R&D NESTER

27 NL mar 2025

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EDITORIAL

Dear Reader,

As the energy sector continues its rapid evolution, R&D Nester remains at the forefront of innovative research, technological development, and collaborative efforts designed to shape a more resilient, sustainable power grid. We are pleased to share this latest edition of our quarterly Newsletter, which showcases our recent activities, partnerships, and contributions to the ongoing energy transition-always guided by our motto, *"Creating a Smart Energy Future."*

In our **Highlights**, you'll read about R&D Nester's involvement at the **Lisbon Energy Summit & Exhibition 2024**. We represented two major European projects-**HEDGE-IoT** and **WeForming**-which focus on optimizing energy systems through digitalization, IoT solutions, and grid-forming buildings.

We also describe the latest developments in **HEDGE-IoT**, including a workshop on Business and System Use Cases, and the project's 1st Plenary Meeting in Arnhem. You'll see how our expertise-ranging from energy market simulation to flexibility aggregation-helps pave the way for the future of grid resilience and consumer participation.

Additional highlights include our **Prot4HiRES** project, which addresses how large-scale renewable penetration impacts transmission line protection systems, and our participation in cutting-edge research around **peer-to-peer energy** (U2Demo), **superconductivity for energy transition** (Hi-SCALE), and **resilience strategies** (MEDPOWER and ENLIT Europe).

We are also delighted to announce our engagement in **new EU-funded initiatives** like STUNNED and ECLIPSE, both aiming to develop innovative frameworks for energy flexibility, consumer empowerment, and sustainable grid operation.

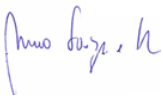
Under the **Technical Information** section, this Newsletter presents a featured article on **innovative approaches for optimizing EV charging stations**. As electric vehicle adoption accelerates, this topic becomes vital for maintaining grid stability, facilitating renewables integration, and ensuring economic viability for both operators and consumers. The methodology discussed integrates clustering techniques, nodal load allocation, and advanced optimization algorithms-offering a robust foundation for future EV infrastructure planning.

We hope this overview inspires you to dive deeper into the projects and technical insights featured in this edition. At R&D Nester, we remain committed to driving research and innovation that support a carbon-neutral, flexible, and consumer-oriented energy future.

This edition finishes with the usual sections on Literature Review, upcoming Events and useful Link, besides the popular Quiz, where this time you can check your knowledge on Green Ports.

Thank you for joining us in our mission to *create a Smart Energy Future*. Happy reading!

Sincerely,



Nuno de Souza e Silva

Managing Director

HIGHLIGHTS

THE FUTURE OF THE EUROPEAN ENERGY SECTOR - R&D NESTER PARTICIPATION

R&D NESTER and F6S Innovation were present at the **Lisbon Energy Summit & Exhibition 2024** representing the European projects **HEDGE-IoT** and **WeForming**. This event was held in FIL - Feira Internacional de Lisboa, last 27-29 May.

LISBON ENERGY SUMMIT & EXHIBITION 2024 | 27 - 29 MAY 2024 | FIL - Lisbon Exhibition & Congress Centre | Lisbon | Portugal

HEDGE-IoT is an ambitious EU-funded initiative within the Horizon Europe framework, dedicated to revolutionizing the energy landscape with innovative IoT solutions. HEDGE-IoT aims to lead the charge by deploying cutting-edge IoT assets and advanced AI/ML tools across energy systems, enhancing resilience and unlocking untapped flexibility potential.

WeForming involves various aspects to drive innovation and collaboration with the focus on energy optimization through Intelligent Grid-Forming Buildings (iGFBs). The project facilitates the integration of all the players across various sectors and geographical regions via standardized data interoperability and Advanced Building Management Systems. The project also promotes the creation of collaborative business models and policy recommendations through co-creation activities with both internal and external participants.



During the even it was possible for visitors to get to know these and other European initiatives focused on developing and demonstrating innovative energy solutions!

To discover more about R&D Nester initiatives and to explore the path towards energy efficiency:

HEDGE-IoT
https://hedgeiot.eu/

WeForming
Empowering Buildings. Energizing the Future.
https://weforming.eu/

HEDGE-IOT PROJECT DEVELOPMENTS: WORKSHOP & 1ST PLENARY MEETING

THE PROJECT

The project, **HEDGE-IoT - "Holistic approach towards Empowerment of the DiGitalization of the Energy ecosystem through adoption of IoT solutions"**, is founded by the European commission and is composed of 42 partners including large ICT companies, leading RTOs, SMEs, energy stakeholders, EU-level associations and legal & regulatory experts from 13 European countries.

HEDGE-IoT has the objective to "revolutionize energy systems by deploying IoT assets across different levels, from behind-the-meter to the TSO level, and infusion intelligence into the edge and cloud layers using advanced AI/ML tools".

The **HEDGE-IoT project**, officially launched in January 2024, brings together a consortium of 42 partner organizations from 13 European countries, including leading academic institutions, major energy players, utilities, and technology suppliers.

R&D NESTER's role in the project spans several work packages, notably WP2, which focuses on stakeholders' requirements and system specifications, and WP5, which involves demonstrating technological solutions across various scenarios, particularly in the Portuguese demo.

WORKSHOP

DEFINITION OF THE BUSINESS AND SYSTEM USE CASES (BUCS AND SUCS)

Recently R&D NESTER participated in a workshop organized by RWTH in Aachen, Germany focused on fine-tuning the Business Use Cases (BUCs) and System Use Cases (SUCs) of the **HEDGE-IoT project**. This initiative, co-funded by the European Union, aims to advance the digitalization of the energy ecosystem through the deployment of IoT solutions across various levels of the energy system, from behind-the-meter to the Transmission System Operator (TSO) level.





