



15min products in HENEX Spot Electricity Markets

This document describes the main concept of market design adaptations to introduce 15' MTU products in the Day Ahead and Intra-Day Auctions (DAM-IDAs) as required by ACER in 2020 amended CACM NEMO Algorithm Methodology and as stipulated by ACER and all NRAs to be developed in Single Day-Ahead Coupling (SDAC) and for Single Intra Day Coupling (SIDC).

Market Context

HENEX Spot Electricity Markets currently consist of the Day-Ahead Market (DAM) and three Complementary Intra-Days Auctions (CRIDAs). The continuous intra-day trading (XBID) is expected to go-live by the end of 2022. CRIDAs will be converted into European Intra-Day Auctions (IDAs), which form an intra-day coupling in SIDC region, by Q1 2024. IDAs will have almost identical timings with CRIDAs and will additionally implement implicit allocation of the Greece-Bulgaria cross-border capacity. The introduction of 15min products in HENEX Spot Electricity Markets, as described in this document, refers to the three following market segments:

- DAM
- IDAs
- XBID

Basic Market Design and Schedule Planning

HENEX Spot Electricity Markets currently support products and relevant orders with hourly resolution. There is work in progress across European NEMOs & TSOs to introduce products and orders with 15min resolution in SDAC and SIDC. Adopting a 15min resolution framework means that a Delivery Day is split into 96 15min Market Time Units (MTUs) and Market Participants (MPs) are able to trade in finer time resolution. Trading in 15min time resolution can help MPs increase the feasibility of their market schedules and reduce imbalances since the imbalance settlement period of IPTO Balancing Market is already in 15min resolution.

When at least one market (DAM or IDAs or XBID) starts supporting 15min products & orders, the market schedule/position of a MP asset has to be defined in 15min resolution. Based on the current market design, HENEX sends the asset market schedules to IPTO, for the IPTO balancing functions (ISP, RTBM). Currently, the imbalance settlement period of RTBM is 15min and the dispatch period of ISP is 30min. Therefore, the prerequisite to introduce 15min resolution products & orders in any HENEX market is that the time resolution of IPTO ISP changes from 30min to 15min resolution.

The introduction of 15min products & orders is not expected to be done simultaneously in all market segments (DAM, IDAs and XBID). Based on the current status of HENEX developments, as well as the work done in market coupling projects, the following planning is available:

XBID

XBID central algorithm already supports multiple time resolution contracts (15min, 30min and 60min). XBID is expected to go-live in Greece by the end of 2022. Initially, only 60min contracts will be offered in the HENEX XBID implementation. 15min contracts could be offered later depending on adaption of 15min resolution in IPTO ISP.

DAM

DAM in the context of SDAC uses the PMB and EUPHEMIA algorithm assets. PMB and EUPHEMIA prototypes that support the use of multiple time resolution products & orders (15min, 30min and 60min) are currently developed and tested. EUPHEMIA prototype has been developed with a cross-product matching functionality that allows 15min, 30min, 60min orders to co-exist in the same market session and be cleared simultaneously. The introduction of 15min orders poses challenges in the EUPHEMIA algorithm performance, therefore extensive research and development is being conducted to mitigate them. The challenges are greater when multiple time resolutions are present and cross product matching is being used (i.e. 15min and 30min and 60min coexist in the same market session) compared to a situation where only 15min orders are present.

15min orders are expected to be offered for DAM in Q1 2025, in the context of a big-bang SDAC go-live, which means that all Bidding Zones will introduce 15min orders simultaneously.

IDAs

IDAs will use the same coupling assets as DAM, i.e. PMB and EUPHEMIA algorithm. Therefore, the performance issues described above could also be valid for IDAs.

