



From Wires...



...To a Platform based
Electricity System

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HEDNO

The energy market is in transition



European Targets for **2030**
Transition to ZERO CARBON ECONOMY



-40% Green House Gas emissions



27% Renewable Energy



30% Energy Efficiency

DSOs across Europe are connecting increasing amounts of distributed generation to their networks, thereby actively facilitating and contributing to the energy transition.

#EnergyUnion

40% cut in GHGs on 1990
Min 27% RES in consumption
Min 27% energy saving
Min 15% interconnection
80% smart meter rollout

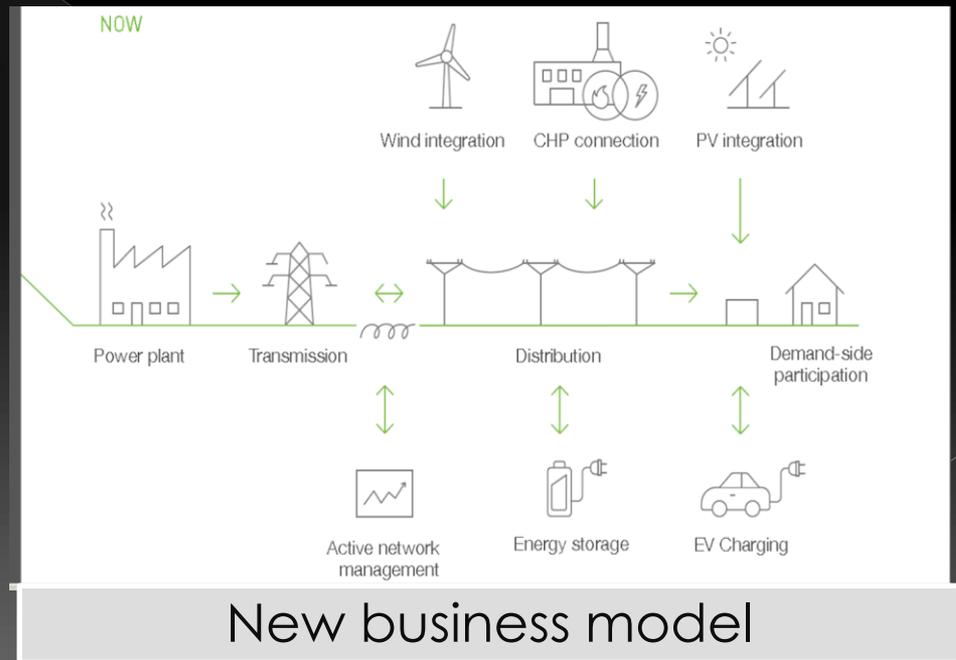
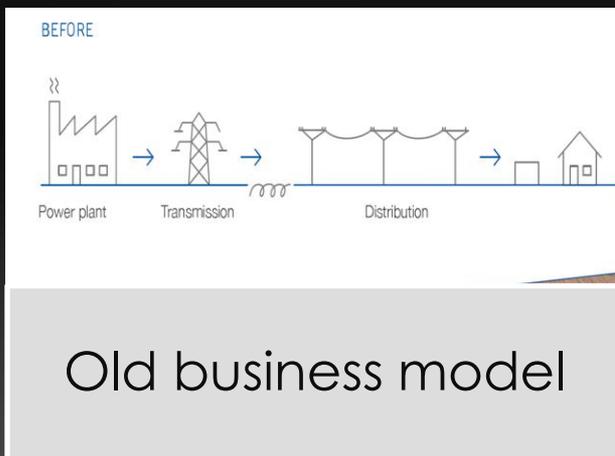
#EnergyUnion

Energy Security and
Solidarity
Moderation of demand
Internal Energy Market
Innovation and
Competitiveness
Decarbonisation

DSOs are investing heavily towards a new business model



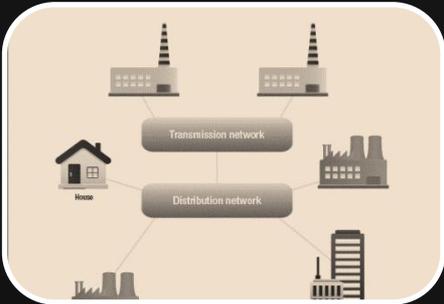
- ❑ European networks will require **€600** billion of investment by 2020
- ❑ **€400** billion of this investment will take place in **distribution grids**
- ❑ The **DSO** share of overall network investments is estimated to grow to almost 75% by 2035 and to 80% by 2050
- ❑ **€62** billion on digitalization for European Power Grids through 2025



DSOs are transforming in to digital utilities
/data centric companies with multiple
new roles...



