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EDITORIAL



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## EDITORIAL



Dear Reader,

As the energy transition advances, the challenge is increasingly moving from defining innovative concepts to demonstrating how they can operate effectively in real power systems, energy markets and infrastructures.

Digitalisation, flexibility, artificial intelligence, energy data and storage are becoming closely interconnected elements of this transformation. **At R&D Nester, we continue to contribute to this evolution through research, development and demonstration activities** that combine technological innovation with the practical requirements of power system operation-always guided by our motto, "Creating a Smart Energy Future".

This 30th edition of our Newsletter provides several examples of this progression from concepts and digital tools towards practical implementation. A central highlight is the **STUNNED project**, where R&D Nester is developing a **Market Emulator** to reproduce key European electricity market mechanisms and support the testing of flexibility strategies involving buildings, energy communities and industrial assets. By covering day-ahead, intraday and balancing markets, this work provides an important environment for assessing how distributed flexibility can participate in increasingly dynamic electricity markets.

The same connection between advanced digital technologies and real power system needs is visible in **HEDGE-IoT**. As the project progresses towards large-scale demonstration, R&D Nester and REN continue contributing to the Portuguese pilot, bringing together **distributed flexibility, energy communities, AI-based services, interoperable data exchange and future market participation mechanisms**. These activities illustrate the importance of ensuring that digital innovation remains firmly connected to the operational realities of the electricity system.

Artificial Intelligence is another important theme in this edition. **EnergyGuard** has now reached its mid-project milestone and is moving from the development of architectures and digital environments towards large-scale experimentation and validation. R&D Nester continues to play a central role through the **Digital Twin of a large-scale transmission network and the coordination of demonstration activities**, helping to ensure that AI solutions for the energy sector can be tested under realistic operating conditions before wider deployment.

We also report on important progress in U2DEMO and INSIEME. **U2DEMO** is moving towards the implementation of its pilot demonstrations, combining energy sharing, forecasting, optimisation, interoperability and the valorisation of distributed energy resources. **INSIEME**, meanwhile, continues the development of the **Common European Energy Data Space**, addressing not only technical interoperability but also governance, standardisation and trusted data exchange. Together, these projects highlight how active consumers, energy communities and data-driven services are becoming increasingly relevant components of the future energy system.

Looking further ahead, this edition also introduces **AVANGUARD**, a new European project dedicated to **Long-Duration Energy Storage**. As renewable penetration continues to increase, storage will become increasingly important for addressing curtailment, congestion, flexibility, sector coupling and security of supply. R&D Nester will contribute across several areas, including power system planning, market analysis and the assessment of storage solutions in the Iberian energy system.

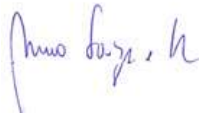
Under the **Technical Information section**, we return to one of the central themes of this Newsletter with an article on the emulation of **European electricity markets for flexible energy systems**. The article explains how the STUNNED Market Emulator reproduces day-ahead, intraday and balancing market mechanisms, creating a controlled environment in which market participation strategies and digital solutions can be developed and tested before their application in real systems.

As usual, we also invite you to explore our Literature Review, Events and Links sections, and to test your knowledge in the Quiz, which this time addresses recent developments in renewable generation, energy storage and flexibility in Portugal.

We hope you enjoy this 30th edition and that it provides useful insight into how R&D Nester is helping bridge research, digital innovation and real-world implementation in the energy transition.

Thank you for following our activities and for joining us in our mission to create a Smart Energy Future.

Sincerely,



Nuno de Souza e Silva  
Managing Director



## HIGHLIGHTS



# R&D NESTER ADVANCING DIGITAL ENERGY MARKETS AND FLEXIBILITY SOLUTIONS FOR EUROPE IN PROJECT STUNNED

## STUNNED PROJECT - THE CHALLENGE

**STUNNED Project** - "SisTemic mUltilevel optimized orchestration of energy maNagement systEms for resiDential, industrial and tertiary energy flexibility services" aims to support the reduction of energy demand from end-users, energy communities and energy districts through the use of intelligent energy management systems for the integration of renewable energy sources and demand-side assets for the provision of flexibility services to the grid operators, contributing to the robustness of the power system.

The **STUNNED** project seeks to lower the overall energy demand of groups of end-users (residential and industrial buildings) grouped together in energy communities or energy districts. **STUNNED** will address this challenge through the integration of renewable energy sources, electric vehicles, and various proprietary energy management systems (EMS), as well as the provision of ancillary services like Demand Response (DR), peak shaving, load shifting, balancing and frequency services, and congestion management.

The project's consortium is composed of 18 members, from 6 different countries, which will be engaged in this project until April 2028.

## R&D NESTER'S ROLE AND RESPONSIBILITIES IN THE PROJECT

Since the beginning of the **STUNNED** project, **R&D Nester** has played a **central technical role** in the development of digital tools supporting energy flexibility and market participation.

In particular, **R&D Nester** leads a task on **Energy Management Platform Development and Testing**, where it is responsible for **Development and Testing of the Market Emulator** adapted to the contexts of the French, Spanish and Italian markets and drafting of the respective **report (Deliverable)**.

This work enables the simulation of real electricity market mechanisms within the **STUNNED** platform, supporting the assessment of **how buildings, communities, and industrial assets can provide flexibility services** in current and future energy markets.

## KEY ACHIEVEMENTS TO DATE

The **STUNNED** project had its most recent General Assembly (GA), hosted by MIW (My Energia Oner SL) in Murcia, Spain.



The meeting gathered all consortium partners to assess progress achieved so far, align technical activities for the next project phase, and collaborate in technical workshops and visit the Spanish demonstration sites.

