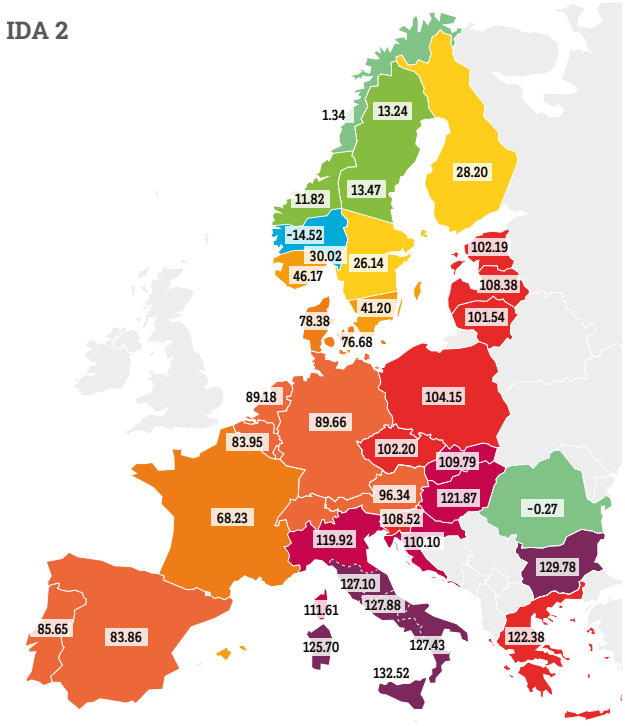


Figure 43

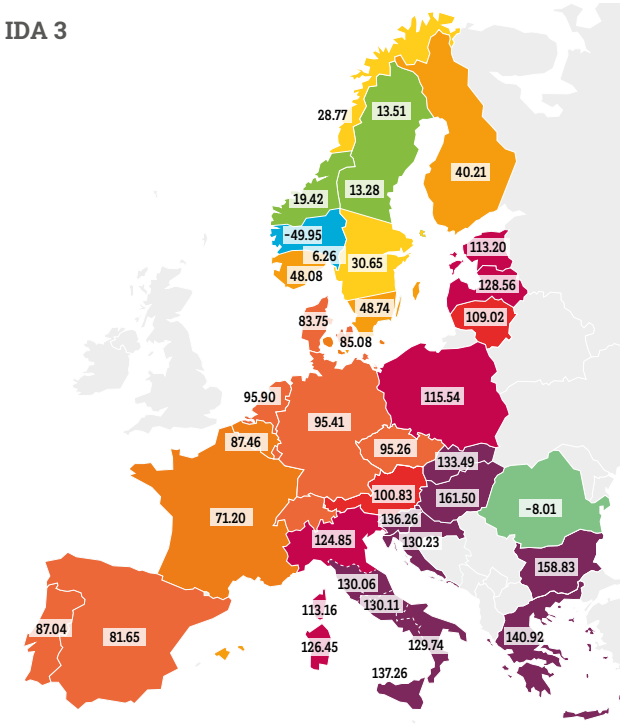


Figure 44

Operations report

This section reports on operational events occurred in SIDC during 2024, including: the incidents, requests for changes decided upon and corrective measures applied. With the introduction of Intraday Auctions (IDAs) the report is now augmented with relevant sections for SIDC Continuous Trading/(CT) and SIDC/IDA.

Incidents (SIDC/CT)

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

- Throughout 2024, SIDC/CT experienced 24 incidents in total, of which 2 incidents of severity 4 were not visible to market participants. 12 incidents were caused by issues not related to the MCO function.
- In SIDC\CT there were 2 incidents of Severity 1 in 2024, i.e. an incident that led to a Market Halt, all of which are depicted in the table below.

Table 12

Date	Real duration	Comments and observations
21/05/2024	64 minutes	Capacity Management Module (CMM) node instances running in parallel, competing on which one sends the data for publishing the capacity first.
28/08/2024	20 minutes	Maintenance by the ECP hosting party caused a disruption in cross-border data processing, delaying responses for Transmission System Operators (TSOs).

"2024 was another year of stable operations of SIDC Continuous Trading"

Incidents on 21/05/2024

The initial findings of the Service Provider showed that the specific files, sent from a specific TSO, triggered validation error which might have caused the Core to crash. However, after deeper analysis, the Service Provider found the issue was linked to the automatic publication of capacity.

The cause of the incident was due to two Capacity Management Module (CMM) node instances running in parallel, competing on which one sends the data for publishing the capacity first.

The mentioned situation repeated twice on 21st of May in a short time interval, resulting in a total of 64 minutes of unexpected outage in the SIDC\CT operation.

Scope of the impact (Severity 1):

Severity 1 incidents have impact on all market areas & all borders, and therefore the XBID solution is halted. Incidents with severity 2, 3 or 4 have less significant impact and are considered as regular operational states. Lower severity incidents are thoroughly treated by SIDC/CT procedures.

Description of the incident on 21st May:

On 21/05/2024 at 14:00 SOB WebGUI went down and automated XBID failover to Core2 was performed.

At 14:09 Incident Committee was opened and NEMOs and TSOs confirmed that the XBID systems were down.

The supplier investigated the issue and tried to ensure that it was safe to restart the XBID system core instances.

At 14:35, once the service provider gave green light to reopen the market and NEMOs and TSOs agreed, the market successfully was set back to trading.

At 14:46 the same situation happened again, and NEMOs and TSOs confirmed that the XBID systems were down with the same root cause, and it was safe to reopen the market if the specific customer who caused the issue could avoid delivery of the respective file. The specific customer confirmed the respective file would not be uploaded again to avoid another Core down.

At 15:15 the market was successfully set back to trading based on specific customer confirmation and service provider advice; the Incident Committee call was closed.

Long term measures:

The issue cannot be experienced again since Service Provider set just a single/primary node of CMM module running in parallel. The other node, is remaining as a viable backup, which will be activated in case of failure of the primary node.

Public incident report:

Market participants are informed about category 1 incidents on [ENTSO-E] and [Nemo Committee] websites.

Incident on 28/08/2024

The cause of the issue was due to Maintenance by the ECP hosting party which caused a 20-minute disruption in cross-border data processing, delaying responses for TSOs. The issue was resolved by the hosting party, Unicorn, and normal operations resumed.

Scope of the impact (Severity 1):

Severity 1 incidents have impact on all market areas & all borders, and therefore XBID solution is halted. Incidents with severity 2, 3 or 4 have less significant impact and are considered as regular operational states. Lower severity incidents are thoroughly treated by SIDC/CT procedures.

Description of the incident on 28th August:

Communication Platform (ECP) experienced disruptions from 14:31 until 14:52 CET, impacting data processing.

14:31 CET: Monitoring systems alerted operations team that files were not being received, and capacities for IDAs were not coming in. Customer reports began to arrive shortly thereafter, indicating delays and a buildup in message queues.

14:45 CET: Initial investigation revealed that the issue originated from maintenance activity on the ECP hosting infrastructure, managed by Unicorn. Connectivity issues with the ECP broker caused delays in processing data for TSOs.

14:50 CET: Unicorn's infrastructure team identified and restored network connectivity to the affected components. This action allowed the message stack to clear.

14:52 CET: DBAG's operations team verified the restoration of normal operations, and data flow resumed as expected.

XBID restored to standard operations at 16:37 CET and therefore IDA 1 was cancelled, with no further impact on SIDC\CT.

Long term measures:

Amprion, acting as host to the CIP solution, plans to conduct post-installation checks whenever certificates are re-installed to detect and address issues more promptly.

Amprion opened a support ticket with VMware to investigate the cause of the unexpected host disconnections and seek guidance on preventing similar incidents in the future.

Public incident report:

Market participants are informed about category 1 incidents on [ENTSO-E] and [Nemo Committee] websites.

Incidents (IDAs)

Throughout 2024, SIDC\IDA experienced 50 incidents in total, of which 20 incidents were not visible to market participants. Only 4 incidents were related to the MCO function. Despite the number of incidents, IDA success rate during 2024 was 97.7 %.

- Throughout 2024, SIDC IDAs experienced 50 incidents in total, of which 20 incidents of severity 4 were not visible to market participants. Only 4 incidents were related to the MCO function.
- There were 21 incidents of Severity 1 in 2024, which included 12 IDA Cancellations, 6 Automatic Partial Decoupling and 3 Partial Decoupling in Advance.
- Despite the high number of incidents, IDA success rate during 2024 was 97.69 %.
- Analysing the incidents occurred during the first 6 months after IDA's go-live last 13rd of June, it can be noticed that in most cases, the root cause of the problems was due to local issues. It shows that IDA joint system has been developed in a robust and stable way.

"2024 was the first year of IDAs in SIDC, with a success rate of 97.69 %"

- Each of the incidents was analysed immediately after the completion of the related IDA by the affected party to ensure the correct functioning of the next auction.
- In all cases, mitigating measures and solutions were applied, being previously tested with satisfactory results. The OPSCOM group is in charge of monitoring it on a weekly basis to ensure the proper functioning of the markets.
- Market participants are informed about category 1 incidents (Automatic Partial Decoupling/IDA Cancellation) on [ENTSO-E] and [NEMO Committee] websites.

Table 13

Date	Type of incident	Affected IDA	Comments and observations
13/06/2024	IDA cancelled	IDA1	Preliminary confirmation missing for IDA1 from a NEMO at target time
25/06/2024	IDA cancelled	IDA3	Preliminary confirmation missing for IDA3 from a NEMO at target time
03/07/2024	IDA cancelled	IDA3	Preliminary confirmation missing for IDA3 from several NEMOs at target time
03/07/2024	Automatic PD	IDA2	Missing Order Book from a NEMO at target time
07/07/2024	IDA cancelled	IDA1	Preliminary confirmation missing for IDA1 from several NEMOs at target time
24/07/2024	Automatic PD	IDA1	Automatic Partial Decoupling
30/07/2024	Automatic PD	IDA1	Automatic Partial Decoupling
08/08/2024	IDA cancelled	IDA2	CZC files reception delayed
28/08/2024	IDA cancelled	IDA1	Critical issues on CMMs side (NTC files from TSOs were not received)
20/09/2024	IDA cancelled	IDA2	Preliminary confirmation missing for IDA2 from a NEMO at target time
21/09/2024	IDA cancelled	IDA2	Preliminary confirmation missing for IDA2 from several NEMOs at target time
16/10/2024	IDA cancelled	IDA1	Missing NEMO PC at target time
18/10/2024	IDA cancelled	IDA2	Missing NEMO order book at target time
29/10/2024	IDA cancelled	IDA1	Rejection of IDA 1 results
31/10/2024	Automatic PD	IDA3	Missing Network Data from a NEMO
06/11/2024	Automatic PD	IDA1	Missing NEMO order book at target time
30/11/2024	Automatic PD	IDA1	Missing NEMO order book at target time
10/12/2024	IDA cancelled	IDA1	Missing CZC in IDA CIP
30/11/2024	Automatic PD	IDA1	Missing NEMO order book at target time
10/12/2024	IDA cancelled	IDA1	Missing CZC in IDA CIP

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.

- Altogether 39 RfCs and 6 system releases were implemented in 2024.
- 5 RfCs were related to IDAs only, while 19 were related to continuous trading and 10 affected both markets.
- Several RfCs related to 15-min resolution and products went live throughout the year, including in Hungary, Poland, Baltic Countries and Italian Bidding Zones.
- Two geographical extensions took place with ETPA extension to Germany and BRM activation in the Romanian delivery area.
- Most RfCs had various aims, like fulfilling flow-based prerequisites and improving usability.
- This report includes a complete list of the RfCs that were implemented.

Corrective Measures

- No Corrective Measures have been applied in SIDC during 2024, as no relevant performance deteriorations have been recorded during the year.

Table 14

IDAs	Severity 1	Severity 2	Severity 3	Severity 4
IDA 1	11	1	2	11
IDA 2	5	0	5	5
IDA 3	5	0	2	4

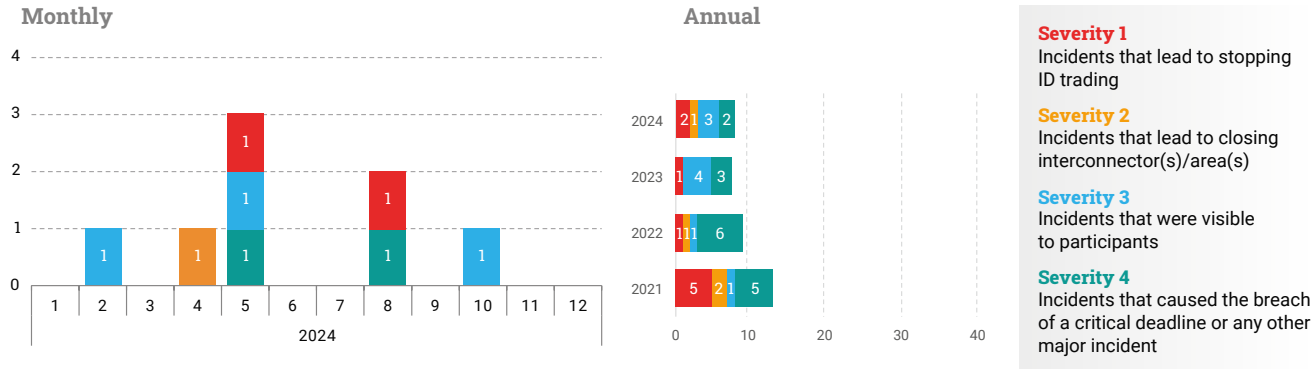


Figure 45

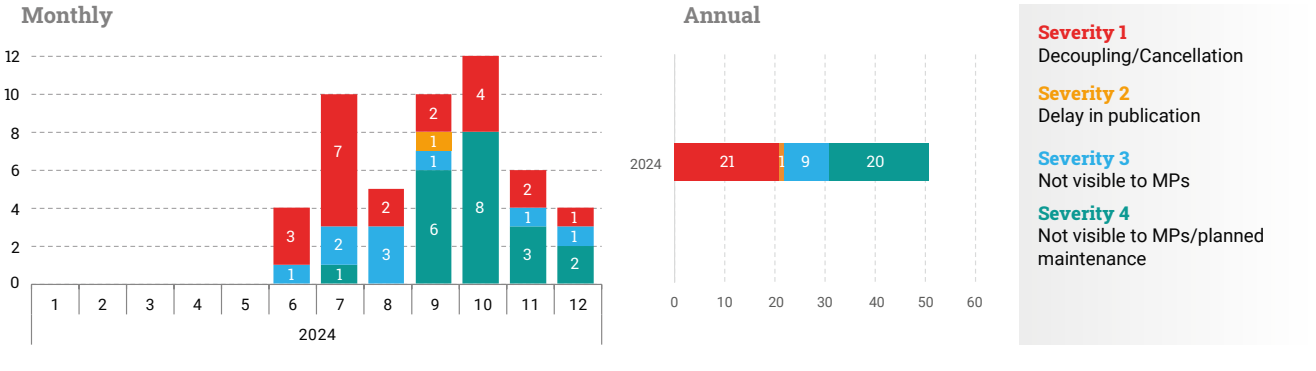


Figure 46

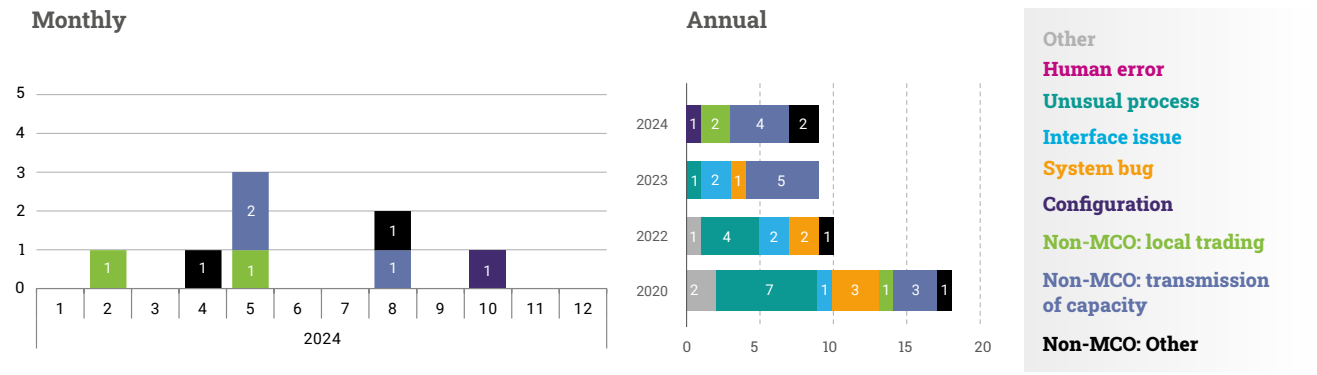


Figure 48

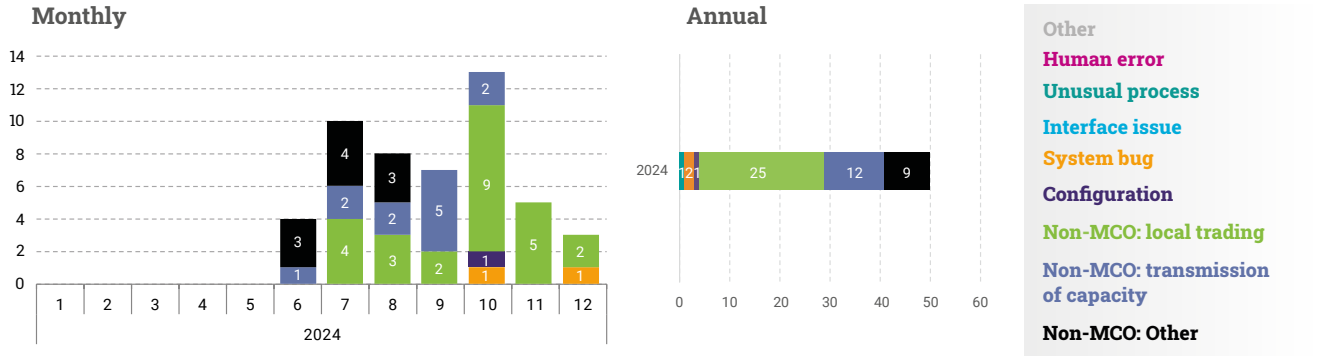


Figure 47

Table 15

IDAs	Non-MCO: Other	Non MCO: transmission of capacity	NON MCO: local trading	Configu-ration	System bug	Interface Issue	Unusual process	Human error	Other
IDA 1	2	7	12	1	2	0	0	0	0
IDA 2	4	5	6	0	0	0	0	0	0
IDA 3	3	0	7	0	0	0	1	0	0

