Electricity Derivatives, Day-Ahead and Intra-Day Markets operation under Target Model

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Contents

- Establishment of EnExGroup
- Overview of the new markets
- Derivatives Market (DM)
- Day-Ahead Market (DAM)
- Intra-Day Market (IDM)
- Clearing House in Spot Markets

HEnEx and EnExClear setup

HEnEx set up:

- Established in June 2018
- 5 mil. € capital
- First BoD was designated
- Personnel: Twenty-four (24) persons
- Outsourcing of activities to ATHEXGroup

EnExClear set up:

- Established in November 2018
- 1 mil. € capital (250,000 € dedicated funds on default waterfall)
- First BoD was designated
- Personnel: Seven (7) persons
- Outsourcing of activities to HEnEx and ATHEXGroup
- Fully staffed since March 2019

HEnEx and EnExClear – shareholders structure

Public share

ΔΑΠΕΕΠ — 22%

ΑΔΜΗΕ — 20%

DESFA Hellenic Gas Transmission System Operator S.A. DEVELOPMENT POWER — 7%

49%

Private share

ATHEXGROUP Athens Exchange Group — 21%

European Bank for Reconstruction and Development — 20%

Χρηματιστήριο Αξιών Κύπρου Cyprus Stock Exchange — 10%

51%

HEnEx Hellenic Energy Exchange S.A.

100% owns

EnEx CLEAR EnEx Clearing House S.A.

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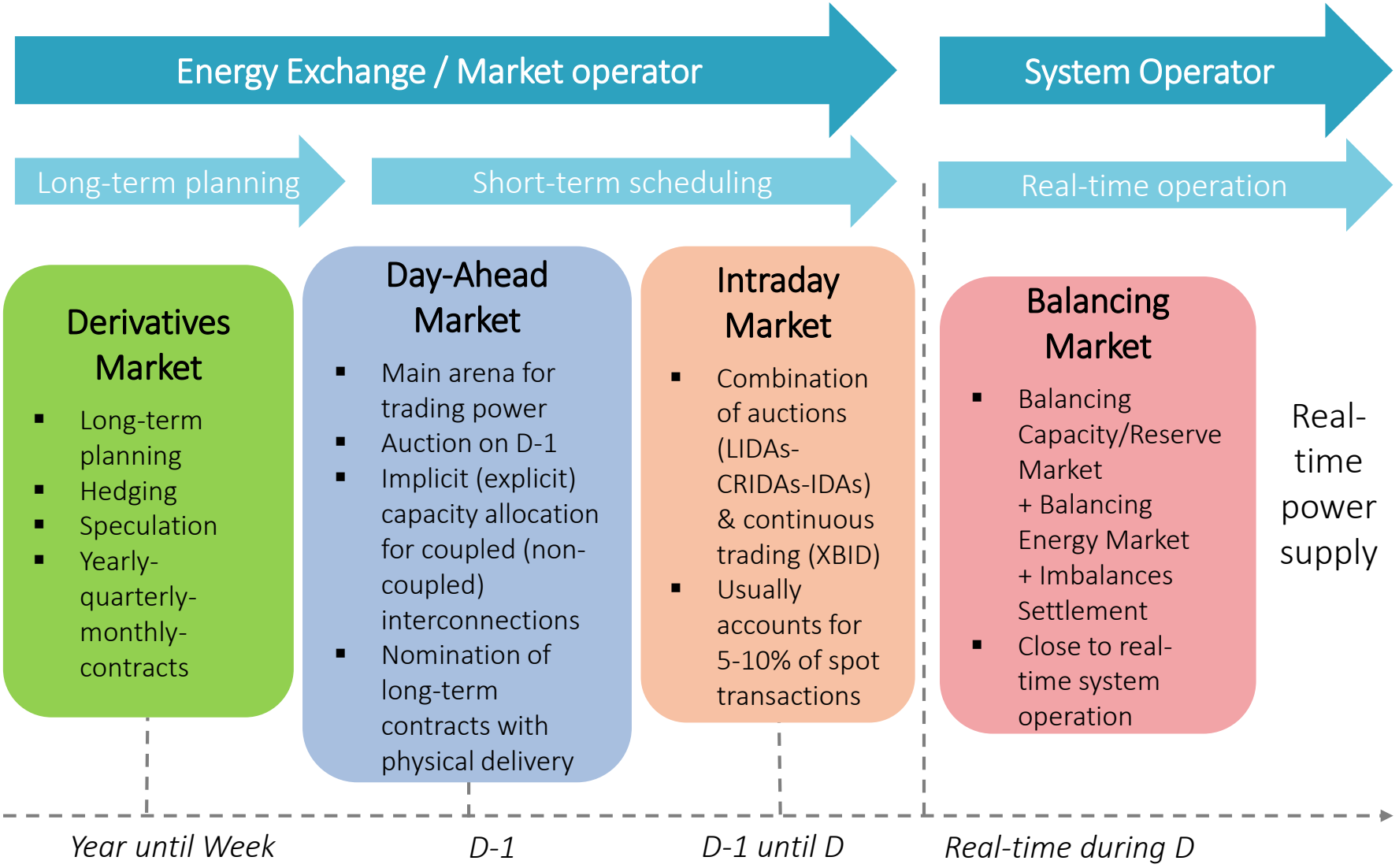
Energy Markets in Greece

