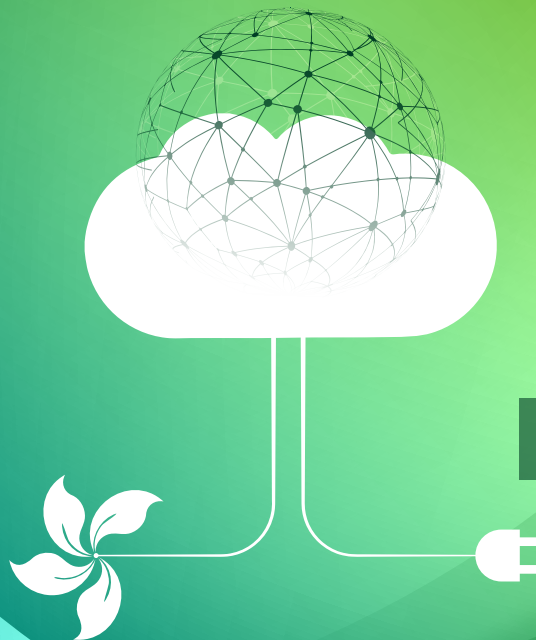




Horizon 2020

# SUPPORTING INNOVATIVE SOLUTIONS FOR **SMART GRIDS AND STORAGE**



PROJECT EXAMPLES

*Innovation  
and Networks  
Executive Agency*

# INEA

Innovation and Networks Executive Agency

***Making implementation happen***

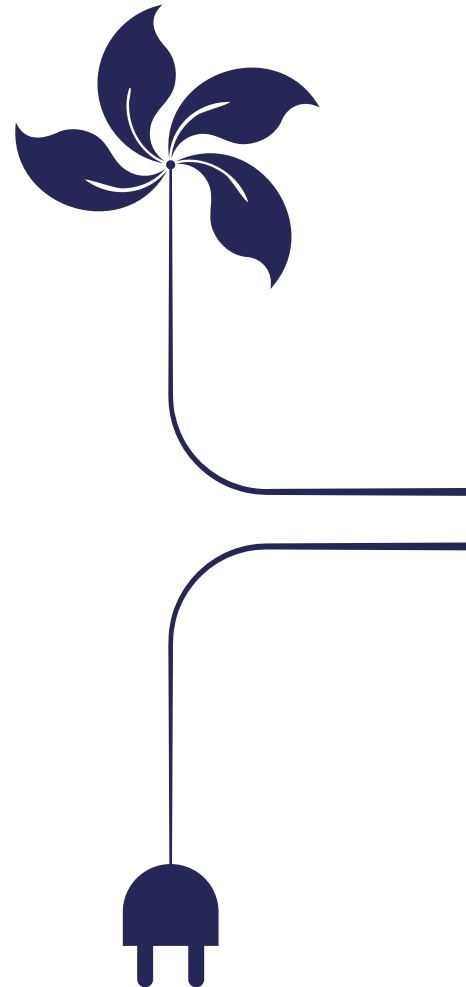
## ***Funding R&I projects for cleaner and more sustainable energy and transport***

INEA, the Innovation and Networks Executive Agency, is responsible for managing parts of the energy and transport research funded by the European Union's Horizon 2020 programme. The Agency supports the European Commission in selecting and funding projects in the areas of secure, clean and efficient energy, and smart, green and integrated transport. Around €6.7 billion of EU funding is available to support projects in these fields from 2014 to 2020, of which €3.8 billion has been earmarked for funding R&I initiatives in the field of energy and €2.9 billion for transport.

## ***The Energy Challenge***

The Energy Challenge is designed to support the transition to a reliable, sustainable and competitive energy system by overcoming a number of challenges, such as increasingly scarce resources, growing energy needs and climate change. It is structured around seven specific objectives and research areas:

- Reducing energy consumption and carbon footprint
- Low-cost, low-carbon electricity supply
- Alternative fuels and mobile energy sources
- A single, smart European electricity grid
- New knowledge and technologies
- Robust decision making and public engagement
- Market uptake of energy and ICT innovation



# SUPPORTING SMART GRIDS AND STORAGE PROJECTS

Electricity is at the centre of the EU energy system. Smarter and better connected distribution and transmission grids, as well as increased storage support the movement towards an integrated energy system.

In its Horizon 2020 energy portfolio, INEA manages **32 smart grids and storage projects**<sup>1</sup>.



**€337 million** in EU funds has been invested in these projects since 2014



**379 organisations** from **31 countries** take part in the projects, including technology providers, R&I bodies, regulated operators, electricity market players, local energy communities and consumers



Electricity markets and ancillary services are **equally** addressed by the projects



The **BRIDGE initiative**<sup>2</sup> unites the Horizon 2020 smart grid and storage projects. It fosters the exchange of information, experience, knowledge and best practices among them



This brochure presents examples of INEA-managed

## SMART GRIDS AND STORAGE PROJECTS

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<sup>1</sup> Data as of 30/06/2017      <sup>2</sup> [www.h2020-bridge.eu](http://www.h2020-bridge.eu)

## *Bringing distributed storage solutions to market*

### **Project full title**

Energy Local Storage Advanced system

### **Topic**

Local / small-scale storage

### **Coordinator**

Bouygues Energies & Services (France)

### **Total funding**

€13,144,250

### **EU contribution**

€9,861,613

### **Duration**

04/2015 – 03/2018

### **Website**

<http://elsa-h2020.eu/>

The project helps integrate distributed storage solutions into the energy system, opening the door for their commercial use.

