
**Cooperation between Horizon 2020 Projects in the field of Smart Grids and Energy Storage**

# The BRIDGE initiative and project fact sheets

May 2019

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More information at http://www.h2020-bridge.eu/.

# Contents

# Foreword

*The vision of the Energy Union put forward by the European Commission in February 2015 is of an integrated continent-wide energy system where strong, innovative and competitive companies can develop the industrial products and technology needed to deliver energy efficiency and low-carbon technologies. Citizens should be able to take ownership of the transition and participate actively in the market. Both the Energy Union and the Digital Single Market focus on tangible benefits for the consumer.*

*Important milestones for this transformation are the EU's energy and climate targets for 2030 which also underpin Europe's leading role in the fight against climate change.*

*A shift towards a low-carbon economy calls for increasing digitalisation of the energy system. Digital developments (big data, the internet of things, 5G, artificial intelligence, smart grids, smart metering, smart buildings, smart charging solutions for electric vehicles, etc.) impact multiple aspects of European energy policy. An ever smarter energy system can perform power generation, transmission, network management and marketing-related tasks with better precision and faster response times than human-dependent systems, thereby saving energy, prioritising usage, and setting policies for quick response to outages. Technological developments also allow for much-needed cross-sectorial synergies (e.g. between energy, ICTs and telecoms).*

*With the strong belief that innovation is an investment in our future, the European Commission is supporting, via Horizon 2020 – the biggest EU Research and Innovation programme ever – close to market projects on Smart Grids and Energy Storage, which have the potential to contribute to a successful, digitally-supported energy transition.*

*To complement the work of each individual project, we have launched the BRIDGE initiative. This allows ongoing Horizon 2020 Smart Grid and Energy Storage projects to contribute to creating a common view on cross-cutting issues they encounter that may be obstacles to innovation.*

*We welcome the BRIDGE projects brochure. It shows clearly the different areas they address in terms of technologies or enabled services, the project partners and the geographical coverage. We look forward to welcoming new projects when they start, thus making it a living platform.*

*Enjoy the reading!*

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# Introduction to the BRIDGE initiative

## Purpose of the initiative

BRIDGE is a cooperation group involving 44 Low Carbon Energy (LCE) Smart-Grid and Energy Storage projects funded under the Horizon 2020 program over the last four years (2014-2017). It aims to foster the exchange of information, experience, knowledge and best practices among its members.

BRIDGE wants to provide field experience, feedback and lessons learned from the participating projects to help overcome the barriers to effective innovation. It aims to gather coordinated, balanced and coherent recommendations to strengthen the messages and maximize their impacts towards policy makers in view of removing barriers to innovation deployment.

## BRIDGE Working Groups

This cooperation group involves four different types of activities (Working Groups) addressing cross-cutting issues enlisted as follows:

### Data Management

- **Communication Infrastructure**, embracing the technical and non-technical aspects of the communication infrastructure needed to exchange data and the related requirements
- **Cybersecurity and Data Privacy**, entailing data integrity, customer privacy and protection
- **Data Handling**, including the framework for data exchange and related roles and responsibilities, together with the technical issues supporting the exchange of data in a secure and interoperable manner, and the data analytics techniques for data processing

### Regulations

- As regards to **energy storage**, the regulatory framework needs to provide clear rules and responsibilities concerning ownership, competition, technical modalities and financial conditions, for island and mainland cases
- In terms of **smart grids**, regulatory challenges arise regarding the incentives for demand-side response, commercial arrangements, smart meter data, etc.

### Customer Engagement

- Customer Segmentation, analysis of **cultural**, **geographical** and **social** dimensions,
- **Value** systems - Understanding Customers
- **Drivers** for Customer **Engagement**
- Effectiveness of Engagement Activities
- Identification of what triggers **behavioral changes** (e.g. via incentives)
- The **Regulatory** Innovation to Empower Consumers

### Business Models

- Defining common language and frameworks around **business model description and valuation**
- Identifying and evaluating **existing and new or innovative business models** from the project demonstrations or use cases
- The development of a **simulation tool** allowing for the comparison of the **profitability of different business models** applicable to smart grids and energy storage solutions is being developed and tested by the Working Group members

# Overview of the BRIDGE projects

## Horizon 2020 calls and corresponding projects

The participating projects to the BRIDGE initiative have been selected under different H2020 calls from 2014 to 2017.

The projects selected under the 2014 calls focus on distribution grid and storage topics.

### LCE-08-2014 - Local / small-scale storage

- **ELSA:** Energy Local Storage Advanced system http://elsa-h2020.eu/
- **NETFFICIENT**: Energy and economic efficiency for today's smart communities through integrated multi storage technologies
  http://netfficient-project.eu/
- **RealValue**: Realising Value from Electricity Markets with Local Smart Electric Thermal Storage Technology
  http://www.realvalueproject.com/
- **SENSIBLE**: Storage-Enabled Sustainable Energy for Buildings and Communities
  http://www.h2020-project-sensible.eu/
- **STORY**: Added value of STORage in distribution sYstems
  http://horizon2020-story.eu/
- **TILOS**: Technology Innovation for the Local Scale, Optimum Integration of Battery Energy Storage
  http://www.tiloshorizon.eu/

### LCE-10-2014 - Next generation technologies for energy storage

- **NAIADES**: Na-Ion bAttery Demonstration for Electric Storage
  http://www.naiades.eu/

### LCE-07-2014 - Distribution grid and retail market

- **AnyPLACE**: Adaptable Platform for Active Services Exchange
  http://www.anyplace2020.org/
- **EMPOWER**: Local Electricity retail Markets for Prosumer smart grid pOWER services
  http://empowerh2020.eu/
- **ENERGISE**: ICT-based ENERgy Grid Implementation – Smart and Efficient
  http://project-energise.eu/
- **Flex4Grid**: Prosumer Flexibility Services for Smart Grid Management
  https://www.flex4grid.eu/
- **FLEXICIENCY**: energy services demonstrations of demand response, FLEXibility and energy effICIENCY based on metering data
  http://www.flexiciency-h2020.eu/
- **FLEXMETER**: Flexible smart metering for multiple energy vectors with active prosumers
  http://flexmeter.polito.it/
- **NOBEL GRID:** New Cost Efficient Business Models for Flexible Smart Grids
  http://nobelgrid.eu/
- **P2P-SmartTest**: Peer to Peer Smart Energy Distribution Networks
  http://www.p2psmartest-h2020.eu/
- **SmarterEMC2**: Smarter Grid: Empowering SG Market Actors through Information and Communication Technologies
  http://www.smarteremc2.eu/
- **UPGRID**: Real proven solutions to enable active demand and distributed generation flexible integration, through a fully controllable LOW Voltage and medium voltage distribution grid
  http://upgrid.eu/

In 2015, the H2020 calls covered transmission grid and large-scale storage areas.

**LCE-05-2015 - Innovation and technologies for the deployment of meshed off-shore grids**

- **PROMOTION**: Progress on Meshed HVDC Offshore Transmission Networks https://www.promotion-offshore.net/

**LCE-06-2015 - Transmission grid and wholesale market**

- **FutureFlow**: Designing eTrading Solutions for Electricity Balancing and Redispatching in Europe http://www.futureflow.eu/
- **MIGRATE**: Massive InteGRATion of power Electronic devices https://www.h2020-migrate.eu/
- **SmartNet**: Smart TSO-DSO interaction schemes, market architectures and ICT Solutions for the integration of ancillary services from demand side management and distributed generation http://smartnet-project.eu/

**LCE-09-2015 - Large scale energy storage**

- **CryoHub**: Developing Cryogenic Energy Storage at Refrigerated Warehouses as an Interactive Hub to Integrate Renewable Energy in Industrial Food Refrigeration and to Enhance PowerGrid Sustainability http://cryohub.eu/en-gb/
- **STOREandGO**: Innovative large-scale energy STOragE technologies AND Power-to-Gas concepts after Optimisation http://www.storeandgo.info/

The demonstration projects selected under the 2016 H2020 calls focused on distribution system (grid and storage). In addition, two projects dealing with renewable technologies and their integration to the power system were invited to join BRIDGE.

**LCE-02-2016 - Demonstration of smart grid, storage and system integration technologies with increasing share of renewables: distribution system**

- **GOFLEX**: Generalized Operational FLEXibility for Integrating Renewables in the Distribution Grid http://www.goflex-community.eu/
- **InteGrid**: Demonstration of INTElligent grid technologies for renewables INTEgration and INTEractive consumer participation enabling INTEroperable market solutions and INTErconnected stakeholders https://integrid-h2020.eu/
- **inteGRIDy**: integrated Smart GRID Cross-Functional Solutions for Optimized Synergetic Energy Distribution, Utilization Storage Technologies http://www.integridy.eu/
- **INTERFLEX**: Interactions between automated energy systems and Flexibilities brought by energy market players http://interflex-h2020.com/
- **INVADE**: Smart system of renewable energy storage based on INtegrated EVs and bAtteries to empower mobile, Distributed and centralised Energy storage in the distribution grid https://www.invadeh2020.eu/
- **SMILE:** SMart IsLand Energy systems http://www.h2020smile.eu/
- **WiseGRID**: Wide scale demonstration of Integrated Solutions and business models for European smartGRID http://www.wisegrid.eu/

**LCE-07-2016-2017 - Developing the next generation technologies of renewable electricity and heating/cooling**

- **GRIDSOL**: Smart Renewable Hubs For Flexible Generation: Solar Grid Stability http://www.gridsolproject.eu/
- **RE-SERVE**: Renewables in a Stable Electric Grid http://www.re-serve.eu/

End 2017, four H2020 projects were selected dealing with transmission.

**LCE-04-2017 - Demonstration of system integration with smart transmission grid and storage technologies with increasing share of renewables**

- **CROSSBOW**: CROSS BOrder management of variable renewable energies and storage units enabling a transnational Wholesale market http://crossbowproject.eu/
- **EU-SysFlex**: Pan-European system with an efficient coordinated use of flexibilities for the integration of a large share of RES http://www.eu-sysflex.com/
- **FLEXITRANSTORE**: An Integrated Platform for Increased FLEXIbility in smart TRANSmission grids with STORage Entities and large penetration of Renewable Energy Sources http://www.flexitranstore.eu/
- **OSMOSE**: Optimal System-Mix Of flexibility Solutions for European electricity http://www.osmose-h2020.eu/

In 2018, eight H2020 projects were selected dealing with Islands and TSO-DSO cooperation:

**LC-SC3-ES-3-2018-2020 - Integrated local energy systems (Energy islands)**

- **COMPILE:** Integrating Community Power in Energy Islands www.compile-project.eu
- **E-LAND:** Integrated multi-vector management system for Energy isLANDs' http://www.elandh2020.eu
- **MERLON:** Integrated Modular Energy Systems and Local Flexibility Trading for Neural Energy Islands *Website not existing yet*
- **MUSEGRIDS:** Multi Utilities Smart Energy GRIDS http://www.muse-grids.eu/

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

- **GIFT:** Geographical Islands FlexibiliTy www.gift-h2020.eu
- **REACT:** Renewable energy for self-sustainable island communities *Website not existing yet*

**LC-SC3-ES-5-2018-2020 -TSO – DSO – Consumer: large-scale demonstrations of innovative grid services through demand response, storage and small-scale (res) generation**

- **CoordiNet:** Large scale campaigns to demonstrate how TSO-DSO shall act in a coordinated manner to procure grid services in the most reliable and efficient way http://www.coordinet-project.eu/
- **INTERRFACE:** TSO-DSO-Consumer INTERFACE architecture to Provide innovative Grid Services for an efficient power system www.interrface.eu

In March 2019, BRIDGE gathers a total of 44 projects, involving **545 organisations** from 38 countries for a total **EC funding to all projects of 484 M€**.

| Distribution Grids | Distributed Storage | Transmission Grids | Large-scale Storage | RES and H&C | Islands | TSO-DSO Cooperation |
|---|---|---|---|---|---|---|
| **2014:**<br>**10 projects, 60 M€** | **2014:**<br>**7 projects, 72 M€** | **2015:**<br>**4 projects, 82 M€** | **2015:**<br>**2 projects, 25 M€** | **2016:**<br>**2 projects, 8 M€** | **2018:**<br>**6 projects, 41 M€** | **2018:**<br>**2 projects, 32 M€** |
| AnyPLACE, EMPOWER, Flex4Grid, FLEXICIENCY, MLEXMETER, Nobel Grid, P2P-smartest, SmarterEMC2, energise, UPGRID | Elsa, NAIADES, RealValue, NETfficient, SENSIBLE, STORY | FutureFlow, MIGRATE, SmartNet, PROMOTioN | CRYOHUB, STORE&GO | GRIDSOL, RESERVE | E-LAND, Compile, MERLON, MUSE GRIDS, REACT, GIFT | coordiNET, INTERRFACE |
| **2016:**<br>**7 projects, 87 M€** | | **2017:**<br>**4 projects, 76 M€** | | | | |
| GOFLEX, inteGRIDy, INVADE, InterFLEX, integrid, sm;e, wiseGRID | | crossbow, EU-SysFlex, flexitranstore, OSMOSE | | | | |

# Stakeholders involved in BRIDGE projects

Different types of stakeholders are participating in the BRIDGE initiative. The following categorisation has been adopted.


**Consumers** include residential, professional and industrial consumers, as well as cities acting as consumers in projects.


**Regulated Operators** are TSOs and DSOs as defined by the Electricity Directive.


**Regulators** are the National Regulatory Authorities as defined by the Electricity Directive.


**Local Energy Communities** are defined as associations, cooperatives, partnerships, non-profit organisations or other legal entities which are effectively controlled by local shareholders or members, generally value rather than profit-driven, involved in distributed generation and in performing activities of a distribution system operator, supplier or aggregator at local level, including across borders.


**Power technology providers** are hardware manufacturers for power transmission, distribution and generation technologies. **Storage providers** are considered in a separate category (all storage technologies are considered, including batteries from EVs and hot water tanks). **ICT providers** are software and telecommunication vendors.


**Energy Suppliers** include power generators, retailers, energy service companies (ESCOs) acting in the competitive energy market. **Aggregators** are market participants that combine multiple customer loads or generated electricity for sale, for purchase or auction in any organised energy market. **Market operators** include power exchanges, brokers and traders on the energy markets.


**Research & Innovation** stakeholders include research centres, universities, think-tanks, consultants and other services.

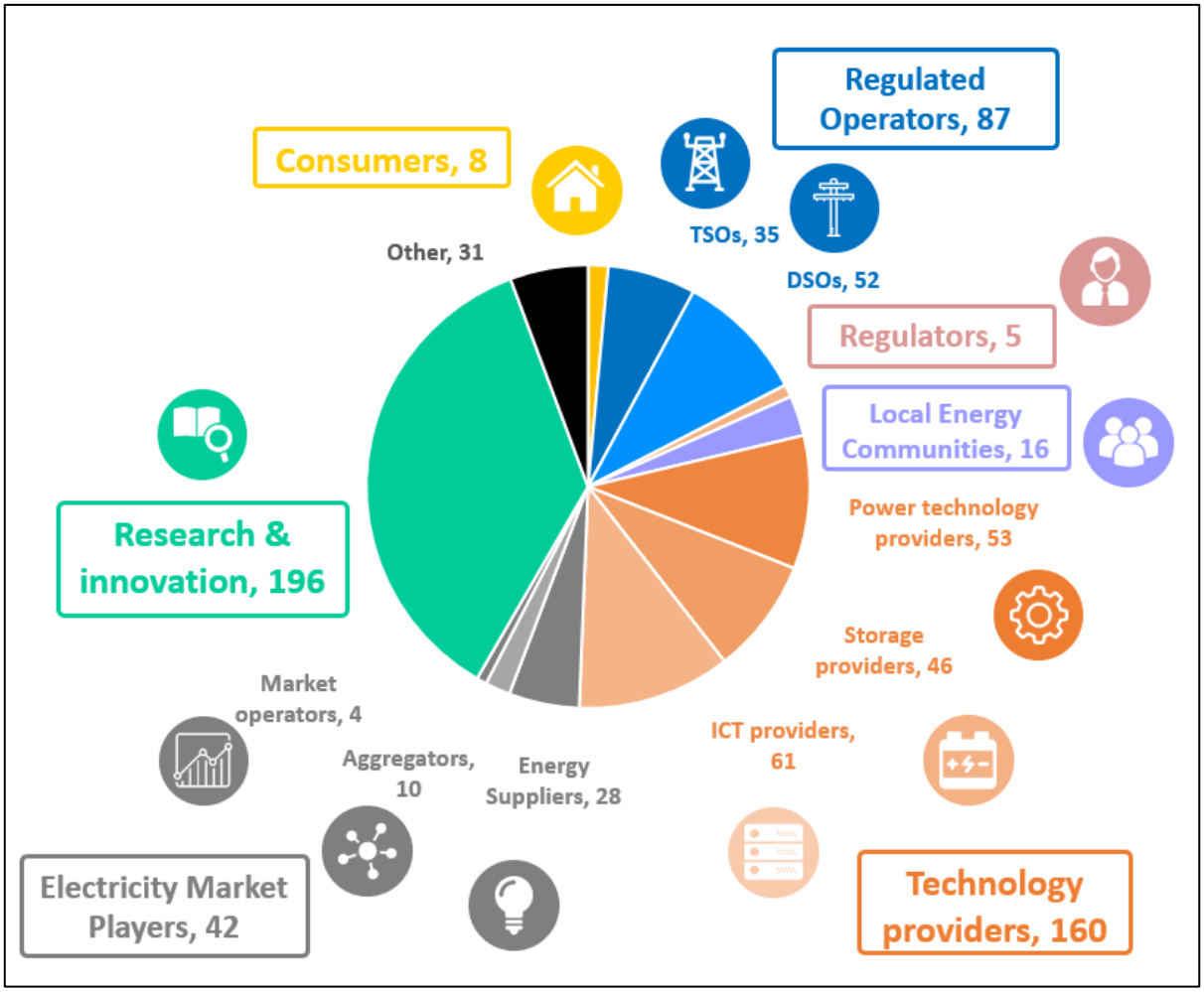

**Others** is a category that covers stakeholders that do not fall in any of the above-defined categories such as international organisations, communication agencies, water supply operators…

The type of an association depends on the type of members it represents.

Some stakeholders fall into several categories: electricity operators on islands for instance, act both as energy suppliers and DSOs; some power technology providers sell ICT tools and storage devices.

The following diagram categorises stakeholders according to their dominant role within the BRIDGE projects, as seen by the project coordinators:

- Around 60% of the regulated operators are DSOs and almost 40% are TSOs.
- Technology providers comprise 33% power technology providers, 29% storage providers and 38% ICT providers.
- Energy suppliers constitute the main electricity market players involved in BRIDGE projects followed by aggregators and market operators.
- Research and Innovation actors are the dominant category of stakeholders in BRIDGE projects.



# Geographical distribution of BRIDGE projects

## Geographical distribution of stakeholders

BRIDGE projects involve stakeholders from 38 countries as presented by the figure below.

- The number of projects per country is calculated based on the stakeholders involved in the projects;
- The number of stakeholders involved per country corresponds to the total number of partners from this country in all the BRIDGE projects.

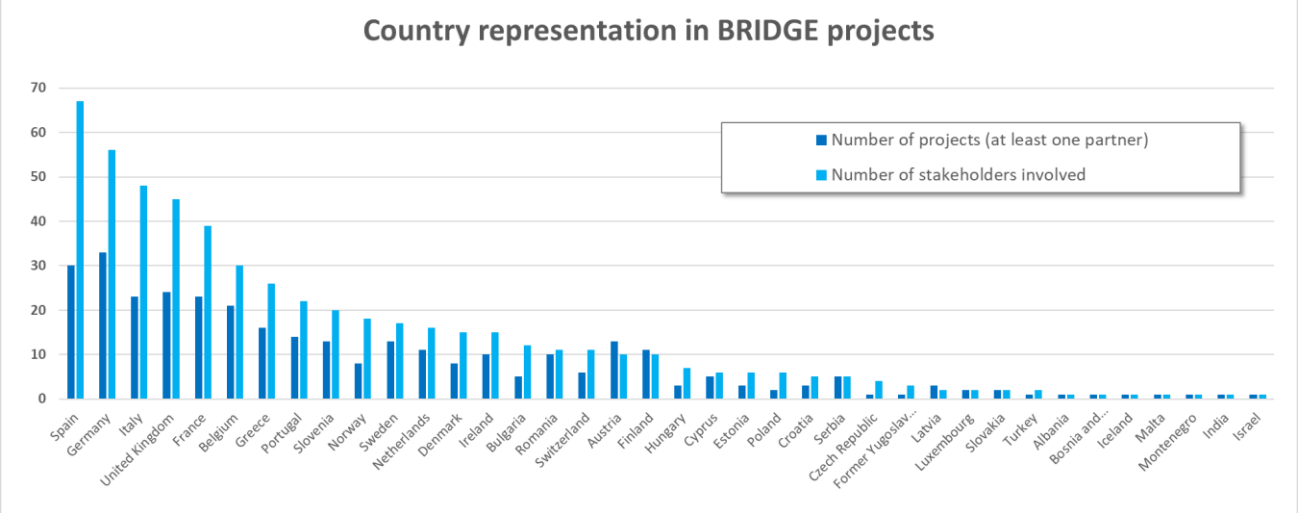
Spanish stakeholders are the most represented in BRIDGE projects, followed by stakeholders from Germany, Italy, UK, France, Belgium and Greece.

When the number of stakeholders involved per country is higher than the number of projects, it means that more than one partner from the same country are participating in each project.

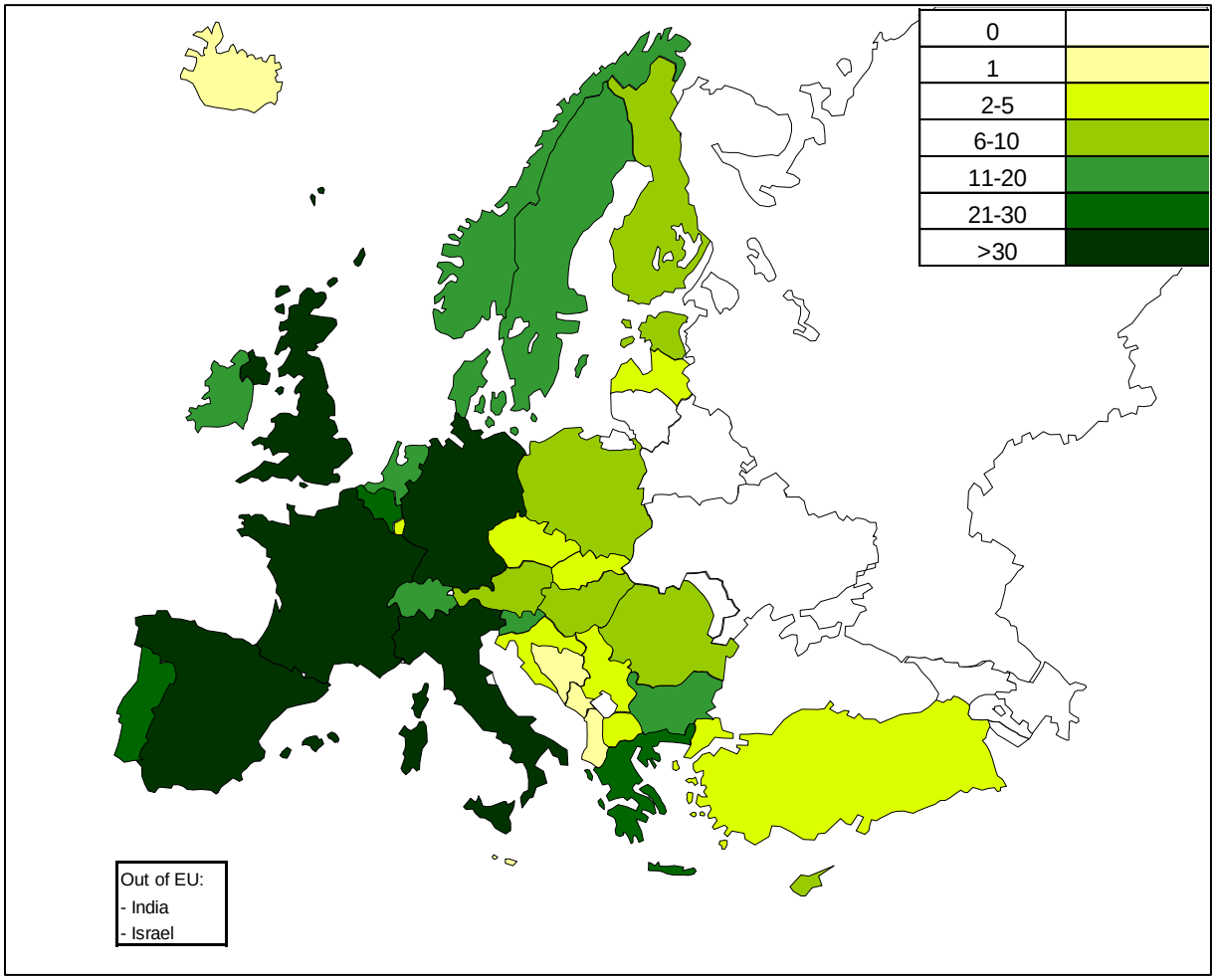
In some cases, there are more projects than stakeholders involved for a given country, meaning that the same stakeholders participate in several projects (examples from Austria, Finland, Latvia…).

A few stakeholders from outside the EU are participating in BRIDGE projects: they are from Norway, Switzerland, Turkey, Iceland, Montenegro, Bosnia and Herzegovina, Albania, Former Yugoslavia, Serbia, India and Israel.

Furthermore, one Member States is not represented in BRIDGE projects: Lithuania.



***Number of stakeholders involved per country***

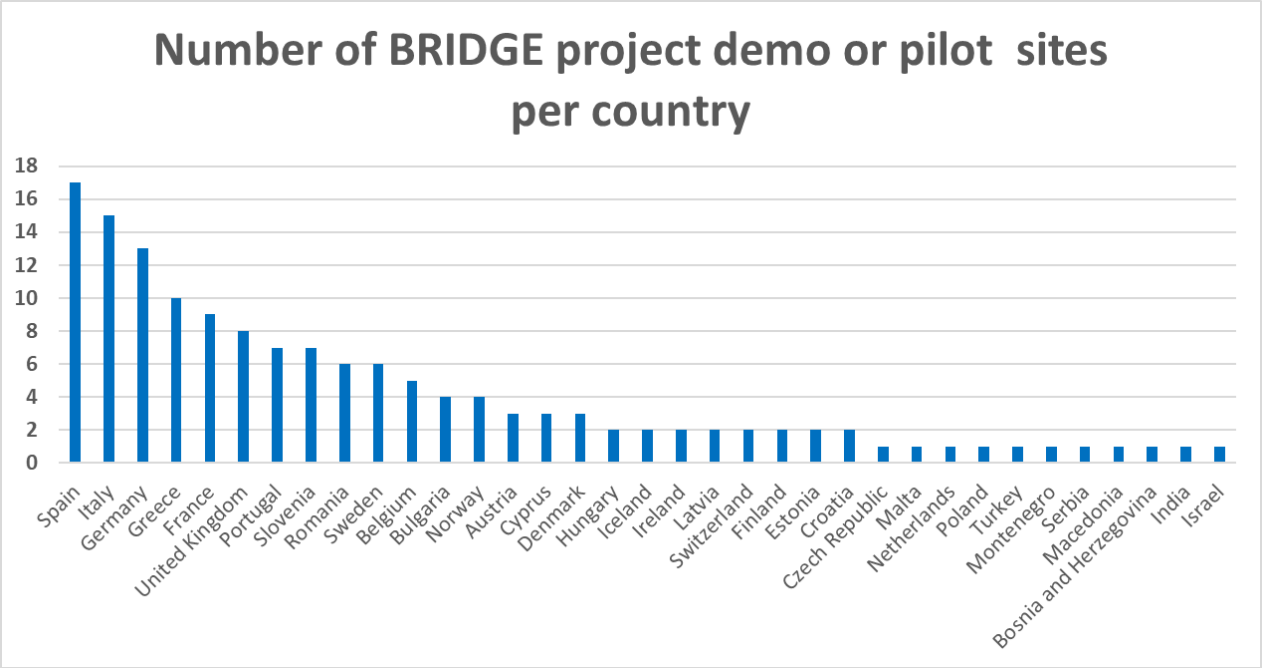


## Geographical distribution of physical demonstrators and pilots

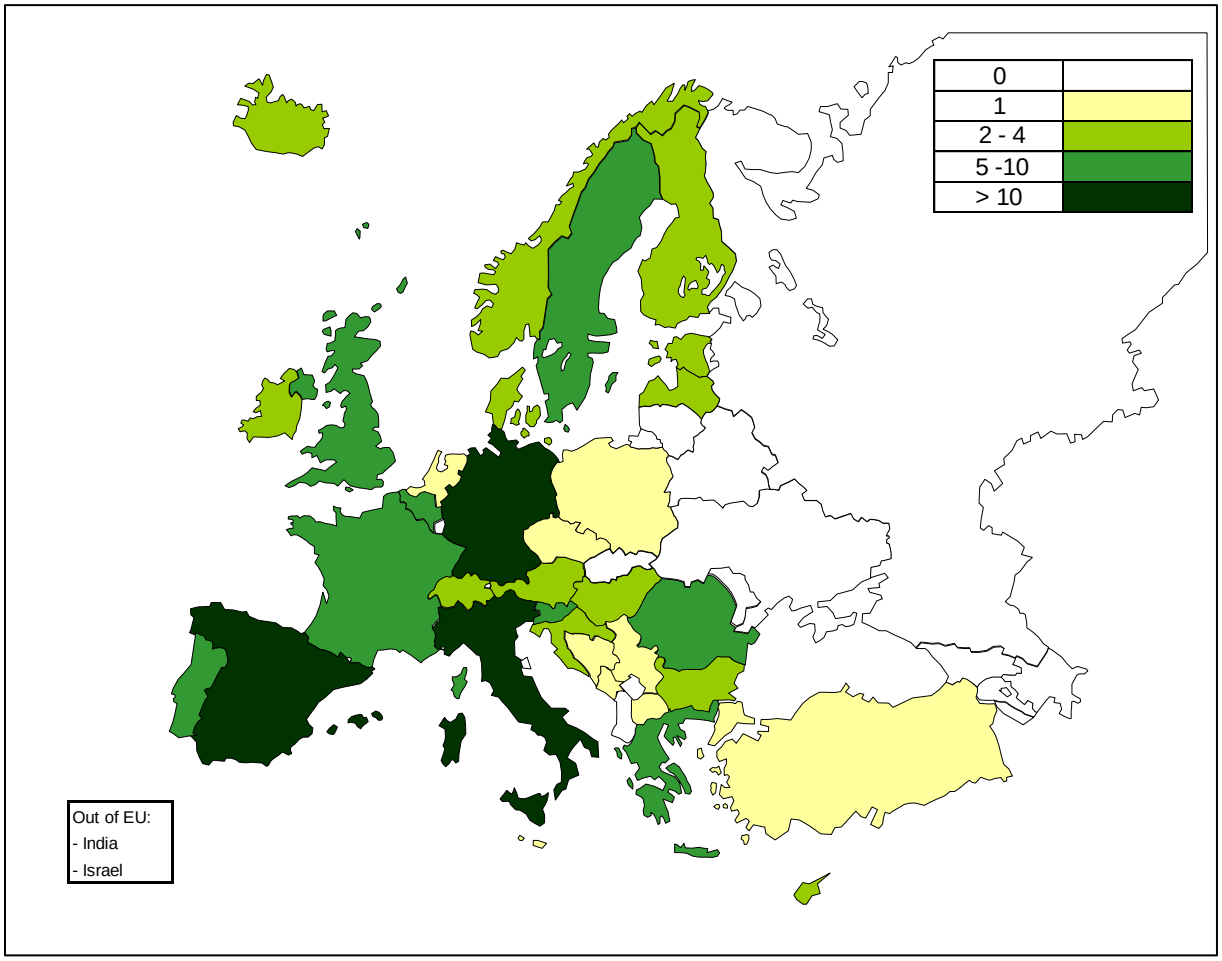
Most of the BRIDGE projects involve demonstrations or pilot tests of technologies and solutions.

BRIDGE demos or pilots are hosted by 35 countries as indicated on the figure and the map below.

Spain hosts the highest number of demo sites, followed by Italy, Germany, Greece, France, UK, Portugal, Slovenia and Romania.



***Number of demos or pilot sites per country***



# Technologies tackled by BRIDGE projects

A broad range of technologies and services are being tested by BRIDGE projects. Six main categories are considered here:

**Technologies for Consumers:** Demand response, smart appliances, and smart metering.

**Grid technologies:** HVDC, HVAC, Multi terminal, protections, HVDC breaker, inertia, network management, monitoring and control tools, and micro-grid.


**Large-scale storage technologies, in general connected at transmission level[1]:** Power to Gas (P2G), Compressed Air Energy Storage (CAES) and hydro storage.

**Small-scale storage technologies, in general connected at distribution level[2]:** batteries (including from electric vehicles), thermal energy storage (including power to heat, heat pumps, hot water tanks, geothermal storage), and flywheels.

**Generation technologies:** wind turbines, photovoltaic (PV), solar thermal, biogas, tidal energy, and micro-generation.

**Market:** electricity market and ancillary services

[1] It might happen however that such technologies, at a smaller scale, are connected at distribution level (in particular CAES).

[2] Batteries might also be connected at transmission level.

The next figure indicates the number of BRIDGE projects deploying the 6 main categories of technologies and services.

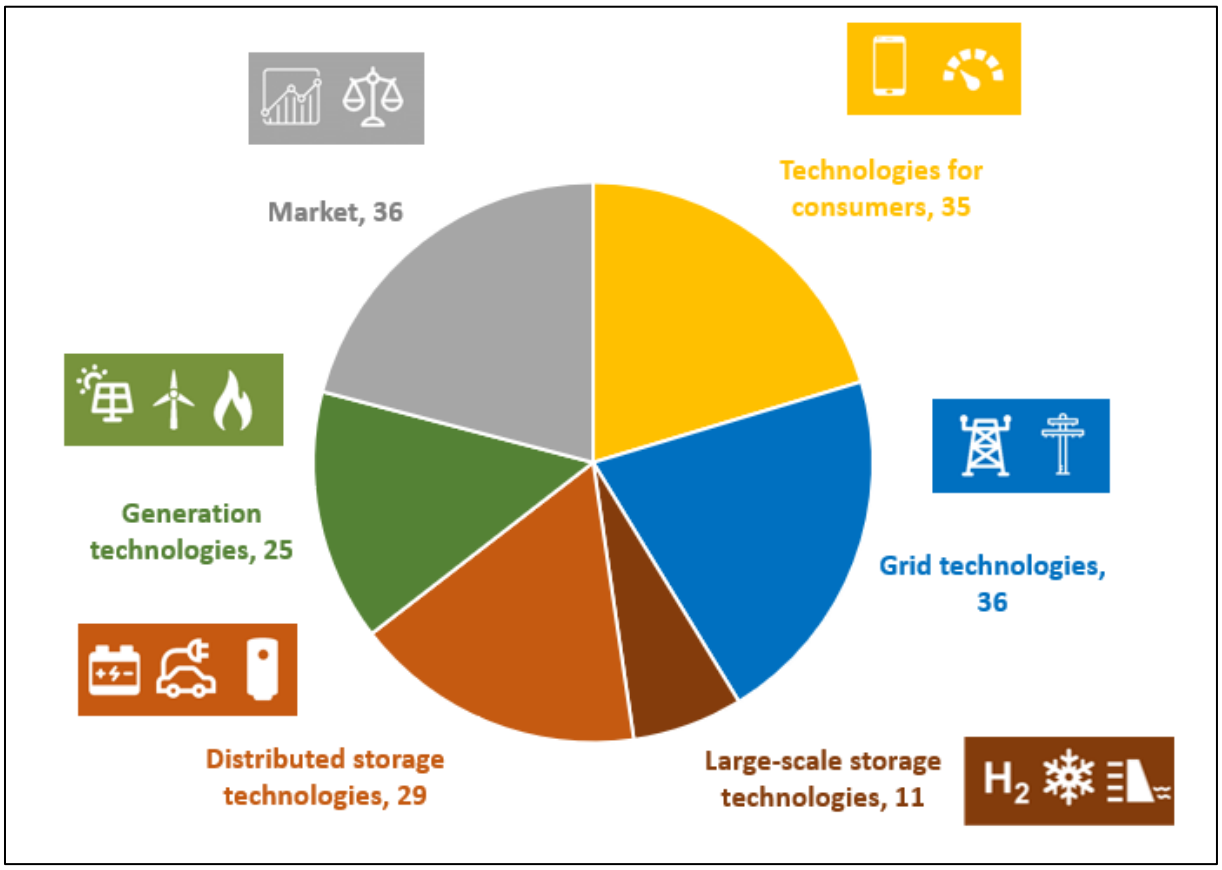
It appears that 79% of the BRIDGE projects (35 out of 44) are dealing with technologies for consumers.

Around 81% of the projects (36 out of 44 projects) are dealing with grid technologies.

Moreover, 81% of the BRIDGE projects (36 out of 44 projects) are addressing market issues.

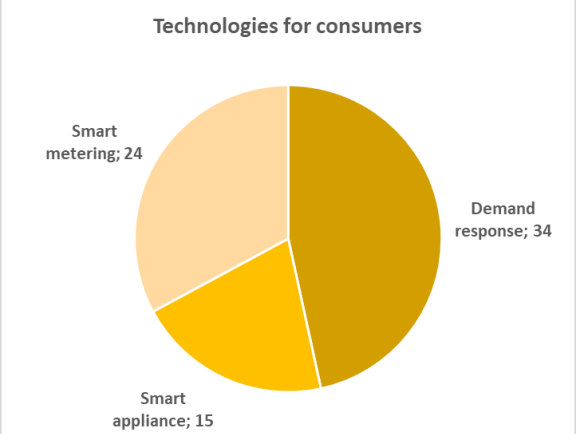
On the other hand, generation technologies are addressed by 25 projects (57%).

Storage aspects are mainly addressed at small-scale level by 29 projects (66%) while large-scale storage is addressed by only 25% of the BRIDGE members (11 projects).

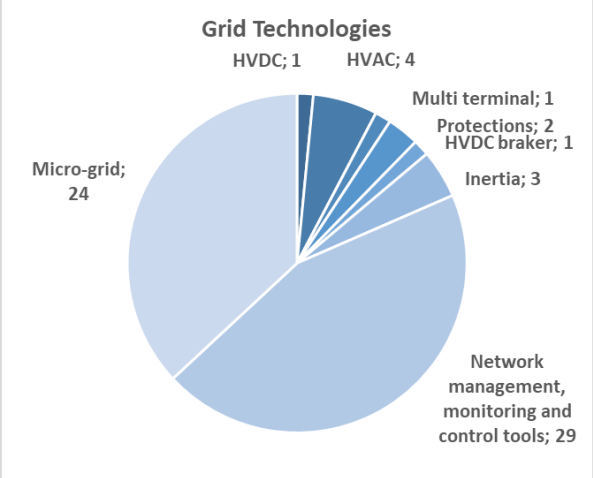


The next figures show more specifically the exact distribution of projects for each category of technologies or services.

