A Turkish Company Looking for Partners for its Project about Smart, AI-driven, Dynamic Hybrid Energy Systems for Adaptive Solar, Wind, Battery, Grid, and Load Integration

Summary

Profile type	Company's country	POD reference
Technology request	**Türkiye**	**TRTR20250711007**

Profile status	Type of partnership	Targeted countries
PUBLISHED	**Commercial agreement with technical assistance**	**• World**

Contact Person	Term of validity	Last update
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General Information

Short summary

The client is an SME in Türkiye working in the renewable energy (RE) sector. The company's project focuses on developing smart, AI-driven, dynamic hybrid energy systems that integrate solar, wind, battery, grid, and load management. Through adaptive control algorithms, the system optimizes energy production, storage, and consumption while ensuring grid stability by utilizing cutting-edge AI technologies.

Full description

The client is launching a project aimed at creating an innovative hybrid energy system that combines solar and wind energy sources with battery storage and adaptive control mechanisms for load and grid integration. The system is intended to address the growing need for intelligent, flexible energy infrastructure capable of managing the variability of renewable energy sources while ensuring grid reliability.

They are open to apply for the "Eurostars (Call 9), Horizon Europe CL5 – CL5-2025-05-Two-Stage or Eurogia2030" programs in these topics.

Currently, renewable energy systems face limitations in integrating multiple sources while maintaining consistent performance and stability. The proposed project aims to overcome these limitations by developing a unified, AI-driven

platform that dynamically balances energy generation, consumption, and storage. At its core, the project focuses on the development of dynamic hybrid energy systems that combine solar, wind, and battery technologies, with a special emphasis on adaptive grid and load management. The goal is to create an energy system that intelligently adjusts and adapts in real-time to varying energy demands, environmental conditions, and grid requirements.

The system will feature a central AI-based control unit to coordinate energy flows based on real-time data from environmental sensors, energy production metrics, and user demand forecasts. This smart control mechanism will support decision-making processes that enhance efficiency, reduce energy waste, and enable seamless integration with existing grid infrastructure.

Key Components of the Project:
Smart AI-Driven Control Algorithms: At the heart of the system is a smart AI-driven control unit that optimizes energy production from solar and wind sources, while also managing battery storage and load demand. Using machine learning, the control system will analyze real-time data to make adaptive decisions that maximize system efficiency and minimize waste. These algorithms will help balance energy supply with consumption, ensuring that the right amount of energy is available when needed.
Dynamic Energy Storage and Grid Integration: The project will focus on advanced energy storage solutions, where batteries play a critical role in ensuring that excess energy from solar or wind production can be stored for later use. This not only supports the availability of renewable energy during periods of low production but also stabilizes the energy supply by smoothing out fluctuations in energy generation. The system will be designed to intelligently control energy flow between the storage units, grid, and various load systems.

Adaptive Load Management: A significant innovation of this project is its ability to adapt to load demands in real-time. Using predictive models, the system can assess energy demand patterns and adjust energy distribution dynamically, ensuring that power is allocated efficiently across different sectors. This approach helps minimize energy waste while maintaining optimal grid stability, especially during peak load times.

Grid and Load Optimization: The hybrid system will be integrated with the national grid, allowing for seamless interaction between renewable energy sources, storage units, and conventional power generation. By intelligently adapting the energy flow between these systems, the project aims to reduce reliance on non-renewable energy sources and enhance the stability of the national grid.

This forward-looking project is designed for scalability and broad adaptability, supporting the transition to a more sustainable and intelligent energy infrastructure.

Advantages and innovations

Intelligent AI-Powered Control: The integration of AI-driven algorithms provides a significant innovation by enabling the system to learn and adapt in real-time. This dynamic decision-making optimizes energy production, storage, and consumption, ensuring that the energy system operates efficiently under varying conditions.
Enhanced Grid Stability: By utilizing dynamic hybrid systems that integrate solar, wind, battery, and grid, this project addresses the variability of RE sources.
Adaptive Load Management: A key innovation is the adaptive load management capability, which dynamically adjusts energy distribution based on real-time demand patterns. This ensures that energy is allocated where it is needed most, reducing waste and improving the efficiency of the overall system.
Energy Storage Optimization: The system leverages advanced battery storage technologies, optimizing energy storage and consumption. By storing excess energy during periods of high generation and utilizing it during low generation, it minimizes reliance on conventional power sources, contributing to energy independence and reducing costs.
Environmental and Economic Impact: The project reduces carbon emissions, promotes energy efficiency, and lowers overall energy costs.
Innovative Control Algorithms: The use of fuzzy logic-powered AI algorithms ensures a more sophisticated and adaptive approach compared to traditional control methods, improving the overall performance and reliability of the

system.

Compared to existing solutions:
Artificial Intelligence at Core: Real-time adaptive control using AI and fuzzy logic, improving decision-making efficiency.
Full System Integration: Unifies multiple renewable sources and storage under a centralized smart management platform.
Energy Efficiency and Waste Reduction: Optimizes production and consumption to reduce costs and energy loss.
Grid and Load Flexibility: Adapts to grid conditions and load demands to enhance reliability and responsiveness.