The ELSA energy storage system is based on second life lithium-ion batteries from the electric vehicle lines Renault Kangoo Z.E. and Nissan LEAF combined with a local ICT-based energy management system. The use of second life batteries not only makes the system more sustainable, but also more affordable and safer due to the fact that the batteries are not dismantled and therefore they comply with the high safety standards required for electric vehicle batteries. The system is able to integrate 12 to 96 kWh modules with each battery managed by a separate controller, which makes it highly scalable and capable of managing batteries of different age and quality.

ELSA proposes energy storage solutions for factories, large offices and residential buildings and districts. During the project, the ELSA system will be tested at six pilot sites in four EU countries to verify if they can provide services such as grid congestion relief, local grid balancing, peak shaving or voltage support and regulation. So far, the system has been successfully installed at three pilot sites and the project has developed a scalable ICT platform for storage and grid services management.



© ELSA



# EMPOWER

**Project full title**

Local Electricity retail Markets for Prosumer smart grid pOWER services

**Topic**

Distribution grid and retail market

**Coordinator**

Schneider Electric Norge AS (Norway)

**Total funding**

€6,120,486

**EU contribution**

€4,429,808

**Duration**

01/2015 – 12/2017

**Website**

<http://empowerh2020.eu/>

## *From energy consumers to active prosumers*

Today, more and more energy consumers are looking for solutions that can make them less dependent on the central energy system, and that would allow them to become active prosumers rather than passive consumers with no say on the energy price. For example, owners of private homes and office buildings invest in PV panels on their rooftops and cooperatives invest in decentralised wind power generators.

EMPOWER is facilitating this transition: it develops a cloud-based ICT platform that enables neighbors to trade electricity. Via the EMPOWER platform, the energy prosumers can also sell flexibility to their local distribution system operators (DSOs) via a new actor, the Smart Energy Service Provider (SESP).

In addition, the project develops a micro-grid containing a fully-fledged power router which makes it possible to operate part of the local grid in the "island mode" in situations with power outages, and then switch the microgrid back to the "connected mode" when the local grid is back to normal.

EMPOWER provides the tools consumers need to take control of their own energy needs, it relieves the central grid, so that more renewable electricity can be fed into the grid, and increases the overall energy security by integrating smart microgrids into the system.



# Flex4Grid

## *Balancing energy production and consumption in the grid*

### **Project full title**

Prosumer Flexibility Services for Smart Grid Management

### **Topic**

Distribution grid and retail market

### **Coordinator**

Teknologian tutkimuskeskus VTT Oy (Finland)

### **Total funding**

€3,147,871

### **EU contribution**

€2,680,253

### **Duration**

01/2015 – 12/2017

### **Website**

<https://www.flex4grid.eu/>

The advent of distributed power sources has given rise to energy prosumers, who not only consume but also generate electrical energy. Energy demand and energy generation by prosumers is, however, volatile and can impact the grid. Flex4Grid proposes a novel system that enables prosumers to better balance energy production and consumption within the grid.

The Flex4Grid system consists of three elements. The Prosumer Flexibility kit consists of smart plugs, a home gateway and a flexibility management app for iOS and Android that enables users to control their appliances in real-time, monitor their daily household consumption and production, receive flexibility management requests from the distribution system operator (DSO), and automate the flexibility management processes. The second element, the Prosumer Cloud, provides services for data and flexibility management, aggregation and analytics and security and privacy provisioning. Finally, the Flexibility Operator Interface tools provide DSOs and other flexibility operators with means to access and manage the flexibilities of their customers, including incentive models such as Critical Peak Pricing, Peak Time Rebate and Demand Bidding.

The Flex4Grid system is currently being evaluated in three large-scale pilots involving distribution networks in Bocholt and Bonn (both in Germany) and in Celje (Slovenia).



© Flex4Grid



# FLEXICIENCY

**Project full title**

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

**Topic**

Distribution grid and retail market

**Coordinator**

e-distribuzione S.p.A. (Italy)

**Total funding**

€19,053,148

**EU contribution**

€13,946,741

**Duration**

02/2015 – 01/2019

**Website**

<http://www.flexiciency-h2020.eu/>

## *European platform for the exchange of metering data and services*

To encourage new players to enter the retail electricity market, it is crucial to provide them with high-quality information about electricity consumption and with ICT tools and services for processing it. Currently, metering data is primarily available to distribution system operators (DSOs) and retailers, but rarely to new actors.

