ETIP SNET

EUROPEAN TECHNOLOGY AND INNOVATION PLATFORM

SMART NETWORKS FOR ENERGY TRANSITION

Presentation of recent and ongoing R&I projects in the scope of the ETIP SNET

August 2018

Presentation of recent and ongoing R&I projects in the scope of the ETIP SNET

INTENSYS4EU Deliverable D3.1: Project monitoring – Part 1

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EXECUTIVE SUMMARY

INTRODUCTION

The European Technology & Innovation Platform Smart Networks for Energy Transition (ETIP SNET) is guiding Research and Innovation (R&I) to support Europe's energy transition[1]. For that purpose, a 10-year R&I roadmap covering 2017-26[2] was adopted in December 2016. It addresses not only smart electricity grids but also interactions with gas and heating and cooling networks and the integration of all flexibility solutions into energy systems, including energy storage and power conversion technologies.

The 10-year R&I roadmap will be updated by 2020 to define the R&I activities planned for the period 2021-2030. In order to do this, a thorough assessment of recent and ongoing R&I projects contributing to the activities planned within the roadmap is to be done. This is the purpose of the "monitoring activity" carried out by the INTENSYS4EU support team[3].

THE MONITORED PROJECTS

The present report contributes to the monitoring activity by analysing and disseminating R&I projects' results lying in the ETIP SNET scope. It has been elaborated following a survey conducted towards 250+ projects, amongst which **121 projects** have contributed: 43 of them are co-funded by FP7 or Horizon 2020 and 78 are funded through other instruments, in general at national or regional level[4].

The budget range for these projects varies from less than 100 k€ to more than 20 M€.

Projects' coordinators are predominantly Research & Innovation stakeholders (research centres, universities, consultants, etc.). Regulated operators (TSOs and DSOs), energy technology providers, ICT and software providers and energy suppliers are also coordinating R&I projects.

Spain and Germany are within the top-3 countries represented in the coordinating organizations of the 121 projects, both for FP7 & H2020 and for other projects. Number 3 is France for FP7 & H2020 projects and Norway for other projects. Stakeholders from Eastern Europe are rarely coordinating FP7 & H2020 projects, with some exceptions from Slovenia, Greece and Cyprus. The situation is more balanced with regards to other projects.

The types of technologies and services tackled by the projects can be grouped into five main categories which are quite equally addressed:

- **Technologies for consumers**, especially to enable demand response;
- **Grid technologies**, including hardware and software solutions to improve network management;
- **Storage and power-to-X[5] technologies**, connected at transmission or distribution level;
- **Power generation technologies**, including dispatchable and non-dispatchable technologies of all sizes;

[1] More information at https://www.etip-snet.eu/about/etip-snet/.
[2] Downloadable at https://www.etip-snet.eu/wp-content/uploads/2017/03/Final_10_Year_ETIP-SNET_RI_Roadmap.pdf.
[3] The INTENSYS4EU project supports ETIP SNET activities and has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731220. More information at https://www.etip-snet.eu/intensys4eu/.
[4] These projects might also benefit from EU funds, for instance from CEF, LIFE, ERDF or ERA-Net.
[5] Power-to-Gas, Power-to-Heat, Power-to-Liquid.

- **Market**: electricity market and ancillary services.

The overall benefits brought by the projects can be grouped into six main categories, the first three being those most often declared by the monitored projects:

- **Improved network management,** corresponding to measures enhancing the transmission and distribution network management, for instance congestion reduction, improvement of grid security and reliability;
- **Decreased carbon emissions,** corresponding to benefits related to decrease of Greenhouse Gas (mainly CO_2) emissions, for instance thanks to the increase of renewable penetration;
- **Efficient business models & market designs,** corresponding to projects working on innovative business models or market designs, aiming at bringing economic benefits to society;
- **Reduced energy bills,** corresponding to benefits linked to the decrease of energy costs for consumers and/or the reduction of energy consumption;
- **Decreased network costs,** corresponding to a reduction in CAPEX and/or OPEX of distribution and/or transmission networks;
- **Improved social acceptance**, corresponding to measures so as to foster the acceptance of technologies by the society.

PROJECTS' KEY EXPLOITABLE RESULTS (KER)

Within the monitoring survey, project representatives have been asked to identify up to 5 project's results which are the most promising for exploitation (Key Exploitable Results or KER). In total, **281 different KER** have been identified.

Different natures of KER have been defined:

- **Methodology**: methodologies for designing new rules, energy scenarios, etc;
- **Software**: development or demonstration of simulation tools, decision making support tools, etc.;
- **Hardware**: development or demonstration of pieces of hardware;
- **Database**: quantified scenarios, results of cost-benefit analyses, etc.;
- **Policy, Regulation, Market**: business models, policy recommendations, etc.

The dominant category of the KER declared by the projects corresponds to software tools (37%), followed by methodologies (23%) and hardware (22%) tools. A significant number of KER are also corresponding to policy, regulation or market recommendations (15%). Only a few correspond to a database (3%).

The majority of KER have a Technology Readiness Level of 7 (system prototype demonstration in operational environment).

In terms of future exploitation of these KER, most of them are expected to be exploited within the next 2 years (42%) or within the next 2 to 5 years (35%). Next steps towards exploitation are in general internal to project consortium (further testing, further demonstration, internal deployment, etc.).

Still, barriers to exploitation have been identified. They are mainly about regulatory and market conditions. Further investment before effective exploitation might also be needed, in general between 100 k€ and 1 M€.

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INTRODUCTION

CONTEXT: ETIP SNET MONITORING ACTIVITY

The European Technology & Innovation Platform Smart Networks for Energy Transition (ETIP SNET) is guiding Research and Innovation (R&I) to support Europe's energy transition[6]. For that purpose, a 10-year R&I roadmap covering 2017-26[7] was adopted in December 2016. It addresses not only smart electricity grids but also interactions with gas and heat networks and the integration of all flexibility solutions into energy systems, including energy storage and power conversion technologies.

The 10-year R&I roadmap will be updated by 2020 to define the R&I activities planned for the period 2021-2030. In order to do this, a thorough assessment of recent and ongoing R&I projects contributing to the activities planned within the roadmap, is to be done. This is the purpose of the "monitoring activity" carried out by the INTENSYS4EU support team[8].

The objective of the monitoring activity is two-fold:

1. To analyse and to disseminate results from R&I projects being in the scope of the ETIP SNET towards the energy community;
2. To measure the coverage degree of each R&I item of the roadmap and decide which R&I activities deserve to be maintained in the next roadmap, and which are sufficiently well covered by results of recent and ongoing projects and could consequently be removed ("gap analysis").

The present report contributes to the first sub-objective of the monitoring activity by analysing and disseminating R&I projects' results lying in the ETIP SNET scope. An upcoming report, to be published during fall 2018, will address the second sub-objective.

METHODOLOGY APPLIED TO ELABORATE THE PRESENT REPORT

Creation of ETIP SNET project database

First, a list of R&I projects in line with the ETIP SNET activities has been created. These R&I projects are either co-funded by the EU Research and Innovation programmes, i.e. FP7[9] or Horizon 2020 (H2020)[10], or are nationally or regionally funded[11]. Sources of information have been:

- The BRIDGE initiative gathering Horizon 2020 projects in the field of Smart Grids and Energy Storage[12];
- Other projects provided by INTENSYS4EU partners (ENTSO-E, EDSO for Smart Grids, EASE and EERA) and by ETIP SNET members. These projects can be EU-funded or not.[13]

In total, the ETIP SNET project database gathers 250+ projects.

[6] More information at https://www.etip-snet.eu/about/etip-snet/.
[7] Downloadable at https://www.etip-snet.eu/wp-content/uploads/2017/03/Final_10_Year_ETIP-SNET_RI_Roadmap.pdf.
[8] The INTENSYS4EU project supports ETIP SNET activities and has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731220. More information at https://www.etip-snet.eu/intensys4eu/.
[9] European Union's Research and Innovation funding programme for 2007-2013: see https://ec.europa.eu/research/fp7/index_en.cfm.
[10] European Union's Research and Innovation funding programme for 2014-2020: see https://ec.europa.eu/programmes/horizon2020/.
[11] These projects might also benefit from EU funds, for instance from CEF, LIFE, ERDF or ERA-Net.
[12] More information at https://www.h2020-bridge.eu/.
[13] Selected non-EU funded projects are also presented at the ETIP SNET regional workshops organised every year. More information at https://www.etip-snet.eu/regional-workshops/.

Gathering of projects' data

A survey has been conducted amongst the 250+ projects in the ETIP SNET database through an online questionnaire.

This questionnaire was structured as follows:

- General information about projects;
- Specific information of projects' Key Exploitable Results (KER);
- Relation between each project's KER and the ETIP SNET R&I roadmap 2017-26: this aspect is not addressed with the present report, it will be detailed in an upcoming report to be published in fall 2018.

A total of 121 projects have participated in the survey and are therefore described in the present report. It is assumed that these projects are a representative sample of the whole database. However, some bias might occur.

STRUCTURE OF THE PRESENT REPORT

The present report is structured as follows:

First, analytics about general project features are presented in order to draw a general picture of the 121 projects that participated in the survey:

- Nature of funding: FP7&H2020 or other;
- Type and location of coordinating entities;
- Technologies and services tackled by the projects;
- Societal benefits brought by the projects.

Then, analytics about projects' Key Exploitable Results (KER) are presented, with a focus on their descriptive and projective features:

- Descriptive features: number and nature of KER, Technology Readiness Level;
- Projective features: expected effective use of KER, time to exploitation, next steps, barriers and investment needed before exploitation.

Finally, individual fiches are made for each project, presenting:

- Synthetic information about the project;
- A focus on their KER emphasizing 3 features:

KER	Name of the KER
 [14]	Solution(s) brought by the KER
	Benefit(s) of the KER
	Final beneficiary(-ies) of the KER

Important disclaimer: The analytics and fiches have been built based on the survey inputs from the different projects as well as on the information provided by official sources (project websites, CORDIS database[15]). For the purpose of this report, only synthetic information has been reported.

[14] Icons made by Freepik, Pause08 and Vectors Market from www.flaticon.com
[15] The CORDIS online database is the primary information source for EU-funded projects: https://cordis.europa.eu/

PART 1 – OVERVIEW OF PROJECTS' MAIN FEATURES

ORIGIN OF THE PROJECTS' FUNDING AND BUDGET

Amongst the 121 projects that have participated in the survey, 40 are co-funded by FP7 or Horizon 2020 and 78 are funded through other funding instruments as illustrated on Figure 1.

Figure 2 shows the different budget ranges both for FP7 & H2020 and other projects.

FP7 & H2020 projects belong to two main budget categories: 1 to 5 M€, and higher than 10 M€, only a few projects having a budget between 5 and 10 M€. This should correspond to Research and Innovation Actions (RIA) on one hand, and Innovation Actions (IA) on the other hand.[16]

Other projects have a more dispersed budget. One third of the projects have a budget below 1 M€. 40% have a budget between 1 and 5 M€. The rest has a budget above 5 M€.

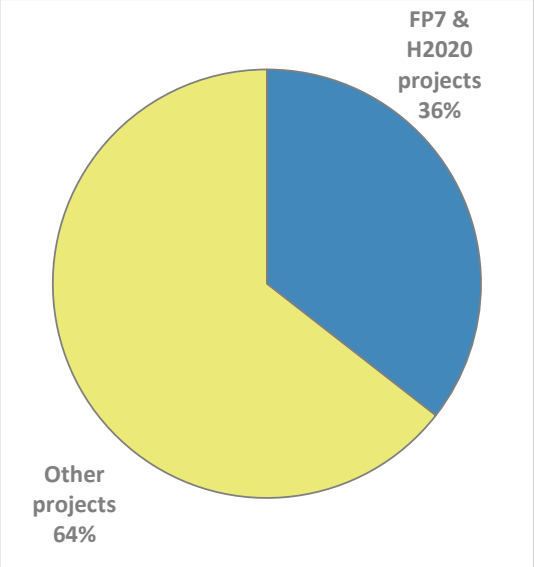

Figure 1. Share of FP7 & H2020 projects and other projects

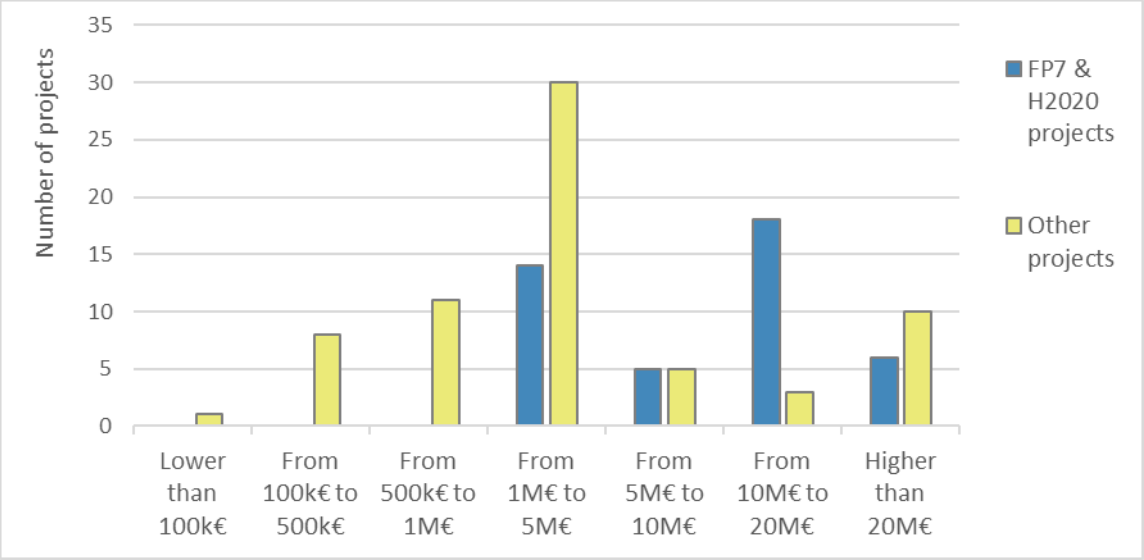

Figure 2. Budget ranges for FP7 & H2020 projects and other projects

[16] See http://ec.europa.eu/research/participants/docs/h2020-funding-guide/grants/applying-for-funding/find-a-call/what-you-need-to-know_en.htm.

TYPE AND LOCATION OF COORDINATING ENTITIES

The following categorization for the projects' coordinating entities has been adopted:

- **Regulated operators** are TSOs and DSOs as defined by the Electricity and Gas Directives;
- **Energy technology providers** gather manufacturers for energy transmission, distribution, generation, conversion and storage;
- **ICT and software providers** include software and telecommunication vendors;
- **Energy suppliers** include energy retailers, energy generators, energy service companies (ESCOs) or aggregators acting in energy markets;
- **Research & Innovation stakeholders** include research centres, universities, think-tanks, consultants and other stakeholders providing R&I-based services.

Figure 3 and Figure 4 display coordinating organizations within the monitored projects, for FP7 & H2020 projects and other projects.

In both cases, Research and Innovation stakeholders are the main category of coordinating entities. ICT and software providers are coordinating mainly FP7 & H2020 projects having participated in the survey, while they are coordinating only a small share of other types of projects. On the contrary, regulated operators are coordinating a large share of non FP7/H2020 projects.

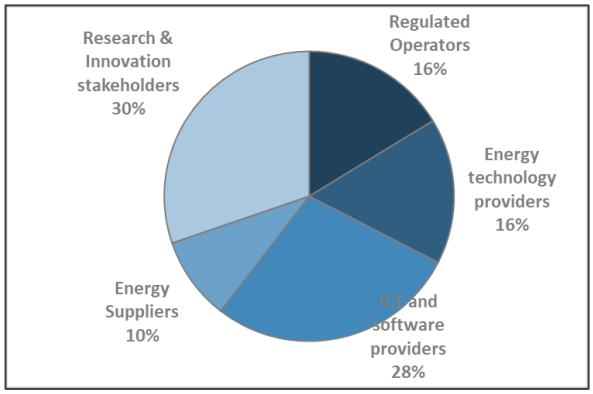

Figure 3. Type of projects' coordinating entities of FP7 & H2020 projects

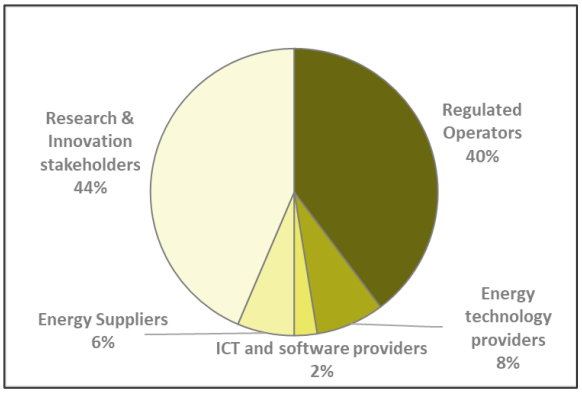

Figure 4. Type of projects' coordinating entities of other projects

The allocation of coordinating organization by countries is illustrated by Figure 5 (FP7 & H2020 projects) and Figure 6 (other projects).

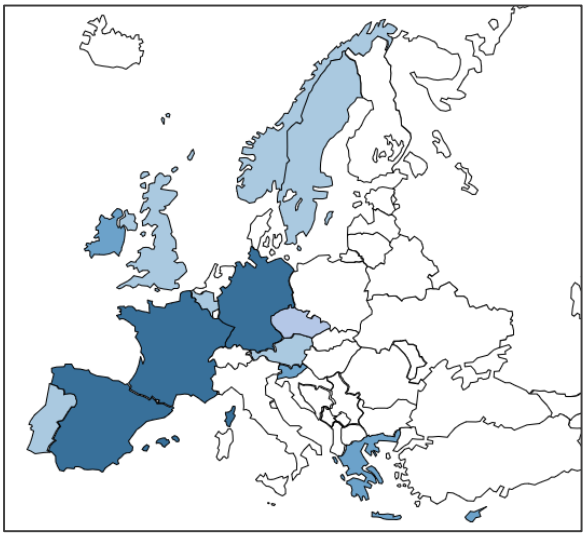

Figure 5. Location of coordinators of FP7 & H2020 projects

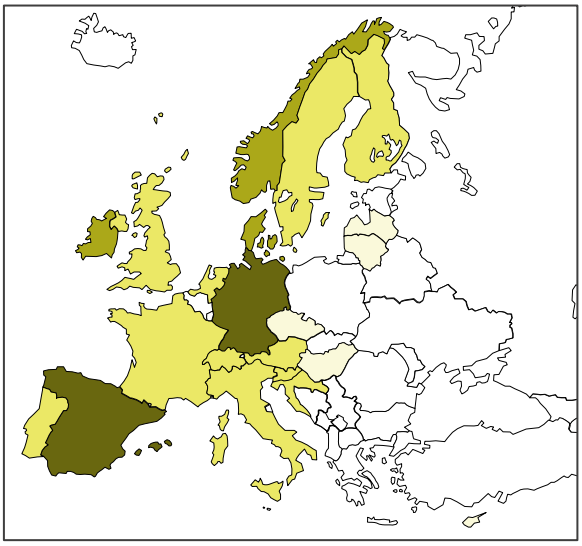

Figure 6. Location of coordinators of other projects

Spain and Germany are within the top-3 countries represented in the coordinating organizations of the 121 projects monitored, both for FP7 & H2020 and for other projects. Number 3 is France for FP7 & H2020 projects and Norway for other projects.

Stakeholders from Eastern Europe are rarely coordinating FP7 & H2020 projects, with some exceptions from Slovenia, Greece and Cyprus. The situation is more balanced with regards to other projects.

TECHNOLOGIES AND SERVICES TACKLED

A broad range of technologies and services are being tested by the projects. Five main categories are considered in the present report:

- **Technologies for consumers**, especially to enable demand response;
- **Grid technologies**, including hardware and software solutions to improve network management;
- **Storage and power-to-X[17] technologies**, connected at transmission or distribution level;
- **Power generation technologies**, including dispatchable and non-dispatchable technologies of all sizes;
- **Market**: electricity market and ancillary services.

Figure 7 and Figure 8 show that the monitored projects are tackling all types of technologies and services in a quite balanced manner. Non-significant differences can be observed between FP7 & H2020 projects and other projects.