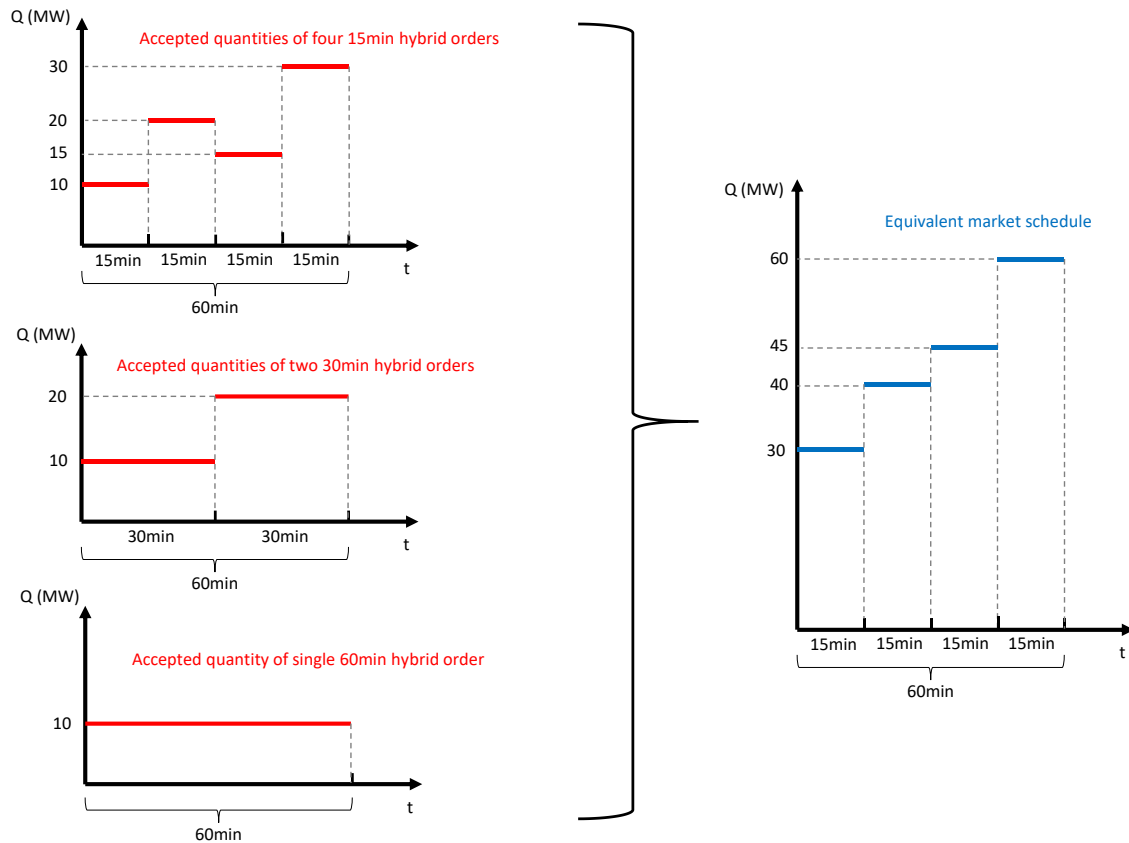
IDAs are scheduled to go-live in Q1 2024 and are expected to offer 15min orders.

Market Design options for the implementation of 15min in HENEX ETSS

On a market design level, concerning DAM, IDAs and XBID, there are two main design options when a market segment moves from a 60min time resolution to 15min time resolution:

- **Option 1:** 15min, 30min and 60min orders are offered in the market.
- **Option 2:** only 15min resolution orders are offered in the market.

In both Options different market segments could have different time resolutions, however the market schedule of an MP asset will be defined in 15min resolution anyway. An example of how this applies to Option 1 can be seen in the figure below.



The two different options have different implications on different market design aspects. The pros and cons of these two options are displayed in the following Table and are analysed afterwards. The plus (+) sign implies a positive impact on the respective market design aspect.

Market Design Aspect	Option 1 15, 30 & 60min orders	Option 2 only 15min orders
Trading flexibility for MPs	+	-
Algorithm performance	-	+
Price formation	-	+
Paradoxically rejected hybrid orders	-	+
Local Market Trading System development, maintenance, and cost	-	+

Trading flexibility for MPs

In Option 1, MPs will have more options (wider range of MTU resolution) for trading. MPs who want to ensure a fixed market schedule within the same hour of the Delivery Day, may continue using 60min orders. In Option 2 where only 15min orders are provided, MPs would be able to submit only 15min which means that, in general, the market schedule could differ between the different 15min MTUs of the same hour.