Request for change (RfCs)[2]

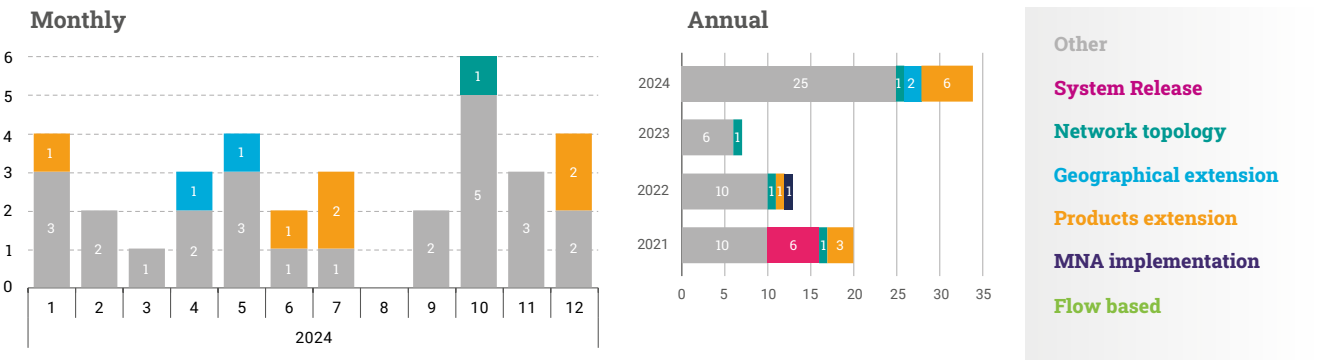


Figure 49

Table 16

Requirement	Name	Go-live Date	Reason	Reason (AM Article 14.1)	Initiator/ Owner (Annex I to AM Article 15.2.c)	Details, Aim of the CR (Annex I to AM – 15.2.a)
Products extension	15 minutes resolution and products HR-SI - HR-HU_HUPX_CROPEX	10.01.2024	CACM	a	NEMOs/TSOs	IDCZGOT prerequisite
Other	Removal of FI-FRE interconnector from XBID topology	10.01.2024	Other	g	TSOs	Ensuring and enhancing the transparency and reliability of information
Other	Max Capacity, Max Quantity and BG Allocation Limit changes on all Core internal borders where below 15 000 MW	13.01.2024	Other	h	TSOs	Improve usability
Other	Increase of Capacity limit on the Bidding Zone Border DK1-DK1A	14.01.2024	Other	h	TSOs	Improve usability
Other	Request for change-implementation of Trade Recall functionality for TGE	01.02.2024	Other	h	NEMOs	Improve usability
Other	Implementation of new virtual area SE3A	16.02.2024	Other	g	NEMOs/TSOs	New virtual interconnector
Other	"Min Capacity" changes on all Core internal borders	18.03.2024	Other	h	TSOs	Configuration change
Geographical extension	ETPA extension to market area Germany	16.04.2024	Other	g	NEMOs	CCP extension
Other	IC CEPS-APG Contract Resolution 60min	24.04.2024	Other	h	TSOs	Configuration change
Other	Max/min capacity, max quantity and BG allocation limit for NO1A-NO2	25.04.2024	Other	h	TSOs	Configuration change
Other	Increasing inquiry limit of the full order capture request	16.05.2024	Other	h	NEMOs	Improve usability
System release	Extend Contract Halt function with a selection of direction(s)	16.05.2024	Other	e	NEMOs/TSOs	Improve usability
Geographical extension	BRM activation in the Romanian delivery area	23.05.2024	Other	a	NEMOs	New NEMO
Other	Configuration Core CCCT AAC and NTC	17.05.2024	OTHER	a	TSOs	Configuration change for IDCC1
Other	"Automatic_Publication_ Offset_and Preview_ Capacity deactivation" changes on all Core internal borders	29.05.2024	Other	h	TSOs	Configuration change
Products extension	15 minutes resolution for intrazonal products in Poland	14.06.2024	CACM	a	NEMOs/TSOs	IDCZGOT prerequisite
Products extension	15 minutes resolution and products in CZ BZ	01.07.2024	CACM	a	NEMOs/TSOs	IDCZGOT prerequisite, relevant also for IDAs

Table 16

Requirement	Name	Go-live Date	Reason	Reason (AM Article 14.1)	Initiator/ Owner (Annex I to AM Article 15.2.c)	Details, Aim of the CR (Annex I to AM – 15.2.a)
Other	New Trading Schedules in MNA areas to allow full SOB	18.07.2024	Other	h	NEMOs	Configuration change
Products extension	EPEX SIDC 15 minutes resolution for intrazonal products in Poland	23.07.2024	Other	a	NEMOs	Local change/NRA
Other	Change of the minimum capacity for DK1A-DK1	14.09.2024	Other	h	TSOs	Configuration change
Flow- based	Max/min capacity, max quantity and BG allocation limit for Statnett & SvK internal and external interconnector	15.10.2024	Other	h	TSOs	Configuration change
Other	Introduction of ramping limit in FI-SE3	29.10.2024	Other	h	TSOs	Ensuring optimal use of the transmission infrastructure, Ensuring operational security, relevant also for IDAs
Flow -based	Change ramping restriction on SwePol PLC-SE4	29.10.2024	Other	h	TSOs	Configuration change, relevant also for IDAs
Other	Removal of virtual Delivery Area NO1A	29.10.2024	Other	g	TSOs	FB prerequisite, relevant also for IDAs
Other	Changes to XBID FTCs for CCCt	12.11.2024	Other	h	TSOs	
Other	ECC always act as a preferred shipper for the CCPBSP	15.11.2024	Other	h	NEMOs	Improve usability
Other	New CORE DI_XBID PROD FTCs	28.11.2024	Other	h	TSOs	
Other	Introduction of EPEX orders in SOB until the latest permitted point of trading per bidding area	10.12.2024	Other	h	NEMOs	Configuration change
Products extension	15 minutes resolution and products in IDCT & IDAs for EE, LV, LT BZs (borders EE-LV & LV-LT)	16.12.2024	CACM	a	NEMOs/TSOs	IDCZGOT prerequisite, relevant also for IDAs
Products extension	15 minutes resolution and products for IDCT & IDA in IT Bidding Zones (internal borders)	31.12.2024	CACM	a	NEMOs/TSOs	IDCZGOT prerequisite, relevant also for IDAs

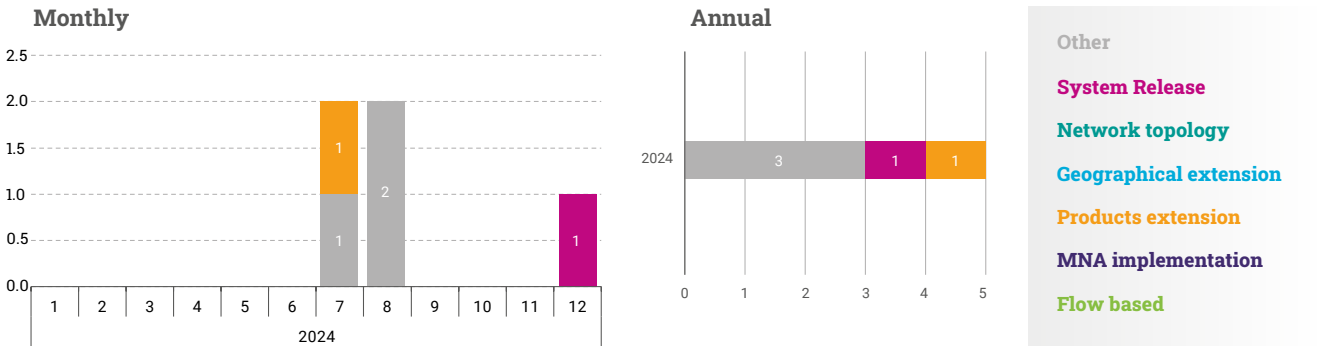


Figure 50

Table 17

Requirement	Name	Go-live Date	Reason	Reason (AM Article 14.1)	Initiator/ Owner (Annex I to AM Article 15.2.c)	Details, Aim of the CR (Annex I to AM – 15.2.a)	# of IDA
Other	IDA_CIP_NOD_ FlowsDeadlines	20.06.2024	Other	h	NEMOs/TSOs	Improve usability	all
Products extension	Change to 15 minutes products in IDAs in the CZ market area	01.07.2024	CACM	a	NEMOs/TSOs	IDCZGOT prerequisite	all
Other	IDA improvement of timings_T5_ T11	05.07.2024	Other	h	NEMOs/TSOs	Improve usability	all
Other	IDA CIP Deadlines for NOD flows to be shortened	13.08.2024	Other	h	NEMOs/TSOs	Improve usability	all
Other	IDA_CIP_ IDACZC_ FlowDeadlines	20.08.2024	Other	h	NEMOs/TSOs	Improve usability	all
Other	Shortening of TIME LIMIT + increasing the GRACE TIME for Euphemia calculation	23.09.2024	Other	h	NEMOs/TSOs	Improve usability	all
Other	Change of T9 due to shortening of the time	16.10.2024	Other	h	NEMOs/TSOs	Improve usability	all
Other	EEX-HUPX BSP Price tick alignment	16.10.2024	Other	h	NEMOs	Creating a level playing field for NEMOs	all
Other	PMB12.2HotFix	04.12.2024	Other	h	NEMOs/TSOs	Hotfix	all
Other	Introduction of simple block orders in GME	31.12.2024	Other	h	NEMOs	Improve usability	all

Performance monitoring report

SIDC CT

For performance monitoring, the indicators listed in the annex 4 of the AM have been considered for all the days of 2024. The maximum, minimum and average values observed throughout the year are reported in the following slides. Where relevant, monthly values are also reported. Notes and explanations on the calculation of these indicators are included as asterisks below the diagrams in the slides where relevant.

Usage Indicators

The majority of the available data reflects the network topology with 34 bidding zones, 71 interconnectors, 15 NEMOs and the product types available; hourly, half-hourly, quarter-hourly and blocks.

The analysis of monthly values regarding executed orders and matched trades in the Continous shows steady increase through 2024.

Performance Indicators*

The analysis of daily values, in terms of processing time for orders/trades and order book update shows improvement and stability through 2024.

Output Indicators

The "total matched – hours to delivery" indicator shows that more than 55 % of the traded volume is matched in the last two hours before gate closure one hour before delivery.

"Steady increase in number of orders in continuous trading and trades through 2024, while indicators showing stable performance. Good performance recorded also for IDAs, for the first six months after the go-live."

* **Ability to maximise the economic surplus 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.
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.

SIDC IDA

According to the annex 4 of the AM, the performance monitoring report for IDAs takes into account the same indicators adopted for SDAC, following a "mutatis-mutandis" approach. The indicators monitoring the performance of the intraday auctions shall be those used in the DA, in accordance with Annex 3 to the AM.

Usage Indicators

- The majority of the products in use in the three IDAs are the curves orders, followed by merit orders and block orders, with a higher number of usage in IDA 1 with respect to IDA 2 and 3.
- Due to the specificities of intraday with respect to the day-ahead auction, complex orders as well as PUN orders, which are in use in SDAC, have not been activated in IDAs.

Performance Indicators*

Time to first solution average values span from 0.61 min down to 0.23 min from IDA 1 to IDA 3, well below the time allowed to the algorithm to run. For the first time, due to the absence of some non-convexity introduced by some products in use in DA, NEMOs were able to calculate the optimality gap values for the IDAs, the results show a good optimality level.

Output Indicators

- The average economic surplus was around 167 M€ for IDA1 19 M€ for IDA 2 and 5 M€ for IDA3.
- The higher values of traded volumes can be traced back to the products most in use, namely curves, block and merit orders.

Usage indicators[9]

Table 18

Usage indicators		2021	2022	2023	2024 Avg	2024 Min	2024 Max
1) Indicators to describe the Usage of products (Annex 4 of AM Article 8)							
Total number of products (per end of year)		4	4	4			4
Total number of daily submitted orders per product and per bidding zone	Hour	26 674	41 214	80 069	80 069	1	2 287 270
	½-hour	4 939	9 826	56 048		0	261 369
	¼-hour	155 110	272 364	384 603	384 603	1	4 290 594
	Blocks	86	4 940	602		1	163 587
Total daily submitted order volume per bidding zone (MWh – avg, min, max)		86 928	305 700	460 828	460 828	5	25 097 339
Total number of explicit capacity allocation request (avg, min, max – per day)		412	602	700	501	79	1 055
2) Indicators to describe the geographical extension (Annex 4 of AM Article 9) [10]							
Total number of NEMO (per end of year)		11	13	14			15
Total number of delivery areas* (per end of year)		33	35	37			44
Total number of bidding zones* (per end of year)		30	32	34			34
Total number of interconnectors* (per end of year)**		62	67	71			71
Total number of borders* (per end of year)		51	54	56			57
3) Indicators to describe Network constraints (Annex 4 of AM Article 10)							
Total number of occurrences of ramping constraints on interconnector level***		437	715	882	911	42	251
Total number of occurrence of Biding Zone net position ramping constraints****		-	-	-	-	-	-
Total number of occurrence of Biding Zone net position volume constraints****		-	-	-	-	-	-

* Delivery areas, bidding zones, interconnectors and borders required for system setup are excluded (with Morocco and Russia, Italian virtual areas)
** Interconnectors that represent the connections with the VDAs to their PDA were removed. (TN_IC = 71)
*** This count started in May 2021. There are 12 interconnectors with Ramping limit;
EE-FI, DE-DK2, DE-NO2, DK1-SE3, DK1-DK2, DK1-NL, DK1-NO2, LT-SE4, LT-PL, NO2-NL, PL-SE4, FI-SE3
**** The net position ramping constraint and the net position volume constraint are not in use in SIDC today, i.e. no values to be reported for these two indicators.

Performance

Table 19

Usage indicators		2021 Avg	2022 Avg	2023 Avg	2024 Avg	2024 Min	2024 Max
Algorithm scalability (Annex 4 of AM Art. 7)							
a) Time for the execution of an order (milliseconds)*	Lower percentile 93 %	18	28	21	17	12	123
	Upper percentile 96.5 %	26	41	30	26	14	230
b) Rate of executed orders (number per day)		2 532 418	4 214 466	7 892 767	14 428 800	7 787 841	23 649 113
c) Time for the execution of a trade*		Equal to (a)	Equal to (a)	Equal to (a)	Equal to (a)	Equal to (a)	Equal to (a)
d) Rate of executed trade (number per hour)		166 866	243 753	411 947	569 506	388 356	893 475
e) Time for generation of post coupling files (milliseconds)		11 983	12 137	16 719	21 035	10 598	64 018
f) Time for processing an order book update (milliseconds)**	Lower percentile 93 %	31	34	20	20	16	29
	Upper percentile 96.5 %	44	56	30	27	20	61

* This indicator measures the time between the moment that an order receives a timestamp from the system and the moment that it is reported by the system as executed. 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.)