The workshop aimed to refine the project's use cases to ensure they effectively address the integration of renewable energy sources, enhance grid resilience, and unlock new flexibility potentials through advanced AI/ML tools and IoT solutions. The project's Business Use-Cases are organized by pilot and listed below:

1. **Finnish Pilot**
   - BUC-FI-01: Anomaly detection and fault forecasting to increase Medium Voltage (MV) distribution network resilience
   - BUC-FI-02: Predictive and real-time congestion management (CM) to increase network hosting capacity

2. **Greek Pilot**
   - BUC-GR-01: Flexibility management through active prosumers/consumers engagement
   - BUC-GR-02: Leveraging data exchange and AI edge algorithms for energy forecasting and prevention of critical grid events
   - BUC-GR-03: Flexibility trading platform for mitigating problems of the T&D networks

3. **Italian Pilot**
   - BUC-IT-01: Energy flow optimisation with dynamic grid limits
   - BUC-IT-02: Flexibility provided by Energy Community to solve a local congestion

4. **Dutch Pilot**
   - BUC-NL-01: Energy Flexibility at business park
   - BUC-NL-02: Enhance local grid resilience through detection & prevention

5. **Portuguese Pilot**
   - BUC-PT-01: GreenVale - Harnessing the potential of energy communities by leveraging Federated Learning strategies
   - BUC-PT-02: Participation of industrial and residential energy communities in ancillary services market for the TSO
   - BUC-PT-03: Flexibility aggregation at tertiary buildings

6. **Slovenian Pilot**
   - BUC-SI-01: Maximizing asset capacity for increased lifetime of DSO and TSO equipment
   - BUC-SI-02: Enhanced Network Manageability and Observability

1st PLENARY MEETING

R&D Nester was present in the 1st Plenary Meeting of **HEDGE-IoT** Project that was held in Arnhem, Netherlands.



In addition to contributing in multiple work packages inside the project, **R&D Nester**, along with **REN**, take action in the Portuguese pilot which has the ambition to optimize and facilitate the deployment of grid flexibility services in residential and commercial energy communities located in different geographies of the country. Specifically, **R&D Nester**'s expertise on energy market participation and simulation capabilities will path the way towards a future implementation and adoption of client participation in ancillary services' markets.

R&D Nester's participation leverages on the improvement of an in-house developed energy market simulator. This tool has ability to use historical data from official sources (e.g. ENTSO-E transparency platform) and evaluate the performance of flexibility bids coming from a Residential or Industrial Energy Communities. In the context of the project, a flexibility bid refers to the ability of a load (aggregated or not), and/or distributed energy sources to modify their consumption/generation profile. This action supports the system operator in the maintenance of the power system's reliability and safety.

Ancillary services can generate an additional revenue stream for Residential or Industrial Energy Communities which are willing to participate in the ancillary services markets. Similarly, the project aims to assess the technical readiness of Residential or Industrial Energy Communities for their participation in ancillary services markets, taking into account the technical requirements for its provision.

This participation opens new opportunities for new stakeholders to actively participate in ancillary services market, being a step forward in the democratization of the support to the stability of the electrical power system.

For more details on **R&D NESTER**'s involvement in the **HEDGE-IoT project**, you can visit the official project page and R&D Nester website.

#HorizonEurope #ClimateAction #EnergyTransition #HEDGE-IoT #RDNESTER

#CreatingSmartEnergyFuture

HEDGE-IoT

R&D NESTER STUDIES THE IMPACT OF THE RENEWABLE ENERGY SOURCES ON THE PROTECTION SYSTEMS FOR TRANSMISSION LINES

As a consequence of the present-day decarbonisation goals, the number of renewable energy sources (RES) connected to the transmission and distribution grids has been continuously growing over the recent years and will continue to grow. This increasing amount of RES, however, places several

changes to the design, planning, operation and regulation of the electric grids.



One important aspect to consider with wind and solar PV RES is that these sources are connected to the grid via power electronics inverters, whereas the conventional sources (thermal and hydro) use synchronous generators.

This new situation may cause problems to the protection systems, since the present protection algorithms have been designed, tested and applied in grids with predominance of synchronous generators. Specifically, the lower current contribution to faults and the consequences in the seen apparent impedance are aspects that might jeopardize the performance of the protection functions.

Having this in mind, R&D Nester undertook the Prot4HiRES project, studying the impact of the renewable energy sources on the protection systems for transmission lines. The scope of the research were the overcurrent, distance and line differential protection functions.

To perform this study, a simulation model of a Type IV wind turbine was developed and integrated in a zone of the Portuguese transmission grid with high penetration of RES. The Type IV is a full converter, that is also suitable to model de DC/AC conversion for the solar PV. Then, faults (short-circuits) were simulated in several points of the grid to produce curves of the currents and apparent impedance seen at the ends of the transmission lines.

The post mortem analysis of these curves (renewable sources against synchronous generators) allowed to envisage the behaviour of the studied protection functions. For instance, it was observed that the short-circuit current supplied by the wind and solar generators was about a half of that supplied by a synchronous generator.

It was concluded that the differential and distance functions are not prone to be affected by the penetration of RES, whereas the overcurrent protection shall be reparametrized.

The project results have been published in three papers, presented at conferences:

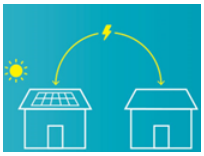
- "Assessment of potential problems on the behaviour of protection functions due to the massive integration of wind sources in transmission networks" (22nd Wind & Solar Integration Workshop)
- "Methodology for the assessment of the behaviour of protection functions in transmission grids with high penetration of renewable sources" (PEPSC 2023 - Power Electronics and Power System Conference)
- "Behaviour analysis of transmission line protection functions in grids with high penetration of renewable sources" (Developments in Power System Protection conference).

For more information: Prot4HiRES Project @ R&D Nester website

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R&D NESTER AND AN INNOVATIVE APPROACH TO PEER-2-PEER ENERGY

U2Demo project aims to advance the field of peer-to-peer (P2P) trading and energy sharing by introducing innovative, user-centric management strategies that foster the widespread development of consumer participation in these mechanisms. The proposed strategies will engage active consumers and promote equitable and democratic access to sustainable energy resources. These strategies will be formulated and seamlessly integrated into tools and platforms that adhere to principles of openness, agnosticism, interoperability, scalability, replicability, reliability, security, and trustworthiness.