During the General Assembly, **R&D Nester** presented the progress achieved so far on the **Market Emulator**, one of the project's core digital components.

#### Highlights include:

- \* Implementation of **Day-Ahead Energy Market**, **Manual Frequency Restoration Reserve (mFRR)**, and **Replacement Reserve (RR)** modules, adapted to the French, Spanish and Italian contexts;
- \* Ongoing development of the **Intraday Energy Market** module, adapted to the French, Spanish and Italian contexts, with completion expected in the coming months;
- \* Preparation for the integration of **balancing market products**, increasing realism for flexibility testing;
- \* Alignment of the emulator with the **STUNNED platform architecture**, supporting aggregator strategies and optimization algorithms.



These developments position the Market Emulator as a **key enabler for testing flexibility strategies** under realistic market conditions, contributing to both technical validation and future exploitation pathways.

### TECHNICAL WORKSHOPS AND SITE VISITS

As part of General Assembly agenda, partners participated in **technical workshops and on-site visits** to the Spanish demonstration sites, reinforcing the practical dimension of the project.

Participants visited **New Concisa**, an industrial site equipped with photovoltaic systems, batteries, and industrial processes relevant for flexibility provision.



The team also visited **Parque Científico de Murcia**, an institutional building where smart metering and energy monitoring solutions are being deployed:



These visits provided valuable insight into the **real operating conditions** that digital solutions such as the Market Emulator must reflect, strengthening the **link between simulation, control strategies, and real-world implementation**.

### **STUNNED PROJECT - GOAL**

Through a demonstration campaign in three distinct EU countries (Italy, Spain, and France), the technological, economic, and regulatory viability of the suggested solution will be confirmed.

One of the main focuses of developing the **STUNNED** concept will be replication, market design, and exploitation.

Additionally, **STUNNED** will create a solution that is consistent with the ongoing regulatory framework and offer suggestions for improving and modernizing the laws pertaining to energy communities.

For more information:



[STUNNED Project website](#)

[STUNNED Project @ R&D Nester website](#)

## HEDGE-IOT: ADVANCING AI, IOT AND FLEXIBILITY FOR THE FUTURE POWER SYSTEM

**HEDGE-IoT** European Project's main objective is to revolutionise energy systems by deploying IoT assets across different levels, from behind-the-meter to the TSO level, and infusing intelligence into the edge and cloud layers using advanced AI/ML tools.

**HEDGE-IoT** will introduce a groundbreaking Digital Framework that bridges the cloud/edge continuum and introduces federated applications governed by advanced computational orchestration solutions. This framework will enhance the resilience of the grid, unlock untapped flexibility potential, and create new market opportunities.

**R&D Nester** contributes to **HEDGE-IoT** by bringing a strong **power system, flexibility and market-simulation perspective** to the development of AI, IoT and Edge-Cloud solutions. Its work is mainly connected with the definition of stakeholder and system requirements, technological enablers, and demonstration activities, particularly in the scope of the Portuguese pilot.

**R&D Nester's** role is especially relevant in the bridge between **digital energy services** and **real power system needs**. In practice, this means contributing to how distributed energy resources, including residential, commercial and community-based assets can be monitored, aggregated, simulated and eventually connected to flexibility services and ancillary service mechanisms.

**R&D Nester** and REN participated in the **4th HEDGE-IoT Plenary Meeting**, in Mikkeli, Finland.



HEDGE-IoT partners group photo

The meeting brought together the project consortium to assess the progress achieved so far, align the technical work towards the next review milestone, and prepare the transition from fully functional implementations to large-scale demonstration activities.

The meeting took place at a particularly important moment for **HEDGE-IoT**. The project has now reached the **M28 milestone**, corresponding to the phase of **fully functional implementation** of the demonstrators. This follows the earlier **M18 proof-of-concept phase** and prepares the ground for the **M38 large-scale demo operation phase**, planned for March 2027.





Kissakoski substation visit



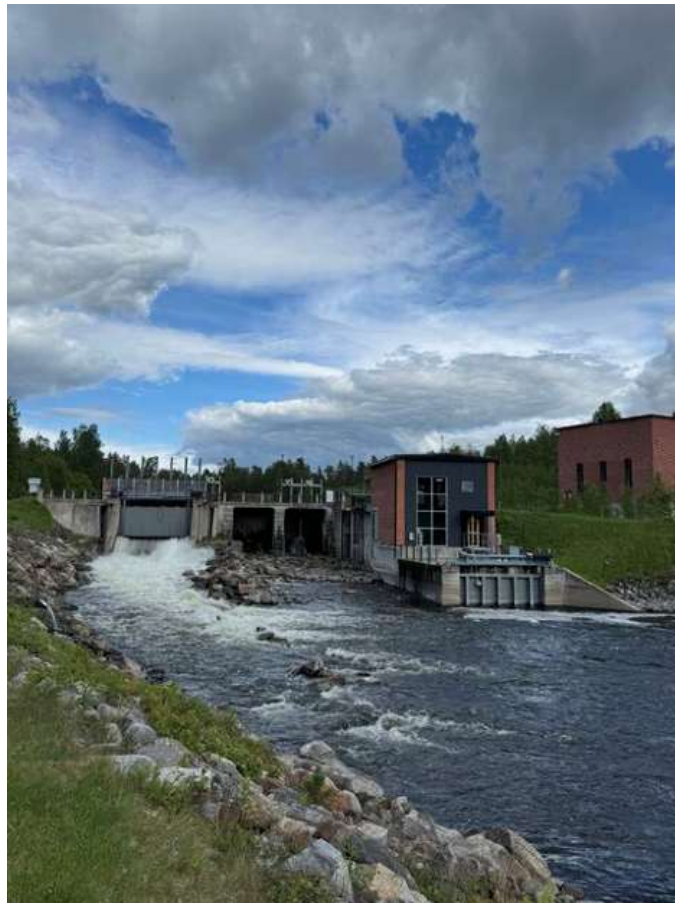
Kissakoski substation power transformer



Kissakosken small hydro power plant visit



Kissakosken small hydro power plant control room visit



Kissakosken small hydro power plant

[For more information:](#)



