



NESOI
EU ISLANDS FACILITY

Wind Turbine Repowering in Kythnos

WIRE-K



 **KYTHNOS**

“Kythnos has a long history of innovative green energy projects since 1982 and the installation of Europe’s first wind farm”




This project is supported by the EU Islands Facility NESOI. NESOI has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement N°864266

The European Islands Facility NESOI aims to unlock the potential of EU islands to become the locomotives of European Energy Transition. To do so, NESOI aims to mobilize more than €100 million of investment in sustainable energy projects to give EU islands the opportunity to implement energy technologies and innovative approaches, in a cost-competitive way. NESOI has selected 56 such projects across the European Union and provide them with financial resources and technical support.



Wind Turbine Repowering in Kythnos

ABOUT THE PROJECT

Project Promoter  PPC Renewables Public Power Corporation Renewables SMSA

Stakeholders

Region of South Aegean + Decentralized Administration of the Aegean + Municipality of Kythnos + Ministry of Environment and Energy+ Regulatory Authority for Energy

 HEDNO

 **Location** Greece

 **Sector** Wind Storage

 **PROJECT VALUE** 1,750,000 €

DESCRIPTION

PPC Renewables SMSA (PPCR), is a wholly-owned subsidiary of the Public Power Corporation SA, Greece's largest power generation company. The proposed project includes the replacement of PPCR's existing wind turbine with modern, state-of-the-art wind turbine and a 'behind-the-meter' lithium-ion battery.

AIM OF THE PROJECT

This innovative arrangement allows the full exploitation of the wind turbine's installed capacity, using a large amount of energy that would under other circumstances be discarded. Thus, the renewable share of island is increased without compromising the grid stability standards set by RAE.

FUTURE STEPS

When the project is implemented according to the plan prepared and there can be a modification of the licenses, the licensing of the new hybrid project and the relocation of the wind farm will begin.

PROJECT

SUPPORT - How the EU Islands Facility NESOI supports it?

- 1 Analysis of permitting procedures, proposed contractual framework, design options, technical documentation, work plan and cost assumptions
- 2 Identification of existing litigations/appeals and evaluation of the associated risks
- 3 Analysis of the soundness of the assumed economic and financial inputs
- 4 Risk analysis and identification of available mitigation strategies
- 5 Listing of condition precedents (CPs) for successive project implementation steps (e.g. tender adjudication, financial close and disbursement, start construction, etc.)
- 6 Action plan and project identification of monitoring procedures





INTERVIEW WITH

Dimitrios Angelopoulos and Apostolos Antoniadis,
 PPC Renewables SMSA

Q: How was the project initially designed? Why choosing this specific technology?

A: The first ever wind farm in Europe was in Kythnos. This was the most important selection factor of this technology and island, as well as the repowering needs that existed.

Q: What were the challenges?

A: The change of land use on the island was one of the challenge, together with the implementation of repowering within the existing legal framework.

Q: How does the project affect citizens at the local level? How are they involved?

A: When relocating the new wind turbine, and if the legal framework allows repowering, the local community will be consulted (local authorities, professionals, residents directly or indirectly affected), and participatory activities will be undertaken. In addition, an effort will be made to find a new location that meets environmental and social criteria. Finally, local professionals will be involved in the construction and management of the project, creating a positive impact on local economy.

Q: What will be done next to pursue this project? How far is it from concrete implementation?

A: If the project can be implemented according to the plan and there can be a modification of the licenses, the licensing of the new hybrid project and the relocation of the wind farm will begin.

Q: What are your next steps towards clean energy transition?

A: The island of Kythnos has an excellent wind potential. The installation of batteries together with wind farms should allow meeting the energy needs of the island community. The installation of solar panels is also being considered.

THE IMPACT

ON LOCAL COMMUNITY



1 Local Economy

Growth is expected due to ecotourism. Several new jobs related to the operation of the overall system are envisaged.

2 Social Acceptance

Expected increase in tourism activity and the green technologies that are applied will lead to increased levels of social acceptance.