	SPOT Markets			Derivative Markets
Market	Day Ahead	Intraday	Balancing	Energy Derivatives Market
Type of Market	Physical	Physical	Physical	Cash Settlement with optional Physical Delivery
Trading	HEnEx	HEnEx	ADMIE	HEnEx
Clearing	EnExClear	EnExClear	ADMIE	ATHEX Clear
Cash Settlement	EnExClear	EnExClear	ADMIE	ATHEX Clear
Technical and Operational Support	ATHEX	ATHEX	ADMIE	ATHEX

Electricity Markets Sequence at a glance



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Derivatives Electricity Market

What is a Derivative?

"A derivative is a financial instrument whose value depends on the value of other basic underlying variables" ...John c hull

Derivatives Contracts traded on Organized Markets

Based on

Underlying Assets

- Stocks
- Index
- Currency rates
- Commodities (power, gas, gold, corn, wheat,, etc)
- ...

Futures Contract

is a binding agreement between **two parties,** one of which promises to buy and the other to sell, a **certain quantity** of a standardized asset, at a specific **future date,** at a specified transaction **price**

Option Contract

An agreement that gives the **buyer** the **right** but **not** the obligation to buy or sell the underlying at a fixed price during a time period or at a specific future date.

Power Future Product Specs (1/2)

Product

The HEnEx's Power Future is a **financial derivatives contract** based on the average power spot market price of future delivery periods of HEnEx's Day Ahead Market (DAM), for all hours for all days of the respective Delivery period.

Licensed Entities on the HEnEx's DAM, **have the option of arranging the physical delivery of power** on the HEnEx's DAM, through the submission of Priority Price-Taking Orders in DAM according to their respective position in an HEnEx's power future product.

Trading Methods

1. **Continuous Automated Matching Method** (CAMM), Monday to Friday (excluding holidays)

✓ *"price -time priority" applied*

2. **Pre-agreed Method** Monday to Friday (excluding holidays)

✓ *Bilateral Contracts will be supported by the Pre–Agreed Method in the HEnEx's Trading system when the price is pre-agreed between the counterparties*

Participation of Market Makers

Market Makers (MM) improve liquidity, through the obligation to transmit for their **own account,** on a continuous basis, **Quotes** (a pair of a buy and a sell order which are entered simultaneously).

Rules for Market Making applied by HEnEx. MM receives, a privileged pricing policy / penalties in case of non-compliance according to the market making rules.

Power Future Product Specs (2/2)

Tradable Delivery Periods

Month (next 6 + current months), Quarter (next 4 quarters) & Next Year (Baseload, Peakload)

Hours																					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Base (hour 1 to 24)																							
Off-Peak								Peak (12 hours, from 8 to 20)												Off-Peak			

Cascading mechanism applies to yearly and quarterly contracts, positions are split into equivalent positions on Contracts of shorter Delivery Periods:

- ✓Yearly Contract cascades into 3 individual Monthly Contracts and 3 Quarterly Contracts.
- ✓Quarterly Contract cascades into 3 individual Monthly Contracts.

Daily Price fluctuation limits

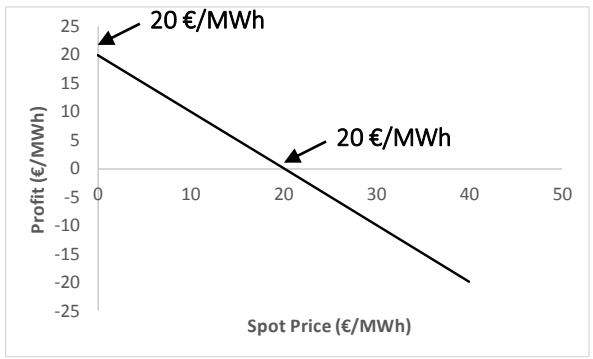
Proposed limits at the start of trading : **+/-20%** of the Reference Price* (the previous Daily Fixing Price).

