

[GrifON] | 04.10.2023 Market Design: Techno-economic assessment of proposed market schemes for standardized products

#### Matteo Troncia Comillas Pontifical University, Institute for Research in Technology (IIT)



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### **OneNet: A Common Market Design for Europe**

### Increase harmonization to:



reduce market fragmentation



facilitate customers' participation



simplify decision-making process for investors





### Market coordination through harmonization

Markets can co-operate by using efficiently use the same pool of resources if they are harmonised

**Conditions** characterizing harmonized markets:

- Product compatibility
- Market design compatibility

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Products harmonization assessment

• Market harmonization assessment (architectural features and phases)



Bid forwarding is a mean of coordinating markets to allocate resources and creating value for market participants.



### **OneNet: Product Harmonization Framework**

#### **Products as a mean for coordination**

Product harmonization enables for **products that can be used for more than one service** e.g. products that can be used for frequency control and congestion management or voltage control services.



Procurement of system services by DSOs and TSOs with seamless coordination among market participants and within and cross-countries.

### **OneNet: Market Harmonization Framework**

Extensive theoretical market framework to support market analysis and design





#### OneNet Deliverable 3.1 and

Troncia, M.; Chaves Avila, J.P.; Damas Silva, C.; Gerard H.; Willeghems, G.; Market-Based TSO-DSO Coordination: A Comprehensive Theoretical Market Framework and Lessons from Real-World Implementations. DOI: <a href="https://doi.org/10.3390/en16196939">https://doi.org/10.3390/en16196939</a> - LINK: <a href="https://doi.org/10.3390/en16196939">https://doi.org/10.3390/en161969</a> - LINK: <a href="https://doi.org/10.3390/en16196949">https://doi.org/10.3390/en16196949</a> - LINK: <

### **OneNet: Market Harmonization Framework**

The market architecture is formed by all market-based interactions

#### **Multilevel TSO-DSO market architectures**

TSO and the DSO are buyers in different submarkets **Two different layers** characterise the market architecture

#### **Common TSO-DSO market architectures**

The TSO and DSO layers collapse. **Both operators** (buyers) interacts with sellers **in the same submarket**.





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### **OneNet Spanish demonstrator: market architecture**



### **OneNet: Market Harmonization Framework**

### Mapping of OneNet demonstrators' market architectures into coordination schemes



#### OneNet Deliverable 3.1 and



Market Integration design challenge

<b>Demonstrator's Challenge</b>	Demonstrator's Solution	
<b>Enhancing TSO–DSO cooperation at the national level.</b> The complexity arises in achieving an efficient multi-layered TSO–DSO structure.	In some demonstrators <b>prioritize local markets</b> , with <b>flexibility allocations</b> <b>from local markets to national ones</b> . <b>Decentralized optimization</b> to ensure local constraints are accounted for before scaling to a national perspective.	
Integrate local and national markets in one cross-border architecture involving multiple TSOs and DSOs. The complexity here is in managing interactions across borders.	Some demonstrators adopted a <b>common TSO–DSO market</b> <b>architecture</b> , integrating both TSO and DSO as buyers in a single coordination platform that realizes a <b>centralized market optimization</b> .	



Liquidity and DERs participation

<b>Demonstrator's Challenge</b>	<b>Demonstrator's Solution</b>
Similar Straing Strain	Unlock DERs' potential by creating multiple business opportunities with value staking from the local to the national level.
Ensuring market liquidity with cross-border markets integration.	A common TSO–DSO market, ensuring all stakeholders, regardless of region, operate on a single platform unlocking cross-border and cross-service market participation.



**Ensuring proper allocation of flexibility** 

Demonstrator's Challenge	<b>Demonstrator's Solution</b>
Ensure adequate coordination between sub-markets that realizes a proper flow and prioritization of bids and optimizes flexibility allocation.	Sequential optimization and bid forwarding from local to national markets, with prioritization for DSOs.
	Centralized optimization with <b>bids shared between</b> <b>sub-markets</b> without TSO or DSO priority.