[HEDGE-IoT website](#)

[HEDGE-IoT @ R&D Nester website](#)

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## FROM DIGITAL TWINS TO REAL-WORLD AI VALIDATION IN POWER SYSTEMS: THE ENERGYGUARD PROJECT REACHED ITS MONTH 18 MILESTONE

The European Project **EnergyGuard** project is building a European Testing and Experimentation Facility (TEF) for trustworthy AI in the energy sector, integrating real infrastructures, high-fidelity digital twins and regulatory assessment environments.

The project reached its Month 18 milestone: at mid-project, much of this foundation is now in place.

The **EnergyGuard** consortium met in Soria, Spain, for its Month-18 in-person meeting, hosted by CIEMAT and FORA at the FORA facilities.



The gathering marked a pivotal point in the project: beyond coordination, partners reviewed concrete technical results already delivered and aligned on the next phase, where **EnergyGuard** moves decisively from framework building to large-scale experimentation and validation of AI solutions under real operating conditions.

Since the start of the project, **R&D Nester** has played a central technical role, acting as the reference facility for large-scale transmission system testing within **EnergyGuard**, and leading the Work Package 6 on the coordination of the demonstrations.

To date, **R&D Nester** has been actively involved in four work packages and in the following core technical outputs:

#### **Digital Twin of Transmission Network with high-share of renewables:**

**R&D Nester** contributes a high-TRL digital twin of a transmission system with realistic size, capable of offline, real-time and hardware-in-the-loop simulations.

This asset underpins EnergyGuard's smart-grid pilot and enables testing of AI solutions against realistic network dynamics, protection behaviour and communication constraints.

#### **Smart grid pilot leadership (WP6 - Pilot 1):**

**R&D Nester** leads the pilot focused on AI services for smart-grids operation, including:

- \* Real-time co-simulation of transmission systems
- \* AI-based fault detection and classification using COMTRADE data from protection relays
- \* Model-free voltage profile estimation techniques for low-observability Low Voltage networks

### **PROJECT'S ACHIEVEMENTS: A TEF TAKING SHAPE**

Across the consortium, several tangible achievements were highlighted in Soria:

- \* The **EnergyGuard** architecture is fully defined, integrating data services, AI development sandboxes, HPC resources and an acceptance environment for trustworthy AI.
- \* Digital twins from all five facilities (transmission network, microgrid, hydrogen platforms, buildings and energy communities) are being operationally connected to the platform.
- \* Early versions of the AI development testing sandbox are running, enabling end-to-end experimentation workflows.
- \* Pilot experiments are moving from design to execution in smart grids, microgrids with high-RES penetration and hydrogen systems.
- \* The foundations of the common AI risk database for the energy sector are in place, linking technical testing to regulatory and ethical assessment.

The Soria meeting clearly showed that **EnergyGuard** has moved beyond "architecture on slides" into hands-on experimentation.

### **FROM MEETING ROOMS TO FIELD REALITY: TECHNICAL SESSION AT CEDER-CIEMAT**

A highlight of the meeting was the technical visit and working session at the CEDER-CIEMAT microgrid, a real operational system combining wind, photovoltaics, batteries, EV charging and grid-connected operation.

Partners discussed how AI models trained in simulation behave when confronted with:

- \* Fast renewable intermittency
- \* Non-ideal measurements
- \* Storage constraints
- \* Network topology changes in radial and ring operation

This on-site session reinforced one of **EnergyGuard**'s core principles: trustworthy AI cannot be validated without exposure to real-world complexity.

For **R&D Nester**, the discussion closely mirrored challenges already seen at transmission level, strengthening the conceptual bridge between microgrids and large-scale networks.

### **OBJECTIVES FOR THE REMAINING MONTHS: FROM VALIDATION TO IMPACT**

Looking ahead, the **EnergyGuard**'s ambition is clear for the second half of the project:

- \* Deliver fully validated AI use cases across grids, hydrogen, buildings and energy communities.
- \* Populate the European AI ecosystem with trustworthy, test-backed energy AI assets.
- \* Demonstrate that rigorous AI testing can reduce time-to-market, cost and risk for critical energy applications.
- \* Lay the technical and business foundations for a self-sustaining **EnergyGuard** TEF beyond the project lifetime.

[For more information:](#)



[EnergyGuard website](#)

[EnergyGuard Project @ R&D Nester website](#)

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## **U2DEMO EUROPEAN PROJECT GENERAL ASSEMBLY ADVANCES INNOVATIVE SOLUTIONS FOR ENERGY COMMUNITIES**

The **U2Demo** project (**Use of open-source P2P energy sharing platforms for energy democratization**) funded by the European Union's Horizon Innovation Actions, aims to create innovative, consumer-centered management strategies that facilitate a widespread participation in Peer-to-Peer (P2P) trading and energy sharing.

**R&D Nester** participated in the European **U2DEMO** project General Assembly, held in Karlsruhe, Germany, hosted by EIFER - European Institute for Energy Research.



The meeting brought together project partners to review technical progress and align the next steps towards the implementation of pilot demonstrations across Europe.

As **U2DEMO** moves from concept development to real-world implementation, discussions focused on integrating key technologies including peer-to-peer (P2P) energy sharing solutions, forecasting, optimization, and the **U2DEMO** Digital Spine platform, ensuring interoperability across all components of the ecosystem.

