Smart Grids – Smart Islands

"Regulatory Authority for Energy (RAE) – Non Interconnected Islands"
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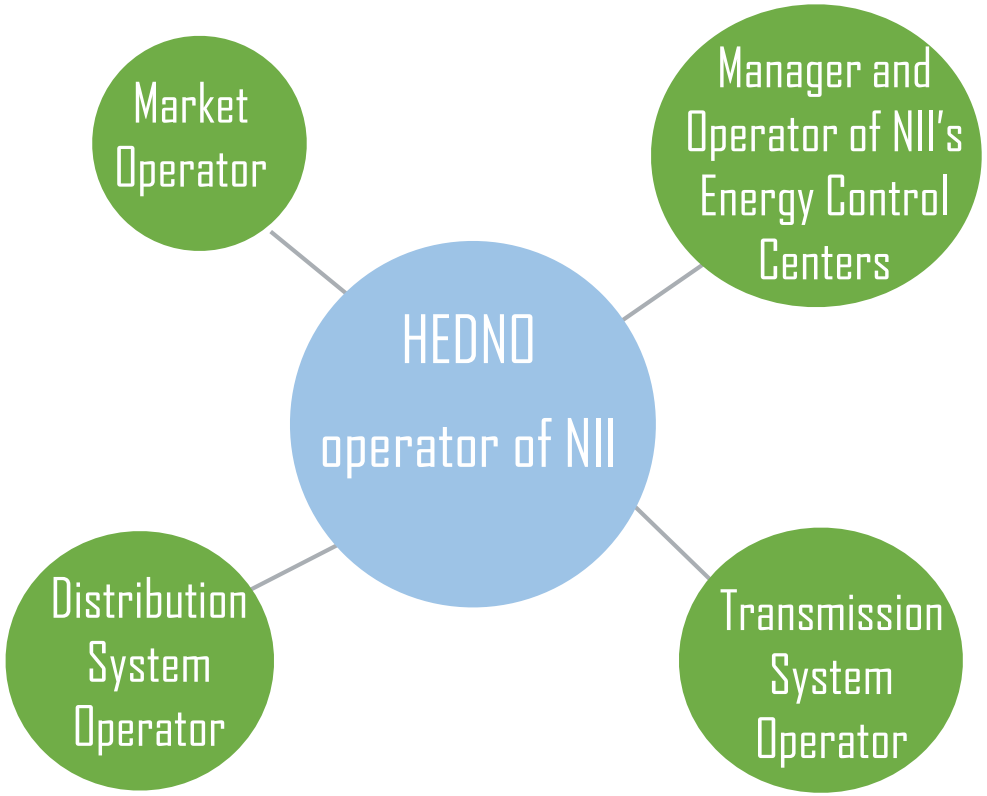
HEDNO'S Role as NII Electrical System Operator

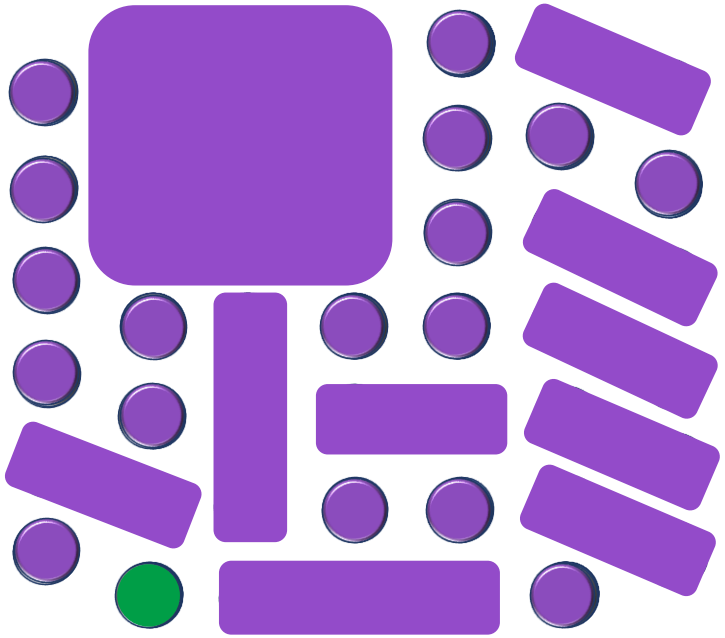


Our MISSION:
- Increase RES penetration in each ES of NII
- Reduce the operational cost of NII's ES
- Ensure uninterruptible electricity supply of prosumers

