meetMED

Mitigation Enabling Energy Transition in the MEDiterranean region

Together We Switch to Clean Energy

Kythnos Smart Island:

A lighthouse island decarbonization project in the Aegean Sea

Κύθνος - Έξυπνο Νησί:

Ένα έργο-σταθμός για την απανθρακοποίηση στο Αιγαίο

Kostas Komninos

General Director, DAFNI Network of Sustainable Greek Islands

Vice President for Smart and Sustainable Islands, FEDARENE

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SMART ISLANDS INITIATIVE

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

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The Path towards the Smart Islands Initiative

2011
ISLEPACT
Pact of Islands

2013
SMILEGOV
Smart Islands Strategy

2016
Smart Islands Initiative

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Smart Islands Initiative

An initiative bringing EU islands together to turn their islands into examples of change and technological disruption towards clean energy transition

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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

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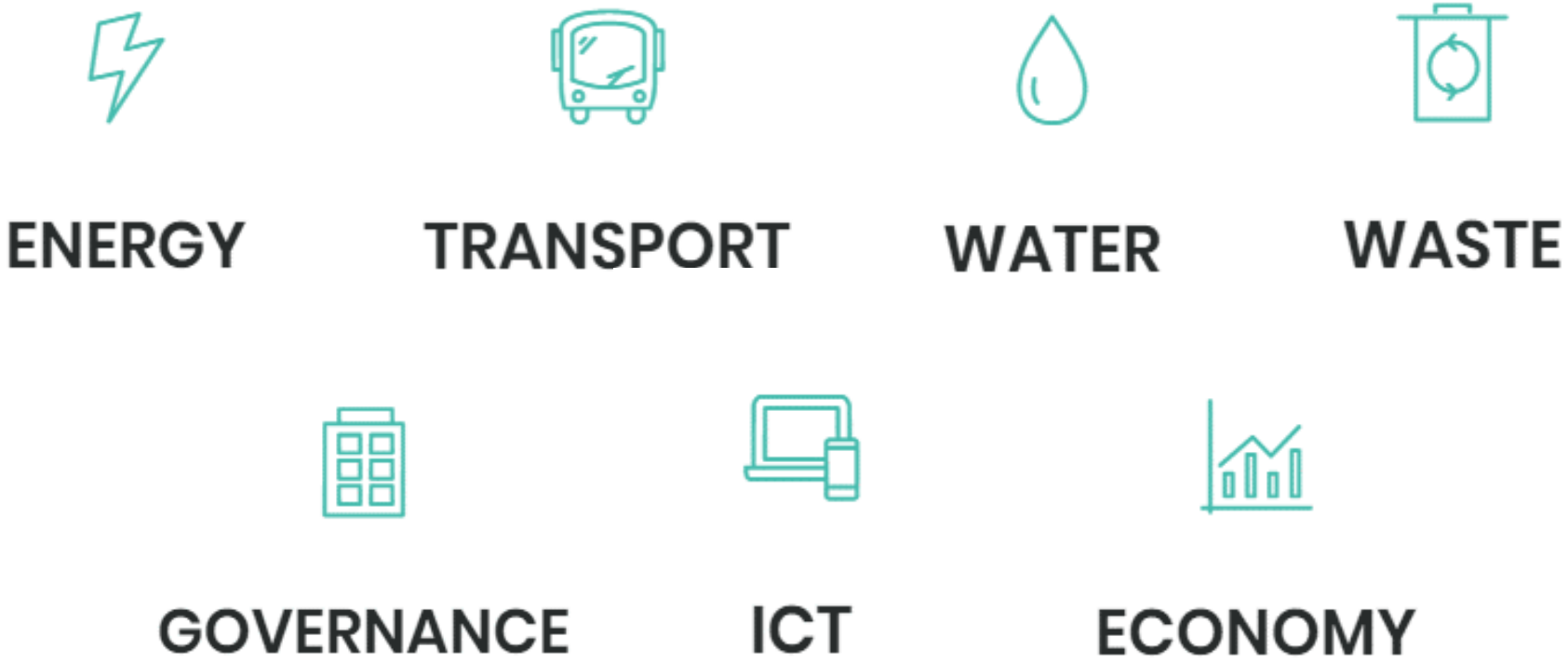
The Smart Islands Initiative | Key areas of intervention