Within **U2DEMO**, **R&D Nester** leads Task 2.2, focused on forecasting and data analytics methods to support the decision-making of Active Consumers and Energy Communities, and Task 3.2, dedicated to standards, interoperability and cybersecurity, ensuring secure and seamless data exchange across the platform and demonstration sites.

**R&D Nester** is also responsible for defining the project's Common Data Model, enabling consistent and harmonized data representation across all tools and partners.

A key technical contribution is the development of the DER Valorization Tool, a high-performance Energy Management System (EMS) optimizer that schedules distributed energy resources such as batteries, electric vehicles, HVAC systems and flexible loads, while optimizing their interaction with photovoltaic generation and the electricity grid to maximize flexibility and system efficiency.

The meeting also included a technical visit to the [KIT Energy Center](#), reinforcing the importance of validating innovative energy solutions under real operating conditions.

Over the coming months, the consortium will focus on integrating the developed technologies and advancing pilot demonstrations across Europe.

[For more information:](#)



[U2DEMO website](#)

[U2DEMO project @ R&D NESTER website](#)

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## COMMON EUROPEAN ENERGY DATA SPACE (CEEDS) INSIEME PROJECT PLENARY MEETING

The **INSIEME** European project is advancing Europe's transition towards fully digitalised, decarbonised and distributed energy infrastructures through large-scale collaboration across the energy and data value chain.

With a consortium of more than 50 European partners, **INSIEME** is developing and piloting the remaining building blocks needed for the full operationalisation of the Common European Energy Data Space, bringing Europe's energy data infrastructure closer to reality through more than 15 deployments across EU Member States.

From 14<sup>th</sup> to 16<sup>th</sup> of April, the **INSIEME** project consortium gathered at ENEDIS headquarters in Paris for a three-day plenary meeting, bringing together project partners to review the progress achieved during the project's first year, align on key developments, and discuss the next steps towards the implementation of the **Common European Energy Data Space (CEEDS)**.



The meeting highlighted progress in the development of the **INSIEME** architecture, the preparation of the project's European deployments and the definition of the technical and governance foundations required to connect energy data ecosystems across countries, organisations and sectors.

A central topic was the development of the **Common Reference Model**, which is intended to support consistent data exchanges and improve interoperability and scalability across European energy data ecosystems. This work will help different national and European data spaces communicate through common models and interfaces, while supporting connections with data spaces from other sectors.



A particular highlight of the plenary meeting was the stakeholder roundtable event held on 16<sup>th</sup> of April, which brought together representatives from European TSOs, DSOs, policymakers, research organisations, technology providers and industry to discuss the future of European energy data spaces.

The discussions focused on four key themes shaping the future European energy landscape:

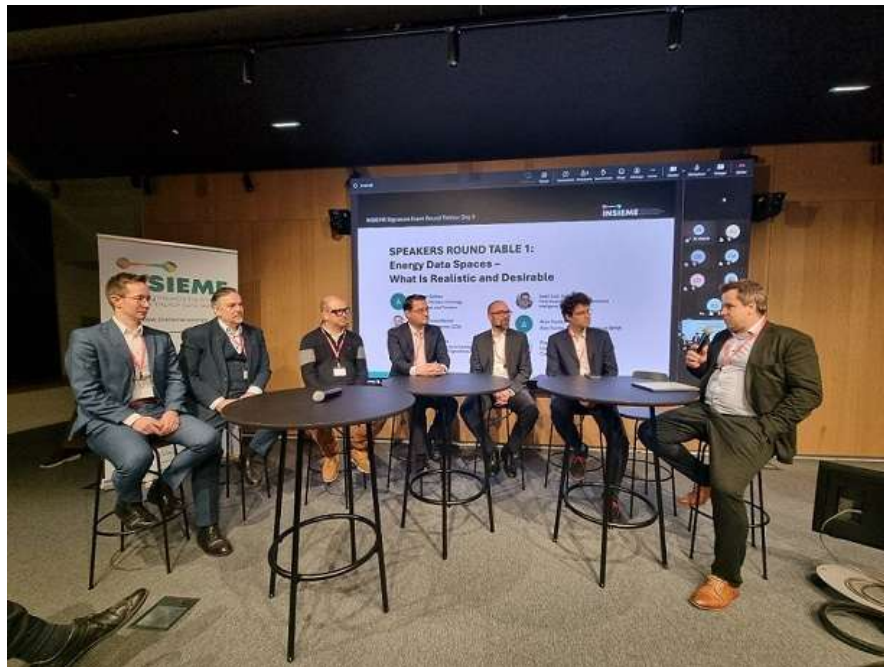
- \* **Building practical Energy Data Spaces**, examining how better data integration can improve affordability, grid reliability and European competitiveness while ensuring robust data protection

and customer trust.

- \* **Governance and value creation**, exploring how interoperable data sharing can unlock new digital services, support AI-enabled applications, preserve data sovereignty and create value for both regulated and competitive energy markets.

- \* **Data-driven flexibility services**, discussing how secure and interoperable data exchange can enable scalable flexibility mechanisms, energy communities, real-time grid management and resilience through coordinated collaboration between system operators, energy suppliers and consumers.

- \* **Standardisation as the foundation of interoperability**, highlighting the importance of harmonised European standards, federated data spaces and common information models to ensure secure and consistent data exchange across the energy sector.



These discussions reinforced one of INSIEME's central messages: the future energy system depends not only on digital technologies but also on trusted governance, common standards and effective collaboration between all stakeholders.