** For each orderbook update, this indicator measures the longest time lapse between the moment that an order enters the system and the moment that the system sends the order book update comprising that order.

Time for the execution of an order/trade (millisec)[3]

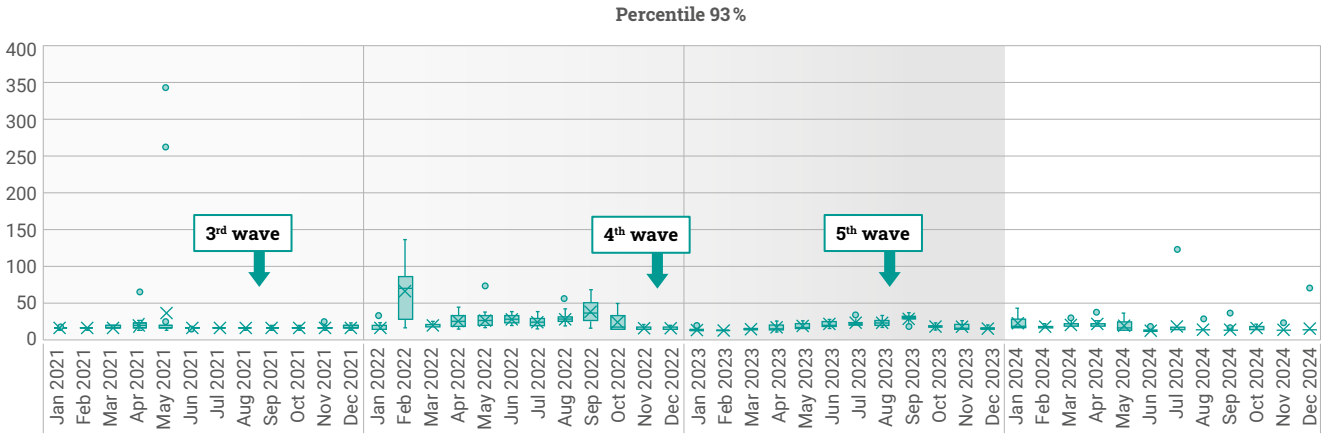


Figure 51

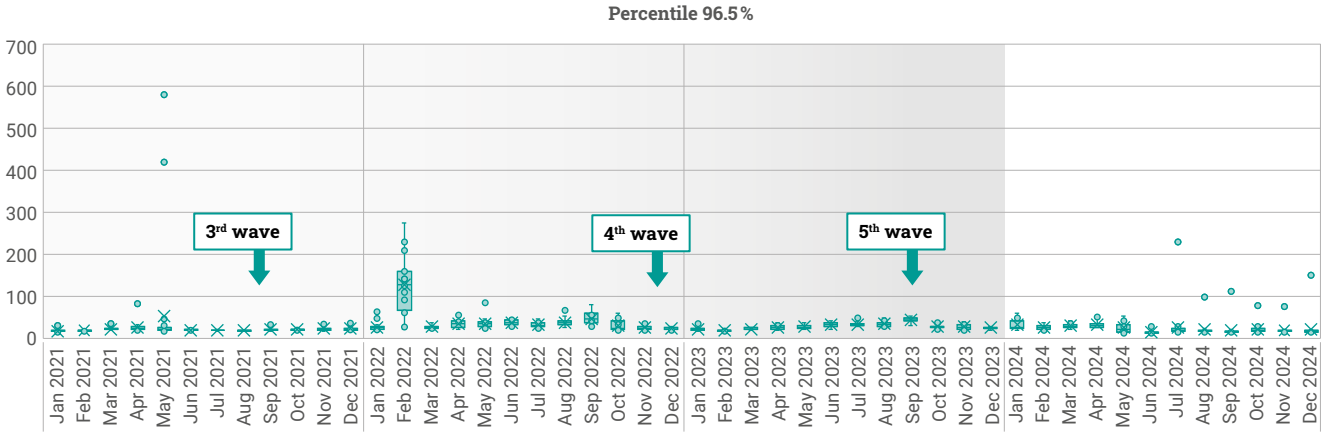


Figure 52

Time for execution of an order/trade in 2024 is stable.

Time for processing an order book update (millisec)[3]

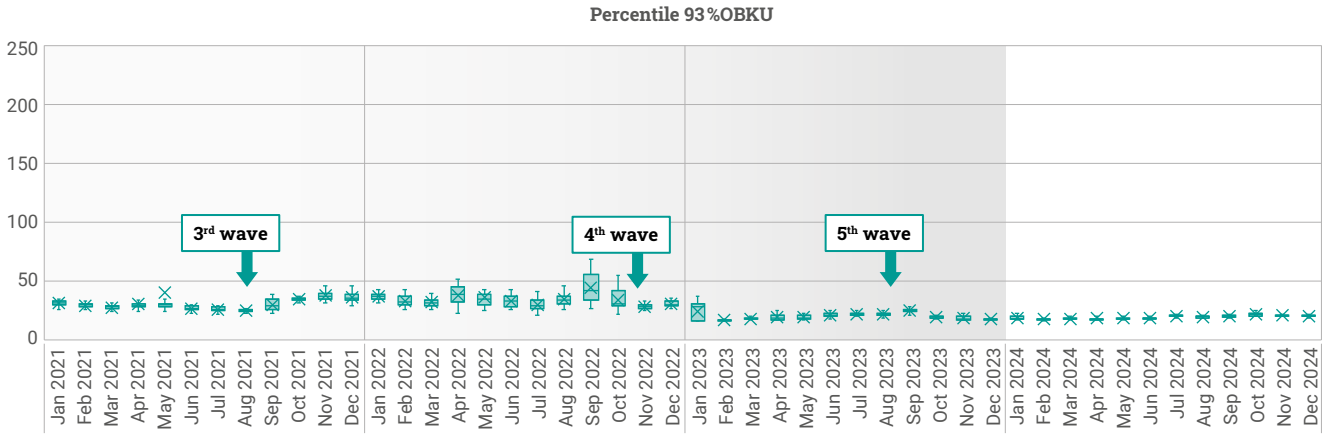


Figure 53

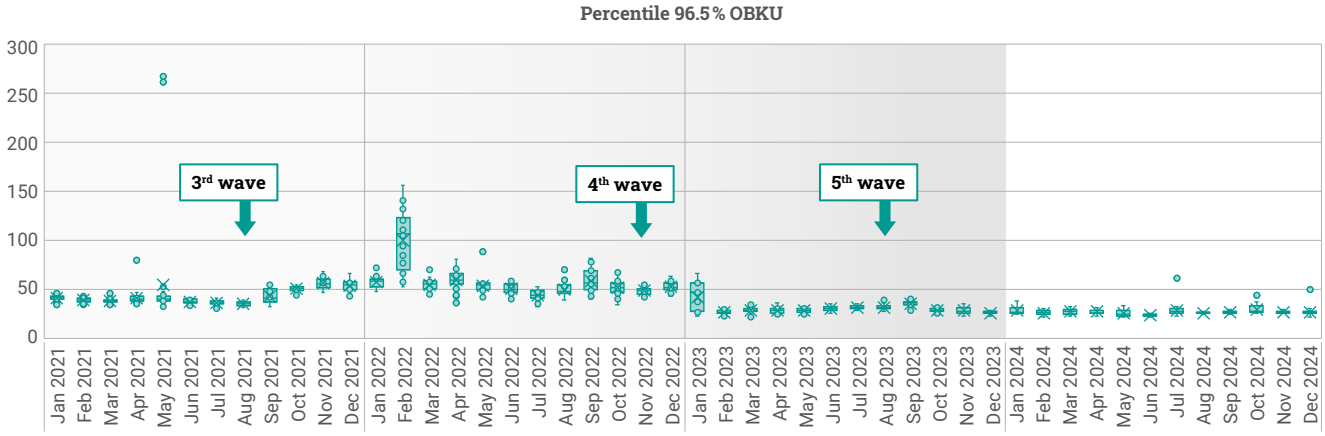


Figure 54

The times for processing an orderbook update are stable through 2024.

Rate of executed orders (number per day)[3]

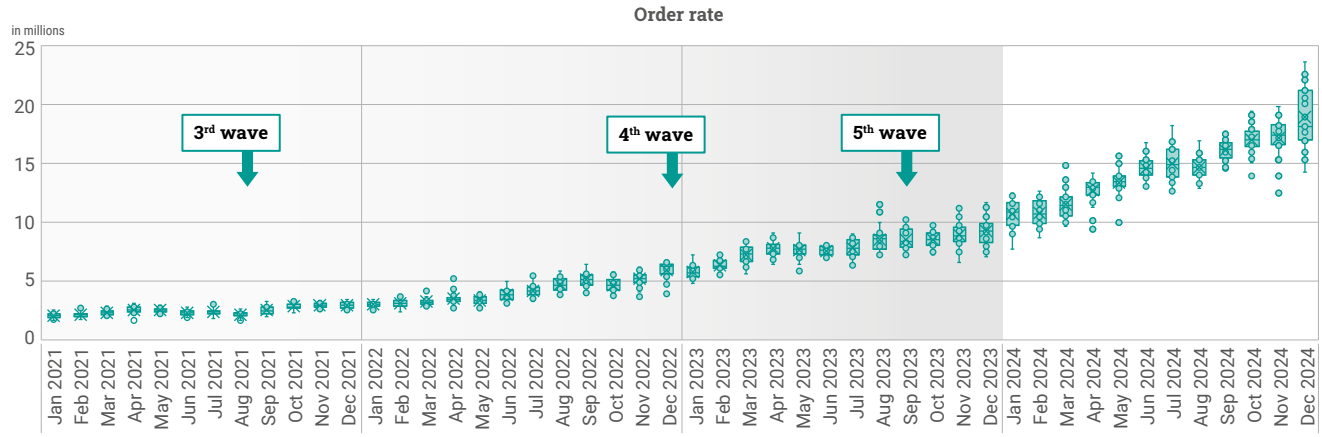


Figure 55

Steady increase in the number of executed orders and trades through 2024.

Rate of executed trades (number per day)[3]

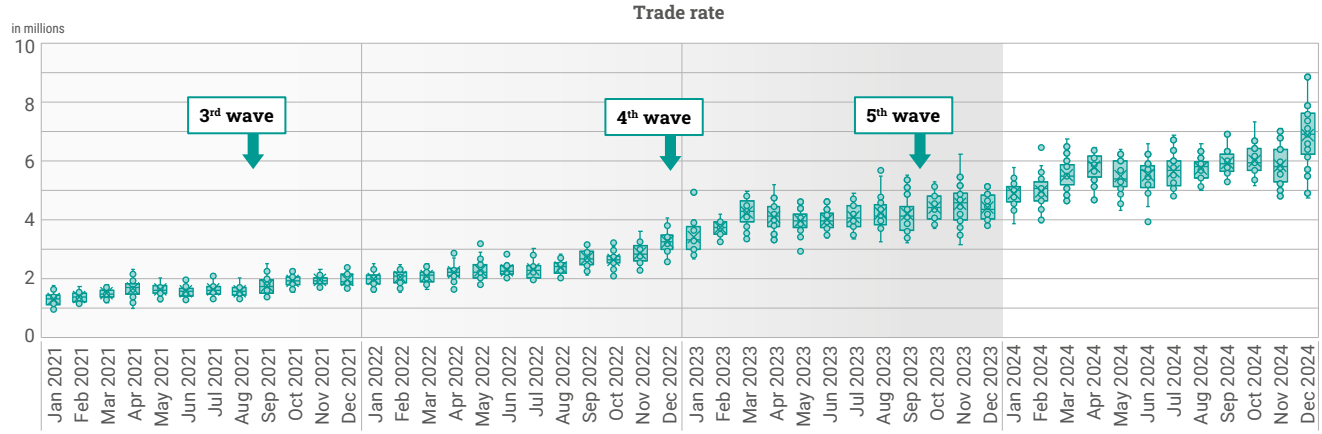


Figure 56

Time for generation of post coupling files (millisec)

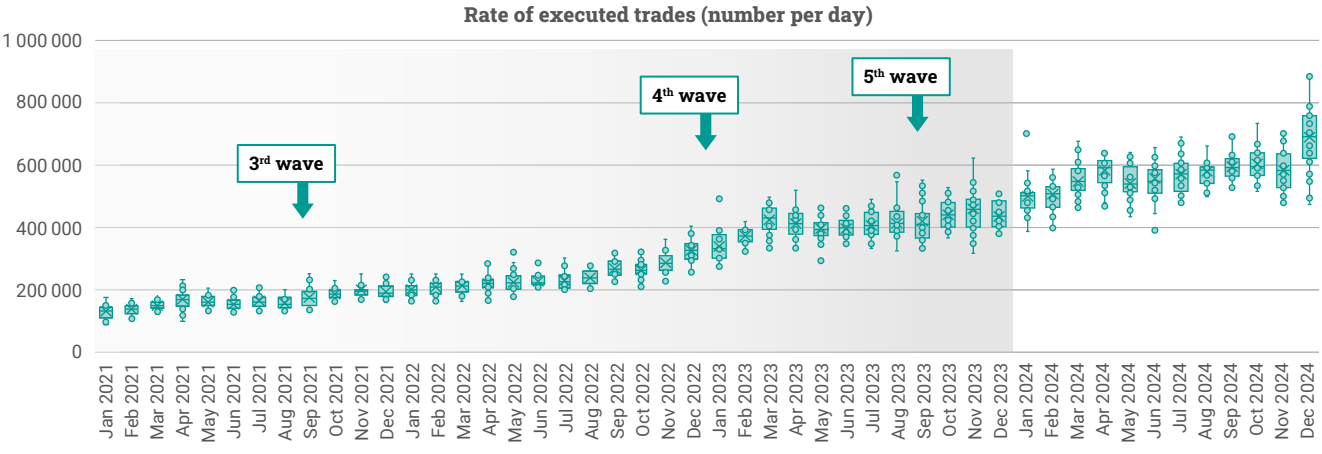


Figure 57

Time for generation of post coupling files is stable despite increase in number of orders and trades.

Output indicators

Table 20

Output			2021 Avg	2022 Avg	2023 Avg	2024 Avg	2024 Min	2024 Max
Indicators on the maximisation of economic surplus (Annex 4 of AM Article 11)								
Number of matched orders of each contract	Total matched volume (MWh) – daily value (MWh)*		256 134	302 681	456 028	566 901	379 030	974 901
	Total matched volumes – hours to delivery (MWh)		**See separate graph**					
	Total number of trades per contracts**		1 468	1 834	2 808	2 808	1	29 758
	Total number of trades per contract – hours to delivery***		1 952 423	3 640 941	6 173 413	6 173 413	2 561	79 751 844
Number of explicit capacity alloca-tion	Total number of daily explicit capacity allocations		5 335	6 762	6 145	7 108	5 410	8 934
Prices	Volume-Weighted Average Intraday Prices (€/MWh)	Hour	97.43	218.19	94.58	79.01	–851.86	1 352.16
		½-hour	109.06	274.24	96.69	69.95	–586.89	3 616.77
		¼-hour	107.47	253.77	102.16	91.03	–2 603.64	4 999.00
		Blocks	71.61	138.13	78.10	69.81	–555.00	1 000.00
	Volume-Weighted Average Intraday Prices – last trading hour (€/MWh)	Hour	97.27	213.70	94.08	80.82	–2 461.62	3 431.30
		½-hour	133.90	263.28	98.56	73.57	–503.12	6 192.29
		¼-hour	107.75	251.92	100.72	89.61	–7 567.13	5 702.68
		Blocks	72.54	141.36	71.19	91.47	–30.00	752.30
	Bid-Ask Spread (€/MWh)	Hour	80.63	124.16	49.18	30.77	0.01	10 012.08
		½-hour	115.85	174.58	65.71	90.86	0.62	3 082.97
		¼-hour	118.59	272.19	115.69	154.92	0.01	9 914.72
		Blocks	436.02	243.10	607.96	102.52	5.00	3 500.00

* Total matched volume is in the table shown as a daily value – average traded volume in MWh per day and the min and max volume in MWh traded in one day.
** Data available since 1 May 2021. Shows how many times each contract has been traded on average, min and max.
*** Data available since 1 May 2021. Shows total number of trades 0–33 hours before delivery. Avg is average number of contract traded per hour to delivery. Max is number of trades in the hour one hour before delivery. Min value in the hour 33 before delivery.