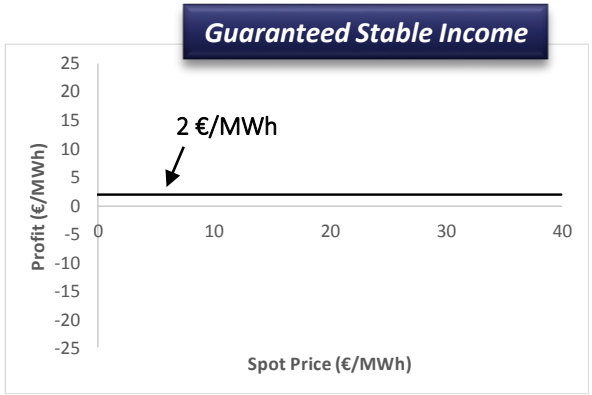
The same limits are also applied for the **pre agreed trades.**

** Reference Price will be available for all series (e.g. first trading day of a contract)*

Power Futures Product Specs
Hedging Strategies

- **Hedging Strategies**
  - **Buy of Futures Contracts**: Hedge against increasing power prices **(Long Hedge)**
  - **Sell of Futures Contracts**: Hedge against decreasing power prices **(Short Hedge)**
- **Example: Producer's Hedge**
  - Fixed production costs 18 €/MWh
  - Sells Futures Contracts for 20 €/MWh





Licensing & Membership Procedure

1 Entities eligible to apply for Trading Membership

Financial entities

- Credit Institutions
- Investment firms

Non financial entities

- Power Producers
- Power Suppliers
- Energy Trading companies
- RES aggregators
- Self-Supplying Customers

2 Licensing from the respective Authority

Επιτροπή Κεφαλαιαγοράς
Hellenic Capital Market Commission

According to the current framework (see investment services table) eligible entities should have been duly **licensed**

- to execute orders on behalf of clients or trade for own account and also
- to trade derivatives commodities as defined in Law 4514/2018 (MIFID II)

PAE RAE
ΡΥΘΜΙΣΤΙΚΗ ΑΡΧΗ ΕΝΕΡΓΕΙΑΣ

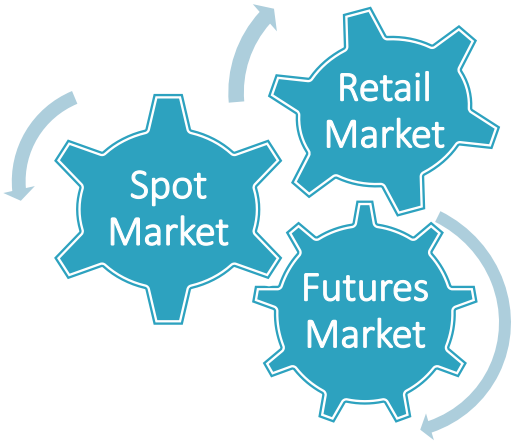
3 Membership status granted by HEnEx

The **membership** granted for those entities who meets the criteria set by HEnEx in the following areas:

- …organizational and financial liability..
- …professional reliability and qualification of its traders…
- …the suitable technical infrastructure…
- …recognition as Clearing Member or arrangement with a General Clearing Member…

Tools & Benefits of the new markets
Derivatives Market

- **A MiFID II compatible market accompanied by an EMIR compliant CCP** increases reliability, transparency, efficiency and minimizes counterparty credit risk exposure.
- **Hedging opportunities are reinforced** since all market participants (producers, suppliers, traders, RES aggregators) can **hedge** against unforeseen prices in the spot market.
  - Hedging price exposure **helps companies** make long-term plans, formulate new business cases and expand their activities, which, in turn, **benefits end-customers who receive** less expensive and/or enhanced services.
- **Optional physical settlement** can serve the Spot market participants needs through a simple, competitive and straight-through service.
- A competitive and liquid Derivatives Market **will enhance competition on both spot and retail markets** for the benefit of all market participants **as well as end-customers.**



Market liquidity affects the entire Electricity Market business

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Differences between the current and the new DAM