REN and **R&D Nester** continue to play a key role in advancing the project, particularly through:

- \* The development of the PEGNIPO ("Portuguese Electricity and Gas Networks for Integrated Planning and Operation") deployment;
- \* Contributions to governance and stakeholder engagement activities;
- \* Participation in ongoing technical work related to data spaces and interoperability.

Looking ahead, the consortium will continue refining and validating the project's technical solutions, strengthening interoperability between the different deployment sites and further advancing the implementation of the Common European Energy Data Space. By combining large-scale demonstrations, common reference models and collaborative governance, INSIEME is helping establish the digital foundations needed for a more resilient, flexible and integrated European energy system.

[For more information:](#)



[INSIEME Project website page](#)



This work has been co-funded by the European Union's Digital Europe Programme under grant agreement No. 101194952

# BUILDING THE DIGITAL FOUNDATIONS FOR LONG-DURATION ENERGY STORAGE IN EUROPE AVANGUARD EUROPEAN PROJECT KICKS OFF

**AVANGUARD Project** - "Advanced Data-Driven Strategies for Optimized Long Duration Energy Storage Deployment in Multi-Energy Networks" is a Horizon Europe-funded project who joins the efforts of 30 partners across the Europe and the full spectrum of Long Duration Energy Storage actors.

Over the next four years, the project will develop and demonstrate the first fully open-source, Python-based digital platform dedicated to assessing, planning, and optimizing Long-Duration Energy Storage (LDES) across interconnected energy systems.

As Europe accelerates the integration of renewable energy, one of the biggest challenges is no longer how to generate clean electricity, but how to store it and use it when needed. Long-Duration Energy Storage technologies will play a central role in addressing renewable curtailment, grid congestion, system flexibility, sector coupling, and energy security.

In June 2026, the **AVANGUARD** project officially started with its kick-off meeting at the Technical University of Denmark (DTU), bringing together a multidisciplinary consortium of 30 organizations from across Europe.



**AVANGUARD** aims to provide stakeholders with the digital tools needed to answer fundamental questions:

- \* Where should storage be deployed?
- \* Which technologies are the most suitable?
- \* What value can they create for power systems, markets, industries and society?

The project will combine advanced planning, network analysis, market simulation and techno-economic modelling within a single platform, validated through real-world use cases in Spain-Portugal, Denmark-Sweden, Italy and Croatia.

Technologies under assessment will range from flow batteries and thermal storage systems to hydrogen-based storage and innovative pumped hydro concepts.

**R&D Nester's** involvement spans the entire **AVANGUARD** value chain, from the early definition of stakeholder needs and system requirements for LDES deployment to the validation of real-world applications. The team will contribute to the development, collection, and validation of datasets representing Portugal and the wider Iberian region, while supporting the implementation of the **AVANGUARD** Data Hub and its open-access modelling ecosystem.

**R&D Nester** will also participate in the enhancement of advanced power system planning tools, network simulation models, and market-oriented assessment methodologies, helping to evaluate the technical and economic value of different LDES technologies. A central part of its role will be the validation of LDES benefits through the cross-border demonstration between Spain and Portugal, where storage solutions will be assessed for their contribution to renewable integration, grid flexibility, and system resilience.

Finally, **R&D Nester** will help translate project findings into regulatory, market, and policy recommendations that can support the large-scale deployment of long-duration energy storage across Europe.

[For more information:](#)



[AVANGUARD LinkedIn page](#)

[R&D Nester website](#)



## TECHNICAL INFORMATION



# EMULATING EUROPEAN ELECTRICITY MARKETS FOR FLEXIBLE ENERGY SYSTEMS

Europe's energy system is evolving quickly. As wind and solar grow, the grid needs more **flexibility**. The ability to adjust generation or consumption when reality doesn't match forecasts. This creates a concrete challenge for aggregators, energy communities and technology providers that need to design, test and validate market strategies before real participation is possible. That's where market emulators come in.

In the STUNNED project, **R&D NESTER developed a Market Emulator**: a modular, reproducible simulation environment that replicates the clearing behaviour of key European markets, so we can stress test ideas, train bidding strategies and validate system integration before deployment.

### THE STUNNED MARKET EMULATOR

At a high level, R&D NESTER's Market Emulator **receives bids**, applies the clearing rules of each market layer and then **return market outputs**, including the accepted quantities and clearing prices, matched trades or balancing activations/rejections.

This is especially useful for countries where flexibility market structures are still developing, because it gives stakeholders a safe way to explore "what would happen if..." scenarios without the risk.

### WHY SIMULATE MARKETS AT ALL?

Electricity trading is not a single market. It's a **stack of markets** operating on different timescales. Participants may buy or sell energy day ahead, adjust positions intraday and then try to provide balancing services to keep the system stable when last minute deviations occur.

For flexibility service providers and aggregators, value often comes from **revenue stacking**, which means using the same physical flexibility (e.g., batteries, HVAC, industrial loads) to earn income across multiple markets, while staying compliant with market rules.

A good emulator allows teams to answer practical questions such as:

- \* What happens if an aggregator shifts capacity from intraday into balancing market?
- \* How do execution rules like "Fill or Kill" change the outcome of a trade?
- \* Can our software reliably submit bids and interpret results in the formats used by real systems?

Because **R&D Nester's Market Emulator is deterministic and reproducible**, the same scenario can be replayed many times, making it ideal for development, training and interoperability testing.

In **STUNNED**, the Market Emulator reproduces the clearing behaviour of three main components used by the pilots: SDAC (day ahead energy market), XBID (intraday continuous energy market) and Balancing Markets - mFRR (Manual Frequency Restoration Reserve) and RR (Replacement Reserves) ancillary services.

Each component has its own rules, timing and outputs. However, they share the same goal: translating bids into a set of accepted volumes, prices, trades or activations, which will ultimately result in revenues.

