SINNOGENES

SINNOGENES Press Release

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PRESS RELEASE

«Demo #5 Ikaria Islanded Grid exploiting Digital Twin capabilities for RES/Hydro-Pump Storage Increase»

Demo Case Overview

The overall goal of the SINNOGENES project is to provide management optimization focusing on the increase of renewable energy sources (RES) penetration through the integration of innovative energy storage solutions. In the Greek demo site, which is located on the non-interconnected island (NII) of Ikaria, the increase of RES penetration is achieved through the synergy between the local Hybrid Power Station (HPS) and the related grid management and operation tools under development.

Specifically, three digital tools are being developed:

- A Digital twin of the electricity grid of Ikaria. The digital twin of Ikaria aims to visualize and capture the status of the island's electricity production and distribution network using actual data, considering the island's load, and energy production from installed wind, solar and thermal capacity, as well as from the HPS.

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- An optimizer tool that aims to provide optimal solutions to production management challenges related to the grid operator's (HEDNO) strategic goals, such as cost minimization or maximization of RES penetration.
- A load forecasting tool that enables fast and accurate prediction of the island's energy demand.

The combination of these tools will provide HEDNO with the opportunity to both increase the efficient operation of the grid and improve the planning capabilities of the day-ahead energy scheduling, while assisting towards the national and European decarbonization goals.

Challenges and Solutions

- **Challenge 1**: Although there are twenty-seven non-interconnected island systems in Greece, Ikaria was chosen for this pilot application due to its pumped storage reservoir, which is part of a Hybrid Power Station, along with two Small Hydropower Plants (SHPPs) and a Wind Park. The challenge is to exploit the HPS in the most efficient way as to reduce CO_2 emissions via decreasing the thermal production and increasing the RES penetration.
- **Challenge 2**: The planned future interconnection of the NII of Samos with the Transmission System, as foreseen in the ten-year network development plan of IPTO, makes Ikaria (which is to be connected with Samos) an ideal field to examine the benefits and limitations of using pumped hydro storage, in line with the National Energy and Climate Plan.
- **Innovative solution**: Integration of the Forecasting, Load-Flow and Optimization tools in an interconnected platform to enable secure data exchange that allows for distribution network management and operation, electricity demand and generation forecasting and digital twin management.

Implementation

- The demo site for the SINNOGENES project will take place in Ikaria island in the Aegean Sea – Greece
- The progress is already on-going. No changes or upgrades will be made on the island's electrical grid or on the HPS as far as infrastructure is concerned. The pilot will test the viability, feasibility and implementation of the proposed

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digital tools in the grid's and the HPP's day to day operation and future planning.

HPP Pumping Station, photo by www.4troxoi.gr

Stravokountoura Wind Park, photo by www.e-mc2.gr

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Proespera Reservoir, photo by www.4troxoi.gr

Results and Impact

- The digital twin of Ikaria could serve as a pilot project for performance and management studies in the NIIs and other similar insular microgrids that exist in Greece and Spain.
- Moreover, the interconnection between Ikaria and Samos will be examined to assess the economic and environmental benefits resulting from the coordination between the Distribution Network Operator (DNO) and Transmission System Operator (TSO). Feasibility studies will be conducted to explore various impacts, including: 1) the hosting capacity for RES on the two islands under different future demand scenarios and the national target for decarbonization, 2) the optimal use of the interconnection capacity under the scenario of Samos and other islands in the Northern Aegean integrated in the Transmission System, and the potential benefits of utilizing pumped hydro storage in efforts to decarbonize and ensure security of supply for the two interconnected islands.
- Furthermore, the lessons learned from the SINNOGENES project and the digital tools that are being developed can be utilized for future applications in various areas in Greece presenting altitudinal differences. In particular, a

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potential future application could involve the regions in the process of deindustrialization (e.g., in Western Macedonia), where large altitudinal differences have been created due to previous coal extraction processes in the lignite mines of Public Power Corporation (PPC). At the same time, these areas are designated as industrial zones, which facilitates the immediate implementation of similar projects. These projects will benefit both the national economy and the local communities.

- The findings will contribute to the promotion of sustainable energy planning, support the achievement of national carbon emission reduction targets (a 10% reduction within the framework of SINNOGENES specifically for Ikaria), and pave the way for a greener and more resilient energy future for both islands, while also enhancing the stability and reliability of the network and simultaneously reducing curtailment of RES. Additionally, the platform will enable network operators and related stakeholders to simulate hypothetical scenarios to inform decisions regarding the optimal integration of RES into the energy mix.

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