The testing of tools and platforms across four pilot projects, within four distinct Energy Communities

(including a demo site in Évora) will enable a comprehensive evaluation of advanced P2P trading and energy-sharing methodologies. These pilots will facilitate the identification of optimal conditions for implementation and support the consolidation of the most promising solutions. In parallel, they will provide valuable insights into the development of robust business models that align with the evolving dynamics of decentralized energy markets and consumer-driven energy systems.

Comprising 20 partner entities from 8 different countries, the U2demo project will follow some core principles namely: the re-use of existing open-source tools and solutions, the creation of social, economic, and environmental benefits for active consumers and ECs, the valorisation of Distributed Energy Resources and the coordination with system and grid operators and other stakeholders. This is a 42 months project starting in September 2024 and ending in February 2028.

The kick-off meeting for this project took place in Lisbon, Portugal on the 5th and 6th of September, where **R&D Nester** team was represented. During the project kick-off meeting, a thorough analysis of the overall project context and key administrative details was conducted. This included a detailed review of the analytical work plan, task schedules, and the timeline for project milestones. The discussion also focused on the expected outcomes of each Work Package (WP), ensuring alignment with the project's strategic objectives. Additionally, resource allocation, risk management strategies, and collaboration protocols among partners were addressed to establish a clear roadmap for the successful execution of the project.





R&D Nester is leading 3 important tasks: **Forecasting and data analytics methods to support the decision of Active Consumers; Standards, Interoperability, and Cybersecurity** of the P2P platform**;** and **Assessment of demonstration results and evaluation of the main KPIs. R&D Nester** will be also involved in the Portuguese demonstrator assessing the potential of **DERs in black-start** and in the development of **valorization algorithms** for the consumers.



The **U2Demo** project is an innovation action funded by the European Union through the Horizon Europe Programme.

For more information:

U2-DEMO PROJECT @ R&D Nester website

HIGH-TEMPERATURE SUPERCONDUCTIVITY FOR ENERGY TRANSITION - R&D NESTER IN INDUSTRY-ACADEMIA WORKSHOP

R&D Nester was present in the final event of the **Industry-Academia Workshop from project Hi-SCALE** (High-Temperature Superconductivity for Accelerating Energy Transition) held in UNINOVA's Campus in Caparica, Portugal.



High-temperature superconducting (HTS) materials, able to enter superconductivity above the temperature of (cheap) liquid nitrogen, make possible more compact, efficient, and even disruptive technologies that can be integrated into **all the links of the electrical energy chain**, from *generation* to *transmission and distribution*, *use* and *energy storage*, enabling its **decarbonisation**.



Project Hi-SCALE addresses the obstacles preventing the widespread use of HTS in the electrical

system, such as financial concerns, doubts about the dependability of cryogenics, and the notion that only highly qualified individuals will be able to use the latter. Additional reasons include a lack of systematic understanding of the development of HTS systems for the grid and the application of common software packages to simulate their operation.

R&D Nester brought the topic of the Energy Transition from the Transmission Networks' perspective. Current and future challenges of transmission systems were presented and discussed, especially the ones that could be addressed by HTS technologies, such as the reduction of electrical losses, compaction of power and transmission equipment due to higher energy density, potential for higher efficiency on HVDC transmission and lower environmental impact.



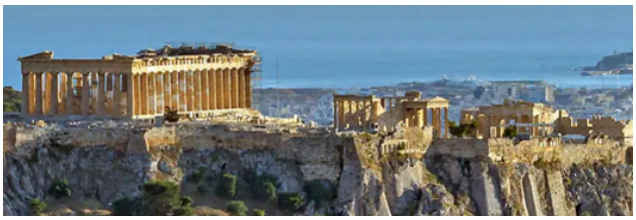
For more information:

R&D Nester - Homepage

KEY CHALLENGES FOR OPERATING FUTURE GRIDS UNDER A CARBON-NEUTRAL EUROPE - R&D NESTER PRESENTS AT MEDPOWER2024

R&D Nester was invited for this year's edition of **MEDPOWER 2024 - Mediterranean Conference on Power Generation, Transmission, Distribution and Energy Conversion.**

The 14th edition of this conference was held in Athens, Greece, last November.



The conference belongs to the series of bi-annual conferences which take place in the Mediterranean region and have established a major energy platform in the region in the last 30 years. The Conference is organized by IET Hellas, IET Cyprus Local Networks and The Malta Group of Professional Engineering Institutions (MGPEI) in Cooperation with the National Technical University of Athens and the University of West Attica with the support of IET.

MEDPOWER is a conference that aims to be at the forefront of shaping the future of decarbonized, efficient, secure and resilient power systems. It intends to provide a forum for distinguished researchers, industry experts, policymakers, and academia to explore the latest trends, challenges, and innovations in the energy landscape. Over three dynamic days, attendees had the opportunity to engage in stimulating discussions, informative keynote presentation, enlightening panel sessions and interactive paper sessions. Participants had the opportunity to showcase their research, share expertise and foster collaborations for energy advancements.

In this 14th edition, **R&D Nester** was represented in the Panel entitled "Resilience Against Natural Disasters and Extreme Weather: Innovations, Applications and Policies in Power Systems", with a presentation titled "**Key challenges for operating future grids under a carbon-neutral Europe**".

Nuno Souza e Silva, **Managing, Managing Director of R&D Nester**, was invited to be a speaker on this panel sharing R&D Nester' experience framing the remaining participants and assistance on the content of R&D Nester's current projects and its results and achievements.