The goal of FLEXICIENCY is to facilitate the deployment of novel services in the electricity retail market thanks to an open EU Market Place platform enabling standardised interactions between all electricity stakeholders. Making data accessible in a non-discriminatory way will trigger the emergence of new markets for energy services, therefore enhancing their competitiveness.

So far, FLEXICIENCY has developed and tested the EU Market Place prototype within the project's consortium and has defined a model for exchanging metering data across Europe. In addition, it has developed a tool to measure the economic potential of new energy services in the European market.

Five demonstrations of the EU Market Place platform and customer services based on data are in the pipeline. They will take place in Austria, France, Italy, Spain and Sweden, bringing together major DSOs, retailers and aggregators, software providers, research organisations and one municipality (City of Malaga) as a large energy consumer.





# FUTUREFLOW

## *Towards the regional integration of ancillary services*

### **Project full title**

Designing eTrading Solutions for Electricity Balancing and Redispatching in Europe

### **Topic**

Transmission grid and wholesale market

### **Coordinator**

ELES d.o.o. (Slovenia)

### **Total funding**

€12,985,234

### **EU contribution**

€12,985,234

### **Duration**

01/2016 – 12/2019

### **Website**

<http://www.futureflow.eu>

Energy consumers and cooperatives, equipped with state-of-the-art devices for renewable energy production, are no longer just ordinary consumers, but can also produce and sell electricity. The advent of new players in the electricity market requires, however, new solutions for balancing and redispatching services and for assuring network security. This is exactly the focus of FutureFlow's research and innovation activities. The project works with four transmission system operators (TSOs) from South-Central Europe – Austria, Hungary, Romania and Slovenia – to deliver a regional integration of balancing markets.

The main task is building and testing a prototype IT system that enables energy consumers and distributed generators to offer flexible balancing and redispatching services to TSOs. The goal is not just to empower new actors in the electricity market, but also to verify if they are actually capable of offering the services on the same quality level as conventional power plants.

FutureFlow develops this novel IT system with a view to better integrate a regional electricity market in South-Central Europe. The main idea is to design cross-border balancing and redispatching mechanisms that would result in 30 to 45 MW of flexible balancing power services to be made available in the control areas of the four TSOs participating in the project.





# NOBEL GRID

## *Developing an energy market benefiting all*

### **Project full title**

New Cost Efficient Business Models for Flexible Smart Grids

### **Topic**

Distribution grid and retail market

### **Coordinator**

ETRA INVESTIGACION Y DESARROLLO SA (Spain)