Total volume matched hours before delivery

Total matched volumes – hours to delivery – this indicator counts the traded volumes, grouped per contract with same "delivery time start-end", per combination of Bidding Zones and grouped according to the hours left to delivery and aggregated per month.

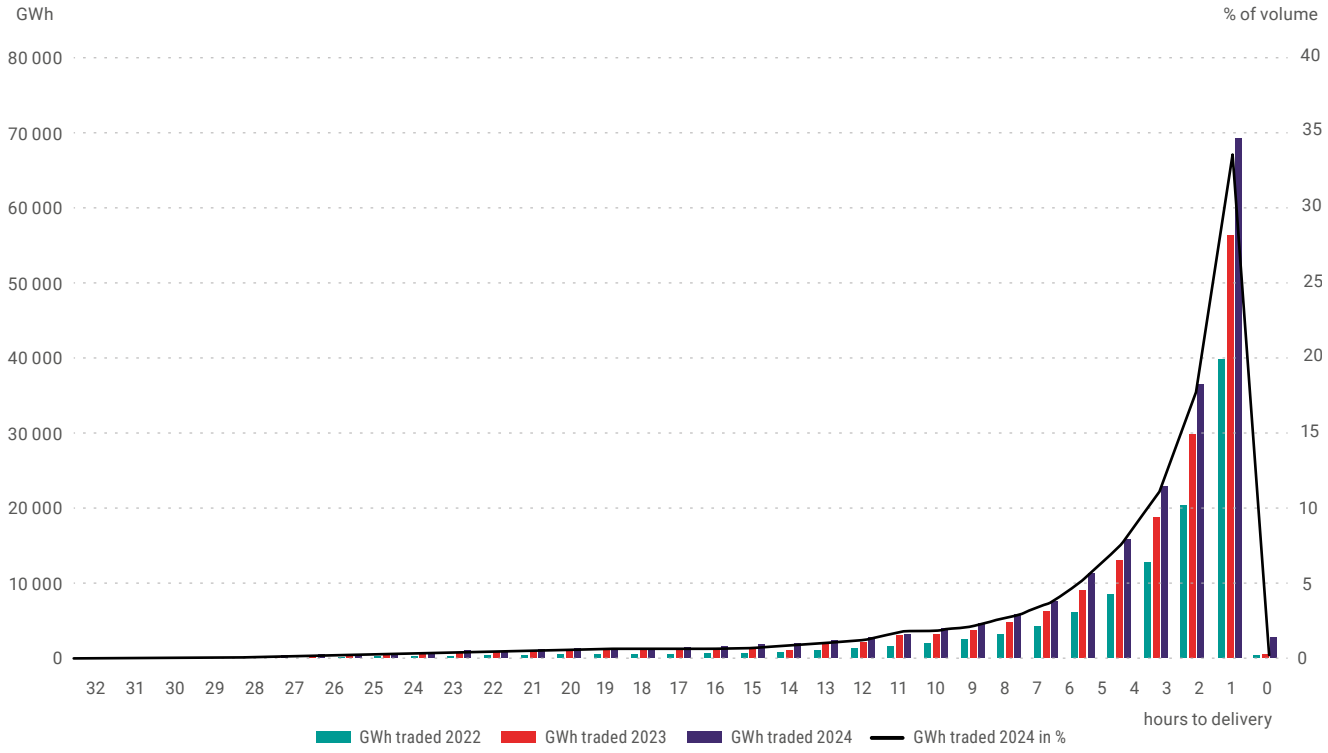


Figure 58

ATC utilisation rate per border – both directions

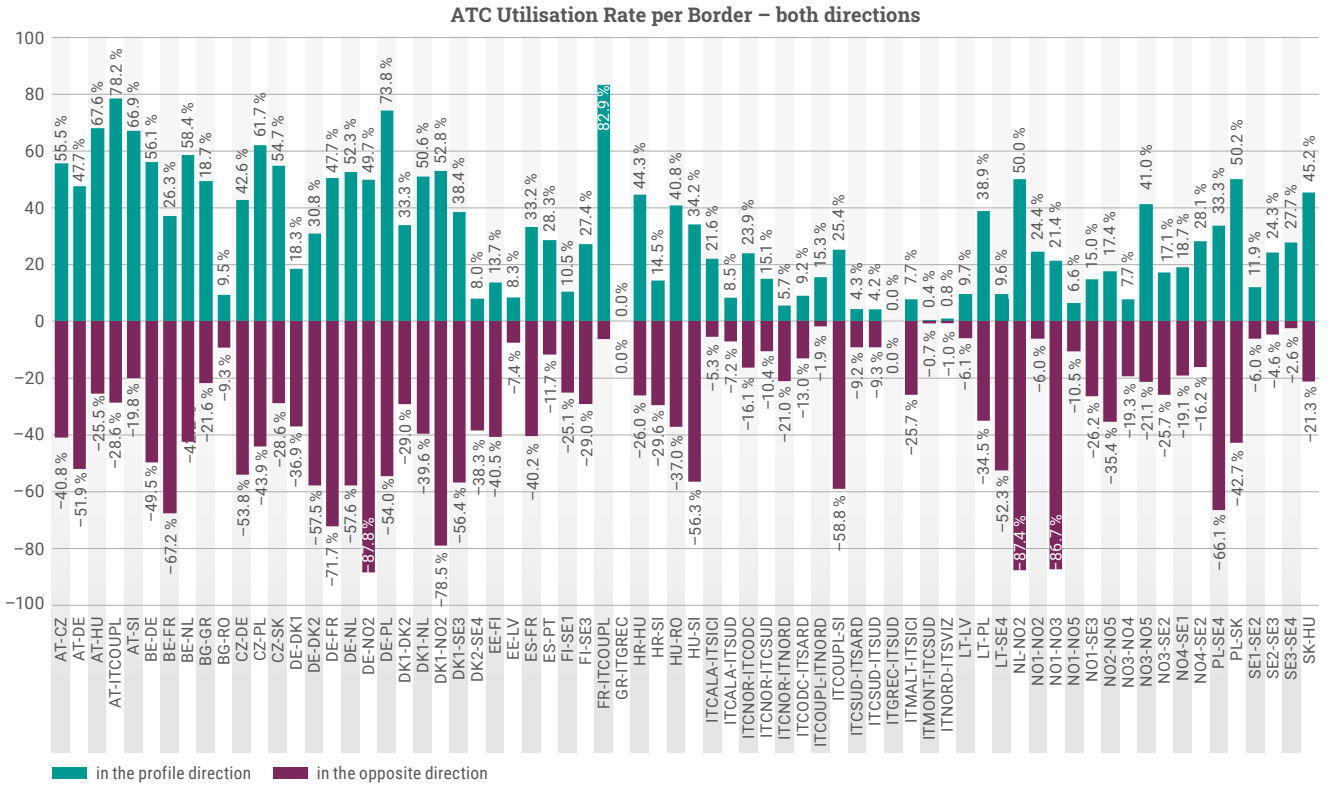


Figure 59

Net position in GWh per bidding zone

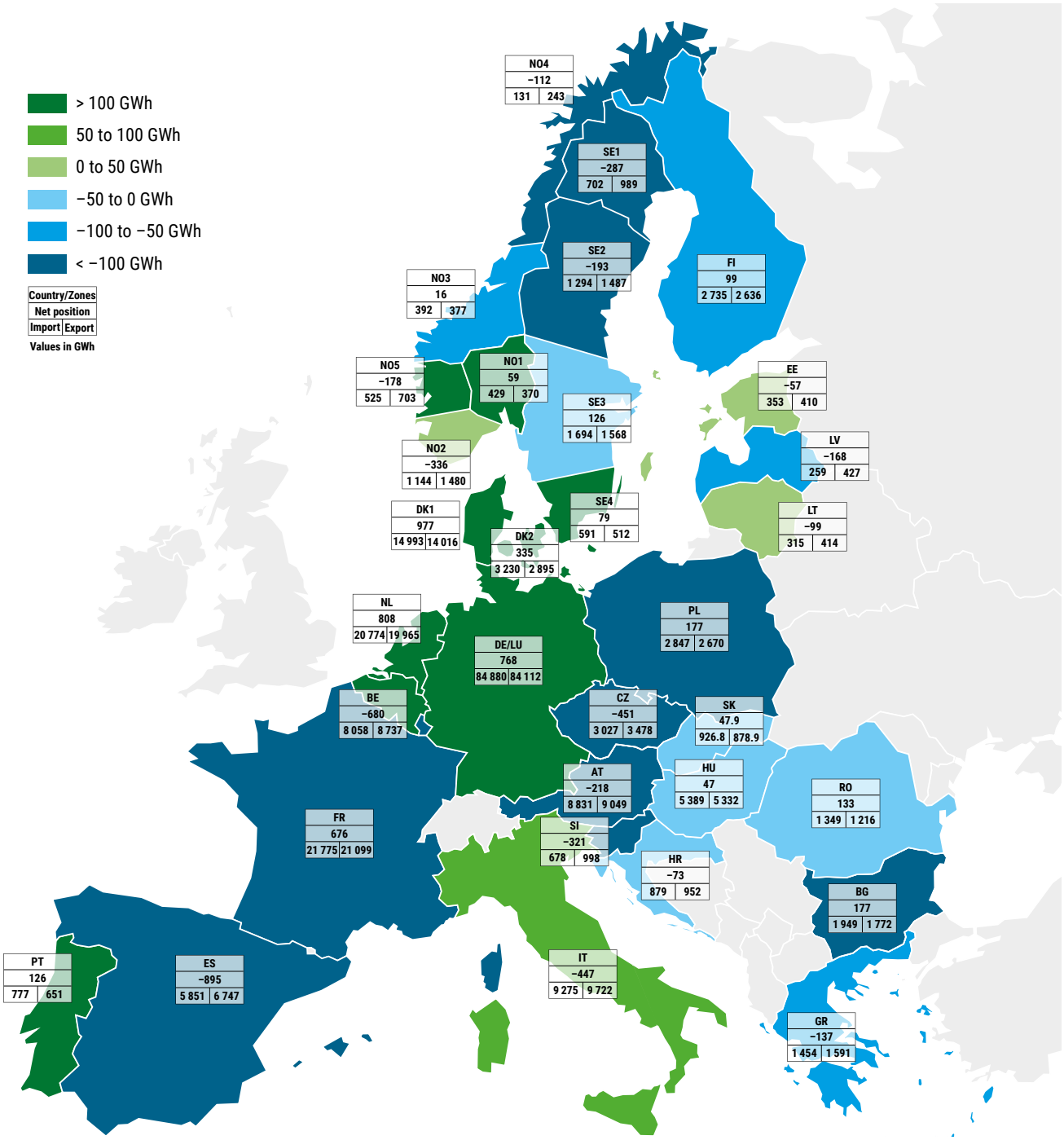


Figure 60

Performance monitoring report

Usage indicators[9]

Table 21

Usage indicators		YEAR 2024**		
1) Indicators to describe the Usage of SIDC IDAs		Avg	Min	Max
IDA 1	Total number of steps at bidding zone level*	142 876.0	105 966	178 544
	Total number of block orders	5 476.1	2 200	7 531
	Total number of block order exclusive groups	16	4	67
	Total number of linked families	0.4	0	5
	Total number of scalable complex orders	0	0	0
	Total number of demand merit orders	16 909.4	12 032	20 363
	Total number of supply merit orders	13 054.4	9 314	17 073
IDA 2	Total number of steps at bidding zone level*	69 894.4	54 586	114 205
	Total number of block orders	5 016.7	2 678	7 596
	Total number of block order exclusive groups	10.8	0	29
	Total number of linked families	0.1	0	4
	Total number of scalable complex orders	0	0	0
	Total number of demand merit orders	15 083.3	9 278	21 523
	Total number of supply merit orders	13 264.0	9 238	17 581
IDA 3	Total number of steps at bidding zone level*	27 853.2	21 434	48 962
	Total number of block orders	2 608.5	767	4 136
	Total number of block order exclusive groups	8.1	0	25
	Total number of linked families	0.2	0	5
	Total number of scalable complex orders	0	0	0
	Total number of demand merit orders	6 734.8	0	9 349
	Total number of supply merit orders	6 098.8	0	9 566

* 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.
** The reported values are calculated excluding the days of Decoupling and Auction Cancellation

Different order of magnitude between the orders submitted in the first two IDAs and in the third one. Constant usage of the product during the six months is observed.

IDA 1 Total number of steps at bidding zone level

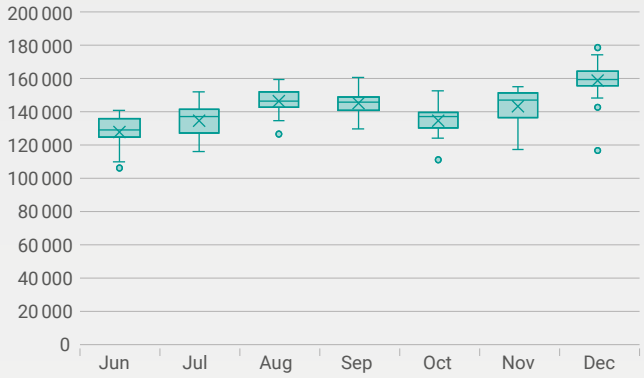


Figure 61

IDA 2 Total number of steps at bidding zone level

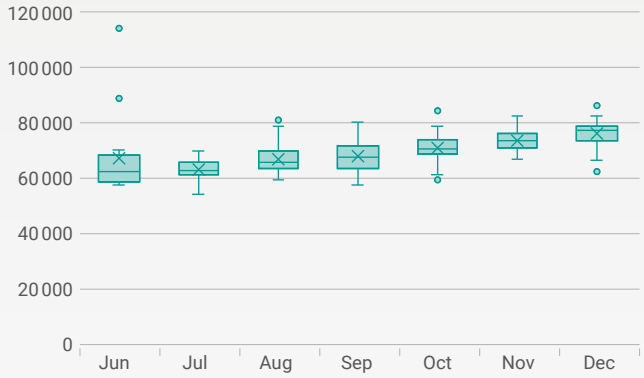


Figure 62

IDA 3 Total number of steps at bidding zone level

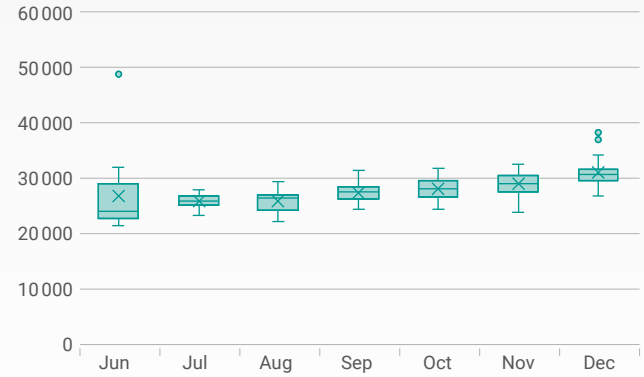


Figure 63

Different order of magnitude between the orders submitted in the first two IDAs and in the third one. Increase in the usage of the product during the six months is observed.