In the same session we had also the insightful presentations on "*HEDNO: Climate Resilience Strategy*", from George Andreakos, on "*Building Machine Learning Supported Resilient Power Grids*" by Jin Zhao, Trinity College Dublin, on "*Resilient, reliable and secure power systems: the eFORT project*", by Maria Fotopoulou, CERTH, Greece, on "*Operational and Infrastructure Planning to Enhance Resilience*", by Dimitris N. Trakas, SMPnet, UK and on "*Regulatory Frameworks and Standards for Resilient Power Systems*", by Aleksandra Krkoleva Mateska, UKIM/FEIT, Ss Cyril and Methodius University in Skopje.

Furthermore, Nuno Souza e Silva also moderated a Keynote session where the following topics were addressed: "*Green hydrogen seasonal storage and generation adequacy*", by Prof. João A. Peças Lopes, "*From Sensors to High-Impact Applications supporting Net-Zero Transition*" by Prof. Haris Patsios, "*Achieving Energy Transition Towards Climate Neutrality: The Potential of Smart Cities and Renewable Energy Communities in the EU*", by Prof. Carlo Alberto Nucci and "*Orchestration of Cooperative and Self-Organizing Electric Vehicles for Implementing V2G-based Ancillary Services in User-Centric Smart Cities*", by Prof. Alfredo Vaccaro.



For more information:

MedPower 2024 Conference

R&D Nester website

"Energy Communities' impact on power grids" - R&D NESTER PRESENTS AT ENLIT EUROPE

R&D Nester was present in this year's edition of **ENLIT Europe** that was held in Milan, Italy, last October.



ENLIT is an event with over 15.000 power & energy professionals which purpose is to connect people, projects and technologies in the path of energy transition.

The Partners of **ENLIT Europe** include organizations that represent the industry stakeholders and the media titles that cover the energy sector in Europe and around the world.

The organization of this event work closely together throughout the year to present the latest sector developments and industry news. This event programme always includes presentations, panels, interviews and other digital content highly relevant. ENLIT Europe is a constantly growing, inclusive, end-to-end forum that addresses every aspect of the energy agenda, and players from the producers of energy to the end consumer and everyone in between.

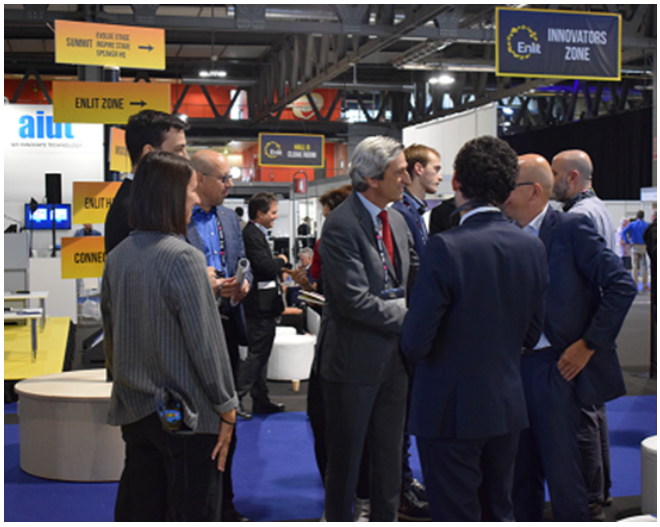
In this year event **R&D Nester** was represented in the Session **"*Energy Communities' impact on power grids: Energy Community Embedment Increasing Grid Flexibility and Flourishing Electricity Markets*"**.

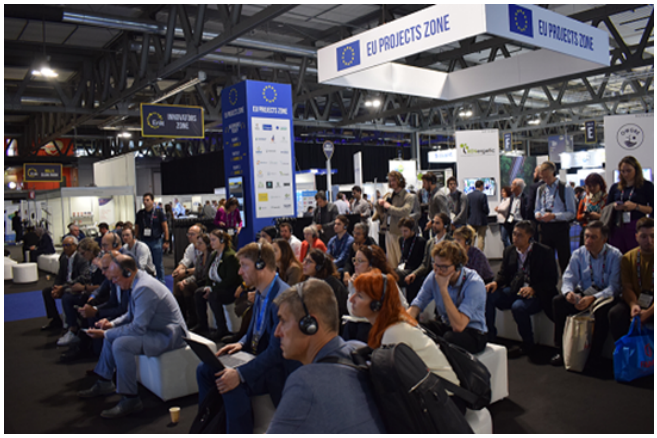
Nuno Souza e Silva, Managing Director of **R&D Nester**, was invited to be a speaker about the document produced in the context of the ETIP-SNET (*European Technology and Innovation Platform - Smart Networks for Energy Transition*).





The discussing addressed on one side the Technical aspects concerning the challenges that Energy Communities pose to the grids and system operation and the benefits that Energy Communities can bring as contributors to solving other concerns. On the other hand, it also addressed economical and monetization aspects regarding the participation of such communities in the Energy System and in the market.





For more information:

ENLIT EUROPE 2024 website

R&D Nester website

ENERGY MANAGEMENT SYSTEMS FOR FLEXIBILITY SERVICES - R&D NESTER IN NEW EUROPEAN PROJECT "STUNNED"

Project **STUNNED** - ***Sistemic Multilevel optimized orchestration of energy management systems for residential, industrial and tertiary energy flexibility services*** was officially launched with a successful kick-off meeting held by RINA in their premises in Genova, Italy, bringing together an international consortium of partners from industry, academia, and energy technology sectors.

The project's consortium is composed of 18 members, from 6 different countries, which will be engaged in this project until April 2028. The meeting set the stage for the collaborative journey aimed at redefining energy management for both industrial sites and buildings. The meeting focused on the discussion of the roadmap, milestones, and demonstration activities, ensuring all partners are aligned toward achieving the project's ambitious goals.

Stunned

The **STUNNED** project seeks to develop and demonstrate a cutting-edge hardware/software solution for optimizing complex energy systems. Its key objectives include:

· enabling groups of buildings and industrial sites to minimize energy costs,
· facilitating market participation, and
· enhancing interoperability between existing energy management systems.

By integrating advanced optimization algorithms and addressing multiple levels of control, the project will empower energy flexibility and support emerging markets such as demand response, smart charging, and congestion management-all while ensuring data security through robust cybersecurity and distributed ledger technologies.