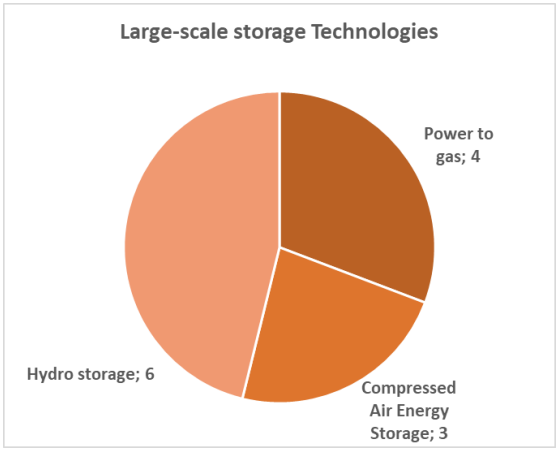
Technologies for consumers mainly address demand response and smart metering; 15 projects also deal with smart appliances to be deployed at consumer level.

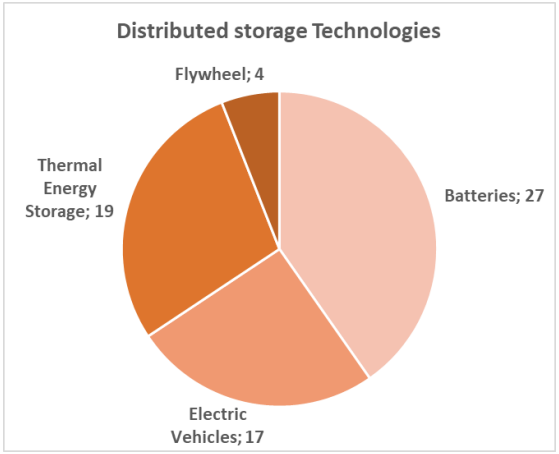



In terms of grid technologies, a high number of projects deal with network management, monitoring and control tools, as well as with micro-grids.

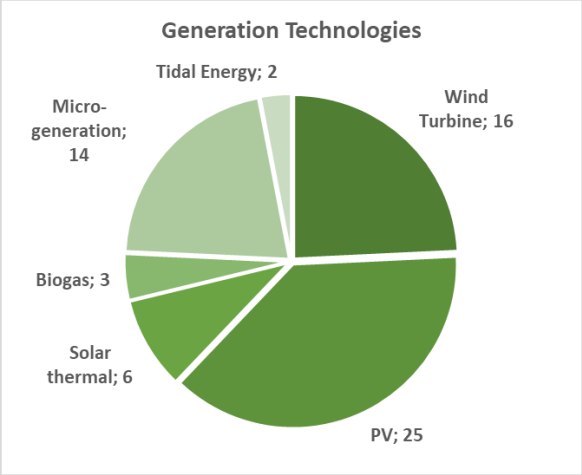



Regarding storage technologies, four projects work with power to gas, three projects with CAES and six projects involve hydro storage. The most addressed small-scale storage technologies by the BRIDGE community are batteries (with one third of the projects working with electric vehicles). Last but not least, thermal energy storage and flywheels are being tested by 19 and 4 projects respectively.

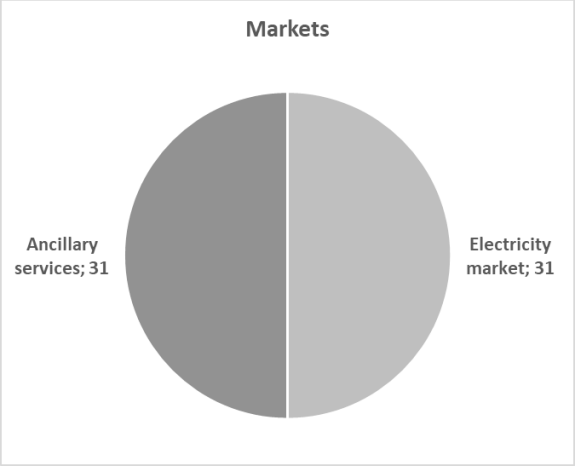


With regards to generation technologies, PV, wind and micro-generation are the most commonly addressed.




In terms of market aspects, electricity markets and ancillary services are equally addressed.



# Project fact sheets

The current section describes each project participating in the BRIDGE initiative.

Projects are presented by call – easily identifiable by a colour – and for each call by alphabetical order.

**LCE-07-2014 - Distribution grid and retail market**

**LCE-08-2014 - Local / small-scale storage**

**LCE-10-2014 - Next generation technologies for energy storage**

**LCE-05-2015 - Innovation and technologies for the deployment of meshed off-shore grids**

**LCE-06-2015 - Transmission grid and wholesale market**

**LCE-09-2015 - Large scale energy storage**

**LCE-02-2016 - Demonstration of smart grid, storage and system integration technologies with increasing share of renewables: distribution system**

**LCE-07-2016-2017 - Developing the next generation technologies of renewable electricity and heating/cooling**

**LCE-04-2017 - Demonstration of system integration with smart transmission grid and storage technologies with increasing share of renewables**

**LC-SC3-ES-3-2018-2020 - Integrated local energy systems (Energy islands)**

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

**LC-SC3-ES-5-2018-2020 -TSO – DSO – Consumer: large-scale demonstrations of innovative grid services through demand response, storage and small-scale (res) generation**

Each project is presented over two pages:

- On the first page, a brief summary of the project is given, as well as the project start and end years, the budget, the website, the technologies and services deployed, the project partners' countries, the name of the coordinating organisation and of the other partners;
- The second page presents the project in details, in terms of scope, technical description and expected impact..

**H2020 call: LCE-07-2014 - Distribution grid and retail market**

# AnyPLACE

Adaptable Platform for Active Services Exchange

AnyPLACE

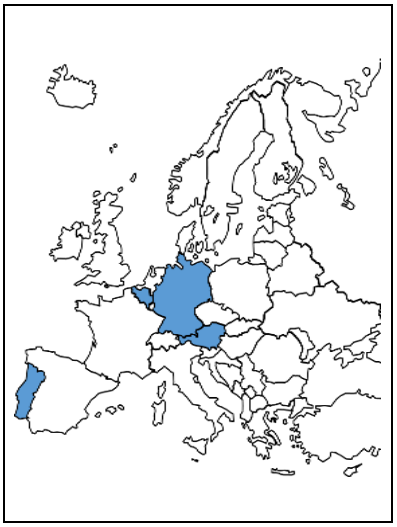
**AnyPLACE is a European project that will develop a modular energy management system capable monitoring and controlling local devices according to the preferences of end-users.**

| From 2015 To 2017 | Project total cost | EU contribution | Website |
|---|---|---|---|
| | 3.0 M€ | 2.5 M€ | http://www.anyplace2020.org/ |

**Technologies and services**

| | |
|---|---|
| Technologies for consumers | ✓ Demand response<br>✓ Smart appliance<br>✓ Smart metering |
| Grid technologies | ✓ Micro-grid |
| Large-scale storage technologies | |
| Distributed storage technologies | ✓ Batteries<br>✓ Electric Vehicles |
| Generation technologies | ✓ PV<br>✓ Micro-generation |
| Market | ✓ Electricity market<br>✓ Ancillary services |

**Project partners' countries**



## Coordinator: INESC TEC (PORTUGAL)

**Other partners:**

- TECHNISCHE UNIVERSITAET WIEN (Austria)
- HOCHSCHULE OSTWESTFALEN-LIPPE (Germany)
- JRC -JOINT RESEARCH CENTRE- EUROPEAN COMMISSION (Belgium)
- EFACEC ENERGIA - MAQUINAS E EQUIPAMENTOS ELECTRICOS SA (Portugal)
- POWER PLUS COMMUNICATIONS AG (Germany)
- BOSCH TERMOTECNOLOGIA SA (Portugal)
- KREIS LIPPE (Germany)

## Project Description

**Context**. The platform to be developed within the AnyPLACE project is designed to allow the energy management of buildings, targeting mainly households, by managing and controlling existing loads, generation and storage resources according to their flexibility. It will allow the local energy management, with the purpose of optimizing the energy use, and allow the end-user to become an active participant in new energy services provision like demand response, offered by service providers like retailers or aggregators.

**Scope.** The overall scope of the project is to implement an energy management platform that truly engages its end-users to manage and control their energy use inside their houses and buildings. In order to achieve that, a variety of functionalities regarding control and management of in-building energy resources have to be defined along with an interoperable strategy between components, systems and actors.

The envisaged solution is expected to be highly configurable and adaptable to different contexts (e.g. regulatory, social and economic), scenarios (e.g. types of building, available loads and generation) and types of end-user (e.g. different age, background), allowing its use to be as broader as possible.

The platform is oriented towards the management of the energy use by exploring the potential flexibility in the electricity consumption, and whenever possible, make use of local energy generation and storage.

As a product the AnyPLACE platform is expected to be used by general domestic users and some special groups of users (commercial and services). The modular and interoperable characteristics makes this solution usable in most of the EU countries.

**Technical description and implementation.** The project is not focused on the research of any particular type of technology but rather on the use of existing one in a cost-effective way that allow the successful implementation of an energy management solution. As such the main result is the design and implementation of a software and hardware platform that interacts with devices, systems and users to explore the flexibility of loads and generation to increase the efficient use of energy. Given the high TRL expected of the final solution of AnyPLACE the technology should be close to the market implementation.

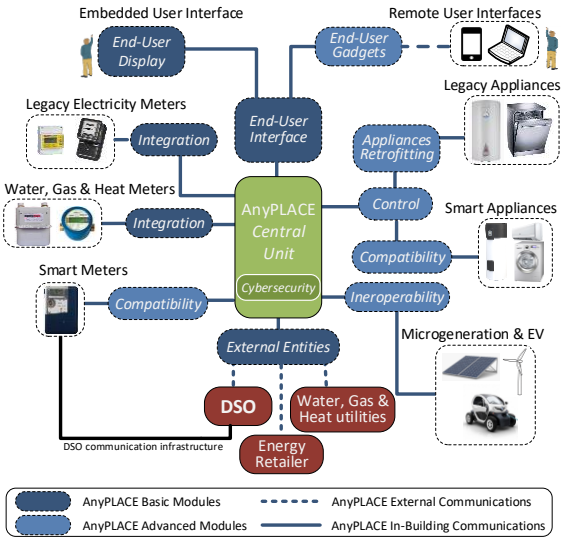
**Impact**. *Replicability:* the modular and configurable nature of the solution supported by the regulatory and context characterization of the potential cases of use of AnyPLACE make the solution under development to be applicable to a wide variety of scenarios.

*Socio-economics:* the characterization of the socio-economic contexts in the different consortium countries and the cost-effective nature of the solution under development makes it focused on taking advantage of existing devices and system that allow benefits to be derived by common users instead of focusing of state-of-the-art fully automated and expensive cases (households) which are not accessible to all.

*Environment:* the increase in awareness by the end-users about the flexible and optimized use of energy resources, that is expected to be accomplished by the solution, will allow them to take more informed decisions and align their financial interest with the potential environmental benefits associated to the efficiency increase.

*Market Transformation:* the integration of several stakeholders in the definition of the solution allows it to be explored in the provision of new energy services by making the end-user an active participant in them.

*Policy:* the support of new services that is expected to be shown by the project can potentially contribute towards their use in countries where currently the legal regulation does not allow them or discourages their implementation (e.g. demand response).



**H2020 call: LCE-07-2014 - Distribution grid and retail market**

# EMPOWER

Local Electricity Retail Markets for Prosumer Smart Grid Power Services

**EMPOWER encourages micro-generation and the active participation of prosumers to exploit the flexibility created for the benefit of all connected to the local grid.**

| From 2015 To 2017 | Project total cost | EU contribution | Website |
|---|---|---|---|
| | 6.1 M€ | 4.4 M€ | http://www.empowerh2020.eu/ |

**Technologies and services**

| | |
|---|---|
| Technologies for consumers | ✓ Demand response<br>✓ Smart appliance<br>✓ Smart metering |
| Grid technologies | ✓ Network management, monitoring and control tools<br>✓ Micro-grid |
| Large-scale storage technologies | |
| Distributed storage technologies | ✓ Batteries<br>✓ Electric vehicles |
| Generation technologies | ✓ Wind Turbine<br>✓ PV |
| Market | ✓ Electricity market<br>✓ Ancillary services |

**Project partners' countries**

## Coordinator: SCHNEIDER ELECTRIC NORGE AS (NORWAY)

**Other partners:**

- SMART INNOVATION NORWAY AS (Norway)
- ESMART SYSTEMS AS (Norway)
- FREDRIKSTAD ENERGI NETT AS (Norway)
- UNIVERSITAET ST. GALLEN (Switzerland)
- UNIVERSITAT POLITECNICA DE CATALUNYA (Spain)
- MALTA INTELLIGENT ENERGY MANAGEMENT AGENCY (Malta)
- NEWEN PROJECTS GMBH (Germany)

## Project Description

**Context**. The EMPOWER project aims to encourage and enable active end-user participation for local energy trading and related services in the distribution grid. To this end, a new market player role titled "Smart Energy Service Provider" (SESP) has been defined. SESP engages the local community, involves various agents towards energy and flexibility trading, optimizes market operations and creates value that can be translated to novel business models. SESP manages all its operations by means of an integrated cloud-based ICT platform that facilitates communication and trading between agents.

**Scope.** The EMPOWER project is focused on:

- Defining a community for local trading of energy, flexibility and energy related services.
- Creating a trading system for continuous exchange of energy, flexibility and service contracts and any combinations of these.
- Designing a cloud-based ICT platform for operating local markets.
- Implementing and testing the ICT platform in three pilot sites for several distribution grid management and services (i.e., decision-making, load forecasting, consumer profiling, load aggregation, demand-response programs, energy consumption and supply balancing, cost reduction).
- Offering communication services, like web access and mobile apps to participants to support their engagement to the ICT platform.

The ICT platform merged with the trading system will allow neighbours from a community to participate in the local markets sending and receiving offers for their energy resources like photovoltaic panels, flexible appliances and storage units.

**Technical description and implementation.** The developments being performed cover two specific areas:

- The local smart grid area, with ICT extensions of the infrastructure will lead to the participation of new actors in local energy markets and development of new business models.
- The business-related area of the project, with the definition of the new players' role and involvement and the design and development of the new local energy market.

The cloud-based trading platform being developed will enhance participation of the market agents and the creation of submarkets in order to satisfy the community needs. The design of cooperative community markets, its effect on incentivizing cooperatives to promote transition to renewable energy generation that fosters climate solidarity will be outlined. Furthermore, investment decisions of cooperatives into energy storage to increase their market options as well as to reach self-sustainability will be designed and implemented. In order to quantify the impact of these effects, a life cycle analysis is being conducted.

**Impact**. *Socio-economics:* Prosumer oriented business models relevant for the market design.

*Environment:* Enabling the transition towards renewable energies thanks to the ICT based monitoring and management system developed by the project.

*Market Transformation:* New market design for local trading and involvement of prosumers through a cloud based ICT.

*Policy:* Standardisation activities identify and advance the Smart Grid standardisation undertakings which are relevant for EMPOWER components (Local Smart Grid (LSG) Architecture, LSG Communications platform, LSG Control Cloud) and selected pilot sites.

**H2020 call: LCE-07-2014 - Distribution grid and retail market**

# ENERGISE

ICT-based ENERgy Grid Implementation – Smart and Efficient

**ENERGISE was launched to analyse smart grid communication infrastructure together with the different parties on DSO, telecommunications and governmental side. The main focus is on identifying the different decision-making factors which determine if a dedicated or shared communication infrastructure should be deployed. The project sets out to facilitate the efficient deployment of smart grid solutions by offering to all relevant stakeholders a toolkit that supports their decision-making process as regards the use of telecommunication infrastructure for existing or projected business cases.**

| From 2015 To 2017 | Project total cost | EU contribution | Website |
|---|---|---|---|
| | 1.0 M€ | 1.0 M€ | http://project-energise.eu |

**Technologies and services**

- Technologies for consumers
- Grid technologies
- Large-scale storage technologies
- Distributed storage technologies
- Generation technologies
- Market

**Project partners' countries**

## Coordinator: TÜV RHEINLAND CONSULTING GMBH (GERMANY)

**Other partner:**

- WIK WISSENSCHAFTLICHES INSTITUT FUER INFRASTRUKTUR UND KOMMUNIKATIONSDIENSTE (Germany)

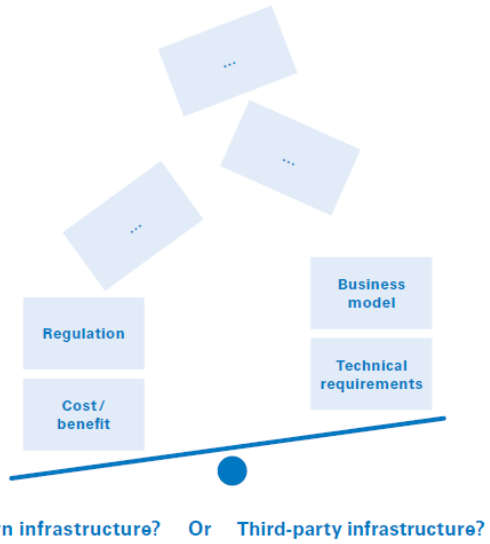
## Project Description

**Context**. In a world of decentralized energy generation and consumption, not only the data volume but also the number of data exchanging parties and devices will increase significantly. New business models and technical solutions will alter the interaction of all energy system participants on every level and scale.

Therefore also the ICT-infrastructure has to evolve and provide the necessary communication solutions to allow for this evolution in the energy sector. The core question is: Who will provide the necessary services and on which communication infrastructure will these services be realized? One solution might be energy grid operators maintaining their own communication infrastructure built upon existing connections – dedicated infrastructure. Another solution could be the use of already deployed public infrastructure like mobile communication operated by the communications providers – shared infrastructure. Considering the high costs linked to infrastructure deployment, a mix of both solutions and a co-operative approach seems to be the best option.

In the end, the search for the optimal solution is affected by a vast amount of different influencing factors. Nonetheless in order to use possible synergies and achieve wide-scale smart grid deployment in the most efficient way cooperation between the energy and telco sector is necessary.

**Scope.** By gathering information from industry and regulatory stakeholders as well as by using results from relevant studies and reports, ENERGISE has established important insight into the motivations and rationales of DSOs' and telecommunication companies' decisions concerning the issue of implementing ICT-infrastructure. On the one hand, the roles and responsibilities (e.g. regarding security requirements or downtime regulations) of DSOs play a major role as well as rules and regulations in the energy sector. Especially the regulation of distribution grids and the question how smart grid investments are treated is of outstanding importance. On the other hand, the telecommunication sector and its specific characteristics (e.g. regarding mobile deep indoor coverage) in different countries are a decisive parameter when it comes to the investment in smart grids.




**Technical description and implementation.** The ENERGISE toolkit consists of two major parts: the decision tool and other relevant project outcomes. The decision tool is a comprehensive compilation of existing and feasible solutions for cross-sector cooperation. The database consists of 47 cases from 17 European countries. For each of the cases information on the country's market environment, company characteristics and a description of the smart grid application and the decision outcome have been listed in a structured way. Overall 5 areas of cooperation in smart grid applications and related relevant areas were identified in the project: smart metering, network operation, infrastructure sharing, joint deployment and the development of new products and services. On top of this information detailed cross-case analysis for drivers of cooperation was executed and included in the toolkit.

In addition, the toolkit represents a central information hub of the main findings gathered during the two years project including all published reports and the survey results. It aims at market players finding themselves faced with the decision to rely on dedicated or shared telecommunications infrastructures for implementing smart grid solutions, and can furthermore present an orientation and evidence base for policy makers.

**H2020 call: LCE-07-2014 - Distribution grid and retail market**

# Flex4Grid

Prosumer Flexibility Services for Smart Grid Management

**Flex4Grid aims at creating an open data and service framework that enables a novel concept of prosumer flexibility management.**

| From 2015 To 2017 | Project total cost | EU contribution | Website |
|---|---|---|---|
| | 3.2 M€ | 2.7 M€ | https://www.flex4grid.eu/ |

### Technologies and services

| | |
|---|---|
| Technologies for consumers | ✓ Demand response<br>✓ Smart appliance<br>✓ Smart metering |
| Grid technologies | ✓ Network management, monitoring and control tools |
| Large-scale storage technologies | |
| Distributed storage technologies | |
| Generation technologies | |
| Market | ✓ Electricity market<br>✓ Ancillary services |

### Project partners' countries

## Coordinator: TEKNOLOGIAN TUTKIMUSKESKUS VTT Oy (FINLAND)

**Other partners:**

- SAE-AUTOMATION, S.R.O (Slovakia)
- SMART COM DOO INFORMACIJSKI IN KOMUNIKACIJSKI SISTEMI (Slovenia)
- INSTITUT JOZEF STEFAN (Slovenia)
- FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V. (Germany)
- ENERGIE- UND WASSERVERSORGUNG BONN/RHEIN-SIEG GMBH (Germany)
- ELEKTRO CELJE D.D. (Slovenia)
- BOCHOLTER ENERGIE UND WASSERVERSORGUNG GMBH (Germany)

## Project Description

**Context**. The advent of distributed power sources, such as photovoltaics and windmill plants, gave rise to energy prosumers, which generate and consume electrical energy. Energy demand and energy generation by prosumers is volatile and can impact the grid infrastructure and stakeholders, but they can be flexibly adapted to thwart those impacts

**Scope.** Flex4Grid aims at creating an open data and service framework that enables a novel concept of managing flexibility of prosumer demand and generation, utilising cloud computing for power grid management and, opening DSO infrastructure for aggregator services. The system will be built up from existing ICT components. This high maturity allows Flex4Grid to aim for a system prototype of TRL 7.

The Flex4Grid system will include a) a data cloud service with anonymised interface and advanced security and privacy mechanisms for data exchange and service management, b) prosumer generation and demand flexibility, and c) a more viable business model to accelerate the deployment. The major innovations are a) opening the market for new entrants by secure and privacy enabling third party cloud data and energy management services, b) actionable common and multilevel data management and analytics services for Smart Grids, and c) the use of co-creation to bring end users into the value creation process.

System validation will be carried out in real-world pilots in three live electricity networks with different scenarios.

**Technical description and implementation.** The goal of Flex4Grid is to combine communication and data cloud service infrastructures with the power grid of DSOs into a data and service framework that enables a novel concept of managing demand and generation flexibility, i.e. prosumer flexibility management and opening DSO infrastructure for operator services.

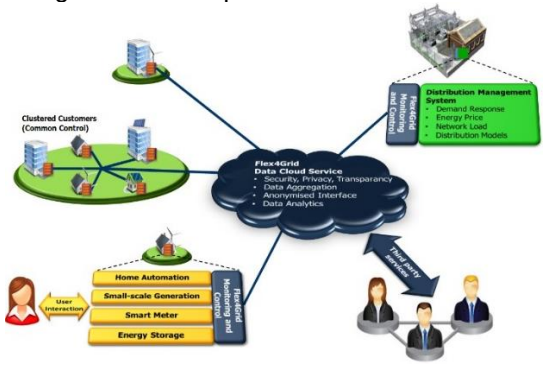
Flex4Grid will draw up new business models, for the demand and generation management scenario co-creation will be used to bring end users, i.e. prosumers, into the value creation process and to engage them in it. In addition, a third-party service model for data management, including data analytics, will be developed in the Flex4Grid project to decouple the data acquisition by the smart meters from the data processing by the DSOs, with a special focus on security and privacy issues.

Pilots covering scenarios from rollout to large-scale federation will be carried out to demonstrate the achievements of the Flex4Grid activity. This is made possible by the three DSO consortium members and their electricity networks that feature different characteristics where the Flex4Grid prototype will be integrated into the Distribution Management Systems and a selected group of households in their electricity networks. In these real-world pilots we will prove that Flex4Grid offers added value and can exploit its prosumer management facilities in order to efficiently reduce and shift peak loads and also to ensure network stability and continuity of electricity supply by managing efficiently the whole network with different distributed generation and demand response scenarios.

**Impact**. The system introduced by the Flex4Grid activity will use results from preceding research projects as baseline to transfer the results into the market and follows a business-driven approach by exploring new value-generating service offerings for customers.

Active demand response will be demonstrated in the life electricity networks of all three pilot locations. New business models will be deployed where DSOs, prosumers and the third party hosting the data manager will act as marketer. Participating companies will roll out new services to the market place to ensure business viability of the project.

The Flex4Grid system will open new markets for third parties via cloud-based services, going beyond smart meters. Applying cloud solutions (security, privacy, analytics, predictions for the customer) in the context of smart grids will strengthen the competitiveness in this sector.



**H2020 call: LCE-07-2014 - Distribution grid and retail market**

# FLEXICIENCY

energy services demonstrations of demand response, FLEXibility and energy effICIENCY based on metering data

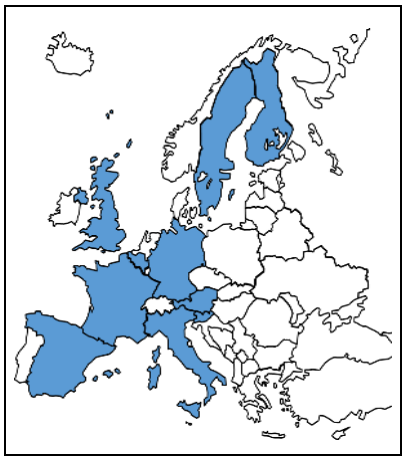
**On the basis of a technical model reflecting a common framework for data exchange at EU level, FLEXICIENCY will demonstrate novel energy services in the electricity retail markets, accelerated via an open EU Market Place for B2B interactions developed in the project.**

| From 2015 To 2019 | Project total cost | EU contribution | Website |
|---|---|---|---|
| | 19.1 M€ | 14.0 M€ | http://www.flexiciency-h2020.eu/ |

**Technologies and services**

| | |
|---|---|
| Technologies for consumers | ✓ Demand response<br>✓ Smart metering |
| Grid technologies | ✓ Network management, monitoring and control tools<br>✓ Micro-grid |
| Large-scale storage technologies | |
| Distributed storage technologies | ✓ Electric Vehicles |
| Generation technologies | |
| Market | ✓ Ancillary services |

**Project partners' countries**



## Coordinator: E-DISTRIBUZIONE SPA (ITALY)

**Other partners:**

- ENDESA DISTRIBUCION ELECTRICA S.L (Spain)
- ENEDIS (France)
- VATTENFALL ELDISTRIBUTION AB (Sweden)
- EUROPEAN DISTRIBUTION SYSTEMS OPERATORS FOR SMART GRIDS AISBL (Belgium)
- ENEL ENERGIA SPA (Italy)
- VATTENFALL AB (Sweden)
- AYUNTAMIENTO DE MALAGA (Spain)
- SAP SE (Germany)
- CYBERGRID GMBH (Austria)
- SIEMENS SPA (Italy)
- JOULE ASSETS EUROPE AB OY (Finland)
- VAASAETT LTD AB OY (Finland)
- FUNDACION CIRCE CENTRO DE INVESTIGACION DE RECURSOS Y CONSUMOS ENERGETICOS (Spain)
- UNIVERZA V LJUBLJANI (Slovenia)
- KIWI POWER LTD (United Kingdom)
- VERBUND Solutions GmbH (Austria)
- ENDESA ENERGIA S.A. (Spain)

## Project Description

**Context**. Four major Distribution System Operators (DSOs) with smart metering infrastructure in place, together with retailers, aggregators, software providers, research organizations and one large consumer, carry out five large-scale demonstrations to show that the deployment of novel services in the retail markets can be accelerated thanks to an open EU Market Place for standardized interactions among electricity stakeholders. Accessibility of metering data made available by DSOs in a non-discriminatory way, under customer consent, will facilitate the emergence of new markets for energy services, enhancing competitiveness and encouraging the entry of new players in the retail energy market. The development of a virtual ICT environment to exchange data and services, together with the definition of a common language at EU level, will catalyse B2B interactions between relevant stakeholders and encourage cross-country and cross-player access to innovative energy services based on data.

**Scope.** Novel energy services will be provided in real world within a framework where metering data made available by DSOs can be exchanged by energy players to design new services to contribute to demand response approaches. FLEXICIENCY will demonstrate in particular novel energy services in the electricity retail markets, such as:

i. Advanced energy monitoring (data from smart meters as well as other relevant measurements),

ii. Local energy control for a larger exploitation of flexibility services at aggregated and system level, as enabling the active management of electricity loads and generation;

iii. Flexibility, by a group of aggregated customers, distributed systems of loads and generators.

The implementation of such energy services in Europe will be accelerated via an open EU Market Place for B2B interactions cross-countries and cross-players, developed in the project. For this to happen, a common language for B2B data exchange has been defined in the project while addressing service accessibility at EU scale.

**Technical description and implementation.** The overall project architecture has been defined to be applicable to different regional and market contexts:

i. Interoperable DSO Platforms for meter data accessibility in a non-discriminatory way, with customer consent.

ii. Service platforms of different market players operating in diverse regional contexts, and making use of data to provide services to their customers.

iii. Field components for measurement, data acquisition and control.

iv. EU Market Place: a virtual ICT environment communicating with both the DSOs and Service platforms, acting as a pan-European meeting point between retail market players and DSOs to exchange data and services.

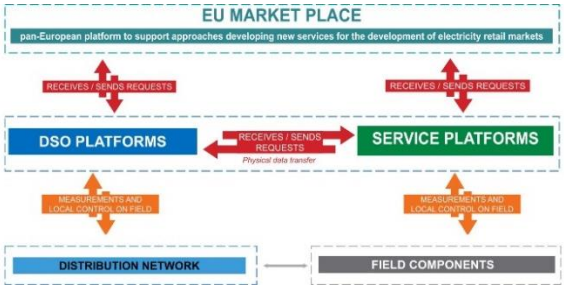
**Impact**. *Replicability:* a modular technical architecture has been defined and adopted in the five demos in different regional contexts and under diverse regulatory and market conditions.

*Socio-economics:* creating new opportunities in the energy market, both for the final customer - empowered with data, evolving to a more active player, and benefit from new services- and for market players, benefiting from a more competitive and open market, exploiting new B2B and B2C services by accessing data and building up new business opportunities.

*Environment:* the provision of information/data to the customers is expected to address higher awareness on their energy behaviours. System's flexibility could also favour a higher production from renewable energy.

*Market Transformation:* Data accessibility would enhance market competiveness and foster the birth of new business models and opportunities.

*Policy:* a framework defining the relationships between DSOs, service providers and end users to support new services for a paradigm shift from passive to active customers and encouraging data accessibility across Europe.



**H2020 call: LCE-07-2014 - Distribution grid and retail market**

# FLEXMETER

Flexible smart metering for multiple energy vectors with active prosumers

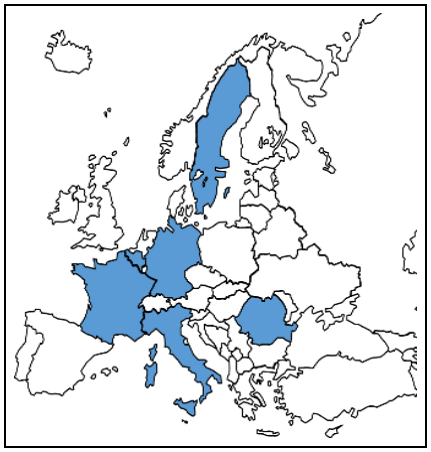
**The FLEXMETER project focus is the development and demonstration of a flexible smart metering architecture, based on cheap and already available components, that can be implemented in a plug and play way, combining metering of different services (electricity, water, gas, district heating), providing advanced services to the users, to the DSOs and to the other utilities, and enhancing the possibilities of the retail market.**

| From 2015 To 2017 | Project total cost | EU contribution | Website |
|---|---|---|---|
| | 3.9 M€ | 3.2 M€ | http://flexmeter.polito.it/ |

**Technologies and services**

| | |
|---|---|
| Technologies for consumers | ✓ Demand response<br>✓ Smart metering |
| Grid technologies | ✓ Network management, monitoring and control tools |
| Large-scale storage technologies | |
| Distributed storage technologies | |
| Generation technologies | |
| Market | |

**Project partners' countries**



## Coordinator: POLITECNICO DI TORINO (ITALY)

**Other partners:**

- STMICROELECTRONICS SRL (Italy)
- TELECOM ITALIA SPA (Italy)
- RHEINISCH-WESTFAELISCHE TECHNISCHE HOCHSCHULE AACHEN (Germany)
- INSTITUT POLYTECHNIQUE DE GRENOBLE (France)
- JRC -JOINT RESEARCH CENTRE- EUROPEAN COMMISSION (Belgium)
- UNIVERSITATEA POLITEHNICA DIN BUCURESTI (Romania)
- SIVECO ROMANIA SA (Romania)
- ALMA MATER STUDIORUM - UNIVERSITA DI BOLOGNA (Italy)
- E.ON SVERIGE AB (Sweden)
- IREN SPA (Italy)

## Project Description

**Context**. The introduction of the electricity market, the widespread diffusion of distributed generation from renewable and non-programmable energy sources and the need for storage are quickly changing the problems that Transmission and Distribution system operators have to face in their activity and are requiring a smarter grid. This smarter grid should also enable new services to increase people awareness of consumption and production to optimize energy usage.

A first step in this direction, is the development and installation of a flexible smart meter architecture to enable an easy development of innovative services for both, the prosumers and the DSOS, and be able to manage meters for multiple energy vectors. For instance, the new metering systems must provide information about end-user affordability of electricity, more detailed information about energy consumption and production, energy and market efficiency improvement, CO2 emissions and pollutants reduction.

**Scope.** In the FLEXMETER project a flexible, multi-utility, multi-service metering architecture is designed and deployed in two demonstrators (Italy and Sweden). The main component of the architecture is a software platform for meter data collection/actuation and a set of data analytics, storage and visualization components. The software platform communicates using IoT (Internet of Things) paradigms and resides on a central cloud system. The proposed architecture allows innovative services for the prosumers (e.g. analysis of the energy consumption), for the Distribution System Operators (DSOs) (e.g. fault detection, network balancing and storage integration) and for the retail market.

In addition, FLEXMETER paves the way for new business models and companies providing such innovative services to end-users and DSOs. Also demand-side management devices could be plugged into the system. The project develops a real-time co-simulation framework able to simulate the smart grid and the whole software infrastructure processing simulated energy data to help the scaling up of demo results (i.e. cities).

**Technical description and implementation.** Smart meters: Unobtrusive and self-powered meters with support for accurate (1Hz) sampling suitable to enable Non-Intrusive Load Monitoring (NILM) have been developed.

Innovative algorithms for grid and load management: i) Fault detection and location algorithms exploiting substation and prosumer-side meters; ii) Storage planning and management algorithms, allowing to optimize the location and dynamically manage the charge-discharge cycles; iii) Load forecasting based on a machine learning approach; iv) NIALM algorithm with fast recognition of loads without requiring a-priori knowledge of energy profiles.

IoT platform: a software platform able to interface with various smart meter devices and with existing utility repositories is being developed.

Real-time co-simulation: A real-time grid distributed simulator that is able to interoperate in different physical locations and supports the co-simulation of the software infrastructure for metering data collection and processing. This innovative simulator enables the evaluation of grid management services at a large scale.

**Impact**. The impact of the FLEXMETER project will be important both on the provider and consumer side, in particular by reducing costs for the utility company for reading the data, real-time services to the user, fault detection and network load balancing being the most important. Moreover, the development of a “second generation electric energy smart meters” interconnected to other public utility services, thanks to a common data-exchange platform, will foster the spreading of innovative services both at consumer and DSO level. Open, real-time data systems will play a fundamental role in the future of smart grid. The multi-service approach should also allow to reduce costs of the whole system.

Social impacts will be strictly related to real-time data availability even at consumer level. The knowledge of each own consumptions (electrical but also others, like water, LPG for heating and cooking,...) is the starting point for other more integrated and innovative services (house remote control systems) that will change people behaviours (active demand).

**H2020 call: LCE-07-2014 - Distribution grid and retail market**

# NOBEL GRID

New cost-effective business models for flexible Smart Grids

Nobel Grid
Smart energy for people

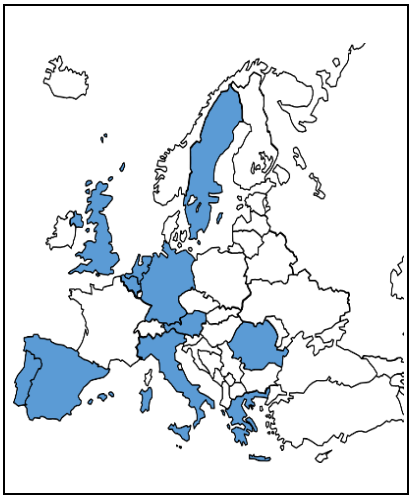
**NOBEL GRID will provide advanced tools and ICT services to all actors in the Smart Grid and retail electricity market in order to ensure benefits from cheaper prices, more secure and stable grids and clean electricity.**

| From 2015 To 2018 | Project total cost | EU contribution | Website |
|---|---|---|---|
| | 14.0 M€ | 11.7 M€ | http://nobelgrid.eu/ |

**Technologies and services**

| | |
|---|---|
| Technologies for consumers | ✓ Demand response<br>✓ Smart appliance<br>✓ Smart metering |
| Grid technologies | ✓ Network management, monitoring and control tools<br>✓ Micro-grid |
| Large-scale storage technologies | |
| Distributed storage technologies | ✓ Batteries |
| Generation technologies | ✓ Wind Turbine ✓ PV<br>✓ Micro-generation |
| Market | |

**Project partners' countries**



## Coordinator: ETRA INVESTIGACION Y DESARROLLO SA (SPAIN)

**Other partners:**

- FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V. (Germany)
- AIT AUSTRIAN INSTITUTE OF TECHNOLOGY GMBH (Austria)
- ENGINEERING - INGEGNERIA INFORMATICA SPA (Italy)
- ASM TERNI SPA (Italy)
- ECOPOWER (Belgium)
- EUROPEAN DISTRIBUTED ENERGY RESOURCES LABORATORIES E.V. (Germany)
- RISE SICS AB (Sweden)
- ATHENS UNIVERSITY OF ECONOMICS AND BUSINESS - RESEARCH CENTER (Greece)
- ECRO SRL (Romania)
- HYPERTECH (CHAIPERTEK) ANONYMOS VIOMICHANIKI EMPORIKI ETAIREIA PLIROFORIKIS KAI NEON TECHNOLOGION (Greece)
- FUNDACIO EURECAT (Spain)
- THE SOCIETY FOR THE REDUCTION OF CARBON LIMITED (United Kingdom)
- FINNOVAREGIO (Belgium)
- SURTEL ELECTRONICA SL (Spain)
- INSTITUTE OF COMMUNICATION AND COMPUTER SYSTEMS (Greece)
- DNV GL NETHERLANDS B.V. (Netherlands)
- THE UNIVERSITY OF MANCHESTER (United Kingdom)
- VAYON ENERGY STORAGE LIMITED (United Kingdom)
- UNINOVA-INSTITUTO DE DESENVOLVIMENTO DE NOVAS TECNOLOGIAS-ASSOCIACAO (Portugal)
- ALGINET DISTRIBUCION ENERGIA ELECTRICA SOCIEDAD LIMITADA (Spain)

## Project Description

**Context**. NOBEL GRID is developing new tools and business models that will allow all European citizens to benefit from a more secure and stable distribution network, promoting the integration of distributed, renewable energy sources and greater participation of consumer and final "prosumer" in the energy market. The project began January 1, 2015 and is estimated to be completed in mid-2018. In this context, during this first period, the consortium of NOBEL GRID has finalised with the analysis and definition of the project requirements, use cases and architecture, and are developing the first version of the prototypes.