### SDAC (DAY AHEAD): PLANNING TOMORROW WITH AN AUCTION

The day ahead market works as a coordinated auction. Bids for supply and demand are collected for each **15 minute Market Time Unit (MTU)**, then cleared after gate closure (midday on D 1). Supply bids are sorted from lower to higher prices, demand bids from higher to lower prices and the intersection of the curves yields the **Market Clearing Price (MCP)** and the traded quantity for each MTU. At the clearing price, bids "in the money" are accepted, bids "out of the money" are rejected and bids exactly at the clearing price can be accepted **pro rata** when needed.

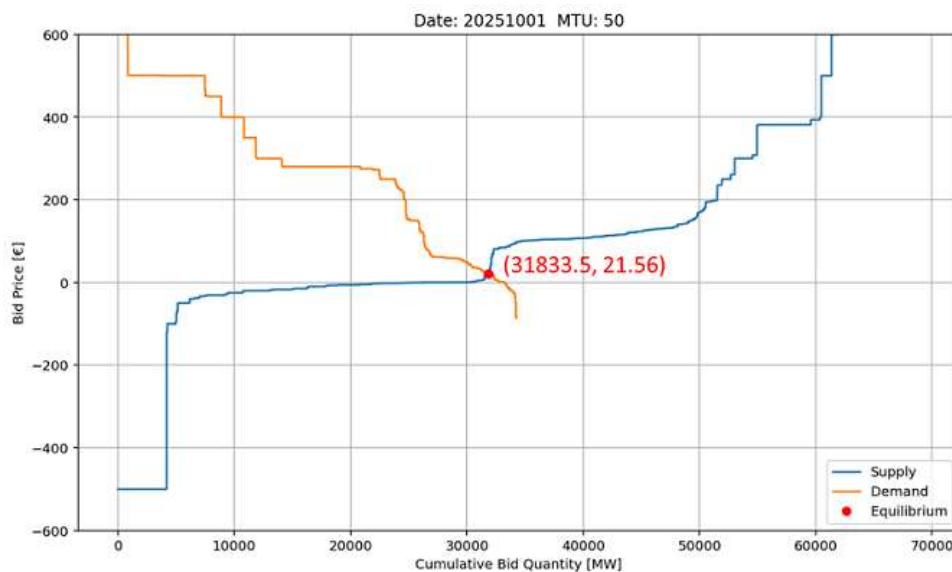


Figure 1 - Simulated Supply and Demand aggregated curves for 12h15, October 1st, 2025, in Spain.

### **XBID (Intraday Continuous): trading like a live exchange**

Intraday continuous trading works differently: it's a peer to peer model based on a shared Order Book. Participants submit buy and sell orders that can match continuously, often using a price time priority logic similar to financial markets.

The Market Emulator supports common intraday order behaviours such as:

- \* **NON** (can match immediately or rest in the Order Book),
- \* **IOC** (match now or cancel),
- \* **FOK** (must fully match now or cancel),
- \* **ICE (iceberg)** where only part of the volume is visible and replenishes as it trades.

Outcomes can be immediate trades, a rejection or insertion into the Order Book (where the order remains until it matches later or expires at gate closure).

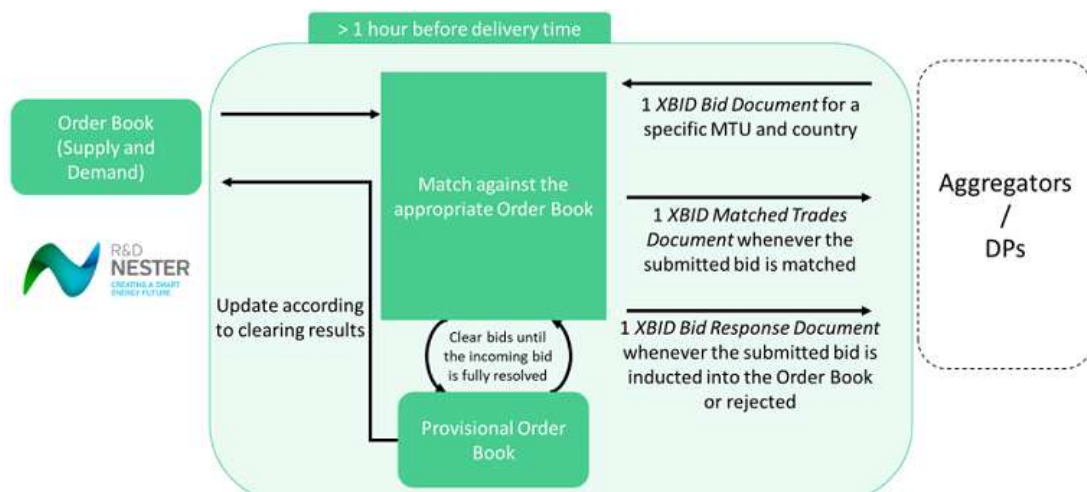


Figure 2 - High-level XBID clearing process of the STUNNED Market Emulator showing bid submission, clearing engine and result publication.

### **BALANCING (MFRR / RR): STABILITY WHEN REALITY DEVIATES**

Balancing markets exist to keep the power system stable when production and consumption drift from scheduled plans. In **STUNNED**, R&D NESTER's Market Emulator covers **mFRR** and **RR** balancing services and clears bids against TSO needs.

Bids are aggregated by MTU and direction ("Up" and "Down"), then the Market Emulator determines a marginal activation price and accepts cheaper bids first, using **pro rata** activation when multiple bids sit at

the marginal price. Outputs are produced using message structures aligned with ENTSO E CIM style reserve bid and activation/rejection documents, supporting downstream integration and automation.