IDA 1 Total number of block orders

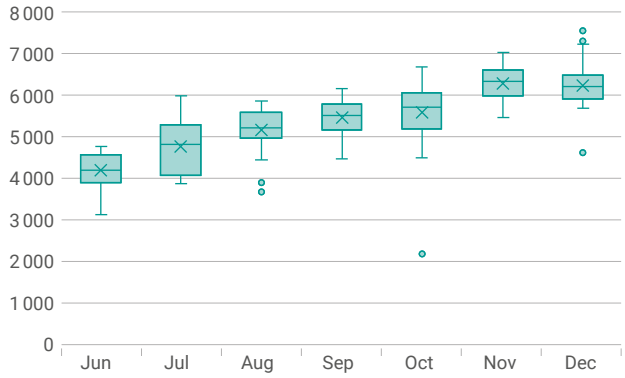


Figure 64

IDA 2 Total number of block orders

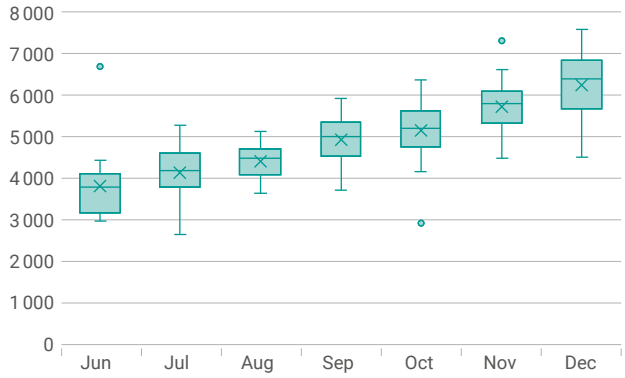


Figure 65

IDA 3 Total number of block orders

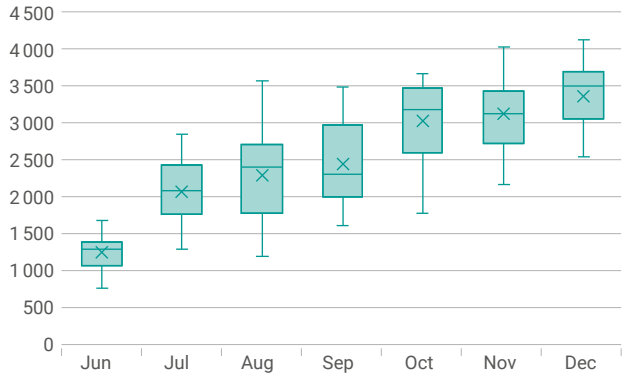


Figure 66

Different order of magnitude between the orders submitted in the first two IDAs and in the third one. Constant usage of the product during the six months is observed.

IDA 1 Total number of block order exclusive groups

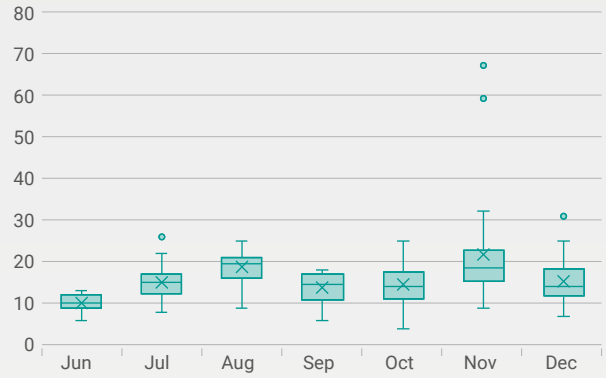


Figure 67

IDA 2 Total number of block order exclusive groups

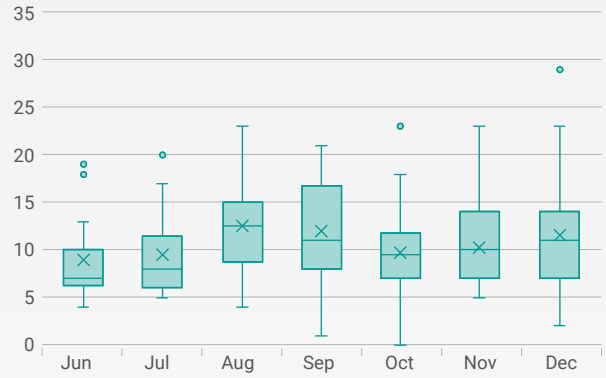


Figure 68

IDA 3 Total number of block order exclusive groups

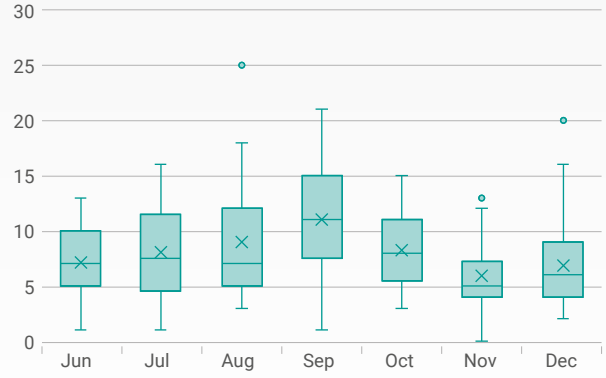


Figure 69

Usage of Linked Families for the IDAs is considerably low, in most cases the values are 0, for this rate reason the boxes in the boxplot are displayed as a horizontal line instead as a rectangle.

IDA 1 Total number of linked families

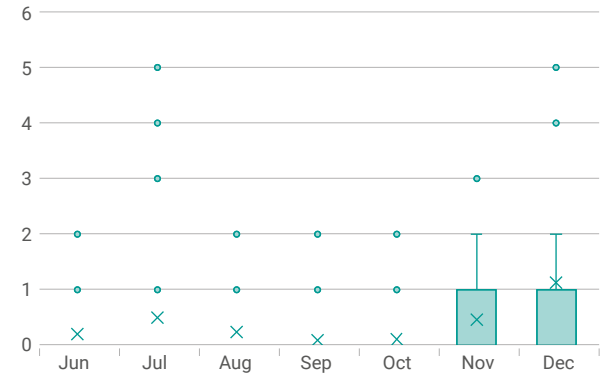


Figure 70

IDA 2 Total number of linked families

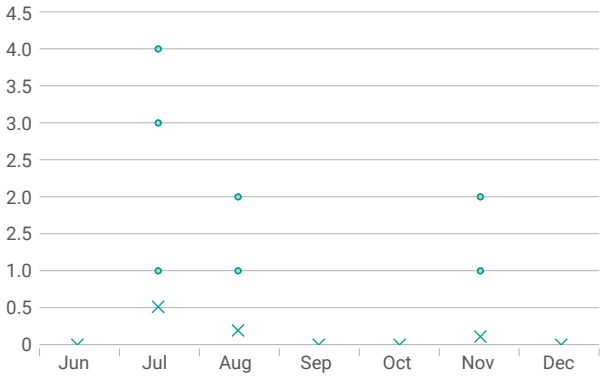


Figure 71

IDA 3 Total number of linked families

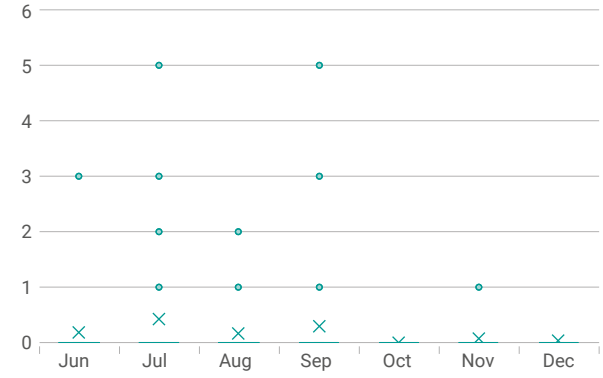


Figure 72

Different order of magnitude between the orders submitted in the first two IDAs and in the third one. Constant usage of the product during the six months is observed.

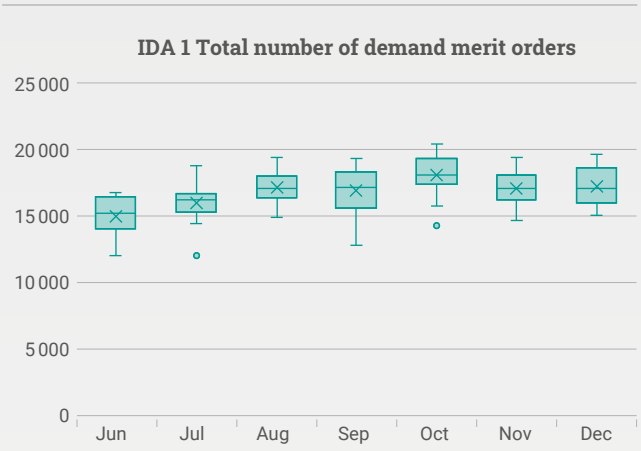


Figure 73

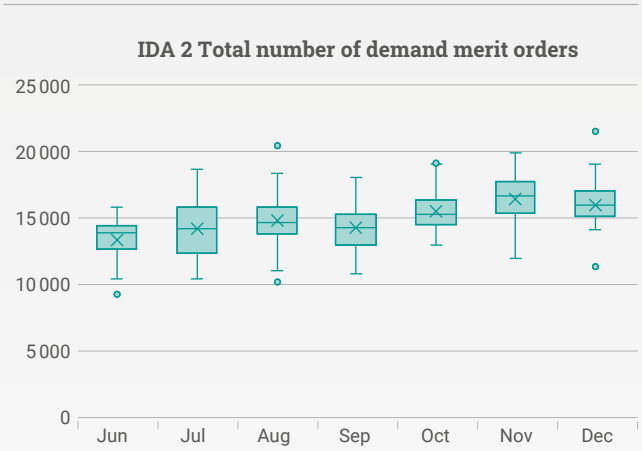


Figure 74

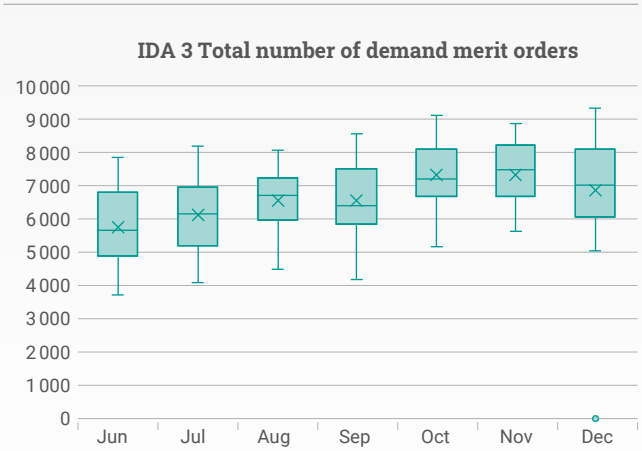


Figure 75

Different order of magnitude between the orders submitted in the first two IDAs and in the third one. Constant usage of the product during the six months is observed.

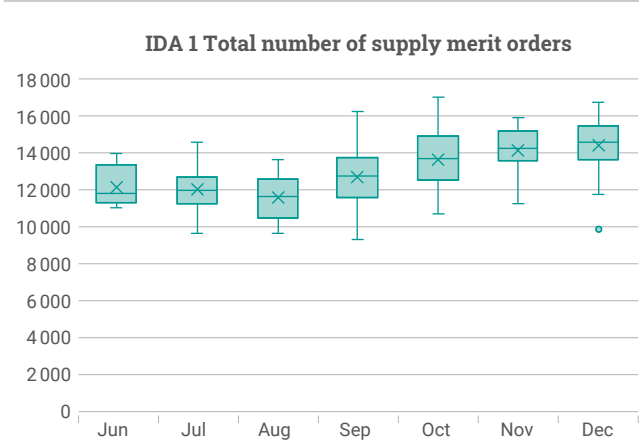


Figure 76

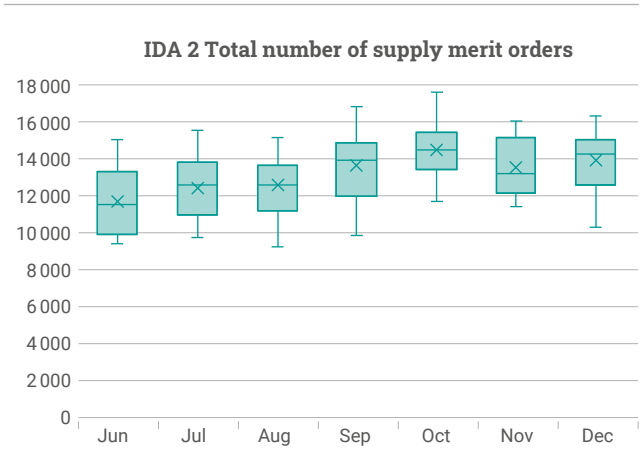


Figure 77

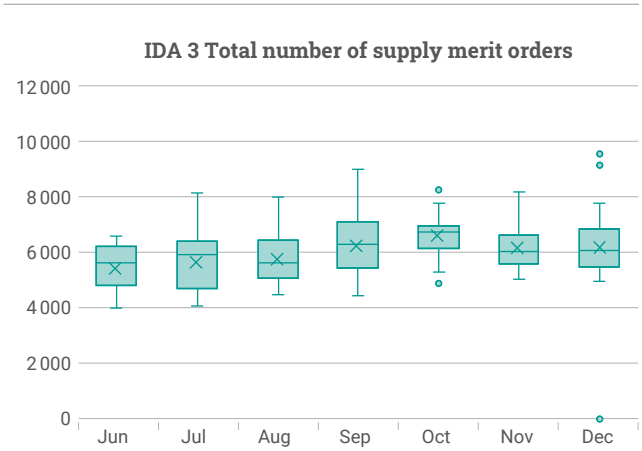


Figure 78

Table 22

Usage indicators	2024* SIDC/IDAs Avg	Min	Max
1) Indicators to describe the geographical extension (Annex 3 of AM Article 11)[10]			
Number of bidding zones	50.7	50	51
Total number of flow-based bidding zones	0	0	0
Number of scheduling areas	53.7	53	54
Number of NEMO Trading Hubs	78.4	77	79
2) Indicators to describe Network constraints (Annex 3 of AM Article 12)			
Total number of bidding zone lines	74.7	74	75
Total number of flow-based PTDF constraints	0	0	0
Total number of scheduling area lines	80.7	80	1
Total number of NEMO Trading Hub lines	156	154	157

* The reported values are calculated excluding the days of Decoupling.

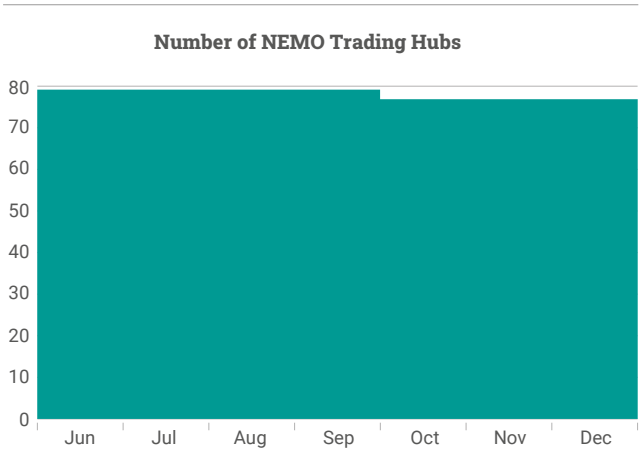


Figure 79

Table 23

Performance			YEAR 2024** SIDC/IDAs		
			Avg	Min	Max
IDA 1	1) Ability to maximise economic surplus (Annex 3 of AM Art. 7)	(a) Increment of economic surplus with respect to the first OK solution (%)	0.000282 %	0 %	0.00505 %
		Final gap (€)	4 750.7	7.3	223 600.0
		Final gap expressed as percentage of the value of the economic surplus of the final solution (%)	0.002768 %	0.000005 %	0.116046 %
	3) Algorithm scalability (Annex 3 of AM Art. 9) TTFS (min)		0.91	0.61	1.31
IDA 2	1) Ability to maximise economic surplus (Annex 3 of AM Art. 7)	(a) Increment of economic surplus with respect to the first OK solution (%)	0.049767 %	0	7.453848 %
		Final gap (€)	4 323.5	0	40 226.8
		Final gap expressed as percentage of the value of the economic surplus of the final solution (%)	0.033228 %	0 %	0.245367 %
	3) Algorithm scalability (Annex 3 of AM Art. 9) TTFS (min)		0.77	0.53	1.21
IDA 3	1) Ability to maximise economic surplus (Annex 3 of AM Art. 7)	(a) Increment of economic surplus with respect to the first OK solution (%)	0.016823 %	0 %	0.645705 %
		Final gap (€)	1 970.5	–0.1	16 711.3
		Final gap expressed as percentage of the value of the economic surplus of the final solution (%)	0.038737 %	–0.000002 %	0.234615%
	3) Algorithm scalability (Annex 3 of AM Art. 9) TTFS (min)		0.43	0.28	0.76

* 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.
** The reported values are calculated excluding the days of Decoupling and Auction Cancellation

Ability to maximise the economic surplus

Increment of economic surplus with respect to the first OK solution: maximum increase around 1.2 M€ in IDA 2, note also that the outlier values are impacting significatively the average values.

Negative axis is not shown due to the absence of negative values.