**Scope.** As main ground-breaking objective of the project, NOBEL GRID provides solutions for all the actors in order to share the benefits of the Smart Grid in a fair, sustainable and efficient way. In this context, NOBEL GRID promotes, by means of new technologies and business models, collective schemes and community initiatives, giving power and protection to the final consumer, contributing to a more competitive and well-functioning internal energy market, and help address serious social problems of vulnerable consumers.

The project results will be demonstrated in real conditions in five European demonstration sites in Belgium, United Kingdom, Italy, Spain and Greece, which are energy cooperatives or non-profit organizations.

**Technical description and implementation.**

a. Architecture: using the Smart Grid Architecture Model (SGAM) Framework, the business context associated with the project has been modelled (use cases and ICT architecture (components, communication protocols and data models)).

b. The Unbundled Smart Meter (SLAM) which is being developed from scratch based on the Unbundled Smart Meter (USM) concept, which contains two different parts:

- a Smart Metrology Meter (SMM), with metrology features and fixed functionality, dealing also with hard real-time functionalities and acting like a “black box”.
- a Smart Meter eXtension (SMX), which has high flexibility to support smart grid, new functionalities and energy services, and to support in a secure way multi-user, multi-protocol communication with various actors in the energy field.

c. The G3M (Grid Management and Maintenance Master framework) is the access point for the operator of distribution grid to the set of functionalities and services offered by NOBEL GRID.

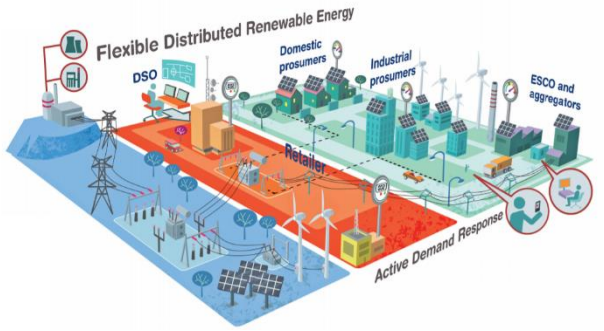
d. The Demand Response Flexibility Market (DRFM) cockpit is a proven platform that allows Aggregator, Retailer and ESCO to manage all aspects of their demand response (DR) programs through a single, integrated system that is able to manage their flexibility assets.

e. The Energy Monitoring and Analytics Application (EMA App) provides domestic and industrial prosumers with real time data visualization and recommendations to improve energy efficiency, maximize use of renewables and minimize energy bills according to user’s profile, giving them more power and protection.

**Impact**. *Socio-economics:* with the promotion of energy cooperatives models, NOBEL GRID would bring economic benefits for end-users (electricity bill reduction), guaranteeing the universal access to energy to any social stratum, reducing also energy poverty.

*Environment:* NOBEL GRID promotes innovative demand response (DR) schemas in order to generate fewer levels of pollutants.

*Market Transformation:* The project is defining attractive business models and exploitation plans to open new markets for advanced smart grid and smart metering technologies and foster and promote European industries competitiveness which will bring a competition of new services and business models offered by a lot of companies, including SMEs.



**H2020 call: LCE-07-2014 - Distribution grid and retail market**

# P2P-SmarTest

Peer to Peer Smart Energy Distribution Networks

**P2P-SmartTest project investigates and demonstrates a smarter electricity distribution system integrated with advanced ICT, regional markets and innovative business models. It will employ Peer-to-Peer (P2P) approaches to ensure the integration of demand side flexibility and the optimum operation of DER and other resources within the network while maintaining second-to-second power balance and the quality and security of the supply.**

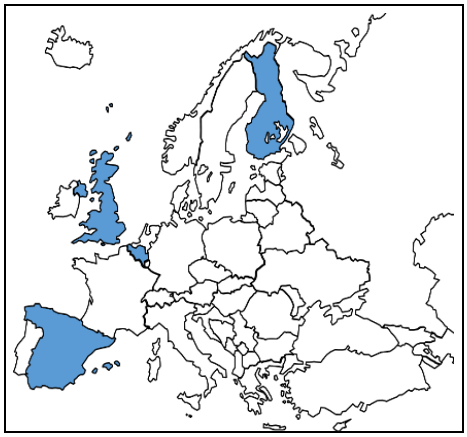
| From 2015 To 2017 |
|---|

| Project total cost | EU contribution | Website |
|---|---|---|
| 3.9 M€ | 3.5 M€ | http://www.p2psmartest-h2020.eu/ |

**Technologies and services**

| | |
|---|---|
| Technologies for consumers | ✓ Demand response |
| Grid technologies | ✓ Micro-grid |
| Large-scale storage technologies | |
| Distributed storage technologies | |
| Generation technologies | |
| Market | ✓ Electricity market |

**Project partners' countries**



## Coordinator: OULUN YLIOPISTO (FINLAND)

**Other partners:**

- UNIVERSITY OF BATH (United Kingdom)
- CARDIFF UNIVERSITY (United Kingdom)
- FUNDACION CENER-CIEMAT (Spain)
- CENTRE TECNOLOGIC DE TELECOMUNICACIONS DE CATALUNYA (Spain)
- INSTRUMENTACION Y COMPONENTES SA (Spain)
- KATHOLIEKE UNIVERSITEIT LEUVEN (Belgium)
- REGENERA LEVANTE SL (Spain)
- ENDESA SA (Spain)

## Project Description

**Context**. Recently, there has been a rapid growth in Distributed Energy Resources (DER) such as distributed generation and energy storage connecting to the distribution network and micro-generation and flexible loads at the premises of end users. Estimates reveal that renewable energy sources based on solar, wind, geothermal and tides can meet a large portion of the energy demand. These resources are not utilised at the distribution system by distribution network operators, retailors or energy service providers, as there are no markets in place to incentivise DERs at the edge of the grid.

**Scope.** P2P-SmartTest project investigates and demonstrates an electricity distribution system integrated with advanced Information and Communications Technologies (ICT), regional markets and innovative business models. It employs Peer-to-Peer (P2P) approaches to ensure the integration of demand side flexibility and the optimum operation of DER and other resources while maintaining second-to-second power balance and the quality and security of the supply.

The technical work packages will provide results for P2P operation of smart grid in all layers including the connectivity (ICT), energy trading and grid operation. These P2P results in different layers of energy system will be validated in a set of demonstrations towards the end of the project which at the same time will be the main deliverable of the project.

**Technical description and implementation.** The P2P-SmartTest project defines and demonstrates the suitable business models for peer-to-peer based distributed smart energy grids, quantify the value from significantly increased system interaction and integration, and assess the required development in ICT and power networks in conjunction with commercial and regulatory frameworks to enable P2P trading realising its full potential. In addition, it develops distributed wireless ICT solutions capable of offloading the required traffic of different applications. Moreover, the optimization mechanisms of energy flows in P2P context are defined, as well as market design solutions. The obtained results are being integrated to demonstration and validation environment to provide real-life results of distributed energy system designs.

As exemplary markets Finland, Spain and Great Britain have been considered. For each business model benchmarking process, the aspects of regulation, market, performance, and innovation of business models in each country have been examined. New business models as those based on e.g. sharing economy and ecosystem thinking are being formulated. Verification procedures are being considered to guarantee the correct performance and compliance of the requirements established for the different markets.

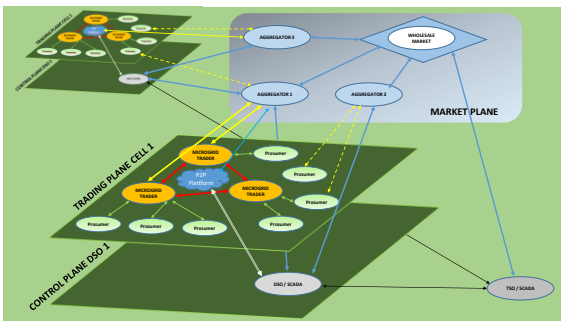
**Impact**. *Replicability*: The results of P2P-SmarTest may be readily deployed in new industrial and residential micro-grids (e.g. in the next generation of smart meters, smart fuse panels or smart home automation systems). The P2P energy trading can be deployed also in existing distribution systems with novel electricity contracts models.

*Socio-economics*: Local energy (from RES) consumption to reduce distribution losses implementing near real time optimal load balancing.

*Environment*: Offering results / tools at distribution level which facilitate the large scale use of emission free micro-generation (DER) and demand response down to household and even individual load level.

*Market Transformation*: Opening up new markets for advanced grid technologies and system architectures to foster European industries' competitiveness and promoting an open market for services deployment.

*Policy*: Via the Bridge initiative, pointing out the vertical requirements of the energy sector in frequency regulation. To allow shared spectrum access or unlicensed spectrum and enable, the so called, “micro-operators” (specialised network operators) which would provide tailored ICT and other services to DSOs, TSOs and prosumers. Furthermore, in many European markets, the deployment of DER and trading of locally generated energy is heavily regulated and thus more flexible market designs should be promoted.




P2P-SmarTest Target Model

**H2020 call: LCE-07-2014 - Distribution grid and retail market**

# SmarterEMC2

Smarter Grid: Empowering SG Market ACtors through Information and Communication Technologies

**SmarterEMC2 implements ICT tools that support the integration of consumers through Demand Response services and the integration of DG/RES through Virtual Power Plants.**

| From 2015 To 2017 | Project total cost | EU contribution | Website |
|---|---|---|---|
| | 3.8 M€ | 3.1 M€ | http://www.smarteremc2.eu/ |

**Technologies and services**

| | |
|---|---|
| Technologies for consumers | ✓ Demand response<br>✓ Smart metering |
| Grid technologies | ✓ Network management, monitoring and control tools<br>✓ Micro-grid |
| Large-scale storage technologies | |
| Distributed storage technologies | |
| Generation technologies | |
| Market | ✓ Electricity market<br>✓ Ancillary services |

**Project partners' countries**

## Coordinator: INTRACOM SA TELECOM SOLUTIONS (GREECE)

**Other partners:**

- UNIVERSITY OF DURHAM (United Kingdom)
- INSTITUTE OF COMMUNICATION AND COMPUTER SYSTEMS (Greece)
- INESC TEC - INSTITUTO DE ENGENHARIA DE SISTEMAS E COMPUTADORES, TECNOLOGIA E CIENCIA (Portugal)
- THALES ITALIA SPA (Italy)
- AYDEM ELEKTRIK DAGITIM ANONIM SIRKETI (Turkey)
- ELEKTRIK DAGITIM HIZMETLERI DERNEGI BASKANLIGINA (Turkey)
- AALBORG UNIVERSITET (Denmark)
- DIACHEIRISTIS ELLINIKOU DIKTYOU DIANOMIS ELEKTRIKIS ENERGEIAS AE (Greece)
- HELLENIC TELECOMMUNICATIONS ORGANIZATION S.A. - OTE AE (ORGANISMOS TILEPIKOINONION TIS ELLADOS OTE AE) (Greece)
- FUJITSU LABORATORIES OF EUROPE LIMITED (United Kingdom)

## Project Description

**Context**. In order to meet European environmental targets SmarterEMC2 implements ICT tools that support the integration of consumers through Demand Response services and the integration of DG and RES through Virtual Power Plants. These tools take into account the Smart Grids Architecture Model (SGAM) as well as the future structure of the Distribution Grids, as described by the relevant EU bodies and organizations. The project also explores whether the existing telecommunication infrastructure is sufficient to support in mass scale the emerging business models and Smart Grid services. Finally, the project explores existing and ongoing standardization activities and proposes adaptations to data models of market-oriented and field-level standards.

**Scope.** The SmarterEMC2 project aims at achieving a breakthrough in the integration of ICT with Power Systems. In detail, the project has the following ambitious objectives:

- Validation of ICT tools that support the integration of consumers through Demand Response services and the integration of DG/RES through Virtual Power Plants;
- Exploration of ICT tools facilitating Distribution Grid management and operation;
- Piloting in 3 real-world sites demonstrating the impact of DR and VPPs services,
- Large-scale simulation in 3 laboratories with the aim to explore the ability of the communication networks to support massive uptake of novel SG services.
- Proposition of new business models that support active customer participation, increased RES penetration, Distribution Grid reliable operation, and open access to the energy markets.

**Technical description and implementation.** The following ICT tools are explored in the project:

- ICT tool for Demand Response Services capable to support multi-level, hierarchically organized business entities (DSOs, DR Aggregators, consumers). The core of this infrastructure is a DR Engine capable to interact with proprietary systems belonging to the DSOs, with higher or lower-level DR Engines of other DR Aggregators, as well as with smart (DR-enabled) or thin (DR-agnostic) clients residing at consumers' premises with a variety of price-based and incentive-based DR programs.
- ICT tool for Virtual Power Plant management adapted in the SGAM and the proposed use cases by Smart Grid Task Force (SGTF) for data handling.
- ICT tools for management of local constraints of the Distribution Grid, and for supporting the operation planning activities of the DSOs.
- Management software of an Energy Hub (EH) which pertains to a system responsible for the optimal planning and control of a Microgrid. Such a system may cooperate with systems of other actors (e.g. the DRMS of a DR Aggregator, or the VPPMS of a VPP Aggregator) in order to provide flexibility services.
- ICT tool for big data storage, analytics and visualization.

**Impact**. *Socio-economics:* demonstrating how properly configured DR programs can empower residential , small industrial and commercial customers rendering them into active participants in the electricity market, but also offer DSOs an efficient tool to balance demand with generation. Ensuring lower electricity prices for consumers.

*Environment:* minimising environmental impact by demonstrating ICT infrastructure that is able to monitor efficiently the grid's operation, leading to better management and operations.

*Market Transformation:* Active participation of prosumers in DR services, and new players in energy markets.

*Policy*: SmarterEMC2 proposes adaptations to data models of the IEC 62325 and IEC 61850 families of standards in the scope of the use cases explored in the project.

**H2020 call: LCE-07-2014 - Distribution grid and retail market**

# UPGRID

Real proven solutions to enable active demand and distributed generation flexible integration, through a fully controllable LOW Voltage and medium voltage distribution grid

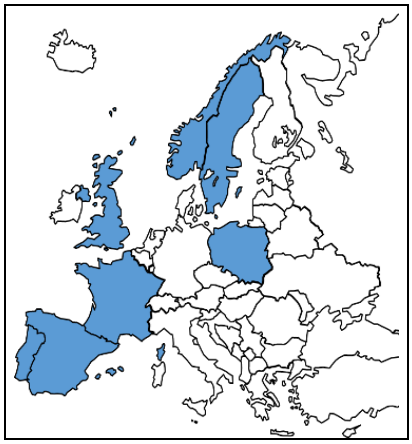
**UPGRID project focuses on addressing the constraints and needs arisen from poor observability of LV grid, local accumulation of distributed generation, risks and difficulties in managing the distribution network, aging infrastructure and social and environmental restrictions that inhibit the grid development. To be successful, UPGRID proposes an open, standardised and integral improvement of the LV grid.**

| From 2015 To 2017 | Project total cost | EU contribution | Website |
|---|---|---|---|
| | 15,7 M€ | 12.0 M€ | http://upgrid.eu/ |

**Technologies and services**

| | |
|---|---|
| Technologies for consumers | ✓ Demand response<br>✓ Smart metering |
| Grid technologies | ✓ Network management, monitoring and control tools |
| Large-scale storage technologies | |
| Distributed storage technologies | |
| Generation technologies | |
| Market | ✓ Electricity market |

**Project partners' countries**



## Coordinator: IBERDROLA DISTRIBUCION ELECTRICA, S.A. (SPAIN)

**Other partners:**

- EDP DISTRIBUICAO ENERGIA SA (Portugal)
- VATTENFALL ELDISTRIBUTION AB (Sweden)
- ENERGA OPERATOR SA (Poland)
- FUNDACION TECNALIA RESEARCH & INNOVATION (Spain)
- IMPERIAL COLLEGE OF SCIENCE TECHNOLOGY AND MEDICINE (United Kingdom)
- UNIVERSIDAD PONTIFICIA COMILLAS (Spain)
- INESC TEC - INSTITUTO DE ENGENHARIA DE SISTEMAS E COMPUTADORES, TECNOLOGIA E CIENCIA (Portugal)
- ZIV METERING SOLUTIONS SL (Spain)
- WITHUS - INOVACAO E TECNOLOGIA LDA (Portugal)
- NOS COMUNICACOES SA (Portugal)
- POWEL AS (Norway)
- SCHNEIDER ELECTRIC INDUSTRIES SAS (France)
- IGE ENERGY SERVICES (UK) LIMITED (United Kingdom)
- ATENDE SPOLKA AKCYNA (Poland)
- POLITECHNIKA GDANSKA (Poland)
- INSTYTUT ENERGETYKI (Poland)
- ASOCIACION INSTITUTO TECNOLOGICO DE LA ENERGIA (Spain)
- ENTE VASCO DE LA ENERGIA (Spain)

## Project Description

**Context**. UPGRID is being developed by 19 partners from 7 European countries: Spain, Portugal, Sweden, Poland, United Kingdom, France and Norway. It includes four big smart grid demonstrators ongoing in Spain, Portugal, Sweden and Poland which main scope is the LV electricity distribution network. To be successful, UPGRID proposes an open, standardised and integral improvement of the LV grid.

**Scope.** The goal is to provide the electrical system with new products and services to enhance the management and operation of distribution networks improving the response to consumer needs (e.g. reduce power supply restoration time, more accurate and immediate information, increase consumer participation in the market, etc.…). UPGRID project focuses on addressing the constraints and needs arisen from poor observability of LV grid, local accumulation of distributed generation, risks and difficulties in managing the distribution network, aging infrastructure and social and environmental restrictions that inhibit the grid development. The main objectives are:

- Economic area: increase of LV infrastructure capabilities, development of new LV products & services and definition of innovative business models.
- Social area: creation of consumer's conscious behaviour, improvement of the services provided to consumers and consumer engagement.
- Technical area: enhanced tools for LV grid and improvement of its observability, integration of Active Demand and DRES at LV level.

**Technical description and implementation.** UPGRID is focused on the four demonstrators and supported by transversal assessment (e.g. data analysis, business models, etc.). The technical description and implementation is explained through the following expected outcomes:

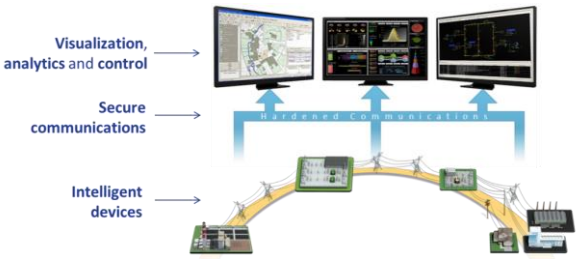
- Functional specification of LV dispatching (LV Network Management System).
- Achieve sound LV network representation.
- Deployment of mobility tools to support LV operation and maintenance (field crews).
- Integration and processing of meter events in the Outage Management System (OMS).
- Deployment of equipment in secondary substation and MV feeders for supplier independent solutions.
- LV grid remote control operation over PRIME infrastructure, and multiservice PRIME subnetwork.
- Combined use of AMI and Home Energy Management Systems (HEMS) for Active Demand Management.
- Web-based tools to increase consumer energy awareness.
- Specification of the neutral market access platform.

**Impact**. *Replicability:* Possibilities of future implementations in other DSO systems by respecting the necessary standards and the application of artificial intelligence and data analytics techniques.

*Socio-economics:* UPGRID could affect positively in a more active participation of market players and realise the socio-economic benefits that smart grids are envisaged to bring with new business opportunities.

*Market Transformation and policy:* Various market design and policy recommendations are expected to emerge which is important in promoting the large scale adoption of UPGRID innovations.

Capital and operational costs mitigation of the grid modernization.



**H2020 call: LCE-08-2014 - Local / small-scale storage**

# ELSA

Energy Local Storage Advanced system

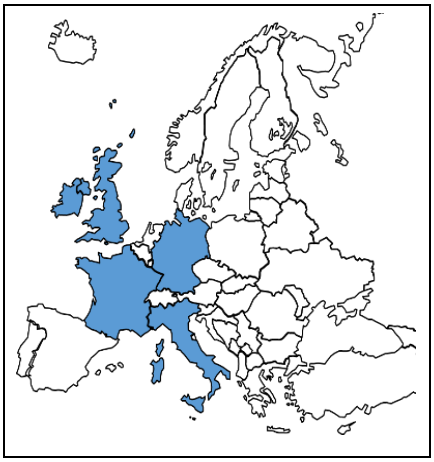
**ELSA will adapt, build upon, and integrate close-to-mature storage technologies and related ICT-based energy management systems for the management and control of local loads, generation and single or aggregated real or virtual storage resources, including demand response, in buildings, districts and distribution grids.**

| From 2015<br>To 2018 | Project total cost | EU contribution | Website |
|---|---|---|---|
| | 13.1 M€ | 9.8 M€ | http://www.elsa-h2020.eu |

**Technologies and services**

| | |
|---|---|
| Technologies for consumers | ✓ Demand response |
| Grid technologies | |
| Large-scale storage technologies | |
| Distributed storage technologies | ✓ Batteries<br>✓ Electric vehicles<br>✓ Thermal energy storage |
| Generation technologies | ✓ PV |
| Market | ✓ Ancillary services |

**Project partners' countries**



## Coordinator: BOUYGUES ENERGIES & SERVICES (FRANCE)

**Other partners:**

- RENAULT SAS (France)
- Nissan West Europe SAS (France)
- RHEINISCH-WESTFAELISCHE TECHNISCHE HOCHSCHULE AACHEN (Germany)
- UNITED TECHNOLOGIES RESEARCH CENTRE IRELAND, LIMITED (Ireland)
- ENGINEERING - INGEGNERIA INFORMATICA SPA (Italy)
- B.A.U.M. CONSULT GMBH (Germany)
- ASM TERNI SPA (Italy)
- Gateshead College (United Kingdom)
- ALLGAUER UBERLANDWERK GMBH (Germany)

## Project Description

**Context**. Integration of distributed small/medium size storage systems can allow operating distribution grids much more flexibly, thus realizing smart grid features like local demand-supply balancing, congestion relief, peak shaving and effective RES integration. However, few technologically mature decentralized storage systems are commercially available today at affordable prices, while both viable business models and the underlying legal and regulatory framework are lagging behind.

As an answer, ELSA will implement and demonstrate an innovative solution integrating low-cost second-life Li-ion batteries and other direct and indirect storage options, including heat storage, demand-side management, as well as use of intermittent RES. The core idea is to consider Storage as a Service towards building and district managers for local energy management optimization, and towards DSO for enhanced network operations.

The goal is to design, develop and validate the industrial energy storage system based on 2nd life batteries to reduce production, installation and maintenance costs to enable the large penetration in the European market of local storage for electricity grid support based on used electric vehicles batteries

**Scope.** ELSA aims at offering a storage-as-a-service system based on cost competitive second-life battery energy storage and an interoperable ICT platform using standard smart grid information and service models for optimized energy management of local resources (e.g. generation, loads and real or virtual storage). ELSA energy storage system and ICT platform will allow the power grid distributors to integrate larger shares of intermittent RES at affordable costs, while mitigating safety and environmental concerns. The ELSA ICT platform becomes the disruptive element by turning on an expensive product-oriented into a more affordable service-based value proposition.

**Technical description and implementation.** The project will provide specification of the core project framework (technical requirements under regulatory constraints and standardization aspects) and will define technical and commercial services enabled by energy storage and its interaction with other local energy resources (e.g. local generation and load management) in various building and network scenarios.

The project aims at maturing the energy storage prototype based on 2nd life batteries from TRL6 to a commercial product able to be installed in the different scenarios defined by ELSA.

The project will also develop a scalable ICT platform for an easy deployment in 6 different demonstration sites that will facilitate the interaction with Building Management Systems (BMS), Energy Management Systems (EMS) and SCADA systems.

**Impact**. The aim of ELSA project is to bring a complete, adaptable (with other systems) and interoperable solution (electricity storage system and ICT EMS) from TRL6 to market ready TRL9 for electricity storage and energy management for building/districts and distribution grids.

The business model will determine the value of the system for different customers (DSO, aggregators, energy producers, building and district/campus managers) in several European countries and determine the production, installation and operation costs. In order to maximize the market potential for the solutions and preserve the investments, the system will be modular, upgradeable and adaptable to as many sites and grids as possible, as well as able to evolve to future battery technologies and new or used batteries from other car manufacturers.

**H2020 call: LCE-08-2014 - Local / small-scale storage**

# NETfficient

Energy and economic efficiency for today's smart communities through integrated multi storage technologies

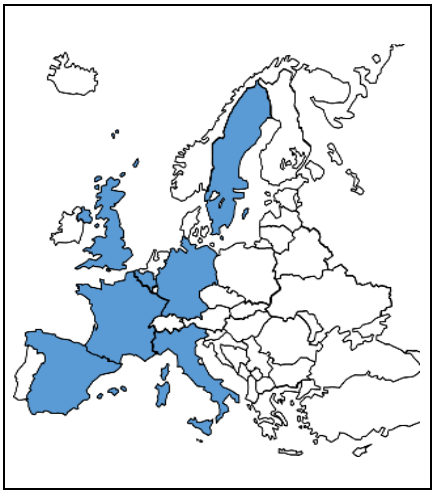
**The NETfficient project will deploy and demonstrate local energy storage technologies and develop information and communication tools, to exploit the synergies between energy storage, the smart grid and the citizens.**

| From 2015 To 2018 | Project total cost | EU contribution | Website |
|---|---|---|---|
| | 11.4 M€ | 9.0 M€ | http://netfficient-project.eu/ |

**Technologies and services**

| | |
|---|---|
| Technologies for consumers | ✓ Demand response<br>✓ Smart appliance<br>✓ Smart metering |
| Grid technologies | ✓ Micro-grid |
| Large-scale storage technologies | |
| Distributed storage technologies | ✓ Batteries<br>✓ Electric Vehicles |
| Generation technologies | ✓ PV<br>✓ Micro-generation |
| Market | ✓ Electricity market<br>✓ Ancillary services |

**Project partners' countries**



## Coordinator: AYESA ADVANCED TECHNOLOGIES SA (SPAIN)

**Other partners:**

- WILLIAMS GRAND PRIX ENGINEERING LIMITED (United Kingdom)
- FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V. (Germany)
- CENTRO DI RICERCA SVILUPPO E STUDI SUPERIORI IN SARDEGNA SOCIETA' A RESPONSABILITA' LIMITATA (Italy)
- STEINBEIS INNOVATION GGMBH (Germany)
- UNIVERSITA DEGLI STUDI DI CAGLIARI (Italy)
- AYUNTAMIENTO DE SANTANDER (Spain)
- SWEREA IVF AB (Sweden)
- POWERTECH SYSTEMS (France)
- WIRTSCHAFTSBETRIEBE DER STADT NORDSEEHEILBAD BORKUM GMBH (Germany)
- SCHNEIDER ELECTRIC GMBH (Germany)
- VANDENBORRE ENERGY SYSTEMS NV (Belgium)
- ZIGOR RESEARCH & DEVELOPMENT AIE (Spain)

## Project Description

**Context**. NETfficient is tackling one of the most pressing challenges of the energy market, as the availability of renewable energies is not considered the sole problem, but its storage and distribution methods due to the time-shift between availability of renewable resources and demand peaks.

The project will deploy and demonstrate local storage technologies and develop ICT tools to exploit the synergies between storage, smart grid, citizens and public services. The demonstration in the real environment on the German island of Borkum in the North Sea will be driven by five use cases covering low voltage and medium voltage scenarios and a wide range of applications and functionalities.

The decentralized energy generation coupled with storage systems and a smart energy software platform being connected to the electric grid and fed by real time data and information will empower citizens, businesses and public services to become active prosumers, which means that all stakeholder groups, from policy makers, municipalities to the citizens will be involved in the energy value chain for a better living and working environment.

**Scope.** NETfficient aims to develop solutions for Smart Energy Cities of any kind. The project aims to enable the exploitation of existing renewable energies on communities with micro-generation and energy storage by developing the missing link for mass uptake of storage and energy management technologies, clean and sustainable energy will be stored in storage systems deployed at medium and low voltage level, and it will be distributed when would be demanded.

The main objectives of the project are to:

- Develop a central Energy Monitoring System to be used by the energy companies to manage their associates´ storage devices and to optimize the energy flows between the devices and the grid
- Provide means to trade the aggregated energy from distributed micro-generation, accomplishing the requirements of energy markets, while maximizing the benefits for the prosumers
- Develop and test through a pilot in Borkum Island, use cases of energy storage systems with a high replicability and profitable business cases for all the stakeholders
- Provide DSOs control systems and decision support tools that enable the integration of renewable generation and storage systems into the grid.

**Technical description and implementation.** The technical activities aim to set up the framework and foundation of the project's solution at different levels (electrical, software, etc.) to enable the integration in an optimized and feasible way of all the components (storage technologies - Hybrid Energy Storage System, Li-ion batteries, Second Life Electric Vehicle Batteries, hydrogen fuel cells, home hybrid technologies -super capacitor+Li-ion batteries-, inverters, smart meters, renewable generators, monitoring and controlling systems, energy software management platform and so on) ranging from MV to LV. Protocols and interfaces to allow the communication between each pair of the elements have been defined.

With regard to implementation, at this stage, storage and energy systems have been developed, use cases defined, energy management platform has been designed and is being implemented, and, finally, the integration of systems has been met on time.

**Impact**. By focusing on distributed renewable energy sources and storage to feed the energy demand, the project will help to reduce carbon emissions as well as the dependency on fossil fuels, empowering households, districts and citizens to adopt a sustainable, clean energy supply. The Island of Borkum, location of the pilot, will be enabled to further realise its goal to become energy autarkic. Furthermore, through participation in working group NETFFICIENT is contributing to the identification of barriers to the deployment of distributed storage and making new proposals to overcome them.

**H2020 call: LCE-08-2014 - Local / small-scale storage**

# RealValue

Realising Value from Electricity Markets with Local Smart Electric Thermal Storage Technology

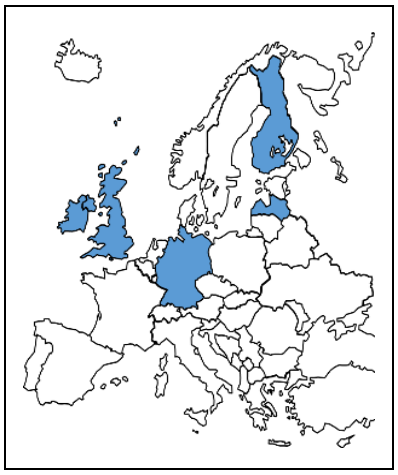
**RealValue will demonstrate, through the deployment of Smart Electric Thermal Storage (SETS) technology in 1,250 properties in Ireland, Germany and Latvia how it can provide value and benefits to the whole electricity supply chain.**

| From 2015 To 2018 | Project total cost | EU contribution | Website |
|---|---|---|---|
| | 15.4 M€ | 12.0 M€ | http://www.realvalueproject.com/ |

**Technologies and services**

| | |
|---|---|
| Technologies for consumers | ✓ Demand response<br>✓ Smart appliance<br>✓ Smart metering |
| Grid technologies | |
| Large-scale storage technologies | |
| Distributed storage technologies | ✓ Thermal Energy Storage |
| Generation technologies | |
| Market | ✓ Electricity market<br>✓ Ancillary services |

**Project partners' countries**



## Coordinator: GLEN DIMPLEX IRELAND (IRELAND)

**Other partners:**

- THE CHANCELLOR, MASTERS AND SCHOLARS OF THE UNIVERSITY OF OXFORD (United Kingdom)
- MVV ENERGIE AG (Germany)
- EIRGRID PLC (Ireland)
- TEKNOLOGIAN TUTKIMUSKESKUS VTT OY (Finland)
- ESB NETWORKS LTD (Ireland)
- UNIVERSITY COLLEGE DUBLIN, NATIONAL UNIVERSITY OF IRELAND, DUBLIN (Ireland)
- DEUTSCHES INSTITUT FUR WIRTSCHAFTSFORSCHUNG DIW (INSTITUT FUR KONJUNKTURFORSCHUNG) EV (Germany)
- SSE AIRTRICITY LTD (Ireland)
- INTEL RESEARCH AND DEVELOPMENT IRELAND LIMITED (Ireland)
- GLEN DIMPLEX DEUTSCHLAND GMBH (Germany)
- RIGAS TEHNISKA UNIVERSITATE (Latvia)

## Project Description

**Context**. The RealValue project has been designed to accelerate innovation and develop the business models necessary for use of small-scale energy storage in residential homes and other types of buildings such as schools and small commercial properties. The project will use a combination of physical demonstrations in Ireland, Germany and Latvia along with innovative modelling techniques, in order to demonstrate how local small-scale energy storage, optimised across the whole EU energy system, with advanced ICT, could bring benefits to all market participants.

**Scope.** RealValue will demonstrate that local small-scale storage of thermal electric loads (e.g. Smart Electric Thermal Storage Systems 'SETS') can be aggregated at scale to provide valuable services to both the end-user households and to the wider energy system across multiple timescales. It will also show that, within the European power system, aggregated local small-scale storage can provide energy, capacity and system services. It will achieve this using a novel virtual demonstration approach combined with a set of expansive and detailed modelling and simulation studies, which when calibrated to physical trial demonstrations (Ireland, Germany and Latvia), will extend the relevance and magnify the impact of the project as a whole.

Research studies will include techno-economic and behavioural analysis that will be used to inform EU regulation and policy decision makers. Moreover, business models will be developed quantifying the potential of small-scale storage as an aggregated controllable load. RealValue will provide system services or release value through price arbitrage within existing energy market structures, and highlight any barriers associated with integration into the electricity grid.

**Technical description and implementation.** SETS is a direct replacement for existing electric thermal storage heaters and water tanks with a combined load of 55GW across the EU. It can also replace direct electric resistance heaters with further connected load of 93GW. RealValue will use modelling & virtual simulation to demonstrate the technical and commercial potential in millions of homes across representative EU regions.

The intelligent demand shifting and high speed demand interruption attributes of the RealValue SETS also constitute a highly flexible energy arbitrage and system services resource to mitigate many of the technical and market challenges associated with variable renewable energy resources based on asynchronous generation technology. SETS that shifts demand away from peak periods can help reduce the overall need for electric power generation capacity at the aggregate level, and when deployed locally at low voltage level it has the scope to reduce distribution system. The benefits of SETS technology and the RealValue aggregated co-optimisation approach will thus be evident in terms of cost savings, renewable energy curtailment mitigation, $CO_2$ emissions reduction, power system reliability improvements and asset investment reductions.

**Impact**. *Replicability:* Risk-mitigation measures have been put in place in multiple deployment sites throughout Europe to ensure replicability.

*Socio-economics:* Socio-economic and market analysis including socio-economic indicators, behaviours and norms will be carried out.

*Environment:* RealValue can establish technical and market solutions that are key to supporting future European decarbonisation and renewables deployment policy.

*Market Transformation:* The energy market in Europe is not yet in a position to take advantage of local small-scale storage or aggregated demand side response based on domestic houses and buildings. RealValue will create a business model which will work, identifying barriers which need to be overcome for this to happen. A thorough analysis of European markets will be conducted to identify early opportunities for adoption of the RealValue approach.

*Policy:* RealValue will inform policy makers and regulators regarding the impact of demand side measures under different market structures and incentive regimes. It will further help to develop policies and regulatory frameworks that can bring about technology uptake in the best consumer interest.

**H2020 call: LCE-08-2014 - Local / small-scale storage**

# SENSIBLE

Storage ENabled SustaInable energy for BuiLdings and communitiEs

SENSIBLE
Storage-Enabled Sustainable Energy for Buildings and Communities

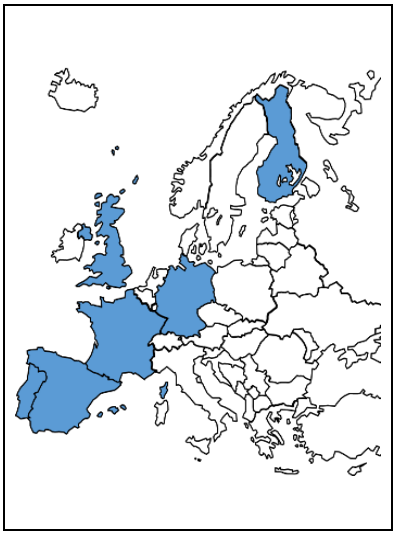
**Project SENSIBLE aims at developing, demonstrating and evaluating a storage-enabled sustainable energy supply for buildings and communities.**

| From 2015 To 2018 | Project total cost | EU contribution | Website |
|---|---|---|---|
| | 15.4 M€ | 11.8 M€ | http://www.h2020-project-sensible.eu/ |

**Technologies and services**

| | |
|---|---|
| Technologies for consumers | ✓ Smart metering |
| Grid technologies | ✓ Network management, monitoring and control tools<br>✓ Micro-grid |
| Large-scale storage technologies | |
| Distributed storage technologies | ✓ Batteries<br>✓ Thermal Energy Storage<br>✓ Flywheel |
| Generation technologies | ✓ PV<br>✓ Micro-generation |
| Market | ✓ Electricity market |

**Project partners' countries**



## Coordinator: SIEMENS AKTIENGESELLSCHAFT (GERMANY)

### Other partners:

- ADEVICE SOLUTIONS S.L. (Spain)
- ASSOCIATION POUR LA RECHERCHE ET LE DEVELOPPEMENT DES METHODES ET PROCESSUS INDUSTRIELS (France)
- LABELEC - ESTUDOS, DESENVOLVIMENTO E ACTIVIDADES LABORATORIALS SA (Portugal)
- EMPOWER IM OY (Finland)
- GREEN POWER TECHNOLOGIES (Spain)
- INESC TEC - INSTITUTO DE ENGENHARIA DE SISTEMAS E COMPUTADORES, TECNOLOGIA E CIENCIA (Portugal)
- INDRA SISTEMAS SA (Spain)
- MEADOWS OZONE ENERGY SERVICES LTD. (United Kingdom)
- TECHNISCHE HOCHSCHULE NURNBERG GEORG SIMON OHM (Germany)
- THE UNIVERSITY OF NOTTINGHAM (United Kingdom)
- UNIVERSIDAD DE SEVILLA (Spain)
- SIEMENS SA (Portugal)
- K & S GMBH PROJEKTMANAGEMENT (Germany)

## Project Description

**Context**. The project SENSIBLE integrates electro-chemical, electro-mechanical and thermal storage technologies, as well as micro-generation (combined heat and power, heat pumps) and renewable energy sources (photovoltaic) into power and energy networks in homes and buildings. The benefits of storage integration is going to be demonstrated with three demonstrators in Portugal (Évora), UK (Nottingham) and Germany (Nuremberg).