Current Day-Ahead Market Model

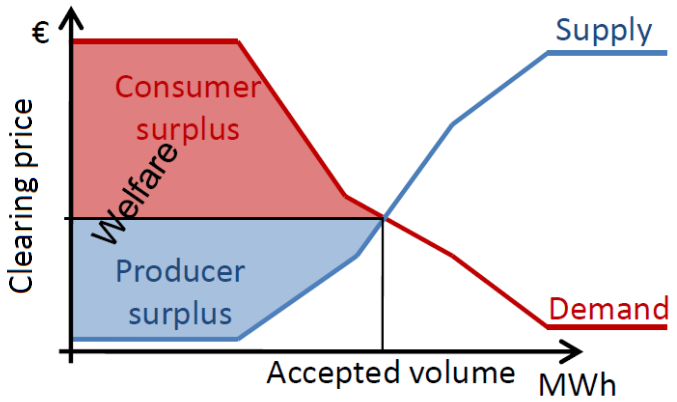
- **Asset-based participation** in the market
- **Co-optimization** of energy & ancillary services
- Unit commitment - **24h social welfare maximization problem with constraints**
- **Order Types** (Buy/Sell)
- Producers submit **Techno-economic/Non-Availability** declarations
- Suppliers submit non-priced Load Declarations for demand
- Settlement of imbalances from ADMIE
- **No bilateral** agreements
- **Explicit allocation** of interconnection capacities (ST-PTRs)

New Day-Ahead Market Model

- **Bidding on a physical asset basis -Portfolio bidding for RES Units & RES Aggregators**
- **Pan-European market clearing algorithm – EUPHEMIA**
- **Only energy products** (Day-ahead hourly energy contracts are traded) - no ancillary services
- **Orders** compatible with PCR standards (Hybrid, Normal Block, Linked Block & Exclusive Group of Block Orders)
- **No lower limit** for generator sell orders (MAVC)
- **No uplift accounts** for recovering generator start-up costs
- **Exchange-based Futures** and **OTC Contracts** with the option of physical delivery
- **Implicit allocation** of interconnection capacities with coupled Bidding Zones (no Daily PTRs)

PCR MC Algorithm - EUPHEMIA

- **EUPHEMIA**: EU Pan-European Hybrid Electricity Market Integration Algorithm
  - Solves the **market coupling problem** on PCR perimeter
  - **Single** price coupling algorithm
  - Calculates **net positions** and **electricity prices** across Europe
  - **Energy-only** market
  - Participants buy/sell at the market clearing price (**no uplifts**)
  - **Short-term transmission capacity rights cease** to exist
- The solution **maximizes EU social welfare**
  - Overall welfare increases
  - Efficient cross-border capacity allocation
  - Most competitive price will arise



Orders in the Day-Ahead & Intra-Day Markets

Auctions

Order Types available	DAM	IDM – LIDA[1]	IDM-CRIDA[2]
Hybrid Hourly Orders	X	X	X
Normal Block Orders	X		X
Linked Block Orders	X		
Exclusive Group of Block Orders	X		