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Smart Islands Initiative – The Kythnos example

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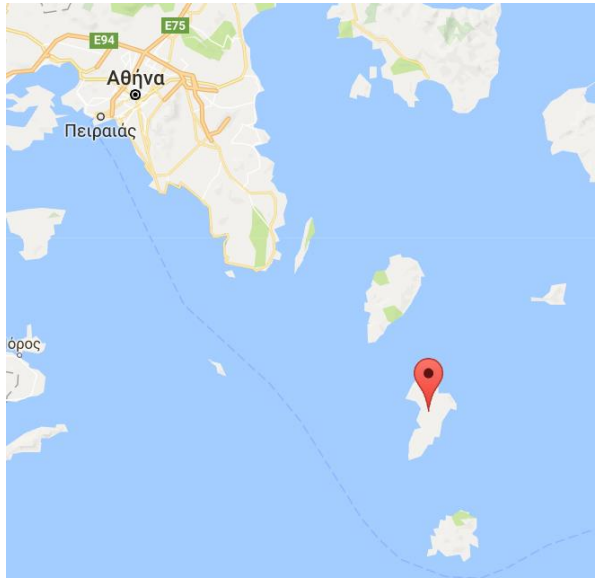
Κύθνος «Έξυπνο Νησί»

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

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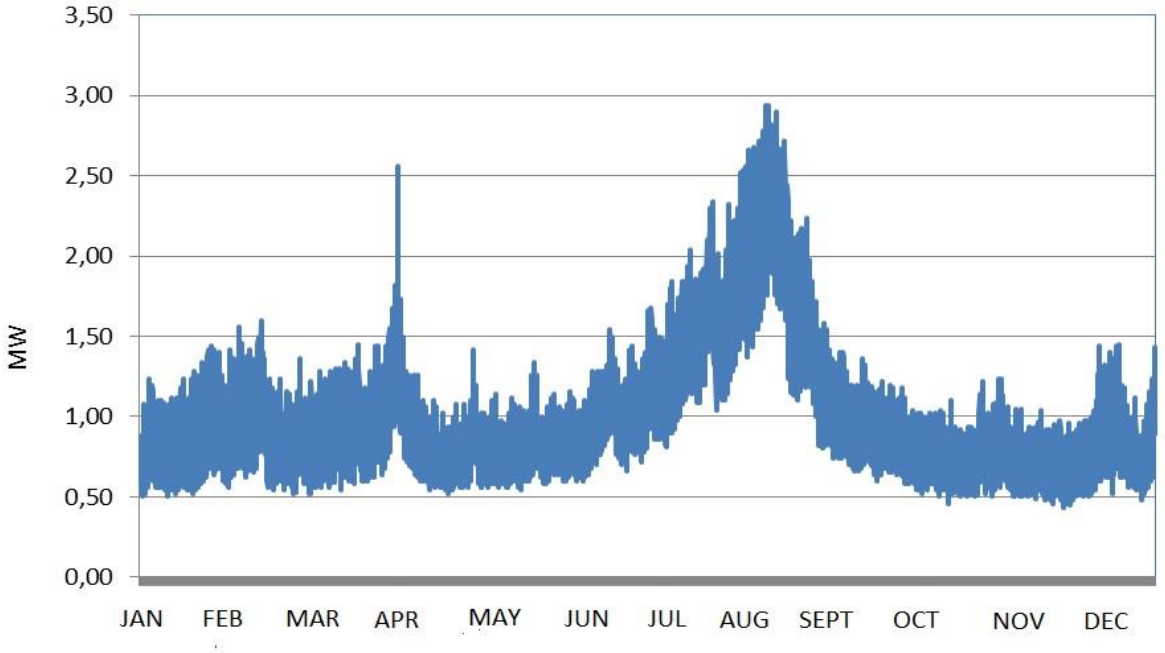
Kythnos – Electrical system



- 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

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Kythnos – Electrical system

- RES in Kythnos

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

5X33kW = 165kW

500kW

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Kythnos – Electrical system

- RES in Kythnos
  2. PVs

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Beaches

Villages

Architecture

Traditional dancing – Balos

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Honey

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Gastronomy

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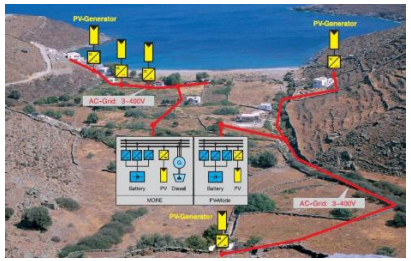
Archeology

