



Virtual Power Plant for Interoperable and Smart isLANDS

Ehsan Heydarian-Forushani, Seifeddine Ben Elghali

ehsan.heydarian@lis-lab.fr
seifeddine.benelghali@lis-lab.fr



Outline...

- Call Details & Partners
- Energy in islands
- Objectives
- Concept & tools
- Validation & User cases



Call details..

- **Work program:**

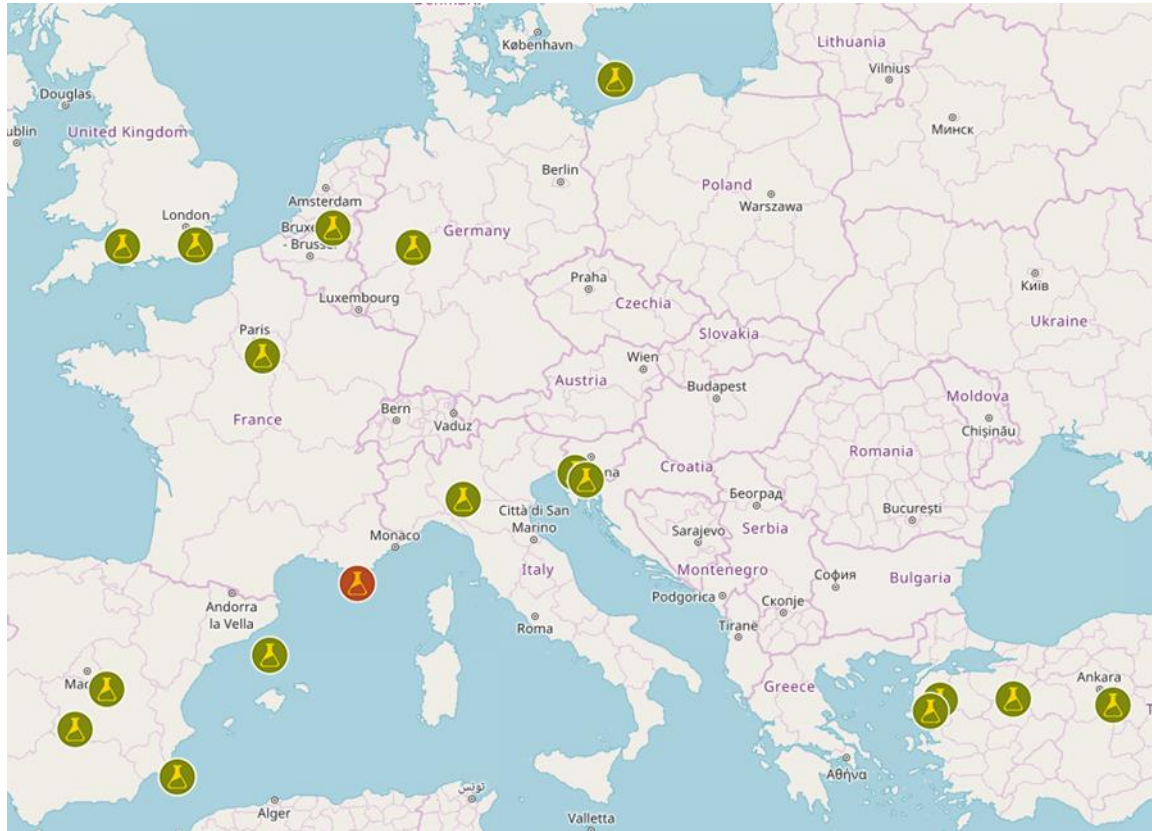
Call: H2020-LC-SC3-2020-EC-ES-SCC

Topic: LC-SC3-ES-4-2018-2020 - Decarbonising energy systems of geographical Islands

- **Type of action:** Innovation Action (IA)
- **TRL:** Strat TRL 5 → End TRL 8
- **Total Budget:** EUR 7 223 108,75 (EU contribution 6 119 378,75)
- **Duration:** 3,5 Years
- **Partners:** 19 from 8 Countries



Partners..