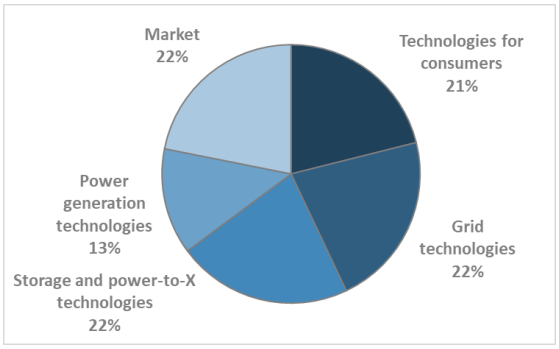

Figure 7. Technologies and services tackled by FP7 & H2020 projects

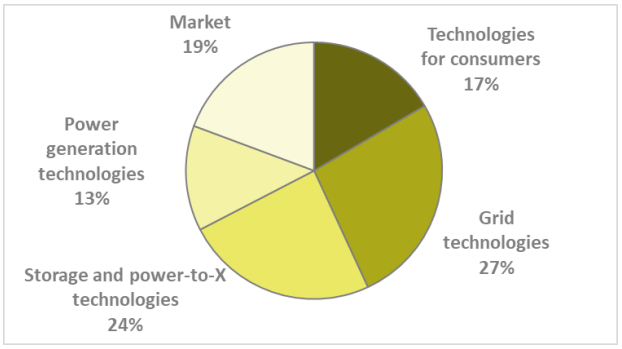

Figure 8. Technologies and services tackled by other projects

[17] Power-to-Gas, Power-to-Heat, Power-to-Liquid.

BENEFITS BROUGHT BY THE PROJECTS

The following benefits brought by the monitored projects have been identified by the INTENSYS4EU support team:

- **Efficient business models & market designs,** corresponding to projects working on innovative business models or market designs, aiming at bringing economic benefits to society;
- **Decreased network costs,** corresponding to a reduction in CAPEX and/or OPEX of distribution and/or transmission networks;
- **Improved network management,** corresponding to measures enhancing the transmission and distribution network management, for instance congestion reduction, improvement of grid security and reliability;
- **Decreased carbon emissions,** corresponding to benefits related to decrease of Greenhouse Gas (mainly CO_2) emissions, for instance thanks to the increase of renewable penetration;
- **Reduced energy bills** corresponding to benefits linked to the decrease of energy costs for consumers and/or the reduction of energy consumption;
- **Improved social acceptance**, corresponding to measures so as to foster the acceptance of technologies by the society.

The allocation of projects' benefits is illustrated by Figure 9[18]. It shows that the top-3 benefits brought by the projects are an improved network management, decreased carbon emissions and efficient business models and market designs.

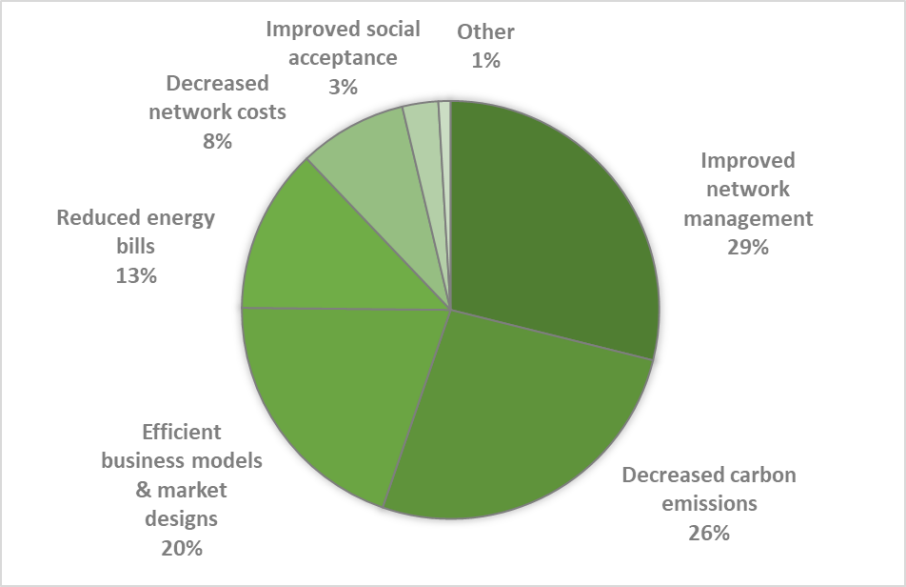

Figure 9. Benefits brought by the projects

[18] This analysis is the result of an assessment performed by INTENSYS4EU team based on the information provided by each project.

PART 2 – OVERVIEW OF PROJECTS' KEY EXPLOITABLE RESULTS (KER)

Within the monitoring survey, project representatives have been asked to identify up to 5 project's results which are the most promising for exploitation (Key Exploitable Results or KER). A total of 281 KER's have been identified by project coordinators.

In this part, some descriptive features of projects' KER are presented as well as projective features i.e. further steps and barriers foreseen before the effective KER exploitation.

DESCRIPTIVE FEATURES OF PROJECTS' KEY EXPLOITABLE RESULTS

Number of Key Exploitable Resultsper project

As illustrated by Figure 10, the 121 projects having participated in the survey, have declared the following number of KER:

- 60 projects have declared to have one KER (50% of the total number of projects);
- 15 projects have declared to have 2 KER;
- 14 projects have declared to have 3 KER;
- 11 projects have declared to have 4 KER;
- And 21 projects have declared to have 5 KER[19].

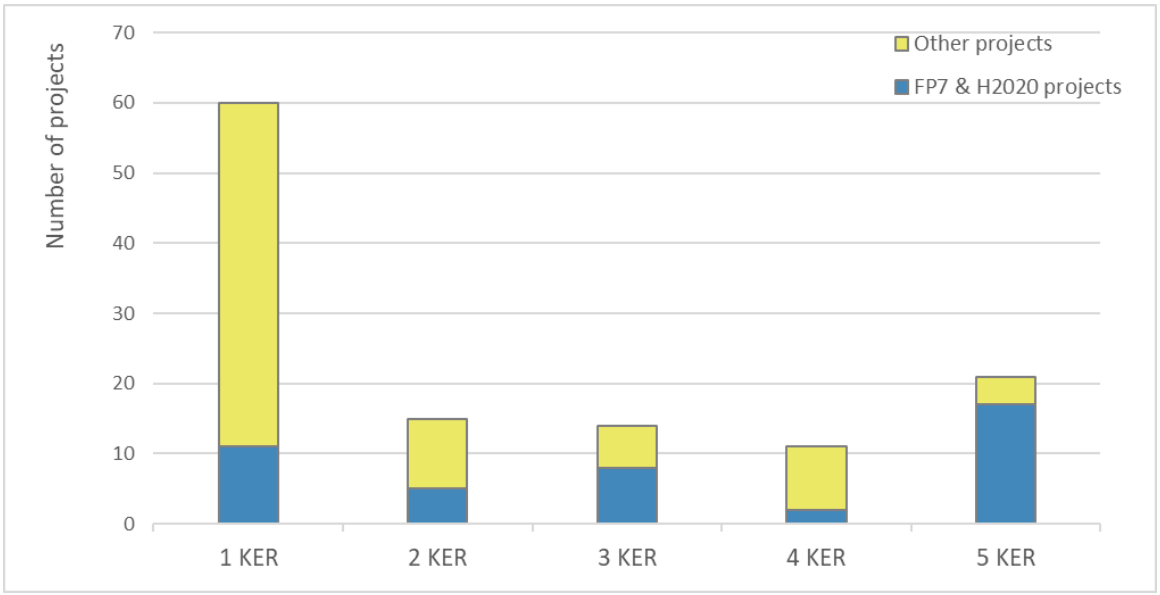

Figure 10. Number of KER by project

The projects declaring 5 KER are mainly FP7 & H2020 projects (80%) when the ones with only one KER are mainly other projects (82%).[20]

A total of **281 different KER** are taken into account in this report, which is considered to be a sufficient sample to develop different tendencies and analyses based on the projects' inputs.

[19] Within the survey, projects were asked to declare up to 5 KER maximum.
[20] "Other projects" are in general nationally or regionally funded. These projects might also benefit from EU funds, for instance from CEF, LIFE, ERDF or ERA-Net.

Nature of Key Exploitable Results

Different natures of results have been defined:

- **Methodology**: methodologies for designing new rules, energy scenarios, etc;
- **Software**: development or demonstration of simulation tools, decision making support tools, etc.;
- **Hardware**: development or demonstration of pieces of hardware;
- **Database**: quantified scenarios, results of cost-benefit analyses, etc.;
- **Policy, Regulation, Market**: business models, policy recommendations, etc.

As shown by Figure 11, the dominant category of the KER declared by the projects corresponds to software tools, followed by methodologies and hardware tools. A significant number of KER are also corresponding to policy, regulation or market recommendations. Only a few correspond to a database.

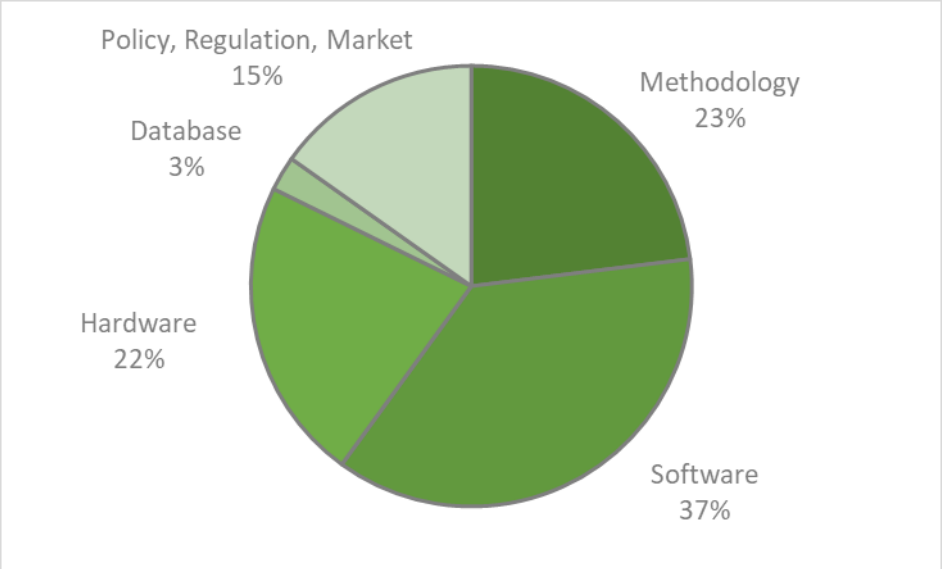

Figure 11. Nature of KER

Output Technology Readiness Level (TRL) of Key Exploitable Results

KER have also been analysed depending on their output TRL:

- TRL 1: basic principles observed;
- TRL 2: technology concept formulated;
- TRL 3: experimental proof of concept;
- TRL 4: technology validated in lab;
- TRL 5: technology validated in relevant environment (industrially relevant environment in the case of key enabling technologies);
- TRL 6: technology demonstrated in relevant environment (industrially relevant environment in the case of key enabling technologies);
- TRL 7: system prototype demonstration in operational environment;
- TRL 8: system complete and qualified;
- TRL 9: actual system proven in operational environment (competitive manufacturing in the case of key enabling technologies).

Figure 12 shows the distribution of KER by their TRL level.

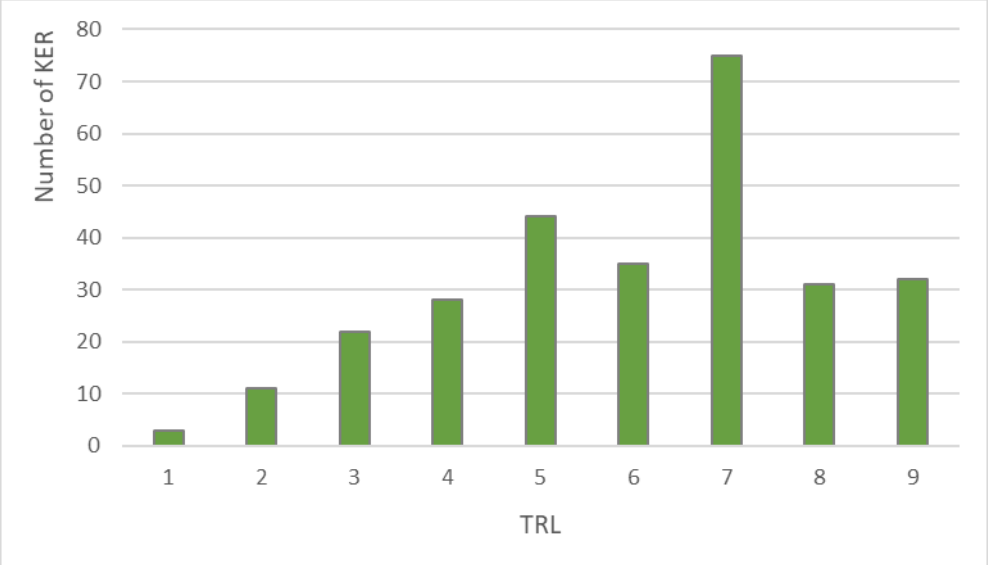

Figure 12. TRL level of KER

The largest number of KER considered in the study have an output TRL 7 (75 KER). Then, around 45 KER have an output TRL 5. The same order of magnitude of KER (around 30 each) are identified with output TRL 4, 6, 8 and 9. Finally, around 40 KER remain with an output TRL 3 or below.

Cross-checking the nature of KER (from previous section) with the output TRL shows that software and hardware tools are the majority within high TRL ranges compared to other types of KER (especially methodologies and policy, regulation or market recommendations).

PROJECTIVE FEATURES OF KEY EXPLOITABLE RESULTS

Expected effective use of Key Exploitable Results

Different (non-exclusive) categories have been defined related to the expected effective use of KER:

- Internal use i.e. by one project consortium partners;
- Collective use i.e. jointly by several project consortium partners;
- Open use (e.g. open source, open data, open access, public domain);
- Commercial use;
- Integration within an educational program.

Figure 13 shows the allocation of the expected effective use for the KER studied.

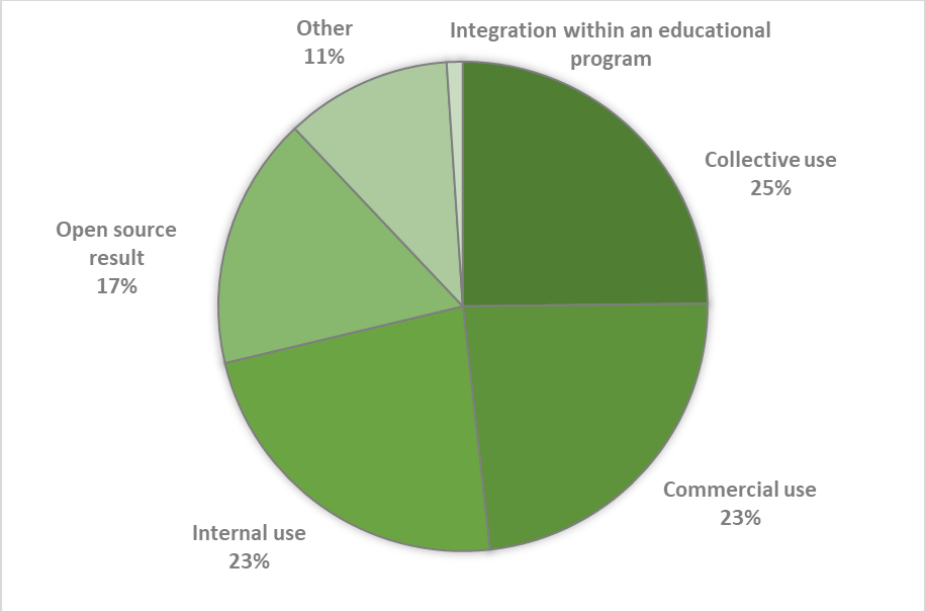

Figure 13. Expected effective use of KER

Next project steps for the exploitation of Key Exploitable Results

Additional next steps necessary towards effective use of results have been provided by the projects. They are gathered within 3 main categories:

- **Next steps internal to project consortium**: such as further testing, further demonstration, internal deployment, etc.;
- **Next steps involving external stakeholders**: such as external certification, external dissemination, etc.;
- **Next steps involving changes in existing framework**: such as regulation, market, etc.

As shown by Figure 14, two thirds of the KER considered have next steps internal to project consortium. Focusing on KER with output TRL 9, it appears that this figure drops at 43%.

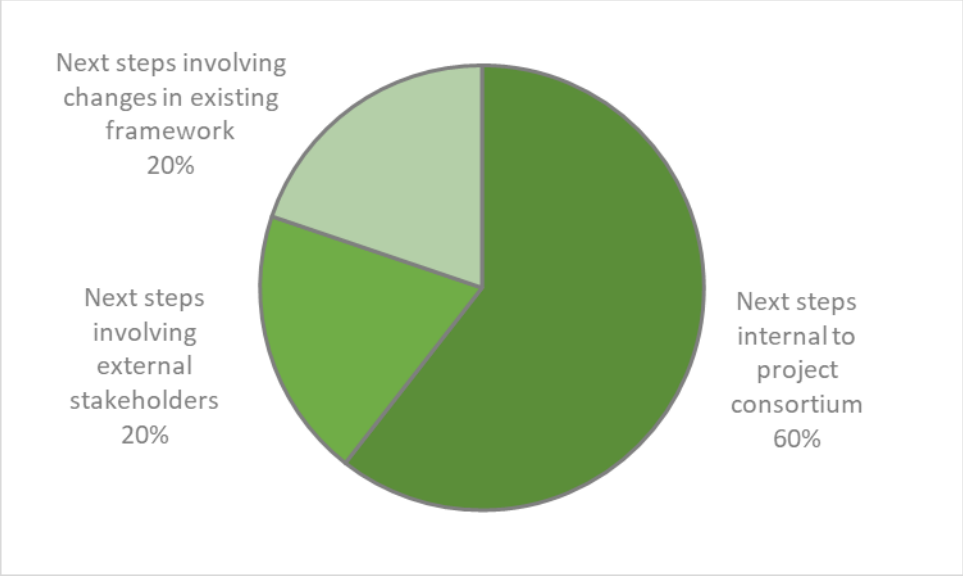

Figure 14. Next steps towards the effective exploitation of KER

Time to exploitation of Key Exploitable Results

"Time to exploitation" includes "time-to-market" for commercial products, and "time to operational use" for non-commercial results (for instance innovations developed within regulated frameworks).

Different timelines have been defined so as to evaluate the time to exploitation for the different KER:

- The KER is already exploited;
- KER exploitation is going to start immediatly;
- KER exploitation will start within less than 2 years;
- KER exploitation will start within less than 5 years;
- KER exploitation will start within less than 10 years;
- KER exploitation will start within more than 10 years;
- time to exploitation is uncertain, it depends on non-controllable conditions.

As shown by Figure 15, most KER are expected to be exploited in less than 2 years (117 KER) or in less that 5 years (99 KER).

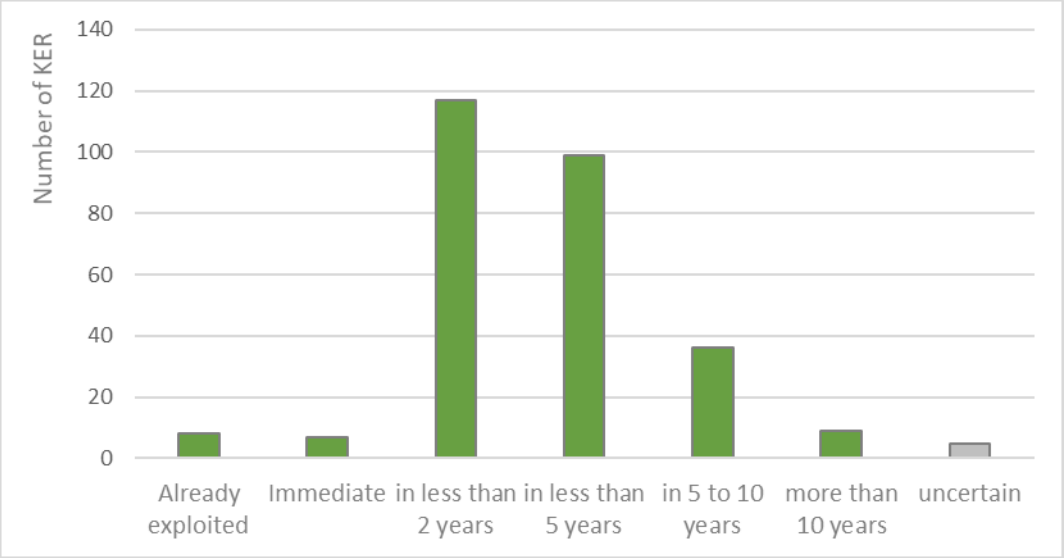

Figure 15. Time to exploitation of KER

Focusing on KER with output TRL 9, it appears that 20% of these will need more than 2 years to be effectively exploited: they mainly correspond to hardware.