As a core partner, **R&D NESTER** will play a pivotal role in developing and demonstrating the market emulator platform for the **STUNNED** demonstrators, focusing on the enabling of innovative energy optimization strategies and advanced control algorithms. Leveraging its expertise in energy and flexibility markets, **R&D NESTER** will lead efforts to facilitate the integration of new actors in both wholesale markets and local markets, enhancing the integration of different energy assets while ensuring a seamless orchestration across diverse energy management platforms. This contribution is instrumental in achieving the project's vision of sustainable, cost-efficient energy management for future markets.

For more details visit **R&D NESTER**'s website. Shortly, the project's official webpage will be also available. Follow us for more news.

#STUNNEDProject #HorizonEurope #EnergyInnovation #SmartEnergy #EnergyManagement #SustainableEnergy #RDNESTER #CreatingSmartEnergyFuture

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"AGGREGATED DEMAND-SIDE FLEXIBILITY PARTICIPATION IN THE ELECTRICITY SPOT MARKET" - R&D NESTER PRESENTS IN SEST 2024

R&D Nester presented the paper entitled **"Distributionally Robust Bidding Strategies for Aggregated Demand-side Flexibility"** at the 7th International Conference on Smart Energy Systems and Technologies, **SEST 2024**, held at the Politecnico di Torino in Turin, Italy.



SEST 2024 has the motto **"Driving the advances for future electrification"** and focuses in particular on research topics concerning the role of electricity in the path towards a sustainable energy transition. The trend to provide more efficient and competitive technologies and electricity services to support decarbonization, energy system integration and progressively higher involvement of the users requires further steps to guarantee security, reliability, safety, resilience, and privacy of the applications. In this context, the SEST 2024 conference intends to offer a meeting point for scientists and operators working in universities, research institutions, industry and public bodies, to exchange ideas and knowledge on new technologies and applications and discuss the latest developments in the electrical energy system field.

Aiming at producing optimal bids from aggregated distributed energy resources in the electricity spot market, the paper presents a risk-based approach exploiting a two-stage framework based on a linear programming approach to deal with uncertainties in renewable energy production and spot prices, while incorporating the risk of grid constraint violation through distributionally robust optimization. The methodology leveraged R&D's NESTER Real Time Power System Simulation laboratory to realistically emulate the operation of aggregated distributed energy resources. This approach facilitates the simulation of the seamless integration of aggregated demand-side flexibility with energy markets, enabling the development and testing of strategies for optimal resource management, while ensuring

compliance with network constraints and, thus, improving the reliability of the aggregated demand-side flexibility in the electricity market.

The paper presented by **R&D Nester** was produced in the scope of its project **Aggregation - "Research on Key Technologies of Distributed Flexible Resource Aggregation and Optimization for EU Market Operation"**. The **Aggregation** project aims to advance technologies for the management and optimization of distributed energy resources (DERs) in the European energy market. This involves developing an aggregation terminal for flexible energy resources and creating models and modules for simulation and hardware-in-the-loop testing to validate the technology's functionality. The project focuses on dynamically managing and controlling distributed flexible resources to enhance the sustainability of the energy communities in the electricity markets.



For more information:

SEST 2024 website

AGGREGATION Project @ R&D Nester website

"A RISK-AVERSE BIDDING STRATEGY FOR ENERGY COMMUNITY TRADING IN THE SPOT MARKET" - R&D NESTER PRESENTS AT IEEE PES ISGT EUROPE 2024

R&D Nester was present in the IEEE PES ISGT Europe 2024 (**ISGT Europe 2024**) conference organized by IEEE Power & Energy and University of Zagreb, Faculty of Electrical Engineering and Computing, held in Dubrovnik, Croatia, from October 14th to 17th, 2024.



The IEEE PES ISGT Europe conference is an IEEE PES flagship conference organized in Europe. The conference theme for the 2024's edition is: "***Towards Net-Zero: Integrating Smart Technologies for a Decarbonized Connected Energy Grid***". It addresses power grid modernization and the applications for the wide use of information and communication technologies for more intelligent operation of electric power systems and integration of renewable and distributed energy resources. The IEEE PES ISGT Europe 2024 conference feature keynotes, plenary sessions, panels, industry exhibits, paper and poster presentations by worldwide experts on smart grid and related technologies.

In this 2024's edition, **R&D Nester** presented a paper titled **"Risk-Averse Bidding Strategy for Energy Community Trading in the Spot Market"**. The paper presents a risk-averse bidding strategy designed to optimize the operational planning of aggregated demand-side flexibility, coordinating the peer-to-peer electricity trading with the participation of the energy community in the European day-ahead and intraday markets. The implementation leverages a hardware-in-the-loop simulation platform, where the simulation is structured following to the Smart Grid reference Architecture Model (SGAM). The setup ensures a realistic, flexible, and scalable simulation environment for multi-sized and multi-asset energy communities interacting with energy markets, aiming for optimal resource utilization. A case study based on simulated data from a Portuguese system demonstrates the effectiveness of the proposed approach, highlighting its potential to improve market operations and resource allocation in the face of renewable energy uncertainties. In the paper, R&D Nester details the methodology and presents a practical design

approach.

The content of the paper presented was produced in the scope of the **R&D Nester** project **Aggregation - Research on Key Technologies of Distributed Flexible Resource Aggregation and Optimization for EU Market Operation**. The **Aggregation** project aims to advance technologies for the management and optimization of distributed energy resources (DERs) in the European energy market. This involves developing an aggregation terminal for flexible energy resources and creating models and modules for simulation and hardware-in-the-loop testing to validate the technology's functionality. The project focuses on dynamically managing and controlling distributed flexible resources to enhance the sustainability of the energy communities in the electricity markets.