Coordinator



Partners




This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement n°957852

Energy in Islands

- High Carbon intensity

Decarbonization




- Dependance to external supply

Energy independancy



- More expensive

Energy cost




- Continuity of services
- Electric power quality

Electricity supply



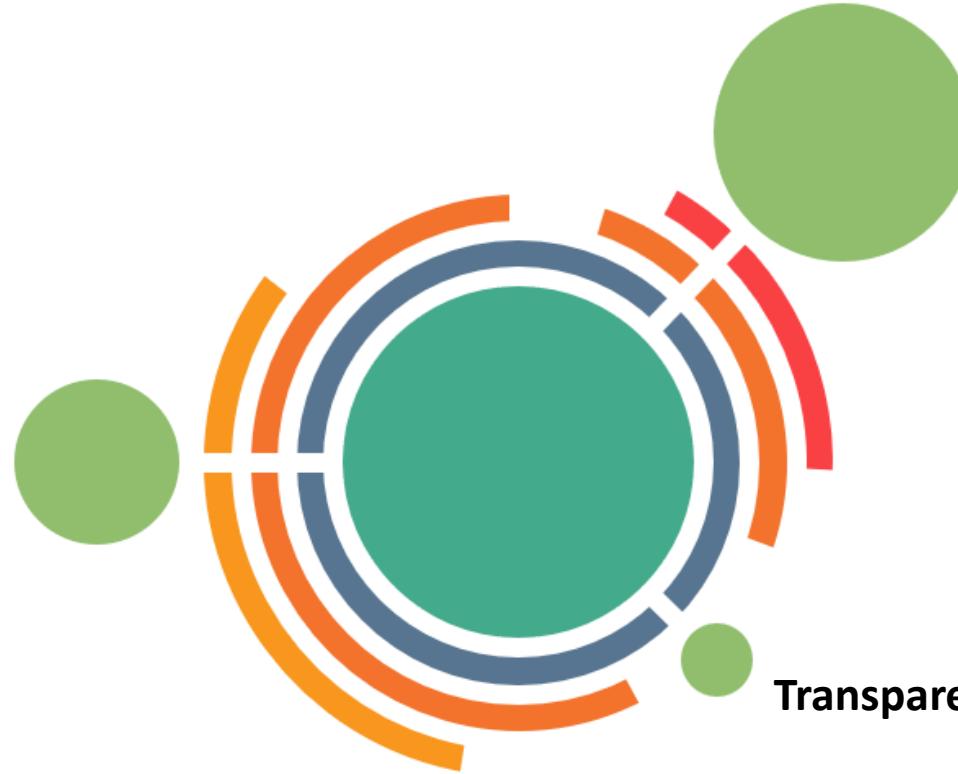
- Power losses

Efficiency



Objectives

**Multi-dimensional flexibility
& Digitalisation**



Renewable energies

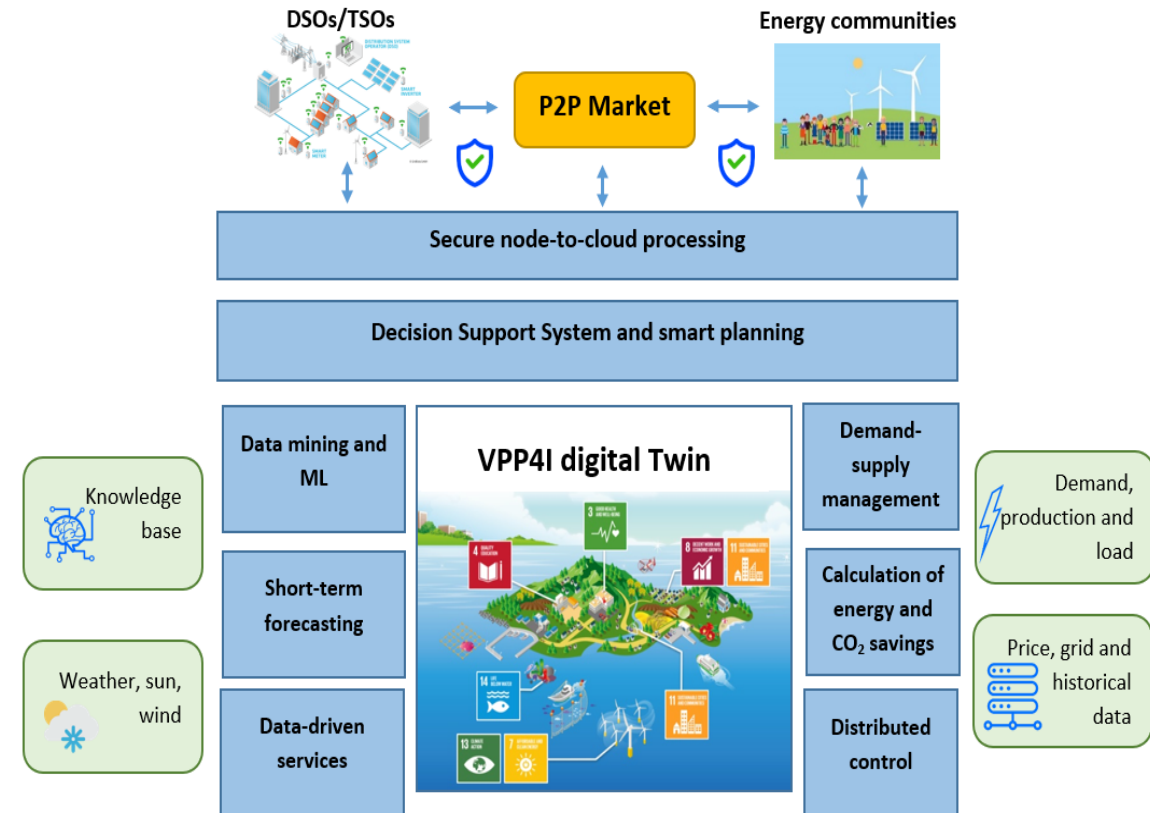
- Increase the penetration level of RES
- Performance of the RES portfolio
- Promote RE Communities

Transparency & cybersecurity



Concepts & Tools

- Digital Twin
- **Historical data :**
 - Better understanding of the energy production and consumption behaviors
 - Propose improvements and lessons learnt from previous experiences
- **Real time data :**
 - Monitor and optimize the decision-making
 - Share experiences with other VPP4Islands
- **Future data :**
 - Forecasting potential factors based on AI/Data-mining and Machine Learning,
 - Increase flexibility.