Barriers to exploitation of Key Exploitable Results

Projects have been questioned about barriers to KER exploitation. Different barriers have been considered for the analysis:

- Inadequate regulations;
- Inadequate market conditions;
- Difficulties in scaling-up;
- Further investments needed.

Figure 16 illustrates the main barriers identified to KER exploitation.

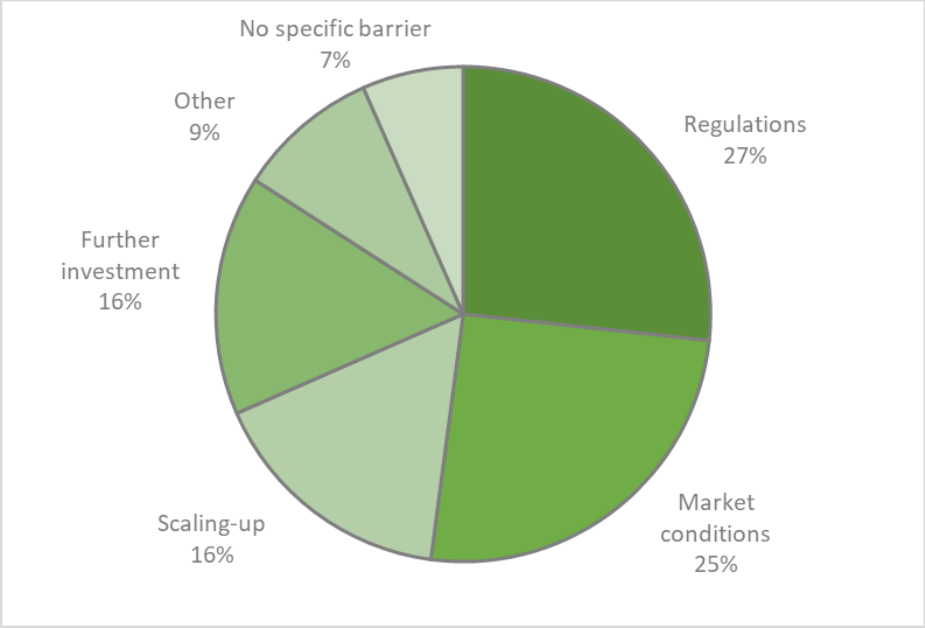

Figure 16. Barriers to exploitation

One quarter of the barriers indicated by the projects are related to **regulatory environment** and another quarter of the barriers are related to **market conditions**. Then, equally displayed, **scaling up** and **further investments** barriers are indicated. The “other” field corresponds for instance to barriers related to:

- Flexibility in power generation not being valued enough;
- Very complex technical processes or specific technologies.

For 7% of KER, no specific barriers have been identified for the exploitation of results.

Focusing on output TRL 9, the main barriers are related to regulations and market conditions.

Investment needed before exploitation of Key Exploitable Results

Regarding the additional investment that might be needed before effective exploitation of KER, projects have been asked to provide the range of such investment, as illustrated by Figure 17.

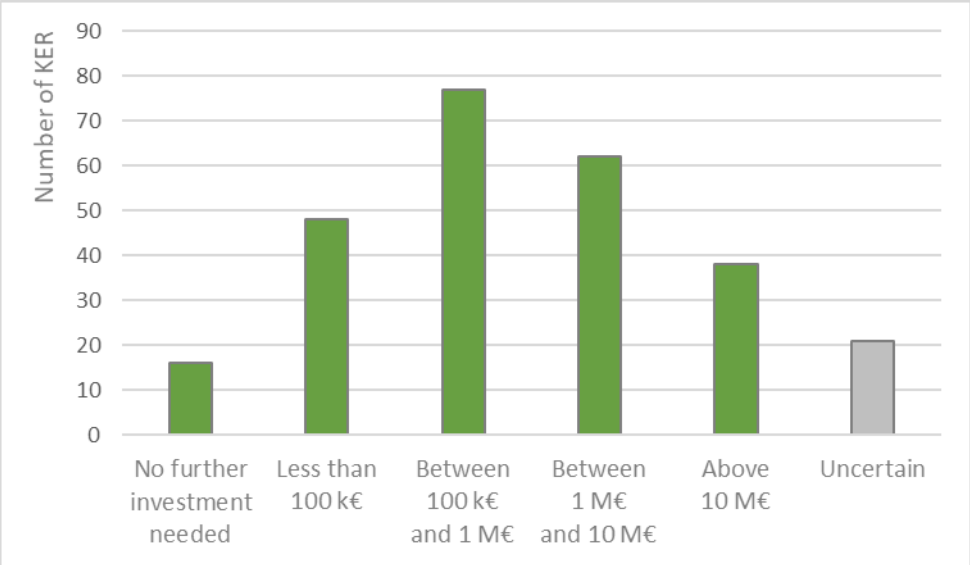

Figure 17. Investment needed before exploitation of KER

Most KER need a significant investment before achieving exploitation.

Even KER with output TRL 9 need significant additional investment before effective exploitation. More than one third of KER with TRL 9 even need an additional investment of 1 M€ or more. This is consistent with the previous observation about hardware and software tools being the majority within TRL 9 KER: investment in hardware and software development is in general higher than in methodologies or policy research.

PART 3 – INDIVIDUAL PROJECT SHEETS

In this part, individual sheets are presented for each of the 121 projects having participated in the survey.

First, FP7 and H2020 projects are presented in alphabetical order; these projects sheets have a blue headline as follows:

FP7 & H2020 PROJECTS

Then, other projects are ordered according to the country of the coordinating organisation, and are presented with the following yellow banner:

OTHER PROJECTS

Within each project sheet, the following information is presented:

- Project acronym, long name (if relevant) and logo (if existing),
- A box explaining the project's main objective,
- A table presenting:
  - The project's start and end years;
  - The project's total costs;
  - The project website;
  - The country of the coordinating organisation;
  - The name of the coordinating organisation;
- Another table presenting:
  - The type of technologies and/or services tackled by the project:

Technologies for consumers, especially to enable demand response;

Grid technologies, including hardware and software solutions to improve network management;

Storage and Power-to-X technologies, connected at transmission or distribution level;

Power generation technologies, including dispatchable and non-dispatchable technologies of all sizes;

Market: electricity market and ancillary services.

  - The number of partners and number of countries involved;
- A last table presenting for projects' Key Exploitable Results (KER):

	Solution(s) brought by the KER
	Benefits of the KER
	Final beneficiaries of the KER

FP7 & H2020 PROJECTS

ANYPLACE

Adaptable Platform for Active Services Exchange

Development of a modular energy management system capable of monitoring and controlling local devices according to the preferences of end-users

Years	Project total cost	Website	Coordinator's country	Coordinator
2015-2017	3 M€	http://www.anyplace2020.org/	Portugal	INESC TEC

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS, GRID, STORAGE & POWER-TO-X, POWER GENERATION, MARKET	8	4

KER	AnyPLACE Energy Management Platform	Smart Meter (SM) Integration	Smart Electric Water Heating Solution	Energy Optimization Software	Community participation in energy management
	Automated energy management solution	Capability of creating SMs compatible with Home Energy Management System (HEMS)	Creation and commercialization of smart thermal appliances	Energy modelling and optimized management for households and buildings	Community participation in energy management
	Better energy management in a household	Development of lines of SMs compatible with HEMS	New smart devices compliant with stricter energy efficiency context	Minimisation of the electricity bill and/or maximisation of integration of local generation (e.g. PV)	Increase of energy efficiency in small communities
	User, customer	User, customer, retailer and DSO	User, customer, retailer	User, customer, retailer	User, customer

ARROWHEAD

Efficiency and flexibility at the global scale by means of collaborative automation for five applications: production (manufacturing, process, energy), smart buildings and infrastructures, electro-mobility and virtual market of energy

Years	Project total cost	Website	Coordinator's country	Coordinator
2013-2017	65 M€	http://www.arrowhead.eu	Sweden	LULEA TEKNISKA UNIVERSITET

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS	>70	15

KER	Arrowhead Framework: for engineering and implementation of digitalisation and automation solutions based on standard architectures
	Reduced engineering efforts for the design and implementation of the digitalisation and automation solution.
	Improvements and guarantees regarding: Real time data handling, Data and system security, Automation system engineering, Scalability of automation systems. Reduction of 75 % or more, in the design and engineering efforts for the predicted multi-billion networked devices.
	Value chain of players in the digitalisation and automation business.

FP7 & H2020 PROJECTS

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

Investigation and extension of the potential of large-scale Cryogenic Energy Storage (CES) and application of the stored energy for both cooling and energy generation

Years	Project total cost	Website	Coordinator's country	Coordinator
2016-2019	8.3 M€	http://www.cryohub.eu/	UK	London south bank university lbg

Types of technologies and services tackled	Partners	Countries involved
STORAGE & POWER-TO-X	14	5

KER	CryoHub demonstrator of the LAES system at a refrigerated warehouse/food production facility
	Integration of Renewable Energy Sources into grid
	Greater use of RES
	Grid operators, Equipment suppliers

DREAM

Distributed Renewable resources Exploitation in electric grids through Advanced heterarchical Management

Two aspects considered within the project: a stable and cost-effective integration of distributed renewable energy sources in existing networks, and more involvement of end-users eager to rationalise their energy use from an economic and ecological point of view

Years	Project total cost	Website	Coordinator's country	Coordinator
2013-2016	5.8 M€	https://cordis.europa.eu/project/rcn/109909_en.html	France	Institut Polytechnique de Grenoble

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS MARKET	15	7

KER	Distributed Market Driven Environments	New Distributed Balancing Markets	Novel Grid contingency management system
	Hardware and software modules for: Energy Market Analysis, Key Drivers for intelligent use of Energy, Economic and Business Modelling, Simulation Model for What If Analysis user and producer behaviour	Development of behavioural profiling methods, Integration of grid entities and design of possible aggregated operational configuration mechanisms	Analysis, Methods, Models, Algorithms, Environment requirements and specifications for Grid contingency management.
	Industrial and business application development	Industrial and business application development	Practical investigations in field tests Contribution to political discussions about future adaptations of grid codes
	All energy system stakeholders, society		

FP7 & H2020 PROJECTS

EBADGE

Development of Novel ICT tools for integrated Balancing Market Enabling Aggregated Demand Response and Distributed Generation Capacity

Optimal pan-European Intelligent Balancing mechanism, piloted on the borders of Austria, Italy and Slovenia, able to integrate Virtual Power Plant Systems that can assist in the management of the power Transmission & Distribution grids in an optimized, controlled and secure manner

Years	Project total cost	Website	Coordinator's country	Coordinator
2012-2015	4.9 M€	http://www.ebadge-fp7.eu/	Slovenia	TELEKOM SLOVENIJE

Types of technologies and services tackled	Partners	Countries involved
GRID	14	5

KER	Balancing market simulator
	Lowering the price of electricity exchange
	More flexibility, less power loss
	Whole ecosystem

ELSA

Energy Local Storage Advanced system

Adaption and integration of close-to-mature storage technologies and related ICT-based EMS for management and control of local loads, generation and (single or aggregated) real or virtual storage resources in buildings, districts and distribution grids

Years	Project total cost	Website	Coordinator's country	Coordinator
2015-2018	13.1 M€	http://www.elsa-h2020.eu	France	Bouygues Energies & Services

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS, STORAGE & POWER-TO-X, POWER GENERATION, MARKET	10	5

KER	Industrial Storage using second-life EV batteries	Recommendation for regulation changes
	Delay the recycling of EV batteries providing a second use	Change in regulation will allow a wider use of storage
	Low cost storage compared to new batteries. Stabilizing the grid locally. Increasing RES penetration and self consumption	Services profitable for the customers and for the grid.
	User and grid (DSO)	EV Owner, user and grid (DSO)

FP7 & H2020 PROJECTS

EMPOWER

Local Electricity Retail Markets for Prosumer Smart Grid Power Services

Facilitation of micro-generation and active participation of prosumers to exploit the flexibility created for the benefit of all connected to the local grid

Years	Project total cost	Website	Coordinator's country	Coordinator
2015-2017	6.1 M€	http://empowerh2020.eu/	Norway	Schneider Electric Norge AS

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS, GRID, STORAGE & POWER-TO-X, POWER GENERATION, MARKET	14	5

KER	EMPOWER platform	Customized version of the EMPOWER platform	EMPOWER multi-agent system (MAS)	IoT for smart grids	Forecasting system
	Provides an ICT platform for local electricity trading between neighbours	Customized version of the EMPOWER platform for German public utility market & Nordic retailer market	Managing and optimizing multiple loads and feeds in a microgrid or congested local market	Creating and supporting a local energy community for different energy management purposes	System for forecasting loads, feeds and congestion problems
	Increased feed-in of DER into the local grid. Increased flexibility at distributed levels	Increased feed-in of DER into the local grid. Increased flexibility at distributed levels	Increased feed-in of DER into the local grid, increased security of supply for end customers	Support of a local energy community for different energy management purposes	Improves the DSO's ability to forecast loads, feeds and congestion problems in a more precise way
	The end customer in the energy system	The end customer in the energy system	The local municipality of Hvaler and its 4.000 inhabitants	The end customer in the energy system	The local DSOs and their customers

FP7 & H2020 PROJECTS

EU-SYSFLEX

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

Demonstration 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

Years	Project total cost	Website	Coordinator's country	Coordinator
2017-2021	26.5 M€	http://eu-sysflex.com/	Ireland	EirGrid

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS, GRID, STORAGE & POWER-TO-X, POWER GENERATION, MARKET	**34**	**15**

KER	Characterise the technical shortfalls of the EU system	Recommendations for enhancing the market and regulation framework	Demonstration of the capability to provide system services required to integrate high RES
	Two high RES-E scenarios for 2030 (commodity costs, generation, grid, dynamics): tools for studies of the future EU power system, and identification of emerging challenges and solutions.	Mitigation of the technical shortfalls faced in a high RES system and at different stages of its evolution. Three different market modelling approaches providing recommendations on effective market structures for flexible future systems.	Demonstrations of six new sources of flexibility for systems operators Development and testing of eight new ICT tools to facilitate the TSO/DSO interactions and cross border exchanges Trial of four innovative real time control and automation systems to ensure that the flexibility sources can be activated in an accurate and timely fashion Demonstrations in multiple EU states to ensure the methods and results Portfolio optimization tools to support trading and the reliable dispatch of multiple flexibility resources
	Strengthen the capability of beneficiaries to study the future system, identify challenges and solutions	Effective procurement of flexibility services Reduced costs and increased use of renewable generation	Increase the flexibility of the system. Reduce costs. Increase use of renewable generation
	TSOs, technology providers, academia	TSOs and end-users	TSOs and end-users

KER	Tools and procedures for transition from system services to the massive integration of RES	Development of a flexibility roadmap
	Development of a decision support tool to simulate real time operations for testing the compatibility of system services: realistic model of the detailed operation of the Polish and German systems (and neighbours) Development of a single, formalized procedure for performing qualification trials for the procurement, integration and monitoring of new services and technologies	Quantification of the effectiveness of the solutions to address technical shortfalls using indicators: stability, capability for frequency and voltage regulation, ramping and balancing, RES curtailment, network congestion and system costs, RES curtailment, technology revenue Reliability models for three new services Provision of an order of magnitude estimate of the volumes (as a function of costs) that solutions can reach if barriers to scalability and replicability are removed (including ICT and data issues)
	Support TSOs with the transition from system services to the massive integration of RES. Reduce costs and increase use of renewable generation	Remove and overcome the technical, regulatory, communication or system operator issues. Reduce costs and increase use of renewable generation
	TSOs and end-users	TSOs and end-users

FP7 & H2020 PROJECTS

FLEXCOOP

Democratizing energy markets through the introduction of innovative flexibility-based demand response tools and novel business and market models for energy cooperatives

Introduction of an end-to-end Automated Demand Response Optimization Framework allowing energy cooperatives to introduce themselves in energy markets under the role of an aggregator. Equipment of cooperatives with innovative and highly effective tools for the establishment of robust business practices to exploit their microgrids and dynamic VPPs

Years	Project total cost	Website	Coordinator's country	Coordinator
2017-2020	4 M€	http://www.flexcoop.eu/	Germany	Fraunhofer

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS MARKET	14	10

KER	FLEXCoop OSB Smart Home Sensing and Control Device	HYPERTECH's Visual Analytics Platform
	Home gateway (ONEM2M Gateway) compliant with EU standards	Flexibility Forecasting, Segmentation, Classification and Clustering Module
	Comfort and energy savings	Enhanced analytics: energy savings and customized services to customers
	Customer	Customer

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, demonstration of novel energy services in the electricity retail markets, accelerated via an open EU Market Place for B2B interactions developed in the project

Years	Project total cost	Website	Coordinator's country	Coordinator
2015-2019	19.1 M€	www.flexiciency-h2020.eu/	Italy	E-DISTRIBUZIONE SPA

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS GRID STORAGE & POWER-TO-X MARKET	18	10

KER	EU Market Place	Data modelling and transmission protocol based on CIM	Advanced services based on data exchanged
	To catalyze the interactions between the relevant stakeholders of the electric system	CIM standard adapted and extended and requirements for communication at B2B level	Advanced monitoring services, local energy control and flexibility services, based on data exchange
	Open and standardized interactions; cross-country & cross-player access to data and services	Standardization: data exchange facilitation	Higher quality and quantiy of information; active participation for custmer in the energy market
	Energy market players	B2B players	Final customers

FP7 & H2020 PROJECTS

FLEXITRANSTORE

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

flexitranstore

Development of 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)

Years	Project total cost	Website	Coordinator's country	Coordinator
2017-2021	21.7 M€	www.flexitranstore.eu	Belgium	European Dynamics Belgium S.A.