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

2000

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

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Building on the past
and
looking to the future

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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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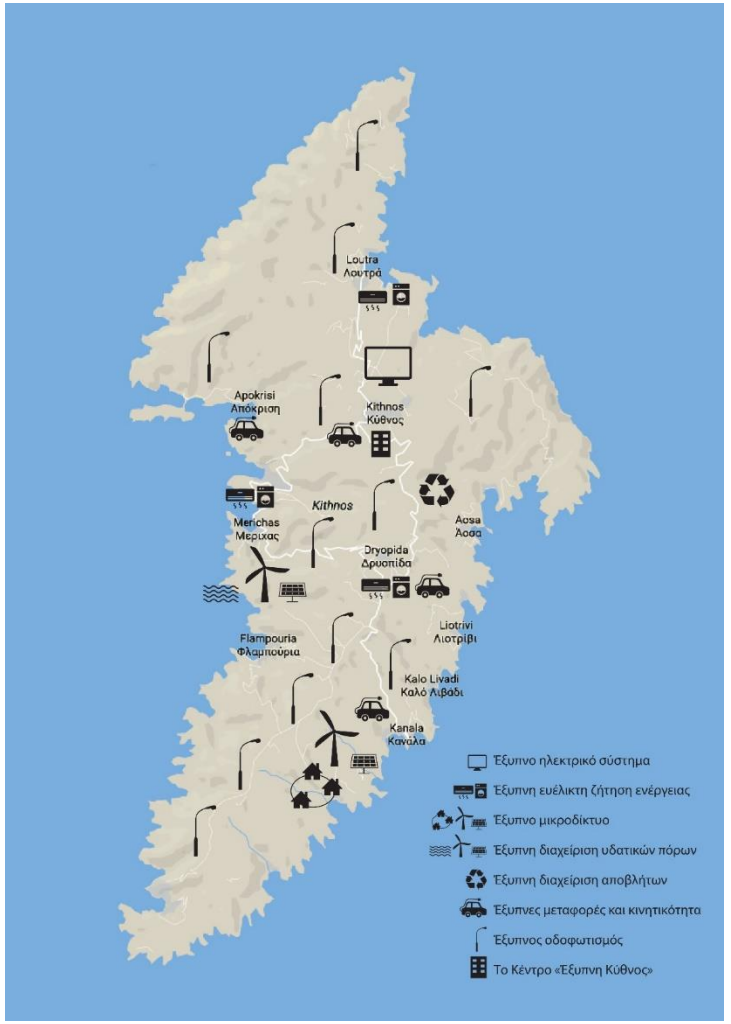
Kythnos Smart Island Master Plan

Smart electrical system management
Smart microgrids
Smart demand response
Smart water management
Smart waste management
Smart transportation and mobility
Smart street lighting
Smart Kythnos Centre



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Smart Electrical System

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*

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Smart Demand Response

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.

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Smart Microgrids

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

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Smart water resources management

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

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Smart Waste Management

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

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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

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Smart street lighting

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;

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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

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Timeline – Budget

✓**Start**: 1st April 2019

✓**Duration**: 2 years

✓**Budget**: ~8M€

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1st Participatory Workshop in Kythnos Island (July 2019)

