Kythnos Smart Island: A lighthouse island decarbonization project in the Aegean Sea

Κύθνος - Έξυπνο Νησί: Ένα έργο-σταθμός για την απανθρακοποίηση στο Αιγαίο

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Network of Sustainable Greek Islands DAFNI

DAFNI, a non-profit organization is a network of island local and regional authorities. It’s comprised of 44 Municipal and 4 Regional members.

DAFNI promotes sustainable development in Greek islands through integrated actions in the fields of energy, environment and culture.

It is a founding member of the Pact of Islands initiative promoting sustainability in European islands through local energy planning.

DAFNI is the coordinator of the Smart Islands Initiative promoting islands as ideas areas for innovative projects in the fields of energy, environment, transport and mobility.
The Smart Islands Initiative

The Smart Islands Initiative is a bottom-up effort of European island authorities and communities which seeks to communicate the significant potential of islands to function as laboratories for technological, social, environmental, economic and political innovation.

Island Quadruple Helix Ecosystems

A collaborative process of public authorities, businesses, academia and civil society actors from islands, setting the Smart Islands Initiative into motion.
The Path towards the Smart Islands Initiative

2011
ISLEPACT
Pact of Islands

2013
SMILEGOV
Smart Islands Strategy

2016
Smart Islands Initiative
Smart Islands Initiative

An initiative bringing EU islands together to turn their islands into examples of change and technological disruption towards clean energy transition
The Smart Islands Initiative | The commitments

We want to become **smart, inclusive and thriving societies** and to this end we will:

1. Take action to **mitigate and adapt to climate change** and **build resilience** at local level
2. Trigger the uptake of smart technologies to **ensure the optimal management** and use of our resources and infrastructures
3. **Move away from fossil fuels** by tapping our significant renewables and energy efficiency potential
4. Introduce sustainable island mobility including electric mobility
5. **Reduce water scarcity** by applying non-conventional and smart water resources management
6. Become **zero-waste territories** by moving to a **circular economy**
7. Preserve our distinctive **natural and cultural capital**
8. **Diversify our economies** by exploiting the intrinsic characteristics of our islands to create new and innovative jobs locally
9. Strengthen social inclusion, education and **citizens’ empowerment**
10. Encourage the shift towards alternative, yearlong, **sustainable and responsible tourism**, inland, coastal and maritime
The Smart Islands Initiative | Key areas of intervention

ENERGY
TRANSPORT
WATER
WASTE
GOVERNANCE
ICT
ECONOMY
Smart Islands Initiative – The Kythnos example
Kythnos “Smart Island”
A vision for sustainable local development
Kythnos Island

- 1608 inhabitants
- Easily accessible (1.5 hour from mainland)
- Non-interconnected
- Desalination for water production
- Not very touristic
Kythnos – Electrical system

- Diesel and fuel oil
  - 4 MWM generating sets of 0.53 MW rated power each
  - 4 MWM generating sets of 0.53 MW rated power each,
  - 2 MITSUBISHI generating sets of 1.275 MW rated power each and 1 MITSUBISHI generating set of 1.250 MW
  - 15kV Medium Voltage distribution grid – 3 lines – 87 km in total
  - High seasonality
Kythnos – Electrical system

- RES in Kythnos

1. Wind park: *Not in operation*, Repowering in process by PPCR

\[5 \times 33kW = 165kW\]
Kythnos – Electrical system

- RES in Kythnos
  2. PVs
Villages
Architecture
Traditional dancing – Balos
Honey
Gastronomy
Archeology
Moreover...

Kythnos has been a Living Lab of technological innovation on clean energy transition
The history

1982
1st wind park in Europe

1983
Installation of 100kW PV system with battery storage (400kWh)

1989
Replacement of the WTs (5 x 33kW)

1992
New inverters in the PV system

1998
Installation of a new Vestas WT 500kW

1999
Operation of a fully automated Intelligent Power System

2001
Operation of the Gaiduromantra microgrid (PV, storage & diesel genset)

2016
WiseGRID H2020 project

2018
Vestas WT repowering
Building on the past and looking to the future
Vision for Local Economic Development

The island’s transition in a smart and sustainable development model which will be based on the expansion of the tourism period while in parallel will retain the impact from the relevant activities.