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS GRID STORAGE & POWER-TO-X POWER GENERATION MARKET	**27**	**12**

KER	RES storage integration	FACTS devices for congestion relief	Market platform	Flexible and stable conventional generation	Demand side flexibility at the TSO-DSO border
	Mitigate RES volatility towards a "near-dispatchable" nature	Relieve congestion, exploit remaining grid capacity	Demonstration of an elaborated market platform that remunerates flexibility services through the wholesale market.	Solutions tailored for GT plants to improve stability from low frequency oscillations and provide several services: frequency response capacity, black-start	Controllers and battery storage situated at the TSO-DSO border
	Less volatility and balancing services	Increase RES penetration and cross-boarder trading, defer new infrastructure investments	Incentives for providing flexibility services by stakeholders, liquidity to suppliers and producers by flexibility remuneration, defer of investments	More flexibility resources for higher RES penetration, reliability and quality of supply	Increase the available flexibility resources
	User, TSO, Customer (more clean energy)	TSO, DSO	User, Market, Stakeholders	Producers, TSOs, Customers	TSOs, DSOs

FP7 & H2020 PROJECTS

FLEXTURBINE

Flexible Fossil Power Plants for the Future Energy Market through new and advanced Turbine Technologies

Development of a technology roadmap consisting in: new solutions for extended operating ranges to predict and control flutter, improved sealing and bearing designs to increase turbine lifetime and efficiency by reducing degradation/damages, improved lifecycle management through better control and prediction of critical parts to improve competitive costs by more flexible service intervals and planned downtime, and by reducing unplanned outages

Years	Project total cost	Website	Coordinator's country	Coordinator
2016-2018	10.6 M€	http://www.flexturbine.eu/	Czech Republic	DOOSAN SKODA POWER SRO

Types of technologies and services tackled	Partners	Countries involved
POWER GENERATION	**24**	**7**

KER	Flutter-resistant turbine blade design	Innovative seals and bearings design for steam and gas turbines	Improved life cycle management
	Improvement of the capability to predict the occurrence of flutter	Provide and maintain reduced leakage flow and allow robust operation at strongly transient conditions	Improvement of the test result database, better mathematical models, accurate prediction of transient temperature fields, and effect on stresses
	Prevent risk of failure in the machinery and the corresponding outages	Fast ramp-up while increasing the efficiencies by 0.5 %. Reduction of wear in key locations by up to 80 % and life cycle cost (increasing service intervals by 30% to 50 %)	Operating hours between service intervals increased by 30% to 50%. Support of the grid stability with less outages and less stand-still. Reduction of costs of operation and hence, costs of energy production.
	Turbomachinery OEM, power plant operators, DSOs	Turbomachinery OEMs, Suppliers, power plant operators, DSOs	Turbomachinery OEMs, power plant operators

FP7 & H2020 PROJECTS

FUTUREFLOW

Designing eTrading Solutions for Electricity Balancing and Redispatching in Europe

Design and pilot testing of 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

Years	Project total cost	Website	Coordinator's country	Coordinator
2016-2019	13 M€	http://www.futureflow.eu/	Slovenia	ELES

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS GRID MARKET	12	8

KER	Definition of power consumers and DER owners that can become secondary reserve (aFFR) market providers	Techno-economic model to optimize coupling of secondary reserve (aFRR) markets	Cyber secure Flexibility Aggregation Platform and Regional Balancing and redispatching cross-border platform	Deployment roadmap for most promising use cases for cross-border exchange of aFRR with DR and DER
	To convince all market players and regulators about the soundness of the technical and market design approach about aFFR market providers.	Increase balancing market liquidity, reducing costs of RES integration and security of supply, with accommodation of massive intermittent generation.	To reduce the gap in electricity end-uses prices for industry vis-à-vis the EU major trading partners	To describe how integrated balancing markets work and what can be anticipated with its expansion from 4 countries to EU wide.
	Higher social welfare for society, increased competition, lower CO2 emissions.	Higher social welfare for society, increased competition, lower CO2 emissions.	Restoring and maintaining the competitiveness of the EU energy-intensive industries.	To expand all benefits of an integrated market highlighted by the project to EU wide framework.
	Customer, TSO, aggregator, regulator	Customer, TSO, aggregator, regulator	Customer, TSO, aggregator, regulator	Final user, DSO, TSO

FP7 & H2020 PROJECTS

GOFLEX

Generalized Operational FLEXibility for Integrating Renewables in the Distribution Grid

Innovation, integration, and demonstration of a group of electricity smart-grid technologies for managing flexibility in energy production and consumption

Years	Project total cost	Website	Coordinator's country	Coordinator
2016-2019	11.2 M€	http://www.goflex-project.eu/	Ireland	IBM IRELAND LIMITED

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS, GRID, STORAGE & POWER-TO-X, MARKET	12	6

KER	Energy flexibility management system
	An integrated system, applicable to small, medium and large prosumers, for the automatic management of energy flexibility
	15% increase in electricity load adaptability. Prosumers' flexibility; deferring grid investments and reducing balancing costs
	Prosumers, utilities

GRIDSOL

Smart Renewable Hubs for flexible generation: Solar Grid Stability

Provision of 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

Years	Project total cost	Website	Coordinator's country	Coordinator
2016-2019	3.4 M€	http://www.gridsolproject.eu	Spain	Cobra Instalaciones Y Servicios

Types of technologies and services tackled	Partners	Countries involved
GRID, STORAGE & POWER-TO-X, POWER GENERATION, MARKET	10	5

KER	Smart Renewable Hubs	Dynamic Output Manager of Energy	CSP Multi-tower concept	New business models for Hybrid RES Dispatchable plants	Integration of storage in existing plants
	To deliver fully dispatchable RES power plants	To ensure optimal techno-economic dispatch among generators and storage systems	To reduce cost/benefit ratio of Concentrated Solar Power technology	To identify new business opportunities, with profitable hybrid RES & Storage units	Flexible generation
	Reduction of power generation, system costs and CO_2, increase of RES and competitiveness, market uptake of new storage technologies	Increase RES and their controllability on generation side, improve power network planning and operation, reduce RES curtailment	To increase the competitiveness of Concentrated Solar Power technology, to facilitate RES integration	Market uptake of RES and storage technologies	Reduction of generation costs, reduction of the customer energy bill
	Generator, Independent Power Producer, Utility, Prosumer	Generator, Utility (transmission and distribution grids)	Generator, Power Producer, Power Plant Owner, Project developer	Project Developer, Generator, Utility	Generator, ecosystem

FP7 & H2020 PROJECTS

H2FUTURE

Hydrogen meeting Future needs of low carbon manufacturing value chains

Generation of green hydrogen from electricity from renewable sources. Support by the Austrian TSO APG of the prequalification of the electrolyser system for the provision of ancillary services

Years	Project total cost	Website	Coordinator's country	Coordinator
2017-2021	17.8 M€	https://www.h2future-project.eu/	Austria	VERBUND

Types of technologies and services tackled	Partners	Countries involved
STORAGE & POWER-TO-X, MARKET	6	3

KER	Integration of state-of-the-art PEM electrolyzer technology combined with grid services into the steel manufacturing process
	Storage of electric energy with hydrogen as energy carrier.
	Scalable power/energy shifting possibilities. Higher liquidity of the national balancing market. Multisectoral aproach. Power and energy intensive steel industry provides "storage" functions to the electricity system. Reduction of CO_2-emissions of steel manufacturing industry.
	Steel industry. Transmission System Operator. Electricity supplier. End user.

IDISTRIBUTEDPV

Solar PV on the Distribution Grid: Smart Integrated Solutions of Distributed Generation based on Solar PV, Energy Storage Devices and Active Demand Management

Development of affordable integrated solutions to enhance the penetration of distributed solar PV (buildings)

Years	Project total cost	Website	Coordinator's country	Coordinator
2017-2020	2.7 M€	http://www.idistributedpv.eu/	Spain	APPA

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS, GRID, STORAGE & POWER-TO-X, POWER GENERATION, MARKET	12	6

KER	Solutions for large penetration of distributed solar PV	Prosumer player
	Solutions for large penetration of distributed solar PV based on real operational conditions and real EU distribution networks	Approaches about the role of the different players in the penetration of distributed solar PV: prosumers, solar PV promoters, load aggregators, DSOs, integration with the electricity system, etc.
	Higher penetration of solar energy	Sustainable electricity at lower price Opportunity to sell the excess of the production to third parties
	Policy makers, technology manufacturers, standardization bodies, society	Prosumers, society

FP7 & H2020 PROJECTS

INTEGRIDY

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

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

Years	Project total cost	Website	Coordinator's country	Coordinator
2017-2020	15.8 M€	http://integridy.eu/	Spain	ATOS SPAIN SA

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS GRID STORAGE & POWER-TO-X POWER GENERATION MARKET	30	6

KER	MV Distribution Networks Management tool	Multi-carrier hub Optimisation engine	Heat pump control hub	Kisense Energy Management System	Intelligent Building Control & Flexibility Prediction-Forecasting Tool
	To support DSO in operating the grid, in scenarios with great penetration of Dispersed Generation	To provide flexibility services to the DSO responsible of the Medium Voltage (MV) line which the micro-grid is connected to	To integrate a network of PV, solar thermal, heat pump, immersion heaters, thermal storage, and electrical storage into a single entity	To deliver state-of-the-art Demand Response technology, integrating energy measurements (such as electrical and thermal) and environmental data (such as temperature and humidity) analysis and providing information regarding past and real-time information	Identification and automated optimal management of a building's assets, based on their forecasted energy flexibility, allowing active Demand Response schemes to be applied.
	Preliminary results: Energy losses in the MV distribution grid improved up to 20% and hosting capacity limits for 10%. Benefit in the overall management of the electric grid: maximization of the system reliability and a reduction of the energy costs. New business opportunity will arise for all the users of the electric grid	Economic advantage from the optimisation. To monitor and control the available DER in order to properly evaluate and satisfy the local electric and thermal needs. Low maintenance expenses for DSOs thanks to the increase of flexibility services offer	Job creation. Reduction of energy costs for residents (around £500 per annum). Each system saves 4000kg CO_2 per annum in 3 residential properties. (Installing the system in 5000 properties results in savings of 6500 tonnes CO_2 per annum).	Improve interoperability with third party systems, reducing future implementation costs and enhance market access of proposed VPS solutions. Cost reduction; enhancement of competitivity of DR tool; Increase feeling of social belonging with sharing benefits mechanisms; Increase of renewables and energy efficiency; Research on energy optimisation and innovative energy business models; Integration failure reduction with third party systems.	Exploitation of energy more efficiently and economically
	DSOs and final users	Micro-grid Energy Managers, DSOs	Final users	Microgrid members/ owner, the building owners or a DSO	Building / Facility Manager. Energy Utility company / Retailers, utilizing DR services

FP7 & H2020 PROJECTS

INTERFLEX

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

Investigation of the INTERactions between FLEXibilities provided by energy market players and the distribution grid. This project focuses on energy storage, smart charging of electric vehicles, demand response, islanding, grid automation and integration of different energy carriers

Years	Project total cost	Website	Coordinator's country	Coordinator
2017-2019	22.8 M€	http://interflex-h2020.com/	France	ENEDIS

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS GRID STORAGE & POWER-TO-X MARKET	**20**	**6**

KER	Enhanced DSO and aggregators platforms (and related interfaces)	Multi-services business models for battery storage, including use of EVSE	Recommendations for grid code evolutions allowing for an increase in DER hosting capacity	New business models for optimization of DSO operation by exploiting the interaction with district heating, district cooling, micro-CHP or other multi-energy devices	Recommendations and market organisation on running a planned and automated islanded mode
	To provide innovative energy services for all the players in the energy market: to use simultaneously flexibilities from multiple sources, to trade them locally on a "Local flexibility market", and to control them remotely (for instance through the German demo "Smart Grid Hub").	To test residential and larger, shared battery systems to relieve network congestion, and increase the renewable hosting capacity of the grid.	To increase DER hosting capacity thanks to using volt-var control V/Q or to using the Q(U) and P(U) characteristics of smart inverters.	To exploit untapped potentials for flexibility provision: flexible use of hybrid heating systems that can run on both electricity and gas and exploitation of termal inertia and the interaction between thermal and electricity grids.	Recommendations for the grid codes on the observability and management of microgrids: required technologies and sensors, communication infrastructure and role description, contractual relationships for market organisation.
	Overcome the common market barriers. Enhanced observability, local energy control, flexibility services.	Reinforce system security, improve the distribution grid observability, solve congestion problems, while taking into account the need of EV users.	Increase DER hosting capacity in LV networks without the need of expenses for new interconnections and reconstruction.	Additional power flexibility provision, conversion of excess renewable power into heat, use of thermal inertia as a significant and cost-efficient source of flexibility.	Improvement of the security of supply for customers; enabling the community to support the use of the renewable energy via automated control of their residential assets.
	DSOs, agregators	DSOs, Aggregators, EV charging stations operators, battery storage owners.	DSOs, Battery storage operators.	DSOs, Local Energy Supply Companies, aggregators, Residential and commercial customers	DSOs, Local Energy Supply Companies, aggregators

FP7 & H2020 PROJECTS

INTERPLAN

INTEgrated opeRation PLAnning tool towards the Pan-European Network

Provision of an INTEgrated opeRation PLANning tool towards the pan-European network, to support the EU in reaching the expected low-carbon targets, while maintaining network security

Years	Project total cost	Website	Coordinator's country	Coordinator
2017-2020	3 M€	http://interplan-project.eu/	Italy	ENEA

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS GRID	6	5

KER	Integrated operation planning tool for the pan-European network	Grid equivalenting	Integrated control system logics
	To provide an operation planning tool for grid equivalents, based on semi-dynamic simulations	Significantly reduce the complexity of investigations on distribution grid, by using appropriate grid equivalents	To adapt the control logics to the complexity of the integrated grid and to address stability and security at area, regional and pan European level
	Achieving security in a low-carbon electricity system and ensuring that the future pan-European grid can host large quantity of RES and allow flexibility in the presence of DER	Providing a validated set of grid equivalents accessible by the public and helping DSOs to identify the optimal standard parametrization of small-scale DER	Increase of network observability and advances in managing all relevant flexibility resources as "local active elements" within the grid"
	TSO, DSO, regulator, network operator	DSO, customer, aggregator, balance Responsible Party BRP	DSO, TSO, network operator

MIGRATE

Massive InteGRATion of power Electronic devices

Development and validation of 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

Years	Project total cost	Website	Coordinator's country	Coordinator
2016-2019	17.9 M€	https://www.h2020-migrate.eu/	Germany	TennetTSO GMBH

Types of technologies and services tackled	Partners	Countries involved
GRID	24	11

KER	PE Penetration in power system
	Security of Supply due to PE penetration through RES
	Stable electricity grid and no black-outs
	European Society

FP7 & H2020 PROJECTS

NAIADES

Na-Ion bAttery Demonstration for Electric Storage

Development and demonstration of the ambient Na-ion battery under realistic conditions as an effective alternative to the Li-ion battery for stationary Electric Energy Storage (EES) application

Years	Project total cost	Website	Coordinator's country	Coordinator
2015-2018	6.5 M€	http://www.naiades.eu/	France	CEA

Types of technologies and services tackled	Partners	Countries involved
STORAGE & POWER-TO-X	**10**	**6**

KER	Development of electrode materials for Na-ion batteries	Scale up of positive material synthesis	Development of Na-ion Cells
	To provide new types of material: a polyanionic cathode and a layered oxide	To produce 50 kg batches of cathode materials	To provide the first large cylindrical cells of 8 Ah
	Better properties than Li-ion battery	Good electrochemical performances	High power and fast charging
	Battery manufacturers	Battery manufacturers	Users

FP7 & H2020 PROJECTS

NETFFICIENT

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

Deployment and demonstration of local energy storage technologies, development of information and communication tools, to exploit the synergies between energy storage, the smart grid and the citizens

Years	Project total cost	Website	Coordinator's country	Coordinator
2015-2018	11.4 M€	http://netfficient-project.eu/	Spain	Ayesa advanced technologies SA

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS, GRID, STORAGE & POWER-TO-X, POWER GENERATION, MARKET	**13**	**7**

KER	Energy Management Platform	Hybrid home energy storage system (LV-HESS)	A hybrid utility-scale energy storage system (MV-HESS)	MV-HESS-inverter	MV-HESS management-system
	Solution for monitoring, optimization, management control and autonomous exploitation of DER Techno-economic optimization for grid design using forecasted data of demand and generation energy to trade energy in the market and optimize the real-time operation	Modular system capable of working in stand alone or aggregated mode.	To allow the lengthening of the batteries life	To provide high density and scalable power electronics.	To allow simple management of different storage technologies and simple Gateway to Energy Managment system.
	Grid stability; self-consumption to save energy and costs for end users; decrease the CO_2 level in the environment by generating green energy; new business model to the market that makes possible selling a new service: Energy Management and not only selling energy	Electricity saving for end user: between 5-20% of electricity consumption. Lengthening the battery investment around 10-20%	Lengthening of the battery investment around 10-20%	Simpler and cost-efficient power electronics for industrial applications	More efficient way of managing HESS Systems
	Customers	Residential and small businesses	Utilities and DSOs	Customers	Producers of storage systems

FP7 & H2020 PROJECTS

NOBEL GRID

New cost-effective business models for flexible Smart Grids

Nobel Grid Smart energy for people

Provision of 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

Years	Project total cost	Website	Coordinator's country	Coordinator
2015-2018	14 M€	http://nobelgrid.eu/	Spain	Etra investigacion y desarrollo sa

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS GRID STORAGE & POWER-TO-X POWER GENERATION	**21**	**11**

KER	SLAM: Advanced Smart meter with extended functionalities	G3M: Application for the monitoring, management and maintenance of distribution network	DRFM: Tool for intermediate entities (aggregators, ESCOs, retailers, etc.)	EMA App: Application for final consumers and prosumers	Nobel Grid Business Model Evaluation tool
	Provision of detailed energy information in real time, generating flexibility strategies, such as demand response	Manage and maintain the MV/LV grid taking advantage of new technologies, and complying with new policy imperatives and changing business frameworks	Bridges Demand-Side Resources and their flexibility with the distribution grid actors to improve the operation of the processes under their control	Get access to the energy data from the smart meter to enrich and make more understandable energy-related information	Calculation how profitable is a business model for different actors
	Reduction of energy consumption, emissions and billing in at least 20%	Reduction of the costs of management and maintenance of the distribution grid.	Reduction of consumption and emissions	Reduce the energy consumption and billing of the consumer	Generation of more benefits in a more efficient way
	Stakeholders of the smart grid: DSO, retailers, aggregators, ESCOs and final customers (industrial and domestic)	DSO, and operators of microgrids	Aggregators', Retailers' and ESCOs', with special focus to energy cooperatives and local communities	End users	Any type of companies that would like to make more economical benefits of a smart grid project or product

FP7 & H2020 PROJECTS

OSMOSE

Optimal System-Mix Of flexibility Solutions for European electricity

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

Years	Project total cost	Website	Coordinator's country	Coordinator
2018-2021	28.3 M€	https://www.osmose-h2020.eu/	France	Réseau de Transport d'électricité SA (RTE)

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS GRID STORAGE & POWER-TO-X POWER GENERATION MARKET	**33**	**9**

KER	Optimal mix of flexibilities and related market design	Demonstrator of grid forming	Demonstrator of coordinated control of different storage and FACTS devices	Smart management system	Near real-time cross-border energy market
	Holistic approach to assess the flexibility sources and propose improvements of the existing market mechanisms and regulatory frameworks	To test new grid forming algorithm	To answer a problematic of 3 problems in one coordinated system (voltage, frequency and capacity)	Multiple services provided by grid devices, large demand-response and RES generation	To catch the flexibility close to real time depending on real time constraints with short term forecast
	Forecast the optimal mix of flexibility solutions at pan-European system level, maximising social welfare	Synchronism in large power systems with high RES. Increase of the global efficiency for the consumer (grid forming and frequency control for example) and congestion management	Improve frequency control, dynamic voltage control and increase of net transfer capacity	Congestion management, system services form RES plants and Increasing Availability of System Services from DR through Aggregation	Enable market players to trade their residual flexible capacities
	Market players, and policy makers	TSOs.	TSOs.	TSOs	Market players, TSOs

FP7 & H2020 PROJECTS

PLAN4RES

Synergistic approach of multi-energy models for an european optimal energy system management tool

Support to the main stakeholders of the European energy system (TSOs, DSOs, Utilities, Energy providers…) by helping them taking better decisions regarding the development and operation of their energy portfolio, also considering the emerging technologies and innovative flexibility sources while maintaining a high level of reliability

Years	Project total cost	Website	Coordinator's country	Coordinator
2017-2020	3.9 M€	https://www.plan4res.eu/	France	Electricité de France (EDF)

Types of technologies and services tackled	Partners	Countries involved
GRID MARKET	7	5

KER	plan4res software	plan4res Case Studies	plan4res public dataset	Solvers and modelling system
	To compute the optimised balance between: • Enhancement of the grid for maximising its capacity to host renewable energies by combining the best use of the existing grid and new investments on the grid infrastructure • Enhancement of the system`s flexibility by combining the best use of all existing flexibilities and new investments in flexible assets	To model different questions and issues which might affect the different stakeholders: • Multi-modal European energy concept for achieving COP 21 goal considering sector coupling of electricity, gas, heat and transport demand • Strategic development of pan-European network considering long-term uncertainties • Cost of RES integration and impact of climate change for the European Electricity System	Public database giving the most possible accurate representation of the european energy system at a 2050 horizon, with hypothesis compliant with COP21 objectives	To solve related optimisation problems linked to high shares of renewable inducing more uncertainties, and coupling of flexibilities (multi energy....) inducing high size problems
	Allowing large shares of renewable in the system	Results from the case studies	Help researchers to conduct studies within a scenario with a high share of renewable	Optimization of problems coming from high share of renewables
	Energy consumers, TSOs, DSOs, Utilities, Energy providers, market operators, etc.	Project partners and energy stakeholders	Energy system stakeholders, researchers	Energy stalkeholders, software providers, researchers

FP7 & H2020 PROJECTS

PLANGRIDEV

Distribution grid planning and operational principles for EV mass roll-out while enabling DER integration

Development of new network planning tools and methods for European DSOs for an optimized large-scale roll-out of electromobility in Europe whilst at the same time maximizing the potential of DER integration

Years	Project total cost	Website	Coordinator's country	Coordinator
2013-2016	15.4 M€	https://cordis.europa.eu/project/rcn/109374_fr.html	Germany	RWE Deutschland Aktiengesellschaft

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS, GRID, STORAGE & POWER-TO-X	12	9

KER	Methodology for combined EV and DER grid integration
	Demonstration that grid integration of EVs and renewables can be optimized by IT control of charging and generation processes and use of storage if the regulatory frameworks allows the grid operators to control the processes (e.g. EV controlled charging,..)
	Lower energy system costs
	Electricity customer (industry as well as private household customers)

PROME3THE2US2

Production Method Of Electrical Energy by Enhanced Thermal Electron Emission by the Use of Superior Semiconductors

Development, validation and implementation of a novel solid-state conversion mechanism able to transform concentrated solar radiation into electric energy, at very high efficiency, with a direct conversion obtained by an enhanced electron emission from advanced semiconductor structures.