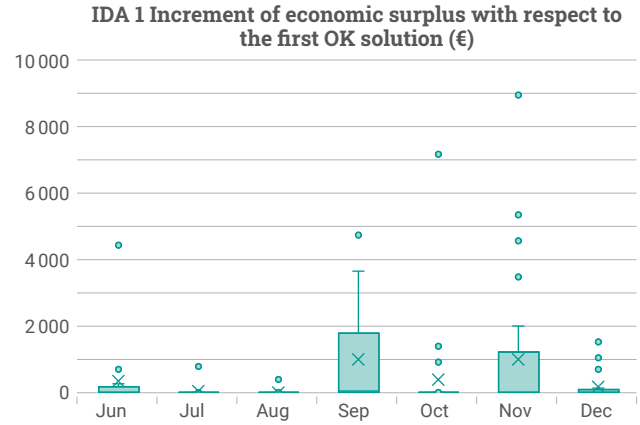


Figure 80

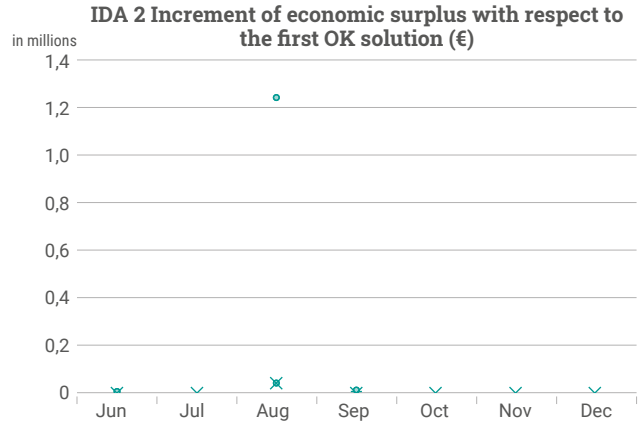


Figure 81

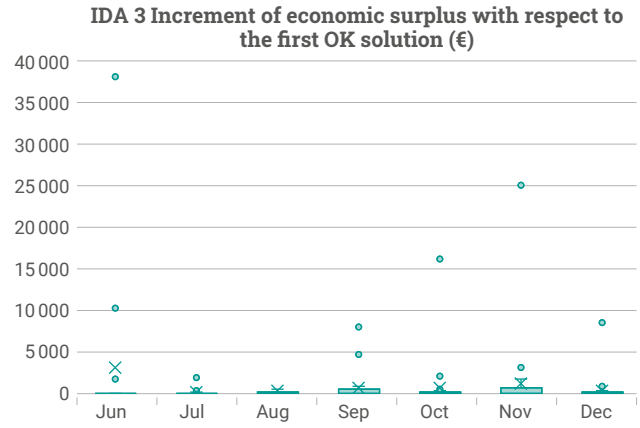


Figure 82

Duration curve shows the Increment of economic surplus with respect to the first OK ordered in descending order of magnitude, rather than chronologically.

Note that most of the values have a value of 0 or very close to 0.

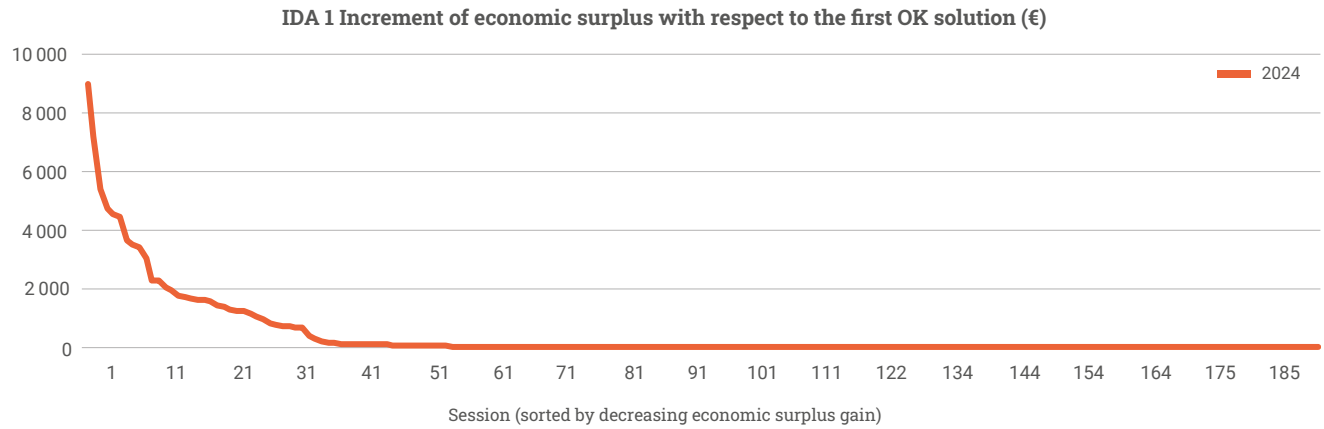


Figure 83

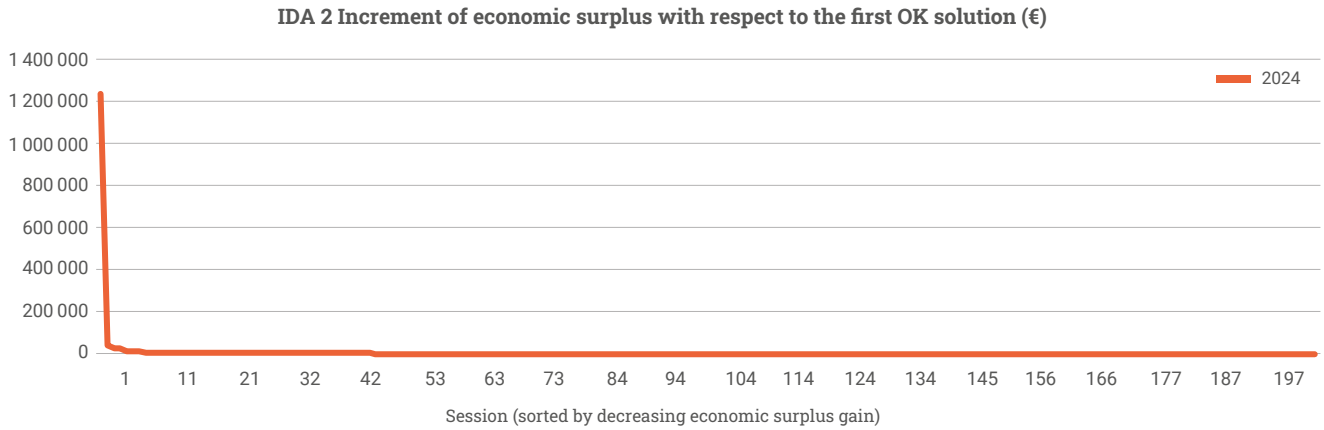


Figure 84

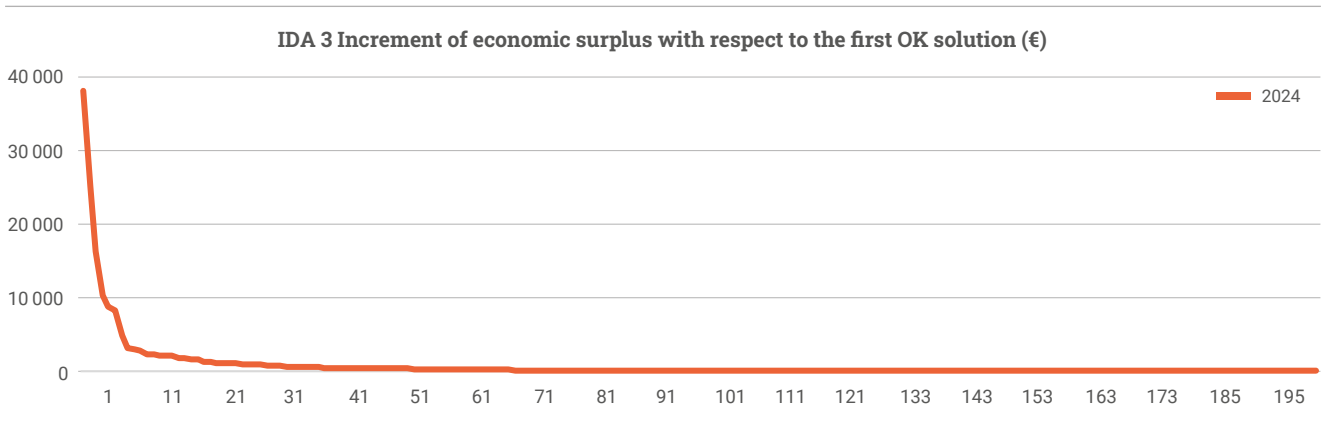


Figure 85

Increment of economic surplus with respect to the first OK solution: maximum final gap value around 0.2 M€ in IDA 1.

Negative axis is not shown due to the absence of negative values.

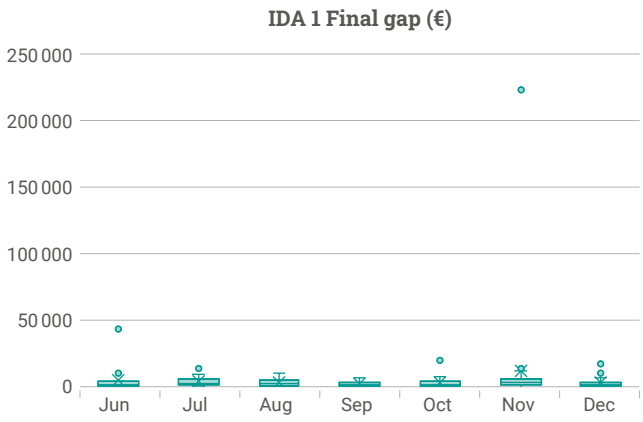


Figure 86

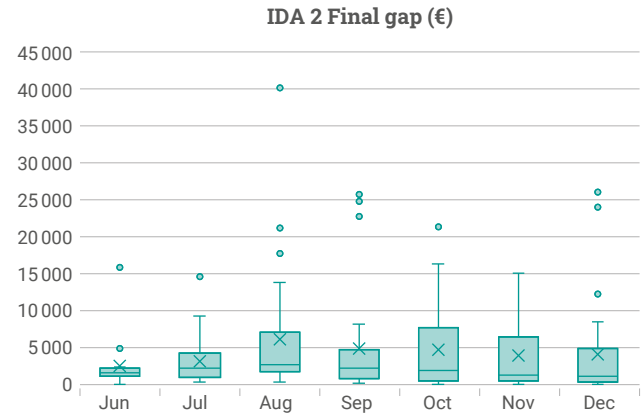


Figure 87

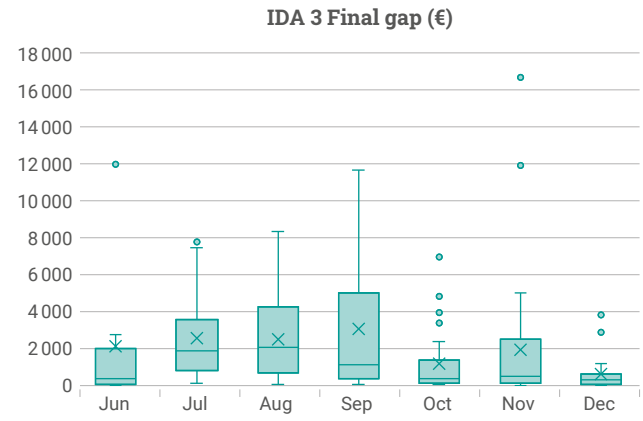


Figure 88

Duration curve shows the final gap in descending order of magnitude, rather than chronologically.

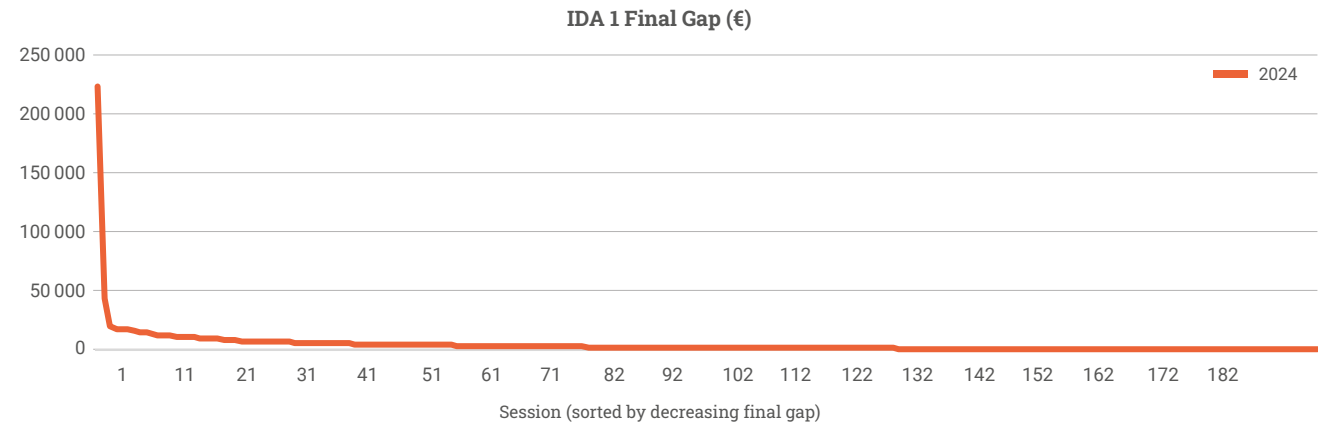


Figure 89

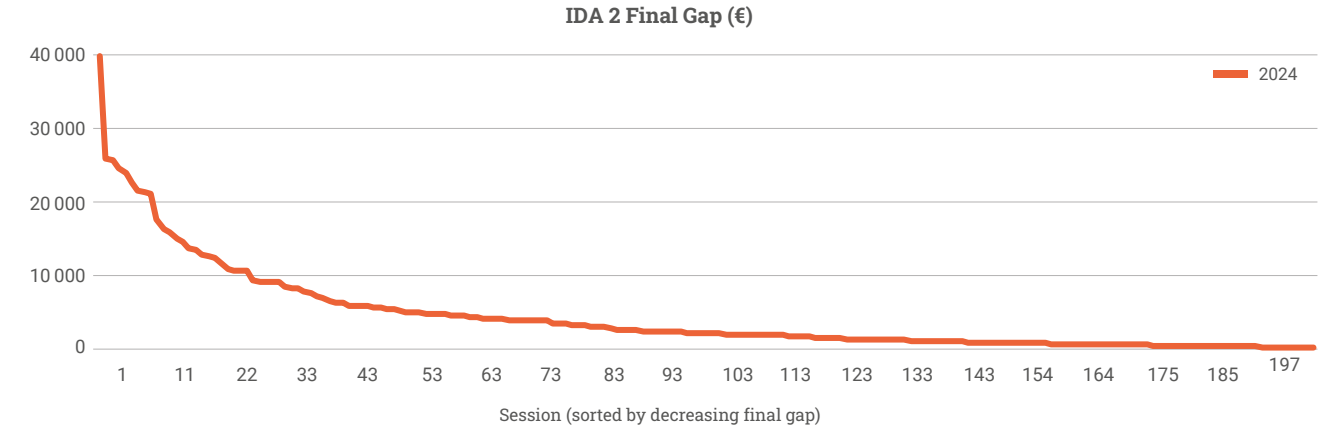


Figure 90

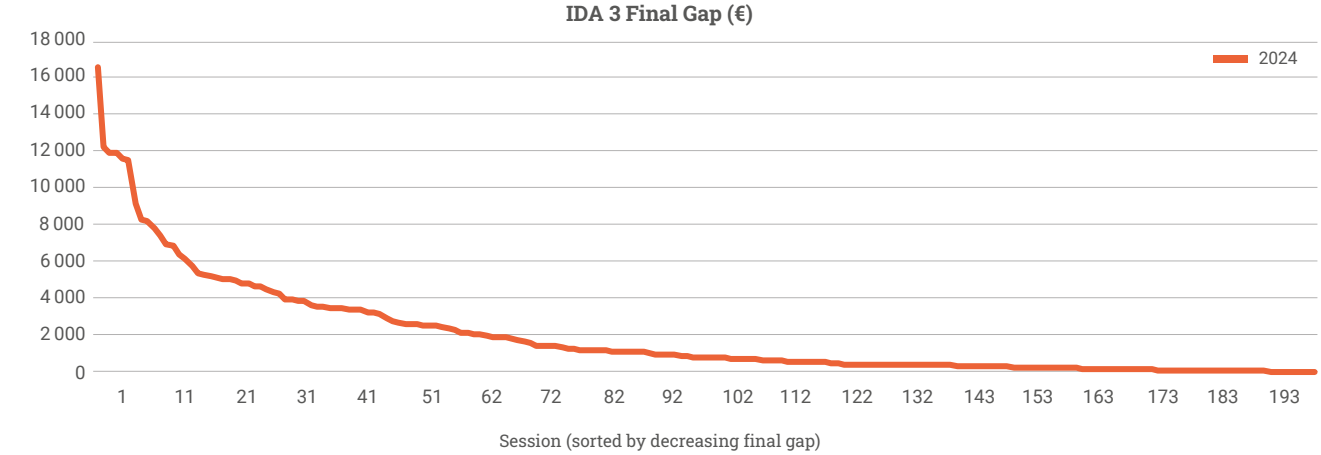


Figure 91

Algorithm scalability (min)

TTFs in most cases is below 1 min.