Our GOAL: Development of all the necessary infrastructure for the 29 ES of NII, covering the emerging needs of all Stakeholders and Participants in the NII's Market

The structure of the Greek Non Interconnected Islands

- 47 Islands
- 29 Electrical Systems (ES)
  - - 9 ES consisting of 27 interconnected islands
  - - 20 ES consisting of autonomus islands
- 28 Isolated Microgrids
- 1 Small Isolated System (Crete)



Greek Non Interconnected Islands

Now

- High reliance on fossil fuels
- High operational cost & CO_2 emissions
- Limitation of RES Penetration

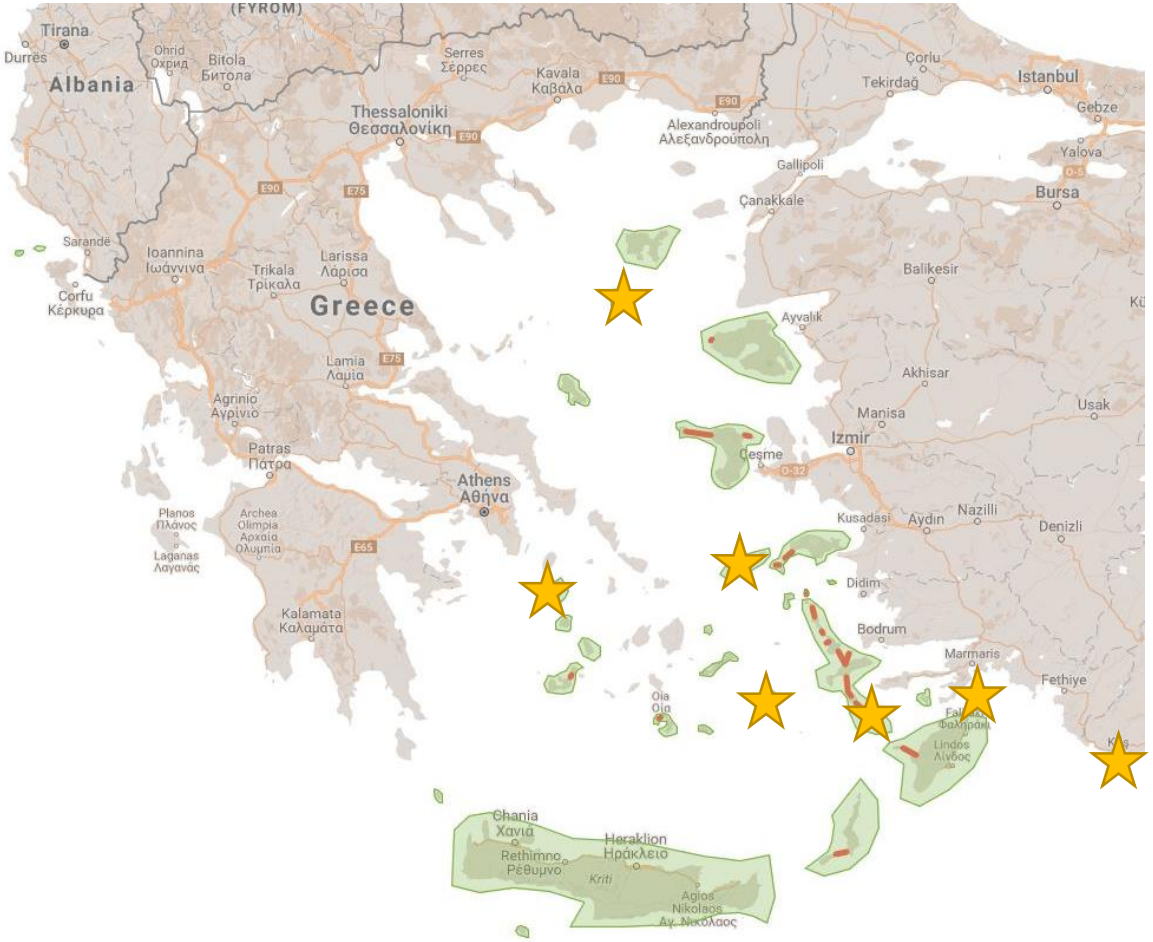
- Pilot Hybrid stations with Smart Management systems
- Electric vehicles
- Energy Storage Solutions