Technical specification or expertise sought

The company seeks at least one of those technical expertise in the following key areas;
- AI and Machine Learning Algorithms: Expertise in AI-driven control systems and machine learning algorithms to optimize energy generation, storage, and consumption. The ability to develop algorithms capable of learning and adapting in real-time to varying energy production and load conditions is crucial.

- Hybrid Energy System Integration: Knowledge and experience in integrating solar, wind, and battery storage systems into a cohesive, efficient hybrid energy system. Specific expertise in balancing energy flow between renewable sources, storage units, and the grid is required.

- Grid and Load Management: Proficiency in designing systems for grid stabilization, load management, and demand-response systems. Expertise in adaptive load management algorithms to ensure optimal energy distribution based on real-time demand is essential.

- Energy Storage Technologies: Expertise in advanced battery storage technologies and systems, focusing on optimization strategies for energy storage, battery management, and integration with hybrid systems.

- Power Electronics and Inverters: Knowledge in the design and implementation of DC/AC inverters, DC/DC converters, and MPPT controllers to ensure maximum energy extraction from solar and wind sources, while maintaining stability and efficiency in the system.

- Simulation and Control Systems: Expertise in modeling, simulating, and implementing control systems for hybrid renewable energy setups. Experience in using fuzzy logic and artificial intelligence to enhance system control capabilities is highly desired.

- System Optimization: Expertise in multi-parameter optimization of hybrid energy systems, including factors such as cost reduction, efficiency improvement, and environmental impact reduction.

- Regulatory Compliance and Standards: Familiarity with international standards, local regulations, and grid integration requirements for hybrid renewable energy systems. Knowledge of safety standards for energy storage systems and renewable energy integration is crucial. Collaborations in these areas will help bring innovative solutions to market, ensuring the project meets its goals of enhanced efficiency, grid stability, and sustainability.

Stage of development	Sustainable Development goals
Lab tested	**• Goal 7: Affordable and Clean Energy** **• Goal 12: Responsible Consumption and Production**

IPR Status

IPR Notes

Partner Sought

Expected role of the partner

The company is seeking partners with complementary expertise to support the development, integration, and future commercialization of the planned smart, AI-driven hybrid energy system. The roles of potential partners are described below according to their specialization:

1.   AI and Machine Learning Experts
- Develop AI-driven control algorithms that dynamically manage energy production, storage, and consumption.
- Contribute to the creation of adaptive systems that adjust in real time based on energy demand, environmental data, and grid conditions.

2.   Hybrid Energy System Integrators
- Integrate solar, wind, battery storage, and grid systems into a cohesive hybrid energy solution.
- Ensure the system is scalable, efficient, and suitable for both local and national applications.
- Support seamless communication between all energy components for optimal coordination.

3.   Energy Storage Technology Providers
- Offer advanced battery storage solutions and help develop battery management systems (BMS) that monitor battery performance.
- Support the integration of battery systems with solar and wind sources to manage efficient charge/discharge cycles.

4.   Grid and Load Management Specialists
- Help design systems that optimize energy flow between renewable sources, battery storage, and the grid.
- Support adaptive load management to ensure energy is distributed efficiently based on real-time consumption levels.

5.   Power Electronics and Inverter Manufacturers
- Provide expertise in DC/AC inverters, DC/DC converters, and MPPT controllers.
- Assist in designing control systems for efficient and stable energy conversion between sources, storage units, and the grid.

6.   Control Systems Engineers
- Contribute to the design and implementation of intelligent control systems using AI and fuzzy logic.
- Work on optimizing system performance across multiple parameters, including solar, wind, battery, and grid interaction.

7.   Regulatory and Compliance Experts
- Ensure the system meets national and international standards for renewable energy systems and grid connection.

- Support alignment with safety regulations and energy infrastructure requirements.

8.   Commercial and Business Development Partners
- Develop market strategies to support the launch and adoption of the system.
- Assist with sales, partnership development, and market expansion.
- Provide financial support to scale the technology and bring it to market.

Collaboration Goal
The overall aim is to develop a scalable, intelligent, and sustainable hybrid energy system that enables efficient integration of renewable energy sources with existing grid infrastructure. By collaborating with partners across these areas, the company seeks to enhance grid stability, lower energy costs, and support the global shift to clean energy.

Type of partnership	Type and size of the partner
Commercial agreement with technical assistance	**• University**
	• Big company
	• SME 50 - 249
	• SME <=10
	• SME 11-49
	• R&D Institution

Dissemination

Technology keywords	Market keywords
• 04007001 - Energy management	**• 06011 - Energy for Transport**
• 04007003 - Process optimisation, waste heat utilisation	**• 06008 - Energy Storage**
	• 06009 - Energy Distribution

Targeted countries	Sector groups involved
• World	