**Scope.** The project SENSIBLE explores the integration of small scale, widely available technologies into local power grids. The project SENSIBLE:

- develops and demonstrates power electronic technologies that enable the full set of storage functions
- develops measures and tools for safe storage integration into buildings, communities and grids
- develops and demonstrates locally-focused energy market services
- conducts life cycle analyses (LCA) and assess the socio-economic impact of small-scale storage integrated in buildings, as well as communities and distribution networks

By integrating different storage technologies into local energy grids as well as homes and buildings, and by connecting these storage facilities to the energy markets, the project SENSIBLE will have a significant impact by increasing self-sufficiency, power quality and network stability all the way to sustainable business models for local energy generation and storage. SENSIBLE also conducts life cycle analyses and assesses the socio-economic impact of small-scale storage integrated in buildings and distribution networks.

**Technical description and implementation.** The three different demonstration sites fit together and complement each other:

- Évora (Portugal) demonstrates storage-enabled power flow, power quality control and grid resilience in (predominantly low-voltage) power distribution networks – under the assumption that these networks are “weak” and potentially unreliable.
- Nottingham (UK) focuses on storage-enabled energy management and energy market participation of buildings (homes) and communities – under the assumption that the grid is “strong” (so, with no or little restrictions from the grid).
- Nuremberg (Germany) focuses on multi-modal energy storage in larger buildings, considering thermal storage, combined heat and power, and different energy vectors (electricity, gas).

**Impact**. *Replicability*: Understand and help to tackle the technological barriers to widespread deployment of energy storage technologies (e.g. interoperability, regulations/standards). The project will test different storage solutions and improve various power electronic components.

*Socio-economics*: Contribution to public acceptance by improving the public perception of energy storage equipment and understanding the social and economic barriers such as perception of cost/benefit, safety, user transparency, security of data, etc.

*Market Transformation*: Investigation of business models for storage.

*Policy*: the appropriate project outputs will be used to make recommendations for future national and international energy policies.

**H2020 call: LCE-08-2014 - Local / small-scale storage**

# STORY

Added value of STORage in distribution sYstems

**STORY is a European project researching new energy storage technologies and their benefits in distribution systems and involves 18 Partner Institutions in 8 different European countries.**

| From 2015 To 2020 | Project total cost | EU contribution | Website |
|---|---|---|---|
| | 15.4 M€ | 12.5 M€ | http://horizon2020-story.eu/ |

**Technologies and services**

| | |
|---|---|
| Technologies for consumers | ✓ Demand response<br>✓ Smart appliance |
| Grid technologies | ✓ Network management, monitoring and control tools<br>✓ Micro-grid |
| Large-scale storage technologies | ✓ Compressed Air Energy Storage |
| Distributed storage technologies | ✓ Batteries ✓ Electric Vehicles<br>✓ Thermal Energy Storage |
| Generation technologies | ✓ Wind Turbine ✓ PV<br>✓ Solar thermal ✓Biogas<br>✓ Micro-generation<br>✓ Tidal Energy |
| Market | ✓ Electricity market<br>✓ Ancillary services |

**Project partners' countries**

## Coordinator: VTT (FINLAND)

**Other partners:**

- TH!NK E BVBA (Belgium)
- VLAAMSE INSTELLING VOOR TECHNOLOGISCH ONDERZOEK N.V. (Belgium)
- VLERICK BUSINESS SCHOOL (Belgium)
- BASEN OY (Finland)
- UNIVERZA V LJUBLJANI (Slovenia)
- BENEENS JOZEF EN ZONEN BVBA (Belgium)
- ELEKTRO GORENJSKA PODJETJE ZA DISTRIBUCIJO ELEKTRICNE ENERGIJE DD (Slovenia)
- VIESSMANN-BELGIUM (Belgium)
- HAWKER GMBH (Germany)
- B9 ENERGY STORAGE LTD (United Kingdom)
- LOPTA FILM GMBH (Germany)
- JOANNEUM RESEARCH FORSCHUNGSGESELLSCHAFT MBH (Austria)
- ACTILITY SAS (France)
- PROSPEX INSTITUTE VZW (Belgium)
- FUNDACION CENER-CIEMAT (Spain)
- EXPOSICION Y CONSERVACION DE ALIMENTOS Sa (Spain)
- UC LEUVEN (Belgium)

## Project Description

**Scope.** The primary objective of the project is to show the added value storage can bring for a flexible, secure and sustainable energy system. Secondary goals have been set up:

- Show a great applicability potential of storages by presenting 8 different demonstration cases each with different storage concepts and technologies.
- Pave the way for increased competitiveness of European industries in the area of storage technologies by thorough analysis of the preconditions for business, by communication of the impacts of the regulatory and political framework to the business and by development of viable business models for deployment of storage at local level.
- Contribute to enhancing innovation capacity and integration of new knowledge through systematic knowledge sharing and innovation integration between the partners and the surrounding community.
- Achieve an impact on common understanding of storage, its meaning and potential of storage in the low and medium voltage grid as well as to ensure that the climate for deployment is created and has therefore set up a broad and attractive communication and deployment plan to reach over 250 000 individuals.

The main outcome of STORY will be a considerable contribution to the roll out of storage in Europe.

**Technical description and implementation.** *Demo 1: Residential buildings and Demo 2: Roll out of a neighbourhood (Oud-Heverlee, Belgium).* The aim is to integrate storage at building level and experience interoperability challenges. Technologies that will be integrated are a set of vacuum solar collectors; hybrid PV; high temperature inter-seasonal underground thermal storage of 24.000 L; shallow geothermal storage; small scale batteries; a smaller thermal storage with improved state of charge measurement systems and smart management of heat pumps. In Demo 2 the buildings are integrated in a microgrid.

*Demo 3: Storage in factory (Navarra, Spain).* Small scale (50 kW, 200 kWh Li-Ion) battery system introduced to optimize the revenues from a PV installation in an industrial environment.

*Demo 4: Storage in residential district (Lecale, Northern Ireland).* Large scale (250 kW, 2 MWh) isothermal compressed air energy storage introduced in a distribution network constrained by large amounts of local renewable production.

*Demo 5: Flexibility and robustness of medium scale storage unit in two industrial areas (Hagen, Germany and Kranj, Slovenia) and one residential area (Suha, Slovenia).* The medium scale Lead-Acid battery unit (800 kW, 660 kWh) to be deployed in two different industrial environments and at a low voltage substation. The battery is embedded in a shipping unit that include also the power electronics and controls and can be installed in different situations.

*Demo 6: Roll out of private multi-energy grid in industrial area (Olen, Belgium).* Medium scale thermal storage in an industrial environment in order to improve the efficiency of an organic Rankine cycle generator and integration within a local thermal grid.

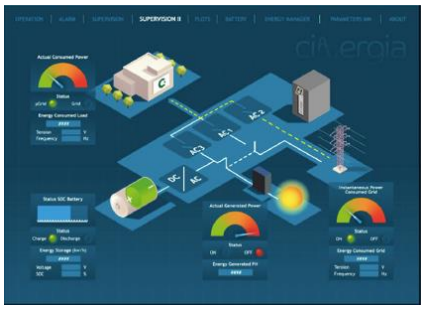
**Impact**. *Replicability:* The selection of cases had as target to assure a high replication potential and a representative mixture of potential applications of storage. The different technologies, the different applications they are used in and thus the different business models all together ensure that the conclusions are technology-independent. One of the partners has since summer 2016 installed three commercial projects with batteries and is preparing one with batteries and thermal storage. This is a partial replication of demonstration 1.

*Socio-economics:* The demonstrations feed in to the models that allow a large-scale impact analysis, including the modelling of new services or an LCA. These activities are upcoming.

*Environment:* The already operational demonstrations - 2 Belgian cases and the one in Spain - have a strong focus on renewables or waste heat to energy. The high share of own consumption in all of these projects as well as the flexibility available in the storages will provide more flexibility on the main grid, allowing a higher share of renewables to be integrated or new products offered on the markets.

*Market Transformation:* The analysis of business model has just started. Vlerick Business School is providing the demonstration site managers with innovative examples of approaches that have proven successful elsewhere. These examples are shared amongst all LCE projects.

*Policy:* Through Bridge, STORY contributes to policy making. The demos will provide important insights related to the Clean Energy for all Package.



**H2020 call: LCE-08-2014 - Local / small-scale storage**

# TILOS

Technology Innovation for the Local Scale,
Optimum Integration of Battery Energy Storage

**TILOS' main goal is to demonstrate the potential of local / small-scale battery storage to serve a multipurpose role within a smart island microgrid that features high shares of renewable energy and trades electricity with the main electricity network.**

| From 2015 To 2019 | Project total cost | EU contribution | Website |
|---|---|---|---|
| | 13.7 M€ | 11.0 M€ | http://www.tiloshorizon.eu/ |

**Technologies and services**

| | |
|---|---|
| Technologies for consumers | ✓ Demand response<br>✓ Smart metering |
| Grid technologies | ✓ Micro-grid |
| Large-scale storage technologies | |
| Distributed storage technologies | ✓ Batteries<br>✓ Thermal Energy Storage |
| Generation technologies | ✓ Wind Turbine<br>✓ PV |
| Market | ✓ Electricity market<br>✓ Ancillary services |

**Project partners' countries**

**Coordinator: PIRAEUS UNIVERSITY OF APPLIED SCIENCES (Former Technological Educational Institute of Piraeus) (GREECE)**

**Other partners:**

- FZSONICK SPA (Italy)
- COMMISSARIAT A L'ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES (France)
- UNIVERSITY OF EAST ANGLIA (United Kingdom)
- INSTITUTO TECNOLOGICO DE CANARIAS, S.A. (Spain)
- RHEINISCH-WESTFAELISCHE TECHNISCHE HOCHSCHULE AACHEN (Germany)
- YOUNICOS AG (Germany)
- UNIVERSITE DE CORSE PASCAL PAOLI (France)
- HELLENIC ELECTRICITY DISTRIBUTION NETWORK OPERATOR S.A. (Greece)
- WORLD WIDE FUND FOR NATURE GREECE (Greece)
- EUNICE LABORATORIES S.A. (Greece)
- KUNGLIGA TEKNISKA HOEGSKOLAN (Sweden)
- EUROSOL PROJEKT UND MANAGEMENT GMBH (Germany)

## Project Description

**Context**. The island of Tilos is currently covering its electricity needs (approximately 3GWh per annum) using oil-based generated electricity that comes from the island of Kos via an undersea cable. This allows for the investigation of the interplay between an interconnector and energy storage, and of energy trade strategies between a smart microgrid (Tilos Island) and a macro-grid (the electricity system of Kos).

**Scope.** The main objective of TILOS is the development and operation of a prototype battery storage system, based on $NaNiCl_2$ batteries that will be provided with a smart grid control system. This system will address the challenge of supporting multiple tasks (microgrid energy management, maximization of RES penetration and grid stability, export of guaranteed energy and provision of ancillary services to the main grid of Kos). The battery system will support both grid-forming (stand-alone microgrid) and grid-following (microgrid coupled with the main grid) operation and will also prove its interoperability with the rest of the microgrid components, including centralized RES, demand side management (DSM), and distributed, residential heat storage in the form of domestic hot water.

Examination of new case studies will be enabled with the development of an advanced microgrid simulating tool, i.e. the Extended Microgrid Simulator, able to simulate different storage technologies and microgrid configurations (stand-alone, grid-connected and power market-dependent systems). Finally, TILOS addresses social issues (public engagement) and develops novel business models and policy instruments.

**Technical description and implementation.** TILOS' system comprises of the following main components:

- Wind power of 800kW and PV power of 160kW.
- Battery Storage System: $NaNiCl_2$ battery storage of 2.88MWh / 800kW and advanced battery inverters.
- Smart Meter and DSM Devices to allow energy monitoring and short-term energy management in local residences and centralized loads such as pumping stations.
- Energy Management System (EMS): A SCADA-based EMS that will coordinate operation of the entire TILOS system.

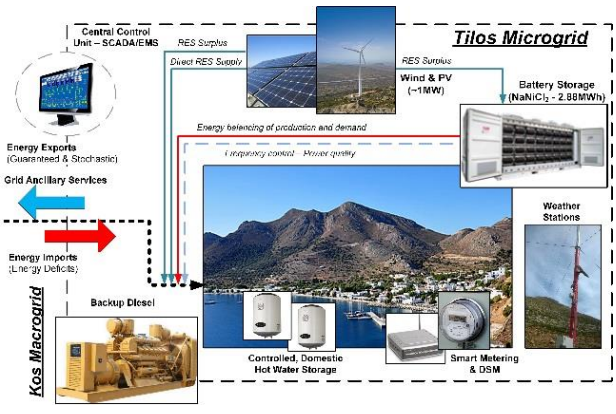
**Impact**. *Replicability:* The system carries modular and scalable characteristics; thus it can satisfy island systems of different size. The Aegean Sea region alone suggests a market of 1GW of oil-based power stations that could be replaced on the basis of TILOS solution.

*Socio-economics*: The project measures public engagement and tries to value the different system aspects, focusing on the battery asset. In the same vein, TILOS investigates the development of novel business models based on public-private partnerships and/or community-scale energy cooperatives (community level prosumers).

*Environment*: TILOS system will allow maximum RES penetration (satisfaction of local demand at 70%). This implies reduction of ~1.7kt of $CO_2$ emissions. Moreover, the project combines RES components with fully-recyclable batteries.

*Market Transformation*: TILOS is already transforming the Greek market, reviving the argument for alternative energy supply models in island regions, with the use of battery storage. However the project aspires to further transform the European market by introducing novel energy trade strategies for community-based micro grids that rely on RES and battery storage and that interface electricity grids with market features.

*Policy*: Contribution to EU-policies (EU Cohesion Policy, the "20-20-20" targets, etc.), and to Greek energy policy and legislation. Furthermore, by building a collaborative relationship with the Ministry of Energy, TILOS is considered the blueprint for similar schemes in other Greek islands, influencing also the New Development Law of Greece, (4399/2016) which provides capital subsidies for local scale energy storage in hybrid power stations of less than 5MW. In addition, TILOS currently chairs the "Regulation" and "Customer Engagement" WGs of the BRIDGE Initiative.



**H2020 call: LCE-10-2014 - Next generation technologies for energy storage**

# NAIADES

Na-Ion bAttery Demonstration for Electric Storage

**The NAIADES project aims to develop and demonstrate the ambient Na-ion battery under realistic conditions as an effective alternative to the Li-ion battery for stationary Electric Energy Storage (EES) application.**

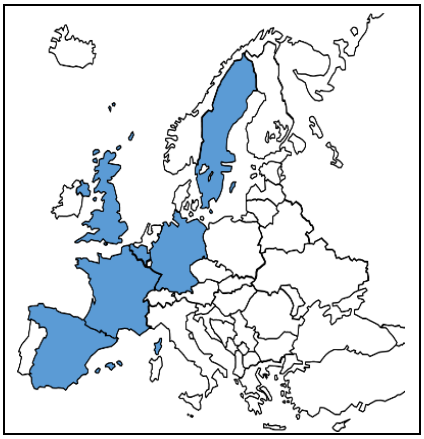
| From 2015 To 2018 |
|---|

| Project total cost | EU contribution | Website |
|---|---|---|
| 6.5 M€ | 6.5 M€ | http://www.naiades.eu/ |

**Technologies and services**

| | |
|---|---|
| Technologies for consumers | |
| Grid technologies | |
| Large-scale storage technologies | |
| Distributed storage technologies | ✓ Batteries |
| Generation technologies | |
| Market | |

**Project partners' countries**



## Coordinator: COMMISSARIAT A L'ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES (FRANCE)

**Other partners:**

- AGENCIA ESTATAL CONSEJO SUPERIOR DEINVESTIGACIONES CIENTIFICAS (Spain)
- CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS (France)
- MAST CARBON INTERNATIONAL LTD (United Kingdom)
- RHODIA OPERATIONS (France)
- SAFT (France)
- VLAAMSE INSTELLING VOOR TECHNOLOGISCH ONDERZOEK N.V. (Belgium)
- ESTABANELL Y PAHISA ENERGIA SA (Spain)
- CHALMERS TEKNISKA HOEGSKOLA AB (Sweden)
- VDE PRUF- UND ZERTIFIZIERUNGSINSTITUT GMBH (Germany)

## Project Description

**Context**. The lithium-ion battery appears as a quite mature technology for large-scale storage applications. However, as the use of large format lithium batteries becomes widespread an increase in the demand for lithium commodity chemicals combined with geographically constrained Li mineral reserves will drive up prices. Based on the wide availability and low cost of sodium, sodium-ion batteries have the potential for meeting the needs of these applications.

NAIADES will demonstrate the feasibility of Na-ion batteries from the knowledge and achievement that has been done at the laboratory scale, up to a module demonstration in a realistic application environment (1 kW) which will serve as data base to demonstrate economical and public acceptance. New energy policy will be developed to integrate the Na-ion battery into the Smart Grid initiative and promote the penetration of renewable energy in the electric network.

**Scope.** The overall purpose is to develop a sodium-ion battery technology for sustainable EES that would bring a radical decrease in cost with respect to the lithium-ion battery technology while ensuring sustainability and performance in terms of safety, cycle life, and energy density. This main aim will be accomplished using a solution-driven approach by achieving the following three main objectives:

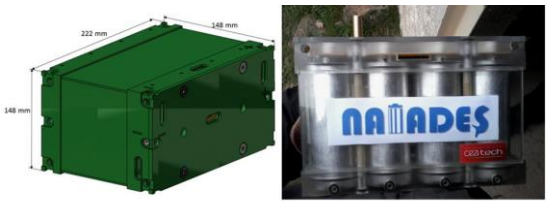
- Contribution to the development of the sodium-ion battery storage technology.
- To scale up materials and to conduct a first demonstration of the sodium-ion battery technology, in order to improve drastically the time-to-market (target - production of commercial cell 6 years after the project kick-off).
- Development of solutions to answer key societal and environmental challenges.

**Technical description and implementation.**

- Materials development: the goal is to obtain, at laboratory scale, optimised materials showing good electrochemical performance, stability and safety.
- Cells and modules realisation: development, assembly, tests and integration into real environment of electrodes and cells. Moreover, to life cycle assessment, economic modelling and public acceptance.

**Impact**. NAIADES expects an enlarged energy storage portfolio, an increased efficiency of the storage technologies, and a facilitated electric energy management in the grid. So far, as this project is focused on the long term evolution of the electric grid, some significant results can already give promising answers.

In addition, NAIADES, expects to lower the cost of its developed technology, increase its efficiency and durability along the project and consequently, this would contribute to lower the environmental impact of its battery system. Finally, it aims at reducing location constraints on energy storage systems.



**H2020 call: LCE-05-2015- Innovation and technologies for the deployment of meshed off-shore grids**

# PROMOTioN

Progress on Meshed HVDC Offshore Transmission Networks

**PROMOTioN seeks to develop meshed HVDC offshore grids on the basis of cost-effective and reliable technological innovation.**

| From 2016 To 2019 | Project total cost | EU contribution | Website |
|---|---|---|---|
| | 51.7 M€ | 39.3 M€ | https://www.promotion-offshore.net/ |

### Technologies and services

| | |
|---|---|
| Technologies for consumers | |
| Grid technologies | ✓ HVDC<br>✓ Multi terminal<br>✓ Protections<br>✓ HVDC breaker |
| Large-scale storage technologies | |
| Distributed storage technologies | |
| Generation technologies | |
| Market | |

### Project partners' countries

## Coordinator: DNV GL NETHERLANDS B.V. (NETHERLANDS)

### Other partners:

- ABB AB (Sweden)
- KATHOLIEKE UNIVERSITEIT LEUVEN (Belgium)
- KUNGLIGA TEKNISKA HOEGSKOLAN (Sweden)
- EIRGRID PLC (Ireland)
- SUPERGRID INSTITUTE (France)
- DEUTSCHE WIND GUARD GMBH (Germany)
- MITSUBISHI ELECTRIC EUROPE BV (Netherlands)
- AFFARSVERKET SVENSKA KRAFTNAT (Sweden)
- ALSTOM GRID UK LIMITED (United Kingdom)
- THE UNIVERSITY COURT OF THE UNIVERSITY OF ABERDEEN (United Kingdom)
- RTE RESEAU DE TRANSPORT D'ELECTRICITE SA (France)
- TECHNISCHE UNIVERSITEIT DELFT (Netherlands)
- STATOIL ASA (Norway)
- TENNET TSO BV (Netherlands)
- STIFTUNG DER DEUTSCHEN WIRSCHAFT FUER DIE NUTZUNG UND ERFORSCHUNG DER WINDENERGIE AUF SEE (OFFSHORE-STIFTUNG) (Germany)
- SIEMENS AKTIENGESELLSCHAFT (Germany)
- DANMARKS TEKNISKE UNIVERSITET (Denmark)
- RHEINISCH-WESTFAELISCHE TECHNISCHE HOCHSCHULE AACHEN (Germany)
- UNIVERSITAT POLITECNICA DE VALENCIA (Spain)
- FORSCHUNGSGEMEINSCHAFT FUER ELEKTRISCHE ANLAGEN UND STROMWIRTSCHAFT E.V. (Germany)
- DONG ENERGY WIND POWER AS (Denmark)
- THE CARBON TRUST (United Kingdom)
- TRACTEBEL ENGINEERING S.A. (Belgium)
- EUROPEAN UNIVERSITY INSTITUTE (Italy)
- IBERDROLA RENOVABLES ENERGIA SA (Spain)
- ASSOCIATION EUROPEENNE DE L'INDUSTRIE DES EQUIPEMENTS ET DES SERVICES DE TRANSMISSION ET DE DISTRIBUTION D'ELECTRICITE AISBL (Belgium)
- UNIVERSITY OF STRATHCLYDE (United Kingdom)
- ADWEN OFFSHORE S.L. (Spain)
- PRYSMIAN (Italy)
- RIJKSUNIVERSITEIT GRONINGEN (Netherlands)
- MHI VESTAS OFFSHORE WIND AS (Denmark)
- ENERGINET.DK (Denmark)
- SCOTTISH HYDRO ELECTRIC TRANSMISSION PLC (United Kingdom)

## Project Description

**Context**. In order to unlock the full potential of Europe's offshore resources, network infrastructure is urgently required, linking offshore wind parks and on-shore grids in different countries. HVDC technology is envisaged but the deployment of meshed HVDC offshore grids is currently hindered by the high cost of converter technology, lack of experience with protection systems and fault clearance components and immature international regulations and financial instruments.

The big players in the European HVDC industry are represented in the PROMOTioN consortium. Europe already is the leading knowledge centre for HVDC in the world. This leadership position will be strengthened by the project, bringing new HVDC technology innovations to a higher TRL and delivering it to the European and international markets.

**Scope.** The project addresses the challenges for meshed HVDC offshore networks development by putting a clear focus on six ambitious objectives:

1. To establish interoperability between different technologies and concepts by providing specific technical and operational requirements, behaviour patterns and standardization methods for different technologies.

2. To develop interoperable, reliable and cost-effective technology of protection for meshed HVDC offshore grids and the new type of offshore converter for wind power integration.

3. To demonstrate different cost-effective key technologies for meshed HVDC offshore grids and to increase their technology readiness level by investigating and overcoming early adopter issues and pitfalls.

4. To develop a new EU regulatory framework, both in accordance with EU wide energy policy objectives and those of the Member States, and to increase the economic viability of meshed HVDC projects by providing a suitable financial framework.

5. To facilitating the harmonization of ongoing initiatives, common system interfaces and future standards by actively engaging with working groups and standardization bodies and actively using experience from the demonstrations.

6. To provide concrete deployment plan for "phase two" in bringing key technologies for meshed HVDC offshore grids into commercial operation in Europe, taking into account technical, financial and regulatory aspects.

**Technical description and implementation.** PROMOTioN focuses on three core technologies; diode rectifier based AC – DC conversion, HVDC grid protection and HVDC circuit breakers. The work is focused on bringing the development of these technologies a step closer to real world implementation by improving and spreading knowledge and understanding about and applicability of these technologies across a range of realistic implementation scales. The North Sea geography, available wind power resources, interconnection potential and characteristics of surrounding utility networks are chosen as a benchmark setting in which this understanding will be showcased. Proof of understanding will be delivered in the form of 'full' scale demonstrators where possible.

**Impact** *Socio-economics:* The main social-economic impact of PROMOTioN is the growth of employment in the European power systems manufacturing and construction industry: with European companies being and becoming the world leaders in offshore HVDC technology, they will grow and create jobs in Europe. Furthermore, the cost reduction for offshore wind (because of a cheaper shore connection) is an important step to make offshore wind a major competitive energy source.

*Environment:* The positive environmental impact of meshed HVDC grids goes further than enabling increased wind energy integration: a meshed HVDC grid reduces the total grid length needed for the wind farm to shore-connection and interconnections – this minimizes the impact on the marine environment. Furthermore, innovations on component level, like the increased power rating per link, the reduced size and weight of offshore converter stations and bio-degradable insulation liquids, reduce the environmental impact of the grid.

*Policy:* The project impacts growth and competitiveness in the HVDC field, themes at the European political agenda.

# FutureFlow

Designing eTrading Solutions for Electricity Balancing and Redispatching in Europe

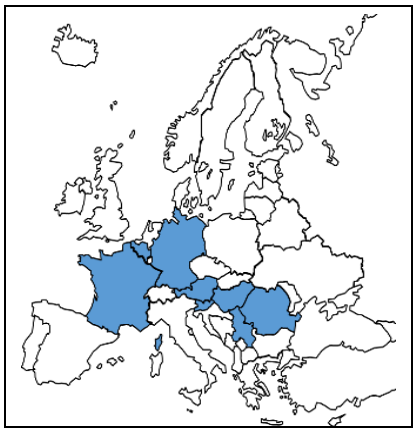
**FutureFlow aims at designing and piloting test comprehensive techno-economic models for open and non-discriminatory access of advanced consumers and distributed generators to a regional platform for ancillary/balancing and redispatching services.**

| From 2016 To 2019 | Project total cost | EU contribution | Website |
|---|---|---|---|
| | 13.0 M€ | 13.0 M€ | http://www.futureflow.eu/ |

**Technologies and services**

| | |
|---|---|
| Technologies for consumers | ✓ Demand response |
| Grid technologies | ✓ Network management, monitoring and control tools |
| Large-scale storage technologies | |
| Distributed storage technologies | |
| Generation technologies | |
| Market | ✓ Electricity market<br>✓ Ancillary services |

**Project partners' countries**



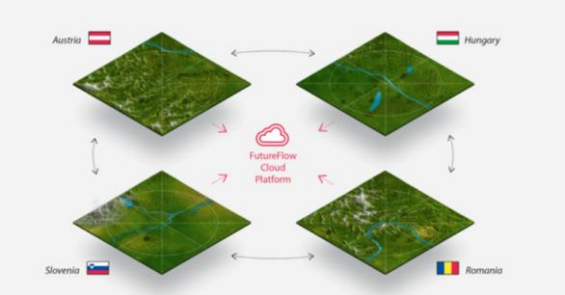
## Coordinator: ELES (SLOVENIA)

**Other partners:**

- AUSTRIAN POWER GRID AG (Austria)
- MAVIR MAGYAR VILLAMOSENERGIA-IPARI ATVITELI RENDSZERIRANYITO ZARTKORUEN MUKODO RESZVENYTARSASAG (Hungary)
- COMPANIA NATIONALA DE TRANSPORT ALENERGIEI ELECTRICE TRANSELECTRICA SA (Romania)
- ELEKTROINSTITUT MILAN VIDMAR (Slovenia)
- ELEKTROENERGETSKI KOORDINACIONI CENTAR DOO (Serbia)
- ELEKTRO ENERGIJA, PODJETJE ZA PRODAJO ELEKTRIKE IN DRUGIH ENERGENTOV, SVETOVANJE IN STORITVE, D.O.O. (Slovenia)
- GEN-I, TRGOVANJE IN PRODAJA ELEKTRICNE ENERGIJE, D.O.O. (Slovenia)
- SAP SE (Germany)
- CYBERGRID GMBH (Austria)
- GEMALTO SA (France)
- 3E NV (Belgium)

## Project Description

**Context**. The growing share of renewable sources has considerably reduced capabilities of conventional, fossil-fuel based power plants to ensure balancing activities and congestion relief through redispatching. There is a need to face future balancing and network security challenges with the help of a more intensive and joint approach at regional level. Therefore, FutureFlow will link interconnected control areas of four TSOs from Central-South Europe (ELES, Slovenia; APG, Austria; MAVIR, Hungary; and TRANSELECTRICA, Romania) that today face increasing challenges to ensure transmission system security.




FutureFlow with its research and innovation activities aims to provide regional integration of balancing markets and to provide infrastructure for consumers and distributed generators to be able to provide flexible balancing and redispatching services. The aim is not just to provide prerequisites that enables participation of those sources but also to validate that they are actually capable of offering services on same quality level as conventional units within an attractive business environment.

**Scope.** The overarching goal of the FutureFlow is to design and pilot test, at a plausible scale, comprehensive techno-economic models for open and non-discriminatory access of advanced consumers (DR) and distributed generators (DG) to the Regional Platform for ancillary/balancing and redispatching services. The main idea of the project is to design and implement cross-border balancing and redispatching mechanisms, including the Common Activation Function (CAF) tailored to congested borders, based on a harmonized set of requirements for DR and DG to be able to compete in these markets.

**Technical description and implementation.** Research and innovation activities shall result in between 30 and 45 MW of flexible balancing power services expected to be made available in the control areas of the four TSOs. For that, following activities are predicted:

- Prototyping of innovative flexibility aggregation platforms for Frequency Restoration Reserve (FRR) within all four control zones,
- Prototyping of a regional IT platform enabling access of these flexibility aggregation platforms to the international ancillary/balancing markets,
- Replicating of the relevant parts of the TSOs Energy Management Systems,
- Pilot testing of these platforms and connections, based on a set of progressively ambitious use cases involving real electricity market players.


**Impact**. *Replicability:* Recommendations for the scaling-up and replication of the developed solutions towards TSOs, policy makers and market players.

*Socio-economics:* By proposing and testing new business models for the prototype flexibility DR and DG aggregation platforms, FutureFlow favours the emergence of new businesses, new job profiles and employment opportunities.

*Environment:* Reduction of $CO_2$ emission by facilitating the integration of DR in balancing mechanisms.

*Market Transformation:* Contribution to further cross-border integration and harmonisation of national electricity markets at regional level.

*Policy:* By fostering the integration of cross-border balancing markets (objectives of the EU Third Energy Package). Contribution to the Network Code on Electricity Balancing with regards to the implementation of the target model.

**H2020 call: LCE-06-2015 - Transmission grid and wholesale market**

# MIGRATE

Massive InteGRATion of power Electronic devices

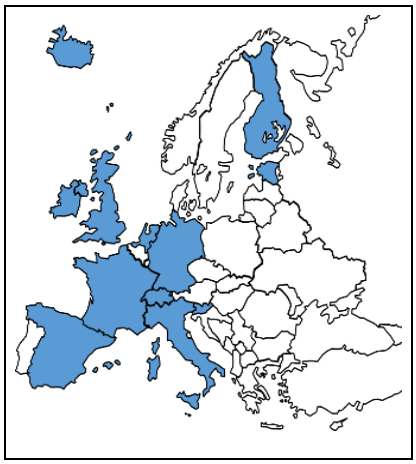
**The aim of MIGRATE is to develop and validate innovative, technology-based solutions in view of managing the pan-European electricity system experiencing a proliferation of Power Electronics (PE) devices involved in connecting generation and consumption sites.**

| From 2016 To 2019 | Project total cost | EU contribution | Website |
|---|---|---|---|
| | 17.9 M€ | 16.7 M€ | https://www.h2020-migrate.eu/ |

**Technologies and services**

| | |
|---|---|
| Technologies for consumers | |
| Grid technologies | ✓ HVAC<br>✓ Protections<br>✓ Inertia |
| Large-scale storage technologies | |
| Distributed storage technologies | |
| Generation technologies | |
| Market | |

**Project partners' countries**



## Coordinator: TENNET TSO GMBH (GERMANY)

**Other partners:**

- TENNET BV (Netherlands)
- SCOTTISH POWER ENERGY NETWORKS HOLDINGS LIMITED (United Kingdom)
- RTE RESEAU DE TRANSPORT D ELECTRICITE SA (France)
- RED ELECTRICA DE ESPANA S.A.U. (Spain)
- ELES DOO SISTEMSKI OPERATOR PRENOSNEGA ELEKTROENERGETSKEGA OMREZJA (Slovenia)
- AMPRION GMBH (Germany)
- EIRGRID PLC (Ireland)
- ELERING AS (Estonia)
- FINGRID OYJ (Finland)
- TERNA RETE ITALIA SPA (Italy)
- LANDSNET HF (Iceland)
- SCHNEIDER ELECTRIC INDUSTRIES SAS (France)
- TECHNISCHE UNIVERSITEIT DELFT (Netherlands)
- UNIVERSITY COLLEGE DUBLIN, NATIONAL
- UNIVERSITY OF IRELAND, DUBLIN (Ireland)
- THE UNIVERSITY OF MANCHESTER (United Kingdom)
- TALLINNA TEHNIKAULIKOOL (Estonia)
- ECOLE NATIONALE SUPERIEURE D'ARTS ET METIERS (France)
- EIDGENOESSISCHE TECHNISCHE HOCHSCHULE ZUERICH (Switzerland)
- FUNDACION CIRCE CENTRO DE INVESTIGACION DE RECURSOS Y CONSUMOS ENERGETICOS (Spain)
- UNIVERZA V LJUBLJANI (Slovenia)
- TECHNISCHE UNIVERSITAET BERLIN (Germany)
- ELEKTROINSTITUT MILAN VIDMAR (Slovenia)
- CONSORZIO INTERUNIVERSITARIO NAZIONALE PER ENERGIA E SISTEMI ELETTRICI (Italy)
- DOWEL MANAGEMENT (France)

## Project Description

**Context**. By 2020, several areas of the HVAC pan-European transmission system will be operated with extremely high penetrations of Power Electronics(PE)-interfaced generators, thus becoming the only generating units for some periods of the day or of the year – due to renewable (wind, solar) electricity. This will result in a) growing dynamic stability issues for the power system (possibly a new major barrier against future renewable penetration), b) the necessity to upgrade existing protection schemes and c) measures to mitigate the resulting degradation of power quality due to harmonics propagation. European TSOs from Estonia, Finland, France, Germany, Iceland, Ireland, Italy, Netherlands, Slovenia, Spain and UK have joined to address such challenges with manufacturers (GE, Schneider Electric) and universities/research centres.

**Scope.** The overarching goal of the project is to develop and validate innovative, technology-based solutions in view of managing the pan-European electricity system experiencing a proliferation of Power Electronics (PE) devices involved in connecting generation and consumption sites.

This overarching goal is split into two components combining two time horizons, i.e.:

- in the short to medium term, incremental technology-based solutions are needed to operate the existing electric HVAC system configuration with a growing penetration of PE-connected generation and consumption, based on novel methods and tools,
- in the long term, breakthrough technology-based solutions are needed to manage a transition towards an HVAC electric system where all generation and consumption is connected via 100% PE, based on innovative control algorithms together with new grid connection standards.

**Technical description and implementation.** The MIGRATE project proposes innovative solutions to progressively adjust the HVAC system operations. Firstly, a replicable methodology is developed for appraising the distance of any EU 28 control zone to instability due to PE proliferation and for monitoring it in real time, along with a portfolio of incremental improvements of existing technologies (the tuning of controllers, a pilot test of wide-area control techniques and the upgrading of protection devices with impacts on the present grid codes). Next, innovative power system control laws are designed to cope with the lack of synchronous machines. Numerical simulations and laboratory tests deliver promising control solutions together with recommendations for new PE grid connection rules and the development of a novel protection technology and mitigation of the foreseen power quality disturbances. Technology and economic impacts of such innovations are quantified together with barriers to be overcome in order to recommend future deployment scenarios.

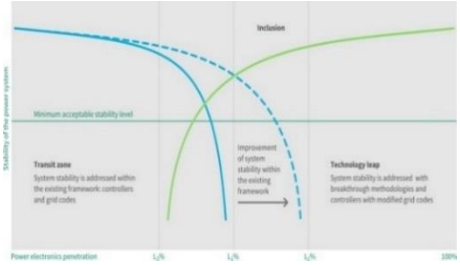
**Impact**. *Replicability:* Overcoming the technical, economic and regulatory barriers identified before proper scaling and replication of the grid connection rules and power system control laws.

*Socio-economics:* The project will validate the business opportunities for its results. In the longer term, this is expected to favour the emergence of new businesses and employment opportunities in the power equipment manufacturing business.

*Environment:* The project will facilitate the integration of large scale intermittent generation and distributed generation. The reduction of visual impact of the transmission line is an important asset (HVDC transmission underground cables). Project results aim at enabling a low carbon transmission network in the future.

*Policy:* By recommending a deployment roadmap for grid connection requirements and standards, the project will provide inputs and contribute to further specifying the following Network Codes, which provide a basis for coordinated and secure real-time system operation across Europe:

- The Network Code on HVDC Connections and DC Connected Power Park Modules (NC HVDC);
- The Network Code for Requirements for Grid Connection applicable to all Generators;
- The Network Code on Demand Connection.