The digital utility captures opportunities all along the value chain



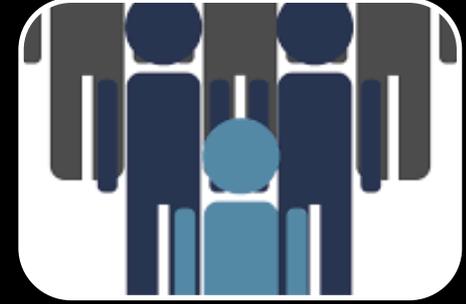
Distributed energy resources enabled by big data driven local balancing of supply and demand



Data driven asset strategies including preventive and condition-based maintenance and predictive outage



Smart Grid allow automated controls to improve networks safety and efficiency



Customer interactions/analysis personalized communication



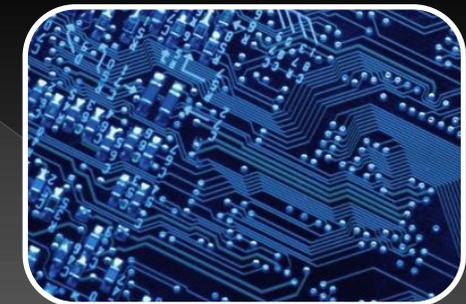
Platform supports distributed energy resources and marketplaces



Back office automation and data driven decision making



Field workforce with mobile access to maps, data, real time expertise



High level of situational awareness to enable energy balancing

*McKinsey & Company

The availability of huge amounts of data leads the digital transformation of energy and DSOs are steadily transformed in to data centric companies



Smart grid operators manage data and information flows through digital communication processes. DSOs manage **millions** of daily real-time signals through satellite, powerline communication systems, radio, fibre-optic lines, and other communication technologies.

Data management will continue being one of the key features of smart grid design, together with infrastructure for digitalisation and automation.



DSOs can provide new services for real market interaction



by launching Distributed System Platforms that will allow, coordinate and manage:

- distributed generation
- energy storage.
- electric vehicles
- demand response

A dramatic change occurs in the way households and business interact with the grid. "Rise of the Prosumer"

A flexible platform paves the way for developing numerous technologies and services and fosters participation of all market actors,

providing the appropriate interface for wholesale and retail markets interaction





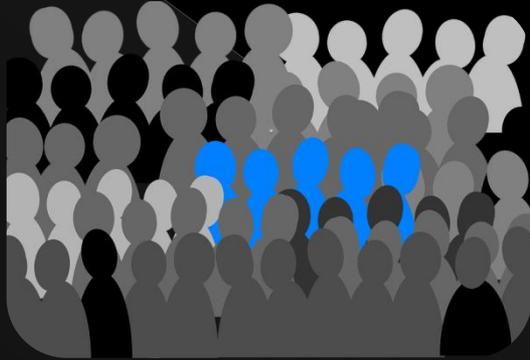
HEDNO

Who we are and what we do



Hellenic Electricity Distribution Network Operator

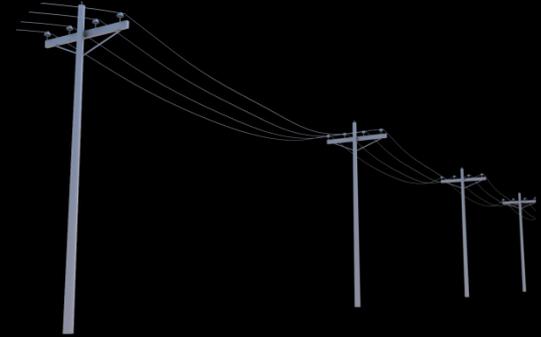
Who we are and what we do



7,000 employees



7,47 million customers



Total network length 237,357

*HEDNO was established in **May 2012** after the spin – off of the Distribution segment of PPC S.A.*



RES capacity: 3,728
MW Amount: 56,832



Delivering uninterruptible electricity to 7,47 million consumers across the country through Medium and Low Voltage networks.