3 Local Grid

The project will increase grid stability as it will smooth-out the wind turbine energy output and make it more predictable.

Wind Turbine Repowering in Kythnos– Technical Data

FOCUS ON THE COMBINATION OF WIND TURBINES AND BEHIND-THE-METER BATTERIES

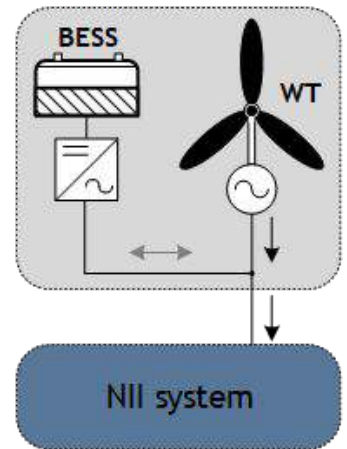
By contrast with large interconnected power systems, the penetration of intermittent renewable energy sources such as wind in non-interconnected island (NII) systems is subject to technical and security limitations.

Two main factors bound renewable energy absorption levels in islands: the first one is the stochastic nature of renewable generation; the second one is related to the technical and operational security limitations imposed by thermal units usually operated on islands.

To improve this situation, the deployment of storage facilities “behind-the-meter” of a wind farm allows optimising the clean energy generation and use: the storage system embedded in a wind farm reduces its variability and enhances its dispatchability, while simultaneously providing additional technical benefits.

The optimal sizing of such a behind-the-meter battery energy storage system (BESS) has to be determined according to a thorough analysis of the island’s power generation and consumption patterns by relying on a dispatch model aligned with the provisions of the local regulatory framework, dynamic simulations and optimisation algorithms.

In the case of Kythnos, the new wind turbine should have a 900-kW rated power. The production license of PPCR is 665 kW. Calculations show that the BESS’ optimal rated power is 390 kW. Thanks to this BESS, the island’s RES penetration should increase up to 31%.



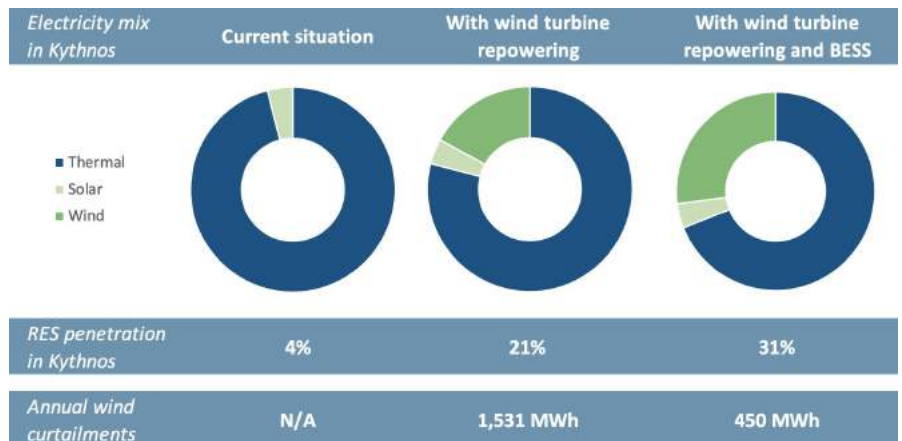
Schematic of wind turbine (WT) and behind-the-meter BESS in an autonomous island system
 (Source: PPCR)

EXPECTED ENERGY SAVINGS

For Kythnos grid, which is not connected to the mainland a PEF of 2.5 is selected, while for the wind turbine a PEF of 1 is selected. Hence, considering the given combined total electricity production substituting the Kythnos thermal station contribution to the grid, the primary energy savings are around 4.5 GWh/yr.

KEY NUMBERS OF THE PROJECT

Designed by NESOI based on data provided by PPCR



REPLICABILITY IN OTHER ISLANDS

The concept of the proposed project can be applied to many other repowering projects to overcome technical restrictions of non-interconnected electricity systems and diminish wind power curtailments.