**H2020 call: LCE-06-2015 - Transmission grid and wholesale market**

# SmartNet

Smart TSO-DSO interaction schemes, market architectures and ICT Solutions for the integration of ancillary services from demand side management and distributed generation

**The SmartNet project arises from the need to find answers and propose new practical solutions to the increasing integration of Renewable Energy Sources in the existing electricity transmission network.**

| From 2016 To 2018 | Project total cost | EU contribution | Website |
|---|---|---|---|
| | 12.7 M€ | 12.7 M€ | http://smartnet-project.eu/ |

**Technologies and services**

| | |
|---|---|
| Technologies for consumers | |
| Grid technologies | |
| Large-scale storage technologies | |
| Distributed storage technologies | |
| Generation technologies | |
| Market | ✓ Electricity market<br>✓ Ancillary services |

**Project partners' countries**

## Coordinator: RICERCA SUL SISTEMA ENERGETICO - RSE SPA (ITALY)

**Other partners:**

- AIT AUSTRIAN INSTITUTE OF TECHNOLOGY GMBH (Austria)
- DANMARKS TEKNISKE UNIVERSITET (Denmark)
- ENDESA DISTRIBUCION ELECTRICA S.L (Spain)
- ENERGINET.DK (Denmark)
- EURISCO APS (Denmark)
- EUROPEAN UNIVERSITY INSTITUTE (Italy)
- NOVASOL AS (Denmark)
- N-SIDE (Belgium)
- SYD ENERGI & KLIMA (Denmark)
- EDYNA SRL (Italy)
- SELTA SPA (Italy)
- SIEMENS SPA (Italy)
- SINTEF ENERGI AS (Norway)
- STIFTELSEN SINTEF (Norway)
- FUNDACION TECNALIA RESEARCH & INNOVATION (Spain)
- TERNA RETE ITALIA SPA (Italy)
- UNIVERSITY OF STRATHCLYDE (United Kingdom)
- VLAAMSE INSTELLING VOOR TECHNOLOGISCH ONDERZOEK N.V. (Belgium)
- TEKNOLOGIAN TUTKIMUSKESKUS VTT OY (Finland)
- VODAFONE PROCUREMENT COMPANY S. A R.L. (Luxembourg)
- NUESTRA NUEVA ENERGIA SL (Spain)

## Project Description

**Context**. Until now, distribution networks have been managed with a fit-and-forget philosophy. In the future, increased reserve needs will require a strict real-time coordination between the different actors that are involved in the provision of ancillary services. Optimising the interface between TSOs and DSOs will prove a crucial factor to ensure the achievement of an overall efficiency target. SmartNet analyses architectures for optimized interaction between TSOs and DSOs in managing the exchange of information for the acquisition of ancillary services (reserve and balancing, voltage regulation, congestion management) from subjects located in the distribution segment.

**Scope.** The SmartNet project aims at providing optimised instruments and modalities to improve the coordination between the grid operators at national and local level (respectively the TSOs and DSOs) and the exchange of information for monitoring and for the acquisition of ancillary services (reserve and balancing, voltage control, congestion management) from subjects located in the distribution segment (flexible load and distributed generation).

The main innovation investigated in SmartNet is represented by the active participation of distribution resources in the system energy balancing. The activity is finalized to demonstrate how new TSO-DSO coordination schemes can be beneficial for the system, especially in scenarios in which RES located at distribution level will constitute a large portion of the total energy production. For this reason, dedicated Cost Benefit Analysis (CBA) will be carried out in order to evaluate which interaction strategies, level of involvement and typology of energy resources will guarantee the highest welfare in the three considered countries (Italy, Denmark, and Spain).

**Technical description and implementation.**

6 main activities are identified as following:

a) To identify and characterize the ancillary services needs for the next future (2030), focusing on the ones that can be provided by resources located at distribution level.

b) Adaptation of the current market clearing mechanisms to the integration of distribution network and related resources in the market optimization engine, maintaining adequate performances in terms of accuracy, convergence and speed.

c) Determining the most appropriate ICTs for the full exploitation of the functions related to the considered TSO-DSO interactions.

d) A simulation platform is built up over three layers (physical network, market and ICT) to simulate realistic next future energetic situations in three European countries (Italy, Denmark and Spain).

e) Three physical pilots (in the same countries already mentioned) are aimed to demonstrate the modalities for exchanging monitoring and control signals between transmission and distribution networks and flexibility services.

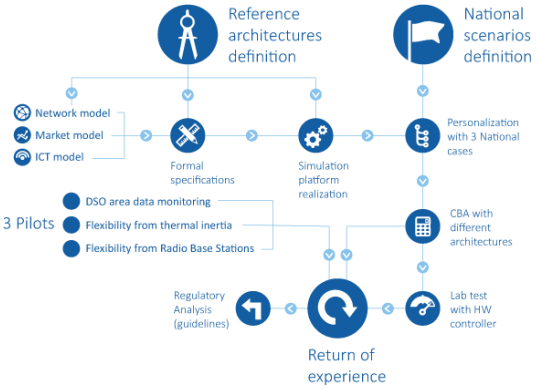
f) Evaluation of the impact of the SmartNet results on the current European regulatory frameworks.

**Impact**. *Replicability*: Providing a view on how the TSO-DSO coordination schemes, the market architectures and the ICT schemes proposed in the demo pilots can be extended on the whole EU territory.

*Socio-economics:* The CBA would provide what economic advantage the overall "system" could draw from allowing flexible resources in distribution networks to provide ancillary services for the system. These economic advantages will also have a social fallout as the electricity commodity is (and even more in the next decades) the main economy motor of the EU.

*Environment:* A higher flexibility of the system will help to enable raising the maximum level of renewable energy in the system.

*Market Transformation and policy:* The project time horizon (2030) could be insufficiently in the long term to allow a substantial modification of the present regulation for the three considered countries regarding ancillary services markets adaptations to enable flexibility from distribution networks.



**H2020 call: LCE-09-2015 - Large scale energy storage**

# CryoHub

Developing Cryogenic Energy Storage at Refrigerated Warehouses as an Interactive Hub to Integrate Renewable Energy in Industrial Food Refrigeration and to Enhance Power Grid Sustainability

**The CryoHub innovation project will investigate and extend the potential of large-scale Cryogenic Energy Storage (CES) and will apply the stored energy for both cooling and energy generation.**

| From 2016 To 2019 | Project total cost | EU contribution | Website |
|---|---|---|---|
| | 8.3 M€ | 7.0 M€ | http://www.cryohub.eu/ |

**Technologies and services**

| | |
|---|---|
| Technologies for consumers | |
| Grid technologies | |
| Large-scale storage technologies | ✓ Liquid Air Energy Storage |
| Distributed storage technologies | |
| Generation technologies | |
| Market | |

**Project partners' countries**

## Coordinator: LONDON SOUTH BANK UNIVERSITY LBG (UK)

**Other partners:**

- PSUTEC SPRL (Belgium)
- L AIR LIQUIDE SA (France)
- FUNDACION CENER-CIEMAT (Spain)
- CRANFIELD UNIVERSITY (United Kingdom)
- INSTITUT NATIONAL DE RECHERCHE EN SCIENCES ET TECHNOLOGIES POUR L'ENVIRONNEMENT ET L'AGRICULTURE (France)
- TECHNICAL UNIVERSITY OF SOFIA (Bulgaria)
- FRIGOLOGIX (Belgium)
- CARBON DATA RESOURCES LTD (United Kingdom)
- INSTITUT INTERNATIONAL DU FROID (France)
- NV MAYEKAWA EUROPE SA (Belgium)
- EUREC EESV (Belgium)
- THE UNIVERSITY OF BIRMINGHAM (United Kingdom)
- INSTITUTE OF REFRIGERATION (United Kingdom)

## Project Description

**Context**. The intermittent supply is a major obstacle to the RES power market. In reality, RES are fickle forces, prone to overproducing when demand is low and failing to meet requirements when demand peaks. The Cryogenic Energy Storage (CES), and particularly the Liquid Air Energy Storage (LAES), is a promising technology enabling on-site storage of RES energy during periods of high generation and its use at peak grid demand. Thus, CES acts as Grid Energy Storage (GES), where cryogen is boiled to drive a turbine and to restore electricity to the grid. To date, CES applications have been rather limited by the poor round trip efficiency (ratio between energies spent for and retrieved from energy storage) due to unrecovered energy losses.

**Scope.** The prime objective of the CryoHub project is to investigate the potential of large-scale LAES at refrigerated warehouses and food factories and to use the stored energy for providing both cooling on site and electrical energy generation during peak demand periods. There are several benefits to integration of LAES into refrigerated warehouses and food factories:

1. To provide large scale energy storage to aid grid balancing on daily and weekly timescales.

2. To store energy from local intermittent RES before supplying to the grid.

3. To 'peak shave' refrigerated warehouse/food factory energy use and at the same time generate and supply part of the required peak energy back to the grid.

4. To provide free cooling to the cold stores during power generation.

5. To decarbonise the electricity grid.

An additional benefit could be to utilise the waste CO2 produced during liquefaction as a cooling medium for transport vehicles, or as a refrigerant for cold stores operating on a CO2 refrigeration system. Alternatively the liquid air could be used in transport vehicles (Dearman engine system) for driving the engine and cooling the refrigerated vehicle.

**Technical description and implementation.** The aim of the CryoHub project is to integrate and demonstrate a LAES system operating in conjunction with a cold storage warehouse. The project will initially establish the current and future potential for use of LAES systems by mapping refrigerated warehouses and food processing facilities. The energy requirements for the facilities and the potential for heat reclaim will be identified. A control system that makes decisions based on energy requirements, costs and grid supply and demand which is critical to the efficient operation of CryoHub.

Using the information from the mapping and the proposed control system a model of the integration between the LAES and the refrigerated warehouse/food factory will be created. This will inform the design and integration of components for the demonstration LAES at a refrigerated warehouse/food factory.

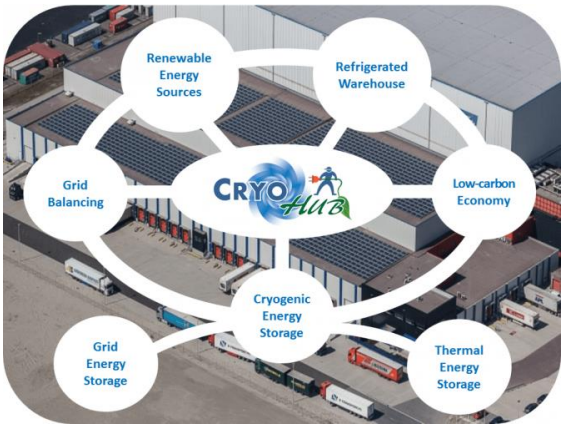
**Impact**. *Replicability:* The use of LAES technologies will be expanded into new industrial sectors with all the benefits these technologies may bring.

*Socio-economics:* CryoHub will provide new business opportunities for CES/LAES technologies.

*Environment:* Reducing energy demand of refrigerated warehouses and food factories which are high energy consumers and carbon emissions by providing energy storage capacity that will make renewable energy a more competitive option.

*Market Transformation:* CryoHub will reduce barriers to take up of the technology by developing new business models and investigating the political climate surrounding feed in tariffs, incentives and benefits for companies wishing to apply the CryoHub technology.

*Policy:* Contributing to the Heating and Cooling action line of the European Energy Union and providing policy guidance.



**H2020 call: LCE-09-2015 - Large scale energy storage**

# STORE&GO

Innovative large-scale energy STOragE technologies AND Power-to-Gas concepts after Optimisation

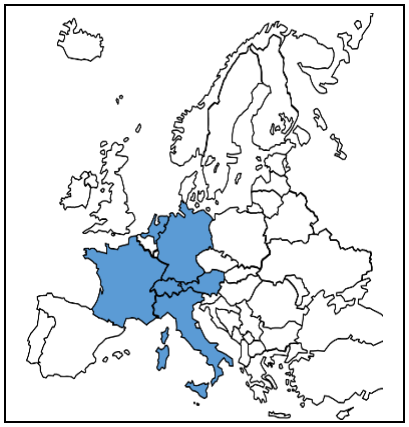
**STORE&GO focuses on the integration of PtG into the daily operation of European energy grids to demonstrate the maturity of the technology. Additionally, STORE&GO identifies current and future PtG business cases to develop a European PtG roadmap.**

| From 2016 To 2020 | Project total cost | EU contribution | Website |
|---|---|---|---|
| | 28.0 M€ (incl. non-EU partners) | 18.0 M€ | http://www.storeandgo.info/ |

**Technologies and services**

| | |
|---|---|
| Technologies for consumers | |
| Grid technologies | |
| Large-scale storage technologies | ✓ Power to gas |
| Distributed storage technologies | |
| Generation technologies | |
| Market | |

**Project partners' countries**



## Coordinator: DVGW (GERMANY)

**Other partners:**

- UNIPER ENERGY STORAGE GMBH (Germany)
- REGIO ENERGIE SOLOTHURN (Switzerland)
- ENGINEERING - INGEGNERIA INFORMATICA SPA (Italy)
- HSR HOCHSCHULE FUR TECHNIK RAPPERSWIL (Switzerland)
- POLITECNICO DI TORINO (Italy)
- ENERGIEINSTITUT AN DER JOHANNES KEPLER UNIVERSITAT LINZ VEREIN (Austria)
- RIJKSUNIVERSITEIT GRONINGEN (Netherlands)
- ATMOSTAT (France)
- COMMISSARIAT A L'ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES (France)
- CLIMEWORKS AG (Switzerland)
- DBI GAS UND UMWELTTECHNIK GMBH (Germany)
- STUDIO TECNICO BFP SOCIETA A RESPONSABILITA LIMITATA (Italy)
- STICHTING ENERGIEONDERZOEK CENTRUM NEDERLAND (Netherlands)
- STICHTING ENERGY DELTA INSTITUTE (Netherlands)
- ELECTROCHAEA GMBH (Germany)
- EIDGENOSSISCHE MATERIALPRUFUNGS- UND FORSCHUNGSANSTALT (Switzerland)
- ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE (Switzerland)
- STICHTING ENERGY VALLEY (Netherlands)
- GASWARME-INSTITUT ESSEN EV (Germany)
- HANZEHOGESCHOOL GRONINGEN STICHTING (Netherlands)
- IREN SPA (Italy)
- KARLSRUHER INSTITUT FUER TECHNOLOGIE (Germany)
- SCHWEIZERISCHER VEREIN DES GAS- UND WASSERFACHES (Switzerland)
- THYSSENKRUPP INDUSTRIAL SOLUTIONS AG (Germany)
- COMUNE DI TROIA (Italy)
- HYSYTECH S.R.L. (Italy)

## Project Description

**Context**. Natural gas has lots of applications in our current energy system, especially in the residential and industrial sector. Furthermore the natural gas grid infrastructure already features vast energy storage capacities which cannot be provided by other technologies due to physical limitations. The targeted share of volatile renewable electricity makes long term energy storage necessary at capacities which can be provided solely by chemical energy carriers. In the case of natural gas the necessary storage and transport capacities are already available today while it is fully interchangeable with synthetic natural gas ("SNG"). The latter can be generated sustainably and "almost carbon-free" from renewable carbon sources (e.g. biomass) and hydrogen, which is previously gained by electrolysis of water. This synthesis process should obviously be powered by renewable electricity and is commonly referred to as Power-to-Gas

**Scope.** The STORE&GO project is going to demonstrate the maturity of Power-to-Gas by installing innovative synthesis plants and by operating these plants, for two years, fully integrated into regular power, gas and heat networks. Key objectives of the project are to compare and evaluate Power-to-Gas technologies as well as legal and regulatory obstacles. Furthermore micro- and macro-economic analyses will be accomplished. The outcome will serve as the basis for the development of policy recommendations and of a European Power-to-Gas roadmap to help decision makers in designing our future energy system.

A key goal is to raise public acceptance and awareness that gas – the synthetic variant – is a valid way to achieve a $CO_2$-neutral energy economy and that the existing natural gas infrastructure fits well to future requirements. By making use of the existing gas infrastructure and existing appliances, PtG may help to decrease the total costs of the energy transition.

**Technical description and implementation.** In STORE&GO complementary technological, economic and societal aspects of Power-to-Gas with an innovation focus on methanation technologies will be implemented and tested at three demonstration sites with available renewable energy sources (high wind power; PV and hydro; PV and wind power), local consumers (low consumption / municipal region/rural area), electricity grid topologies (transmission / municipal distribution / regional distribution grids), gas grid topologies (long distance transport / municipal distribution / regional distribution grids), type of $CO_2$ source (biogas / waste water / atmosphere) and heat integration (veneer mill / district heating / $CO_2$ enrichment).

The employed methanation processes will be developed and improved from Technology Readiness Level 5 (TRL 5) close to maturity (TRL 6–7):

- Catalytic honeycomb methanation
- Biological methanation
- Modular milli-structured catalytic methanation.

These technologies will be demonstrated at a considerable scale between 200 kW and 1 MW for a runtime of about two years. The resulting product – synthetic natural gas – will be delivered to customers by injection into the existing gas grids, and by liquefaction to LNG.

**Impact**. *Replicability*: Details will be published in public deliverables, scientific publications and scientific theses.

*Socio-economics*: Analysis of how the use of PtG and the existing gas infrastructure can help decrease the socio-economic costs of the energy transition.

*Environment*: Showing a decarbonized energy system that includes non-fossil gas as an integral component.

*Market Transformation*: Business models showing the integration of PtG into the European energy market.

*Policy*: Policy recommendations and a European Power-to-Gas roadmap.

**H2020 call: LCE-02-2016 - Demonstration of smart grid, storage and system integration technologies with increasing share of renewables: distribution system**

# GOFLEX

Generalized Operational FLEXibility for Integrating Renewables in the Distribution Grid

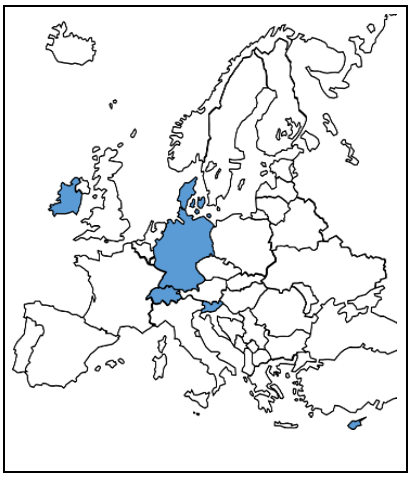
**The GOFLEX project innovates, integrates, and demonstrates a group of electricity smart-grid technologies for managing flexibility in energy production and consumption.**

| From 2016 To 2019 | Project total cost | EU contribution | Website |
|---|---|---|---|
| | 11.2 M€ | 6.8 M€ | http://www.goflex-project.eu/ |

**Technologies and services**

| | |
|---|---|
| Technologies for consumers | ✓ Demand response |
| Grid technologies | ✓ Network management, monitoring and control tools |
| Large-scale storage technologies | |
| Distributed storage technologies | ✓ Batteries<br>✓ Electric Vehicles<br>✓ Thermal Energy Storage |
| Generation technologies | |
| Market | ✓ Ancillary services |

**Project partners' countries**



## Coordinator: IBM IRELAND LIMITED (IRELAND)

**Other partners:**

- INEA INFORMATIZACIJA ENERGETIKA AVTOMATIZACIJA DOO (Slovenia)
- AALBORG UNIVERSITET (Denmark)
- TECHNISCHE UNIVERSITAET DRESDEN (Germany)
- ETREL SVETOVANJE IN DRUGE STORITVE DOO (Slovenia)
- ROBOTINA D.O.O., PODJETJE ZA INZ ENIRING, MARKETING, TRGOVINO IN PROIZVODNJO (Slovenia)
- B.A.U.M. CONSULT GMBH (Germany)
- UNIVERSITY OF CYPRUS (Cyprus)
- ARCHI ILEKTRISMOU KYPROU (Cyprus)
- HAUTE ECOLE SPECIALISEE DE SUISSE OCCIDENTALE (Switzerland)
- L'ENERGIE DE SION-REGION SA, ESR (Switzerland)
- SWW WUNSIEDEL GMBH (Germany)

## Project Description

**Context**. GOFLEX focuses on active use of distributed sources of flexibility to provide services for grid operators, balance electricity demand and supply, and optimize energy consumption and production at the local level. Sources of load flexibility include thermal (heating/cooling) and electric storage (electric vehicles charging/discharging). A backbone data-services platform offers localised estimation and short-term predictions to support data-driven decisions for stakeholders. Demonstration sites for GOFLEX are in Cyprus, Switzerland and Germany and cover a diverse range of structural and operational distribution grid conditions. The project has kicked-off from November 2016, and is in the process of specifying in detail how the various smart-grid technologies work together and how they will be deployed at the demonstration sites.

**Scope.** GOFLEX involves the creation of a system where energy flexibility is offered to a market and used to balance electricity supply and demand at local level. The project aims at enabling DSOs, BRPs, or other actors, to bid for flexibility offered by prosumers.

In addition, the project intends to foster energy trading for a variety of "flexible" prosumer types (industrial, tertiary, and residential). Moreover, GOFLEX will develop a cloud platform to integrate data from sources that traditionally were considered in isolation such as network telemetry data and customer profiles. These innovations have the potential to spur new businesses to enter the market.

The project delivers demonstrations of flexibility trading at three European sites and their results will be publicly available.

**Technical description and implementation.** The project builds upon existing technology (TRL5-7) from several areas:

- Demand-response schemas and infrastructures
- Energy storage systems
- Energy management systems
- Electrification of transport
- Distribution grid monitoring and management
- Energy data management infrastructures

An expected outcome of the project is an increase to technology readiness level of seven or eight.

The project takes a phased approach over its three-year implementation period. An initial requirements analysis by month 6 allows completion of the first prototypes by the end of the first year. The second year sees these prototypes integrated tested under simulated and real-world conditions. In the third year, fully integrated systems are demonstrated and evaluated.

**Impact**. *Replicability:* By adopting the harmonized market model and deploying each solution technology in at least two cases replicable solutions are achieved.

*Socio-economics:* GOFLEX delivers technology to enable final consumers to be an active part of the energy market. The consumption and generation patterns of the final user thus become better aligned with wholesale energy prices and therefore more cost-effective.

*Environment:* By delivering technologies that allow ingestion of a higher share of renewable energies into the grid and the electrification of transport, GOFLEX will generate positive impacts towards the reduction of green-house emissions.

*Market Transformation:* The services and solutions targeted by GOFLEX are designed for distribution system operators (real-time trading of load flexibility and improved observability of energy demand, generation and flexibility at a localised level), aggregators (load flexibility to compose the desired portfolio of grid-service offerings), and empowerment of prosumers in the emerging energy market.

*Policy:* Demonstration activities can contribute to policy recommendations. GOFLEX aims to provide evidence that flexibility solutions based on demand-response are able to compete with other means to enlarge the capacity of grids, avoid grid congestions and to balance supply and demand.

**H2020 call: LCE-02-2016 - Demonstration of smart grid, storage and system integration technologies with increasing share of renewables: distribution system**

# InteGrid

Demonstration of INTElligent grid technologies for renewables INTEgration and INTEractive consumer participation enabling INTEroperable market solutions and INTErconnected stakeholders

**InteGrid's vision is to bridge the gap between citizens and technology/solution providers such as utilities, aggregators, manufacturers and all other agents providing energy services.**

| From 2017<br>To 2020 | Project total cost | EU contribution | Website |
|---|---|---|---|
| | 14.5 M€ | 11.3 M€ | https://integrid-h2020.eu/ |

**Technologies and services**

| | |
|---|---|
| Technologies for consumers | ✓ Demand response<br>✓ Smart metering |
| Grid technologies | ✓ Network management, monitoring and control tools |
| Large-scale storage technologies | |
| Distributed storage technologies | ✓ Batteries |
| Generation technologies | ✓ PV<br>✓ Micro-generation |
| Market | ✓ Electricity market<br>✓ Ancillary services |

**Project partners' countries**

## Coordinator: EDP DISTRIBUICAO ENERGIA SA (PORTUGAL)

**Other partners:**

- ADP - AGUAS DE PORTUGAL, SGPS SA (Portugal)
- AIT AUSTRIAN INSTITUTE OF TECHNOLOGY GMBH (Austria)
- CNET - CENTRE FOR NEW ENERGY TECHNOLOGIES, S.A. (Portugal)
- CYBERGRID GMBH (Austria)
- ELEKTRO LJUBLJANA PODJETJE ZADISTRIBUCIJO ELEKTRICNE ENERGIJE D.D. (Slovenia)
- ELLEVIO AB (Sweden)
- GE GRID SOLUTIONS (UK) LIMITED (United Kingdom)
- INESC TEC - INSTITUTO DE ENGENHARIA DE SISTEMAS E COMPUTADORES, TECNOLOGIA E CIENCIA (Portugal)
- DNV GL NETHERLANDS B.V. (Netherlands)
- KUNGLIGA TEKNISKA HOEGSKOLAN (Sweden)
- SAP SE (Germany)
- STADEN I MOBILEN AB (Sweden)
- UNIVERSIDAD PONTIFICIA COMILLAS (Spain)

## Project Description

**Context**. InteGrid's vision is to bridge the gap between citizens and technology/solution providers such as utilities, aggregators, manufacturers and all other agents providing energy services, hence expanding from DSOs distribution and access services to active market facilitation and system optimisation services while ensuring sustainability, security and quality of supply. InteGrid will develop tools to enhance data exchange between market participants to the benefit of end-consumers and facilitate the market entry of new players and services.

**Scope.** The project will demonstrate how DSOs may enable all stakeholders to actively participate in the energy market and distribution grid management and develop and implement new business models, making use of new data management and consumer involvement approaches. Moreover, the consortium will demonstrate scalable and replicable solutions in an integrated environment that enables DSOs to plan and operate the network with a high share of DRES in a stable, secure and economic way, using flexibility inherently offered by specific technologies and by interaction with different stakeholders.

InteGrid's concepts/approaches are based on:

1. the role of the DSO as system optimiser and as market facilitator and,

2. the integration of existing demonstration activities in three different regions while focusing on the scalability and replicability considering current and evolving market (and regulatory) conditions.

A market hub platform coupled with smart grid functions and innovative business models will open opportunities for new services and an effective roll-out of emerging technologies in the short-term.

**Technical description and implementation.** Overall, the project will address the following technologies:

1. Demonstrate the feasibility of smart distribution networks with a high amount of DRES using available DER flexibility for various functions / business cases at different levels.

2. Develop and implement technologies offering different levels of flexibility: DR at various customer levels (domestic, commercial, industrial), electrical storage (utility scale/domestic scale) and E-mobility.

3. Demonstrate smartened monitoring and automation in a secure and integrated network

4. Demonstrate a market hub concept to facilitate market access allowing new business models and services.

5. Develop business models complying with market-driven and secure network operations, and enabling to share benefits among stakeholders.

6. Make a functional validation of the proposed concepts close to large scale in real-environment and commercial exploitation (up to TRL 8 / 9).

7. Investigate the potential for replication to other boundary conditions (DRES landscape, markets setups, regulatory framework, etc.) and design detailed exploitation plans.

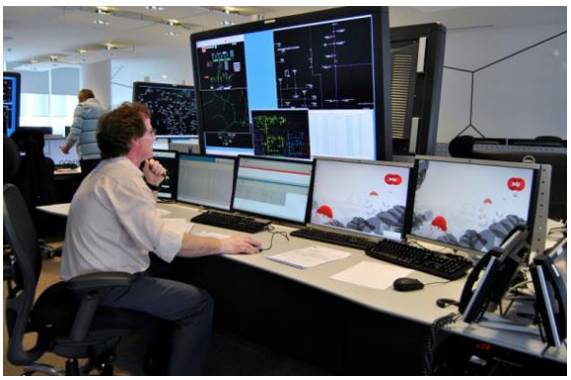
**Impact**. *Replicability*: Promote a EU wide market for energy services through standards and interoperable solutions.

*Socio-economics:* Giving the citizens the right set of tools to play an active role on the energy system (evolution of smart homes and energy market mechanisms involving customers).

*Environment:* Increase capability for Renewables Integration.

*Market Transformation:* Support EU based companies' products and services to the market in 2-5 years and developing new business models around the functionalities and services created: Home Energy Management Systems; Virtual Power Plant (VPP); new grid management solutions; LV control function; Market Hub platform data management, etc.

*Policy:* Contribute to policy on new energy market design and regulatory orientations (i.e. VPPs and demand side management).



**H2020 call: LCE-02-2016 - Demonstration of smart grid, storage and system integration technologies with increasing share of renewables: distribution system**

# inteGRIDy

integrated Smart GRID Cross-Functional Solutions for Optimized Synergetic Energy Distribution, Utilization & Storage Technologies

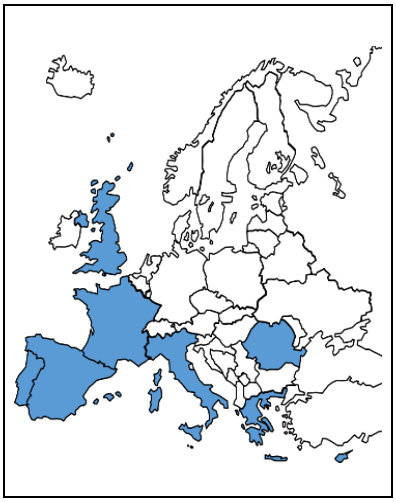
**inteGRIDy pursues facilitating the optimal and dynamic operation of the Distribution Grid, fostering the stability of the electricity grid and coordination of distributed energy resources, Virtual Power Plants and innovative collaborative storage schemes within a continuously increased share of renewable energy.**

| From 2017 To 2020 | Project total cost | EU contribution | Website |
|---|---|---|---|
| | 15.8 M€ | 12.3 M€ | http://www.integridy.eu |

**Technologies and services**

| | |
|---|---|
| Technologies for consumers | ✓ Demand response ✓ Smart metering |
| Grid technologies | ✓ Network management, monitoring and control tools ✓ Micro-grid |
| Large-scale storage technologies | |
| Distributed storage technologies | ✓ Batteries ✓ Electric Vehicle ✓ Thermal Energy Storage |
| Generation technologies | ✓ Wind Turbine ✓ Solar thermal ✓ PV ✓ Micro-generation |
| Market | ✓ Electricity market ✓ Ancillary services |

**Project partners' countries**



## Coordinator: ATOS SPAIN SA (SPAIN)

### Other partners:

- SIEMENS PUBLIC LIMITED COMPANY (UK)
- ETHNIKO KENTRO EREVNAS KAI TECHNOLOGIKIS ANAPTYXIS (Greece)
- ENGINEERING - INGEGNERIA INFORMATICA SPA (Italy)
- TEESSIDE UNIVERSITY (UK)
- ISLE OF WIGHT COUNCIL (UK)
- UNIVERSITY OF NEWCASTLE UPON TYNE (UK)
- MINUS7 LIMITED (UK)
- EMSc (UK) Ltd (UK)
- A.T. KEARNEY LIMITED (UK)
- ASM TERNI SPA (Italy)
- UNIVERSITA DEGLI STUDI DI ROMA LA SAPIENZA (Italy)
- POLITECNICO DI MILANO (Italy)
- AZIENDA SAN SEVERINO MARCHE SPA (Italy)
- ENERGY@WORK SOCIETA' COOPERATIVA A R.L. (Italy)
- UNE SRL (Italy)
- GAS NATURAL SDG SA (Spain)
- SISTEMES AVANCATS DE ENERGIA SOLAR TERMICA SCCL - AIGUASOL (Spain)
- INNED SN (France)
- TREK CONSULTING (Greece)
- ARCHI ILEKTRISMOU KYPROU (Cyprus)
- UNIVERSITY OF CYPRUS (Cyprus)
- PH ENERGIA LDA (Portugal)
- LISBOA E-NOVA AGENCIA MUNICIPAL DE ENERGIA E AMBIENTE DE LISBOA (Portugal)
- UNIVERSIDADE CATOLICA PORTUGUESA (Portugal)
- VIRTUAL POWER SOLUTIONS SA (Portugal)
- SIVECO ROMANIA SA (Romania)
- SOCIETATEA ENERGETICA ELECTRICA SA (Romania)
- SYSTEMS SUNLIGHT INDUSTRIAL & COMMERCIAL COMPANY OF DEFENSIVE, ENERGY, ELECTRONIC AND TELECOMMUNICATIONS SYSTEMS (Greece)
- WATT AND VOLT (Greece)

## Project Description

**Scope.** The projects' primary objectives are the following:

1. Facilitate the decarbonisation of the electricity grid and the integration of large shares of distributed renewable generation, deploying innovative DR, storage, EV management and SG technologies;
2. Integrate innovative smart grid technologies and concepts with a scalable and replicable Cross-functional Modular Platform, enabling optimal and dynamic operation of the distribution system's assets;
3. Use modelling and profiling extraction techniques for network topology representation, innovative DR mechanisms and Storage System characterization, supporting automated scenario-based decision making;
4. Use predictive algorithms and scenario-based simulation for innovative Operation Analysis Framework of the DG enabling avoidance of RES curtailment and enhancing self-consumption or net metering;
5. Demonstrate an integrated Decision Making and Optimisation Framework featuring a grid balancing and stability engine, optimization-based energy synergies to ensure energy security;
6. Deliver integrated Visual Analytics tools, with innovative HMIs and Services for stakeholders and end users, allowing monitoring and control of distribution network in real-time context;
7. Implement and Deliver added value end-user applications for all stakeholder and new business models involved in the smart grid value chain, enabling, also, their participation in energy markets;
8. Contribution to the transformation of the energy market situation in Europe in order to comply with the ongoing energy related activities for standardization and regulatory frameworks;
9. inteGRIDy system deployment, integration and validation in real-life large-scale demonstration pilot use cases

**Technical description and implementation.** The main outcome of the project would be its 10 envisaged pilots, in which assessment for the viability of technical solutions and the real-life adaptations needed to implement them and interconnect them with existing infrastructure will be provided. Among the technical innovations themselves, the main outcome is represented by the Cross-Functional Modular platform proposal, as it is the core of the project, integrating and coordinating all other innovations and already existing technologies.

**Impact**. *Replicability:* The concept of the cross-functional standardized interface API layer has been introduced to enable replicable and expandable products, solutions, services and field level information/data exchange. The Internet of the Grid paradigm introduced in the inteGRIDy project offers the required scalability potential for mass-scale application of innovative demand response schemes.

*Socio-Economics:* Savings from lower electricity distribution and retail prices, resulting from the efficiencies obtained from a smart grid by the distribution and retail companies are expected to be a profit for the customers.

*Environment:* inteGRIDy contributes to the uptake of alternative energy sources especially for local communities, where the available energy mixture is quite limited.

*Market transformation:* The project will release an integrated platform of the enhanced version of already existing tools together with proper models and methodologies for smart cooperation between energy users and the Grid. These results will significantly contribute to the market of services that a new generation of energy users will be able to provide to the operators of the energy distribution networks.

*Policy:* inteGRIDy can contribute to become a credible and solid pilot project, where the existing policies and the related regulatory frameworks will be further investigated in order to propose the required adaptations and solutions in the form of a complaint cross-functional framework.

The project will promote the deployment of novel strategies to manage energy storage systems with the purpose to perform, in addition to self-consumption, further ancillary services, to be supplied to the power system through the dispatching services market.

**H2020 call: LCE-02-2016 - Demonstration of smart grid, storage and system integration technologies with increasing share of renewables: distribution system**

# InterFlex

Interactions between automated energy systems and Flexibilities brought by energy market players

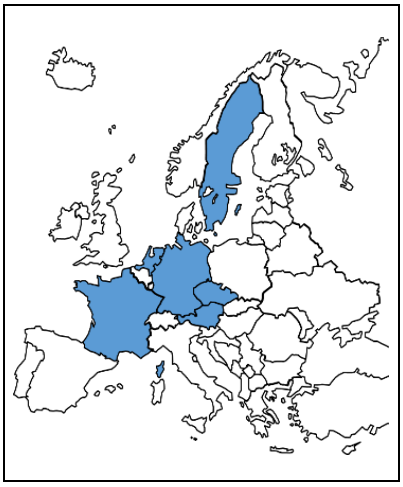
**InterFlex investigates during 36 months the INTERactions between FLEXibilities provided by energy market players and the distribution grid. This project focuses particularly on energy storage, smart charging of electric vehicles, demand response, islanding, grid automation and integration of different energy carriers (gas, heat, electricity).**

| From 2017 To 2019 | Project total cost | EU contribution | Website |
|---|---|---|---|
| | 22.8 M€ | 17.0 M€ | http://interflex-h2020.com/ |

**Technologies and services**

| | |
|---|---|
| Technologies for consumers | ✓ Demand response<br>✓ Smart metering |
| Grid technologies | ✓ Micro-grid |
| Large-scale storage technologies | |
| Distributed storage technologies | ✓ Batteries<br>✓ Electric Vehicle<br>✓ Thermal Energy Storage |
| Generation technologies | |
| Market | ✓ Ancillary services |

**Project partners' countries**



## Coordinator: ENEDIS (FRANCE)

**Other partners:**

- AVACON AG (Germany)
- CEZ DISTRIBUCE AS (Czech Republic)
- E.ON SVERIGE AB (Sweden)
- ENEXIS BV (Netherlands)
- GRDF SA (France)
- CEZ SOLARNI, SRO (Czech Republic)
- ELECTRICITE DE FRANCE (France)
- ENGIE (France)
- FRONIUS INTERNATIONAL GMBH (Austria)
- ALSTOM GRID SAS (France)
- SCHNEIDER ELECTRIC CZ SRO (Czech Republic)
- SIEMENS SRO (Czech Republic)
- AIT AUSTRIAN INSTITUTE OF TECHNOLOGY GMBH (Austria)
- STICHTING ELAADNL (Netherlands)
- RHEINISCH-WESTFAELISCHE TECHNISCHE HOCHSCHULE AACHEN (Germany)
- NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK TNO (Netherlands)
- ACCENTURE SAS (France)
- TRIALOG (France)
- SOCOMEC (France)

## Project Description

**Scope.** InterFlex explores pathways to adapt and modernize the electric distribution system in line with the objectives of the 2020 and 2030 climate-energy packages of the European Commission. Six demonstration projects are conducted in five EU Member States (Czech Republic, France, Germany, The Netherlands and Sweden) in order to provide deep insights into the market and development potential of the orientations that were given by the call for proposals, i.e., demand-response, smart grid, storage and energy system integration.

**Technical description and implementation.** With Enedis as the global coordinator and ČEZ Distribuce as the technical director, InterFlex relies on a set of innovative use cases. Six industry-scale demonstrators are being set up in the participating European countries:


*French demonstrator:* investigation of flexibilities to support the grid, storage systems and islanding operation.

*Czech demonstrator:* use of grid automation and energy storage to integrate decentralized renewable energy within the distribution grid and smart functions of charging stations for electric vehicles as a source of flexibility, in different areas of the country.

*German demonstrator:* Management of a centralized platform of flexibilities and distributed energy resources to use energy where it is generated in order to relieve the distribution grid.

*Swedish demonstrators:*

- Investigation of the energy carrier integration using heat inertia of buildings as a flexibility measure in order to attain a more optimized and environmental friendly production in a distributed energy system.
- Exploration of means to island a portion of the distribution grid, supported by the client through a "peer to peer" approach, while assessing the benefit of advanced control of Local Energy Systems for the DSO.