### Maintaining grid security with DERs

Demonstrator's Challenge	Demonstrator's Solution
With increasing distributed energy resources participating in the market, maintaining the security of the electricity supply becomes more complex.	<b>Bid filtering and aggregation at DSO level with grid</b> <b>constraints</b> check before bid forwarding to the TSO market.
	Flexibility register with prequalification to ensure grid constraints are respected and the uniqueness of bid selection among the sub-markets avoiding double clearing

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# Market architecture harmonization assessment: Coordination trough bid forwarding

As an example, we showcase two applications for the OneNet demonstrations:



OneNet Deliverable 3.2 and



Bindu, S., Troncia, M., Ávila, J. P. C., & Sanjab, A. (2023, June). Bid Forwarding as a Way to Connect Sequential Markets: Opportunities and Barriers. In 2023 19th International Conference on the European Energy Market (EEM) (pp. 1-6). IEEE. DOI: 10.1109/EEM58374.2023.10161855

# Flow Diagram of the Adopted Methodology for Bid Forwarding Potential Analysis



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### Market design features enabling bid forwarding



**Necessary:** Market design feature that <u>requires a strict compliance</u> -> **no harmonization procedure admitted** 

**Conditional:** Market design feature that <u>does not require a strict compliance</u> -> harmonization procedure possible

### Market architecture of the Spanish demonstrator



# Case 1: From Spanish short-term congestion management market to Spanish intraday auction markets

**Comparison of market design features** between Spanish OneNet local CM market and intraday auction markets

Market design feature	Spanish OneNet local CM market	Spanish intraday auction market
Allowed technology	No restriction by technology type	No restriction by technology type
Aggregation conditions	No restriction on aggregation	Generation and consumption cannot be aggregated in a single bid
Market time unit (MTU)	15 minutes	1 hour
Locational granularity	Nodal	Zonal
Gate Closure Time	Day-before delivery 14:45	Day-before delivery: 15:00, 17:50, 21:50 Intraday: 01:50, 04:50, 09:50
Type of product	Energy	Energy
Technical requirements	FAT < 1 hour	No specific technical requirements
Bid structure	Simple bids	Complex conditions allowed including maximum income condition and load gradient
Minimum bid size	0.01 MW	0.1 MW
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OneNet Deliverable 3.2 and



# Case 1: From Spanish short-term congestion management market to Spanish intraday auction markets - comparison

**Comparison of market design features** between Spanish OneNet local CM market and intraday auction markets

Market design feature	Spanish OneNet local CM market	Spanish intraday auction market
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Type of product	Energy	Energy
Technical requirements	FAT < 1 hour	No specific technical requirements
Bid structure	Simple bids	Complex conditions allowed including maximum income condition and load gradient
Minimum bid size	0.01 MW	0.1 MW

#### OneNet Deliverable 3.2 and



Favorable conditions



Bindu, S., Troncia, M., Ávila, J. P. C., & Sanjab, A. (2023, June). Bid Forwarding as a Way to Connect Sequential Markets: Opportunities and Barriers. In 2023 19th International Conference on the European Energy Market (EEM) (pp. 1-6). IEEE. DOI: 10.1109/EEM58374.2023.10161855

# Case 1: From Spanish short-term congestion management market to Spanish intraday auction markets - evaluation

The three unfavorable conditions for bid forwarding are aggregation conditions, market time unit and minimum bid size.

It may be **possible to forward the bids** between the markets by **designing an appropriate bid processing stage**.

The **bid processing stages required** for enabling forwarding are:

- Conversion of quarterly products to hourly products
- Aggregation of bids to meet the minimum size requirement, following the aggregation conditions of ID markets





Bindu, S., Troncia, M., Ávila, J. P. C., & Sanjab, A. (2023, June). Bid Forwarding as a Way to Connect Sequential Markets: Opportunities and Barriers. In 2023 19th International Conference on the European Energy Market (EEM) (pp. 1-6). IEEE. DOI: 10.1109/EEM58374.2023.10161855

### **Market phases harmonisation assessment**



**Commonalities among market phases, products, and services result in enhanced overall market efficiency.** However, **in certain scenarios, specific processes might be essential to cater to unique characteristics or needs**, such as technical requirements or local specificities.



#### **Dedicated phases:**

Dedicated market phases and procedures are established for each product, service, SOs, and markets.