For more information:

IEEE PES ISGT EUROPE 2024

AGGREGATION Project @ R&D Nester website

"FLEXIBLE CONSUMPTION BEHAVIOUR" - PROMOTED BY EU ECLIPSE PROJECT AND R&D NESTER

The new ECLIPSE project will facilitate energy consumption reduction through the implementation of an open-source reference framework.

The European Commission committed to developing a Common European Reference Framework (CERF) for the implementation of consumer applications. As introduced in the Digitalising the Energy System EU Action Plan, these applications will inform consumers on how to make voluntary reductions in their energy consumption and energy bills, while supporting the resilience of the energy system.

On 1st September 2024, the new Digital Europe project **ECLIPSE** on **"Energy Consumption reduction based on Open-source Reference framework"**, funded by the European Commission with 4.9M€ and set for 2 years, was launched. This project, coordinated by ETRA I+D, will be driven by a consortium of 23 partners in 13 countries throughout Europe.



At the core of **ECLIPSE** is the objective to implement a Common European Reference Framework (CERF) for energy consumer applications. By the utilization of this common and open-source approach, **ECLIPSE** aims to create a collaborative environment for stakeholders to access innovate solutions that enable informed energy decisions, reduced carbon footprints, and enhanced grid stability.

ECLIPSE will establish guidelines for creating new energy consumer applications and improving existing ones. These applications will offer users accessible and practical information about energy savings and associated benefits, such as reduced carbon emissions and other financial incentives. By encouraging flexible consumption behaviours-like smart electric vehicle (EV) charging and load shifting-the project aims to bolster grid resilience and improve overall energy efficiency, all while focusing on consumer engagement and voluntary participation.

ECLIPSE CERF will be deployed and demonstrated across 16 EU countries, involving 11 grid operators, 2 energy services companies, 2 energy associations and 8 energy R&D entities.

R&D Nester is a partner in the Portuguese pilot which will deploy a project focusing on three Portuguese cities in the center-north of Portugal (Porto, Braga and Guarda). The goal of the pilot is to engage participation of low-voltage consumers (and prosumers) in energy markets through economic and non-economic incentives as well as contribute to mitigating extreme situations in the grid.

R&D Nester aims to deepen TSO/DSO, as well as fostering collaboration between local and wholesale markets, namely through enabling demand-side response as a reliable and participating agent in the grid services market. Its main tasks involves; Performing grid analysis for power flow profiles at TSO-DSO interfaces, fostering TSO/DSO coordination; Enable participation of consumers in grid management through energy saving applications, promoting collaboration between local and wholesale energy markets. It has its main involvements in Work Package 5 (pilot project) and Work Package 2 (CERF use-cases, requirements and services), Work Package 6 (User satisfaction assessment and recommendations of the regulatory framework) and Work Package 7 (dissemination, communication and exploitation activities) with Active participation in the rest of the Work Packages.

On 25th and 26th September, the project's consortium gathered in Valencia for the **ECLIPSE** kick-off meeting. During this initial meeting, partners including **R&D Nester** discussed the distribution of tasks and roles within the project. The event set the stage for a successful collaboration, aligning efforts to achieve the ambitious goals of the project.



For more information:

ECLIPSE Project @ R&D Nester website

INNOVATIVE APPROACHES FOR OPTIMIZING EV CHARGING STATIONS

The rapid growth in electric vehicles (EVs) has necessitated significant advancements in infrastructure planning to meet the associated energy demands. A critical area of focus is the deployment and sizing of EV Charging Station (EVCS) clusters integrated with Renewable Energy Sources (RES) and Battery Energy Storage Systems (BESS). This newsletter summarizes a state-of-the-art methodology designed to optimize these clusters, balancing grid security with the economic and operational needs of EVCS promoters and network operators.

A COMPREHENSIVE METHODOLOGY FOR EVCS DEPLOYMENT AND SIZING:

The proposed methodology takes a trifold approach:

* **Dataset Clustering Analysis**: Identifies representative daily net-load patterns to streamline computational efforts.

* **Nodal Load Allocation (NLA)**: Evaluates grid capacity and identifies optimal connection points for new EVCS installations.

* **BESS Dimensioning**: Optimizes BESS requirements using advanced optimization techniques to ensure grid stability and maximize renewable integration.

This integrated process ensures that new EVCS clusters can be deployed effectively, mitigating potential grid congestion and maximizing local renewable energy utilization.

Step 1: Dataset Clustering Analysis

The first step of the methodology identifies representative net-load scenarios to streamline computations. Using either historical or planning datasets with 15-minute granularity, the approach clusters daily net-load profiles within the electrical neighborhood of a pre-selected location. N-levels graph analysis of the network topology narrows down relevant buses for evaluation.

The clustering process, performed with K-means, identifies key patterns, with the number of clusters determined by metrics like Silhouette, Davies-Bouldin, and Calinski-Harabasz scores. This ensures efficient analysis of the most significant load profiles for further grid impact assessments.

Step 2: Nodal Load Allocation

The NLA step determines the maximum allowable load at each candidate bus while ensuring that grid constraints-such as transformer and line congestion or voltage violations-are not breached. The process involves iteratively increasing the load at a given bus, simulating power flows, and halving the load increment once constraints are detected. This ensures precise identification of grid capacity limits.

The methodology accounts for all time steps of the representative daily profiles, ensuring the robustness of results across different load scenarios. The candidate bus with the highest safe load margin is selected as the preferred site for EVCS installation.

Step 3: BESS Dimensioning

Once the EVCS location is identified, the BESS dimensioning step optimizes storage requirements to mitigate grid impacts and maximize renewable energy integration. The Evolutionary Particle Swarm Optimization (EPSO) algorithm is used to minimize the power and energy capacity of the BESS while maintaining grid stability. The objective function incorporates costs for BESS power and energy, as well as penalties for unresolved congestion.

Sensitivity analyses evaluate various scenarios, including differing levels of RES integration and EV charging profiles. Results demonstrate that increasing RES capacity significantly reduces the need for BESS, with the optimal balance typically achieved at 15% of peak load capacity from RES.