Towards this direction the Municipality aims:

- **in the holistic infrastructure planning** integrating smart and innovative solutions in the sectors of energy, water, waste, transport and mobility

- **in the exploitation of the island’s natural and cultural resources** which will boost the development as a smart and sustainable destination

For the Municipality and the citizens of Kythnos the vision is to move towards a smart and sustainable development of the island promoting the extension of the tourism period and minimising the impact of relevant activities.
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Objective

The automated and efficient operation of the Kythnos non-interconnected electrical system

• Development of an Energy Control Centre
• Ensure RES high penetration
• Investigation of the integration of storage at grid level
Objective

Demonstrate the potential to enhance the electrical consumption efficiency of the existing system through the integration of flexibility at the demand side

• Installation of *smart and energy efficient electrical appliances* (air conditions and washing machines) in most of the island’s *households*

• Installation of *smart home control units* in the respective households allow control and monitoring of the appliances’ operation

• Development of *optimized management* of the electrical system and the exploitation of locally produced energy from RES.
Objective
To maximize self-consumption at microgrid scale while minimizing grid losses

• Modernization of the existing microgrid in Gaidouromandra
• Establishment of a new microgrid at a selected location
• Demonstration of operation in island- and interconnected-mode
• Introduction of small wind turbines connected to the microgrids for diversification of energy sources increase
Objective
Optimization of the water production and distribution system

• Installation of a PV station and a small wind turbine coupled with battery storage which will cover a significant part of the desalination plant’s electricity demand;
• Optimization of the sizing of the upper reservoir storing the desalinated water in order to provide additional energy storing capabilities to the batteries;
• Study on the potential of seasonal storage of desalinated water in underground water aquifer making use of available RES and implement a demo phase of this activity;
• Installation of water kiosks in isolated areas where water transportation would be unprofitable, in order to increase fresh water use and consumption
• Design of an integrated stand-alone water and waste water treatment solution for isolated areas, where the connection to the network would be unprofitable
Objective

Optimization of waste management and collection system to transform the island to a zero-waste island

• Installation of micro-anaerobic digester to produce biogas from local agro-waste
• Maximization of the locally reused waste by-products aiming to strengthen the local circular economy
• Actions for the reduction of the produced waste
• Enablement of decentralized composting at the consumption side (rural)
• Optimization of the waste collection plan
Smart transport and mobility

Objective

Promote the uptake of electric mobility on land and sea transportation. Aim to decarbonize the island’s transport sector

- Installation of RES-coupled EV charging stations
- Procurement of EVs (municipal and shared-fleet)
- Installation of a shore-side charging station for small boats at Merichas port
- Procurement of a small electrical boat to operate between the port and the nearby reputable Kolona beach
- Installation of a central fleet and charging management system
- Business model for the operation of the EV fleet
Objective

Energy upgrade and smartening of the island’s street lighting network but also for the improvement of the visual comfort and minimizing the lighting pollution in Kythnos

- Replacement of the existing luminaires with high efficiency LED technology ones along with the use of smart control systems;
- Incorporation of adaptive lighting systems with the possibility to introduce predefined patterns (based on timing, pedestrian or vehicle presence, events, weather etc.);
- Installation of a SCADA infrastructure for the dynamic wireless control of the lighting systems;
- Test of different scenarios of the abovementioned technologies under different conditions and in different locations taking into account the effect of seasonality;
Kythnos Smart Island Centre and Smart Training Lab

Convert two buildings of cultural heritage in NZEB to promote the Kythnos Smart Island

&

Kythos Energy Community

To enable local ownership and benefit of the project
Timeline – Budget

✓ **Start:** 1\(^{st}\) April 2019

✓ **Duration:** 2 years

✓ **Budget:** ~8M€
1st Participatory Workshop in Kythnos Island (July 2019)
Thank you