Managing the High Voltage networks in Attica and the Islands.

Our fundamental tasks are **to ensure:**

- The efficient **Operation, Maintenance & Development of the country's Distribution Network**
- The **management of the Non-Interconnected Islands electricity systems**
- **Unhindered access** to our Network for all energy consumers and dispersed generation
- Facilitate the smooth operation of electricity supply market

HEDNO is the electrical System Operator of the Non Interconnected Islands (NII)



60 Islands -32 Electrical Systems
They account for almost 14% of total national annual electricity consumption

Market Operator

Manager and Operator of Energy Control Centers



Distribution System Operator

Transmission System Operator

Our vision and strategy



Vision

Our VISION is to become one of the top 10 Distribution Network Operator in Europe achieving the optimal combination of **QUALITY** and **LOW-COST SERVICES**, respecting **ENVIRONMENTAL PROTECTION**.

Investment Plan

Our INVESTMENT PLAN foresees a total budget of €250 million annually and includes projects for reinforcing and modernizing the Distribution Network with a core of 12 fundamental strategic projects.



Strategy

Our STRATEGY aims to the integration of modern technologies (“Smart Grids”, Remote Metering, Remote Services, Automations etc)

Goal

Our GOAL is to modernize the Distribution Network and transform it into a “Smart System” that will continually optimize the management of the connected consumers and producers, covering their emerging needs by an optimal techno-economical way.



The road to our digital transformation



Our strategy is built upon the implementation of new technologies through our transformation plan



HEDNO's Transformation Plan (2015-2020):

1. Modernize Attica network Control Centers
2. Establish Island network Control Centers
3. Modernize network control centers in the rest of the Country
4. Upgrade remote metering equipment of the regional networks
5. Set up a Geographic Information System (G.I.S.)
6. Set up a new web-based Customer Service System
7. Set up remote customer service systems
8. Upgrade Network Development Planning
9. Build infrastructure in Non-Interconnected Islands to implement NII Code
10. Develop "Smart Island", Pilot project – Further expansion plan
11. Apply remote metering for LV customers, Pilot project - Further expansion plan
12. Re-organize supply chain



1.25 billion of investments
(total 2.50 billion incl. smartmeter rollout)



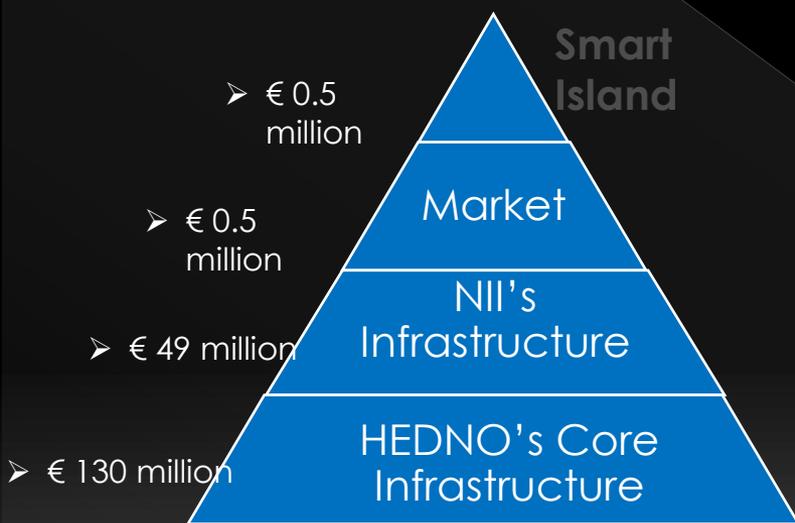
Our automatic meter reading of Low Voltage project



Our strategic plan for NIIPs



Strategic Plan for NIIPs



HEDNO's Core Infrastructure

- Further implementation of Smart Metering
- Digitalization and Data Management through smart and integrated systems