1. LIDA - Local Intra Day Auction
2. CRIDA - Complementary Regional Intra Day Auction

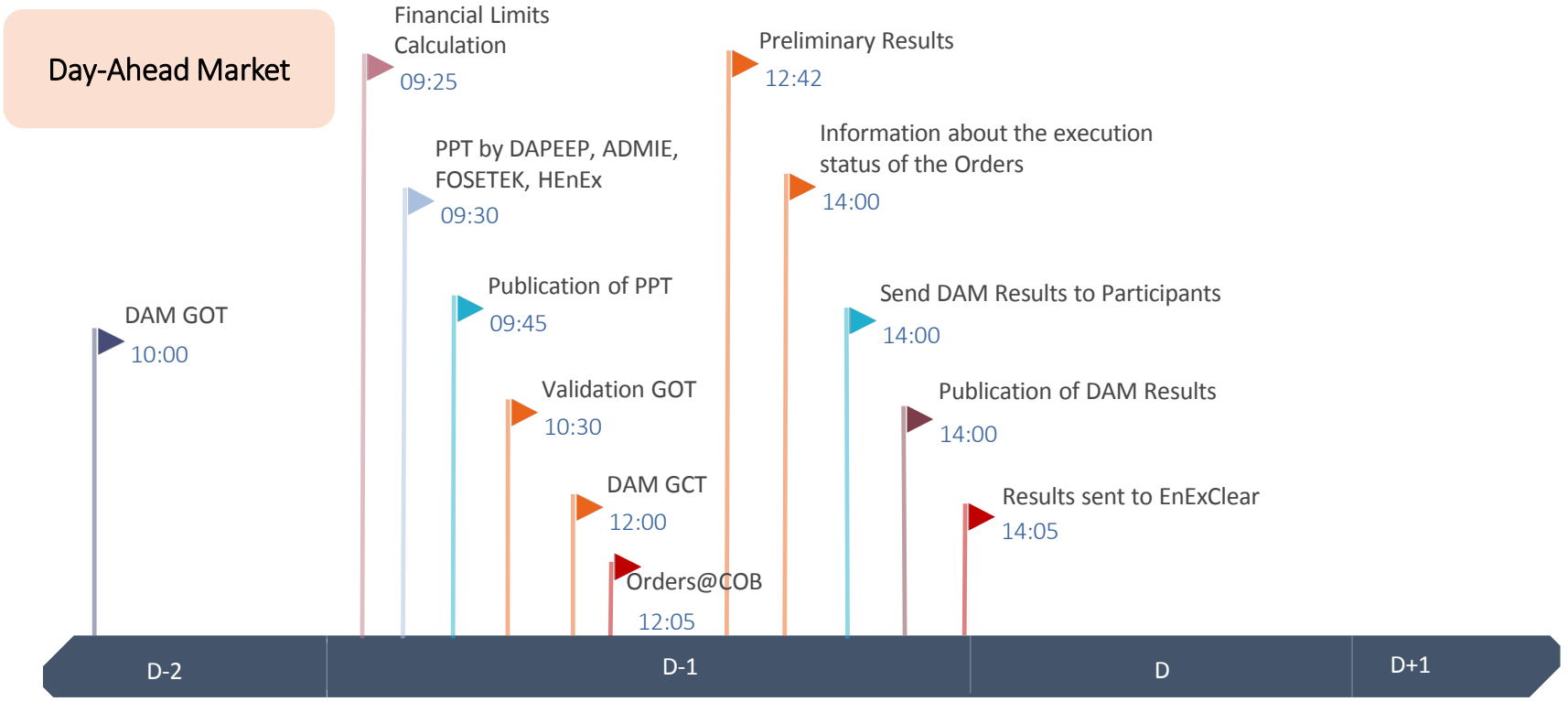
XBID

Order Type	Execution Restrictions	Validity Restrictions	Predefined	User-Defined
Regular predefined (currently 30')	NON IOC FOC	GTD, GFS - -	Yes	No
Regular user-defined block	AON	GTD GFS	No	Yes
Iceberg	NON	GTD GFS	Yes	No

Pre-Coupling/Coupling/Post Coupling Processes

Pre - Coupling Processes	Coupling Processes	Post - Coupling Processes
➢ Cross-Zonal Capacities by Coordinated Capacity Calculator (CCC) (till 12:00, d-1) ➢ By TSO: Participant portfolio update, availabilities, LT and ST PTRs ➢ By DAPEEP: RES registry update ➢ By Clearing House: Credit Limit (for Priority price-taking orders too), suspended Participants ➢ Cross-Zonal Capacities to MCC ➢ Validation of Orders by ETS ➢ Local Order Book	➢ Rotational Role of MCC ➢ Euphemia Algorithm (welfare maximization) ➢ Order Types acceptance rules	➢ Preliminary Results by MCC ➢ HEnEx's confirmation of Preliminary results to MCC ➢ TSO's confirmation of Preliminary results to MCC (via HEnEx) ➢ Secondary Auction Activation ➢ Final Results by MCC ➢ Final Results to Participants by HEnEx ➢ Final results to Clearing House ➢ Calculation of penalties (availability and max forward contact usage rules)

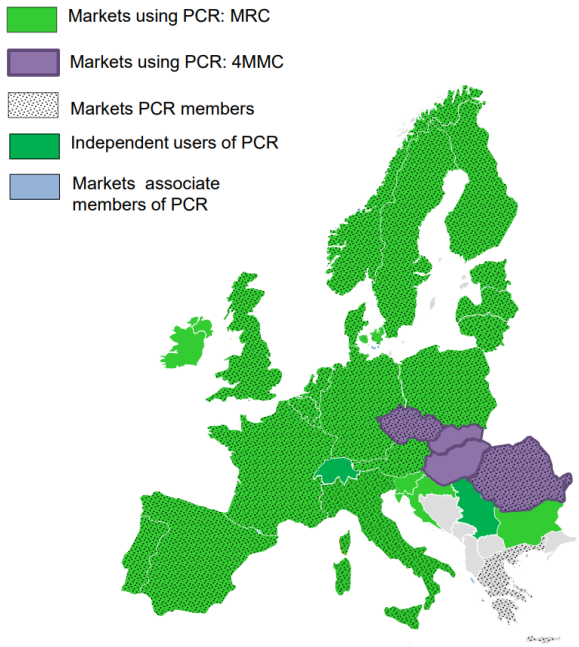
Day-Ahead Overview



All hours refer to Central European Time (CET)