The future

- Increase of RES penetration
- Compliance with Domestic & EU directives
- Minimization of operational cost & CO_2 emissions
- Development of active customers & energy communities

Innovative Projects in Islands

- ✓Kythnos
- ✓Ikaria
- ✓Tilos
- ✓Agios Efstratios
- ✓Symi
- ✓Megisti
- ✓Astypalea



★ Islands with Innovative Projects

Innovative Projects in Kythnos (1)

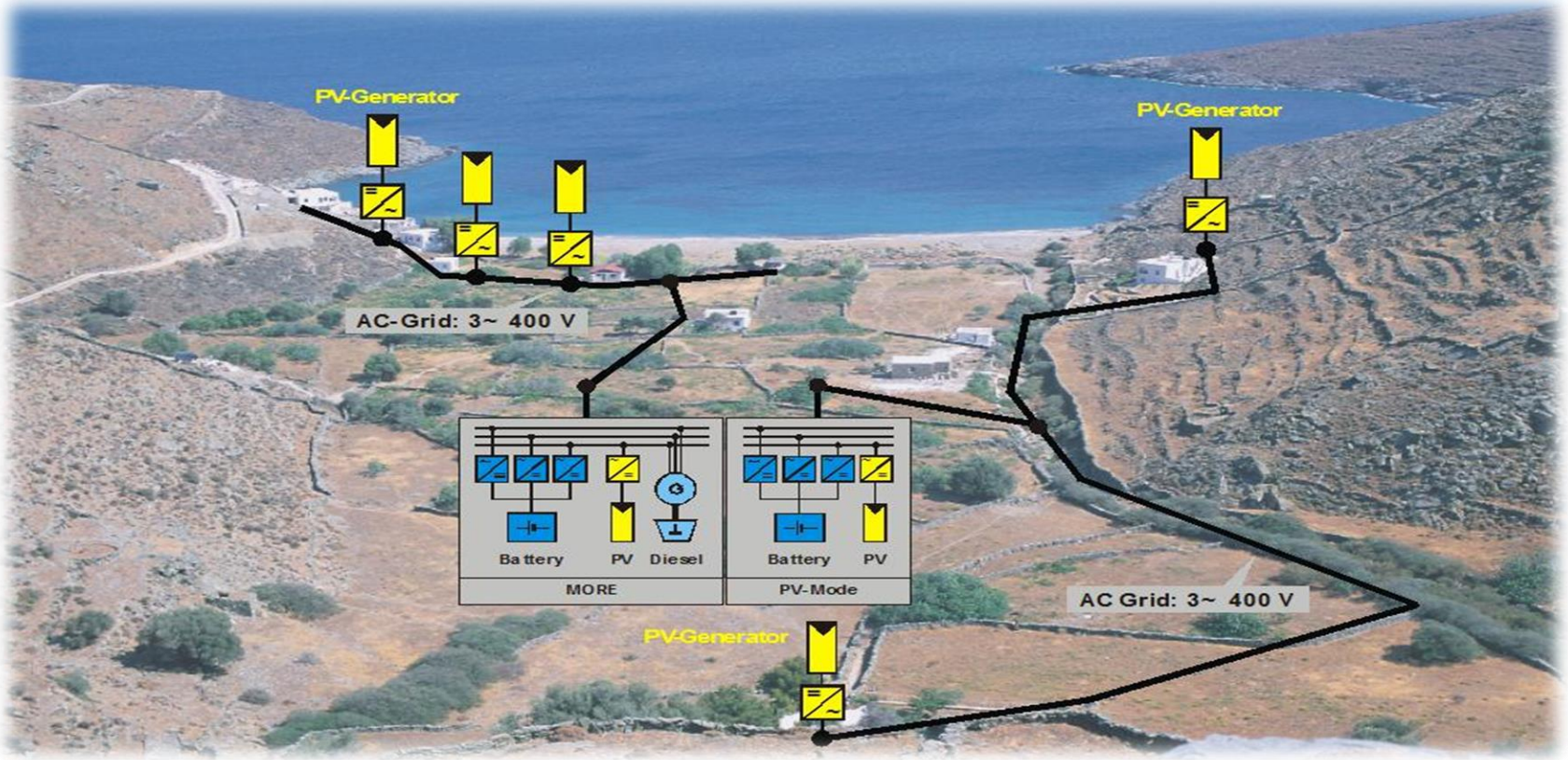
- **Kythnos** is an island in the Western Cyclades with a population of 1.632 people and its **5-year Average Peak Demand** is **3,1 MW**.
- The island has been a **pilot site** for **many innovative projects** which have taken place on the island **during the last three decades**:

- 1982 - Operation of the **first Wind Park in Europe** (5x20kW)
- 1983 - Installation of a **100 kW PV system with Battery storage** (400kWh)
- 1989 - **Replacement of the wind turbines** (5x33kW)
- 1992 - **Inverters in the PV system**

- 1998 - Installation of the **new Vestas 500kW wind turbine**
- 2000 - Operation of a **fully automated power system with 500kW battery storage and a 500kW Wind Turbine**
- 2001 - Operation of a **Microgrid** electrifying **12 houses** with **intelligent autonomous Load Control**

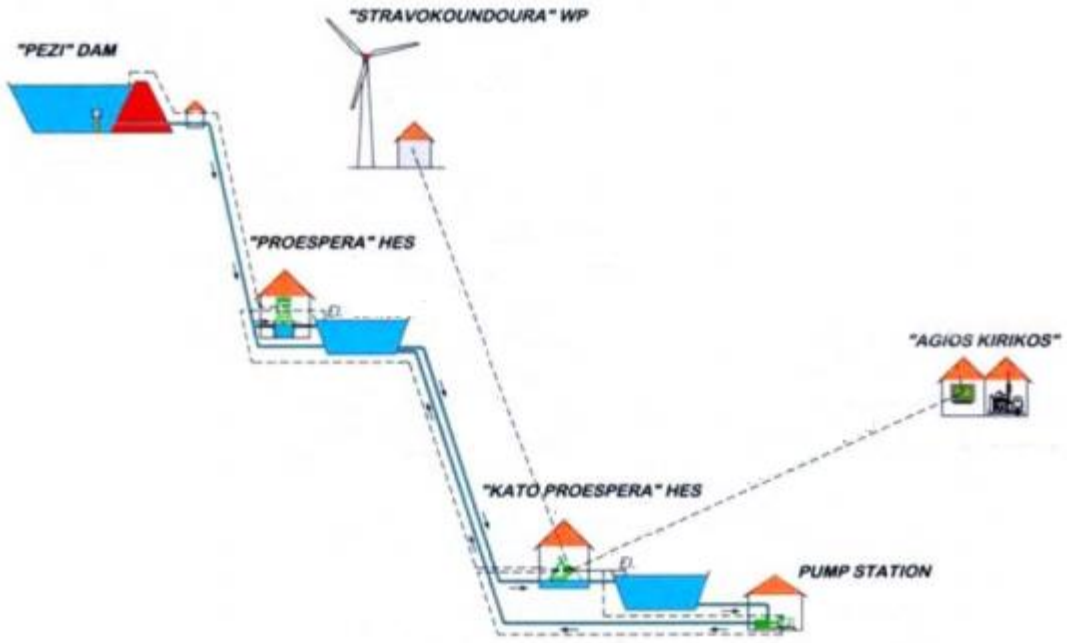
Innovative projects in Kythnos (2)

- **Kythnos Microgrid** in Gaidouromantra, consists of 12 houses with PVs and Batteries (52 kWh), 9 kVA Diesel (only back-up), flexible loads (1-2 kW irrigation pumps) and Intelligent Load Controllers.