*Dutch demonstrator:* Multi-service approach to unleash all available local flexibilities such as stationary storage and electric vehicle batteries, by using interactions between the distribution system operators, balance responsible parties and the charge point operators for electric vehicles.

Through the different demonstration projects, InterFlex will assess how the integration of the new solutions can lead to a local energy optimisation. Technically speaking, the success of these demonstrations requires that some of the new solutions, which are today at TRLs 5-7, are further developed reaching TRLs 7-9 to be deployed in real-life conditions. This allows new business models and contractual relationships to be evaluated between the DSOs and the market players.

**Impact**. *Environment:* Through the optimisation of the local energy system, the project generates benefits in terms of increased energy efficiency (load shifts to off peak hours; optimized self-consumption in case of prosumers, increased awareness leading to active DSM and reduced electricity consumption), power generation optimization (peak shaving, avoiding electricity generation from carbonized peak load generation units) and increased share of renewables (optimized integration of intermittent renewable energy sources), resulting in the overall reduction of GHG emissions.

*Socio-economic*: The project stimulates the development of new services for end-customers allowing for instance the development of demand response service packages for small and large consumers as well as prosumers. The provision of community storage solutions or the optimal use of multiple source flexibilities should help to decrease the electricity bill without any noticeable impact on the supply quality.

*Policy*: The Use cases of the project will help to

- formulate recommendations for micro grid operation (control schemes and observability),
- elaborate an appropriate regulatory framework for self- consumption and storage solutions (community or individual residential storage)
- provide guidelines on the participation of distributed resources in DSO operations (modifications of grid codes).

**H2020 call: LCE-02-2016 - Demonstration of smart grid, storage and system integration technologies with increasing share of renewables: distribution system**

# INVADE

Smart system of renewable energy storage based on integrated EVs and batteries to empower mobile, distributed and centralised energy storage in the distribution grid

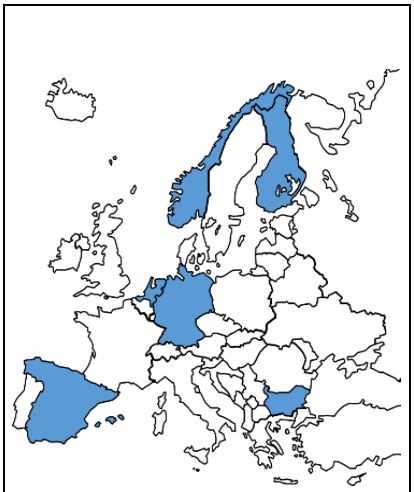
**INVADE proposes to deliver a cloud-based flexibility management system integrated with EVs and batteries empowering energy storage at mobile, distributed and centralised levels to increase renewables share in the smart distribution grid. The project integrates different components: flexibility management system, energy storage technologies, electric vehicles and novel business models.**

| From 2017 To 2019 | Project total cost | EU contribution | Website |
|---|---|---|---|
| | 16.3 M€ | 13.3 M€ | https://www.invadeh2020.eu/ |

**Technologies and services**

| | |
|---|---|
| Technologies for consumers | ✓ Demand response<br>✓ Smart appliance<br>✓ Smart metering |
| Grid technologies | ✓ Network management, monitoring and control tools<br>✓ Micro-grid |
| Large-scale storage technologies | |
| Distributed storage technologies | ✓ Batteries<br>✓ Electric Vehicles |
| Generation technologies | ✓ Wind Turbine ✓ PV |
| Market | ✓ Electricity market<br>✓ Ancillary services |

**Project partners' countries**



## Coordinator: SMART INNOVATION NORWAY AS (NORWAY)

**Other partners:**

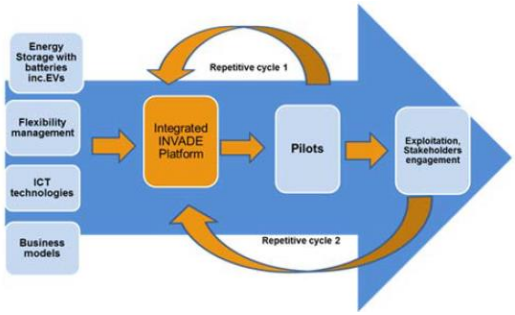
- UNIVERSITAT POLITECNICA DE CATALUNYA (Spain)
- NORGES TEKNISK-NATURVITENSKAPELIGE UNIVERSITET NTNU (Norway)
- TEKNOLOGIAN TUTKIMUSKESKUS VTT OY (Finland)
- ESMART SYSTEMS AS (Norway)
- NEWEN PROJECTS GMBH (Germany)
- ALBENA AD (Bulgaria)
- SCHNEIDER ELECTRIC NORGE AS (Norway)
- LYSE AS (Norway)
- ESTABANELL Y PAHISA ENERGIA SA (Spain)
- STICHTING ELAADNL (Netherlands)
- GREENFLUX ASSETS B.V. (Netherlands)

## Project Description

**Scope.** INVADE aspires to develop, test and implement a cloud-based integrated platform capable of managing flexibility and energy storage assets connected to a distribution network through a Flexibility Operator for maximal uptake of renewable energy in the grid. Flexibility assets in the grid include household appliances such as water boilers, heated floors, air conditioning/heating, etc., that can be controlled both in terms of power and time of operation. Energy storage is realized by means of battery deployment at mobile, distributed and centralized levels in the distributed grid. The Integrated INVADE platform is based on demand-response, battery-based energy storage systems, EVs, and control and automation through ICT layer along with the active participation of end-users. The Integrated INVADE platform will also be capable of participating in a micro power market for determining the most suitable flexibility asset for the required service. The micro power market will be the marketplace in which all electricity agents will provide or receive flexibility services through a Flexibility Operator.

**Technical description and implementation.** INVADE is focused on integration of different components and on testing and validating the integrated INVADE environment in large scale pilots using different use cases. The Consortium considers the project to be on a TRL 5 and reach TRL 7, which is exemplary for a system prototype pilot in an operational environment. The mentioned TRL 7 level is also reflected in the communication and exploitation process as DSOs, municipalities and local communities as well as emerging markets are expected to be important target groups for exploitation activities. The overall project methodology is based on 1) delivering a generic INVADE architecture applicable 2) testing and validating the adapted INVADE platform in large scale pilots' demonstrations. The overall project methodology is based on two repetitive cycles that are underpinned by the Integrated INVADE Platform.

The project will validate the Integrated INVADE Platform in use cases that are of strategic importance to research and industry and laying a foundation for deployment of the project's outcomes in the European market and beyond.




**Impact**. *Replicability:* INVADE is designed to provide a generic platform that could be demonstrated on different energy storage technologies based on integrated EVs and batteries to empower mobile, centralised and distributed energy storage in the distribution grid.

*Socio-economics:* INVADE is a result of the political, environmental and market pressure. The project addresses many stakeholders, each seeking to gain different benefits and links many energy topics (e.g. renewable energy, transport, climate change and others). It also strengthens the foundation of industry sectors such as ICT, and for each of these sectors the project will in effect open up additional employment opportunities and will contribute to an establishment of new business ventures.

*Environment:* INVADE will help to cater more environmentally-friendly energy and help to regulate the system to reduce energy losses, improve the energy balance and to help reduce the vulnerability of the energy system to undesired impacts. Also the second-life EV batteries will become an important environmental issue considering the recent policy developments and agreements for electric vehicles expansion.

*Market transformation and Policy:* The EU policy on the internal electricity market is addressed by INVADE as follows: 1) increased share of renewables in the smart grid, 2) making national markets more independent, 3) competitive demand-response schemes and changes in consumption patterns influenced by local renewable energy sources and Cloud based flexibility management systems, 4) integration of novel business models and dynamic pricing, 5) best practices and recommendations for regulatory frameworks in pilots countries, and 6) an integrated ecosystem for triggering additional investments in innovative products and services to ensure an affordable, secure and sustainable electricity supply in the future.

**H2020 call: LCE-02-2016 - Demonstration of smart grid, storage and system integration technologies with increasing share of renewables: distribution system**

# SMILE

SMart IsLand Energy systems

**The SMILE project aims at demonstrating different innovative technological and non-technological solutions in large-scale smart grid demonstration projects in islands, paving the way for their introduction in the market in the near future.**

| From 2017 To 2021 | Project total cost | EU contribution | Website |
|---|---|---|---|
| | 14.0 M€ | 12.1 M€ | http://www.h2020smile.eu/ |

**Technologies and services**

| | |
|---|---|
| Technologies for consumers | ✓ Demand response<br>✓ Smart metering |
| Grid technologies | ✓ Micro-grid<br>✓ Network management, monitoring and control tools |
| Large-scale storage technologies | ✓ Hydro storage |
| Distributed storage technologies | ✓ Batteries<br>✓ Electric Vehicles<br>✓ Thermal Energy Storage |
| Generation technologies | ✓ Wind Turbine ✓ PV<br>✓ Solar Thermal ✓ Tidal Energy<br>✓ Micro-generation |
| Market | ✓ Electricity market<br>✓ Ancillary services |

**Project partners' countries**

## Coordinator: RINA CONSULTING SPA (ITALY)

**Other partners:**

- COMMUNITY ENERGY SCOTLAND LIMITED (United Kingdom)
- VCHARGE UK LTD (United Kingdom)
- SUNAMP LIMITED (United Kingdom)
- ROUTE MONKEY LTD (United Kingdom)
- ASSOCIACAO COMERCIAL E INDUSTRIAL DO FUNCHAL - CAMARA DE COMERCIO E INDUSTRIA DA MADEIRA (Portugal)
- EEM EMPRESA DE ELECTRICIDADE DA MADEIRA SA (Portugal)
- MITI - MADEIRA INTERACTIVE TECHNOLOGIES INSTITUTE - ASSOCIACAO (Portugal)
- BRIGHT CURIOSITY, LDA (Portugal)
- AALBORG UNIVERSITET (Denmark)
- SAMSO KOMMUNE (Denmark)
- SAMSØ ENERGIAKADEMI (Denmark)
- SAMSO ELEKTRO APS (Denmark)
- TEKNOLOGISK INSTITUT (Denmark)
- LITHIUM BALANCE A/S (Denmark)
- STICHTING ENERGY VALLEY (Netherlands)
- ETHNIKO KENTRO EREVNAS KAI TECHNOLOGIKIS ANAPTYXISCENTRE FOR RESEARCHAND TECHNOLOGY HELLAS CERTH EKETAANAPTYXIS (Greece)
- RIJKSUNIVERSITEIT GRONINGEN (Netherlands)
- DIKTYO AEIFORIKON NISON TOY AIGAIOU AE (Greece)

## Project Description

**Context**. The SMILE project aims at demonstrating different innovative technological and non-technological solutions in large-scale smart grid demonstration projects in the Orkneys (Scotland), Samsø (Denmark) and Madeira (Portugal) islands (with different policies, regulations and energy markets), paving the way for their introduction in the market in the near future. SMILE pilots will demonstrate operation of the distribution grid under stable and secure conditions to implement solutions for demand response, intelligent control and automation of distribution networks; they have high shares of RES in the electricity grid or have planned increasing shares in the next years

**Scope.** The objective is to test solutions while establishing mutual learning processes and providing best practice guidance for replication in other regions. The three pilots will test different combinations of technological solutions according to local specificities and conditions and the existing infrastructure and will involve all value chain actors needed to efficiently implement projects system-wide. The sites are therefore effectively representative of the majority of the EU energy markets and offer excellent demonstration settings which will deliver maximum impact in terms of replicability. It is important to highlight that the Orkney Islands and Samsø are electrically connected to the mainland network and Madeira is the only case of a total energy island.

**Technical description and implementation.** The main technological solutions faced by the project vary from integration of battery technology, power to heat, power to fuel, pumped hydro, electric vehicles, electricity stored on board of boats, an aggregator approach to demand side management (DSM) and predictive algorithms. Within this framework and to maintain the replicability of procedures the following activities are to be implemented in each demo site:

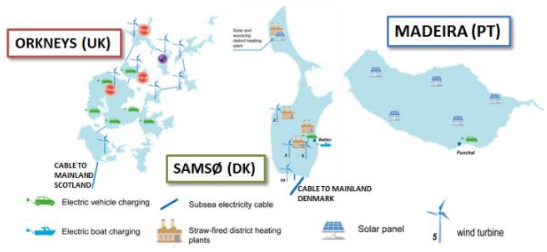
- Development of common frameworks and controls, demand response strategies and cyber security.
- Life Cycle Assessment/Costing (LCA/LCC), cost/benefit analyses, socio-economic studies, definition of financial mechanisms for incentivizing participation in smart grid operations, business modelling and business planning activities.
- Legal and regulatory analysis of smart energy supply concepts which are relevant for developing smart energy supply systems.
- Impact analyses, including energy system impacts, energy strategies and energy market design.
- Communication, dissemination and replication of results.

**Impact**. *Replicability:* As SMILE relies on plug-and-play scalable software, the proposed smart grid solutions will be modular and scalable.

*Socio-economics:* Establishing market opportunities for new smart grid products and services, thus stimulating companies' growth and the creation of job opportunities. Also, reduction of investments for increased generation capacity and grid reinforcement thanks to the exploitation of demand-side flexibility.

*Environment:* Reduction of the environmental impact and carbon footprint of the whole electricity supply system, alleviation of fuel poverty and promoting self-consumption.

*Market Transformation and Policy:* By facilitating the connection of distributed energy sources of all sizes/natures in the energy grid and by allowing consumers to play their part in optimizing the operation of the system through demand response schemes. Moreover, allowing consumers to play an active role in electricity retail, thus reaping the benefits and value added associated to energy markets. In addition, by demonstrating smart grid solutions in real-life settings, the project will strongly support ongoing policy developments in the field of the design of the internal electricity market. Real-life testing of DSM approaches will also contribute to the design of new rules for electricity trading.



**H2020 call: LCE-02-2016 - Demonstration of smart grid, storage and system integration technologies with increasing share of renewables: distribution system**

# WiseGRID

Wide scale demonstration of Integrated Solutions and business models for European smartGRID

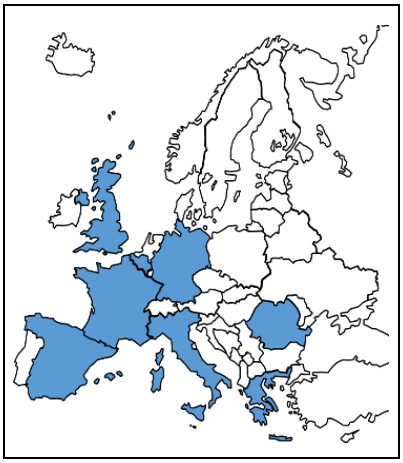
**WiseGRID will provide a set of solutions and technologies to increase the smartness, stability and security of an open, consumer-centric European energy grid.**

| From 2016 To 2020 | Project total cost | EU contribution | Website |
|---|---|---|---|
| | 17.6 M€ | 13.9 M€ | http://www.wisegrid.eu |

**Technologies and services**

| | |
|---|---|
| Technologies for consumers | ✓ Demand response ✓ Smart appliance ✓ Smart metering |
| Grid technologies | ✓ Network management, monitoring and control tools ✓ Micro-grid |
| Large-scale storage technologies | |
| Distributed storage technologies | ✓ Batteries ✓ Electric Vehicle ✓ Thermal Energy Storage |
| Generation technologies | ✓ Wind turbine ✓ PV |
| Market | ✓ Electricity market ✓ Ancillary services |

**Project partners' countries**



## Coordinator: ETRA INVESTIGACION Y DESARROLLO SA (SPAIN)

**Other partners:**

- BOUYGUES ENERGIES & SERVICES (France)
- ENGINEERING - INGEGNERIA INFORMATICA SPA (Italy)
- CENTRUL ROMAN AL ENERGIEI - CRE (Romania)
- ASM TERNI SPA (Italy)
- ECOPOWER (Belgium)
- COOPERATIVA ELECTRICA BENEFICA SAN FRANCISCO DE ASIS SOCIEDAD COOPERATIVA VALENCIANA (Spain)
- HYPERTECH (CHAIPERTEK) ANONYMOS VIOMICHANIKI EMPORIKI ETAIREIA PLIROFORIKIS KAI NEON TECHNOLOGION (Greece)
- AMPERE POWER ENERGY SL (Spain)
- ASOCIACION INSTITUTO TECNOLOGICO DE LA ENERGIA (Spain)
- INSTITUTE OF COMMUNICATION AND COMPUTER SYSTEMS (Greece)
- DIACHEIRISTIS ELLINIKOU DIKTYOU DIANOMIS ELEKTRIKIS ENERGEIAS AE (Greece)
- ATHENS UNIVERSITY OF ECONOMICS AND BUSINESS - RESEARCH CENTER (Greece)
- RESCOOP EU ASBL (Belgium)
- VARTA STORAGE GMBH (Germany)
- QUEEN MARY UNIVERSITY OF LONDON (United Kingdom)
- EMOTION SRL (Italy)
- PARTAGO (Belgium)
- ENERGEIAKO GRAFEIO AIGAIOY (Greece)
- ETAIRIA PAROCHIS AERIOU ATTIKIS ANONIMI ETAIRIA (Greece)
- ASOCIACION ESPANOLA DE NORMALIZACION (Spain)

## Project Description

**Scope.** WiseGRID provides services for the actors of the distribution network in different scenarios in order to promote more sustainable energy grids, empowering the prosumers and enabling the establishment of a near real-time pan European energy balancing market. The final aim is to demonstrate an integrated Ecosystem that will establish an innovative approach for the management of the power grids.

**Technical description and implementation.** WiseGRID will integrate and demonstrate innovative and advanced Demand-Response mechanisms that will facilitate the active participation, protection and empowerment of the European consumers and prosumers in the energy grid and market, through flexible RES generation, self-consumption and storage, or through intermediaries such as aggregators and suppliers on behalf of the former. WiseGRID will also address the smartening of the distribution grid, including both technologies and methods to gain advanced monitoring and awareness of variable generation and consumption loads, as well as the integration of VPPs and microgrids as active balancing assets; the integration of renewable energy storage systems in the network, such as batteries or heat accumulator; and the integration of tools to plan the deployment of electric mobility services, as well as the management of loading and unloading of these vehicles -including the possible use of their batteries as storage systems or VPPs.

The project technological solutions will be packaged in the form of 9 different results:

*1. WiseGRID InterOperable Platform* (real time monitoring and decentralized control).

*2. WG Cockpit* for Operators in order to control, manage and monitor their own grid.

*3. WiseCORP*: application to become smarter energy players.

*4. WiseCOOP*: Application to help small businesses, consumers and prosumers achieve better energy deals.

*5. WiseHOME*: Application for individual domestic consumers and prosumers to become active energy players.

*6. WiseGRID Electric Vehicle Platform (EVP)* for vehicle-sharing companies and e-vehicles fleet.

*7. WG FastV2G*: EV charging station that will make possible to use EV as dynamic distributed storage devices.

*8. WiseGRID energy STorage as a Service/Virtual Power Plants (WG STaaS/VPP)*: Service by which consumers/prosumers can easily offer to the market their unused storage capacity or aggregate their spare energy generation capacity and offer it in the form of a VPP.

*9. WiseGRID Renewable Energy Service Company (WG RESCO)* to enable the provision of energy to the consumers from renewable energy sources.

**Impact**. *Replicability:* Thanks to different sizes and conditions of the pilot sites, the replicability and scaling up of the results in other scenarios and/or regions of Europe will be demonstrated and the potential barriers to overcome will be identified.

*Socio-economics:* WiseGRID intends to have a significant business, economic and social impact: Access to new energy services of 860,000 citizens and more than 23,000 organisations; Preventing energy poverty, reducing consumer energy bill by an 25%; Increase of 50% in the share of RES; Contributing with the creation of more than 1,800 jobs; Yearly turnover of 146.7 M€; ROI for the partners of less than 30 months after commercialisation of WiseGRID products; IRR of 11.7% for the first 5 years of commercialisation.

*Environment:* WiseGRID project will promote the integration of DER, such as wind and solar energy. It is expected by means of the integrated WiseGRID solutions to reduce total European emissions by 20%.

*Market Transformation:* WiseGRID will define effective and attractive exploitation plans and business innovation strategies and plans in order to generate benefits by means of the commercialisation of the project services and products in short-term, with special attention to European SMEs.

*Policy:* WiseGRID will actively contribute to ongoing work of regulation bodies, policy makers and experts groups.

**H2020 call: LCE-07-2016-2017 - Developing the next generation technologies of renewable electricity and heating/cooling**

# GRIDSOL

Smart Renewable Hubs for flexible generation: Solar Grid Stability

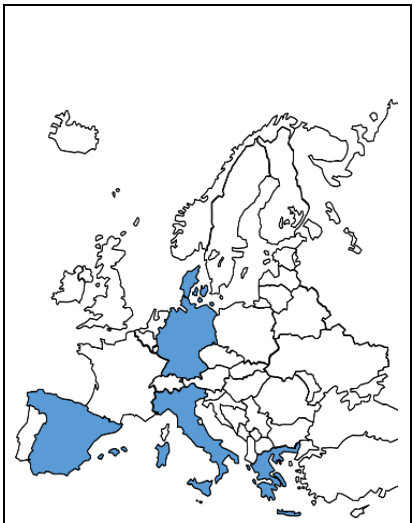
**GRIDSOL aims to provide secure, clean and efficient electricity by combining primary renewable energy sources and technology under an advanced control system called Dynamic Output Manager of Energy (DOME) supplying secure electricity and contributing to grid stability through Smart Renewable Hubs.**

| From 2016 To 2019 | Project total cost | EU contribution | Website |
|---|---|---|---|
| | 3.4 M€ | 3.4 M€ | http://www.gridsolproject.eu |

**Technologies and services**

| | |
|---|---|
| Technologies for consumers | |
| Grid technologies | ✓ Inertia<br>✓ Network management, monitoring and control tools<br>✓ Micro-grid |
| Large-scale storage technologies | |
| Distributed storage technologies | ✓ Batteries<br>✓ Thermal Energy Storage<br>✓ Flywheel |
| Generation technologies | ✓ Solar thermal ✓ PV<br>✓ Wind Turbine ✓ Biogas |
| Market | ✓ Electricity market<br>✓ Ancillary services |

**Project partners' countries**



## Coordinator: COBRA INSTALACIONES Y SERVICIOS (SPAIN)

**Other partners:**

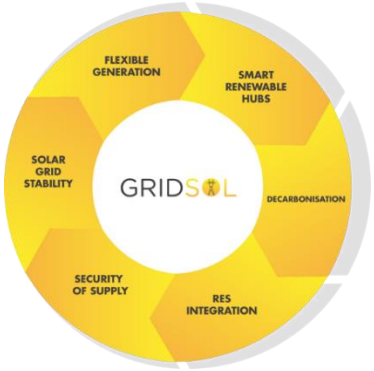
- COBRA INSTALACIONES Y SERVICIOS S.A (Spain)
- INVESTIGACION DESARROLLO E INNOVACION ENERGETICA SL (Spain)
- SBP SONNE GMBH (Germany)
- FUNDACION TECNALIA RESEARCH & INNOVATION (Spain)
- DANMARKS TEKNISKE UNIVERSITET (Denmark)
- ETRA INVESTIGACION Y DESARROLLO SA (Spain)
- CESI - CENTRO ELETTROTECNICO SPERIMENTALE ITALIANO 'GIANCINTO MOTTA' SPA (Italy)
- DIACHEIRISTIS ELLINIKOU DIKTYOU DIANOMIS ELEKTRIKIS ENERGEIAS AE (Greece)
- INSTITUTE OF COMMUNICATION AND COMPUTER SYSTEMS (Greece)
- EA ENERGIANALYSE AS (Denmark)

## Project Description

**Context**. GRIDSOL solution is based on firm hybrid power plants which combine a core of synchronous generators such as Steam Turbine (ST), through Concentrated Solar Power (CSP) with molten salts as unique Heat Transfer Fluid (HTF), and Biogas/Gas Turbine (GT) with HYSOL, along with non-synchronous generators such as Photovoltaics (PV), under a dynamic control system (DOME). The control system of the electricity dispatch is self-regulating and able to provide ancillary grid services thanks to firm and flexible generation on a single output, tailored to a specific location and relieving pressure on TSO.

**Scope.** GRIDSOL project strives to maximize the use of available local renewable sources and storage under an advanced control system (DOME) providing secure electricity in order to meet grid and market requirements. The main objectives of the project are:

- To create the required environment for Smart Renewable Hubs development.
- Development of DOME system to displace traditional fossil generators in grid regulation markets.
- To improve the integration of energy storage technologies by means cost-effectiveness.
- To design the optimum CSP multi-tower configuration.
- Reduction of auxiliary backup fuel for electricity production below 20%.
- Synergies between different kinds of renewable energy technologies.
- To enhance electricity dispatchability adding firmness thanks to energy storage and back-up systems.
- Assessment of the adequacy and feasibility of Smart Renewable Hubs in continental and island scenarios.




**Technical description and implementation.** The main technologies under investigation are CSP multi-tower configuration, Hybrid renewable power plants and DOME.

The scalability of GRIDSOL plant (Smart Renewable Hub) will be around a few hundreds of MW per each plant. Furthermore, this concept is highly replicable in other locations with a good solar or wind resource. The expected results are an increase of RES penetration and a cost reduction of CSP technology and hybrid power plants. The market uptake is close and therefore it is expected that GRIDSOL plant and the new technologies approaches under investigation could be potentially implemented around 2022.

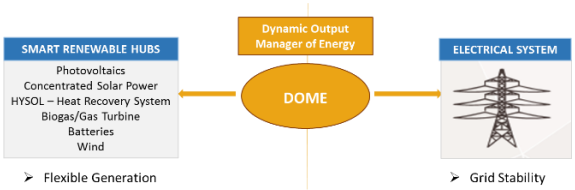
**Impact**. *Replicability:* GRIDSOL solution can be replicable in southern areas of Europe, isolated locations and in other countries with a good solar resource. Moreover, GRIDSOL concept could be used with other renewable sources such as wind.

*Socio-economics:* GRIDSOL implementation will increase employment rates (over 140,000 direct-jobs per year may be created) and raise social awareness on RES technologies, costs (new pricing mechanisms and incentives would be developed) and capabilities (new European technological leadership).

*Environment:* GRIDSOL will increase the share of energy from renewable sources. Thus contributing to the renewable energy targets aimed to reduce pollution and greenhouse gas emissions, decrease land impact and water consumption.

*Market Transformation:* GRIDSOL aims to demonstrate the feasibility of the solution in islands, since this application will be the first niche market to address due to its high generation costs and requirements of backup systems for grid regulation. Furthermore, GRIDSOL aims to substitute in high solar irradiation hours conventional power plants with the greatest carbon footprint.

*Policy:* Contributing to the definition and amendments of new and current Energy System policies and regulation standards that will be needed in order to strongly promote Smart Renewable Hubs.



**H2020 call: LCE-07-2016-2017 - Developing the next generation technologies of renewable electricity and heating/cooling**

# RE-SERVE

Renewables in a Stable Electric Grid

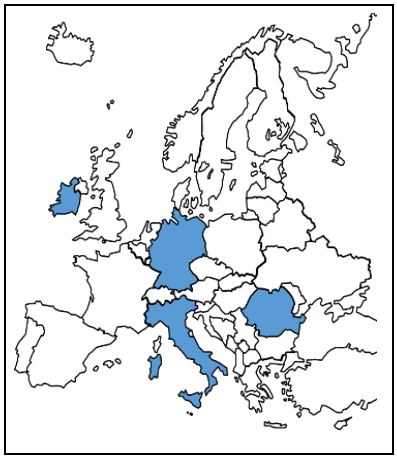
**RESERVE is researching new energy system concepts, implemented as new system support services enabling distributed, multi-level control of the energy system using pan-European unified network connection codes.**

| From 2016 To 2018 | Project total cost | EU contribution | Website |
|---|---|---|---|
| | 5.0 M€ | 5.0 M€ | http://www.re-serve.eu |

**Technologies and services**

| | |
|---|---|
| Technologies for consumers | |
| Grid technologies | ✓ Network management, monitoring and control tools |
| Large-scale storage technologies | |
| Distributed storage technologies | |
| Generation technologies | |
| Market | ✓ Ancillary services |

**Project partners' countries**



## Coordinator: ERICSSON GMBH (GERMANY)

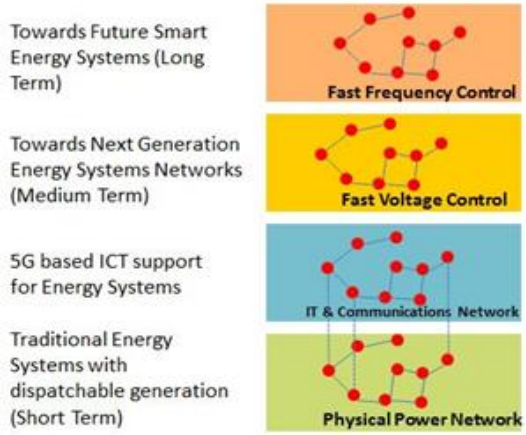
**Other partners:**

- COMPANIA NATIONALA DE TRANSPORT ALENERGIEI ELECTRICE TRANSELECTRICA SA (Romania)
- CENTRUL ROMAN AL ENERGIEI - CRE (Romania)
- ESB NETWORKS LTD (Ireland)
- FLEXIBLE ELEKTRISCHE NETZE FEN GMBH (Germany)
- GRIDHOUND UG (HAFTUNGSBESCHRÄNKT) (Germany)
- POLITECNICO DI TORINO (Italy)
- RHEINISCH-WESTFAELISCHE TECHNISCHE HOCHSCHULE AACHEN (Germany)
- UNIVERSITATEA POLITEHNICA DIN BUCURESTI (Romania)
- UNIVERSITY COLLEGE DUBLIN, NATIONAL UNIVERSITY OF IRELAND, DUBLIN (Ireland)
- WATERFORD INSTITUTE OF TECHNOLOGY (Ireland)

## Project Description

**Context**. Currently large generators powered by fossil fuel turbines maintain the stability and quality of energy supplies through their inertia. The inertia of these generator-turbine groups gives providers a significant time window in which to react to network events. It is urgently needed to find ways to stabilise energy systems with up to 100% RES (where inertia is often lost due to power converter mediated energy transfer) to generate "RESERVEs" so that society can relax in the knowledge that it has a stable and sustainable energy supply.

**Scope.** The RESERVE Strategic Objective is to enable up to 100% penetration of renewables by developing innovative approaches to system level automation based on innovative ancillary service provision with a close to market level of maturity, supported with validation of the concepts and policies using a pan-European real time simulation Infrastructure, anchoring the approach with the main sectors in Europe and beyond.




RESERVE will develop two innovative research approaches, Linear Swing Dynamics (LSD) and Virtual Output Impedance (VOI), enabling the stabilisation of voltage and frequency in energy systems with little inherent inertia; supported by inter-disciplinary research on ethical business models for energy systems based on 100% use of RES.

**Technical description and implementation.** The RESERVE architecture is composed of a combination of energy and ICT components and functionalities providing the ancillary services needed to support energy systems operating with up to 100% RES. The RESERVE architecture is building on the secure platform and API's of the SUCCESS project.

**Impact**. RESERVE will create Impact through:

- RESERVE research concepts, implemented using the latest 5G ICT technologies, and promoted as ancillary service definitions to ENTSO-E/ACER and as an input to the definition of harmonised network codes will solve the energy sector issue of providing a stable power supply using RES,
- RESERVE new ancillary service definitions will enable energy providers to integrate high levels of RES to complete the European Internal Energy market as defined in the SET plan of the European Commission,
- RESERVE will provide the software needed to connect to our novel pan-European real-time simulation platform and our Dynamic Phasor solver as Open Source code creating the capability of capitalising on the availability of computational resources across Europe to create a unified virtual simulation environment, enabling much larger scale energy system simulations than are currently possible,
- RESERVE demonstrations to TRL levels 4 and 5, of our research results in laboratory experiments and in field trials will create confidence in the energy sector community that our techniques are applicable to today's and future energy systems,
- RESERVE contributions to regulations and network codes will provide the basis for scalable deployment of solutions and demonstrate European leadership in RES integration internationally,
- RESERVE results will create jobs in the spin-off service company to be started by the project partners as well as in the service operations of the partner organisations and contributing to job creation in European based energy sector actor organisations, in the ICT and energy sectors,
- RESERVE results will unlock new markets mostly for innovative SMEs in implementing new energy services based on the innovative RES integration concepts and the new automation and monitoring concepts, and
- Partner organisations aim to increase their revenue streams and market shares by providing new innovative services to the energy sector which leverage the results of the RESERVE project

**H2020 call: LCE-04-2017 Demonstration of system integration with smart transmission grid and storage technologies with increasing share of renewables**

# CROSSBOW

CROSS BOrder management of variable renewable energies and storage units enabling a transnational Wholesale market

**CROSSBOW proposes a shared use of resources to foster cross-border management of variable RES and storage units, enabling a higher clean energies penetration whilst reducing network operation costs and improving economic benefits of RES and storage units.**

| From 2017 To 2021 |
|---|

| Project total cost | EU contribution | Website |
|---|---|---|
| 22 M€ | 17 M€ | http://crossbowproject.eu/ |

**Technologies and services**

| | |
|---|---|
| Technologies for consumers | |
| Grid technologies | ✓ Network management tools<br>✓ Demand response |
| Large-scale storage technologies | ✓ Hydro storage |
| Distributed storage technologies | ✓ Batteries |
| Generation technologies | ✓ Wind Turbine ✓ PV |
| Market | ✓Electricity market<br>✓Ancillary services |

**Project partners' countries**

## Coordinator: ETRA INVESTIGACION Y DESARROLLO SA (SPAIN)

### Other partners:

- Centrul Roman Al Energiei - Cre (Romania)
- Compania Nationala De Transport Alenergiei Electrice Transelectrica Sa (Romania)
- Institute of Communication and Computer Systems (Greece)
- Independent Power Transmission Operator Sa (Greece)
- Diacheiristis Ellinikou Diktyou Dianomis Elektrikis Energeias Ae (Greece)
- Public Power Corporation S.A. (Greece)
- Cobra Instalaciones Y Servicios S.A (Spain)
- Varta Storage Gmbh (Germany)
- Elektroenergien Sistemen Operator Ead (Bulgaria)
- Joint Stock Company Elektromreza Srbije Belgrade (Serbia)
- Centar Za Koordinaciju Sigurnosti Scc Doo Beograd-Vozdovac (Serbia)
- Nezavisni Operator Sistema U Bih (Bosnia And Herzegovina)
- The University Of Manchester (United Kingdom)
- Hrvatski Operator Prijenosnog Sustava Doo (Croatia)
- Koncar - Inzenjering Za Energetikui Transport Dd (Croatia)
- Sveuciliste U Zagrebu Fakultet Elektrotehnike I Racunarstva (Croatia)
- Univerza V Ljubljani (Slovenia)
- Elpros Elektronski In Programski Sistemi Doo (Slovenia)
- Crnogorski Elektroprenosni Sistem Ad Podgorica (Montenegro)
- Operator Na Elektroprenosniot Sistem Na Makedonija Akcionersko Drushtvo Za Prenos Na Elektrichna Energijai Upravuvanje So Elektroenergetski (Republic of North Macedonia)
- Ss. Cyril And Methodius University In Skopje (Republic of North Macedonia)
- State Owned Joint Stock Company For Production Of Electricity Power Plants Of Macedonia Skopje (Republic of North Macedonia)
- Cybergrid Gmbh & Co Kg (Austria)

## Project Description

**Context**.

The EU committed to reach a share of renewables of at least 27% by 2030. These targets aimed at helping the EU achieve a more competitive, secure and sustainable energy system and to meet its long-term 2050 greenhouse gas reductions target.

Indeed, the increasing share of fluctuating Renewable Energy Sources (RES) has become key to improve the carbon footprint of the European electricity system and achieve energy and climate change policy goals. This increase has been accompanied by an emerging decentralized and transnational RES ecosystem and the promotion of specific interconnection projects. With low penetration levels, the effects of renewable generation and distributed energy resources (DER) may be ignored; but as the penetration levels rise, a new approach is required to integrate and manage the vast amount of DER which is expected to drive the grid in the -not so distant- future.

In the case of the South Eastern Europe (SEE), even if all its MSs are on track to achieve their RES penetration targets, **the region still has a huge potential to become a clean energy hub for Europe,** reducing the 53% of imported energy at a cost of 400 billion.

**Scope.**

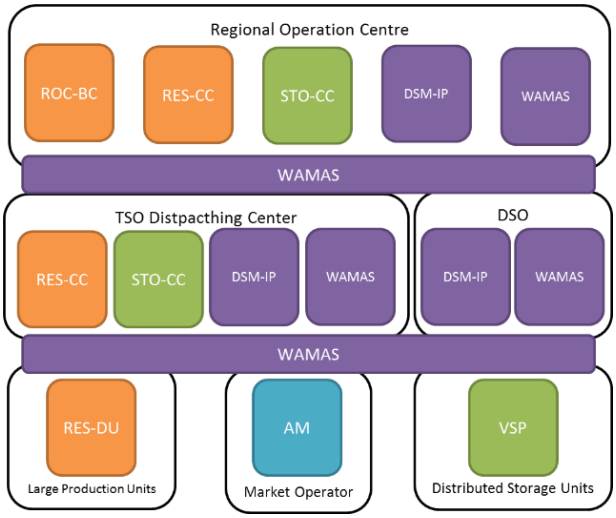
CROSSBOW is a TSO driven project with the goal to successfully deploy a set of technological solutions which enable increasing the **shared use of resources to foster transmission networks cross-border management of variable renewable energies and storage units**, making possible a higher penetration of clean energies whilst reducing network operational costs and improving economic benefits of RES and storage units.

CROSSBOW results will be evaluated during 18 months by one of the European RSC and 8 TSOs in SEE, demonstrating how CROSSBOW tackles the regional challenges faced by these TSOs.

**Technical description and implementation.**

The project technological solutions will be packaged in the form of 9 different products/results:

- CROSSBOW Regional Operation Centre Balancing Cockpit (**ROC-BC**)
- CROSSBOW RES Regional Coordination Centre (**RES-CC**)
- CROSSBOW Hybrid RES Dispatchable Unit (**RES-DU**)
- CROSSBOW Regional Storage Coordination Centre (**STO-CC**)
- CROSSBOW Virtual Storage Plants (**VSP**)
- CROSSBOW **WAMAS** (Wide Area Monitoring and Awareness System)
- CROSSBOW Regional DSM integration platform (**DSM-IP**)
- CROSSBOW Wholesale and Ancillary Market toolset (**AM**)
- CROSSBOW Cooperative ownership of flexibility assets (**CFP**)




**Impact**. *Replicability:* The project involves all relevant actors in SEE to guarantee not only replicability, but also scalability beyond the context of CROSSBOW.