NII's Infrastructure

- Metering Infrastructure for producers
- Development of the IT System for NII
- Energy Control Centers (ECC) in Athens, Grete and Rhodes
- Energy Control Centers (ECC) in the rest ES

Market

- NII's market Infrastructure

Smart Island

- increase of RES penetration
- reduction of the operational cost
- contribution to environmental protection
- saving of resources
- ensure reliable and uninterrupted supply of electricity



Our smart island project



Project overview

The pilot project deals with the design of the technical specifications and the introduction of the necessary changes in the regulatory framework for the operation of a Non Interconnected Island, with very high (more than 60%-70%) penetration of Renewable Energy Resources, reducing operational costs, while meeting demand in a reliable, secure and economical way.

BENEFITS

- Ensuring system adequacy and power quality by the commitment of dispatchable Hybrid Stations, comprising RES and storage units to provide guaranteed power and ancillary services
- Maximization of RES penetration in the energy mix of the Electric System
- Environmental benefits
- Reduction of reliance on imported fuels
- Minimization of thermal production costs
- Promotion of new technologies and innovative solutions in the operation and management of isolated island systems and microgrids
- Development of advanced expertise and experience building

- Increase RES penetration beyond 60% by Hybrid stations with RES and storage
- Sustainable solution
- Does not increase the total cost in the island
- Should be an attractive investment
- Ensure the security of power supply in the island
- Minimize impact on thermal production
- Expertise and Know How to replicate the solution in other islands

Challenges

- Technical

The system may run only with RES + Storage for several hours

- Regulatory

Energy Market framework in the Non-Interconnected Islands (NII)

- Operational

Too many actors actively involved in the operation of the Hybrid (Hybrid station, Thermal Station operator (PPC), NII Operator (HEDNO), other RES

Smart Islands Project



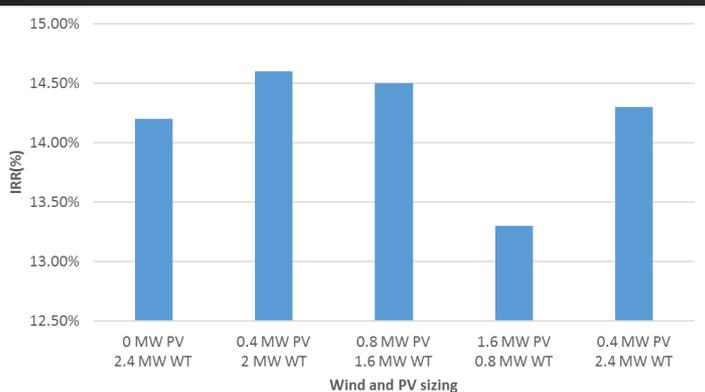
- Hybrid Control Center
- Local SCADA (monitoring, control and management of RES and Storage)
- Functionalities for the participation in the island operation
- Local Control Center
- Real time control
- Direct connection with other SCADA systems (Thermal Station, Hybrid, RES)
- Central Control Center (in Athens)
- Metering infrastructure (for billing)

Required
Infrastructure

Preliminary Findings

Peak annual demand
2.3 MW, total thermal
capacity 4.3 MW.

0.4 MW ground PV,
2 MW wind farm and a 2
MW/8 MWh battery
storage provide RES
penetration levels of 73%,
Attractive IRR >14%



R&I is a key activity in our business



Research, Development and Innovation



HEDNO'S main objective is the continuous modernization through research and development, with emphasis on innovation

"Smart grids" create new opportunities for HEDNO's 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.

Active member of:



HEDNO's Smart Grids projects



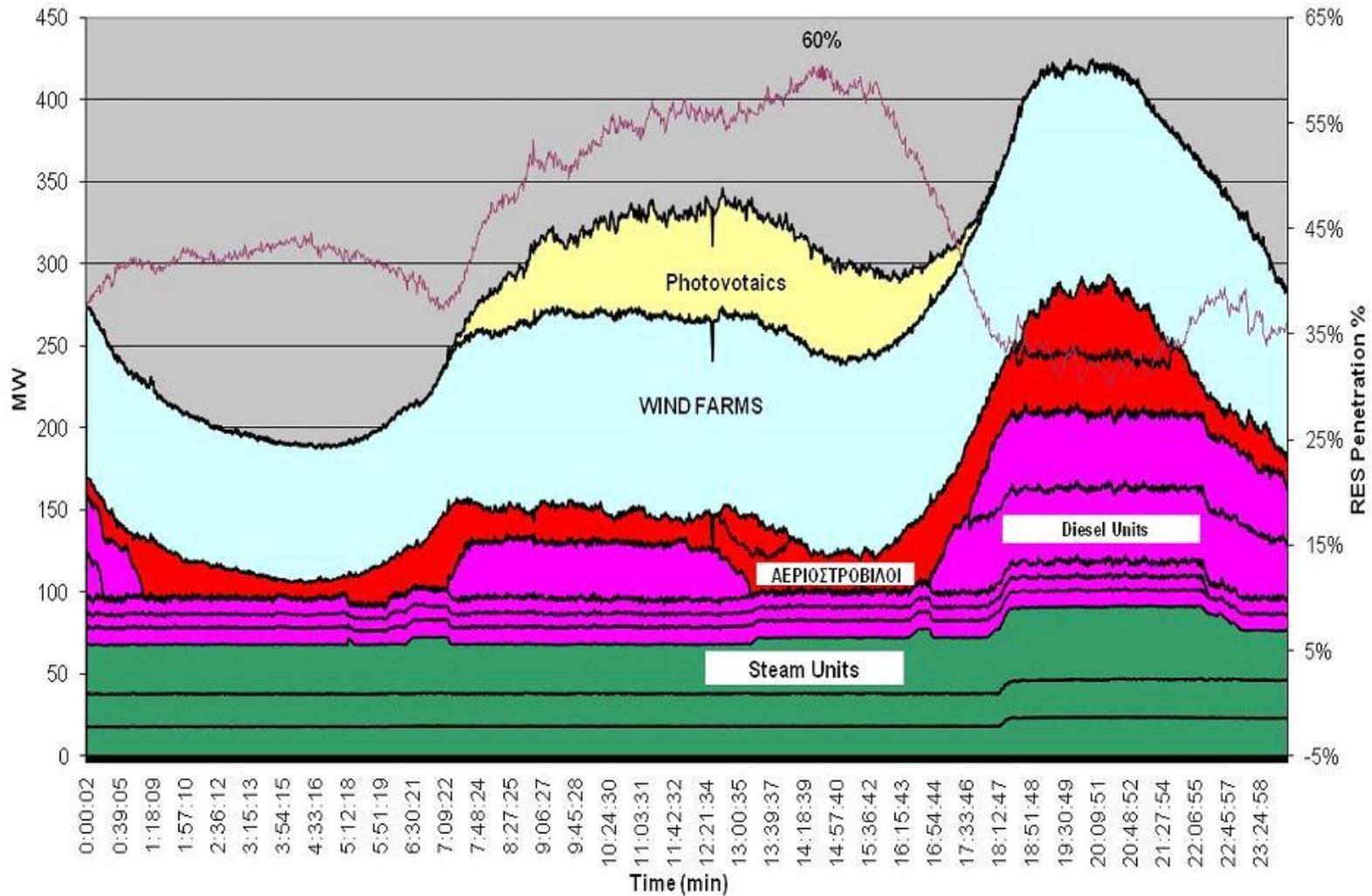
Research and Innovation in the Greek Islands

Success stories



- Kythnos (1982) Operation of the first Wind Park in Europe (5x20kW)
- Kythnos(1983) Operation of the first hybrid station comprising a 100 kW PV system with Battery storage
- Kythnos (2000) Operation of a fully automated power system with 500kW battery storage and a 500kW Wind Turbine
- Kythnos (2001) Operation of the first Microgrid electrifying 12 houses with intelligent autonomous Load Control
- Crete (2003) Development of advanced control software system for isolated systems with high RES penetration
- Ikaria hybrid power station: Consisting of 1.05 MW small hydro, 3MW pumped storage and 2.7MW wind farm (*Almost completed*)
- TILOS: Small Hybrid station (Wind Turbine, PV and battery storage) (on-going)
- Several RD&D projects