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 not yet in operation and it is expected to be **partially operated by the end of 2018** with the operation of the wind turbine

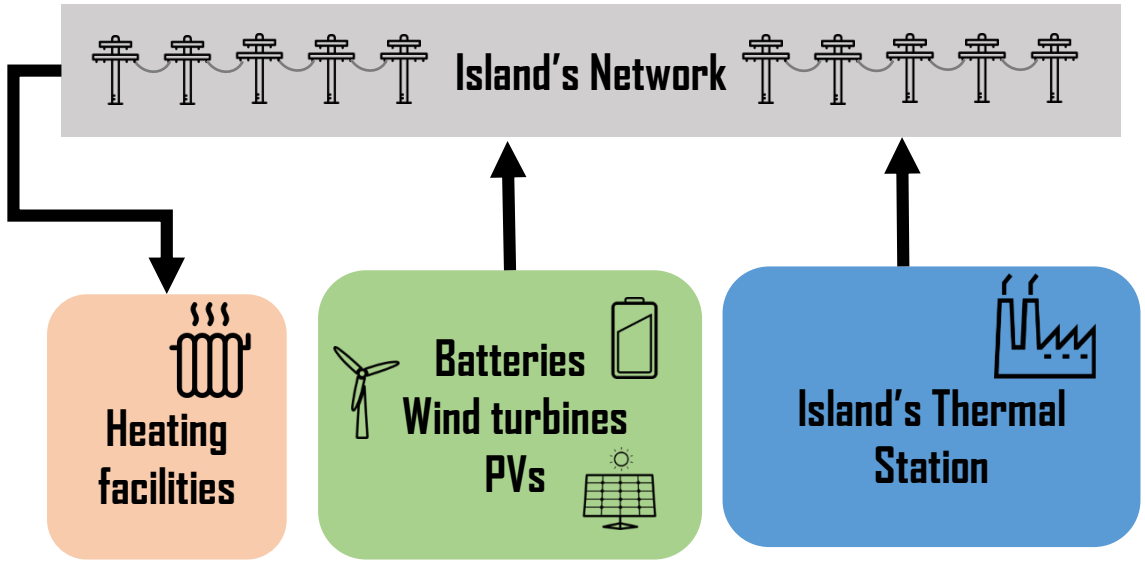
TILOS project

- **TILOS** project is a **Horizon 2020 EU funded project** located in the island of Tilos.
- **Tilos** is an island of the Dodecanese complex. It is **interconnected with Kos** and it is one of the 9 islands of the **ES of Kos-Kalymnos**, The **5-year Average Peak Demand** of the **Kos-Kalymnos ES** is **94,8 MW**.
- The **main objective of TILOS** project, is the 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** and coping with the challenge of 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
- The **project's guaranteed power** is **0,4 MW** and it is expected to start its **trial operation** in **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**.

Agios Efstratios – "Green Island" project

- **Agios Efstratios** is a small island in the North – East part of the Aegean Sea, with only 270 inhabitants (2011) and its **5-year Average Peak Demand 0,32 MW**.
- The **project** of Agios Efstratios includes **two subprojects**, the development of **a Hybrid power plant** and the development of **a District Heating system** (teleheating).
- The **Hybrid power plant** consists of **Wind turbines** (900 kW), **PVs** (150 kW) & **Batteries** (2,5 MWh), which is combined with a **District Heating system** (Teleheating).
- The target of the project is to accomplish **85% energy of the island to come from RES**.
- The project is **funded by the EU**, it is run by the CRES and it is still **under study**.



- Law 4495/2018 authorizes the Ministry of Energy, RAE and HEDNO to take all necessary actions for the implementation of the project.

"Smart Island" pilot projects (1)

- During the last 10 years, significant efforts have been made to further **enhance RES integration in the Non Interconnected islands.**
- **Law 4495/2017 & Law 4546/2018** authorize the Ministry of Energy, RAE and HEDNO to take all necessary actions for the implementation of "Smart Island" pilot projects in **3 Greek islands**.
- Each pilot project will consist of new **RES** units in combination with **storage** units controlled by a **smart management system**.

- The target of the "Smart Island" pilot projects is to **increase RES penetration**, while **ensuring the supply of demand** and **the secure operation of the power systems in a cost efficient way**.
- The "Smart Island" pilot projects will be implemented by investors who will have to participate in **tenders** held by the Regulatory Authority for Energy.