### **Total funding**

€14,034,360

### **EU contribution**

€11,725,973

### **Duration**

01/2015 – 06/2018

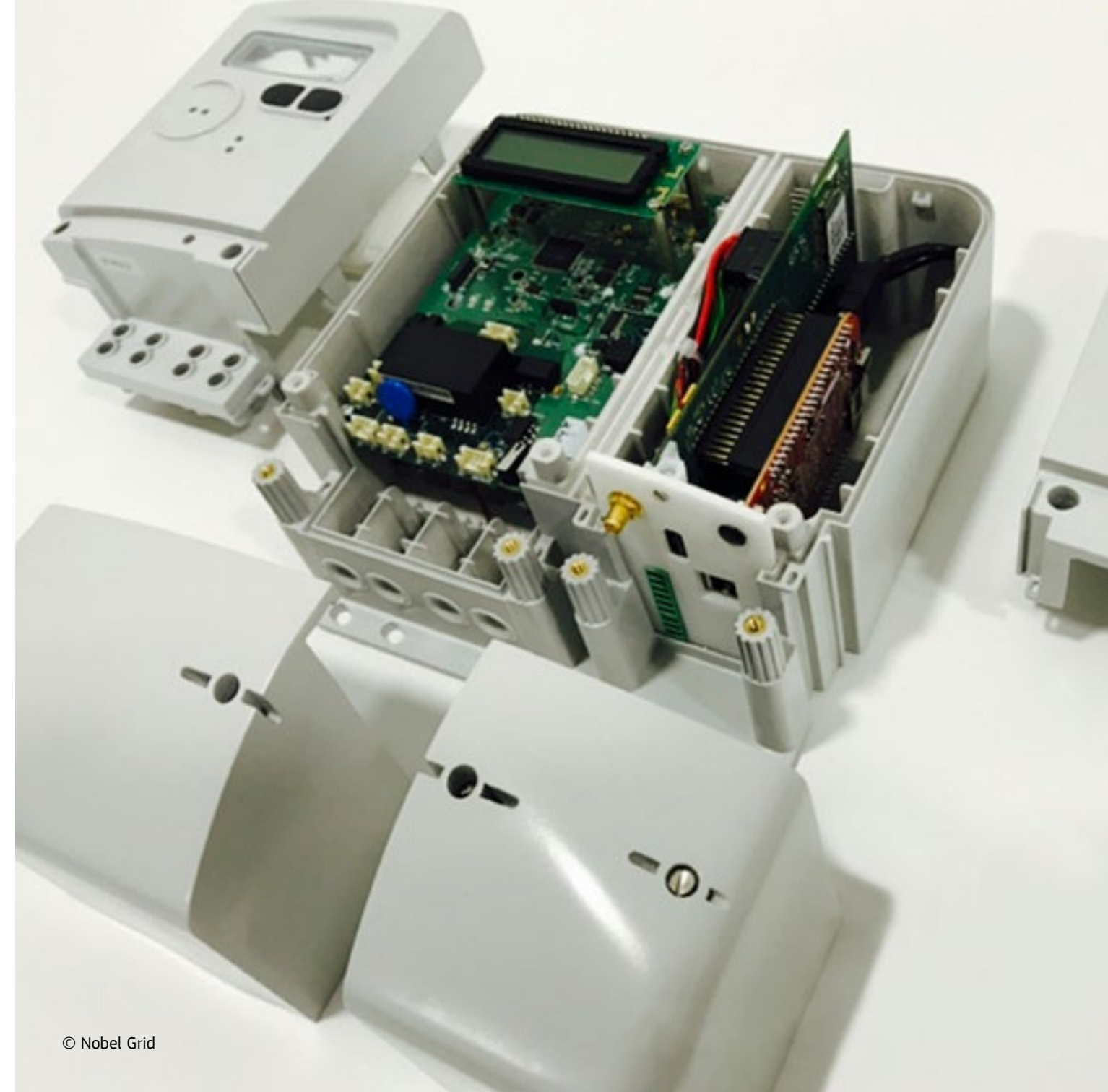
### **Website**

<http://nobelgrid.eu/>

Sharing the benefits of the smart grid in a fair, sustainable and efficient way is a pressing challenge in the European energy sector. NOBEL GRID contributes to achieving an all-win result, giving power and protection to the end-user, facilitating a more competitive internal energy market and helping to address serious social issues of vulnerable consumers and energy poverty.

The project provides 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. It encourages active involvement of energy consumers, at the same time enhancing flexibility of the market through developing new business models and integrating distributed renewable energy production.

In particular, NOBEL GRID designs innovative solutions and tools for distribution system operators (DSOs) to mitigate costs of management, replacement and maintenance of the grid with a very large share of renewable energy. It also proposes new services for all the actors of the distribution grid, including services for next-generation distributed renewable energy integration and active demand-response. In addition, the project develops the Smart Advanced Meter (SAM) to facilitate the emergence of new business models with the active involvement of end-users.



# P2P-SMARTEST

## *New business models for smart grids*

### **Project full title**

Peer-to-Peer Smart Energy  
Distribution Networks

### **Topic**

Distribution grid and retail market

### **Coordinator**

University of Oulu (Finland)

### **Total funding**

€3,866,215

### **EU contribution**

€3,496,142

### **Duration**

01/2015 – 12/2017

### **Website**

<http://www.p2psmartest-h2020.eu/>

Currently, there are few business models in place to encourage the use of distributed energy resources (DER) in the grid. P2P-SmarTest is changing this situation. It investigates and tests an electricity distribution system integrated with advanced ICT, regional markets and innovative business models based on a peer-to-peer (P2P) approach.

The project has already developed a business model framework for smart grid and energy business. For the first time, P2P-SmarTest has proposed a business concept for smart grid and energy, where energy is approached as a service rather than a product. Using this framework, three business models for P2P energy exchange have been developed: a P2P aggregator platform model, a shared network access model for distribution system operators (DSOs) and a micro-grid trader model. The first results are promising. For example, according to a first assessment, the micro-grid trader model can help reduce the energy consumption in a residential community with a moderate proportion of consumers with individual PV systems by 30%, it increases the self-consumption by 10 to 30% and increases the community's self-sufficiency by 20%.

By designing novel business models, P2P-SmarTest opens the door to new markets for advanced grid technologies and system architecture, which can foster European competitiveness and facilitate an open market for energy services.





# REALVALUE

## *Smart electric thermal storage for European homes*

### **Project full title**

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

### **Topic**

Local / small-scale storage

### **Coordinator**

Glen Dimplex Heating & Ventilation Ireland

### **Total funding**

€15,413,331

### **EU contribution**

€11,987,430

### **Duration**

06/2015 – 05/2018

### **Website**

<http://www.realvalueproject.com/>

The energy market in Europe is not yet ready to take advantage of local small-scale energy storage or aggregated demand-side response. More solutions still need to be developed to integrate end-users into the energy system.

RealValue is testing the use of Smart Electric Thermal Storage (SETS) space and water heating devices. Its goal is to bring cost reductions to consumers and increase the use of energy generated from renewable sources.

So far, the project has recruited over 600 domestic and non-domestic properties across Ireland, Germany and Latvia for a trial using SETS. Sophisticated customer support mechanisms and an IT platform have been developed, and a user app has been released allowing remote control of heating system and access to energy usage data.