Tools & Benefits of the new markets
Day-Ahead Market

- The DAM is still the main spot market which now also serves as the **underlying market** for the Derivatives market.
- The DAM can be used for trading hourly load/generation profiles. Additionally, it can be used for **position fine-tuning** after the Derivatives Market as well as registration of physically settled Futures positions and OTC contracts.
- **Implicit trading** requires no a priori purchase of transmissions rights for coupled interconnections thus removing unnecessary trading risks.
- The set of new order types (hybrid, blocks, linked families, exclusive groups) **can serve all market participant needs**, including those with complex physical assets, trying to optimize their bidding strategies and operational profiles.
- The optimization algorithm, *EUPHEMIA*, is a **common algorithm across all Europe** which guarantees a level and familiar playing field for all.



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Intra-Day Markets & Implementation Phases

- **Intra-Day Markets :**
  - Three Local Intra-Day Auctions (LIDAs) / Complementary Regional Intra-Day Auctions (CRIDAs) / pan-European Intra-Day Auctions (IDAs) **after DAM and before Balancing**
    - The EUPHEMIA algorithm will also be used for clearing the auction-type IDMs, similarly to DAM
    - CRIDAs are aligned with the pan-European Intra-Day Auctions (IDAs)
    - Trading periods: 1st LIDA/CRIDA: 14:00-16:00, D-1
      2nd LIDA/CRIDA: 16:30-23:00, D-1
      3rd LIDA/CRIDA: 05:00-08:30, D
  - Continuous Trading (XBID), **up to one hour before actual delivery**
- **Basic characteristics:**
  - Optional participation
  - Unit-based market
- **2 Implementation phases:**
  - **1st Phase:** Local Intra-Day Auctions (LIDAs)
  - **2nd Phase:**
    - Complementary Regional Auctions (CRIDAs)
    - Continuous Trading (XBID)

XBID Example
Local LTS

Example

- Matching of Orders within the Greek market

T=0

Greek LTS	
Buy	Sell
50MW@-60€	50MW@-65€
30MW@-58€	25MW@-70€
25MW@-55€	20MW@-80€

T=1

Greek LTS	
Buy	Sell
50MW@-60€	80MW@-57€
30MW@-58€	50MW@-65€
25MW@-55€	25MW@-70€
	20MW@-80€