### T11.2 market phases harmonization analysis scope

- ✓ Analysis of the demonstrators' solutions
- ✓ Understanding the harmonization potential

### **Prequalification phase**

Harmonised procedures across products

Harmonised procedures across SOs

Harmonised procedures across units and groups (simplification)



## **OneNet solutions for harmonised prequalification procedures**

### **Grid prequalification**



#### **Product prequalification**





### **COMMON prequalification procedure among DSOs and TSOs**

### **Arguments in Favour:**

### **Arguments Against:**





#### Please participate to this survey:

https://forms.office.com/e/2WKYhByGcA



## **COMMON prequalification procedure among DSOs and TSOs**

### **Requirements (must have conditions):**

- Interoperable platforms
- Robust Communication Infrastructure
- Shared Data Repositories
- Stakeholder Engagement
- Detailed Requirement Analysis
- Uniform Prequalification Criteria

#### **Barriers:**

- Differing Objectives
- Operational Inertia (or Path Dependency)
- Data Privacy Concerns

#### **Enablers (nice to have conditions):**

- Pilot Projects and Test Beds
- Digital Twins
- Quality Assurance
- Joint Training Initiatives
- Stakeholder Forums
- Benchmarking
- Regulatory Support
- Incentive Mechanisms



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Procedural

al Regulatory

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https://forms.office.com/e/2WKYhByGcA

### **COMMON prequalification procedure across products**

### **Arguments in Favour:**



### **Arguments Against:**





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#### Please participate to this survey:

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# **COMMON prequalification procedure across products**

### **Requirements (must have conditions):**

- Standardized (Unified) Technical Requirements
- Interoperable IT Systems
- Requirements Adequacy
- Pilot Testing
- Unified Regulatory Framework:
- Neutrality

### **Barriers:**

- Divergent Technical Needs
- Incompatible IT Systems
- Potential for Service Disruption

 Conflicting Regulatory Mandates

#### **Enablers (nice to have conditions):**

- Clear Economic Incentives
- Transparent and Uniform Procedures
- Flexible Integration Mechanisms
- Robust Dispute Resolution Mechanism
- Continuous Training and Capacity Building
- Feedback Mechanism

- Lack of Stakeholder Consensus
- Complex Integration Procedures



Procedural Regulatory

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## **Prequalification procedure for resources' portfolios**

### **Arguments in Favour:**





### **Arguments Against:**





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Please participate to this survey:

# **Prequalification procedure for resources' portfolios**

### **Requirements (must have conditions):**

- Portfolio Management Framework
- Aggregate Performance Metrics
- Advanced Monitoring & Control Systems
- Interoperability Standards
- Detailed Asset Documentation

#### **Enablers (nice to have conditions):**

- Scalability
- Advanced IT Systems
- Integrated Data Repositories
- Regulatory Support:
- Knowledge & Expertise
- Industry Collaboration:

#### **Barriers:**

- Lack of Standards
- Integration Challenges

- Regulatory Hurdles
- Complexity

- Economic Hurdles
- Resistance to Change
- Data Privacy and Security Concerns



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Procedural Regulatory

Please participate to this survey:

### **Conclusions**

The energy transition requires **innovating the electricity sector** to maximise the use of renewable energy sources. Satisfactory levels of **liquidity and competition** allow **reducing costs and increasing reliability** in service provision. **OneNet project** contributes addressing the **integration of flexibility service markets**:

- Devises and demonstrates solutions for harmonising products and markets functioning;
- Proposes instruments to guide the design activities of future integrated electricity markets;
- **Demonstrates in real conditions** the proposed solutions filling the gaps related to the lack of historical information and empirical experience.

Market coordination is a promising means to allocate the available resources across markets, to enable this channel, market harmonisation is required. To promote market harmonisation, it is recommended:

- Local markets should be designed by maximising the bid forwarding potential with the existing markets (e.g., coherent timings, compatible products, favourable aggregating conditions)
- Define clear rules, roles, and responsibilities regarding the bid processing stage (how aggregation is done, how to convert from one MTU to another etc).
- Prequalification conditions should be designed to maximise participation in a way that allows the resources in participating in local markets to also participate in central markets.



## Market coordination through harmonization

The OneNet journey in the harmonised market design





### Thank You

### Matteo Troncia, Ph.D.

#### **Contact Information**

Affiliation: Comillas Pontifical University, Institute for Research in Technology (IIT) Email: matteo.troncia@iit.comillas.edu

#### **Credits:**

Matteo Troncia (Comillas) Shilpa Bindu (Comillas) José Pablo Chaves Ávila (Comillas) Gwen Willeghems (VITO) Helena Gerard (VITO) Madalena Lacerda (E-REDES) Beatriz Corceiro (E-REDES)