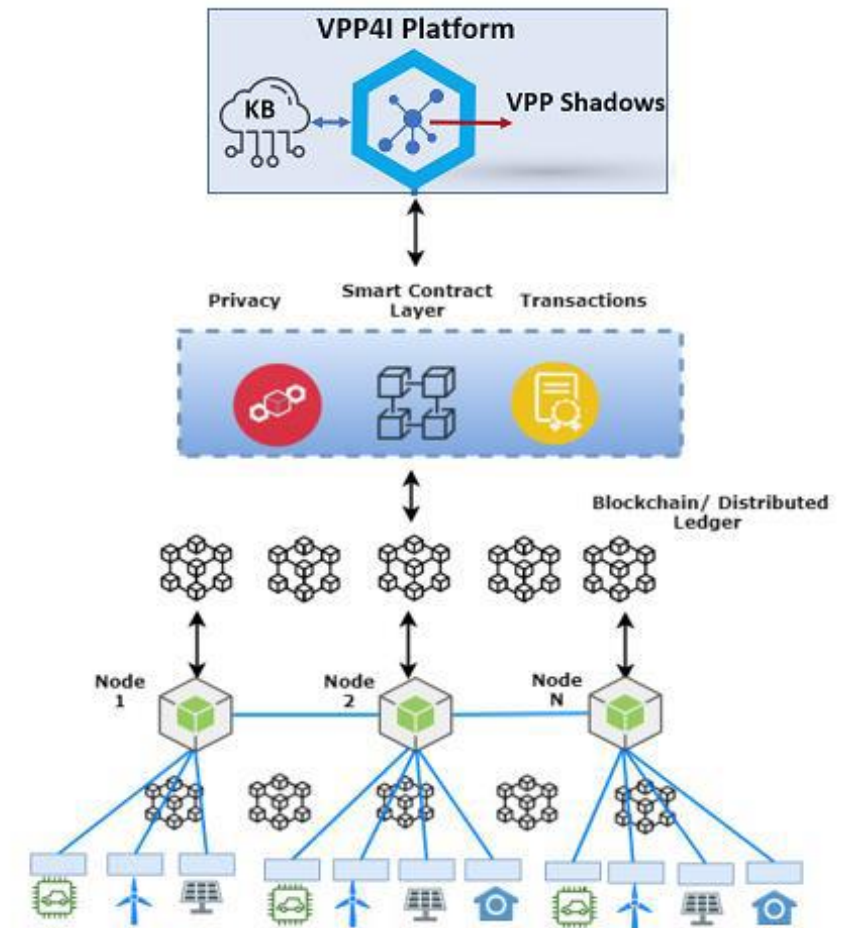


Concepts & Tools

- Distributed Ledger Technology (DLT)

The DLT Technology will ensure:

- Security and trust of the energy information exchange,
- Energy data traceability,
- Elimination of intermediaries and promote P2P energy exchanges,
- Secure access for the stakeholders through the use of relevant security standards and state of the art security and privacy algorithms.