Years	Project total cost	Website	Coordinator's country	Coordinator
2013-2016	4 M€	https://cordis.europa.eu/project/rcn/108455_en.html	Italy	CONSIGLIO NAZIONALE DELLE RICERCHE

Types of technologies and services tackled	Partners	Countries involved
POWER GENERATION	8	5

KER	High-temperature solar cells	Dielectric microspacer
	Higher output power and flexibility than the current solar conversion technology	Thermal-to-electric converters working closely to ideal conditions. Can be employed in all applications needing high electrical and thermal insulation between two surfaces distant of few micrometres
	Improvements of technology performances. Maximum conversion efficiency close to 70% (simulation)	Improvements of technology performances
	Industrial hardware developers of solar conversion technologies	Industrial hardware developers

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REALVALUE

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

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

Years	Project total cost	Website	Coordinator's country	Coordinator
2015-2018	15.4 M€	http://www.realvalueproject.com/	Ireland	Glen dimplex ireland

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS, STORAGE & POWER-TO-X, MARKET	12	5

KER	DSM Smart Tariff	Power system modelling and market modelling	VPP optimisation algorithm	Consumer engagement guidance	Understanding of grid and network constraints
	To customise the benefit from variable electricity pricing	Modelling of systems which are relevant for thermal storage - possibility on electricity networks	Simplified process for managing numbers of complex devices to provide value for system operators	Guidances for interaction with large number of consumers across different demographics	Practical learnings on wide spread use of flexible devices for DSM purposes on distribution networks
	Value for en-users	Ability to quickly assess the potential of innovative technologies on the electricity system	Optimisation against many different criteria (environmental, financial)	Commercial: Better interaction with end consumer; Societal: minimised disruptions	Investment deferral on distribution networks - less need for upgrading of lines wires/cables
	End consumer	Academia, system & market operators	System operator – consumer	End consumer and Businesses	Systems operators

RESERVE

Renewables in a Stable Electric Grid

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

Years	Project total cost	Website	Coordinator's country	Coordinator
2016-2018	5 M€	http://www.re-serve.eu	Germany	ERICSSON GmbH

Types of technologies and services tackled	Partners	Countries involved
GRID, MARKET	11	4

KER	New techniques for frequency management with up to 100% RES	New techniques for voltage control with up to 100% RES	Villas node co-simulation Software
	Continued stable operation of the power grid even when the proportion of RES generation reaches very high levels and the use of fossil fuels is reduced	Stable power supplies even as the proportion of power generation based on RES increases towards 100%	Enabling co-simulation of very complex power network scenarios
	Lower climate impact of power generation enabling environmental goals to be reached, stable power supplies	Lower climate impact of power generation enabling environmental goals to be reached, stable power supplies	The software will contribute towards stablising future power networks with up to 100% RES generation, without hydro-electric power
	TSOs, society as a whole	TSOs, society as a whole	Society as a whole

FP7 & H2020 PROJECTS

SENSIBLE

Storage ENabled SustaInable energy for BuiLdings and communitiEs

Development, demonstration and evaluation of a storage-enabled sustainable energy supply for buildings and communities

Years	Project total cost	Website	Coordinator's country	Coordinator
2015-2017	6.1 M€	http://www.h2020-project-sensible.eu/	Germany	Siemens Aktiengesellschaft

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS, GRID, STORAGE & POWER-TO-X, POWER GENERATION, MARKET	**14**	**5**

KER	Multi-modal building automation system	Storage as an integrated smart grid asset	Residential home energy management solution	Socio-economic effects of local storage	Cost/benefit assessment methodology for network planning with local storage
	Optimization of electrical energy consumption and generation by using electrical and thermal energy storage	Development, demonstration and evaluation of a storage-enabled sustainable energy supply for buildings and communities	Control of residential assets (PV, water heaters, residential batteries, controllable loads) in an aggregated way	Contribution to bridge the gap in understanding and accounting for social attitudes towards energy storage	Assessment and gauge of the investment level needed in planning the electrical network with local storage
	Increase of energy efficiency of building energy system (storage and other components, e.g. PV, heater, heating ventilation). Minimisation of energy procurement costs	Increase of quality and continuity of service, reduction of technical losses, more extended grid reliability (in islanding operation)	Energy price reduction by bridging the gap between citizens and energy markets	Opportunity to influence public acceptance of energy storage, thus inducing improved community resilience, pride and trust as well as willingness to share excess energy	Reduction of the need for infrastructure investments
	Technology providers	DSOs, consumers	DSOs, utilities, retailers, aggregators, consumers	DSOs, infrastructure providers, society as a whole	DSOs, infrastructure providers, consumers

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SHAR-Q

Storage capacity over virtual neighbourhoods of energy ecosystems

Optimisation of storage capacities deployed in the grid with the help of a peer-to-peer interoperability network that connects neighbourhooding RES+Storage ecosystems into a collaboration framework

Years	Project total cost	Website	Coordinator's country	Coordinator
2016-2019	4 M€	http://www.sharqproject.eu/home	Spain	ATOS SPAIN SA

Types of technologies and services tackled	Partners	Countries involved
STORAGE & POWER-TO-X; POWER GENERATION; MARKET	**11**	**7**

KER	SHAR-Q Platform
	Interoperability network that connects the capacities of the neighbourhooding and wide regional Renewable Energy Sources (RES) and Electrical Energy Storage (EES) ecosystems into a collaboration framework that mitigates the requirement on the overall EES capacities thanks to the shared capacities among the participating actors following a decentralised approach
	Sharing distributed resources and providing added-value services to exploit the interoperability among resources, not only benefit users but also create a new business ecosystem with novel services based on data
	Energy infrastructure operators, ICT players

ETIP SNET
EUROPEAN TECHNOLOGY AND INNOVATION PLATFORM
SMART NETWORKS FOR ENERGY TRANSITION

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SMARTEREMC2

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

Implementation of ICT tools that support the integration of consumers through Demand Response services and the integration of DG/RES through Virtual Power Plants

Years	Project total cost	Website	Coordinator's country	Coordinator
2015-2017	3.8 M€	http://www.smarteremc2.eu/	Greece	Intracom SA telecom Solutions

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS GRID MARKET	11	6

KER	Demand Response Management System (DRMS)	Virtual Power Plant Management System (VPPMS)	Energy Hub (EH)	Smart Grid data analytics platform (SDAP)	Algorithms for bad data detection for Smart Grids
	ICT enabler for delivering / leveraging demand side management as an option for injecting flexibility in the operation of the Distribution Grid	ICT enabler to aggregate and manage flexible assets (DERs, distributed storage units, loads)	ICT enabler for better management of the Distribution Grid	ICT component helping systems that are in need of a data management and visualization solution	To detect both stealthy and non-stealthy attacks. To quickly identify which node has been attacked. To advise how to change system topology to avoid future attack
	For DSO: provision of the necessary flexibility, solving grid problems. For DRA: provision of DR services to the DSO, or participation in the energy market	Load and production forecasting	Better management of the Distribution Grid	From a commercial perspective, attractive component to be integrated into total ICT solutions	Improvement of the cyber security of the grid
	DR Aggregators, DSOs	VPP Operators and DSOs	DSOs, Microgrid Operators	ICT solution providers	ICT solution providers

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SMARTNET

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

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

Years	Project total cost	Website	Coordinator's country	Coordinator
2016-2018	12.7 M€	http://smartnet-project.eu/	Italy	RSE - Ricerca sul Sistema Energetico

Types of technologies and services tackled	Partners	Countries involved
MARKET	**22**	**9**

KER	SmartNet TSO-DSO ancillary services market simulator	SmartNet testing facility for DSO system monitoring and control	SmartNet testing facility for AS provision from thermostatically controlled loads	SmartNet testing facility for AS provision from localized storage facilities	An analysis procedure to discover ICT requirements in energy systems
	Comprehensive model including transmission, distribution, DER for detailed technical economic assessments	Real time monitoring and control of distribution grid located DER from the national TSO	To use a scattered amount of thermostatically controlled loads as flexibility resources	To use a scattered amount of localized storage systems-controlled loads as flexibility resources	Possibility to maintain links between data flow diagrams and ICT requirements in SGAM tools; and to use parametrized scripts to alter ICT requirements and to assess their impacts on the system design
	Better know-how on optimized TSO-DSO interactions and market modality to enable AS from distribution	Increase flexibility, system costs reduction, further business possibilities for DER	Increase flexibility, system costs reduction, further business possibilities for DER	Increase flexibility, system costs reduction, further business possibilities for DER	More successful system design
	TSO, DSO, regulators, EC	TSO and DSO, utilities, final users	TSO and DSO, utilities, final user	TSO and DSO, utilities, final user	TSO, DSO, ICT companies, Ancillary service providers

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SMILE

SMart IsLand Energy systems

Demonstration of 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

Years	Project total cost	Website	Coordinator's country	Coordinator
2017-2021	14 M€	http://www.h2020smile.eu/about-the-project/	Italy	RINA CONSULTING SPA

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS, GRID, STORAGE & POWER-TO-X, POWER GENERATION, MARKET	**19**	**6**

KER	Battery Energy Management System	Load Controller	EV managed charging	Energy Management System	PCM storage systems
	Management of storage	Control of loads/Aggregator	Smart charging of Electric Vehicles	Efficient Energy Management	Heat storage
	N.A.	*N.A.*	Effective management of Electric Vehicle charging	*N.A.*	*N.A.*
	Customer	Customer	Customer/user	Customer	User/customer

SOGNO

Service Oriented Grid for the Network of the Future

Provision of turnkey services for DSOs implementing next generation data-driven monitoring and control systems, based on 5G based ICT. Combination of hardware, software solutions and research activities on different areas, such as advanced deep learning, 5G communication, and cloud virtualisation, to build a new philosophy of electrical grid management

Years	Project total cost	Website	Coordinator's country	Coordinator
2018-2020	5 M€	https://www.sogno-energy.eu/	Germany	Ericsson GmbH

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS, GRID	**13**	**6**

KER	Turnkey distribution automation services
	Services implementing next generation data-driven monitoring and control systems, based on 5G based ICT State of the art algorithms optimizing power network status transparency with a low number of sensors per 100 nodes in the power network Possibility to upgrade the solution without the need to visit a customer site as it is provided as a virtual service
	Power networks more stable and run more efficiently reducing environmental impact of power generation and reducing minutes of service lost to customers Enhancement of transparency of the status of the network, thus increasing network operation efficiency. Reduction of investment budgets for distribution system automation for utilities
	Society, Consumers, DSOs / Utilities

FP7 & H2020 PROJECTS

STORE&GO

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

Integration of Power-to-Gas into the daily operation of European energy grids to demonstrate the maturity of the technology and identification of current and future PtG business cases to develop a European PtG roadmap

Years	Project total cost	Website	Coordinator's country	Coordinator
2016-2020	28 M€	http://www.storeandgo.info/	Germany	DVGW

Types of technologies and services tackled	Partners	Countries involved
STORAGE & POWER-TO-X	27	6

KER	Demonstration of innovative PtG technologies
	European-wide definition of the future role of PtG in the energy system and recommendations for the regulative and economic implementation
	Evaluation of business cases for potential users, investment and operation costs perspectives, analysis of ecological effect of PtG technologies, assessment of social acceptance of PtG
	Politics, TSO, utilities, manufacturers of PtG technologies

SUCCESS

Securing Critical Energy Infrastructures

Design, development and validation on small scale field trials of a novel holistic adaptable security framework able to significantly reduce the risks of cyber threats and attacks when next generation, realtime, scalable, unbundled smart meters are deployed in smart electricity grids

Years	Project total cost	Website	Coordinator's country	Coordinator
2016-2018	5 M€	https://success-energy.eu/	Germany	Ericsson GmbH

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS GRID MARKET	17	8

KER	Pan-European Security monitoring centre for Critical Infrastructures	A range of innovative countermeasures improving the cyber-security and resilience to attacks of critical infrastuctures
	Identification at an early stage of attacks across many countries on critical infrastructure using the project pan-European monitoring approach, enabling countermeasures to be deployed more quickly and disruption to be minimized	Availability of countermeasures that, after rapid identification of attacks through the monitoring system, can limit the impact of future attacks and enable faster resumption of service to consumers
	Reduced disruption by cyber-attacks on critical infrastructures, benefiting citizens and society in general. More stable operation of critical infrastructures providing an improved basis for industry to thrive. Enhanced technology for the detection of sophisticated cyber-attacks on critical infrastructures	More stable critical infrastructures with benefits for the individual user and for society in general. Technical advances made by the project enhance the security and resilience of infrastructure to cyber attacks
	Citizens and society in general, critical infrastructure owners	Citizens and society in general, critical infrastructure owners

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SUNSEED

Sustainable and robust networking for smart electricity distribution

Evolutionary approach to utilisation of already present communication networks from both energy and telecom operators, to be suitably connected to form a converged communication infrastructure for future smart energy grids offering open services

Years	Project total cost	Website	Coordinator's country	Coordinator
2014-2017	4.7 M€	http://sunseed-fp7.eu/	Slovenia	Telekom Slovenije DD

Types of technologies and services tackled	Partners	Countries involved
GRID	9	6

KER	Methodology for monitoring electricity distribution grids
	Demonstrating that public Long Term Evolution (LTE) communication network can be used for monitoring of electricity grid
	Increasing grid availability, possibility to include more renewable sources of energy
	Electricity distributor, end-user, environment

TILOS

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

Demonstration of 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

Years	Project total cost	Website	Coordinator's country	Coordinator
2015-2019	13.7 M€	http://www.tiloshorizon.eu/	Greece	Piraeus University of Applied Sciences

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS, GRID, STORAGE & POWER-TO-X, POWER GENERATION, MARKET	13	7

KER	Integrated NaNiCl2 Battery & Grid-forming Battery Inverter	Prototype Smart Meter & DSM Panel	Forecasting Platform
	MW-scale multi-functional BESS supporting island operation	Smart Meter & DSM Panel for the monitoring and remote control of residential and other type of loads	Robust forecasting platform able to interface EMS
	High shares of renewable energy	Monitoring and remote control of loads	Foster increased RES contribution
	Operator scheme of the Hybrid Power Station in Tilos island	End-users of Tilos island and leader beneficiary	Members of the beneficiaries that developed the platform

FP7 & H2020 PROJECTS

TURBO-REFLEX

TURBOmachinery REtrofits enabling FLEXible back-up capacity for the transition of the European energy system

Provision of technology upgrades to retrofit the installed power plants to enable flexible operation without penalties on life, cost and emissions

Years	Project total cost	Website	Coordinator's country	Coordinator
2017-2020	8.1 M€	https://www.turbo-reflex.eu/	Germany	General Electric deutschland holding gmbh

Types of technologies and services tackled	Partners	Countries involved
POWER GENERATION	**25**	**9**

KER	Reduction of costs per cycle	Increasing low load capability of existing plants	Increasing load following capability
	Methodology to increase part load efficiency, resistance to wear and accurate life information	Reduction in the number of hot starts by increasing the low load capability of existing plants	Doubling the ramp rate to allow thermal plants to better follow the load requirements of the system
	30% reduction of cycle costs: security of supply and stability of the transmission grid	33% reduction in the number of hot starts: security of supply and stability of the transmission grid	10% of the installed fossil capacity in Europe could be retrofitted by 2030. Potential annual cost reduction of 100 million EUR at the European level by reducing variable operation and maintenance costs
	DSO	DSO	DSO, and end users

ETIP SNET
EUROPEAN TECHNOLOGY AND INNOVATION PLATFORM
SMART NETWORKS FOR ENERGY TRANSITION

FP7 & H2020 PROJECTS

UPGRID

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

Focus 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 project proposes an open, standardised and integral improvement of the LV grid

Years	Project total cost	Website	Coordinator's country	Coordinator
2015-2017	15,7 M€	http://upgrid.eu/	Spain	Iberdrola distribucion electrica, s.a.

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS GRID MARKET	**19**	**7**

KER	Low Voltage Network Management System	Equipment for LV/MV networks	LV software tools	New Generation Home Gateway and Home Energy Management application	PRIME Network Management System
	Supports accurate and reliable LV O&M decisions and processes	Modular solutions to monitor, automate and control LV/MV networks	Monitor the LV grid based on information provided by smart meters, existing systems and RTUs	Leverage the implementation of additional services on top of the UPGRID HEMS development	Enables a PRIME multiservice network, for example, combine AMI and control over LV network.
	Reduction of time in the detection of network incidences /faults in the LV network (36 minutes improvement) + Reduction of time in the resolution of the incidences/faults in the LV network (16 minutes) = nearly 1 hour less lack of electricity service to our customers			Open software development kit, with libraries and documentation that enable 3rd parties to implement plugins that will run in the gateway's middleware fostering new business models	Detection of real-time issues in AMI data concentrators. Positive impact on LV incident management and then on Consumers QoS
	DSOs, Software developpers and customers			Software developers, liberalised agents, and Customers	DSOs, Software developpers and customers

FP7 & H2020 PROJECTS

WISEGRID

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

Provision of a set of solutions and technologies to increase the smartness, stability and security of an open, consumer-centric European energy grid

Years	Project total cost	Website	Coordinator's country	Coordinator
2016-2020	17.6 M€	http://www.wisegrid.eu	Spain	Etra investigacion y desarrollo sa

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS GRID STORAGE & POWER-TO-X POWER GENERATION MARKET	**21**	**8**

KER	WG Cockpit: cockpit for DSOs or microgrids operators to control, manage and monitor their own grid	WiseCORP: corporate application to become active, smarter energy players	WiseCOOP: Application achieving energy deals while relieving beneficiaries from administrative procedures and cumbersome research	WiseEVP: tool/platform used by EVSE operators and EV fleet managers	WG FastV2G: fast EV charging station
	Effective control of small distribution networks with DER	The effectively management of the energy assets of a building allowing DR participation	Strengthen DR by means of DER	Management of smart charging sessions	Allow V2G activities in EV charging sessions
	Improving flexibility, stability and security of the network with the increasing share of RES	Reducing energy bill, supporting self-consumption	15% and 32% of energy savings to its customers	Optimization of the activities related with smart charging and discharging of the EVs and reduce energy billing	Use EV as dynamic distributed storage devices, feeding electricity stored in their batteries back into the system when needed (fast V2G supply)
	Small DSOs	Businesses, industries, ESCOs and public facilities consumers and prosumers	Energy retailers, aggregators, local communities and cooperatives of consumers and prosumers (and other intermediary companies)	EV fleet managers and EVSE Operators	EVSE Operators

OTHER PROJECTS

Austria

LEAFS

Integration of Loads and Electric Storage Systems into Advanced Flexibility Schemes for LV Networks

LEAFS

Evaluation of the effects of increased costumer and energy market driven utilization of energy storage systems and load flexibility on power distribution grids. Technologies and operation strategies are developed enabling optimal use of distribution grid infrastructure by activating flexibilities using direct or indirect control by the local grid operator or incentives

Years	Project total cost	Website	Coordinator's country	Coordinator
2016-2018	3.3 M€	https://www.ait.ac.at/en/research-fields/smart-grids/projects/leafs-lv-loads-and-storage-integration/	Austria	Austrian Institute of Technology

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS, GRID, STORAGE & POWER-TO-X, POWER GENERATION, MARKET	***N.A.***	**1**

KER	Active Intelligent Control of Flexibilities
	Multi-Use (Grid, Customer and Market) intelligent Control of a Central Storage System
	More PV Integration, Local Consumption of Renewables, Less CO_2 emissions. Flexible integration of distributed energy resources at minimum network reinforcement costs as well as higher self-consumption level for customers
	Customer and Solution Providers.