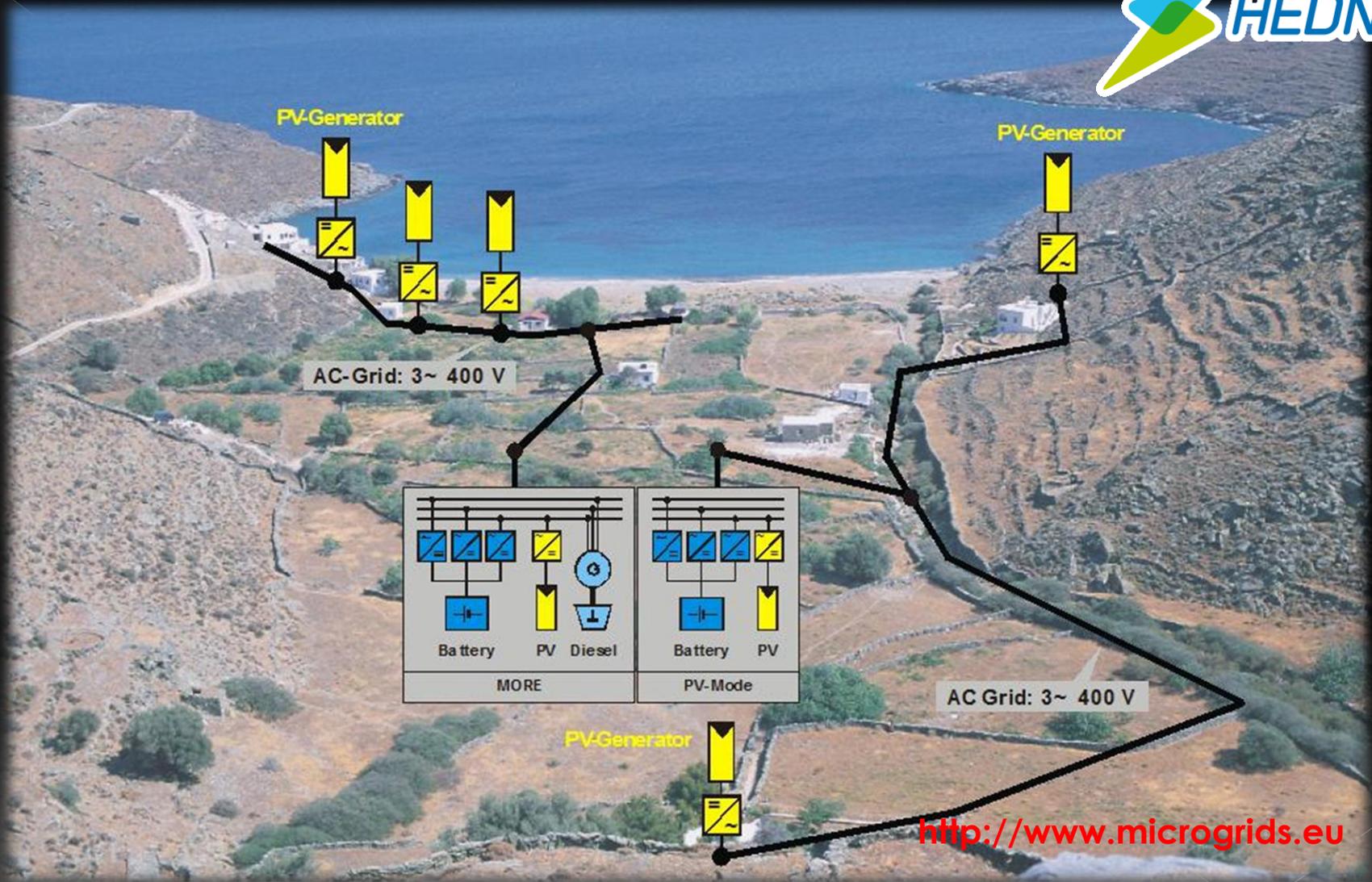
Production Mix: 05/03/13



Crete Power Production – 60% hourly RES penetration

Innovation in Kythnos





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

The Kythnos System House

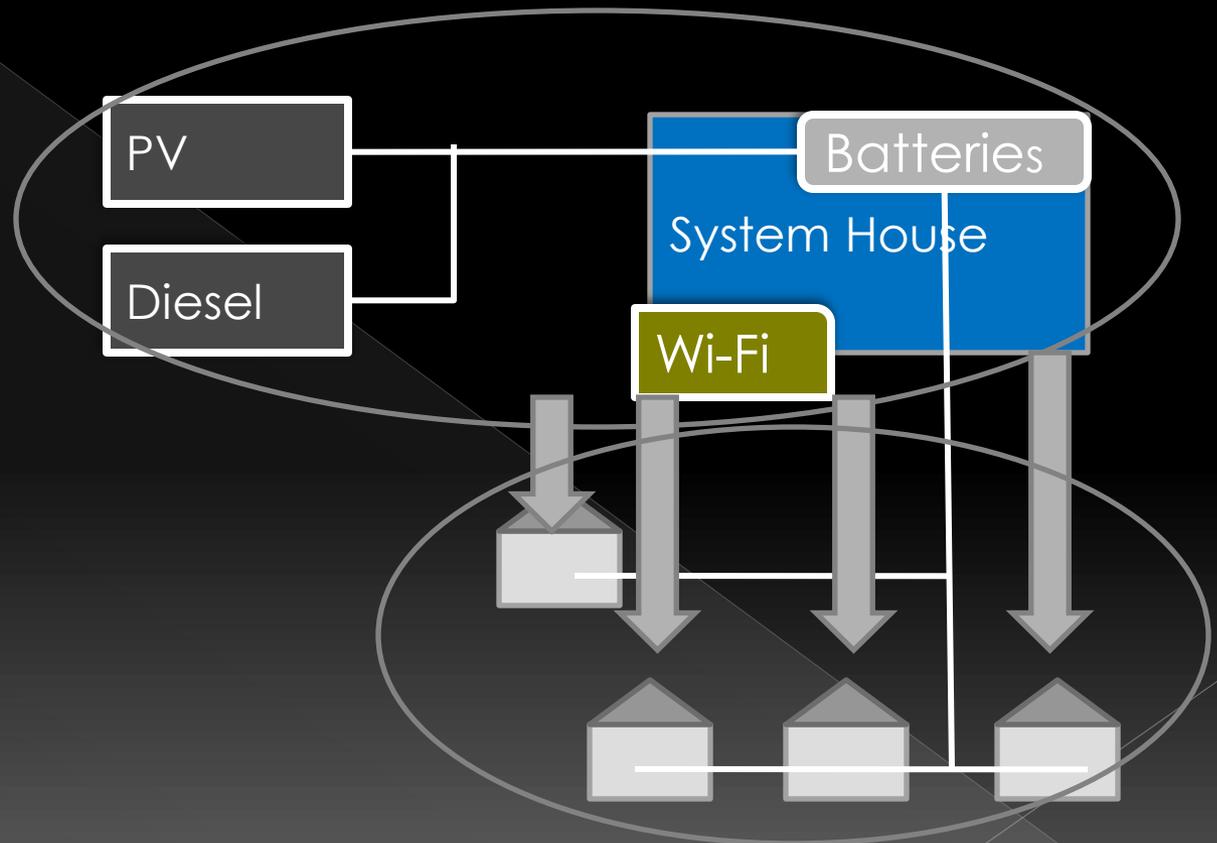


Decentralized MAS Based Control for Energy Efficiency (Kythnos)



Agents embedded in Intelligent Load Controllers identify the status of the environment (available energy)

Agents negotiate on how to share the available energy without central coordination





Our expertise:

- Island operation
- Microgrids
- Advanced DER management

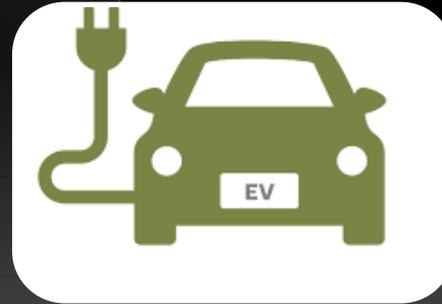
Our next focus:



High RES penetration in Islands (including Storage)



DER mobilization in Islands



Electromobility



Support to local energy communities

Thank you very much