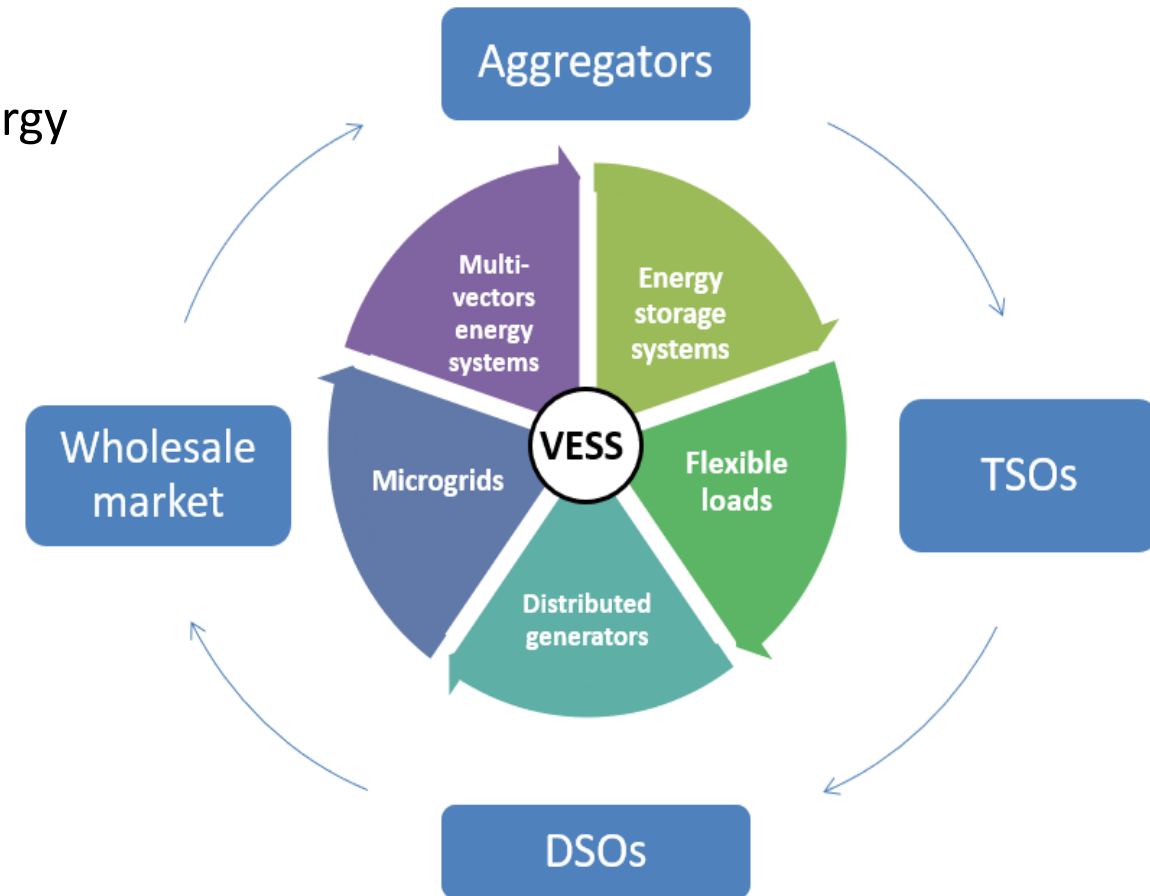
Concepts & Tools

- Virtual Energy Storage System

The aggregation of various controllable components of energy systems:

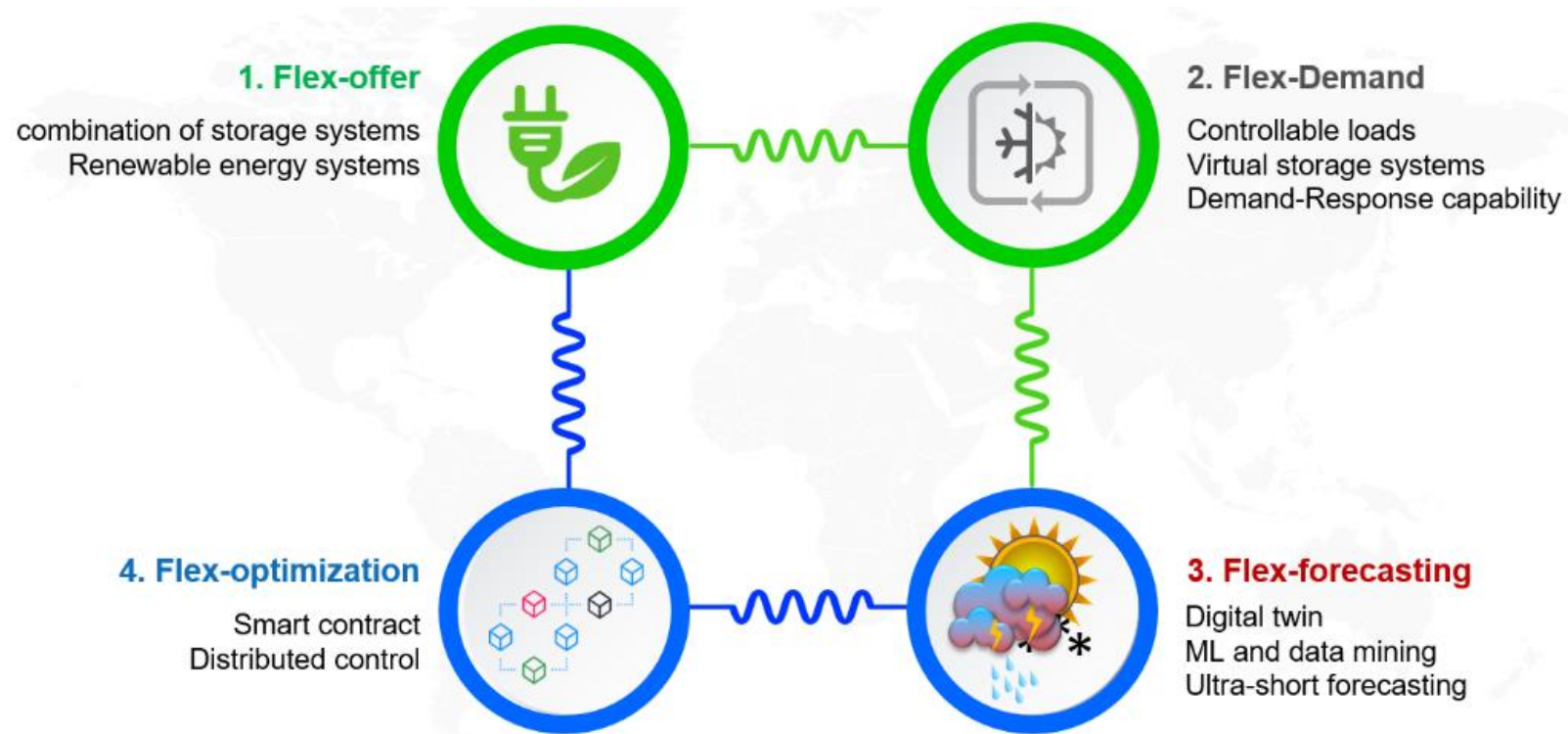
- Conventional energy storage systems
- Flexible loads,
- Distributed generators,
- Microgrids,
- local DC networks,
- Multi-vector energy systems.