T=2

Greek LTS	
Buy	Sell
25MW@-55€	50MW@-65€
37MW@-52€	25MW@-70€
15MW@-49€	20MW@-80€

XBID Example
Cross – LTS

Example

- Matching of Orders between Greek and Italian market

Italian LTS

Buy	Sell
48MW@-61€	50MW@-65€
22MW@-52€	25MW@-69€
38MW@-49€	30MW@-82€

Greek LTS

Buy	Sell
50MW@-65€	21MW@-67€
30MW@-58€	27MW@-70€
25MW@-55€	20MW@-80€

CZC=0

Italian LTS

Buy	Sell
48MW@-61€	50MW@-65€
22MW@-52€	25MW@-69€
38MW@-49€	30MW@-82€

Greek LTS

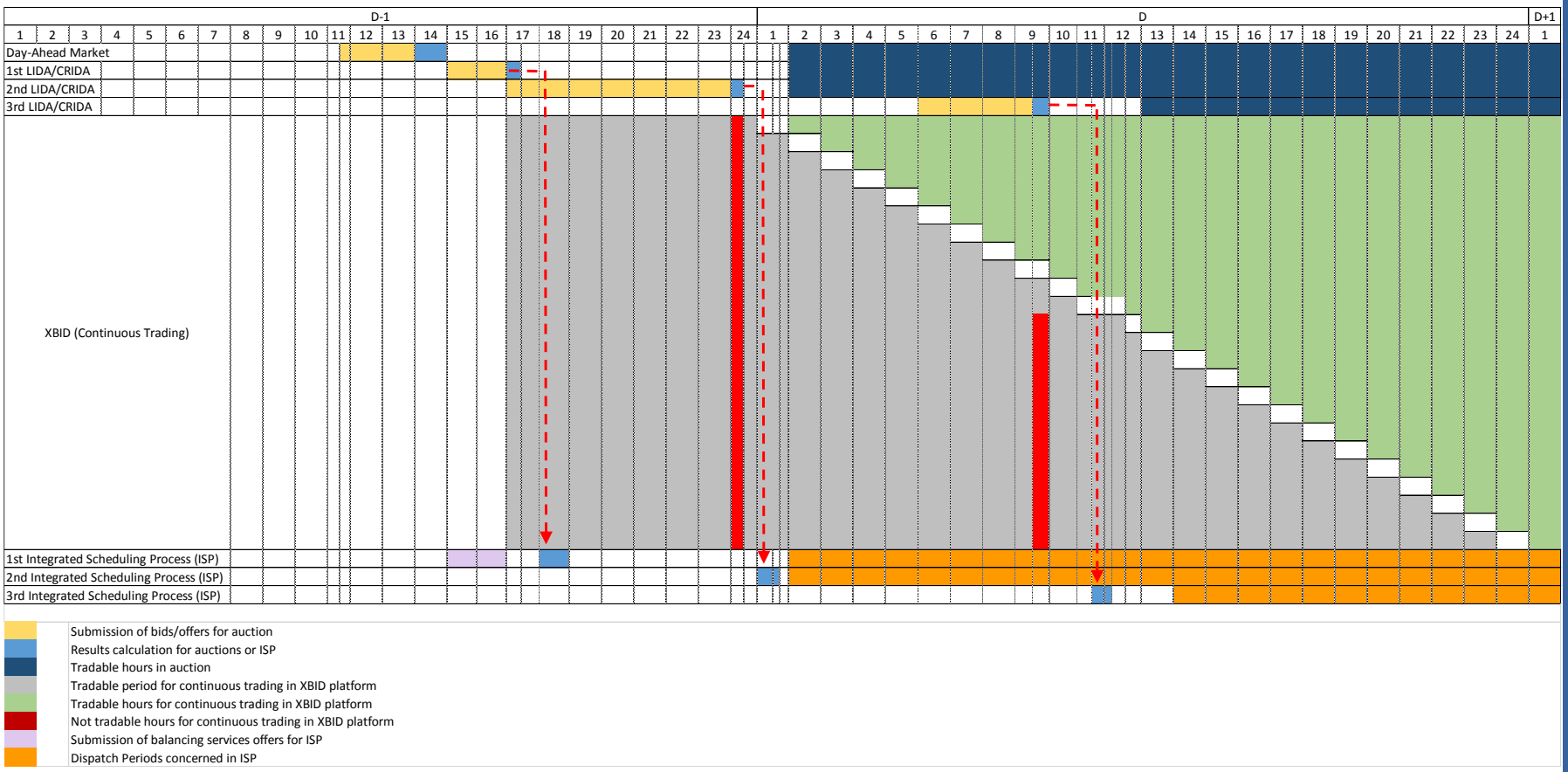
Buy	Sell
50MW@-65€	50MW@-65€
30MW@-58€	21MW@-67€
25MW@-55€	27MW@-70€
	20MW@-80€

CZC=50 MW

Tools & Benefits of the new markets
Intra-Day Market

- IDM can be used **for further fine tuning of positions and reduction of imbalances** (thus reducing the financial exposure) prior to the TSO-managed Balancing market.
  - In case of power plant outages or changes in demand market participants can **update their trading position.**
  - The submission of more accurate short-term RES forecasts **can benefit the RES Producers and Aggregators business** and help them handle the associated RES stochasticity, thus reducing risk exposure and allowing for further integration of intermittent renewable production.
  - **Flexibility providers can leverage their portfolio** to maximize the use of their resources while contributing to the energy balance.
  - New products with **finer time resolution** (e.g. 15-min or 30-min) will provide more efficient power schedules