As a consumer-centric project, RealValue has also gained a wide range of consumer insights from focus groups, surveys and interviews with participants, as well as installers, local authorities and property managers. In the final months of the project these findings will be compiled and published in a Consumer Impact Study. Detailed building, power system and network models are under development, and will be validated using real data from the demonstration.

Feedback from RealValue's demonstrations will contribute to the development of business models and regulatory analysis that will be used to inform EU policy makers.



# SMARTEREMC2

## *Novel ICT tools for an even smarter grid*

**Project full title**

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

**Topic**

Distribution grid and retail market

**Coordinator**

Intracom S.A. Telecom Solutions (Greece)

**Total funding**

€3,751,891

**EU contribution**

€3,072,655

**Duration**

01/2015 – 12/2017

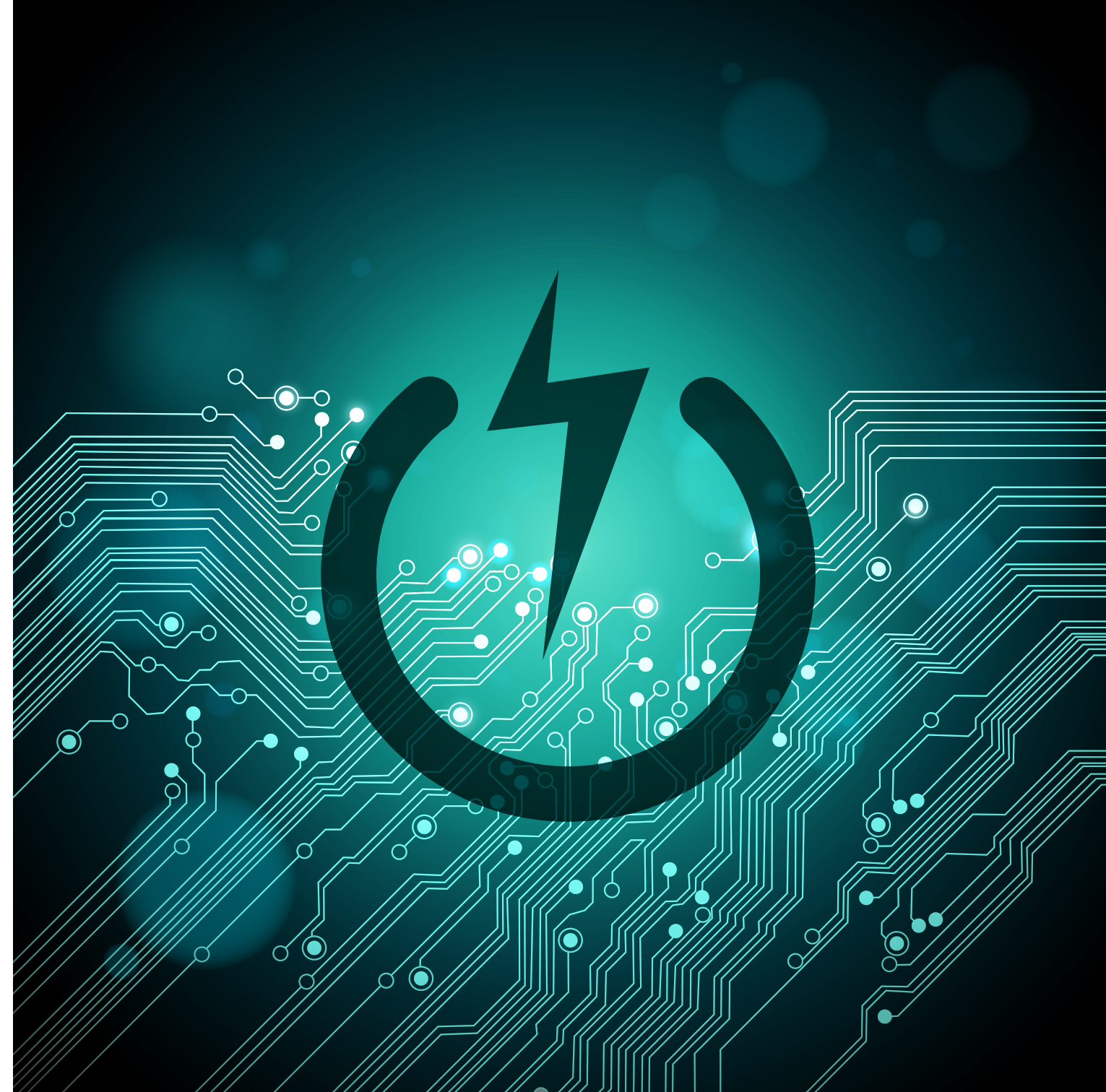
**Website**

<http://www.smarteremc2.eu/>

Power systems undergo massive technological changes due to the ever increasing concerns for environmental and energy sustainability. SmarterEMC2 develops ICT tools that support the integration of consumers in the energy system through demand response services and the integration of renewable energy sources in the grid through virtual power plants. These tools take into account the smart grids architecture model as well as the future structure of the distribution network.