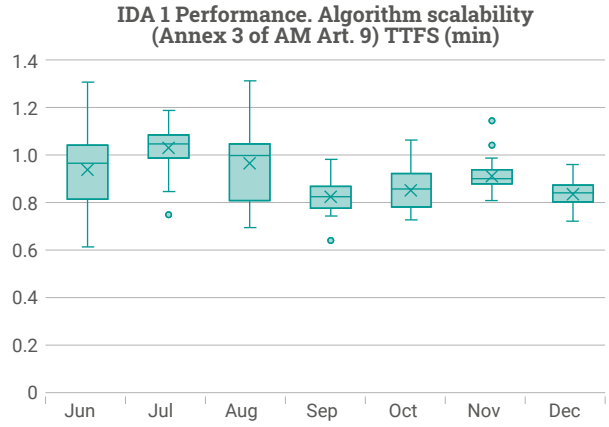


Figure 92

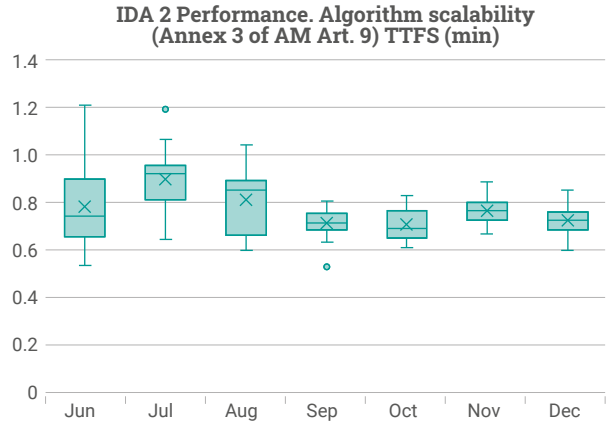


Figure 93

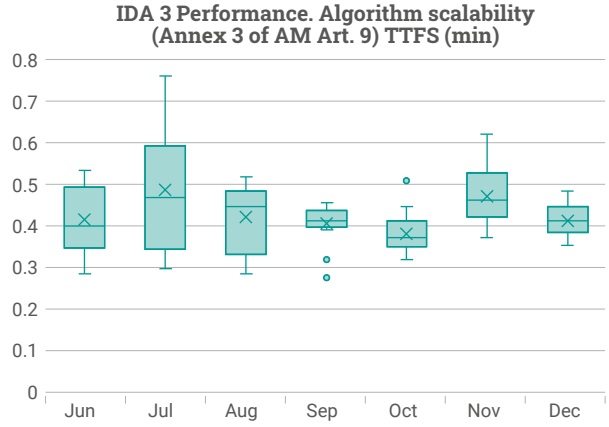


Figure 94

Duration curve shows the TTFS in descending order of magnitude, rather than chronologically.

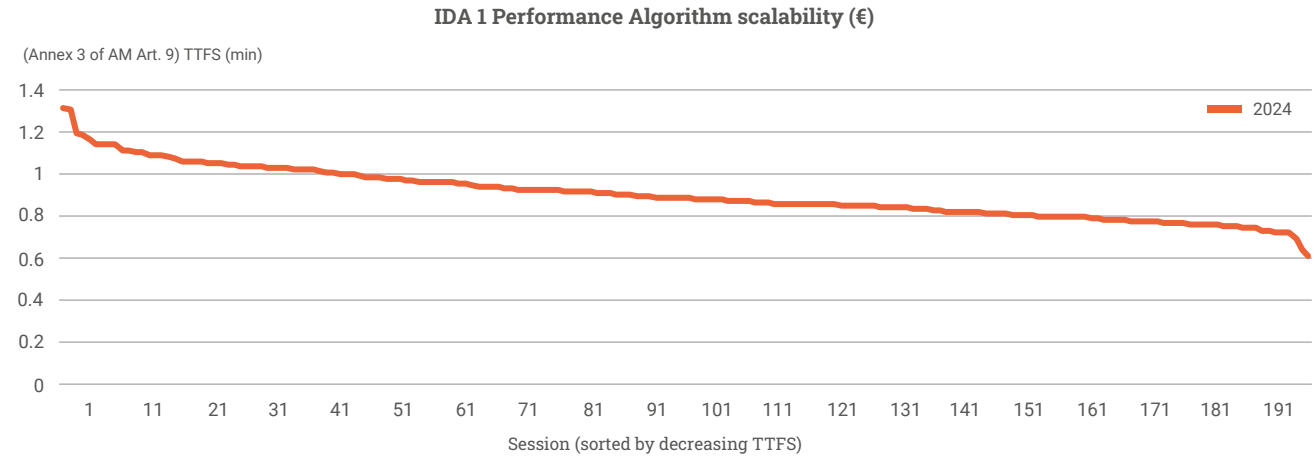


Figure 95

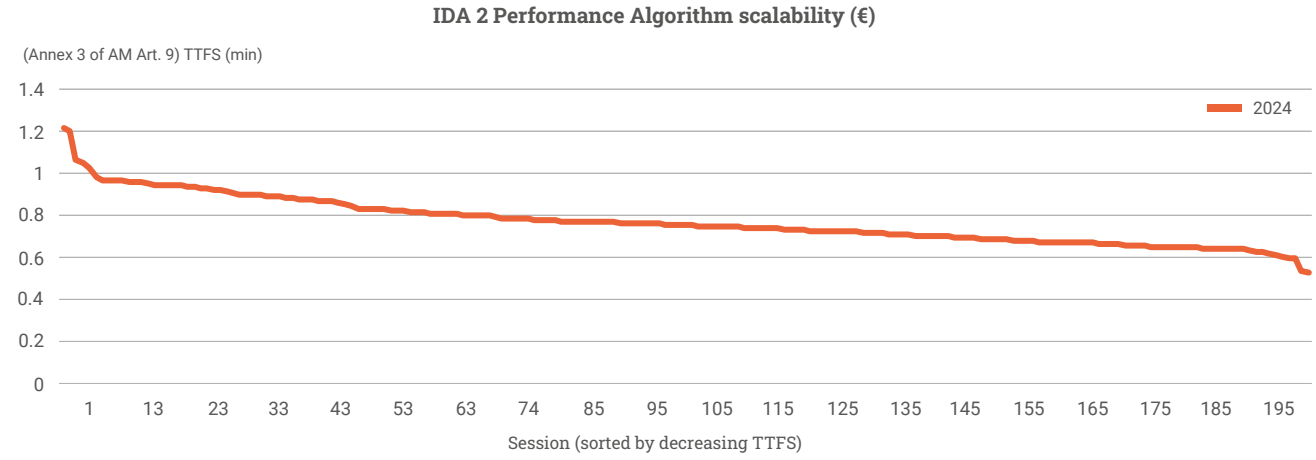


Figure 96

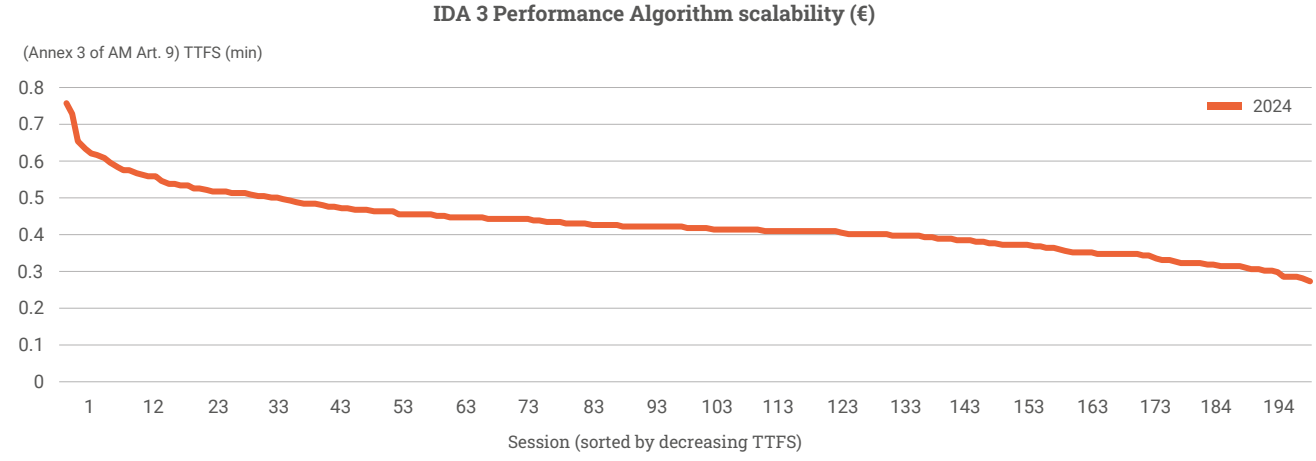


Figure 97

Table 24

Output Indicators		YEAR 2024** SIDC/IDAs		
IDA 1		**Avg**	**Min**	**Max**
1) Indicators on the maximisation of economic surplus (Annex 3 of AM art. 13)				
Maximisation of the first economic surplus	Economic surplus of first OK solution (M€)	167.469	111.497	254.569
	Economic surplus of the final solution (M€)	167.469	111.498	254.569
2) Indicators to describe the status of orders (Annex 3 of AM art. 14)				
Evolution of number of matched orders	Total number of matched blocks	479	208	832
	Total number of matched complex orders	0	0	0
	Total number of matched scalable complex orders	0	0	0
	Total number of matched non-PUN merit orders	16 078	12 858	18 772
	Total number of matched PUN orders	0	0	0
	Total matched volume from curves (MWh)	120 785	98 282	206 811
	Total matched volume from blocks (MWh)	18 733	6 981	61 745
	Total matched volume from scalable complex orders (MWh)	0	0	0
	Total matched volume from (non-PUN) merit orders (MWh)	71 749	43 777	102 025
Paradoxically rejected orders	Number of PRBs in the final solution	77.8	11	250
	Number of PRMICs in the final solution	0	0	0
	Maximum Delta P in the final solution	147.8	0.7	4 990.0
	Maximum Delta MIC in the final solution	0	0	0
	PRB utility loss in the final solution (k€)	70.057	0.331	1 904.208
	PRMIC utility loss in the final solution (k€)	0	0	0
	Volume of PRBs in the final solution (MWh)	5 872	290	28 088
	Volume of PRMICs in the final solution (MWh)	0	0	0
Indicators on the evolution of the use of network constraints along the time	Number of periods for ATC/DC lines with flows at full capacity	1 448.5	785	1 840
3) IT calculation process (Annex 3 of AM Article 15)				
Time spent in every phase of the algorithm calculation process	TTFS (s)	54.5	36.8	78.9
	Input data reading time (s)*	11.1	2.0	35.6
	Input data delivery day creation (s)*	10.3	6.6	18
	Time to solve the root node for the master computer (s)*	2.0	1.2	4.5
	Time to solve the root node for the job that found first solution (s)*	2.1	1.4	3.5
	Number of successive improvements of the solution in the given timeframeThis 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 ***	1.7	1	4
	Total number of nodes in the master branch and bound tree**	145.3	42	331

Table 24

Output Indicators		YEAR 2024** SIDC/IDAs		
IDA 2		**Avg**	**Min**	**Max**
1) Indicators on the maximisation of economic surplus (Annex 3 of AM art. 13)				
Maximisation of the first economic surplus	Economic surplus of first OK solution (M€)	18.67	6.491	142.623
	Economic surplus of the final solution (M€)	18.678	6.492	142.623
2) Indicators to describe the status of orders (Annex 3 of AM art. 14)				
Evolution of number of matched orders	Total number of matched blocks	417	115	1 031
	Total number of matched complex orders	0	0	0
	Total number of matched scalable complex orders	0	0	0
	Total number of matched non-PUN merit orders	15 443	11 893	20 162
	Total number of matched PUN orders	0	0	0
	Total matched volume from curves (MWh)	95 150	65 289	171 787
	Total matched volume from blocks (MWh)	13 617	3 357	69 360
	Total matched volume from scalable complex orders (MWh)	0	0	0
	Total matched volume from (non-PUN) merit orders (MWh)	31 462	18 318	73 536
Paradoxically rejected orders	Number of PRBs in the final solution	42.4	3	211
	Number of PRMICs in the final solution	0	0	0
	Maximum Delta P in the final solution	202.1	2.2	4 954.6
	Maximum Delta MIC in the final solution	0	0	0
	PRB utility loss in the final solution (k€)	65.034	0.133	806.228
	PRMIC utility loss in the final solution (k€)	0	0	0
	Volume of PRBs in the final solution (MWh)	6 096	195	60 930
	Volume of PRMICs in the final solution (MWh)	0	0	0
Indicators on the evolution of the use of network constraints along the time	Number of periods for ATC/DC lines with flows at full capacity	1 204.5	669	1 810
3) IT calculation process (Annex 3 of AM Article 15)				
Time spent in every phase of the algorithm calculation process	TTFS (s)	46.3	31.8	72.7
	Input data reading time (s)*	9.6	2.5	33.6
	Input data delivery day creation (s)*	7.7	5.1	18.9
	Time to solve the root node for the master computer (s)*	1.2	0.7	2.0
	Time to solve the root node for the job that found first solution (s)*	1.5	1	2.4
	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 ***	2.3	1	10
	Total number of nodes in the master branch and bound tree**	231	28	1 819

Table 24

Output Indicators		YEAR 2024** SIDC/IDAs		
IDA 3		**Avg**	**Min**	**Max**
1) Indicators on the maximisation of economic surplus (Annex 3 of AM Article 13)				
Maximisation of the first economic surplus	Economic surplus of first OK solution (M€)	5.157	1.776	20.852
	Economic surplus of the final solution (M€)	5.158	1.776	20.852
2) Indicators to describe the status of orders (Annex 3 of AM Article 14)				
Evolution of number of matched orders	Total number of matched blocks	115	20	324
	Total number of matched complex orders	0	0	0
	Total number of matched scalable complex orders	0	0	0
	Total number of matched non-PUN merit orders	6 635	0	8 663
	Total number of matched PUN orders	0	0	0
	Total matched volume from curves (MWh)	28 252	17 492	53 577
	Total matched volume from blocks (MWh)	3 149	407	10 647
	Total matched volume from scalable complex orders (MWh)	0	0	0
	Total matched volume from (non-PUN) merit orders (MWh)	15 802	0	36 534
Paradoxically rejected orders	Number of PRBs in the final solution	42.2	3	190
	Number of PRMICs in the final solution	0	0	0
	Maximum Delta P in the final solution	186.1	1	5 099.6
	Maximum Delta MIC in the final solution	0	0	0
	PRB utility loss in the final solution (k€)	41.774	0.157	856.398
	PRMIC utility loss in the final solution (k€)	0	0	0
	Volume of PRBs in the final solution (MWh)	2 949	90	11 273
	Volume of PRMICs in the final solution (MWh)	0	0	0
Indicators on the evolution of the use of network constraints along the time	Number of periods for ATC/DC lines with flows at full capacity	674.4	320	1 112
3) IT calculation process (Annex 3 of AM Article 15)				
Time spent in every phase of the algorithm calculation process	TTFS (s)	25.8	16.5	45.6
	Input data reading time (s)*	4.8	1.3	10.5
	Input data delivery day creation (s)*	4.6	3	11.7
	Time to solve the root node for the master computer (s)*	0.5	0.3	0.8
	Time to solve the root node for the job that found first solution (s)*	0.7	0.4	1.7
	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 ***	1.9	1	11
	Total number of nodes in the master branch and bound tree**	318.5	13	7 328

R&D report

2024 Outcomes

The R&D focus in 2024 was mainly on the principal extension of the SIDC functionalities, namely finalisation of Intraday Auctions, further analysis of Flow-Based Allocation as well as on improvement of performance to level up with the higher utilisation of the trading platform.

Intraday Auctions (IDAs)

Completion of the IDAs initial solution, including improvements related to the stability, robustness, technology and operational use as consequence of thorough testing, were the main aspects of IDAs development in 2024. There was also an initial development of the IDAs extension to allow smoother process for situations in which partial IDA decoupling is triggered. An immense testing campaign with key testing stages in the first half of 2024 is also considered as an inseparable part of the IDAs initial development.