"Smart Island" pilot projects (2)

- In order to promote the implementation of the "Smart Island" pilot projects, according to the Law, **HEDNO was set responsible to issue its suggestion to RAE and the ministry**, which has been already done on the 21st of May 2018, regarding the following subjects:

1. The power systems where the pilot projects are going to be implemented
2. The configuration of the RES and storage units
3. The implementation time
4. The minimum RES penetration margin to be achieved
5. Remuneration issues
6. Special authorization procedures

“Smart Island” pilot projects (3)

The selected islands are:

Symi

Astypalea

Megisti/Kastelorizo

Based on the following criteria

- Size
- Installed RES
- Operational Cost
- RES penetration
- Future Interconnection scenarios

"Smart Island" pilot projects (4)

Action Plan:

- **RAE's opinion** by **October 2018**
- **1st Ministerial Decision** by **December 2018**
- **2nd Ministerial Decision**, regarding the contracts to be signed for the projects, **after HEDNO's suggestion and RAE's opinion**
- **Call for the competitions**, which will be conducted **by RAE** after public consultation
- **Completion of the competitions** within **9 months from their call**
- **Estimated duration for the completion** of each project is approximately **12 months**
- **Desired starting year** of the full operation for the first "Smart Island" pilot project ➔ **2021**

Public Electric Vehicle Charging Infrastructure (1)

- According to the EU Direction 2014/94/EU, Greece is obliged to have **13,000 electric vehicle charging stations by 2020** (1 charging station per 10 vehicles).
- **Today** there are **less than 45** charging stations in the whole country.
- **HEDNO's Plan** for the installation of Electric Vehicle Supply Equipment (EVSE) takes place **in order to unlock the market & satisfy the EU Directives.**

Phase A

Pilot Phase
Installation of *Mode 3* (AC 2x22kW)
EV Charging Stations in the Islands

2018-2019
Budget: 450.000 €

Phase B

Installation of **1000-1500** *Mode 3* (AC 2x22kW) & *Mode 4* (DC 50kW)
EV Charging Stations in the Mainland

2019-2020
Budget: ≈ 10M€

Public Electric Vehicle Charging Infrastructure (2)

- The Tender for the purchase of 100 (with an option of -30% ÷ +50%) EV Charging Stations of Phase A is in progress and the opening of the bids took place on the 20th of July 2018
- At least one Charging station is expected to be installed in every island (interconnected and non interconnected) which has an average peak demand higher than 1 MW. Especially for the islands of Crete and Rhodes, 35 and 10 Stations respectively are foreseen.
- HEDNO will be the Charging Points Owner and Operator (CPO). Additionally, HEDNO will be responsible of metering and data management.
- The E-Mobility Service Providers of the charging services, as well as the Energy Suppliers, will be external companies/bodies.

Future actions for NII

- Island interconnections to the mainland grid
- Actions for the remaining NIIPS (not to be interconnected in the near future)
  - ❑ Energy Control Centers
  - ❑ Implementation of storage
  - ❑ Deployment of Dispatchable RES
  - ❑ Demand Side Management
  - ❑ Expansion of "Smart Island" Pilot Projects to other islands

Requirements

- Relaxation/adjustment of EU legislation
- Establishment of necessary legislative and financial framework
- Technical, operational and feasibility studies
- Social inclusive solutions to be endorsed by the local actors
- Funding for the necessary investments

Benefits

- Significant increase of RES penetration even more than 50%
- Reduction of conventional cost
- Contain overall production cost
- Maximize environmental benefits
- Lighthouse projects to develop know-how
- Explore potential for replication and upscale of innovative solutions
- Development of local economies

Research and Innovation

- HEDNO'S main objective is the continuous modernization through research and development, with emphasis on innovation and the introduction in the Hellenic market of new design, operation and management practices for the electricity Distribution network.
- The developing perspective of "smart grids" creates new opportunities for HEDNO's substantial contribution to the country's productive reconstruction.
- HEDNO participates in various research projects through European and national partnerships, and with a particular focus on fields such as the optimal integration of RES into the Network, the production and load forecasting, the Network development and upgrading, the remote metering of electricity consumption etc.

HEDNO is an active member of organizations such as :

EDSO for smart grids

eurelectric ELECTRICITY FOR EUROPE

SMARTGRIDS

cigré INTERNATIONAL COUNCIL ON LARGE ELECTRIC SYSTEMS

CIRED

Connecting people –business –infrastructure
Providing Energy for every aspect of our life

THANK YOU

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