OTHER PROJECTS

SMART GRID BATTERY STORAGE PROJECT PROTTES

PROTTES

Multimodal operation of battery storage for grid services and ancillary services

Presentation of how battery systems can contribute to system stability in addition to the contribution for providing ancillary services with high share of renewable energy

Years	Project total cost	Website	Coordinator's country	Coordinator
2016-2019	4.7 M€	https://www.netz-noe.at/Netz-Niederosterreich/Wissenswertes-2/Forschungsprojekt.aspx	Austria	Netz NÖ GmbH

Types of technologies and services tackled	Partners	Countries involved
GRID, STORAGE & POWER-TO-X, MARKET	*N.A.*	1

KER	Multimodal operation of battery systems	Synthetic (virtual) inertia	Business Models for battery systems	Battery systems as an alternative to grid reinforcement
	Operation for two or more functions simultaneously: primary regulation, static voltage level maintenance, reactive power injection, etc.	Test and proof of the provision of virtual inertia by battery systems	Improved economy of battery systems by simultaneously running more than one function	Recommendations for adapting regulations
	Provision of ancillary services, participation in system stabilisation and facilitation of renewable integration	Stability of electrical grids	Speeding up the implementation of battery technology, improvement of grid stability	Cost decrease for services for system stability
	Electricity companies, grid operators	Grid operators	Grid operators	Grid operators

UNDERGROUND SUN.STORAGE

UNDERGROUND SUN.STORAGE

Storing energy from wind and solar power below ground

Testing of the approach of transforming renewable energy to methane by using electrolysis and storage in the same underground infrastructure [21]

Years	Project total cost	Website	Coordinator's country	Coordinator
2013-2017	4.6 M€	https://www.underground-sun-storage.at/en	Austria	RAG

Types of technologies and services tackled	Partners	Countries involved
STORAGE & POWER-TO-X	7	1

KER	Seasonal balancing (storage) of Renewable Energy	Underground Methanation
	To make Hydrogen via electrolysis out of renewable energy by using the Power to Gas process	Transformation of renewable energy to methane (natural gas), using the same infrastructure for conversion and storage
	Feasibility of an energy system based on a high share of renewables	Establishment of a sustainable carbon cycle, since CO_2 is consumed in the process of transforming RES to a "green gas"
	All stakeholders in a renewable energy system	All stakeholders in a renewable energy system, and society

[21] The follow-up of this project is the UNDERGROUND SUN.CONVERSION project: Production of natural gas directly within a gas reservoir using a microbiological process with storage it in the same reservoir (see https://www.underground-sun-conversion.at/en).

OTHER PROJECTS

Croatia

SIREN

Smart Integration of RENewables

Assessment of Croatia's transmission and generation adequacy in order to determine the flexibility requirements at different operating states of the system. Investigation of the benefits of energy storage units in transmission systems

Years	Project total cost	Website	Coordinator's country	Coordinator
2015-2018	0.3 M€	http://siren.fer.hr/en/siren	Croatia	FER UNIZG

Types of technologies and services tackled	Partners	Countries involved
GRID, STORAGE & POWER-TO-X, MARKET	**3**	**1**

KER	New Operating Procedures	New Investment Strategies	Requirements for Connection of new Wind Power Plants	Services provided by storage	Rules on Storage Operation
	New operating procedures considering the volatility and uncertainty of the wind	Identification of potential locations and capacitiy of storage in the Croatian transmission expansion model	Imbalance penalty system to be impelmented within the Renewable energy act	Definition of battery services to support non-dispatchable generation	Assessment of the role of the batteries and flywheel in Croatian transmission network
	Better assessment of the reserves needed	Comparison of different storage options (large-scale batteries, pumped hydro and CAES technologies)	Higher power system operation security	Financial self-sustainability of batteries	Arbitrage, frequency regulation, ramping, congestion relief, voltage support, transient stability
	Croatian energy system	Croatian energy system	Croatian energy system	Croatian energy system	Croatian energy system

ETIP SNET
EUROPEAN TECHNOLOGY AND INNOVATION PLATFORM
SMART NETWORKS FOR ENERGY TRANSITION

OTHER PROJECTS

UGRIP

MicroGRId Positioning

Development of a full-scale microgrid that consists of distributed generators, both renewable and controllable, storage units and flexible loads. A structure of the local, distribution-level market will be defined and demonstrated

Years	Project total cost	Website	Coordinator's country	Coordinator
2016-2019	1.1 M€	http://www.ugrip.eu/	Croatia	FER-UNIZG

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS, GRID, STORAGE & POWER-TO-X, POWER GENERATION, MARKET	6	3

KER	Development of a microgrid	Standardized communication protocols	Microgrid operation optimization	Market design scheme for the distribution level markets
	Microgrid scenarios will be specified and simulated Test cases run in the FER-UNIZGs' laboratory in order to advance from simulation to real operation	Development and definition of standardized communication protocols between the microgrid elements and the central computer in charge of the microgrid operation, as well as the microgrid and local (distribution level) electricity markets	Centralized EMPC-based controller provides a trajectory of future control inputs satisfying system dynamics and constraints. Robust framework that optimizes the scheduling process (including uncertainty management) of a microgrid while actively participating in electricity markets.	Definition and demonstration of a structure of the local, distribution-level market. Investigation of complex interactions between microgrid, distribution network, wholesale electricity market and local distribution level market: proposition of a viable operation mechanism
	Lab demonstration of the technical feasibility and economic viability of microgrids as means to profit from local clean energy sources. Increase system – wide efficiency, reliability and security and support the transition towards low – carbon energy systems	Commercial and technological benefits that will enable the participation of new market players, i.e. aggregators and prosumers in the future flexibility markets	Minimization of the microgrid operational costs. Policies that will reduce energy consumption Improvement of energy efficiency	---
	Small consumers	Communities, industry and society in general	End-users	End-users

OTHER PROJECTS

Cyprus

CYPRUS RESGRID

CYPRUS RESGRID

Technical assistance for assessing the current state of the transmission and distribution electricity systems and proposing optimum solutions for increasing the amount of Renewable Energy Sources generation that can be fed in the electricity system of the Republic of Cyprus

Years	Project total cost	Website	Coordinator's country	Coordinator
2014-2016	0.4 M€	*N.A.*	Cyprus	JRC/European Commission

Types of technologies and services tackled	Partners	Countries involved
GRID	**10**	**3**

KER	Market analysis model
	Support the Government of Cyprus to establish a comprehensive medium- to long-term policy for the optimum penetration of renewable energy in the electricity system until 2030
	Cheaper, more secure, more environmental friendly energy system
	Government of Cyprus (Ministry of Energy)

SMARTPV

Smart net metering for promotion and cost-efficient grid integration of PV technology in Cyprus

Investigation of pilot net metering schemes for cost-effective PV implementation and higher grid penetration of distributed generation in Cyprus

Years	Project total cost	Website	Coordinator's country	Coordinator
2013-2017	1.2 M€	http://www.smartpvproject.eu/	Cyprus	University of Cyprus

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS, POWER GENERATION, MARKET	**5**	**1**

KER	Policy Recommendation	Web application	Time of Use tariff application
	Promotion of smart net-metering, pointing the way towards a more economically and environmentally sustainable electricity grid	Capability of electricity consumers to monitor their energy profiles in real time and compare them with historical energy data	Optimisation of time-varying electricity pricing, allowing to postpone build-up of additional capacity and thus contributing to efficient utilisation of existing production capacity
	Increase of self-consumption levels (39.5% of total consumption)	Residential peak consumption reduction (up to -3.19%) and energy conservation (-2,17%)	Reduction of residential peak energy consumption (-3.19%, 1.03% and 1.4% for the summer, middle and winter season, respectively)
	Energy stakeholders (local authorities, network operators, prosumers)	Utilities, consumers	Consumers, prosumers, utilities

OTHER PROJECTS

STORES

Promotion of higher penetration of distributed PV through storage for all

Boosting PV self-consumption in the MED region through an optimal residential storage solution. Testing of coupled solutions for the consumer in different pilot sites taking into account local parameters for optimization and using efficiency measures

Years	Project total cost	Website	Coordinator's country	Coordinator
2016-2019	1.2 M€	https://stores.interreg-med.eu/	Cyprus	FOSS Research Centre for Sustainable Energy

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS, STORAGE & POWER-TO-X, POWER GENERATION, MARKET	9	5

KER	Policy Recommendation	Pilot Implementation
	Development and validation of an improved self-consumption policy	Use of services by five pilot residential consumers, including increased self-consumption, based on PV systems in conjunction with ESS. Possibility to do peak-load shaving by utilizing stored energy
	Introduction of innovative smart policies to promote PV integration. Adoption of smart self-consumption policies to integrate PV and ESS at the residential and social level.	Reduction of dependency of residential users on the electricity network. Reduction of CO_2 emissions. Implementation of a social ESS in a distribution substation, sharing the same LV feeder with the residential pilots.
	Key energy stakeholders (public authorities, policy makers, DSOs, etc.) in participating regions as well as in islands and rural areas throughout the Mediterranean region	End-users in residential households

Czech Republic

SAVR

Automatic voltage regulation and reactive power system

SAVR

Voltage control in pilot nodes by reactive power of the connected generators. Demanded voltage is defined by dispatcher or by the OPF. Producers with the SAVR installations support the distribution grid instead of neutral behaviour only

Years	Project total cost	Website	Coordinator's country	Coordinator
Since 2000	*N.A.*	*N.A.*	Czech Republic	ČEZ Distribuce and producers

Types of technologies and services tackled	Partners	Countries involved
GRID	7	1

KER	Increase of DER hosting capacity
	U/Q regulation is cost effective solution – in other case DSO would either stop further RES integration or reinforce the grid
	Quality of supply. Reduction of grid related costs (avoided grid investments). Loss reduction. Higher RES availability in given place
	Customer

OTHER PROJECTS

Denmark

CITIES

Center for IT-Intelligent Energy systems

Addressing the deficiency of the energy system by establishing an integrated research centre covering all aspects of the energy system, including gas, power, district heating/cooling and biomass, and most importantly methods to forecast, control and optimize their interactions through the use of advanced ICT solutions

Years	Project total cost	Website	Coordinator's country	Coordinator
2014-2021	10 M€	http://smart-cities-centre.org/	Denmark	Technical University of Denmark

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS, GRID, STORAGE & POWER-TO-X, POWER GENERATION, MARKET	*N.A.*	**5**

KER	Smart grids
	An integrated research centre data intelligent with an integrated energy systems.
	An accelerated path towards a fossil-free society, new products, more flexibility in the energy system.
	The entire energy system stakeholders

ELECTROGAS

Electrogas, the renewable e-storage buffer

ELECTROGAS

Biogenic production of CH_4 from CO_2 in anaerobic digesters (AD), by either ex situ or in situ supply of reducing equivalents which may be added indirectly via addition of H_2 gas produced by electrolysis, or directly via cathodic supply of electrons to microbes

Years	Project total cost	Website	Coordinator's country	Coordinator
2014-2019	3.5 M€	http://projects.au.dk/electrogas/	Denmark	Aarhus University

Types of technologies and services tackled	Partners	Countries involved
STORAGE & POWER-TO-X, POWER GENERATION	**8**	**2**

KER	Biomethanation technology
	Power to gas (CH4) technology which can operate on off in an renewable electricity dominated grid.
	Up to 80% more methane from biomass via biogas + methanation. Either as electricity storage with gas to power or a cheap (same price or less than biomethane) source of CH4 for transport or platform chemicals. Cost effective technology.
	Producers and consumers of the developed technology.

OTHER PROJECTS

EL UPGRADED BIOGAS

EL UPGRADED BIOGAS

Demonstration of a 10 Nm3/h biogas upgrading plant using 50 kW Solid Oxide Electrolyzer and catalytic methanation

Years	Project total cost	Website	Coordinator's country	Coordinator
2013-2017	5.3 M€	https://energiforskning.dk/en/node/7155	Denmark	Haldor Topsøe A/S

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS, STORAGE & POWER-TO-X, POWER GENERATION, MARKET	10	1

KER	Demonstration of integrated Solid Oxide Electrolyzer and catalytic (SOEC) and methanation
	Using SOEC to provide hydrogen for catalytic methanation
	Increase methane potential from biogas by 60 % by converting renewable electricity and make it storable. Demonstration of high effciency, transient response and durability
	Farmers and society as a whole

ENERGY DATA SERVICE

ENERGY DATA SERVICE

Development of third party web-access to energy data

Years	Project total cost	Website	Coordinator's country	Coordinator
2016-2017	1.6 M€	*N.A.*	Denmark	Energinet

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS	1	1

KER	Web-portal: https://energinet.dk/El/Data-om-energisystemet
	Enabler for digitalisation, new business models, new services
	Enabler for digitalisation, new business models, new services
	Universities, market participants, IT-companies

OTHER PROJECTS

IHSMAG

Integrating Households in the Smart Grid

IHSMAG

Development of a comprehensive design of household smart grid solutions: technologies in households, daily electricity consumption practices of the household members and electrical system administrative and institutional rules that affect the implementation of new smart grid solutions

Years	Project total cost	Website	Coordinator's country	Coordinator
2012-2016	1.1 M€	https://ses.jrc.ec.europa.eu/ihsmag	Denmark	Danish Building Research Institute, Aalborg University

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS, STORAGE & POWER-TO-X, MARKET	4	3

KER	Insights into user behaviour and user experiences with DR solutions
	Static time-of-use pricing combined with EVs.
	Improvement of the balancing of renewable energy generation and energy consumption. Participation of households in demand response (load shifting).
	DSOs and consumers.

Finland

EL-TRAN

Transition to a resource effective and climate neutral electric energy system

EL-TRAN

Resolution of policy problems involved in a transition to a resource efficient, climate neutral electricity system by outlining requirements for Finnish energy policy actors to implement the transition and by defining a roadmap for the public sector to support the process

Years	Project total cost	Website	Coordinator's country	Coordinator
2015-2017	3.2 M€	https://el-tran.fi/in-english/	Finland	University of Tampere

Types of technologies and services tackled	Partners	Countries involved
MARKET	6	1

KER	Roadmap for a more resource effective and climate neutral electric energy system in Finland
	Roadmap for the Finnish public sector to support the key actors and stakeholders in the initiated energy transition: tasks for each public-sector actor and suggestions for institutional change and regulation
	To attain an optimal balance between costs and benefits Prioritisation among various solutions to improve resource efficiency and climate neutrality.
	Society

OTHER PROJECTS

HEILA

Integrated business platform of distributed energy resources

HEILA

Construction of extensive business development platform, based on the integration of laboratories and simulation environments of the research centre VTT and universities. The platform includes real-life pilots for developing and testing the functions needed in the management of future energy system. One essential target is to build a virtual microgrid

Years	Project total cost	Website	Coordinator's country	Coordinator
2017-2018	1 M€	*N.A.*	Finland	Tampere University of Technology

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS GRID MARKET	***N.A.***	**1**

KER	Development platform
	Scalable concept for information exchange. Larger scale piloting platform through combining different laboratories and pilot sites using remote connections
	Cost-effective operation of the future smart grids. Information exchange with a multitude of small-scale resources
	Companies developing new solutions and research organizations

VAGE

Improving the value of variable and uncertain power generation in energy systems

VAGE

Improvement of operational decision making in power systems when considering the variability and uncertainty of wind, solar, water inflow, heat and electricity demand, their correlations and possible sources of flexibility, enabling optimisation of storage time scales (up to 10 days) and wind/PV forecasting with uncertainty estimates in different time scales

Years	Project total cost	Website	Coordinator's country	Coordinator
2015-2018	1.4 M€	https://clicinnovation.fi/projects/vage-improving-value-variable-uncertain-power-generation-energy-systems/	Finland	VTT

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS GRID STORAGE & POWER-TO-X POWER GENERATION	**2**	**1**

KER	Backbone - Open source energy systems modelling framework
	Better optimization of interconnected energy systems using high temporal and geographic resolution for high shares of variable generation, storages and demand side representation
	Increasing the value of variable power generation for society
	Policy and business decision makers, academia

OTHER PROJECTS

WIVE

Wireless for Verticals

WIVE

Development of future radio technology and study of its application for verticals by setting up use cases, scenarios and requirements for the technology as well as via testing. Testing and trialing of the technology will happen in test facilities provided by 5G Test Network Finland as well as in the testbeds from the consortium

Years	Project total cost	Website	Coordinator's country	Coordinator
2017-2018	4 M€	https://wive.turkuamk.fi/	Finland	Turku University of Applied Sciences

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS	6	1

KER	Feeder line protection
	To experiment and validate what types of existing and forthcoming wireless technologies can be applied for remote monitoring, control, and protection in a realistic environment
	Significant CAPEX and OPEX cost savings and better flexility to re-configure monitoring, control, and protection capabilities in medium voltage networks. Better quality of electricity and reduced distribution outages
	DSOs, TSOs, Consumers

France

POSTE INTELLIGENT

Development of a 100% digital and optical solution that will enhance the energy and operational performance of the grid as well as its reliability

Years	Project total cost	Website	Coordinator's country	Coordinator
2012-2018	32 M€	http://www.posteintelligent.com/	France	RTE

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS, GRID, STORAGE & POWER-TO-X, POWER GENERATION	7	1

KER	Digitized substations
	A substation which was a power hub will be a data hub Digitization of a TSO
	Enhance the energy and operational performance of the grid as well as its reliability
	Users and customers

OTHER PROJECTS

SUBZERO

Next Generation Compact Substations

SUBZERO

Co-development (RTE and industrial partners) of the next generations of compact HV substations which will be ecodesigned (e.g. SF6-free up to 400kV), digital ready (e.g. NCIT and IEC61850 process-bus) and more flexible for maintenance and operation

Years	Project total cost	Website	Coordinator's country	Coordinator
2018-2024	322 M€	*N.A.*	France	RTE

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS GRID	***N.A.***	**8**

KER	Ecodesigned compact substation
	To provide SF6-free solutions for compact Substations up to 400kV including life-cycle analysis methodologies to assess the complete environmental perfomance of such solutions.
	Lower the impact of the substations assets on the environment and reduce the life-cycle cost and outages caused by those assets.
	Overall society and customer.

Germany

ADELE

Adiabatic Compressed-Air Energy Storage for Electricity Supply

ADELE

Development of Compressed Air Energy Storage (ACAES) for electricity storage

Years	Project total cost	Website	Coordinator's country	Coordinator
2013-2017	0.8 M€	https://www.rwe.com/web/cms/mediablob/en/391748/data/364260/1/rwe-power-ag/innovations/Brochure-ADELE.pdf	Germany	RWE/DLR

Types of technologies and services tackled	Partners	Countries involved
STORAGE & POWER-TO-X	**6**	**1**

KER	Adiabatic Compressed Air Energy Storage
	Improved grid integration of renewable energy.
	Transition towards CO2-neutral energy generation, grid stability, avoided curtailment of RES.
	Utilities, grid operators, power plant operators.

OTHER PROJECTS

ALEGRO

Aachen Liege Electricity Grid Overlay

ALEGRO

320-kVDC-Connection between Belgian and German Electrical Transmission Grid aiming at carrying around 1,000 megawatts. The power line will use high-voltage direct-current (HVDC) transmission technology and will be installed as an underground cable

Years	Project total cost	Website	Coordinator's country	Coordinator
2009-2021	500 M€	https://www.amprion.net/Grid-expansion/Our-Projects/ALEGrO/	Germany	Amprion

Types of technologies and services tackled	Partners	Countries involved
GRID MARKET	***N.A.***	**2**

KER	Electrical capacity on Transmission grid between Belgian and Germany
	Connection of electricity markets
	Connection of electricity markets. Security of supply
	European electricity market

AMPACITY

Ampacity - 10 kV superconductor system for high-power electricity links

AMPACITY

Proof of the technical suitability of superconducting technologies in distribution grids; evaluation of the investment for a 10-kV cable in combination with a superconducting fault current limiter as an alternative to a 110-kV cable system

Years	Project total cost	Website	Coordinator's country	Coordinator
2011-2016	13.5 M€	*N.A.*	Germany	Innogy SE

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS GRID MARKET	*N.A.*	**3**

KER	Guidelines: "Implementation and specification of the cable system"
	Proof of the technical suitability of superconducting technologies
	Open source result
	DSO

OTHER PROJECTS

DC-BLOCKING DEVICE

DC BLOCKING DEVICE

Test installation of DC-Blocking device prototype, connected to the neutral of a transformer to suppress any DC-current

Years	Project total cost	Website	Coordinator's country	Coordinator
2016-2019	*N.A.*	*N.A.*	Germany	Amprion

Types of technologies and services tackled	Partners	Countries involved
GRID	***N.A.***	**1**

KER	DC-current suppression in HVAC-Grid
	A DC-Blocking device connected to the neutral of a transformer
	Suppression of any DC-current
	TSOs

FLEXITES

Kraftwerksflexibilisierung durch Thermische Energiespeicher

FLEXITES

Operational flexibilisation of coal-fired steam power plants through integration of heat storage

Years	Project total cost	Website	Coordinator's country	Coordinator
2017-2019	3.5 M€	*N.A.*	Germany	German Aerospace Center (DLR)

Types of technologies and services tackled	Partners	Countries involved
STORAGE & POWER-TO-X; POWER GENERATION; MARKET	***N.A.***	**1**

KER	Flexible steam power plants	Improved heat storage technologies
	Flexibilisation of coal-fired steam power plants through integration of heat storage	Provision of high-temperature heat storage technology for use in power plants and for industrial process heat.
	Transition technology offering contribution to grid stability and preventing curtailment of RE. Integration of Renewable Energy Source on the grid.	Improved utilisation of RE in the energy system.
	Utilities, power plant operators	Supplier of heat storage technology

OTHER PROJECTS

INTEGRATED IT-SYSTEMS

INTEGRATED IT-SYSTEMS

Building up a platform to easily connect the existing and new IT-Systems in a standardized way

Years	Project total cost	Website	Coordinator's country	Coordinator
2017-2018	1 M€	*N.A.*	Germany	Amprion GmbH

Types of technologies and services tackled	Partners	Countries involved
GRID	***N.A.***	**1**

KER	Implementation of a data exchange infrastructure	Implementation of a CIM based Enterprise Data Model	Integration of a CIM-Cache
	Infrastructure with standardized ways to develop, deploy and operate an integrated internal IT-landscape	Develop the CIM based Data Model when new requirements arise using the standardized Data Model for grid data	Standard software product covering most of the needed functionality and development of an interface to reach a full support in the existing infrastructure
	Technical support of a single-point-of-truth perspective and raise of data quality	Connection of the data in new systems to the legacy data silos. Common understanding of the data used by different systems leading to high quality	Standardized way of storing the data achieving high data quality
	Internal IT departmenent, integrators of IT systems and their users	Data users and data providers	User of the exchanged data and data quality managers

KRYOLENS

Kryogene Luftenergiespeicherung
(Cryogenic air energy storage)

KRYOLENS

Increase of the technology readiness level of the bulk energy storage technology of Liquid Air Energy Storage (LAES) by process and component optimisation and determination of the techno-economic potential

Years	Project total cost	Website	Coordinator's country	Coordinator
2016-2019	2.8 M€	*N.A.*	Germany	Linde AG

Types of technologies and services tackled	Partners	Countries involved
STORAGE & POWER-TO-X	**6**	1

KER	LAES technology development and economic assessment
	Increase the TRL of LAES technology, thus contributing to meet the need for large-scale energy storage
	Availability of large-scale energy storage combining proven technology with scalability and site independence
	Utilities, equipment manufacturers

OTHER PROJECTS

KWK FLEX

Highly flexible Combined Heat and Power by Thermal Energy Storage and „Power-to-Heat“

Thermal load prediction and flexible generation and dispatch of combined heat and power for district heating

Years	Project total cost	Website	Coordinator's country	Coordinator
2016-2019	0.3 M€	*N.A.*	Germany	Kempten University of Applied Sciences

Types of technologies and services tackled	Partners	Countries involved
STORAGE & POWER-TO-X; POWER GENERATION; MARKET	2	1

KER	Advanced thermal load prediction	Advanced dispatch optimisation tool	Instationary power plant and energy storage simulation models
	On-site advanced thermal load prediction in district heating grids, using machine-learning technologies, in particular based on "deep learning".	Optimised dispatch of thermal generation units and thermal energy storage in district heating and cooling systems	Improved insight into plant dynamics of thermal generation and energy storage units
	Reduced emissions and cost by optimized plant dispatch according to required thermal loads.	Reduced use of fossil fuels (i.e. reduced costs, emissions).	Reduced fuel consumption, costs and wear of components during transient operation
	District heating and cooling system operators.	Operator of thermal generation units and thermal energy storage for district heating and cooling.	