Through the coordination of each unit, a VESS will act as a **single high capacity ESS** with **reasonable capital costs**.



Concepts & Tools

- Multi-dimensional Flexibility



Concepts & Tools

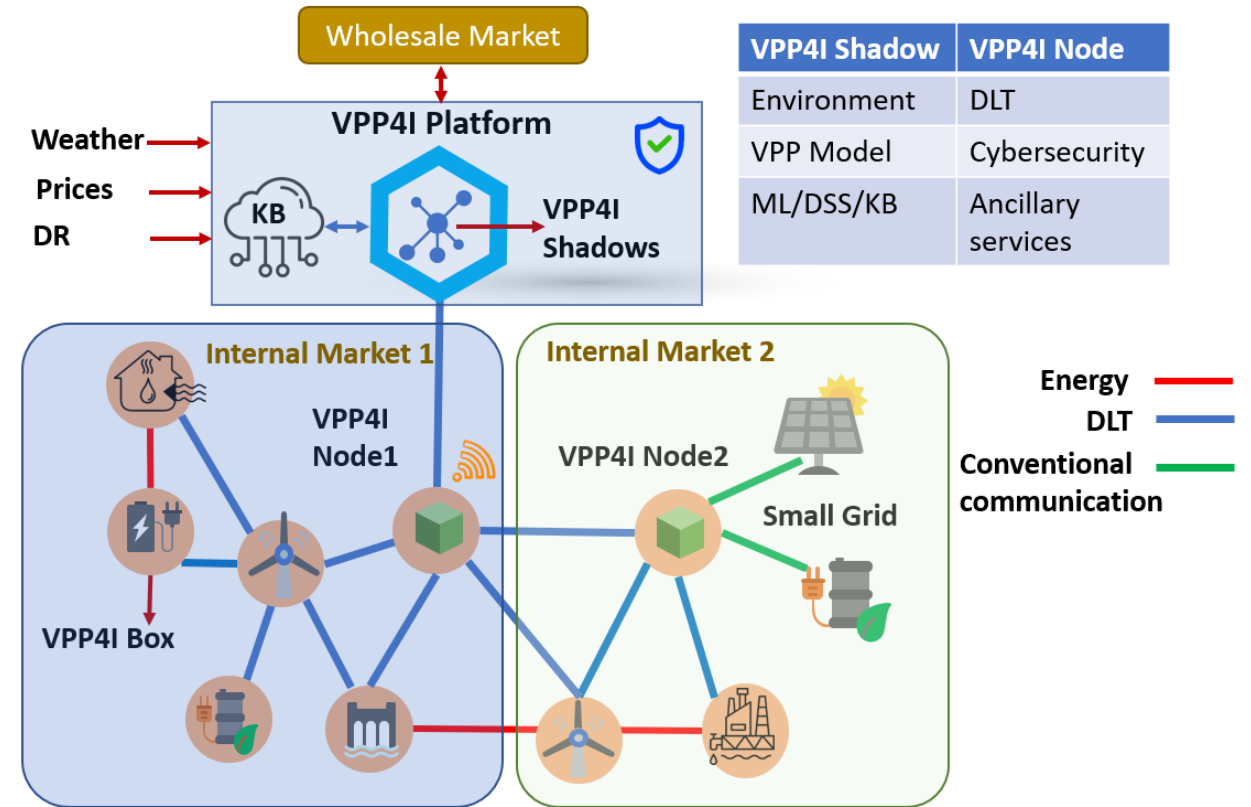


The project aims to develop three tools:

VPP4I-Platform: is a data and information service provider based on advanced software tools

VPP4I-Node: ensure a distributed control and provide setting points for individual energy system of each consumer/prosumer.