The project focuses entirely on achieving maximum impact. To validate its tools, SmarterEMC2 has planned three pilots and three large-scale lab simulations. The pilots will verify the impact of demand response and virtual power plants services in real-world settings, while the simulations will explore the capability of communication networks to support massive uptake of novel smart grid services.

Three pilots are currently being carried out in Greece, Turkey and Italy. In the first two countries, the project tests the potential of its demand response services, involving around 65 residential customers (Greece) and 430 commercial and industrial customers (Turkey). In Italy, SmarterEMC2 pilots a set of novel ICT tools for the management of low-voltage networks which branch off radially from medium voltage/ low voltage transformation points and directly distribute electric power to residential, commercial and industrial customers.





# SMARTNET

## *Enabling ancillary services from distribution networks*

### Project full title

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

### Topic

Transmission grid and wholesale market

### Coordinator

Ricerca Sul Sistema Energetico (Italy)

### Total funding

€12,657,928

### EU contribution

€12,657,928

### Duration

01/2016 – 12/2018

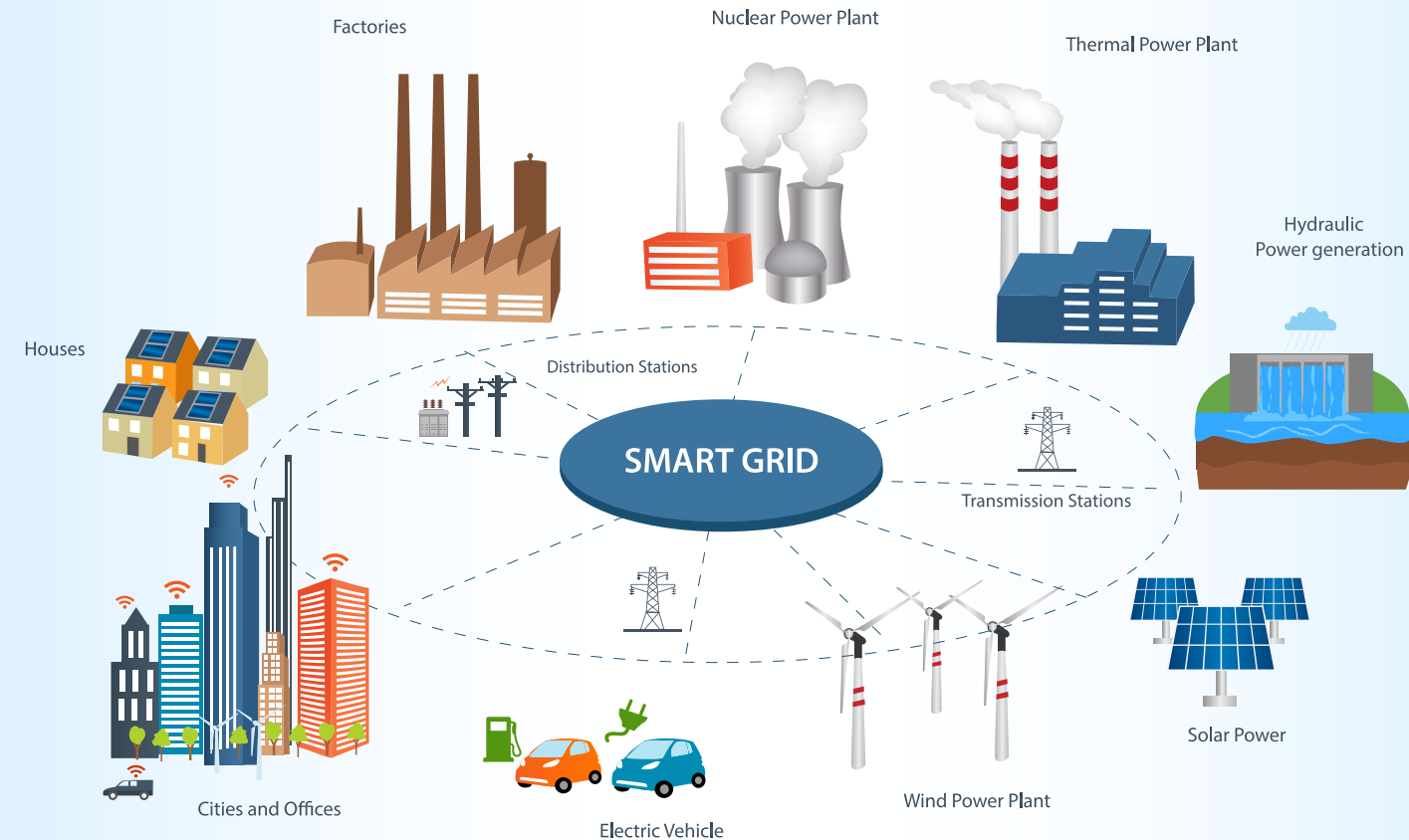
### Website

<http://smartnet-project.eu/>

Integrating large quantities of electricity from renewables is a challenge for the European system, increasing the need for system reserve and calling for a better coordination between transmission system operators (TSOs) and distributed system operators (DSOs).