*Socio-economics:* The project will have a significant impact in the commercial operation and innovation activities of the consortium - with a planned ROI for the partners of less than 36 months after full deployment and commercialisation of CROSSBOW products and services starts- and the European sector at large, contributing to the creation of jobs and the access to better quality energy services for EU citizens and businesses.

*Environment:* The project will trigger a saving of 3 MTons of GHG, and the increase of 10% in the share of RES (15,2 TWh).

*Market Transformation:* One of the main mechanisms that the project will propose to achieve higher penetration of RES, is the evolution towards a Regional flexibility market.

*Policy:* CROSSBOW not only counts with the participation of 8 TSOs in SEE, but also with the active support in the User Group of 5 National Regulatory Authorities (NRA) of the region and the Energy Community Secretariat.

**H2020 call: LCE-04-2017 - Demonstration of system integration with smart transmission grid and storage technologies with increasing share of renewables**

# EU-SysFlex

Pan-European system with an efficient coordinated use of flexibilities for the integration of a large share of RES

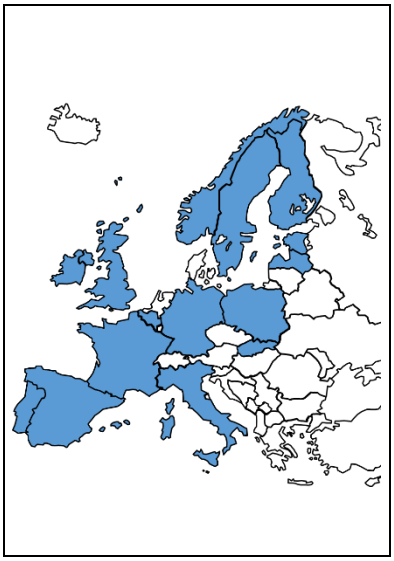
**EU-SysFlex will ensure that an efficient and sufficient level of system services are provided to help facilitate world leading levels of RES-E while maintaining the level of resilience that consumers and society expect from the European electricity system.**

| From 2017 To 2021 | Project total cost | EU contribution | Website |
|---|---|---|---|
| | 26.5 M€ | 20.3 M€ | www.eu-sysflex.com |

## Technologies and services

| | |
|---|---|
| Technologies for consumers | ✓ Demand response<br>✓ Smart metering |
| Grid technologies | ✓ Inertia ✓ Micro-grid<br>✓ Network management, monitoring and control tools |
| Large-scale storage technologies | ✓ Hydro storage |
| Distributed storage technologies | ✓ Batteries ✓ Electric Vehicles<br>✓ Thermal energy storage<br>✓ Flywheel |
| Generation technologies | ✓ Wind Turbine ✓ PV<br>✓ Solar thermal ✓ Biogas<br>✓ Micro-generation |
| Market | ✓ Electricity market ✓ Ancillary services |

## Project partners' countries



## Coordinator: EirGrid, Plc (Ireland)

### Other partners:

- Soni, Limited (UK–North Ireland)
- University College Dublin (Ireland)
- Imperial College London (UK)
- Upside Energy, Limited (UK)
- Pöyry Sweden AB (Sweden)
- Electricité de France (France)
- AKKA Informatique et Systèmes (France)
- Polskie Sieci Elektroenergetyczne operator SA (Poland)
- Narodowe Centrum Badan Jadrowych (Poland)
- Elering AS (Estonia)
- Guardtime AS (Estonia)
- Tartu Ulikool (Estonia)
- AS Augstsprieguma Tikls (Latvia)
- innogy SE (Germany)
- ENERCON GmbH (Germany)
- Fraunhofer – IWES (Gremany)
- Universität Kassel (Germany
- Teknologian tutkimuskeskus VTT Oy (Finland)
- EDP Distribuiçao Energia SA (Portugal)
- CNET – Centre for New Energy Technologies SA (Portugal)
- Instituto de Engenharia de Sistemas e Computadores, Tecnologia e Ciencia (Portugal)
- Siemens AG (Germany)
- e-distribuzione SpA (Italy)
- Ricerca sul Sistema Energetico SpA (Italy)
- Vlaamse Instelling voor Technologisch Onderzoek NV (Belgium)
- Katholieke Universiteit Leuven (Belgium)
- Zabala Innovation Consulting SA (Spain)
- I-Europa SRO (Slovakia)
- Enoco AS (Norway)
- Cybernetica AS (Estonia)
- Elektrilevi OÜ (Estonia)
- Fundación ESADE (Spain)
- Helen Oy (Finland)

## Project Description

**Context**. European policy makers have set ambitious targets for the decarbonisation of the energy system, demanding increased levels of energy efficiency and world leading levels of renewable energy technologies (RES).

**Scope.** EU-SysFlex will make an important contribution in meeting the European Union (EU) world leading RES objectives. The results and later impacts of the project will be decisive for the cost-effective transformation of the electricity system, by enhancing the flexibility required, while maintaining the level of resilience that consumers and society expect from the European electricity system.
A key characteristic of the transformation of the electrical system is that existing conventional plant and the flexible services they provide will be increasingly displaced by new RES and technologies including wind, solar and battery storage. This raises two issues: 1/ the conventional plant are today's service providers and their displacement leads to shortfalls in flexibility and needed services, 2/ the nature of the power system is transformed requiring a range of new or different technical shortfalls to be addressed. Failing to meet the required long term flexibility and system services will undermine Europe's ability to enable the cost-effective transformation of the electrical system, and the additional costs which will be borne by consumers.

**Technical description and implementation.** Firstly, the technical needs of the pan-European system will be defined for scenarios with more than 50% RES. This requires advanced simulation of the technical performance of the future system from load generation balancing including different aspects of flexibility to electromechanical and electromagnetic issues. Secondly, the electricity market design and regulation need to be enhanced to efficiently and effectively procure the appropriate combination of flexibility and system services. Thirdly, implicit and explicit barriers to competitive forces being applied need to be removed. The project will develop and demonstrate innovative approaches to utilise, dispatch and schedule a range of new technologies to meet the flexibility and system services required to facilitate meeting European long term policy objectives.

**Impact**. *Replicability:* EU-SYSFLEX will provide a product range of solutions that will be demonstrated or simulated during the project. A validation of scalability approaches, based on the models developed within the project, will be undertaken to check that technical issues are being solved and considered appropriately. Replicability of all the solutions will be assured.

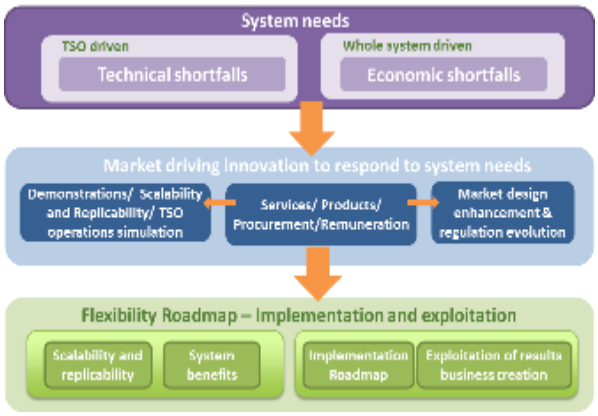
*Socio-economics:* Some solutions will derive in the creation of start-ups which will commercialise them and further develop them, creating highly skilled and value adding jobs and thus strengthening Europe's smart SMEs ecosystem: it will contribute to achieve a resilient and secure European power system, with citizens at its core taking ownership of the energy transition, benefitting from new technologies to reduce their bills, participating actively in the market, and where vulnerable consumers are protected.

*Environment:* EU-SysFlex will make an important contribution to meeting European world leading RES objectives. Meeting these objectives will represent an opportunity for society from both the perspective of climate change mitigation and a driver for innovation, competitiveness of our industries and job creation.

*Market Transformation:* The EU-SysFlex project will impact several critical areas of the European energy sector such as:

- Transnational problems, namely cross-border and cross sectoral issues.
- Market design and regulatory options for innovative services, as well as business models and Pan-European market integration.

*Policy*: The project will develop a flexibility roadmap to remove and overcome the technical, regulatory, communication and system operator issues that limit the full benefit of each of the solutions developed and demonstrated, thus presenting a potential for tangible benefits to the pan-European cost-effective system by reducing system costs and $CO_2$ emissions.

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**H2020 call: LCE-04-2017 - Demonstration of system integration with smart transmission grid and storage technologies with increasing share of renewables**

# FLEXITRANSTORE

An Integrated Platform for Increased FLEXIbility in smart TRANSmission grids with STORage Entities and large penetration of Renewable Energy Sources

**FLEXITRANSTORE project will develop the next generation Flexible Energy Grid (FEG), which will provide the technical basis supporting the valorisation of flexibility services and enhancing the existing European Internal Energy Market (IEM).**

| From 2017 To 2021 | Project total cost | EU contribution | Website |
|---|---|---|---|
| | 21.7 M€ | 17 M€ | www.flexitranstore.eu |

**Technologies and services**

| | |
|---|---|
| Technologies for consumers | ✓ Demand Response |
| Grid technologies | ✓ Network management, monitoring and control tools |
| Large-scale storage technologies | ✓ Battery |
| Distributed storage technologies | |
| Generation technologies | ✓ PV ✓Wind turbine |
| Market | ✓ Electricity Market ✓ Ancillary Services |

**Project partners' countries**

## Coordinator: European Dynamics Belgium S.A. (Belgium)

### Other partners:

- Institute of Communication and Computer Systems/ National Technical University of Athens (Greece)
- Technical University of Sofia (Bulgaria)
- University of Cyprus (Cyprus)
- Budapest University of Technology and Economics (Hungary)
- Loyola University Andalusia (Spain)
- EMAX (Belgium)
- WING Computer Group SRL
- Abengoa Innovación S.A. (Spain)
- JEMA Energy S.A. (Spain)
- GE Energy Products France SNC (France)
- Schneider Electric España SA (Spain)
- Smart Wires Europe (Ireland)
- C&G d.o.o. Ljubljana (Slovenia)
- Studio elektronike Rijeka d.o.o. (Croatia)
- Software Company Ltd. (Bulgaria)
- Independent Power transmission Operator (Greece)
- Elektroenergien Sistemen Operator EAD (Bulgaria)
- Transmission Systyem Operator – Cyprus (Cyprus)
- Centro de Investigação em Energia REN - State Grid, S. A., (R&D NESTER) (Portugal)
- Operatori Sistemit Transmetimit OST (Albania)
- CEZ Distribution Bulgaria AD (Bulgaria)
- Elektro Ljubljana, d.d. (Slovenia)
- Electricity Authority of Cyprus (Cyprus)
- Independent Bulgarian Energy Exchange EAD (Bulgaria)
- VPP Energy Zrt (Hungary)
- Cyprus Energy Regulator Authority (Cyprus)

## Project Description

**Context**. Renewable energy is gaining a continuously increasing share in the production mix throughout the world. System decarbonization, long-term energy security and expansion of energy access in developing countries, due to the distributed nature of renewable sources are only a few of the benefits they introduce. However, the further integration of renewables remains a challenge. Their intermittent production and unpredictability, combined with the need for large-scale storage integration and the lack of valorisation of the services that they offer by the energy market pose as barriers against their establishment.

The FLEXITRANSTORE project identifies the need for flexibility integration in the European power system as the main driver to overcome the aforementioned barriers and reaching higher RES penetration. At a technical level, novel smart grid technologies, control and storage methods will be introduced into the existing power system. At a market level, new business plans, players and market rules will facilitate the valorisation of flexibility services offered by renewables and enable increased cross-border flows.

**Scope.** The FLEXITRANSTORE project will assist the evolution towards a pan-European transmission network with high flexibility and interconnection levels. The Flexible Energy Grid proposed includes adaptation and integration of technologies to ensure that their management demonstrates flexible resource applications that mitigate the effects of RES variability on the network. The project will, thus, work towards the advancement of the Internal European Market, focusing on technologies that facilitate the networking of cross-border players and further enabling energy trading. Within this context the strategic objectives of the project have been defined as follows:

- To enhance and accelerate the integration of renewables into the European energy systems.
- To increase cross-border electricity flows across Europe.

**Technical description and implementation.** A range of state-of-the-art ICT technologies and control improvements will be exploited to enhance the flexibility of the energy grid by integrating storage and demand response management. The FEG components and the market infrastructure will be deployed in 8 Demonstrations installed in 6 countries. Key technologies that will be introduced include:

- Power System Stabilizers for conventional generation and Battery Energy Storage Systems (BESS) integration at TSO/DSO border substations, at wind farms substation and at synchronous GT plants to increase flexibility in the power system.
- Power Flow Controllers and Dynamic Line Rating sensors and algorithms to relieve congestion and to mitigate weather effects.
- A representative grid model which predicts the dynamic behaviour of the grid following big disturbances, thus improving the grid's observability and stability.
- An integrated market platform based on an enhanced EUPHEMIA market model, which valorises flexibility services.

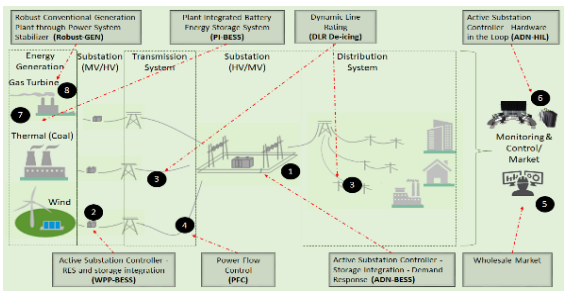
**Impact**. *Replicability:* Work is ongoing at the moment to develop a liberalized energy market in Cyprus. FLEXITRANSTORE can feed into this project. Once the approach succeeds in the Cypriot system it can be seen as a starting point for scaling the approach on a regional and finally pan-European level towards the development of a single European IEM.

*Socio-economics:* The new market approach will include consumer participation in the market and the novel technologies will facilitate the improved utilization of the available energy, thus reducing operational and capacity costs. The project will ensure that the EU electricity network operates within a wholesale market, providing consumers with competitive prices and integrating renewable sources.

*Environment:* By enabling higher RES penetration, FLEXITRANSTORE will contribute towards the reduction of $CO_2$ and other greenhouse gases emissions.

*Market Transformation:* FLEXITRANSTORE is in line with the ETIP SNET 10 Year R&I Roadmap and the ENTSO-E R&I Roadmap 2017-2026 and will impact both new and existing market participants.

*Policy:* FLEXITRANSTORE will provide policy recommendations to TSOs, DSOs, Market Regulators, Power Plant owners and other actors of the energy value chain.



**H2020 call: LCE-04-2017 Demonstration of system integration with smart transmission grid and storage technologies with increasing share of renewables**

# OSMOSE

Optimal System-Mix Of flexibility Solutions for European electricity

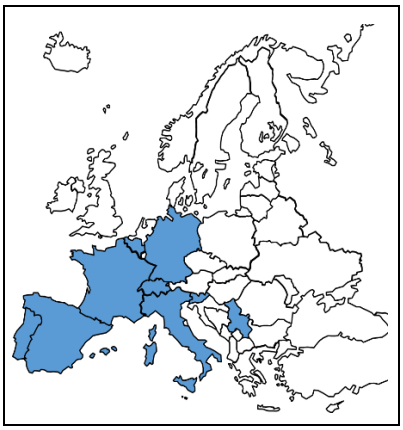
**OSMOSE addresses flexibility for the integration of renewable energy sources, through a holistic approach in order to capture "silo-breaking" synergies across needs and sources flexibilities.**

| From 2018 To 2021 | Project total cost | EU contribution | Website |
|---|---|---|---|
| | 28.3 M€ | 21.9 M€ | http://www.osmose-h2020.eu |

**Technologies and services deployed**

| | |
|---|---|
| Technologies for consumers | ✓ Demand response |
| Grid technologies | ✓ Network management, monitoring and control tools |
| Large-scale storage technologies | ✓ Hydro storage |
| Distributed storage technologies | ✓ Batteries ✓ Flywheel |
| Generation technologies | ✓ Wind power ✓ PV |
| Market | ✓ Electricity market ✓ Ancillary services |

**Project partners' countries**



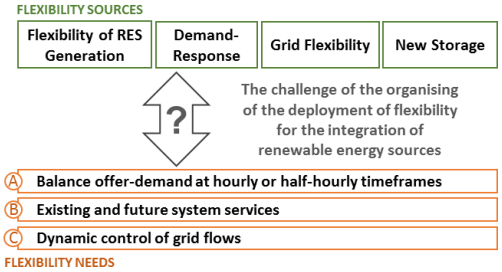
## Coordinator: RTE RESEAU DE TRANSPORT D'ELECTRICITE SA (RTE)

**Other partners:**

- RED ELÉCTRICA DE ESPAÑA (Spain)
- TERNA S.p.A.(Italy)
- REN (Portugal)
- SISTEMSKI OPERATER PRENOSNEGA ELEKTROENGETSKEGA OMREZJA (Slovenia)
- ELIA (Belgium)
- Edison (Italy)
- HOLDING SLOVENSKE ELEKTRARNE D.O.O. (Slovenia)
- SAFT (France)
- GREENPOWER TECHNOLOGIES (Spain)
- ASEA BROWN BOVERI (Italy)
- IBM (Italy)
- EFACEC (Portugal)
- ENEL (Italy)
- COMPENDIA (Italy)
- COMMISSARIAT À L'ENERGIE ATOMIQUE (France)
- ECOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE (Switzerland)
- UNIVERSITÉ PARIS DAUPHINE (France)
- UNIVERSITÄT DUISBURG ESSEN (Germany)
- TECHNISCHE UNIVERSITÄT BERLIN (Germany)
- RICERCA SISTEMA ENERGETICO (Italy)
- ENERGIA E SISTEMI ELETTRICI (Italy)
- UNIVERSIDAD DE LAS PALMAS GRAN CANARIAS (Spain)
- CENTRO NACIONAL DE ENERGÍAS RENOVABLES (Spain)
- IT4POWER (Switzerland)
- ELEKTROENERGETSKI KOORDINACIONI CENTAR D.O.O. (Serbia)
- R&D NESTER (Portugal)
- ENGINEERING (Italy)
- E2I ENERGIE SPECIALI (Italy)
- INGETEAM (Spain)
- HYDRO DOLOMITI ENERGIA S.R.L. (Italy)
- SCHNEIDER ELECTRIC FRANCE SAS (France)
- FUNDAZIONE BRUNO KESSLER (Italy)

## Project Description

**Context**. Six TSOs, eleven research partners, together with sixteen industries (manufacturers, solution providers) and market (producers, ESCo) players address, through a holistic approach, the identification and development of flexibilities required to enable the Energy Transition to high share of renewables. This approach captures synergies across needs (energy markets, system services, grid flow control) and sources of flexibilities (renewable generation, demand response, grid, storage), such as multiple services from one source, or hybridizing sources, thus resulting in a cost-efficient power system.




**Scope.** OSMOSE proposes four TSO-led demonstrations (RTE, REE, TERNA and ELES) aiming at increasing the techno-economic potential of a wide range of flexibility solutions and covering several applications, i.e.: synchronisation of large power systems by multiservice hybrid storage; multiple services provided by the coordinated control of different storage and FACTS devices; multiple services provided by grid devices, large demand-response and RES generation coordinated in a smart management system; cross-border sharing of flexibility sources through a near real-time cross-border energy market.

The demonstrations are coordinated with and supported by simulation-based studies which aim (i) to forecast the economically optimal mix of flexibility solutions in long-term energy scenarios (2030 and 2050) and (ii) to build recommendations for improvements of the existing market mechanisms and regulatory frameworks, thus enabling the reliable and sustainable development of flexibility assets by market players in coordination with regulated players.

Interoperability and improved TSO/DSO interactions are addressed so as to ease the scaling up and replication of the flexibility solutions. A database is built for the sharing of real-life techno-economic performances of electrochemical storage devices.

**Technical description and implementation.** For the integration of high-shares of non-dispatchable renewables, to foster the cost-efficient roll-out of flexibility solutions required for energy markets, for existing and future system services and for the dynamic control of grid flows:

- by demonstrating flexibility solutions enabling synergies across flexibility sources and applications, thus assessing and increasing their techno-economic feasibility;
- by increasing the techno-economic scalability of these solutions;
- by forecasting the economically optimal mix of flexibilities for the European power system, taking into account these synergies, for the best social welfare;
- by proposing evolutions of market designs & regulations leading to this mix and capturing these synergies, in order to achieve this social welfare.

**Impact**. *Replicability:* The demonstrations have a large coverage of the needs for flexibility, three of them focussing on the coordinated use of flexibility solutions mostly based on proven technologies (in stand-alone applications). Dedicated tasks will address the scaling-up and replicability issues, together with interoperability.

*Socio-economics:* the pan-European roll-out of flexibility solutions and (new) associated services will be beneficial for the industrial partners of the project by creating new market opportunities supporting this deployment.

*Environment:* The project, by facilitating the integration of very high shares of RES generation, improves the overall GHG emissions reduction of the pan-European power system.

*Market Transformation:* A real-time “FlexEnergy” dispatching market platform operating simultaneously at the national and cross-border levels, providing a supply-demand matching of bids maximising social welfare in a given time interval will be operated based on calculation of cross-border flexibility exchange capability close to real time.

*Policy:* The OSMOSE project will provide recommendations on market designs and regulations to ensure sufficient and cost-efficient provision of flexibilities and will also make a critical assessment of the current framework.

**H2020 call: LC-SC3-ES-3-2018-2020 Integrated local energy systems (Energy islands)**

# COMPILE

Integrating Community Power in Energy Islands

Compile

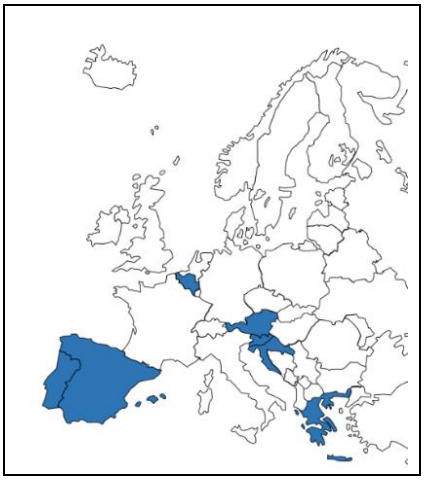
**The main aim of COMPILE is to show the opportunities of energy islands for decarbonisation of energy supply, community building and creating environmental and socio-economic benefits.**

| From 2018 To 2022 | Project total cost | EU contribution | Website |
|---|---|---|---|
| | 6.9 M€ | 5.4 M€ | www.compile-project.eu |

**Technologies and services deployed**

| | |
|---|---|
| Technologies for consumers | ✓ Demand response ✓ Smart appliance ✓ Smart metering |
| Grid technologies | ✓ Network management tools ✓ Micro-grid |
| Large-scale storage technologies | |
| Distributed storage technologies | ✓ Batteries ✓ Electric Vehicles ✓ Thermal Energy storage |
| Generation technologies | ✓ PV ✓ Microgeneration |
| Market | ✓ Electricity market ✓ Ancillary services |

**Project partners' countries**



## Coordinator: UNIVERSITY OF LJUBLJANA (SLOVENIA)

**Other partners:**

- ETRA INVESTIGACION Y DESARROLLO SA (Spain)
- JOANNEUM RESEARCH FORSCHUNGSGESELLSCHAFT MBH (Austria)
- INSTITUTE OF COMMUNICATION AND COMPUTER SYSTEMS (Greece)
- PETROL SLOVENSKA ENERGETSKA DRUZBA DD LJUBLJANA (Slovenia)
- ETREL SVETOVANJE IN DRUGE STORITVE DOO (Slovenia)
- RESCOOP EU ASBL (Belgium)
- DISTRIBUIDORA ELECTRICA DE CREVILLENT S.L.U (Spain)
- IDEAZ STORITVE DOO (Slovenia)
- COOPERNICO - COOPERATIVA DE DESENVOLVIMENTO SUSTENTAVEL CRL (Portugal)
- DIMOS RAFINAS-PIKERMIOU (Greece)
- ZELENA ENERGETSKA ZADRUGA ZA USLUGE (Croatia)

## Project Description

**Context**. Development in RES and IT technologies together supported by social activity creates new opportunities for setting up Energy Community (EnC). The main aim of COMPILE is to show the opportunities of energy islands for decarbonisation of energy supply, community building and creating environmental and socio-economic benefits.

**Scope.** COMPILE objectives are:

- Empowering Local Energy Systems (transition from a centralized system into a flexible but secure decentralized network);
- Optimal integration and control of all the energy vectors, storage and electromobility options to maximize decarbonisation and energy savings;
- Foster the creation of energy communities taking into account positive effects on the local economy and user acceptance considering vulnerable groups;
- Create new ways to stimulate actors in the value chain to cooperate and maximize the social benefit, to foster the adoption of the technological solutions and enable a large-scale replication of the developed technological solutions and business models.

**Technical description and implementation.** In order to reach the objectives of the project, 4 technical tools and 2 EnC creation/support tools will be developed/enhanced and tested at 5 pilot site locations in 5 different countries. The pilot sites vary in organizational maturity from starters Rafina municipality (Greece) to mature EnC in Crevillent (Spain). Pilot sites also vary in size from individual multi apartment building in Lisbon (Portugal) to small city of Crevillent (Spain) in order to test the replicability and scalability potential of developed tools.

**Impact**. *Replicability:* Replicability of COMPILE results are ensured by understanding the roles, opportunities and limitation of the actors, as well as their interplay. The COMPILE tools are validated and tailored to the needs of different actors, improving their replicability.

*Socio-economics:* COMPILE aims to understand what are the factors that are relevant for community building, for behaviour changes and for the uptake of new technologies by citizens. These factors are included in the community building activities in the pilot sites.

*Environment:* The methods of COMPILE include also life cycle analysis (LCA), so that the environmental impact of all the results is understood. LCA also guides the optimization of Local Energy Communities and contributes to the overall aim of the decarbonization of the economy.

*Market Transformation:* To successfully contribute to market transformation, we need to understand new value chains, the roles of different actors and their revenue streams. COMPILE covers all stages of an innovation system, from knowledge generation through demonstration to market formation. It investigates and even shapes the enabling framework, the “innovation ecosystem” in which the COMPILE solutions can be deployed. COMPILE solutions enable different actors to pursue new business models and use the knowledge gathered in the project to arrive at positive business cases.

*Policy:* COMPILE is one of 4 sister projects under the LC-SC-3 call. The demonstrations cover pilot sites in more than 12 EU countries. This way, the policy recommendations can be shared and harmonized via BRIDGE and direct cooperation among sister projects. Insight and learnings can be better generalized, guaranteeing robust conclusions for national and EU legislation.

*International dimension:* COMPILE also shares the results with goal of increasing the replicability of solutions through cooperation with 2 international partners: Institute of Rural Management Anand (IRMA) from India and China University of Mining and Technology-Beijing from China.

**H2020 call: LC-SC3-ES-3-2018-2020 Integrated local energy systems (Energy islands)**

# E-LAND

Integrated multi-vector management system for Energy isLANDs'

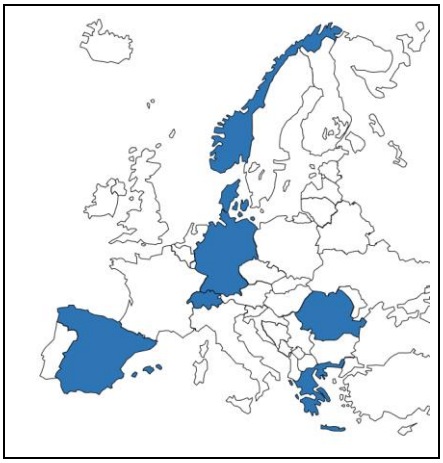
**E-LAND develops a toolbox for Multi-Energy Islands including tools and methods for addressing business, society and technology challenges.**

| From 2018 To 2022 | Project total cost | EU contribution | Website |
|---|---|---|---|
| | 5.9 M€ | 5.3 M€ | http://www.elandh2020.eu |

**Technologies and services deployed**

| | |
|---|---|
| Technologies for consumers | ✓ Demand response ✓ Smart Metering |
| Grid technologies | ✓ HVAC ✓ Network management and control tools ✓Micro-Grid |
| Large-scale storage technologies | ✓ Power to gas |
| Distributed storage technologies | ✓ Batteries ✓ Electric Vehicles ✓ Thermal energy storage |
| Generation technologies | ✓ Wind Power ✓PV ✓Solar thermal ✓Micro-generation |
| Market | ✓ Electricity market ✓ Ancillary services |

**Project partners' countries**



## Coordinator: UNIVERSITAT DE GIRONA (Spain)

**Other partners:**

- Schneider Electric Norge AS (Norway)
- BORG HAVN IKS (Norway)
- INSTITUTT FOR ENERGITEKNIKK (Norway)
- GECO GLOBAL IVS (Denmark)
- SMART INNOVATION NORWAY AS (Norway)
- INTRACOM SA TELECOM SOLUTIONS (Greece)
- REINER LEMOINE INSTITUT GGMBH (Germany)
- UNIVERSITATEA VALAHIA TARGOVISTE (Romania)
- ASOCIATIA CENTRUL DE RESURSE PENTRU EFICIENTA ENERGETICA (Romania)
- UNIVERSITAET ST. GALLEN (Switzerland)
- INSTRUMENTACION Y COMPONENTES SA (Spain)

## Project Description

**Context.** In the era of urgency to tackle the climate change, synergies between multiple energy vectors can support decarbonization of local energy islands and, at the same time, relieve constraints from the electricity grid. Multi-vector energy systems offer flexibility to integrate variable and economic local energy generation. However, the implementation and operation of multi-vector energy systems face technical, societal and business-related challenges.


**Scope.** E-LAND addresses previously identified challenges by developing and implementing the E-LAND Toolbox for Multi-Energy Islands. Technologically, E-LAND bridges the communication and information flow between different local energy systems to create and implement an integrated solution. Socially, E-LAND incorporates citizens and other local community members as part of the solution development team to facilitate bottom-up solution development. Involving citizens to co-create solutions ensures better acceptance of novel technologies and facilitates changes in behaviour, which together strengthen energy reliability and increase the self-sufficiency of communities. In the business field, E-LAND develops tools, which will support market players to innovate their business model to cope with energy-transition and rapid implementation of renewable energies, storage facilities and data-analytic tools.

**Technical description and implementation.** The final product will be a powerful toolbox consisting of tools to build decarbonised, multi-vector Energy Islands on a foundation of advanced ICT and data analytics technologies, strong community engagement tools and solid business models. To meet the goals of the project, a co-creative process has been designed which involves active participation of end-users together with technology developers. The toolbox will be modular and customizable to specific local requirements, expandable to incorporate new tools and interoperable with standards-based legacy systems.

The tools will be implemented and validated at three pilot locations in Europe (Spain, Norway & Romania) and two simulated pilots in India.

**Impact**. *Replicability:* E-LAND ensures the potential for wide rollout of the Toolbox by validating the replicability of the tools with different locations in terms of geography, demography, sociography and maturity.

*Socio-economics:* The E-LAND project seeks to develop, pilot and validate new and innovative solutions suitable for the European market as well as the global market. The project involves many stakeholders, each seeking to gain different benefits and link many energy topics. It strengthens the foundation of multiple industry sectors, and for each of these sectors the project opens additional employment opportunities and new business ventures.

*Environment:* Through the 3 European pilots implemented in the project, E-LAND will demonstrate a reduction of $CO_2$ emissions, an increase in renewables utilisation and self-sufficiency. E-LAND tools have potential to simultaneously decarbonise electricity sector, transport sector and gas sector. In countries like India where rural areas are still dependent on the burning of fossil fuels E-LAND will make implementation of renewable-based microgrid affordable.

*Market Transformation:* As a general goal for sustainable business creation, E-LAND aims for financially self-sustainable pilots after the project execution. The new business models developed for energy islands will support communities to run their own energy system in a self-sustaining and profitable way. E-LAND will develop a business model innovator tool which can be readily used by broader market players to design new business models or to improvise on existing ones under changing energy paradigm.

*Policy:* The project will expose existing regulatory barriers in general and specific barriers existing in the pilot countries. Results of the work will lead to the identification of current regulatory barriers, including risk preparedness regulations and regulations on crisis management. Policy recommendation will be framed to facilitate development of multi vector energy islands.

H2020-LC-SC3-ES-3-2018-2020 - Integrated local energy systems (Energy islands)

# MERLON

Integrated Modular Energy Systems and Local Flexibility Trading for Neural Energy Islands

**MERLON introduces an Integrated Modular Local Energy Management Framework for the Holistic Operational Optimization of Local Energy Systems in presence of high shares of volatile distributed RES.**

| From 2019 To 2021 |
|---|

| Project total cost | EU contribution | Website |
|---|---|---|
| 7.6 M€ | 5.7 M€ | https://www.merlon-project.eu/ |

**Technologies and services deployed**

| | |
|---|---|
| Technologies for consumers | ✓Demand response<br>✓Smart appliance<br>✓Smart metering |
| Grid technologies | ✓ Micro-grid |
| Large-scale storage technologies | |
| Distributed storage technologies | ✓ Batteries<br>✓ Electric Vehicles<br>✓ Thermal energy storage |
| Generation technologies | ✓ PV |
| Market | ✓ Electricity market<br>✓ Ancillary services |

**Project partners' countries**

**Coordinator:** HYPERTECH (CHAIPERTEK) ANONYMOS VIOMICHANIKI EMPORIKI ETAIREIA PLIROFORIKIS KAI NEON TECHNOLOGION (Greece)

**Other partners:**

- ATOS SPAIN SA (Spain)
- IMPERIAL COLLEGE OF SCIENCE TECHNOLOGY AND MEDICINE (United Kingdom)
- COBRA INSTALACIONES Y SERVICIOS S.A (Spain)
- SUITE5 DATA INTELLIGENCE SOLUTIONS LIMITED (Cyprus)
- ENERGIE GUSSING GMBH (Austria)
- SOREA SOCIETE DES REGIES DE L'ARC (France)
- EUROPAISCHES ZENTRUM FUR ERNEUERBARE ENERGIE GUSSING GMBH (Austria)
- MERIT CONSULTING HOUSE (Belgium)
- XOROTEXNIKI ANONYMO TEXNIKO ETAIREIA (Greece)
- UNIVERSITY OF NEWCASTLE UPON TYNE (United Kingdom)
- UNIVERSITY OF PELOPONNESE (Greece)
- INDIA SMART GRID FORUM (India)

## Project Description

**Context.** MERLON spans local generation output, energy demand, storage flexibility and options offered by EVs, and interconnection among different energy vectors to facilitate RES integration into the grid, curtailment avoidance and satisfaction of balancing/ancillary grid needs. This is achieved through integration of innovative technologies for local energy system integration, human-centric demand response, optimised energy storage, Grid-to-Vehicle (G2V), Virtual Thermal Energy Storage and coordination with local CHP plants as well as their operational optimisation.

**Scope.** The key objectives of MERLON are:

- To introduce and integrate Smart Inverter technology combined with Battery Energy Storage Systems connected at key network locations of the Integrated Local Energy Systems;
- To facilitate maximum RES integration, self-consumption and satisfaction of balancing/ ancillary grid needs through holistic integration and optimal coordination of local flexibility resources (generation, demand, storage, EVs);
- To contribute to the establishment of local energy communities with their local flexibility markets;
- To introduce innovative technologies able to automatically modify demand profiles, without violating prosumer preferences/ schedules;
- To democratise energy flexibility markets via corresponding business models accompanied by clearly defined and transparent rules, standardised contracts and appropriate technological tools for local energy markets.

**Technical description and implementation.**

MERLON brings together a wide range of mature and proven technologies and integrates them in a holistic and interoperable framework, comprising in a fully-fledged suite of tools and applications for all major stakeholders involved in the Optimisation of Local Energy Management Systems. The backbone of the MERLON solution consists in a modular and extendable Smart Inverter system connected at substation level, which is responsible for the Battery Energy Storage Systems (BESS) integration and its operation orchestration while enabling temporal intentional islanding and grid forming when required to ensure security of supply and power quality.

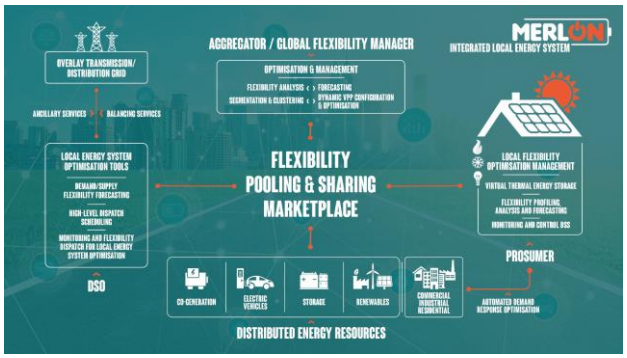
**Impact.** *Replicability:* The diversity of the selected MERLON pilot sites ensures a sound validation process and a high replication potential around EU. The scale of the prominent pilots, the diversity of involved stakeholders and the population size actively involved, establish the necessary critical mass upon which the large-scale promotion and uptake of project results is pursued.

*Socio-economics:* Based on an assumption that, for every conventional GWh reduction, around 0.17-0.6 jobs are created in the EU, 40,000-150,000 jobs can be created until 2050 only by avoiding the curtailment.
MERLON will contribute to tackling the energy poverty problem around EU directly through the pilot sites.

*Environment:* The avoidance of extra conventional generation capacity will lead to significant reduction of $CO_2$ emissions. MERLON will also support the self-consumption model. Self-consumption can make an important contribution to finance the energy transition. Commercial consumers can reach high rates of renewable energy self-consumption (e.g. 50%-80%).

*Market Transformation:* MERLON solution will be validated in two local energy systems/pilot sites in Austria and France, enabling the extraction of conclusions, policy recommendations and market reform requirements addressing diverse political, market/ business, demographic and cultural contexts.

*Policy:* MERLON adopts and establishes a user-driven innovative environment that accelerates collaborative knowledge, technology customisation, validation against real market and end-user needs as well as end-product definition and go-to-market strategy creation. MERLON brings together all the value-chain stakeholders in an effort to leverage their multi-disciplinary expertise towards setting the basis for the efficient co-creation of market-ready, cutting-edge, innovative solutions.