ADVANTAGES OF THE METHODOLOGY:

This approach offers several key benefits:

* **Grid Security**: Ensures new EVCS installations do not compromise network integrity.

* **Economic Efficiency**: Optimizes investment in BESS by leveraging RES.

* **Scalability**: Adaptable to diverse network conditions and load scenarios.

* **Data-Driven Decision-Making**: Uses machine learning and optimization techniques to provide actionable insights.

CONCLUSION:

As EV adoption accelerates, the integration of EVCS clusters with RES and BESS will be critical for maintaining grid stability and advancing renewable energy goals. The described methodology provides a robust framework for network operators and EVCS promoters to plan and deploy infrastructure that balances technical and economic considerations. By combining advanced data analysis, grid impact assessment, and optimization algorithms, this approach paves the way for smarter and more sustainable energy systems.

LITERATURE REVIEW

World Energy Council - Nov 2024 - HUMANISING ENERGY: A LOOK AT THE G20 AGENDA

Why is global progress on energy transitions slower than expected, and how can we shift policy gears?

The World Energy Council welcomes the Brazil G20 presidency's focus on social inclusivity and justice. Mobilising more , generations, and diverse communities is crucial if we want to drive "better" energy transitions.

In reviewing the G20 agenda, are identified five key opportunities to accelerate faster, fairer, and more inclusive energy transitions worldwide. To build a bridge towards Humanising Energy, we call on G20 energy ministers to collaborate more closely with the World Energy Council and its community. Together, we can address the challenges of balancing energy security, affordability, sustainability, resilience, and justice.



WORLD ENERGY COUNCIL 100 YEARS OF IMPACT

HUMANISING ENERGY:
A LOOK AT THE G20 AGENDA

MAKING CLEAN AND INCLUSIVE ENERGY TRANSITIONS HAPPEN

WHY IS GLOBAL PROGRESS ON ENERGY TRANSITIONS SLOWER THAN EXPECTED AND HOW CAN WE SHIFT POLICY GEARS?

Humanity is losing ground in addressing the climate change emergency, even with the increase of solar and wind power in global electricity generation from less than 2% to 12% since 2010. By 2050, at least half of world energy usage is expected to be met with renewables. Even so, only 6% believe the Paris Agreement limit of 1.5°C will be met. According to the Chair of the IPCC, the world is on track for 3°C by 2100, and a heroic effort is needed to stay below 2°C by 2050.

We are now in a critical and unpredictable phase of climate crisis. Investment and actions on adaptation and mitigation must progress accordingly. Climate change impacts – including more frequent extreme weather events – are no longer future possibilities, but present realities. Their unevenly distributed impacts increase the risk of ecological collapse and present a new threat of massive societal upheaval.

Integrating renewables at scale is not easy, cheap or fast - and the renewables revolution is at risk from climate change, the cost-of-living crisis, new energy shocks and supply chain disruptions.

Progress cannot be achieved through top-down, supply-side or technology-centric approaches. The challenge is not only to go faster, but to accelerate deeper decarbonisation with justice and resilience. All energy levers will be needed – financial, technological and societal.

There is no shortage of global capital or technology.

But the role of people and communities better understanding their roles and agency remains the biggest blind spot in all net zero roadmaps.

THE WORLD ENERGY COUNCIL WELCOMES THE BRAZIL G20 PRESIDENCY FOCUS ON SOCIAL INCLUSIVITY AND JUSTICE.

HOW CAN WE MOBILISE MORE PEOPLE, GENERATIONS AND DIVERSE COMMUNITIES IN MAKING 'BETTER' ENERGY TRANSITIONS HAPPEN?

In April 2024, the Council's 100th anniversary World Energy Congress convened over 4,000 leaders from across 84 countries in a groundbreaking, inclusive, and intergenerational leadership dialogue, on the theme Redesigning Energy for People and Planet. The conclusion reached is sobering.

HOW WE GOT TO HERE, WON'T GET US TO WHERE WE NEED TO BE!

Multiple energy transitions along diverging technology pathways are emerging in different places, at different paces, across diverse regions. There is no single breakthrough technology; it is essential to utilise all available levers and avoid specific policy prescriptions.

Success depends on managing complex interconnected coordination challenges. The pull of societal transformation is key to scaling the push of technology and financial innovation.

HUMANISING ENERGY OPENS A NEW SPACE FOR MOBILISING INCLUSIVE SOLUTIONS

The social realities of energy transitions are messy. It is important to rise above fragmented, single-issue agendas – green jobs, modern access, affordability, capabilities, licensing, resilience, etc.

The Council has led the world in championing more holistic and inclusive energy transitions, with

WORLD ENERGY COUNCIL | SPOTLIGHT BRIEF

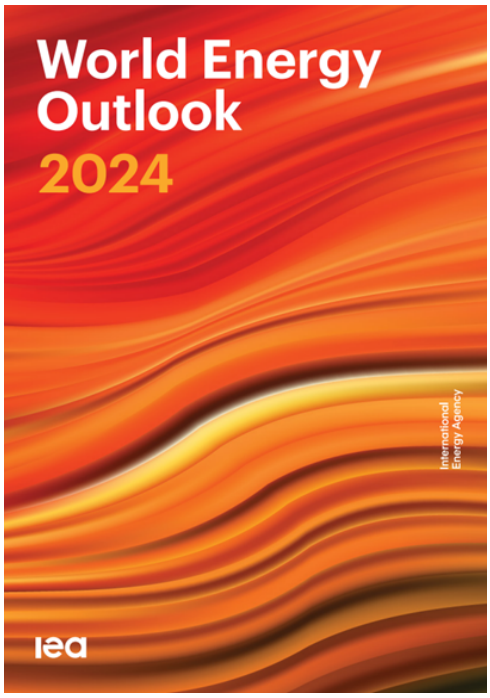
LINK FOR PUBLICATION

World Energy Outlook 2024 - IEA - Oct 2024

The IEA's flagship **World Energy Outlook**, published every year, is the most authoritative global source of energy analysis and projections. It identifies and explores the biggest trends in energy demand and supply, as well as what they mean for energy security, emissions and economic development.