SmartNet compares different TSO – DSO coordination schemes for system monitoring and acquisition of ancillary services, such as balancing, voltage regulation and congestion management. The project is developing an ad hoc simulation platform to model the physical network (transmission + distribution), the ancillary services market and the aggregation-disaggregation process. Subsequently, the platform will be scaled to a full replica lab, where the performance of real controller devices will be tested.

At the same time, three physical pilots are taking place in Denmark, Italy and Sweden. In Denmark, the project demonstrates the use of price signals to control the set-points of swimming pool heating systems in rental summer houses so that they can provide services to the system. In Italy, SmartNet focuses on the real-time aggregation of monitoring data on distributed energy resources, which is transmitted through the DSO to the TSO. Voltage and power-frequency regulation set-points are elaborated by the TSO and re-transmitted to the DER for actuation. Finally, the Spanish pilot tests how DSOs could use mobile phone base stations to reduce congestion in distribution grids and to help TSOs maintain system balance by fixing an exchange schedule at the TSO-DSO connection point.



# STORE&GO

**Project full title**

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

**Topic**

Large-scale energy storage

**Coordinator**

DVGW - Deutscher Verein des Gas- und Wasserfaches (Germany)

**Total funding**

€27,973,370

**EU contribution**

€17,937,359

**Duration**

03/2016 – 02/2020

**Website**

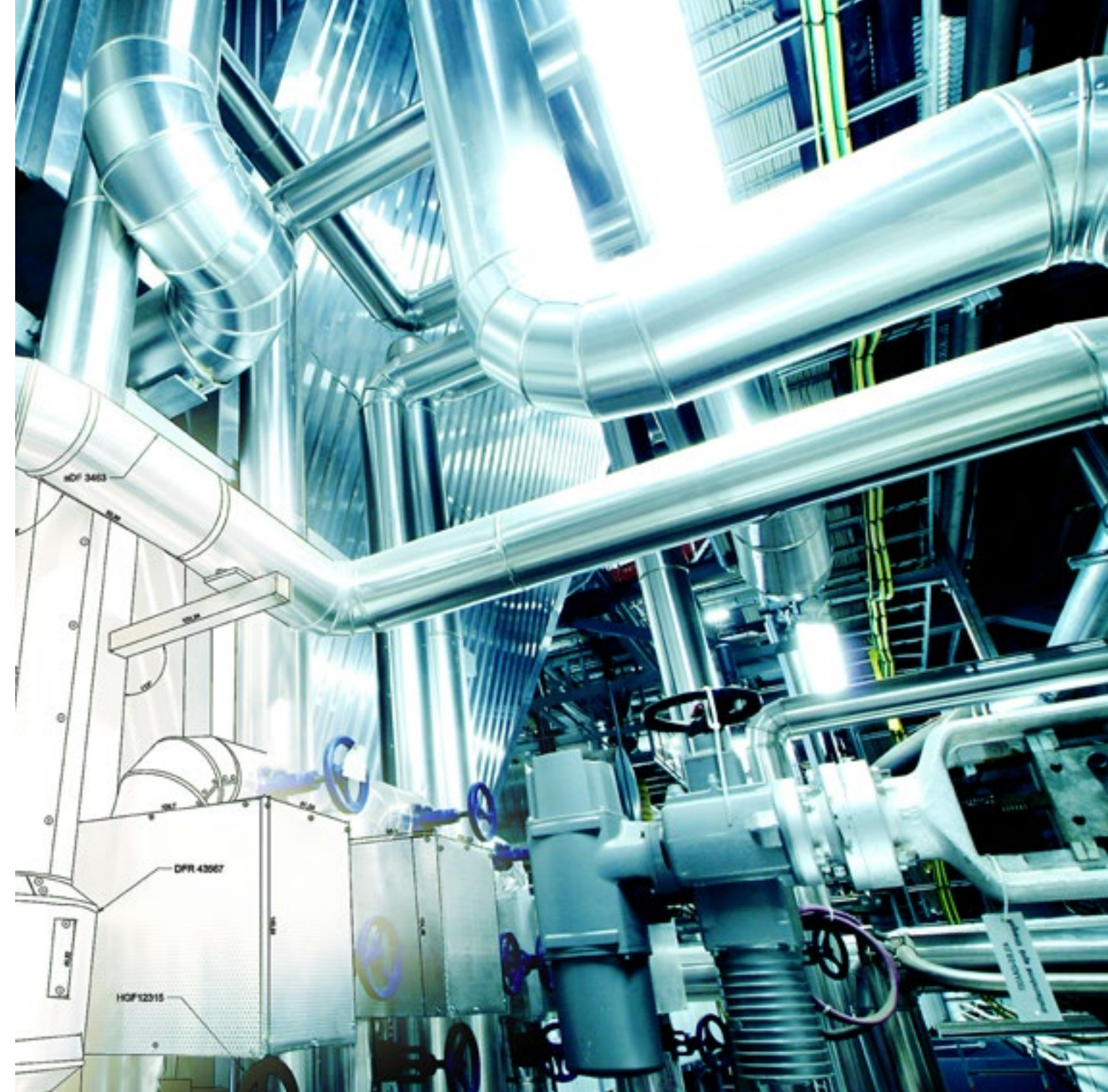
<http://www.storeandgo.info>

## *Power-to-gas technology for smart storage*

To accommodate more renewable electricity in the energy mix, it is necessary to ensure adequate energy storage. One of the ideas is to convert excess electricity produced from renewable energy sources to gas (methane), which can be then stored in the existing natural gas infrastructure, connected to the gas grid, and used for heating or reconversion to electricity.