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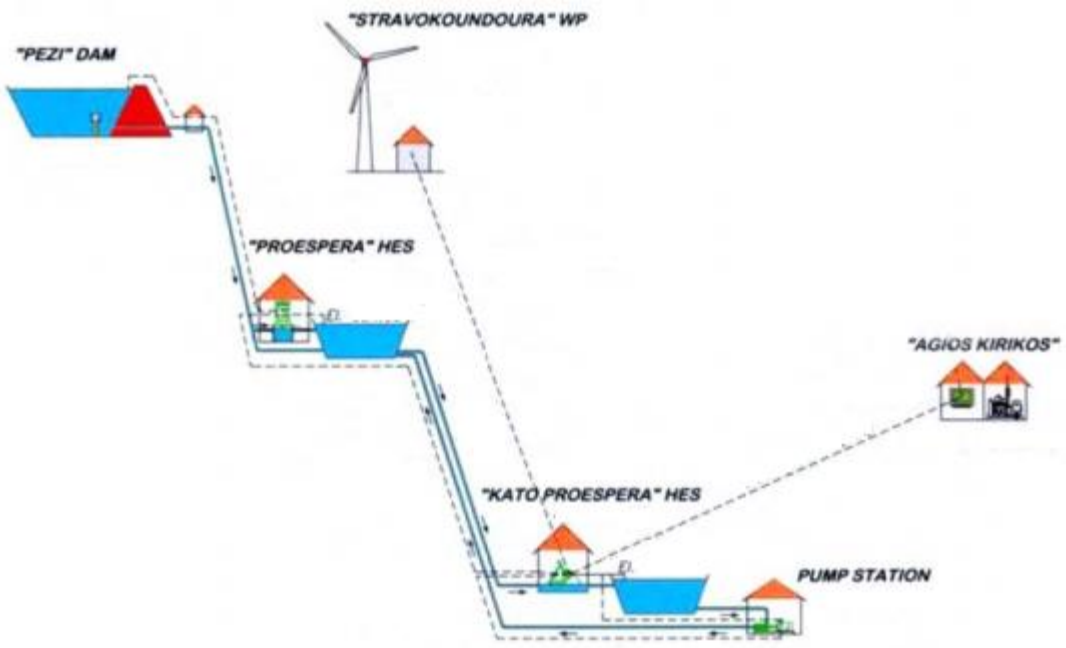
Ikaria's Hybrid Station

- The project combines **Hydro Electric** power and **Wind** power and its **guaranteed power** is **2,55 MW**, when the **5-year Average Peak Demand** of Ikaria is **7,3 MW**.

- The whole project consists of **two hydro power plants** (1 MW & 3 MW) with two reservoirs that exploit water that comes from a dam and a **wind park** (2,7 MW) which provides energy to the **water pumps** (3 MW).

- It is expected that the Hybrid plant will cover **30% of the energy needs of the island**.

- The project is **partially operated since the end of 2018**



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TILOS project

- **TILOS** project is a **Horizon 2020 EU funded project** located in the island of Tilos.
- **Main objective:** development and operation of a **prototype battery system** based on $NaNiCl_2$ batteries (2,4MWh) with **Wind turbines** (800 kW) and **PVs** (160 kW), provided with an **optimum, real-environment smart grid control system** supporting multiple tasks including:
  - Micro grid energy management
  - Maximization of RES penetration
  - Grid stability
  - Export of guaranteed energy
  - Ancillary services to the main grid of Kos
- **Guaranteed power: 0,4 MW**
- **In trial operation** since **autumn of 2018**.

- The TILOS project won **two European Sustainable Energy Week (EUSEW) Awards** in Brussels in 2017. The first ever **Energy Islands award** and the **Citizen's Award**.

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Connections of Non Interconnected Island Electrical systems to the Mainland

A: Completed

A: Cyclades - 3 ES of NIIPS

- ES – Mykonos:
  - Mykonos
  - Dilos
  - Rinia
- ES – Syros:
  - Syros
- ES – Paros:
  - Paros
  - Naxos
  - Antiparos
  - Koufonisi
  - Sxinousa
  - Iraklia
  - Sikinos
  - Folegandros
  - Ios

B: In Progress

B: ES – Crete

- Main Connection with Attica:
  - DC underwater
  - 2x350 MW
  - 400 km
  - by 2023
- Reduced Cost Connection with Peloponnese:
  - AC underwater
  - 200 MVA
  - 150 km
  - by 2020

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C: Under Study

C1: Interconnections via HV Underwater Cables

- ES–Thira (Islands: Thira, Thirasia) with ES-Paros and ES-Milos
- ES–Sifnos: (Islands: Sifnos) with ES-Syros
- ES–Milos: (Islands: Milos, Kimolos) with ES-Thira, ES-Sifnos and possibly ES-Serifos
- ES–Serifos: (Islands: Serifos) with ES-Syros

C2: Interconnections via MV Underwater Cables

- ES–Serifos: (Islands: Serifos) with ES-Sifnos
- ES–Anafi: (Islands: Anafi) with ES-Thira
- ES–Astypalea: (Islands: Astypalea) with ES-Thira

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Thank you

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