VPP4I-Box: hardware with embedded software at each consumer/prosumer location that enables communication with the VPP4I-Node



Validation and User cases

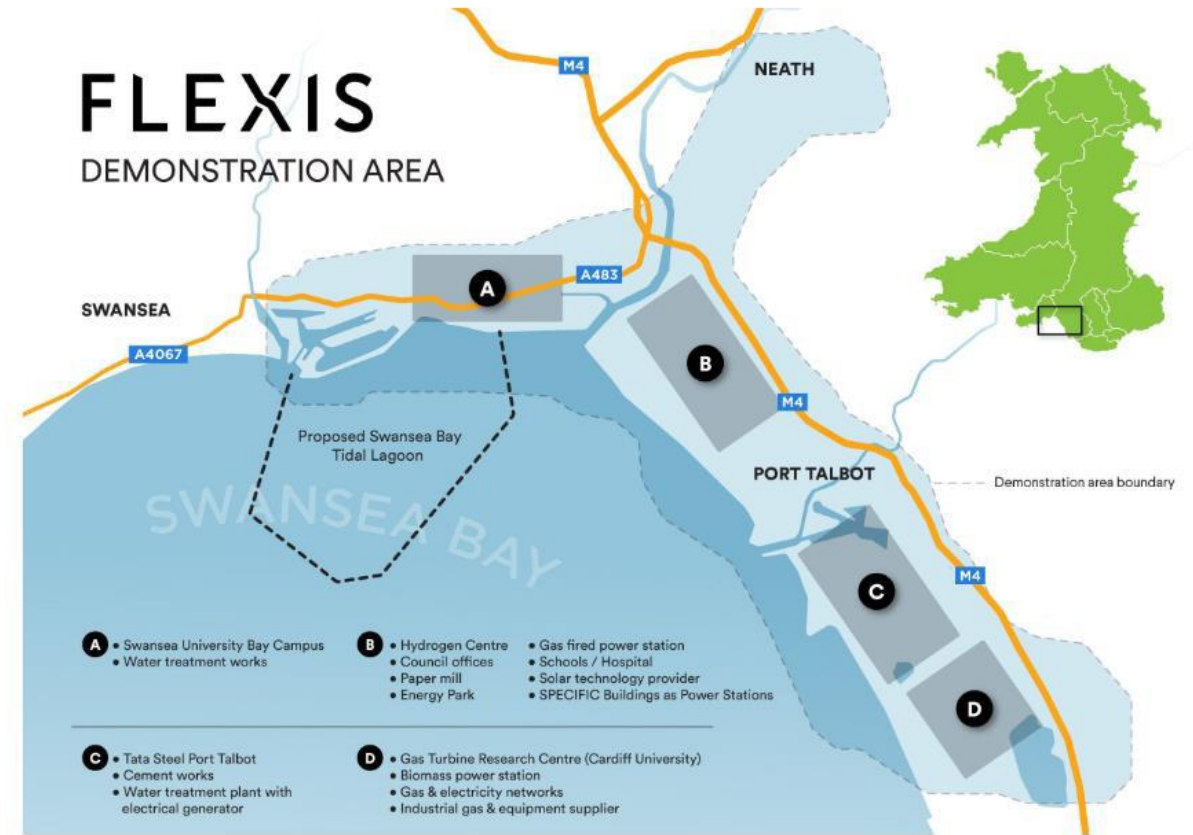
- Demonstration area VESS

The electrical generators within the demonstration site include:

- two biomass power stations,
- Solar farm,
- wind farm / Tidal Lagoon,
- numerous behind-the-meter renewable generation and storage systems.