This year's Outlook comes against a backdrop of escalating risks in the Middle East and heightened geopolitical tensions globally, and explores a range of energy security issues that decision makers face as they proceed with clean energy transitions. With rising investment of clean technologies and rapid growth in electricity demand, the WEO 2024 examines how far the world has come on its journey towards a safer and more sustainable energy system, and what more needs to be done to reach its climate goals.

Reflecting today's uncertainties, our three main scenarios are complemented with sensitivity cases for renewables, electric mobility, liquefied natural gas and how heatwaves, efficiency policies and the rise of artificial intelligence might affect the outlook for electricity.



LINK FOR PUBLICATION

EVENTS

26 -27 Mar 2025
LISBON, PORTUGAL
LARGE SCALE SOLAR EUROPE - SOLAR: THE POWER BEHIND EUROPE'S ENERGY TRANSITION

31 -2 Mar /Apr 2025
NARA, JAPAN
QCNC 2025 - INTERNATIONAL CONFERENCE ON QUANTUM COMMUNICATIONS, NETWORKING, AND COMPUTING 2025

5 -6 May 2025
MUSCAT, OMAN
ERRA 22ND ANNUAL CONFERENCE

27 -29 May 2025
LISBON, PORTUGAL
THE INTERNATIONAL CONFERENCE ON EUROPEAN ENERGY MARKETS (EEM) 2025

3 -4 Jun 2025
ÅLAND ISLANDS, FINLAND
9TH INTERNATIONAL HYBRID POWER PLANTS & SYSTEMS WORKSHOP

11 -13 Jun 2025
BOCHUM, GERMANY
7TH GLOBAL POWER, ENERGY AND COMMUNICATION CONFERENCE - GPECOM2025

29 -2 Sep /Oct 2025
QUÉBEC, CANADA
CIGRE 2025 INTERNATIONAL SYMPOSIUM

6 -7 Oct 2025
BERLIN, GERMANY
RENEWABLE ENERGY GRID INTEGRATION WEEK 2025 - "E-MOBILITY POWER SYSTEM INTEGRATION

7 -10 Oct 2025
BERLIN, GERMANY
RENEWABLE ENERGY GRID INTEGRATION WEEK 2025 - "24TH INTERNATIONAL WIND & SOLAR INTEGRATION

20 -23 Oct 2025
MALTA
IEEE PES ISGT EUROPE 2025

23 -28 Aug 2026
PARIS, FRANCE
CIGRE 2026 SESSION

SYMPOSIUM" WORKSHOP"

QUIZ

1) WHAT IS A "GREEN PORT"?
- ◯ A) A port focused on economic growth over environmental sustainability.
- ◯ B) A port that prioritizes reducing its environmental impact and increasing efficiency.
- ◯ C) A port with a specific color-coding system for incoming vessels.
- ◯ D) A port that operates solely with renewable energy sources.

2) WHICH OF THE FOLLOWING IS NOT A STRATEGY USED IN GREEN PORTS?
- ◯ A) Electrifying equipment to reduce air pollution.
- ◯ B) Using renewable energy sources like wind and solar.
- ◯ C) Replacing dock space with parking lots to manage congestion.
- ◯ D) Implementing water recycling systems.

3) HOW DOES SHORE POWER CONTRIBUTE TO A PORT'S SUSTAINABILITY EFFORTS?
- ◯ A) By allowing ships to turn off engines and reduce emissions.
- ◯ B) By providing a faster way for ships to unload cargo.
- ◯ C) By generating heat for nearby industrial buildings.
- ◯ D) By encouraging ships to stay longer at the port.

4) WHICH ORGANIZATION OFTEN SETS GUIDELINES FOR SUSTAINABLE PORT PRACTICES?
- ◯ A) The World Trade Federation (WTF)
- ◯ B) The United Nations International Port Association (UNIPA).
- ◯ C) The International Maritime Organization (IMO).
- ◯ D) The Global Alliance of Shipping Trade (GAST).

5) WHICH IS NOT A BENEFIT OF GREEN PORT INITIATIVES?
- ◯ A) Improved air quality for surrounding communities.
- ◯ B) Increased water pollution due to increased port activity.
- ◯ C) Enhanced efficiency in port operations.
- ◯ D) Reduced carbon emissions from ships and equipment.

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) A port that prioritizes reducing its environmental impact and increasing efficiency.

2. Answer: C) Replacing dock space with parking lots to manage congestion.

3. Answer: A) By allowing ships to turn off engines and reduce emissions.

4. Answer: C) The International Maritime Organization (IMO).

5. Answer: B) Increased water pollution due to increased port activity.

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
- DGGE - Direção-Geral de Energia e Geologia

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)

ON RESEARCH, DEVELOPMENT AND INNOVATION

Portugal

- Portugal 2020
- Portal da Inovação
- Agência Nacional de Inovação (ANI)
- COTEC Portugal
- Portugal in Europe Research and Innovation Network (PERIN)
- 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

- JRC Publications - Joint Research Centre - Smart Electricity and Interoperability
- The European Commission's Priorities
- A Europe fit for the digital age | European Commission
- European Climate, Infrastructure and Environment Executive Agency (CINEA | ex-INEA)
- EUASP - The European Union Agency for the Space Programme
- ESA - The European Space Agency

- Horizon 2020
- Horizon Europe
- BlueInvest
- EIT InnoEnergy
- Eurostat - Science, Technology and Innovation
- Funding, Tenders | European Commission
- Research and Innovation | European Commission
- Energy, Climate Change, Environment | European Commission

Rest of World

- CIGRE - International Council on Large Electric Systems
- CTCN - Climate Technology Centre and Network
- GEIDCO - Global Energy Interconnection Development and Cooperation Organization
- Energy Web
- 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
- EPRI- Electric Power Research Institute
- EU-GCC Clean Energy Technology Network

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