STENSEA

Stored Energy in the Sea

Development and testing of a novel pumped storage concept for storing large amounts of electrical energy offshore in combination with offshore wind farms: use of the sea itself as upper storage reservoir and a hollow sphere on the seabed as the lower storage reservoir

Years	Project total cost	Website	Coordinator's country	Coordinator
2013-2017	*N.A.*	https://www.iee.fraunhofer.de/en/research_projects/search/2017/stensea.html	Germany	Fraunhofer IEE

Types of technologies and services tackled	Partners	Countries involved
STORAGE & POWER-TO-X; POWER GENERATION	3	1

KER	Feasibility proved	Full-Scale concept developed
	To add a valuable storage option (demonstrated in a relevant environment) to the future energy system as well as to Europe's storage portfolio.	Availability of a concept of a full scale system and logistics, based on results from model experiment, thus making a good exploitation possible. Results partly published.
	The technology can store energy for around 2€cent/kWh, without severe geological impact compared to conventional pumped hydro storage plants.	High impact of results (partly published) in public, thus raising a high interest of possible users, companies and public.
	European energy system stakeholders.	Public, Research, Policy makers.

OTHER PROJECTS

SWARMGRID

Safe operation of electric grids with swarm-enabled system services

SWARMGRID

Simulation and contribution of decentralized system units “swarm" to system stability

Years	Project total cost	Website	Coordinator’s country	Coordinator
2015-2018	4.2 M€	http://www.acs.eonerc.rwth-aachen.de/cms/E-ON-ERC-ACS/Forschung/Forschungsprojekte/Gruppe-Large-Software-System-Challenges/~lrjn/SwarmGrid/?lidx=1	Germany	RWTH Aachen - Institute for High Voltage Technology

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS GRID MARKET	4	1

KER	Secured system operation approaches
	To develop approaches for the secure operation of the electrical energy systems.
	Stablity and security of the whole system.
	All participants of the electrical energy system.

VARIABLE SHUNT REACTOR

VARIABLE SHUNT REACTOR

Enhancement of voltage control in the 400kV-Grid due to the large regulation range of the shunt reactor (50 to 250MVAr)

Years	Project total cost	Website	Coordinator’s country	Coordinator
2013-2017	4 M€	N.A.	Germany	Amprion

Types of technologies and services tackled	Partners	Countries involved
GRID	N.A.	1

KER	Enhanced voltage control in the 400kV-Grid
	Wide regulation range of the shunt reactor (50 to 250MVAr) in combination with a tap changer designed for max. 300.000 switching operations.
	Improved voltage control.
	TSOs.

OTHER PROJECTS

Hungary

SMART SYNERGY

Measuring the impact of smart meters on consumers

SMART SYNERGY

Analysis of Smart Meter rollout solutions, obstacles and technological needs from a DSO point of view, and in particular of the attitude of consumers, the technological possibilities of multi-utility smart metering, possible business models and data security & protection aspects

Years	Project total cost	Website	Coordinator's country	Coordinator
2012-2013	*N.A.*	https://www.interregeurope.eu/policylearning/good-practices/item/915/smart-synergy-project/	Hungary	DÉMÁSZ

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS GRID	**4**	**1**

KER	Conclusions of the analysis of smart meter rollout solutions, obstacles and technological needs from a DSO point of view
	Definition of the best available and most cost efficient technological solutions for multi-utility smart metering (in terms of metering, data transmission and data registering). Demonstration of not relevant resistance of consumers.
	Successful smart meter data reading implemented by GSM (97-99%) and by PLC (96-98%).
	TSOs, DSOs, Government, Consumers.

Ireland

DLR

Dynamic Line Ratings

DLR

Four-year trial of dynamic line rating technology on selected 220kV and 110kV feeders in the Irish system. This trial will include collaboration with the asset owner to ensure the overall least cost solution is found

Years	Project total cost	Website	Coordinator's country	Coordinator
2018-2022	0.5 M€	*N.A.*	Ireland	EirGrid

Types of technologies and services tackled	Partners	Countries involved
GRID	***N.A.***	**1**

KER	Results of Trial Dynamic Line Ratings Deployment
	Increase utilization of existing assets at minimal cost. Relaxing operational limits with limited impact on security.
	Relieving congestion and reduce capital and operational expenditure through increased utilization of true asset capacity
	Customers

OTHER PROJECTS

DS3

Delivering a Secure Sustainable System

DS3

Ensuring that the power system can securely be operated with increasing amounts of variable non-synchronous renewable generation over the coming years

Years	Project total cost	Website	Coordinator's country	Coordinator
2011-2020	*N.A.*	http://www.eirgridgroup.com/how-the-grid-works/ds3-programme/	Ireland and Northern Ireland	EirGrid and SONI

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS, GRID, STORAGE & POWER-TO-X, POWER GENERATION, MARKET	3	2

KER	Wind Security Assessment Tool (WSAT)	New System Services for managing high renewable penetration	New control room tools	Enhanced performance monitoring
	Real time assessment of transient and voltage stability.	New service products: synchronous inertial response, fast frequency response, fast post fault power recovery, dynamic/steady state reactive reserve and ramping.	Monitoring of renewable penetration, inertia and RoCoF; 24 hours look ahead calculation of ramping requirements, forecast of the voltage profile and stability forecasting with an enhanced WSAT.	Standardisation and documentation of existing processes on an all-island basis.
	More renewable generation in Ireland and Northern Ireland and reduce carbon emissions: from 60% to 65%; lower costs.	Expected production cost saving of €300m by 2020 realized by allowing the system to operate with up to 75% renewable generation. Continuing increase of SNSP to 75% by 2020.	Extract the full benefit from renewable generation and avoid increasingly widespread curtailment.	Flag non-compliances, so that generating units can remedy these issues, submit derogations or revise their contracted values.
	Customer.	Customer.	User, Customer.	TSO, Customer.

POWER OFF AND SAVE

Save money by better managing your electricity use

POWER OFF AND SAVE

Rewarding customers who agree to reduce their energy use when electricity demand is high

Years	Project total cost	Website	Coordinator's country	Coordinator
2016-2018	0.3 M€	http://www.eirgridgroup.com/how-the-grid-works/power-off-save/	Ireland	EirGrid

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS, MARKET	2	1

KER	Availability, response time and volume of domestic demand response
	Assessment of the possibility to get Demand Response technologies into the homes, including consumer behaviour aspects
	Provision of flexibility to power systems allowing for a greater penetration of intermittent energy supply
	TSOs, Consumers

OTHER PROJECTS

POWER LINE GUARDIAN / TOWER ROUTER

POWER LINE GUARDIAN / TOWER ROUTER

Demonstration of a tower router from SmartWires expanding on the capabilities of the technology of the distributed power flow controller "Power Guardian®", also from SmartWires. This device can increase or decrease a line's reactance to electrical power flow in real time, permitting greater use of existing transmission capacity

Years	Project total cost	Website	Coordinator's country	Coordinator
2015-2019	0.3 M€	*N.A.*	Ireland	EirGrid

Types of technologies and services tackled	Partners	Countries involved
GRID	*N.A.*	**2**

KER	Results of Trial Power Flow Controller Deployment
	Managing power flows on constrained boundaries to ensure utilization of parallel assets and avoid building new assets
	Reduce costs and impact on customer/environment. Reduce capital and operational expenditure for customer
	Customer

SCHWUNGRAD RHODE HYBRID TEST FACILITY

SCHWUNGRAD RHODE HYBRID TEST FACILITY

Development and implementation of an operational testing of a flywheel energy storage plant (4 x 150 kW units) connected to the 110kV electrical grid to demonstrate the provision of fast acting stabilisation system services required by the Transmission System Operator, Eirgrid. Schwungrad will also integrate battery technology to produce an innovative hybrid system, connected to the electrical grid to provide further system services

Years	Project total cost	Website	Coordinator's country	Coordinator
2014-2017	2.75 M€	*N.A.*	Ireland	Schwungrad Energie

Types of technologies and services tackled	Partners	Countries involved
STORAGE & POWER-TO-X, POWER GENERATION	***N.A.***	**3**

KER	Trial Results for Hybrid Flywheel/Battery Storage
	Increase the penetration of storage into the system and demonstration that hybrid battery flywheel storage can provide services in the time frame of 500ms to 20 minutes.
	Grid stability as the penetration of non-synchronous generation increases.
	Flywheel/battery hybrid users. Customer.

OTHER PROJECTS

Italy

ADVANCE DISPATCHING & LFOR

Advance Dispatching and real-time forecasts of active&reactive load

ADVANCE DISPATCHING & LFOR

A real-time software currently in use in the National Dispatching Control Room of Terna (Italian TSO). Its main goal is to define and propose the best dispatch of all the power-generating modules qualified for the Italian ancillary services market

Years	Project total cost	Website	Coordinator's country	Coordinator
N.A.	*N.A.*	*N.A.*	Italy	Terna

Types of technologies and services tackled	Partners	Countries involved
GRID, MARKET	***N.A.***	**1**

KER	Advance Dispatching and real time load forecast, LFOR Platform	Advanced algorithms for linear programming, adopting mixed-integer variables (MILP)
	LFOR Platform applicable, with high performances, for the active power net load forecast and nodal active or reactive power forecasts.	
	Strengthen system operation and increase security of supply for final customers; Reduction of system costs for balancing; Improvement of both load forecast accuracy and system security	
	All power system users	

LIVING GRID

LIVING GRID

Development of new models for the enhancement of the system observability and the optimal management in emergency conditions of: the National Transmission Network (NTN), the disconnection and reconnection of portions within the network and of the related DER, contributing to overcome the traditional "load shedding" concept, and the distributed generation curtailment

Years	Project total cost	Website	Coordinator's country	Coordinator
2018-2020	1 M€	*N.A.*	Italy	ENEA

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS, GRID, STORAGE & POWER-TO-X, MARKET	***N.A.***	**1**

KER	Grid observability & controllability
	Enhancement of the observability and of the forecasting capacities of available resources finalized to their optimal management. Increase of the automation and control both on HV and MV networks, and on the interface between the networks of medium and high/extra high voltage, in an increasingly integrated approach.
	Safety and reliability of networks in the presence of DER (generation and loads). Higher quality of service levels, monitoring capabilities, observability and controllability. Otimizing the use of the transport network capacity. Reduction of CO2 emissions and environmental impact.
	TSOs and DSOs.

OTHER PROJECTS

STORAGE LAB

STORAGE LAB

Field testing of power-intensive Electrochemical Storage Systems (ESSs) installed in the main Italian islands of Sardinia and Sicily and connected to the national transmission grid for the provision of system services (e.g. primary and secondary frequency response, black start)

Years	Project total cost	Website	Coordinator's country	Coordinator
2014-2018	50 M€	https://www.terna.it/en-gb/sistemaelettrico/progettipilotadiaccumulo.aspx	Italy	TERNA

Types of technologies and services tackled	Partners	Countries involved
GRID, STORAGE & POWER-TO-X, MARKET	**5**	**1**

KER	Regulation services	Know-how sharing
	To allow to identify the best storage technologies and their key findings in order to set specific services to be provided from this kind of systems for TSO applications and ancillary services market.	To allow to spread the key findings of the project and make people interested in storage systems more aware of pros and cons of each technology and of advantages for the electric system.
	Exploitation of storage for providing grid services to TSO. Increase of grid security. CO_2 reduction: 337 tons/year.	Publication of project reports and public workshops for presenting results of experimentation.
	Society, private investors (in storage technologies).	Society, investors, TSOs.

OTHER PROJECTS

Latvia

ITCITY

An ICT platform for sustainable energy ecosystem in smart Cities

Response to the citizens' needs for new information technologies applications of various energy technologies usage, integrated in an intelligent way within Platform area at City level

Years	Project total cost	Website	Coordinator's country	Coordinator
2017-2020	0.6 M€	http://fei-web.lv/en/itcity	Latvia	Institute of Physical Energetic (IPE)

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS	7	5

KER	Electricity consumption web-based platform for smart cities	Methodology for municipalities in transition to Smart Cities	A framework based on a mobile application for smartphones	Simulation for communication solutions in Wireless Sensor Networks (WSN)
	Use of instrumentation values available in smart meters, with high time granularity for the measurement of rms values for voltages and currents, active and reactive powers, energy, dynamic tariffs, time of use etc. to derive load profiles for typical households in Smart Cities.	Specification of the techniques to characterize the methodology for Smart Cities services for energy (intelligent planning, design and operation of urban energy networks, including renewables and smart grids technologies integration).	To engage people to contribute to smart cities, focusing on reducing energy consumption by changing consumption behaviors in daily life.	To determine the scope and new frontiers of wireless sensor networks, in order to feed different systems distributed throughout the city, mainly working on the internet of things (IoT) and MachinetoMachine (M2M).
	Contribution to city energy ecosystem, improvement of city services and quality of life at national and transnational level. More efficient planning of the grid operation.	Raise the level of development of all main structures of the city, from awareness of the inhabitants to the introduction of progressive technologies.	Impact on future endeavours towards smart cities, reduction of energy consumption.	To efficiently manage the energy in homes, neighborhoods and metropolitan urban areas.
	End users of electrical energy, mainly in households from Smart Cities. DSOs and ESCOs.	Citizens, municipality, merchants, research institutions.	End users.	End-users.

OTHER PROJECTS

Lithuania

DIGITALIZATION OF THE VIDIŠKIAI TRANSFORMER SUBSTATION

VIDIŠKIAI DIGITALIZATION

Implementation of Vidiškiai 110 kV transformer substation (TS) as the first digital substation in the grid. New generation Robotic Process Automation (RPA) equipment manufactured under IEC 61850 which ensure interoperability in the horizontal communication within the optical data network was introduced

Years	Project total cost	Website	Coordinator's country	Coordinator
2013-2016	0.6 M€	*N.A.*	Lithuania	Litgrid

Types of technologies and services tackled	Partners	Countries involved
GRID	***N.A.***	**1**

KER	Digitalisation of the network
	Full digitalisation in transmission network: monitoring, automation and control and ully redundant communication
	- 80% cost of cables, - 50% time of cubicles making, - 80% design modification, 100% noise resistance
	TSO

Netherlands

CO-RISE

Community innovation for sustainable energy: Aligning social and technological innovation

CO-RISE

Alignment of social and technical innovation through investigating the innovative potential of local energy initiatives in terms of technology, social embeddedness and normativity as well as researching the innovative potential of emerging sustainable energy technologies, including their social and normative dimensions

Years	Project total cost	Website	Coordinator's country	Coordinator
2016-2020	0.5 M€	*N.A.*	The Netherlands	University of Gronigen

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS GRID STORAGE & POWER-TO-X POWER GENERATION MARKET	*N.A.*	**1**

KER	Set up of local energy co-operatives
	Community acceptance, local energy solutions.
	The energy costs for local communities can be reduced by as high as 30 % through local management of energy system in synergy with centralized energy system.
	Local energy communities

OTHER PROJECTS

DYNAMO

Define possible business models for Smart Meter system

DYNAMO

Definition of possible business models for Smart Meter systems, in order to start a distributed Flexibility market based on USEF (Universal Smart Energy Framework)-standardized market rules and to enable cooperation between aggregators, DSO and other market parties

Years	Project total cost	Website	Coordinator's country	Coordinator
NA	3 M€	*N.A.*	The Netherlands	Alliander

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS GRID MARKET	***N.A.***	**1**

KER	Flexibility market model	Management of flexibility by a DSO
	Promoting demand response provided by market players in an open and standardized way	Smart Grid management, digitization of daily grid management
	New market for aggregators and customers. Give value to flexibility	Reduce grid investments
	Customer, Balance Responsible Party BRP, aggregator, TSO and DSO	DSO, customer, aggregator

Norway

CEDREN HYDROBALANCE

Large-scale balancing and energy storage from Norwegian hydro power

CEDREN HYDROBALANCE

Potential future uses of hydropower flexibility and storage up to the year 2050: Economic opportunities, environmental impacts, mitigation of new operational regimes in reservoirs, challenges in terms of regulatory framework, policy, public acceptance

Years	Project total cost	Website	Coordinator's country	Coordinator
2013-2017	2.6 M€	http://www.cedren.no/english/Projects/HydroBalance	Norway	SINTEF Energi

Types of technologies and services tackled	Partners	Countries involved
GRID STORAGE & POWER-TO-X MARKET	**N.A.**	**1**

KER	Flexibility and energy storage needs in the transistion	Investment tool for pumped-storage and hydro in a multimarket setting	Environmental assesment of hydro reservoirs
	Method for calculation of detailed future wind and solar output - for operation and energy system planning	Prototype for estimation of revenues from additional pumped-storage for investment and operation purposes	Methodology for assessing environmental and economic consequences of pumped-storage between reservoirs
	Support the transition towards emmision free electricity sector	Improve investement decisions for a key tecnology for flexibility (Hydro Power), helpful in revisions of hydropower regulation, New advances in methodology for planning and Investment	Contribution to the dicussion regarding how to use and expand hydropower as energy storage
	Government. Regulators. Operators. Consultancy	Power Companies and service providers	Policy makers and the Hydro Power industry

OTHER PROJECTS

CINELDI

Centre for intelligent electricity distribution
to empower the future smart grid

Enabling a cost-efficient implementation of the future flexible and robust electricity distribution grid. This will pave the ground for increased distributed generation from renewable resources, electrification of transport, and more efficient energy use

Years	Project total cost	Website	Coordinator's country	Coordinator
2016-2024	40 M€	https://www.sintef.no/projectweb/cineldi/	Norway	SINTEF Energi AS

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS, GRID, STORAGE & POWER-TO-X, POWER GENERATION, MARKET	29	1

KER	Decision support for planning and asset management	New concepts and solutions for smart operations	Cost effective integration of flexible resources	Microgrid concepts, technologies and solutions	Roadmap for the transition to the future distribution system
	Decision support methodologies and tools for the optimal planning and asset management of the future distribution system	New cost-effective concepts and solutions for smart operations based on new emerging control and monitoring technologies and extensive real time monitoring	Methods and models for cost effective integration of flexible resources in smart distribution grids, including business models on how to utilize this flexibility	Microgrid concepts, technologies and solutions for optimal design, operation, and integration with the distribution system. Technologies and solutions for micro grids, self-contained electricity system	Develop a credible set of Smart Grid visions and scenarios, guidelines and recommendations for the transition to the future flexible, robust, and cost-efficient electricity distribution system by integrating the results and findings from the other KER into a holistic strategy
	More efficient grid through better utilisation of existing and new infrastructure, more target-oriented investments, and better control of risks. Reduction of grid tariffs, increase of share of Distributed renewable generation, more efficient Power and energy use, strengthening Research institutes	More flexible operation of the distribution grid, contributing to cost reductions, enhanced energy efficiency and improved system reliability and security, as well as standardised solutions. Better Control of cyber risks	Market solutions for flexibility, securing electricity supply, increased utilisation of the grid, flexibility as alternative to grid investments. Improved interaction DSO-TSO to benefit the total power system, especially by enabling DER flexibility to all levels	Better Control of Security of electricity supply, integration of DER, strengthened Research institutes. Contribution to cost-efficient and robust integration of microgrids with the distribution grid	Strategy for the future electricity distribution system, regarding grid Investments, smarter operation, utilisation of flexible Resources and microgrids. Opportunities for the future distribution system
	Grid companies, power producers, end-users, software companies	Grid companies, power producers, end-users, ICT and technology providers	Grid companies, TSO, end-user	Grid companies, power producers, end-users, technology providers	Grid companies, end-users, power producers, technology and ICT providers

OTHER PROJECTS

FASAD

Fault and interruption handling in smart distribution systems

FASAD

Investigation on how smartgrid technology can be utilized in the electric distribution grid to reduce interruptions in the electricity supply as well as the socio-economic costs of interruptions

Years	Project total cost	Website	Coordinator's country	Coordinator
2016-2017	*N.A.*	https://www.sintef.no/en/projects/fault-and-interruption-handling-in-smart-distribut/	Norway	Sintef Energi AS

Types of technologies and services tackled	Partners	Countries involved
GRID	*N.A.*	1

KER	Smart fault and interruption handling
	Utilisation of fault current sensors connected to the Control system, in combination with remotely controlled disconnectors.
	Improved work processes and faster restoration of electricity supply. More efficient handling of faults and interruptions, reduced costs of interruptions, improved system solutions before scaling up.
	Grid companies and end-users.