In terms of consumers the demonstration site includes:

- the Welsh Water Treatment plant (with onsite electrical generation), a cement works, a paper mill, an Amazon warehouse, schools, hospitals, council offices, the University of South Wales Hydrogen Centre, Cardiff University's Gas Turbine research...



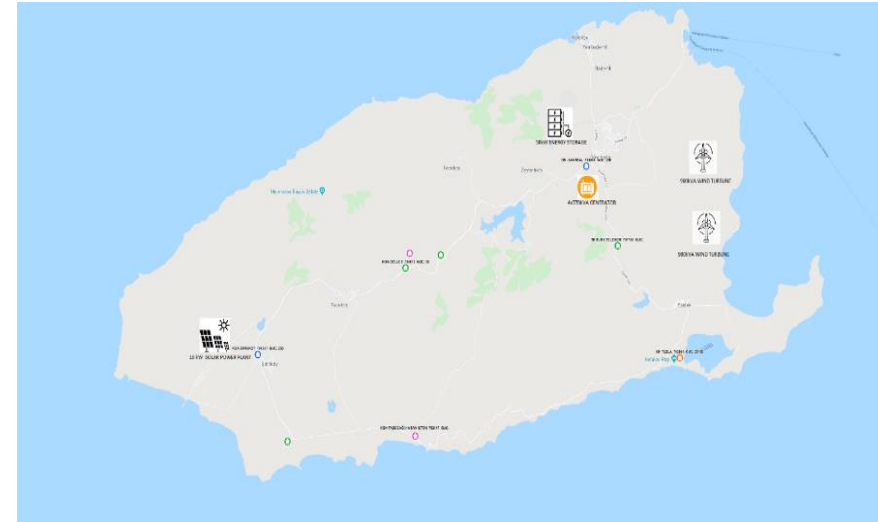
Validation and User cases

- Lead Island 1 : GOKCEADA ISLAND (Turkey)

Area : 279 km²
Population : 9403 (2019)

Power installations:

- Connected to the mainland
- Diesel generators : 4x770 kVA
- Wind turbine : 2x 900 kW
- Solar plant : 200 kW
- Energy storage system: 50 kW (->1 MW)



GOKCEADA ISLAND

Validation and User cases

- Lead Island 2 : FROMENTERA ISLAND (Spain)

Area : 83 km²

Population : 12111

Power needs:

- Winter : 7 MW
- Summer : 18 MW

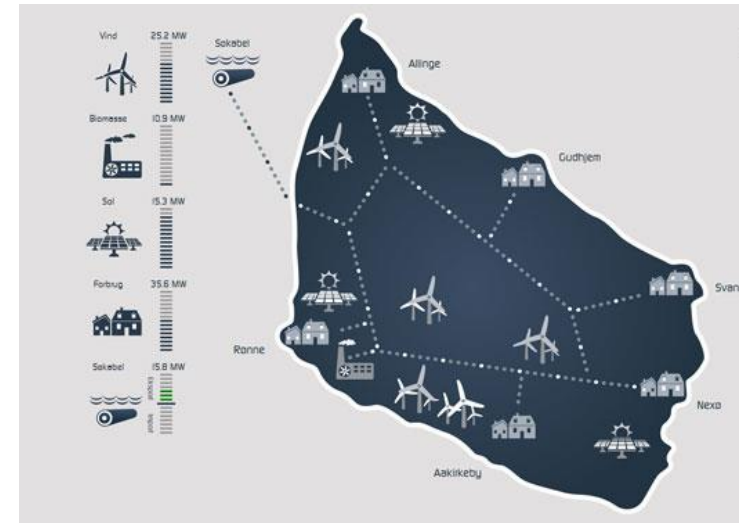
Power Installation:

- Connected to Mallorca island
- Solar plant: 2 MW



Validation and User cases

- Follower Islands
 - Bornholm Island (Denmark)
 - Bozcaada Island (Turkey)
 - Grado Islands (Italy)



Bornholm Island



Grado Islands



Bozcaada Island

Thank you for your attention