Algorithm performance

This aspect refers mainly to the DAM and IDAs, i.e. the auction based market segments that use the EUPHEMIA algorithm. There are ongoing discussions in SDAC technical working groups and bodies concerning the algorithm performance issues that arise from the introduction of 15min orders in DAM (mainly) and IDAs (to a lesser extent). The algorithm performance tends to worsen, when the cross-product matching functionality is used, so that orders of different resolution can be matched between them. The ongoing discussion on the algorithm WGs focus on whether the algorithm can indeed accommodate orders of different duration for SDAC & SIDC IDAs, without jeopardizing the security of market operations. In that sense, Option 1 has a much worse impact in algorithm performance compared to Option 2.

Price formation

This aspect refers to the DAM and IDAs, i.e. the auction based markets that use the EUPHEMIA algorithm. Option 1 could potentially jeopardize price formation. When multiple time resolution orders co-exist in the same market session, it means that a 60min hybrid curve among 15min orders is treated as a “curtailable block” in order to have a fixed cleared quantity for the relevant hour. Therefore, a mix of 15min, 30min and 60min orders forms an “inflexible” mix that could worsen the price formation, compared to the case that these orders are submitted all as 15min orders. The degree of price formation degradation depends on the exact mix of orders of different time resolution and therefore it cannot be anticipated in advance.

Paradoxically rejected hybrid orders

This aspect refers to the DAM and IDAs, i.e. the auction based markets that use the EUPHEMIA algorithm. In Option 1, the cross-product functionality is implemented, i.e. the algorithm matches orders of different time resolution. When orders with multiple time resolution are present, the Market Clearing Prices (MCPs) are calculated in all resolutions (15,30,60min). The MCPs of coarser resolution are calculated as the average of the 15min MCPs. MCPs of different resolutions should be consistent with the acceptance status of the orders submitted in the respective resolution. It has been observed that, in some cases, trying to impose consistent MCP calculation, can lead in

15min MCP to exceed the price limits (i.e. -500€/MWh for price floor and 4000€/MWh for price cap). Since this cannot be accepted, the 15min MCP is limited to the price limit, which in turn modifies the higher resolution (30,60min) MCPs and leads to in paradoxically rejected orders of higher resolution. This issue is still under investigation in the Algorithm WGs. However, it seems that when all resolutions are available in a Bidding Zone, the cross-product matching functionality can lead to market inefficiency problems. This issue is not present in Option 2.

Local Market Trading System development, maintenance, and cost

In Option 1, the development effort/time, maintenance, and cost resources of HENEX Local Trading Platform (ETSS), would be much demanding, since GUIs, internal interfaces, DBs would need to accommodate the complexity of simultaneously hosting market orders of different resolution, implementing the necessary conversions, API adaptations etc.

In Option 2, ETSS would accommodate orders of a single time resolution per market segment. For example, during a certain period, DAM could have 60min resolution orders, IDAs and XBID only 15min resolution orders. The option of moving from 60min to 15min and having only 15min would be much easier to implement, test and maintain and therefore lead to decreased costs and resources.

HENEX perspective

Based on the above analysis, HENEX favors Option 2, which means that a market segment should support products & orders of a single time resolution, because:

- Algorithm performance is superior and coupling projects are operationally secured.
- Price formation, which is of paramount importance for the sound market operation, is not jeopardized.
- Market design is more robust and issues that could cause MPs' discomfort, like paradoxically rejected hybrid orders, are not present.

The ultimate decision for the market design will take also into account the following:

- The feedback from the SDAC and SIDC WGs on algorithm performance with 15min orders.
- The mandates of the Greek Regulatory Authority.
- The view and needs of the MPs.



Questionnaire for MPs

MPs are encouraged to give feedback on market design options for the 15min products, by answering the following Questionnaire **by 18 September 2022**

Market Participant name:		
Question	Answer	Comments
Would market design Option 2 pose serious limitations to your trading activities? If yes, are there any mitigation measures that you would propose?	Yes/No	
Do you anticipate that under Market Design Option 2 you would make increased use of block orders existing functionality, compared to Market Design Option 1?	Yes/No	
Is the introduction of 15min orders urgent for your trading needs? If yes, is there a specific market segment (DAM, IDAs, XBID) where you believe that 15min orders should be introduced with priority compared to the others?	Yes/No	