H2020-LC-SC3-ES-3-2018-2020 - Integrated local energy systems (Energy islands)

# MUSE Grids

Multi Utilities Smart Energy GRIDS

**MUSE Grids aims to be a lighthouse inspiration project for the EU. It will demonstrate in two inspiring demosites a set of both technological and non-technological solutions towards local energy independency via the promotion of a smart energy system.**

| From 2018 To 2022 |
|---|

| Project total cost | EU contribution | Website |
|---|---|---|
| 7.4 M€ | 5.9 M€ | http://www.muse-grids.eu/ |

**Technologies and services deployed**

| | |
|---|---|
| Technologies for consumers | ✓ Demand response ✓ Smart appliance ✓ Smart metering |
| Grid technologies | ✓ Network management, monitoring and control ✓ Micro-grid |
| Large-scale storage technologies | |
| Distributed storage technologies | ✓ Batteries ✓ Electric Vehicles ✓ Thermal energy storage |
| Generation technologies | ✓ Wind power ✓ PV |
| Market | ✓ Electricity market |

**Project partners' countries**

## Coordinator: RINA CONSULTING SPA (Italy)

**Other partners:**

- FUNDACION CARTIF (Spain)
- AALBORG UNIVERSITET (Denmark)
- UNIVERSITA POLITECNICA DELLE MARCHE (Italy)
- ASTEA SPA (Italy)
- TH!NK E (Belgium)
- SIEMENS GAMESA RENEWABLE ENERGY INNOVATION & TECHNOLOGY S.L. (Spain)
- TECHNISCHE UNIVERSITEIT EINDHOVEN (Netherlands)
- ENERGETICA S COOP (Spain)
- BELGISCH LABORATORIUM VAN DE ELEKTRICITEITSINDUSTRIE (Belgium)
- GALU LIMITED (Ireland)
- DUFERCO ENERGIA SPA (Italy)
- EUROPEAN ASSOCIATION FOR STORAGE OF ENERGY (Belgium)
- GLEN DIMPLEX HEATING & VENTILATION IRELAND UNLIMITED COMPANY (Ireland)
- Eptisa Servicios de Ingeniería S.L. (Spain)
- MUNICIPALITY OF EILAT (Israel)
- ABB OF ASEA BROWN BOVERI (Belgium)
- SCAME PARRE SPA (Italy)

## Project Description

**Context**. MUSE Grids aims to demonstrate, in two weakly connected areas (a town on a top of a hill and a rural neighbourhood), a set of both technological and non-technological solutions targeting the interaction of local energy grids (electricity grids, district heating and cooling networks, water networks, gas grids, electromobility etc.). This would enable maximization of local energy independency through optimized management of the production via end user-driven control strategies, smart grid functionality, storage, CHP and RES integration.

**Scope.** MUSE Grids promotes two concepts – Smart Energy System and Local Energy Community – not only in physical pilot sites, but also in virtual demo sites in India, Israel and Spain. Social and environmental aspects of the smart multi-energy system transition will be investigated, and citizens in the physical pilot sites will be directly involved. The project involves leading EU companies and energy utilities, and will inspire dedicated policy redaction by also providing insights to the BRIDGE initiative.

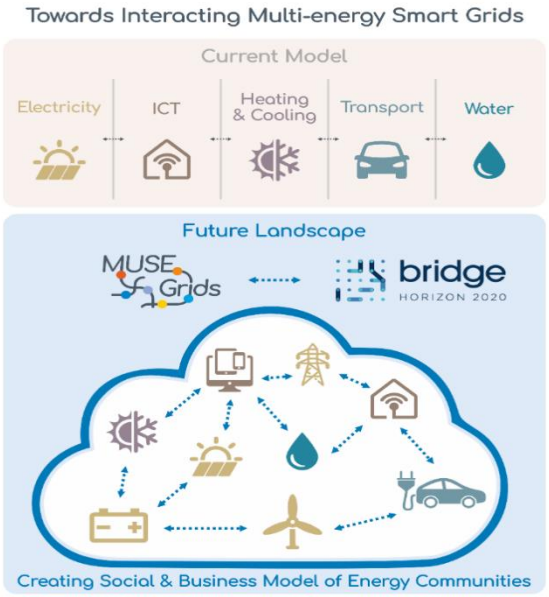
**Technical description and implementation.**

The two MUSE Grids physical demo sites help in understanding the energy system and defining baseline scenarios for the main challenges faced by EU local energy systems with weak connections to the main grid:

- Belgian demo: the rural district of Oud-Heverlee (part of a municipality with around 10,800 inhabitants, in the province of Flemish Brabant) brings into MUSE Grid a street on a weak grid from transformer to end of line. Voltage swings measured show values of below 200V and up to over 260V. Additionally, a severe imbalance between the phases can be observed, leading to unacceptable deviations, mainly on the third harmonic. These two phenomena cause damage to electronics and have a negative impact on the lifetime of electrical devices;

- Italian demo: the town of Osimo (an old city with around 35,000 inhabitants, in the province of Ancona in the Marche region) has a challenging single line connection to the main electricity grid. Due to the high penetration of renewable energy generation (mostly PV), the municipal microgrid witnesses a huge variance in the netload exchange with national grid throughout the year, swinging from 30MW of peak absorption, when the renewable generation is not sufficient to cover for the local energy demand, down to 20MW of peak injection towards the national grid, when the local generation exceeds the total loads (mainly during summer weekends).

These demos are complemented with four virtual demonstration cases, located in Spain, Israel, India, representing a significant variety of urban / rural contexts.




**Impact**. *Replicability:* MUSE Grids focuses on technology demonstration, as well as on the market viability and the replicability of the MUSE Grids technologies and the targeted subcomponents (products and services).

*Socio-economics:* MUSE Grids empowers citizens to consume energy more responsibly, contributes to energy savings and help grids become more flexible so they can operate more efficiently and qualitatively.

*Environment:* MUSE Grids aims to increase the perception and the importance of interconnecting grids towards a more robust and RES based energy scenario.

*Market Transformation & Policy:* MUSE Grids is committed to making a major contribution to the BRIDGE initiative and in doing so, to ongoing policy developments in areas of internal electricity market design, retail market design and ongoing discussions on self-consumption. MUSE Grids is also already supported by EERA and will provide insights to ETIP SNET and SCI.

**H2020 call: LC-SC3-ES-4-2018-2020 Decarbonising energy systems of geographical Islands**

# GIFT

Geographical Islands FlexibiliTy

**GIFT is an innovative project that aims to decarbonise the energy mix of European islands through holistic energy management, trading and innovative storage solutions.**

| From 2019 To 2022 |
|---|

| Project total cost | EU contribution | Website |
|---|---|---|
| 12 M€ | 9.5 M€ | www.gift-h2020.eu |

**Technologies and services deployed**

| | |
|---|---|
| Technologies for consumers | ✓ Demand response |
| Grid technologies | ✓ HVAC ✓ Micro-grid ✓ Network management tools |
| Large-scale storage technologies | ✓ Power to gas |
| Distributed storage technologies | ✓ Batteries ✓ Electric Vehicles ✓ Thermal energy storage |
| Generation technologies | |
| Market | ✓ Electricity market ✓ Ancillary services |

**Project partners' countries**

**Coordinator:** **INEA INFORMATIZACIJA ENERGETIKA AVTOMATIZACIJA DOO (Slovenia)**

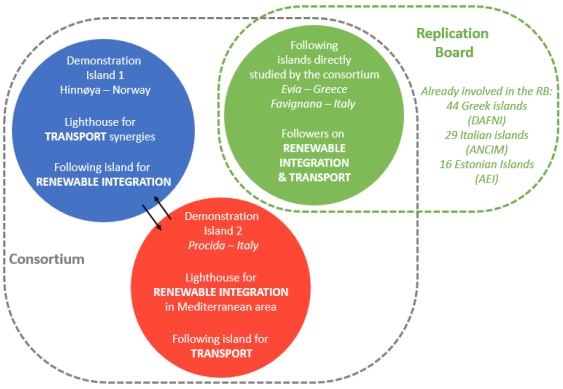
**Other partners:**

- INTRACOM SA TELECOM SOLUTIONS (Greece)
- TRIALOG (France)
- ETREL SVETOVANJE IN DRUGE STORITVE DOO (Slovenia)
- SYLFEN (France)
- ELESTOR BV (Netherlands)
- Odit-e (France)
- HAFENSTROM AS (Norway)
- EUROQUALITY SARL (France)
- HALOGALAND KRAFT NETT AS (Norway)
- HARSTAD KOMMUNE (Norway)
- COMUNE DI PROCIDA (Italy)
- CENTRO DE INVESTIGACAO EM ENERGIA REN - STATE GRID SA (Portugal)
- NORGES TEKNISK-NATURVITENSKAPELIGE UNIVERSITET NTNU (Norway)
- CENTRE FOR RENEWABLE ENERGY SOURCES AND SAVING FONDATION (Greece)
- ASSOCIATION POUR LA RECHERCHE ET LE DEVELOPPEMENT DES METHODES ET PROCESSUS INDUSTRIELS (France)
- UNIVERSITA DEGLI STUDI DI ROMA LA SAPIENZA (Italy)

## Project Description

**Context**. Energy prices on geographical island are typically 100% to 400% higher than on the mainland; therefore the large-scale deployment of local renewable energy sources brings economic benefits and, at the same time, contributes to decarbonise the energy system of the island, reduce greenhouse gas emissions and improve, or at least not deteriorate, air quality. European islands have to abidec by the law of their countries that push toward a greener energy mixc to comply with the European and international agreements.

**Scope.** GIFT is willing to develop innovative systems to allow islands to integrate vast amount of renewables. In order to reach that goal, the coordinator INEA has built a well-balanced consortium gathering a total of 17 partners of 7 countries, including 1 industrial partner, 9 SMEs, two municipalities, 3 research centres and 2 universities. Through the development of multiple innovative solutions, GIFT increases the penetration rate of renewable energy sources into the islands' grid, reducing their needs for diesel generation and thus decreasing the greenhouse gases emissions directly related to it. During 4 years, the partners will develop and demonstrate the solutions in two lighthouse islands, in Hinnøya, Norway's largest island and the small island of Procida in Italy and study the replicability of the solution in a Greek and Italian islands at the minimum, respectively Evia and Favignana. The complementarity of these islands in terms of climate, energy mix, population and activities is meant to have solutions adaptable to different situations.




**Technical description and implementation.** In the project, we will demonstrate several technical solutions, each specifically designed to address real life scenarios in the electric grid. The main differentiator of the GIFT project is focus on the integration. We will deliver a comprehensive integrated solution that will fit to several different environments. This approach will significantly improve the exploitation potential of the GIFT solution. We segment our technologies in the following segments:

- Grid observability: short-term prediction algorithms, IoT, GIS, modelling;
- Predictions of energy supply and demand;
- Visualisation of energy supply and demand;
- Enterprise Service Bus: integration with legacy systems, supporting interoperability;
- Virtual power system: addressing the flexibility in a standardized way, through techno-economical optimization;
- Several types of storage solutions: Ship/Harbour EMS, EVs, Virtual storage in processes, Factory EMS, Smart Energy Hub (multi vector storage), HBr storage system.

**Impact**. *Replicability*: Our project carries on the work from several different projects under FP7 and H2020, as well as privately funded and national projects. Most of the partners in the consortium are from industry and the technologies they bring on board are part of their strategic development. Furthermore, those partners are active on the market and will exploit the results through their market channels. We construct a special replication board within the project, which is responsible to disseminate our technologies to interested islands.

*Socio-economics:* Our project will enable the electricity users to become active players in optimization of electricity system. Through gains for all players, we also stimulate investments. With reducing the stress on the grid, as well as solving the congestions, we help ensuring stable and reliable supply to end users.

*Environment*: Our technologies are low or zero carbon. Furthermore, the whole GIFT system allows for high level penetration of renewables that would otherwise endanger the normal grid operation.

*Market Transformation and Policy:* We are promoting new business models through our roles and players model, which is based on European harmonized role model. We are acting local, our partners are DSOs, BRPs and local energy suppliers. We are in line with the "Winter package", which puts the prosumer in central role.

**H2020 call: LC-SC3-ES-4-2018-2020 - Decarbonising energy systems of geographical Islands**

# REACT

Renewable Energy for self-sustAinable island CommuniTies

**REACT delivers a scalable and adaptable cloud-based ICT platform for planning and management of RES and storage enabled infrastructures supporting a holistic cooperative energy management strategy at the community level in geographical islands.**

| From 2019<br>To 2022 | Project total cost | EU contribution | Website |
|---|---|---|---|
| | 10.7 M€ | 9 M€ | *Not existing yet* |

**Technologies and services deployed**

| | |
|---|---|
| Technologies for consumers | ✓ Demand response<br>✓ Smart appliance |
| Grid technologies | ✓ HVAC ✓ Network management, monitoring and control tools<br>✓ Micro-grid |
| Large-scale storage technologies | |
| Distributed storage technologies | ✓ Batteries<br>✓ Thermal energy storage |
| Generation technologies | ✓ PV<br>✓ Micro generation |
| Market | ✓ Electricity market<br>✓ Ancillary services |

**Project partners' countries**

**Coordinator:** **VEOLIA SERVEIS CATALUNYA SOCIEDAD ANONIMA UNIPERSONAL (Spain)**

**Other partners:**

- NATIONAL UNIVERSITY OF IRELAND GALWAY (Ireland)
- ESB NETWORKS LTD (Ireland)
- The sustainable Energy Authority of Ireland (Ireland)
- UDARAS NA GAELTACHTA (Ireland)
- MITSUBISHI ELECTRIC R&D CENTRE EUROPE B.V. (Netherlands)
- FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V. (Germany)
- AIT AUSTRIAN INSTITUTE OF TECHNOLOGY GMBH (Austria)
- FENIE ENERGIA SA (Spain)
- FUNDACION TEKNIKER (Spain)
- SUMINISTROS ORDUNA SL (Spain)
- ASOCIACION PROVINCIAL DE INDUSTRIALES DE ELECTRICIDAD Y TELECOMUNICACIONES DE LAS PALMAS AIE LAS PALMAS (Spain)
- UPPSALA UNIVERSITET (Sweden)
- R2M SOLUTION SRL (Italy)
- MIDAC SPA (Italy)
- COMUNE DI CARLOFORTE (Italy)
- ALBUFERA ENERGY STORAGE SL (Spain)
- Electrochaea GmbH (Germany)
- TEESSIDE UNIVERSITY (United Kingdom)
- PANEPISTIMIO AIGAIOU (Greece)
- INSTITUT MIHAJLO PUPIN (Serbia)
- COMET GESINCO SL (Spain)
- UNIVERSITE DE LA REUNION (France)

## Project Description

**Context**. REACT develops the technical and business ecosystem to convincingly demonstrate the potential of the large-scale deployment of RES and storage assets on geographical islands to bring economic benefits, contribute to the decarbonisation of local energy systems, reduce GHG emissions and improve environmental air quality.

**Scope.** REACT sets up the conditions for wide-scale replicability across EU island communities by:

- Integrating existing and emerging technologies to create cloud-based solution enabling an integrated and digitalised smart grid to support 100% energy autonomy of geographical islands;
- Demonstrating in 3 pilots the potential to reduce GHG emission and energy costs both by > 60%, achieve at least 10% of energy savings;
- Developing partner-backed viable plans for large-scale replication on 5 follower islands that measure the socio-economic benefits of enhancing islands' energy autonomy.

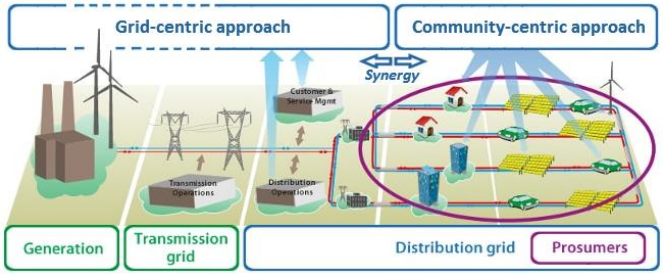
**Technical description and implementation.**

*Advanced Innovative Technologies* including optimised control of smart-grids in geographical islands, DR platform for flexibility management at community level via automated and manual strategies, smart energy grid design tool for island optimal RES integration, real-time generation and load forecasting for optimal grid balancing, energy storage (deployment of high-capacity and environmental friendly batteries), innovative heat pumps and PV systems to be managed at community level, and enhanced grid operation monitoring to perform identification, localization of grid failures during operations in a scenario of high intermittent RES penetration and storage into the island energy grid.

*Technology Integration* and testing in demo islands and via hardware-in-the-loop to reduce costs based on cloud-based platform, Hardware-in-the-loop (HiL) laboratory testing, and integrative optimisation approach that combines real-time optimisation of both multi-carrier energy supply and demand side of target energy infrastructure.

*New Synergies* - synergy between different grids such as water, transport (EV charging stations), energy and heat. REACT will use real technology assets combined with partners' expertise in computational modelling and simulation of physical systems to account for the existing grids at demo sites.

*User Engagement & Business Models* - REACT engages the end consumers, i.e. the island residents and involve them in demand reduction and time shifting (e.g. peak shaving) activities. Therefore, REACT will raise the awareness of island residents through the recommendations for energy conservation opportunities, provision of estimated energy performance, monitored data, information about incentives and energy pricing, etc. As a result, REACT aims to adapt the behaviour of island residents (considering availability of renewable generation, grid load balancing, energy pricing, etc.) through their involvement, thus becoming an active part of cooperative strategy. Finally, innovative business models and exploitation plans to maximise REACT impact will be developed and deployed by strong industrial consortium.




**Impact**. *Replicability*: REACT integrated solution for optimal control and strategy will ensure a high degree of interoperability with current systems

*Environment*: REACT will enable the achievement of at least 10% energy saving in islands and 60% energy price drop that will be directly translated in end-user bill reduction and CO2 savings.

*Market Transformation and Policy*: REACT enables higher penetration (min. +50%) of renewables in islands grids and drastically reduce 50% the fossil fuel consumption by using battery storage to improve the technical and economic performance and the flexibility and resilience of the electricity grid. Enable innovative and integral business model unlocking new services for the entire energy value chain and will promote a holistic energy purchase and DR strategy at community level.

*Socio-economics*: REACT unlocks the full potential of DR in residential and tertiary buildings, making the flexible load portion available for use in grid balancing and other ancillary services. It also reduces/defers a maximum of 30% the DSOs required investments in grid reinforcements and grid balancing by improving assets and network utilization which in the mid-term will reduce the final user energy price.

**H2020 call: LC-SC3-ES-5-2018-2020 TSO – DSO – Consumer: large-scale demonstrations of innovative grid services through demand response, storage and small-scale (res) generation**

# CoordiNet

Large scale campaigns to demonstrate how TSO-DSO shall act in a coordinated manner to procure grid services in the most reliable and efficient way

**CoordiNet establishes different collaboration schemes between transmission system operators (TSOs), distribution system operators (DSOs) and consumers to contribute to the development of a smart, secure and more resilient energy system.**

| From 2019 To 2022 | Project total cost | EU contribution | Website |
|---|---|---|---|
| | 19 € | 15 € | http://www.coordinet-project.eu/ |

**Technologies and services deployed**

| | |
|---|---|
| Technologies for consumers | ✓ Demand response ✓ Smart appliance ✓ Smart metering |
| Grid technologies | ✓ Network management, monitoring and control<br>✓ Micro grid |
| Large-scale storage technologies | ✓ Power to gas ✓ CAES ✓ Hydro storage |
| Distributed storage technologies | ✓ Batteries<br>✓ Thermal Energy storage |
| Generation technologies | ✓ Wind power ✓ Micro generation<br>✓ PV |
| Market | ✓ Electricity market<br>✓ Ancillary services |

**Project partners' countries**

## Coordinator: ENDESA DISTRIBUCION ELECTRICA S.L (Spain)

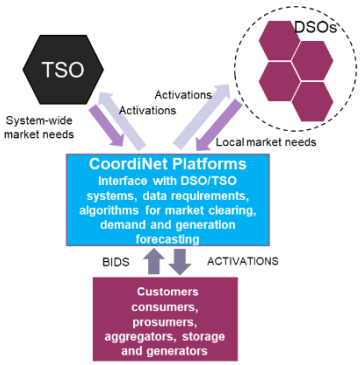
**Other partners:**

- IBERDROLA DISTRIBUCION ELECTRICA, S.A. (Spain)
- RED ELECTRICA DE ESPANA S.A.U. (Spain)
- Fundacion Tecnalia Research & Innovation (Spain)
- Universidad Pontificia Comillas (Spain)
- NUESTRA NUEVA ENERGIA SL (Spain)
- Ayuntamiento de Malaga (Spain)
- VATTENFALL ELDISTRIBUTION AB (Sweden)
- E.ON Energidistribution AB (Sweden)
- AFFARSVERKET SVENSKA KRAFTNAT (Sweden)
- UPPSALA KOMMUN (Sweden)
- Energiforsk AB (Sweden)
- Expektra AB (Sweden)
- RHEINISCH-WESTFAELISCHE TECHNISCHE HOCHSCHULE AACHEN (Germany)
- DIACHEIRISTIS ELLINIKOU DIKTYOU DIANOMIS ELEKTRIKIS ENERGEIAS AE (Greece)
- INDEPENDENT POWER TRANSMISSION OPERATOR SA (Greece)
- Institute of Communication and Computer Systems (Greece)
- Vlaamse Instelling Voor Technologisch Onderzoek N.V. (Belgium)
- N-SIDE (Belgium)
- Engineering - Ingegneria Informatica SPA (Italy)
- OFFIS EV (Germany)
- European Distribution Systems Operators For Smart Grids AISBL (Belgium)
- ETRA INVESTIGACION Y DESARROLLO SA (Spain)

## Project Description

**Context.** The pan-European power system is experiencing a major and profound change as a result of the massive integration of Renewable Energy Sources (RES) and the increasing role of consumers as active participants under various forms (e.g. self-generation, energy efficiency or demand response). The shift of generation is multifold: generation is moved from conventional sources connected to the transmission grid towards the distribution grid thereby becoming more dispersed, less predictable and less dispatchable. All these aspects require an additional change to make both generation and consumption more flexible. This is leading to an evolved role of the end-consumer and the emergence of new actors as market participants (e.g. storage, aggregators, virtual power plant).

**Scope.** CoordiNet aims to demonstrate how DSOs and TSOs, by acting in a coordinated manner, can provide favourable cooperation conditions to all actors while removing barriers to participation for customers and small market players connected to distribution networks. CoordiNet also develops new mechanisms, which are more suitable for real time operations, in order to define requirements for the development of standard European platforms. The proposed CoordiNet mechanisms is tested at three large-scale demonstration projects across 10 different locations spread out Spain, Sweden and Greece. They apply different coordination schemes and test the complete set of products for grid services defined within the project.




**Technical description and implementation.** The CoordiNet project contribute to, among others a smart, secure and more resilient energy system through demonstrating cost-efficient model(s) for electricity network services that can be scaled up to include networks operated by other TSOs and DSOs, that are replicable across the EU energy system, and provide the foundations for new network codes, particularly on demand-response.

**Impact**. *Replicability:* contribute to a smart, secure and more resilient energy system through demonstrating cost-efficient model(s) for electricity network services. Replicability of the very same standardized products and market platforms tested within the ten demonstration pilots will be assessed and through consultations within the Stakeholders Forum (targeted stakeholders in other geographic areas and though other load, voltage and grid morphology contexts).
The result of this analysis will be a set of rules on how to replicate the proposed solutions at the national level but also in other EU countries, considering their specificities and the overall European framework.

*Socio-economics:* Opening up significant new revenue streams for consumers to provide grid services. The industrial partners (utilities, energy service companies, aggregators and RES providers) benefit from clear market rules and platforms allowing transparency and non-discriminatory access to grid services market.

*Environment:* Increase the share of RES in the electricity system. CoordiNet contributes to the overall GHG emissions reduction of the pan-European power system through increased market integration of RES.

*Market Transformation:* As an innovation action CoordiNet capitalizes some R&I results in terms of lessons learned from previous projects and demonstrations. New knowledge will consist in new market design schemes, new operation protocols and new use of data resulting from operations to draw recommendations and improvement of standards. The project explores new types of interaction between project partners (System Operators - IT industry – academic - market participants). Several tasks also investigates brand new routes. Potential game changer technologies to facilitate consumer participation and reduce transaction costs. New market mechanisms for local services to solve constraints at DSOs networks constitute real test cases for extending current market designs as well as opening the existing markets (at TSO level) to new participants: demand-side resources, energy storage and small agents (tested in the Spanish demonstration).

*Policy:* CoordiNet provides recommendations on market designs and regulations that are the object of consultation by targeted stakeholders. The outputs of the project will support the Clean Energy for all Europeans Package in general, but both the Market Design Directive and the Market Design Regulation will be object of specific recommendations.

**H2020 call: LC-SC3-ES-5-2018-2020 – TSO–DSO–Consumer: Large-scale demonstrations of innovative grid services through demand response, storage and small-scale (RES) generation**

# INTERRFACE

TSO-DSO-Consumer INTERFACE architecture to Provide innovative Grid Services for an efficient power system

**INTERRFACE**

**The INTERRFACE project designs, develops and exploits an Interoperable pan-European Grid Services Architecture (IEGSA) to act as the interface between the power system operators (TSO and DSO) and the customers and allow the coordinated operation of all stakeholders to use and procure common services.**

| From 2019 To 2022 | Project total cost | EU contribution | Website |
|---|---|---|---|
| | 20.9 M€ | 16.8 M€ | www.interrface.eu |

**Technologies and services deployed**

| | |
|---|---|
| Technologies for consumers | ✓ Demand Response |
| Grid technologies | ✓ Network management, monitoring and control tools<br>✓ Micro-grid |
| Large-scale storage technologies | |
| Distributed storage technologies | ✓ Battery |
| Generation technologies | ✓ Micro-generation ✓ PV |
| Market | ✓ Electricity Market ✓ Ancillary Services |

**Project partners' countries**

## Coordinator: EUROPEAN DYNAMICS Luxembourg S.A. (Luxembourg)

### Other partners:

- University of Piraeus Research Center (Greece)
- European Network of Transmission System Operators for Electricity (ENTSO-e) (Belgium)
- EMAX (Belgium)
- Innovative Energy and Information Technologies LTD (Bulgaria)
- EMPOWER IM OY (Finland)
- Software Company Ltd (Bulgaria)
- C&G d.o.o. Ljubljana (Slovenia)
- Cintech (Cyprus)
- REALAIZ DOO (Serbia)
- European University Institute (Italy)
- Ricerca sul Sistema Energetico - RSE SPA (Italy)
- University POLITECHNICA of Bucharest (Romania)
- TECHNICAL UNIVERSITY OF SOFIA (Bulgaria)
- Budapest University of Technology and Economics (Hungary)
- Loyola University of Andalucia (Spain)
- UNIVERSITA POLITECNICA DELLE MARCHE (Italy)
- RHEINISCH-WESTFAELISCHE TECHNISCHE HOCHSCHULE AACHEN (Germany)
- RIGAS TEHNISKA UNIVERSITATE (Latvia)
- Tampere University of Technology (Finland)
- ELERING AS (Estonia)
- AKCIJU SABIEDRIBA AUGSTSPRIEGUMA TIKLS (Latvia)
- FINGRID OYJ (Finland)
- Bulgarian Electricity System Operator EAD (Bulgaria)
- COMPANIA NATIONALA DE TRANSPORT ALENERGIEI ELECTRICE TRANSELECTRICA SA (Romania)
- ELES DOO SISTEMSKI OPERATOR PRENOSNEGA ELEKTROENERGETSKEGA OMREZJA (Slovenia)
- REN - REDE ELECTRICA NACIONAL SA (Portugal)
- EDP DISTRIBUICAO ENERGIA SA (Portugal)
- CEZ DISTRIBUTION BULGARIA AD (Bulgaria)
- Distributie Energie Oltenia SA (Romania)
- ELEKTRO LJUBLJANA PODJETJE ZADISTRIBUCIJO ELEKTRICNE ENERGIJE D.D. (Slovenia)
- ELEKTRILEVI OU (Estonia)
- Elenia Oy (Finland)
- E.ON Hungary (Hungary)
- NKM (Hungary)
- AGENCIJA ZA ENERGIJO (Slovenia)
- ASTEA SPA (Italy)
- Mytilineos (Greece)
- Mig 23 Ltd. (Bulgaria)
- Alteo PLC (Hungary)
- Independent Bulgarian Energy Exchange (Bulgaria)

## Project Description

**Context**. With an increasingly RES-dominated future grid, both TSOs and DSOs are expected to face similar problems and challenges in grid operation and the collaboration between these operators is crucial. Digitalisation is a key driver for coordination and active system management in the electricity grid, enabling TSOs and DSOs to optimise the use of distributed resources to ensure a cost-effective and secure supply of electricity for all customers. The measures encourage procurement of services at both the transmission and distribution level, recognizing that this will enable more efficient and effective network management, will increase the level of demand response and will increase the capacity of renewable generation that is connected to the European electricity network. TSOs and DSOs must now define the services they want to procure in collaboration with market participants and must set up ways to procure them in a coordinated manner.

**Scope.** The INTERRFACE project demonstrates the added value of sharing data among all participants in the electricity system value chain (customers, grids, market), from local, regional to EU level. Also, it enables TSOs, DSOs and customers to coordinate their efforts to maximise the potential of distributed energy resources (DERs), demand aggregators and grid assets, to procure energy services in a cost-efficient way and create consumer benefits. It therefore facilitates renewable energy integration and demonstrates global leadership by the EU electricity sector in a way that is cost effective and secure. It also simulates an integrated wholesale and retail market at local and global levels, engaging consumers/prosumers to exploit the DERs capacity and channel it into the common EU electricity market. INTERRFACE demonstrates services for congestion management and local flexibility in the network, supporting the integration of new and existing distributed generation projects.

**Technical description and implementation.** A range of state-of-the-art ICT technologies and control improvements will be exploited to enhance the interconnection among system operators and customers. Digital tools based on blockchains and big data management will provide new opportunities for electricity market. The INTERRFACE project designs, develops and exploits an Interoperable pan-European Grid Services Architecture (IEGSA) to act as the interface between the power system (TSO and DSO) and the customers and allow the seamless and coordinated operation of all stakeholders to use and procure common services. INTERRFACE incorporates a design phase, providing the design of new services, market and INTERRFACE system architecture design, based on customers, grid, and market participants' perspective, as well as a demonstration phase, including the elaboration of well-designed demonstrations, in three discrete pillars: (a) Congestion management and balancing issues, (b) Peer to peer transactions, and (c) Integrated retail and wholesale market. The project provides an architecture that can integrate the main tools and data for TSOs, DSOs, consumers, power exchanges and market participants, and enables communication between different data hubs and market participants, facilitating market integration.

**Impact**. *Replicability/Scalability*: Solutions are replicable across the EU energy system and architecture is interoperable –based on a plug' n' play concept that enables inclusion of new actors and platforms- across borders and is suitable for deployment in energy systems throughout Europe. It decreases the cost to deliver renewable energy projects and flexibility services.

*Socio-economics:* INTERRFACE assists national markets in acquiring a pan-European monitoring framework that ensures integrity and transparency at the European level. The project ensures that the EU electricity network operates within a wholesale market, providing consumers with competitive prices and integrating renewable sources, upgrading at the same time consumers' position within the value chain and constituting them active market participants.

*Environment*: The project facilitates the increased integration of renewables into the European electricity mix. This increase in RES would lead toward the reduction of CO2 and other greenhouse gases emissions. It would also reinforce the preservation of natural resources. This increase in RES will lead toward the reduction of $CO_2$ and other greenhouse gases emissions.

*Market Transformation:* The coupling of the retail and wholesale markets also creates revenue visibility that does not exist in today's electricity market. This drives price signals, creating much stronger commercial incentives for flexibility service providers to participate in the market.

*Policy*: INTERRFACE provides policy recommendations to TSOs, DSOs, Market Operators and other actors of the energy value chain.

# Physical Demonstrations' sites

The table below[3] provides information about the physical demonstrations' sites (i.e. possibility to be physically visited). Please contact the BRIDGE support team for more information.

| Projects | Name of the Demonstration | Country | City |
|---|---|---|---|
| **LCE-07-2014 - Distribution grid and retail market** | | | |
| Flex4Grid | Flex4Grid – Slovenian pilot | Slovenia | Celje |
| **LCE-08-2014 - Local / small-scale storage** | | | |
| RealValue | RealValue Germany | Germany | Mannheim |
| SENSIBLE | Nuremberg Demonstrator Site | Germany | Nuremberg |
| SENSIBLE | Évora Demonstrator Site | Portugal | Évora |
| SENSIBLE | Nottingham Demonstrator Site | United Kingdom | Nottingham |
| STORY | Industrial site demonstration | Belgium | Olen |
| STORY | Residential microgrid | Belgium | Oud-Heverlee |
| STORY | Neighbourhood CAES | Northern-Ireland | Lecale |
| STORY | Village battery | Slovenia | Suha |
| STORY | Industrial building battery | Spain | Marcilla |
| TILOS | Tilos Hybrid Power Station with local scale battery storage of 2.88MWh | Greece | Tilos island |
| TILOS | DSM Platform (smart meters & DSM panels in the local residential and tertiary sector, including also water pumping stations) | Greece | Tilos island |
| TILOS | High (Island) Level Energy Management Centre coordinating all microgrid assets | Greece | Tilos island |
| TILOS | Solar-based EV charging station | Greece | Tilos island |
| TILOS | DSM platform (controllable boilers in local residences and hotels) | Greece | Tilos island |
| **LCE-05-2015 - Innovation and technologies for the deployment of meshed off-shore grids** | | | |
| PROMOTION | HVDC MMC test bench demo | Germany | Aachen |
| PROMOTION | HVDC circuit breaker demo | Netherlands | Arnhem |
| PROMOTION | HVDC gas insulated systems demo | Netherlands | Arnhem |
| PROMOTION | HVDC gas insulated systems demo | Netherlands | Delft |
| PROMOTION | HVDC gas insulated systems demo | France | Lyon |
| **LCE-06-2015 - Transmission grid and wholesale market** | | | |
| MIGRATE | MIGRATE WP3 : full Power Electronic grid. | France | Lille |
| **LCE-09-2015 - Large scale energy storage** | | | |
| STORE&GO | Power-to-gas plant | Italy | Troia |
| STORE&GO | Power-to-gas plant | Switzerland | Solothurn |
| **LCE-02-2016 - Demonstration of smart grid, storage and system integration technologies with increasing share of renewables: distribution system** | | | |
| GOFLEX | University of Cyprus campus and dispersed prosumers within Cyprus | Cyprus | Nicosia |

[3] Non-exhaustive list

| Projects | Name of the Demonstration | Country | City |
|---|---|---|---|
| GOFLEX | German flexibility demo | Germany | Wunsiedel |
| GOFLEX | Swiss flexibility demo | Switzerland | Sion |
| InteGrid | From smart grid to disruptive business models | Portugal | Several Sites around Lisbon |
| InteGrid | Self-sustainability facilitation | Slovenia | Ljjubljana |
| InteGrid | Consumer engagement towards sustainability | Sweden | Stockholm |
| inteGRIDy | Coordinated DR and DSM at academic campus and households with RES and CHP | Cyprus | Nicosia |
| inteGRIDy | Novel Demand Response & Virtual Energy Storage Schemes | France | St. Jean |
| inteGRIDy | Optimum Distributed Control of RES-enabled Islanded Grids Local Storage | Greece | Xanthi |
| inteGRIDy | Flexible DR at Residential and Tertiary building with Local Storage | Greece | Thessaloniki |
| inteGRIDy | Combining Smarter Decentralized MV/LV Automation with Local Coordinated DER-DSO Operation for improving Grid Optimization | Italy | Teni |
| inteGRIDy | Advanced DG Monitoring Power Flows Forecasting & Topology Optimization | Italy | San Severino Marche |
| inteGRIDy | DR in Industrial Buildings with PV powered Microgrid & Energy Storage | Portugal | Lisboa |
| inteGRIDy | Intelligent Energy Demand and Supply Matching feat. innovative simulation & command-control for energy grids | Romania | Ploiesti |
| inteGRIDy | Smart Grid Integration, self-consumption & enlarged RES penetration factor | Spain | Barcelona |
| inteGRIDy | Smart Grid feat. fast Charging EV Facilities, Demand Side Response & Energy Storage | United Kingdom | Isle of Wight |
| InterFlex | Demo 2 | Czech Republic | Various sites in Czech Republic |
| InterFlex | Demo 1 - Nice Smart Valley: Islanding, storage, local flex market | France | Metropolitan area of Nice |
| InterFlex | Demo 3 - Local flex activations : the Smart Grid Hub | Germany | Lüneburg, Salzgitter |
| InterFlex | Demo 4A Sector coupling | Sweden | Malmö |
| InterFlex | Demo 4B Islanding - Local energy community | Sweden | Simris |
| InterFlex | Demo 5 Local flex market - EV integration | The Netherlands | Eindhoven |
| INVADE | Pilot in in Bulgaria | Bulgaria | Varna/Albena (BG) |
| INVADE | Pilot in in Germany | Germany | Freiburg (DE) |
| INVADE | Pilot in Norway | Norway | Stavanger (NO) |
| INVADE | Pilot in in Spain | Spain | Granollers |
| WiseGRID | Ecopower | Belgium | Ghent |
| WiseGRID | Kythnos | Greece | Kythnos Island |
| WiseGRID | Mesogia | Greece | East Attica Region |
| WiseGRID | ASM Terni | Italy | Terni |
| WiseGRID | Cooperativa de Crevillent | Spain | Crevillent |
| **LCE-04-2017 - Demonstration of system integration with smart transmission grid and storage technologies with increasing share of renewables** | | | |
| EU-SysFlex | Coordination of cross-border and cross-sector flexibilities | Estonia | Tallin |
| EU-SysFlex | Coordination of flexibilities connected to LV in Distribution Network (DN) | Finland | Helsinki |
| EU-SysFlex | Coordination of flexibilities of multi-resources for multiservices provision | France | Seine-et-Marne |

| Projects | Name of the Demonstration | Country | City |
|---|---|---|---|
| EU-SysFlex | Coordination of flexibilities connected to HV in DN | Germany | Leipzig |
| EU-SysFlex | Coordination of flexibilities connected to MV in DN | Italy | Emilia-Romagna |
| EU-SysFlex | Coordination of flexibilities connected to HV in Transmission Network | Portugal | Venda Nova |
| FLEXITRANSTORE | Active Substation Controller with storage integration at the TSO/DSO interface | Cyprus | Athienou Cyprus Island |
| **LC-SC3-ES-3-2018-2020 - Integrated local energy systems (Energy islands)** | | | |
| COMPILE | Luče | Slovenia | Luče |
| COMPILE | Križevci | Croatia | Križevci |
| COMPILE | Crevillent | Spain | Crevillent |
| COMPILE | Rafina | Greece | Rafina |
| COMPILE | Lisbon | Portugal | Lisbon |
| E-LAND | E-LAND Romania | Romania | Targoviste |
| E-LAND | E-LAND Spain | Spain | Huesca |
| E-LAND | E-LAND Norway | Norway | Fredrikstad |
| MERLON | French Pilot Site | France | Maurienne Valley |
| MERLON | Austrian Pilot Site | Austria | Strem |
| MUSE GRIDS | Osimo pilot | Italy | Osimo |
| MUSE GRIDS | Oud-Heverlee pilot | Belgium | Oud-Heverlee |
| **LC-SC3-ES-4-2018-2020 - Decarbonising energy systems of geographical Islands** | | | |
| REACT | Aran Islands | Ireland | Aran Islands |
| REACT | San Pietro island | Italy | San Pietro island |
| REACT | La Gracios island | Spain | La Gracios island |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