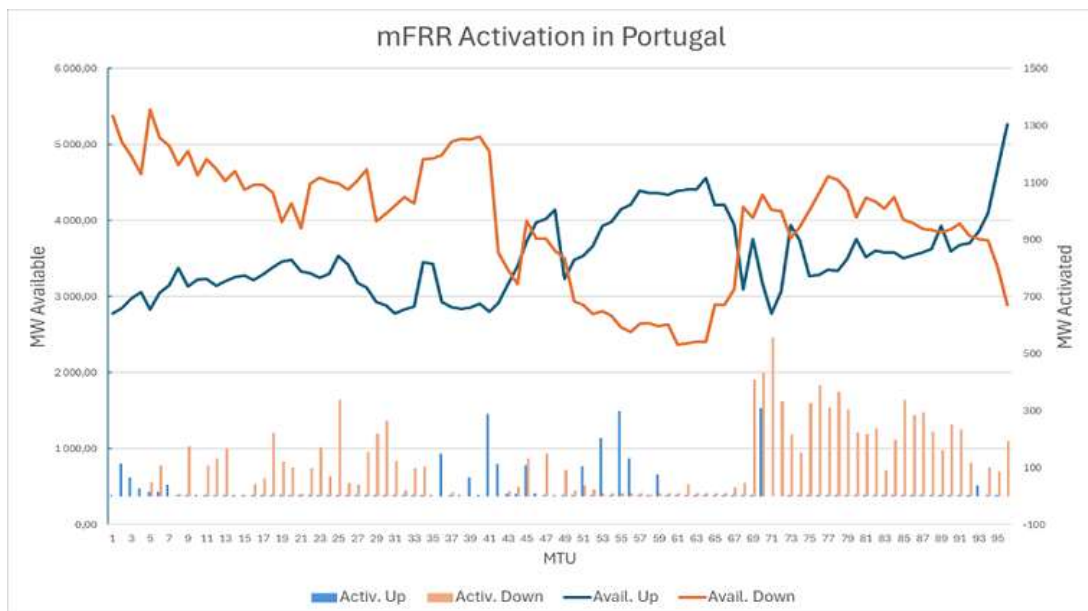


Figure 3 - Example of mFRR Availability and Activation in Portugal (Source: REN 18/02/2026)

### FROM SANDBOX TO PILOTS: WHAT COMES NEXT

The Market Emulator includes a **practical interface**, which allows the submission of bids for SDAC, XBID, mFRR and RR, enabling other STUNNED components to interact with it like they would with real market systems.

Figure 4 - Market Emulator Bid Submission Endpoint Details for mFRR bid

R&D Nester's Market Emulator let us **test energy and flexibility market participation safely, repeatedly and realistically**, building confidence in strategies and software before the real grid is ever involved.

For more information:



[STUNNED Project website](#)

[STUNNED Project @ R&D Nester website](#)



LITERATURE REVIEW



# The Energy Council's Annual Global Industry Survey Report 2026 - Energy Council - Apr/2026

In a season of extraordinary disruptions to global oil and gas markets arising from the conflict in the Persian Gulf, nearly 200 senior managers from all sectors of the energy industry shared their perspectives and insights with the Energy Council as part of our annual survey. Timing is everything in energy markets, and the Energy Council's 2026 survey engaged senior managers just when the war in the Middle East was in its first days. So, this meant many respondents had not fully digested the implications of the conflict on energy markets. Furthermore, the scale and severity of the disruption could not be foreseen by anyone in those early days. Had the survey been conducted a mere two weeks later, year-end oil price forecasts would certainly have trended significantly higher than the sub-\$75 forecast estimated by 84% of respondents.

As this survey report was finalized, the prospect of a long-term supply crisis was growing with damage to oil and gas infrastructure that could take months to repair. While the duration and eventual outcomes of the war were still unknown at the time of this report's publication, the 2026 survey nonetheless reveals some important long-term trends and strategic considerations in the energy industry.



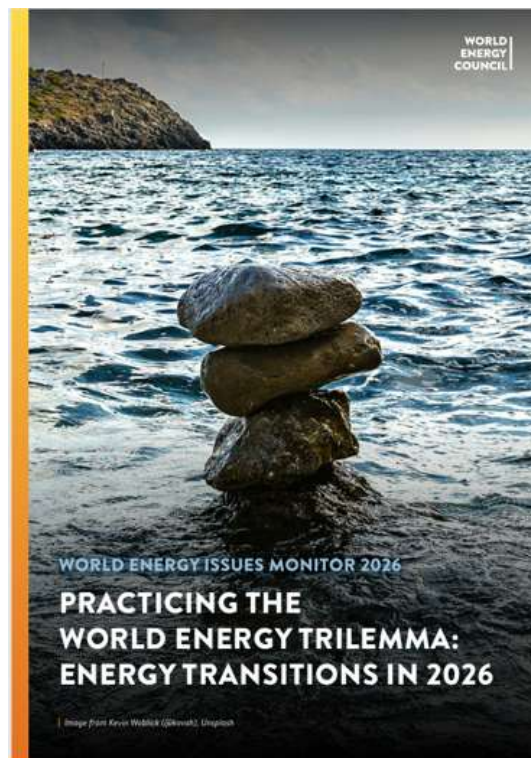
[LINK FOR PUBLICATION](#)

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## WORLD ENERGY ISSUES MONITOR 2026 - WORLD ENERGY COUNCIL - Mar/2026

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[LINK FOR PUBLICATION](#)



## EVENTS



20 -21 Oct  
2026

AMSTERDAM, THE  
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## QUIZ



1) FOR THE FIRST TIME IN PORTUGAL, WHICH TECHNOLOGY BECAME THE LARGEST SOURCE OF ELECTRICITY GENERATION DURING A MONTH IN JULY 2026?