Performance improvements

R&D in 2024 was also focused on investigating the technical limits of the Continuous Trading (CT) and defining the set of technical improvement measures to allow further growth in CT utilisation (moving from the Realistic Test Scenarios which simulated limited production behavior to more focused stress tests of the overall technical landscape). This allowed the development of strategies focused on the specific points of performance concerns and resulted in scoping several performance releases, to operational needs on the one side and complexity and time to deliver on the other side (some performance improvements impact only one part of the technical landscape and can be delivered with a limited time while other improvements impact all elements of the technical landscape).

These performance improvements are subject to discussion for the increase of the contractually agreed system boundaries.

Flow-Based Allocation (FB)

There were two tracks of R&D in 2024. The 1st track focused on the so-called interim solution, implementation of FB for IDAs, where the performance impact is not posing a principal issue. For FB in IDAs the technical specification was developed to allow a technical discussion with the service provider. The 2nd track focused on the final solution which is intended to cover also Continuous Trading. In this respect preparations for further analysis were executed.

REMIT reporting

In 2024 optimisation and improvements in the central functionalities of REMIT reporting for continuous market were implemented, e.g. related to mini auctions or handling of orders.

Major items in SIDC R&D programme

Budget/cost share per topic

The biggest investment of R&D is in IDAs and execution of the Performance Improvements. The investment in Flow-Based allocation in 2024 was limited as the activities were mainly focused on the analysis and description of the requested functionalities, in comparison to 2023 when the so called Minimum Viable Product was developed.

The R&D costs mainly consist of 3 elements:

- Central cost of chairs and team leaders.
- Cost for drafting and testing activities – this is usually done evenly by the team members and therefore it is not reflected as a central cost.
- Cost provided by 3rd parties (usually solution providers). This may cover implementation cost for final deliverables, analyses and cost for the prototypes usually focused on the limited functionalities with high impact on the performance.

Major items in SIDC R&D programme: budget/cost share per topic

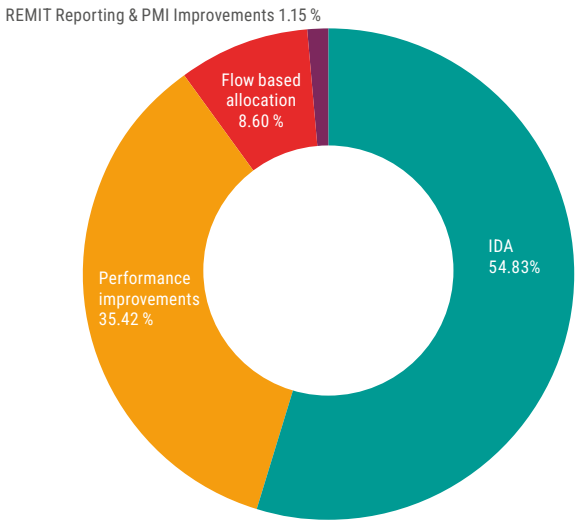


Figure 98

Table 25

Description	Share of Cost	CACM compliance	Outcome and impact on CACM compliance	Future steps/Implementation in production (forecast)
IDA				
Intraday Auctions – based on Commission regulation 2015/1222 of 24 July 2015 – Capacity allocation and congestion management – implementation of a methodology to price cross-zonal intraday capacity (Article 55)	54.83 %	Regulatory requirements implementation	Finalisation of development and testing activities executed in 2024 for all IDA assets used (XBID, CIP, Euphemia, PMB).	Foreseen steps: • Improvements of Partial decoupling
Losses				
Losses In line with Algorithm Methodology requirements the continuous trading matching algorithm shall allow to incorporate losses on interconnector(s) between bidding zones during capacity allocation, if requested by the owner(s) of the relevant interconnector after approval by the relevant NRAs.	0.00 % (covered in IDA's share of the cost)	Regulatory requirements implementation	High Level design adjustment proposed clarified (balancing account introduction)	Foreseen steps: • Considering performance impact of losses and SIDC priorities the losses in continuous allocation were put on hold • Losses consideration under IDAs was part of IDAs development but further enhancements were required to allow functionality use. These enhancements are described and their analysis with DBAG and inclusion in development shall be planned.
Performance improvements				
The development of the market, geographical extensions and implementation of new functionalities contribute to the growth of the system performance needs. The performance is constantly monitored and improved if needed.	35.42 %	Increase performance	Implementation of the agreed performance improvement measures, execution of the tests in order to establish the technical XBID limits, specification of the performance improvements having a direct impact on LTS API.	Foreseen steps: • Development and testing of the quick performance optimisation measures (R4.1.50) • Finalisation of development and testing of the performance optimisation measures which do not have impact on LTSs (R5.0)- Start of development of the performance optimisation measures having an impact on LTSs (R5.1)
Flow-Based allocation (FB)				
In line with Algorithm Methodology requirements the continuous trading matching algorithm shall allow for Flow-Based allocation in order to introduce a method in which energy exchanges between bidding zones are limited by power transfer distribution factors and available margins on critical network elements.	8.60 %	Regulatory requirements implementation	Analysis of the results of initial FB prototype and evaluation of performance impact on continuous trading including discussion on the mitigation measures (the impact on continuous trading is adverse, sufficient mitigation measures not available for the time being), design of FB interim solution (FB)	Foreseen steps: • Finalisation of the functional specification for the FB interim solution (IDA) • Development of FB interim solution (IDA) • Assessment on implementation feasibility of FB for Continuous Market
REMIT Reporting & PMI Improvements				
In line with the methodology, NEMOs provide market information to ACER so that ACER can monitor market behavior.	1.15 %	Regulatory requirements implementation	Development of minor improvements requested by ACER implemented, tested and deployed in operation	Foreseen steps: • Minor improvements in line with the operational experience and further ACER's requirements

Annexes


69.8112
35.9398
44.1984

Annex 1: Parameters

SDAC parameters

Table 27

Indicator	Parameter	Description	Value	Purpose	Annex 3 of AM
	K	Number of months which define the recent historical set	3	Definition of recent historical set	Art. 2(a)
Scalability	X%	Minimum percentage of cases which have to comply with the scalability indicator threshold	1. 97 % of cases should be below Running time; 2. 100 % of cases should be below 180 % of running time.	• 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) Art. 4(2)(a) Art. 4(2)(b) Art. 5(2)(a) Art. 5(2)(b) Art. 6(2)(a)
	y	Threshold for scalability indicator on the indicator values distribution	1. TBD accordingly for the SDAC Scalability Report	• 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) Art. 4(2)(a) Art. 4(2)(b) Art. 5(2)(a) Art. 5(2)(b) Art. 6(2)(a)
	Z	Threshold for scalability indicator on the average value	∞	• 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) Art. 4(2)(a) Art. 5(2)(a) Art. 5(2)(b) Art. 6(2)(a)
Ability to maximise economic surplus	T	Time extension for first OK-solution calculation	10 min		Art. 7(2)
Repeatability	pi	Weight for the different component of the repeatability indicator	1	• Clearing prices • Products output	Art. 8

SIDC parameters

Table 28

Parameter	Value	Scope	Proposed Annex 4 of AM
K	12	Number of months which define the recent historical set	Art. 2(a)
t	NA [8)]	Scalability threshold as defined in the service agreement with the service provider	
X %	NA [8)]	Minimum percentage of cases which have to comply with the scalability indicator threshold	

Annex 2: Notes

[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. Incidents not related to MCO assets are classified in three different categories: "Non-MCO: local trading", "Non-MCO: transmission of capacity" and "Non-MCO: Other"

[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 not 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 plot). 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 economic surplus indicator:

The first indicator illustrates the economic improvements realised in production, from the first valid solution found (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 17 minutes). These latter results were obtained re-running the sessions on a simulation environment. For individual sessions the economic surplus gain after increasing allowed calculation time by 10 minutes can be negative, i.e. a decrease. This is evidenced by the reported minimum values (–0.000929 %), as well as the plot with differences, which has a tail with some negative values. Such effects may stem from differences between the production and simulation machine, lack of reproducibility or different paths followed when exploring the branch & bound tree.

2) Repeatability indicator:

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. Potential differences are calculated using the same inputs, configuration of hardware and software and at the and comparing the last common solutions in both runs. Comparison is made on the latest common solution over two consecutive runs of production input data in a production-like machine. The machine used for the study fulfils the minimum requirements set for machines used in production. Comparisons are done considering 6 decimal places precision (1e-6 tolerance).

One indicator 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. Since Euphemia 10.4, there exists the possibility of activating a parameter named "deterministic time" that allows to use an internal clock that can be used to assure that the decisions are taken in the same time sequence in two consecutive runs on the same input data on the same machine. For 2024 repeatability study, it was run using E11.4 and time limit as stopping criterion.

The same input data has been run with and without the "deterministic time" parameter activated, but only the case without the parameter activated has been plotted because when using "deterministic time" activated the results were able to obtain the same relevant results in all cases. In 2024 it has been observed that using the 1e-6 tolerance leads to a lower number of sessions in which 100 % reproducibility is obtained when not using the "deterministic time". If this tolerance value is set to the 1e-5 tolerance value used internally by Euphemia for the results, the number of sessions in which we reach 100 % reproducibility increases to similar values obtained in previous years. As a result, for the following years it is advised to review the value of this tolerance and set it to the same value that is used internally by Euphemia.

[5] Ability to maximise the welfare indicator

The indicator on foregone welfare due to limiting calculation shows that for some sessions the economic surplus decreases with the time extensions. This effect reflects, among others, the non full repeatability of the SDAC Algorithm when the parameter "deterministic time" is not activated, the usage of newer machines in production that outperform the testing production-like machine used in the ex-post calculations and the differences that might exist in the algorithm versions used for the extended time calculation (the newest version of the algorithm used in the historical data is used for the extended time calculation). For IDAs, a new approach is followed: instead of comparing the increment of economic surplus when using additional 10' calculation time, the final gap and the final gap expressed as percentage of the value of the economic surplus of the final solution in (%) are reported. These indicators add transparency providing a value about the theorical maximum that the accepted solution could be improved. Note that the gap is a hypothetical value that measures the distance to the best potential economic surplus of all the unexplored nodes. It can happen that the optimal solution could have already been found but, as not all nodes have been explored yet, it is not possible to assert it, and that final gap that measures the distance to the most promising welfare of the unexplored nodes can be provided. Note also that there may exist negative values of final gap, which are the result of the limited precision used for the calculations. Nevertheless, these negative values are expected to be small.

[6] Individual impact of products

1) Usage of default and special configurations.

All the scenarios, except for the one in which piecewise curves are converted in stepwise curves, are calculated using default configuration (the one used in production). For the scenario in which piecewise curves are converted in stepwise curves, different internal parameters have been used, as suggested by the algorithm provider (these are different than the default configuration). This approach is the same as was followed for previous year 2022 and 2023. For 2024 Q4 data it has been observed again that the special configuration used in previous years only provided a significant improvement in just one of the scenarios. The other ones delivered similar or better performance when default configuration was in use.

[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 the 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 requests 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 the MSA sets out principles of confidentiality which, among others, apply to the provisions of the Service Level Agreement regulating e.g. availability and performance of the XBID system. Based on the confidentially principles, the details may be, and are, shared with SIDC stakeholders (NRAs, ACER, EC) but cannot be revealed to the general public and therefore they are not integrated within this report. Note that NRAs have full access to the MSA.

[9] SIDC Performance indicators & Performance monitoring

The evaluation of the performance indicators is carried out in SIDC on a monthly basis in line with the processes stipulated in the MSA. As a basis for the evaluation of the performance the Service Level Agreement (SLA) applies. The SLA represents contractually agreed parameters and in combination with agreed system boundaries it defines the performance of SIDC guaranteed by the vendor. The technical thresholds of SIDC are not de-fined (known) though it is assumed that they are well above the SLAs (which is also proven by the scalability report). Every month the vendor provides an evaluation of the performance indicators, based on the production data, in the form of a performance report. SIDC parties review the performance report and provide the vendor with anticipated changes of the processed data, as e.g. changes/growth in the number of implicit and explicit orders. The vendor analyses the provided data and in case the analysis indicates a risk or need of the optimisation measures the vendor provides a proposal for the SIDC Solution improvements which are jointly discussed.

[10] Order Transition

Means Order entry (including activation of new iceberg slice), Order modification (including Order activation and deactivation) and Order deletion (excluding Order deletions due to contract expiration); partial matches as well as full Order executions are not to be considered as Order Transaction.

Disclaimer

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

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

Imprint

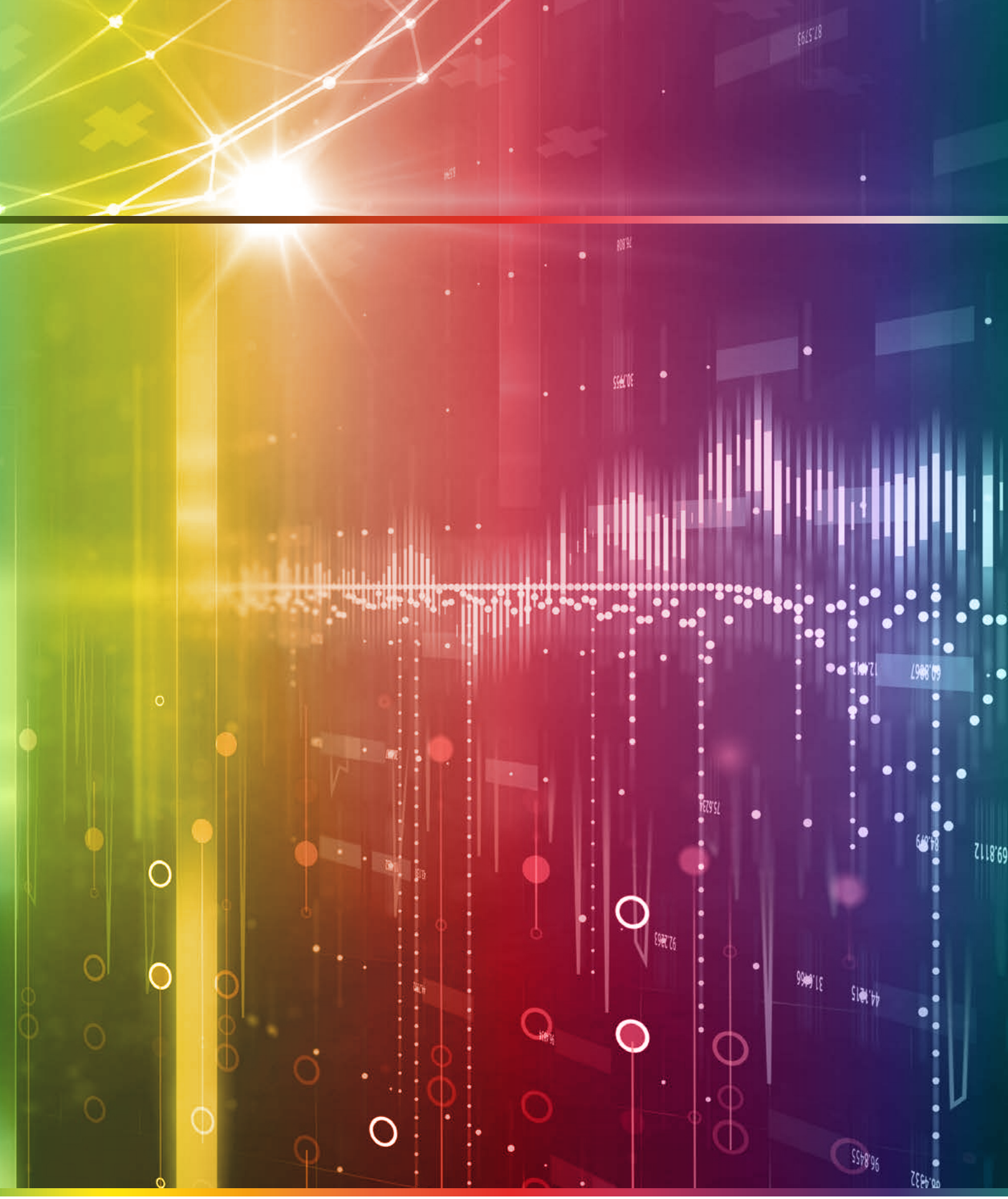
Publisher:
All NEMO Committee

Pictures:
Cover: iStockphoto.com, monsitj
pages 16, 43, 52 – 53, 94 – 95: iStockphoto.com, monsitj
page 85: iStockphoto.com, Sangkhamanee

Design:
DreiDreizehn GmbH, Berlin
www.313.de

Publishing date:
1 July 2025

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



ALL NEMO COMMITTEE

in coordination with entsoe