STORE&GO aims to show the potential of the power-to-gas (P2G) technology by testing three P2G concepts at pilot sites in Germany, Italy and Switzerland. There, the project plans to install three different innovative synthesis plants fully integrated into regular power, gas and heat networks, and operate them for a period of two years. STORE&GO will control the quality of the converted gas to ensure that at least 90% of its content is methane, and work to increase flexibility in the plants' operations. The project aims to achieve high efficiencies by using waste heat, and to decrease capital costs for large plants by more than 15%.

The key objective of the project is to compare and evaluate different P2G technologies, and to analyse the legal and regulatory obstacles. At the same time STORE&GO wants to raise public acceptance and awareness that synthetic methane can help achieve CO<sub>2</sub>-neutral energy economy, and that the existing natural gas infrastructure can be integrated in future energy systems.





# UPGRID

## Project full title

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

## Topic

Distribution grid and retail market

## Coordinator

Iberdrola Distribución Eléctrica S.A. (Spain)

## Total funding

€15,653,828

## EU contribution

€11,937,258

## Duration

01/2015 – 12/2017

## Website

<http://upgrid.eu/>

## *Paving the way to a smart low-voltage grid*

Low-voltage (LV) electricity networks are still managed in an old-fashioned way: the visibility of power and voltage or grid components' status remains limited, the knowledge of connectivity is poor, switches are operated manually and there are few and very limited support tools. UPGRID proposes an open, standardised and integral improvement of the LV grid that can generate profits and provide business opportunities to all the actors involved, including end-users.

The project has developed integrated solutions for the LV grid based on existing technologies, such sound LV network representation and management systems, field crew mobility tools, LV control over the advanced PRIME metering infrastructure, new smart grid devices, and home energy management systems for active demand management. The solutions improve the analytics, monitoring and control and visualisation of the grid, at the same time connecting it to intelligent devices via secure communication channels.

Currently, UPGRID's solutions are being tested in four large demonstrations in Spain, Portugal, Poland and Sweden, involving in total almost 220,000 LV grid customers. Their goal is to verify the technical aspects of the proposed solutions, and to engage with and empower consumers.

If successful, UPGRID will help pave the way to a high-quality, efficient and consumer-oriented smart LV/MV grid.

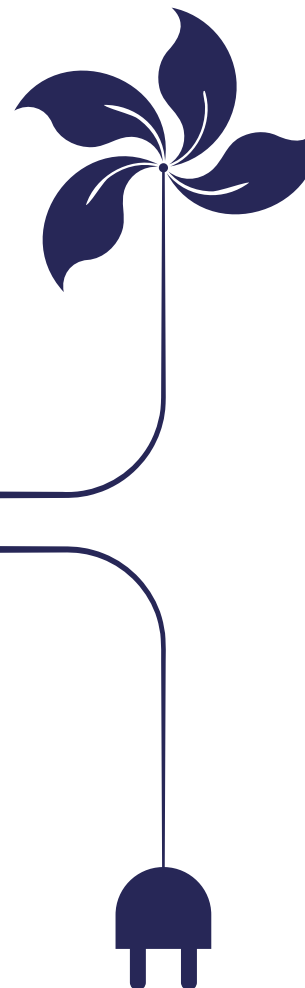


This brochure presented  
twelve examples of  
mature smart grids and storage  
projects from INEA's portfolio.

Factsheets of all the projects,  
currently 32, are available on  
INEA's website  
([www.ec.europa.eu/inea](http://www.ec.europa.eu/inea))  
in the Horizon 2020 section.

More information about the  
smart grids and storage projects,  
including a general overview,  
statistics and detailed factsheet,  
are presented in the brochure  
published recently by the  
Horizon 2020 BRIDGE initiative  
(<http://www.h2020-bridge.eu/>).

Information about all  
Horizon 2020 projects  
can be found on  
the CORDIS platform  
([cordis.europa.eu/](http://cordis.europa.eu/)).



### **MORE INFORMATION**

#### **Energy research**

[ec.europa.eu/programmes/horizon2020/en/area/energy](http://ec.europa.eu/programmes/horizon2020/en/area/energy)

### **APPLY FOR H2020 FUNDS**

#### **Horizon 2020 Participant Portal**

[ec.europa.eu/research/participants/portal](http://ec.europa.eu/research/participants/portal)

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