- ☐ A) Wind
- ☐ B) Solar
- ☐ C) Hydropower
- ☐ D) Biomass

4) IN JULY 2026, APPROXIMATELY HOW MUCH SOLAR AND WIND CAPACITY IN PORTUGAL WAS AUTHORISED TO PARTICIPATE IN THE MFRR MARKET?

- ☐ A) 340 MW
- ☐ B) 750 MW
- ☐ C) 1,668 MW
- ☐ D) 3,800 MW

2) APPROXIMATELY WHAT SHARE OF PORTUGUESE ELECTRICITY CONSUMPTION WAS SUPPLIED BY RENEWABLE GENERATION DURING THE FIRST HALF OF 2026?

- ☐ A) 45%
- ☐ B) 58%
- ☐ C) 71%
- ☐ D) 89%

3) WHICH OF THE FOLLOWING TECHNOLOGIES CAN PROVIDE ENERGY STORAGE WITHOUT USING AN ELECTROCHEMICAL BATTERY?

- ☐ A) Pumped-storage hydropower
- ☐ B) Thermal energy storage
- ☐ C) Both A and B
- ☐ D) Neither A nor B

5) IN R&D NESTER'S PORTUGUESE WEFORMING DEMONSTRATOR, WHICH ASSET IS BEING USED TO TEST THE ABILITY OF A LARGE COMMERCIAL BUILDING TO SHIFT ITS ELECTRICITY DEMAND?

- ☐ A) Hydrogen storage system
- ☐ B) Ice-based thermal energy storage system
- ☐ C) Flywheel energy storage system
- ☐ D) Vehicle-to-grid charging station

6) WHICH BALANCING SERVICE WAS SPECIFICALLY EXPLORED IN THE PORTUGUESE WEFORMING DEMONSTRATOR TO TEST BUILDING FLEXIBILITY?

- ☐ A) FCR
- ☐ B) aFRR
- ☐ C) mFRR
- ☐ D) Capacity market

Correct answers will be provided to you soon.  
If you have problems answering this quiz, click here to answer this via browser.

1. Answer: B) Solar

2. Answer: C) 71%

3. Answer: C) Both A and B

4. Answer: C) 1,668 MW

5. Answer: B) Ice-based thermal energy storage system

6. Answer: C) mFRR



## LINKS



### OTHER ENTITIES

#### Portugal

- [Laboratório Nacional de Energia e Geologia \(LNEG\)](#).
- [Associação de Energias Renováveis \(APREN\)](#).
- [Associação Portuguesa da Economia da Energia \(APE\)](#).
- [Portugal Energia](#)
- [Portal de Ciência e Tecnologia | Fundação para a Ciência e a Tecnologia \(FCT\)](#).
- [ERSE - Entidade Reguladora dos Serviços Energéticos](#)
- [Direção-Geral de Estatísticas da Educação e Ciência \(DGEEC\)](#).
- [Observatório da Energia](#)
- [Agência Portuguesa do Ambiente \(APA\)](#)

#### Europe

- [European Network of Transmission System Operators for Electricity \(ENTSO-E\)](#).
- [The European Wind Energy Association \(EWEA\)](#).
- [The Alliance for the Internet of Things Innovation \(AIOTI\)](#).
- [Joint Research Centre - Smart Electricity and Interoperability](#).
- [Strategic agenda 2024-2029 - Consilium](#)
- [The European Commission's Priorities](#)
- [A European Green Deal | European Commission](#)

### ON RESEARCH, DEVELOPMENT AND INNOVATION

#### Portugal

- [Portugal 2030](#)
- [Portal da Inovação](#)
- [Agência Nacional de Inovação \(ANI\)](#)
- [Agência para o Desenvolvimento e Coesão \(AdC\)](#).
- [Direção-Geral de Estatísticas da Educação e Ciência \(DGEEC\)](#).

#### Europe

- [BRIDGE \(H2020\)](#).
- [European Energy Research Alliance \(EERA\)](#).
- [ETIP SNET - European Technology and Innovation Platform Smart Networks for Energy Transition](#)
- [Horizon 2020](#)
- [Horizon Europe](#)
- [BlueInvest](#)
- [EIT InnoEnergy](#)

- [European Climate, Infrastructure and Environment Executive Agency \(CINEA | ex-INEA\)](#)
- [EUASP - The European Union Agency for the Space Programme](#)
- [ESA - The European Space Agency](#)
- [European Distributed Energy Resources Laboratories \(DERlab\)](#)

- [Eurostat - Science, Technology and Innovation](#)
- [Funding, Tenders | European Commission](#)
- [Research and Innovation | European Commission](#)
- [Energy, Climate Change, Environment | European Commission](#)
- [CRESYM - The Non Profit Association Delivering Future Collaborative Opensource Tools for Energy System Simulation](#)

#### **Rest of World**

- [CIGRE - International Council on Large Electric Systems](#)
- [CTCN - Climate Technology Centre and Network](#)
- [GEIDCO - Global Energy Interconnection Development and Cooperation Organization](#)
- [World Intellectual Property Organization \(WIPO\)](#)
- [International Energy Agency \(IEA\)](#)
- [International Electrotechnical Commission \(IEC\)](#)

#### **Rest of World**

- [China Electric Power Research Institute \(CEPRI\)](#)
- [Mission Innovation](#)
- [Innovation - Department of Energy \(USA\)](#)
- [NREL - National Renewable Energy Laboratory](#)
- [Electric Power Research Institute \(EPRI\)](#)
- [EU-GCC Clean Energy Technology Network](#)



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