Spot Market Trading/Delivery Periods at a glance



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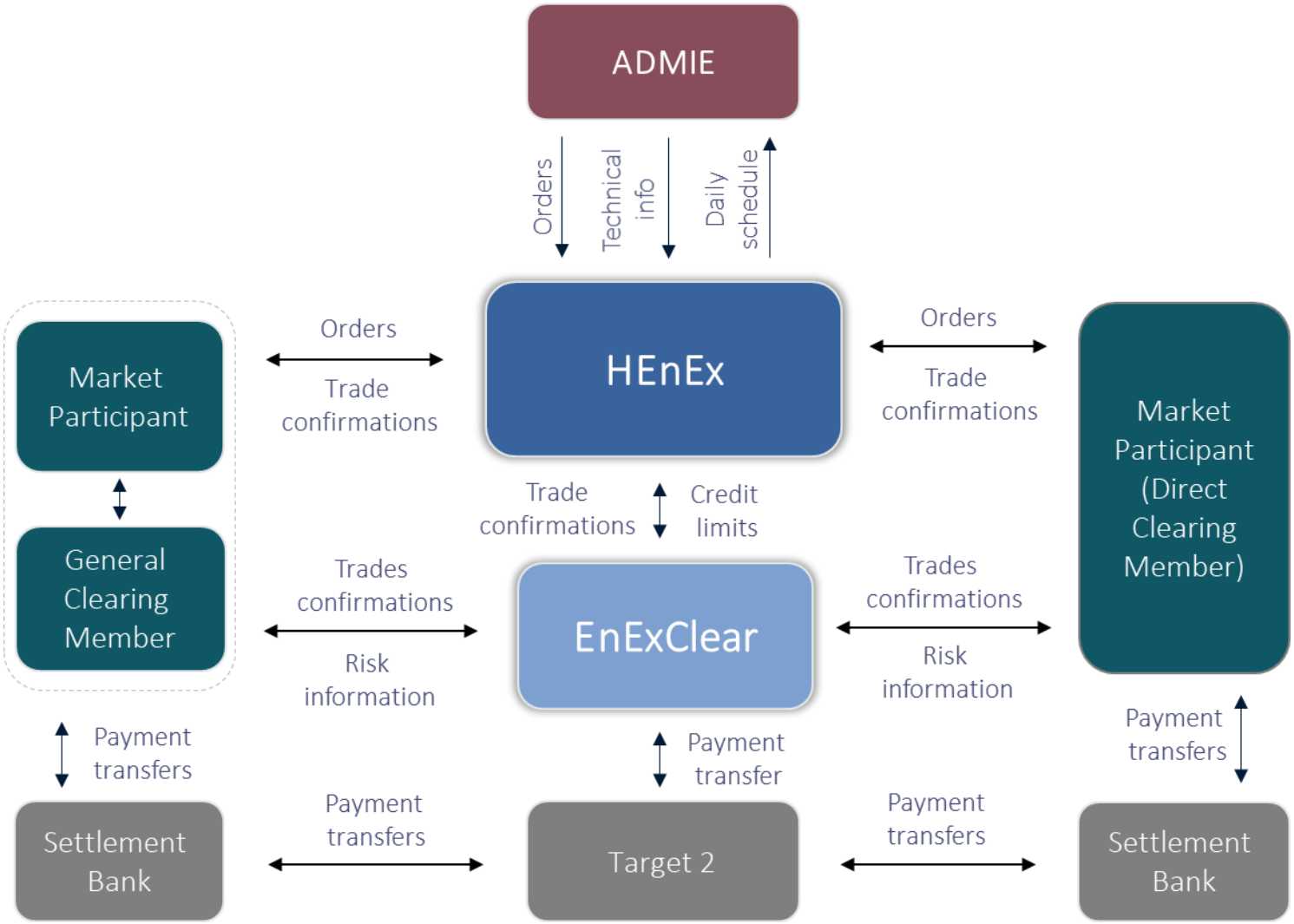
Clearing House in Spot Markets (1/2)



Clearing House in Spot Markets (2/2)

- **EnExClear** acts a central counterparty and takes on the risk of default of the counterparties' transactions within the Spot Electricity Market (DAM & IDM) by undertaking the role of the buyer vs each seller and vice versa, for the clearing & settlement of the **financial side** of transactions.
- It achieves ***efficiency*** by netting the position of the counterparties.
- It ***manages the risk*** of counterparties by applying a **proactive risk management model** no Collaterals → no Credit Limit → no Trade!
- It administers the **Clearing Fund**, the assets of which belong to the **Clearing Members (CM)** according to their contributions **(Risk Sharing Fund)**. **In case of default**, EnExClear makes use sequentially of the defaulting CM's contribution to the Clearing Fund, the other CMs contributions to the Clearing Fund and finally EnExClear's own resources.
- As a result **the default risk is not incurred by Load Representatives**, as it is under the current risk management model under DAS.
- The provision for **daily settlement of transactions** allows for **less capital requirements for Participants** and **more efficient Working Capital management.**

Why Target Model?

What are the benefits of European Price Coupling in short?

- An integrated European electricity market promotes increased liquidity, transparency, efficiency and social welfare since:
  - A market with a lot of power traded "in and out" leads to **depth** in the market
  - Liquidity helps the market **price discovery** process, leading to reliable price signals
  - An efficient price formation mechanism provides **sufficient incentives for investments**
- Price coupling guarantees the overall welfare and **optimal use of electricity network resources.**
- **Implicit trading removes unnecessary risks** of trading cross-border capacity and electricity separately.

EnEx
Energy Exchange Group

Thank you for your attention!

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