FLEXNETT

Flexibility in the future smart distribution grid

Increase of the future smart grid distribution flexibility in a cost effective, sustainable and reliable way. This will be done by demonstrating and verifying technical flexibility solutions in the market on different grid levels to identify the effect of solar production on flexibility

Years	Project total cost	Website	Coordinator's country	Coordinator
2015-2017	2.2 M€	https://hafenstrom.com/new-project-flexnett/	Norway	BKK Nett

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS, GRID, STORAGE & POWER-TO-X, POWER GENERATION	17	1

KER	Battery for postponement of grid investment	Self-healing technology	Sun map for customers
	Battery installed at a prosumer contributes to voltage support as an alternative to new cable.	Implementation of technology for self-healing in the distribution grid.	Demonstration of the benefit from solar panels.
	Postponement of grid investment.	Reduced outages for the customers.	Increased self-consumption for the customers.
	DSO and customers.	Customers.	Customers.

OTHER PROJECTS

MODFLEX

Modelling Flexible resources in the distribution grid

MODFLEX

Development of dynamic models representing the consumption and production profiles for different flexible resources in the smart distribution grid. The Project will address how such resources can be utilized to increase the flexibility in the grid - without introducing new peak load hours due to the rebound effect

Years	Project total cost	Website	Coordinator's country	Coordinator
2016-2019	1.6 M€	https://www.sintef.no/en/projects/modelling-flexible-resources-in-smart-distribution/	Norway	SINTEF Energi

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS	*N.A.*	**1**

KER	Modelling flexible resources
	To describe high resolution consumption profiles for different new types of electricity units (load, DG and storage), including potential for flexibility and possible rebound effect, and identify how Photovoltaic (PV), EV, instant water heaters and other demanding loads affect the distribution grid with and without the use of demand response and storage
	Evaluation of how flexible resources can be an alternative to grid Investments. Software improvement for grid planning
	DSO

STRONGRID

Smart Transmission Grids Operation and Control

Development of knowledge and solutions to improve security and efficiency in operation and control of the next generation electric power systems

Years	Project total cost	Website	Coordinator's country	Coordinator
2011-2015	24 M€	https://ses.jrc.ec.europa.eu/strongrid	Norway	Norwegian University of Science and Technology

Types of technologies and services tackled	Partners	Countries involved
GRID	**12**	**7**

KER	Applications of PMU measurements in power system operation
	Improved situational awareness and understanding among power system operators of dynamic performance and stability issues
	Better utilization of the power grid without jeopardizing power system security
	End user

OTHER PROJECTS

Portugal

GRACIOSA

Renewable Generation with Intelligent Storage and Consumption to Operate Distribution Networks with Auto-consumption Systems

GRACIOSA

Intelligent power controls and purpose-built Energy Management System combined with a battery storage system, a wind park and a photovoltaic power plant. The system allows to power the island by wind and solar energy with the existing diesel needed only for back-up power during prolonged periods of unfavorable weather

Years	Project total cost	Website	Coordinator's country	Coordinator
2014-2017	24 M€	https://www.younicos.com/case-studies/graciosa/	Portugal	Younicos

Types of technologies and services tackled	Partners	Countries involved
GRID, STORAGE & POWER-TO-X, POWER GENERATION	**4**	**1**

KER	**Integrate different power units without disturbing the stability of the grid.**
	Use endogenous resources such as wind and sun.
	About 2/3 of annual consumption will be provided through renewables energy.
	Customers.

SINAPSE

Near Real-Time Outage Detection With Spatio-Temporal Event Correlation

SINAPSE

Platform to improve the visibility over the low voltage grid, making available an automatic communication channel for low voltage anomalies, with internal and external sources of data, adding intelligence to the distribution grid

Years	Project total cost	Website	Coordinator's country	Coordinator
2014-2017	0.06 M€	https://www.edp.com/en/stories/sinapse	Portugal	EDP Inovação/ EDP Distribuição

Types of technologies and services tackled	Partners	Countries involved
GRID	**2**	**1**

KER	**Real-time external events correlation**
	Sinapse leverages on real-time signals (events) from external stakeholders such as telecom operators and other industrial players to correlate events and detect grid outages in real-time
	Shortened operational reaction times and increased quality of service
	Consumers (both business and residential)

OTHER PROJECTS

Slovenia

NEDO PROJECT

NEDO

Study of the technological possibilities of multi-utility smart metering (partnership with the Japanese agency NEDO)

Years	Project total cost	Website	Coordinator's country	Coordinator
2016-2019	35 M€	https://www.eles.si/en/nedo-project	Slovenia	ELES

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS · GRID · STORAGE & POWER-TO-X · POWER GENERATION · MARKET	**3**	**2**

KER	Increased supply of tertiary frequency control with advanced services	Increased supply of secondary reserves using environmentally friendly technologies	Increased reliability of supply to grid users	Involving small consumers (households, small businesses) in ancillary services
	Increasing competitiveness of tertiary reserve supply.	Provision of Secondary Frequency Control by Energy Storage Systems.	Real-life operation of advanced DMS (Distribution Management System) functionalities.	Involving consumers on a very low-cost principle in actively participating in electricity markets and system services.
	Very low-cost ancillary service.	Demonstration of the feasibility of storage.	50% higher reliability of electricity supply and 50% higher reliability of the provision of services to the TSO from lower-voltage levels.	20 % reduction of consumption in peak hours.
	TSOs, grid users.	TSOs, grid users.	Grid users.	DSOs, TSOs.

ETIP SNET
EUROPEAN TECHNOLOGY AND INNOVATION PLATFORM
SMART NETWORKS FOR ENERGY TRANSITION

PLAN. INNOVATE. ENGAGE.

OTHER PROJECTS

SINCRO.GRID

Implementation of the SINCRO.GRID
PCI - Phase 1

Solving network voltage, frequency control and congestion issues enabling further deployment of renewables and displacement of conventional generation by integrating new active elements of transmission and distribution grids into the virtual cross-border control centre based on advanced data management

Years	Project total cost	Website	Coordinator's country	Coordinator
2016-2021	88.5 M€	https://www.sincrogrid.eu/en/	Slovenia	ELES d.o.o.

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS · STORAGE & POWER-TO-X · MARKET	***N.A.***	**1**

KER	**Real-Time voltage control for optimization at national and international level between TSOs and DSOs**	**Flexibility of Active power. Increased supply of ancillary services.**
	Higher potential penetration of renewables. Solved issue of voltage profiles. Relieved shortage of ancillary services (secondary reserve). Improved system balancing performance in the control block area. Better utilization of existing transmission grid using the DTR system. Better observability of distribution and transmission grids using advanced forecasting tools, DTR and information. Additional tertiary reserve provided by the DSM by establishing a common communication platform.	Provision in a secure manner and impact on a wider- regional level.
	Higher social welfare for society, increased competition, lower CO2 emissions, new research findings. Increasing the system flexibility. Increasing network capacities.	Reduction of CO2 emissions. Better grid utilization. Enable a larger proportion of RES.
	Customers, TSOs, DSOs, aggregators	TSOs and grid users

KER	**Flexibility of Reactive power**	**Dynamic thermal rating of power lines**	**Virtual cross-border control centre.**
	Installation of compensation devices for reactive power control	Reducing the construction of new transmission lines.	Support remote control of new devices (SVC/STATCOM/VSR, Storage, Wind farms)
	Preventing voltage breakdown or network element failure.	Increased utilization of the grid, increased maximum thermal capacity and increased system realiabitlity, facilitating system control in case of extreme operational conditions, deferred transmission grid investments.	Possibilities of new SW implementation. Customized solutions to existing system. Control system upgrade.
	TSOs, customers	TSOs, Customers	TSOs, DSOs, Customers

OTHER PROJECTS

Spain

ADOSA

Analyzis Sizing and Optimization of Energy Storage Systems

ADOSA

Development of a software tool for analyzing and sizing from a techno-economic perspective energy storage systems jointly operated with renewable energy generators

Years	Project total cost	Website	Coordinator's country	Coordinator
Ended in 2017	0.3 M€	*N.A.*	Spain	Acciona Energia & Tecnalia

Types of technologies and services tackled	Partners	Countries involved
STORAGE & POWER-TO-X; POWER GENERATION; MARKET	***N.A.***	**1**

KER	Software tool
	Capacity of systematically analyzing and sizing energy storage systems and applications.
	Reducing technical and financial risk from early stages.
	The user and the final customer.

ALISIOS

Almacenamiento para la integración de renovables en sistemas aislados

ALISIOS

Evaluation of storage capabilities to provide system services in the context of isolated electrical systems with large RES penetration

Years	Project total cost	Website	Coordinator's country	Coordinator
2017-2021	10 M€	*N.A.*	Spain	REE

Types of technologies and services tackled	Partners	Countries involved
STORAGE & POWER-TO-X	***N.A.***	**1**

KER	Tool for system frequency enhancement	Tool to cope with RES variability
	Tool to keep system frequency within security margins	Mitigation of the effect of short-term variations of RES generation
	Enhancement of power quality in term of frequency stability; better quality of supply	Increase of RES penetration at isolated power systems, system-wide thus contributing to less pollution, and cheaper electrical system
	All users of the power system	All users of the power system

OTHER PROJECTS

AMCOS

Advanced Modular COmpensator System

AMCOS

Design of a new cost-effective modular converter to act both as a Static Synchronous Compensator (STATCOM) and an Energy Storage System (ESS). The modular approach of this development permits to combine different types of energy storage devices, as some modules may comprise supercapacitors while others comprise batteries

Years	Project total cost	Website	Coordinator's country	Coordinator
2014-2017	2.6 M€	http://www.ree.es/en/red21/rdi/rdi-projects/amcos	Spain	REE

Types of technologies and services tackled	Partners	Countries involved
STORAGE & POWER-TO-X	***N.A.***	**1**

KER	Modular converter (Prototype of control)
	Control of Modular Multilevel Converter (MMC) modules: the independence offered allows to differentiate between active and reactive power flows
	Storage devices can be easily implemented. Improvement of communications and response time. Good control with excellent power grid quality. Reduction of losses and flow control
	User

CECOVEL

Control Center for Electric Vehicle

CECOVEL

Robust and reliable SCADA that allows the visualization and management of the demand generated by electric vehicle charging points

Years	Project total cost	Website	Coordinator's country	Coordinator
2014-2016	0.6 M€	*N.A.*	Spain	REE

Types of technologies and services tackled	Partners	Countries involved
GRID	***N.A.***	**1**

KER	Guidelines for EV Demand management
	Safe integration of electric vehicle demand into the electricity system and intelligent charging management
	Spread the use of EVs. System allowing the charge of electric batteries at any time in an efficient way. Efficiency and sustainability. Technological innovation.
	System operators

OTHER PROJECTS

HVDC LINK

HVDC links for marine energy evacuation: future solutions

HVDC LINK

Investigation on HVDC technologies aiming at reducing the cost and complexity of the current HVDC existing architectures to connect offshore wind farms to the main grid

Years	Project total cost	Website	Coordinator's country	Coordinator
2015-2017	1.3 M€	*N.A.*	Spain	TECNALIA

Types of technologies and services tackled	Partners	Countries involved
GRID	**4**	**1**

KER	Hybrid HVDC transmission architecture	High-level control of VSC-HVDC converter stations	Current and voltage measurement in HVDC systems
	New HVDC hybrid system optimized for the transmission of energy generated in offshore generation plants.	Analysis of the interaction between VSC-HVDC converters and the AC system, for different phenomena related to power quality, voltage and frequency control.	Two sensors, one optical for current and one R-C divider for voltage, to provide digital measurements for HVDC lines.
	Lower complexity than offshore substations based on MMC converters. Lower size and weight of the offshore substation. Higher efficiency and reliability. Lower cost.	Knowledge acquired in this field of analysis (today lack of knowledge).	Specific solutions and accuracy of the measurement.
	Consumer.	User.	Customer.

OTHER PROJECTS

IDEAS

Interoperabilidad de Equipos de Automatización de Subestaciones

Development and demonstration of a complete solution for a HV / MV substation incorporating IEC 61850 into its Integrated Control and Protection System, covering all the lines associated with a new automation system

Years	Project total cost	Website	Coordinator's country	Coordinator
2016-2018	0.8 M€	https://www.fcirce.es/web/data/project.aspx?source=capacitynew&id=77955&idc=21&sourcec=areaoffelec	Spain	ENDESA

Types of technologies and services tackled	Partners	Countries involved
GRID MARKET	5	1

KER	Control and protection system for an electrical substation according to IEC 61850	Increase of functional and communications capacities of electrical substations	Integral meditated and viable standard of the IEC 61850 standard	Enhancement of interoperability between control and protection equipment of electrical substations
	To transform inefficient connections by adopting a TCP / IP model (the one that supports the definitions of IEC 61850 protocols).	Adaptation of the substations to the new (smart) grid model topologies.	To prevent subsequent technological developments from being subject to the implementation of a particular supplier.	To follow the international guidelines for the design of interoperable Smart Grid systems [thus guaranteeing a more optimized management of the network.
	To make the substation a new agent, ready to interact with others and assume a new role in future services of the electricity market.	Incorporation of additional functionalities into an updated communications network.	Costs reduction.	Enhancement of interoperability, reduction of costs, increase of competitiveness.
	DSO, TSO.	DSO, TSO.	DSO, TSO.	Final user, DSO, TSO.

OTHER PROJECTS

LIFE FACTORY MICROGRID

Electric vehicles to grid, renewable generation and Zn-Br flow battery to storage in industry

Demonstration, through the implementation of a full-scale industrial smartgrid, that microgrids can become one of the most suitable solutions for energy generation and management in factories that want to minimize their environmental impact

Years	Project total cost	Website	Coordinator's country	Coordinator
2014-2017	1.9 M€	http://www.factorymicrogrid.com/	Spain	Jofemar Corporation

Types of technologies and services tackled	Partners	Countries involved
STORAGE & POWER-TO-X; POWER GENERATION	3	1

KER	New environmentally friendly business model
	Implementation of a smart industrial microgrid at real size and demonstration that the microgrids can be a solution for the generation and energetics management of factories willing to minimize their environmental impact.
	Reduction of GHG emissions, increase of self comsuption up to 100% depending of smartgrid characteristics Electric dependence, reduction of black outs and energy transmision costs.
	Customers.

LIFE ZAESS

Zinc Air Energy storage system

Demonstration of a low cost and environmentally friendly Zinc-Air Flow Battery Energy Storage System for renewable energy integration

Years	Project total cost	Website	Coordinator's country	Coordinator
2014-2017	1.2 M€	http://www.zaess.eu/	Spain	Tecnicas reunidas

Types of technologies and services tackled	Partners	Countries involved
STORAGE & POWER-TO-X	2	1

KER	Zinc-Air flow battery
	To address the needs of intermittent renewable energy
	Increased rechargeability and life span; less energy lost in the storage process; increased total system capacity, making it suitable for grid-scale renewable energy storage; and reduced production costs, because inexpensive and abundant materials are used
	Researcher in the same field, DSOs, TSOs

OTHER PROJECTS

MMC

Modular Multilevel Converter

MMC

Design and development of a small scale Modular Multilevel Converter and the necessary electronic boards to interface with a Hardware-in-the-Loop (HIL) system. The final goal is to get a fully flexible and modular converter to test different control algorithms, in order to validate multiterminal HVDC architectures that are being designed to integrate offshore wind farms into the main grid

Years	Project total cost	Website	Coordinator's country	Coordinator
2015-2016	0.7 M€	*N.A.*	Spain	TECNALIA

Types of technologies and services tackled	Partners	Countries involved
GRID, POWER GENERATION	**1**	**1**

KER	MMC Converter for Labs
	To provide a facility for research and development of control algorithms for VSC-HVDC multi-terminal links and meshed grids.
	Fully flexible and modular converter, integrate offshore wind farms into the main grid.
	Users.

NOISEEK

NOISEEK

Development of a platform (device + web application) designed to detect the electrical phase and the meter from wich a noise arrives, disturbing the PLC communications in an electrical network

Years	Project total cost	Website	Coordinator's country	Coordinator
2017-2018	0.1 M€	*N.A.*	Spain	Tecnalia

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS, GRID, MARKET	***N.A.***	**1**

KER	NOISEEK device (Hardware)	NOISEEK web application
	Saving time in PLC roll-outs and improving the successful rate in PLC communications (problems in PLC communication is estimated to affect up to 2% of the meters).	Analysis of a problem in an aggregated way,helping comparing the problems in different places.
	Improvement of the management of the 2% meters impacted by problems in PLC communications.	
	Utilities and their customers.	Utilities and their customers.

OTHER PROJECTS

REDACTIVA

Innovación en la automatización de la red de distribución de neutro aislado

REDACTIVA

Development of new solutions and innovative equipment that enable a higher degree of automation in the medium & low voltage distribution networks in order to improve grid operation

Years	Project total cost	Website	Coordinator's country	Coordinator
2016-2018	3.5 M€	http://www.unionfenosadistribucion.com/en/smart+grids/research+and+development/spanish/1297303835189/redactiva.html	Spain	UNION FENOSA DISTRIBUCION SA

Types of technologies and services tackled	Partners	Countries involved
GRID MARKET	7	1

KER	Applications to avoid undesired "isle" generation	Solutions to avoid or reduce ferro-resonance appearance in MV grids	Voltage / intensity sensors	Early detection of faults for predictive / preventive maintenance
	Development and implementation of several algorithms, not only to protect the grid from accidental anti-isle events but also to research about grid response by implementing anti-isle events intentionally.	Development of electronic equipment based on an electronic power converter that behaves like a resistance emulator with ability to detect the occurrence of ferro-resonance phenomena in inductive voltage measurement transformers.	Sensors integrated in the switchgear that allow the measurement of voltage in bars and cables in the same transformation center.	Capacitive sensors integrated in the MV electrical switchgear to capture signals of the partial discharges and the reference of the voltage wave.
	Improvement of the efficiency of automatisms to grid re-connection and reduction of risks for the power generator equipment, increasing the rate of success of remote control operations.	Mitigation and prevention of overvoltages and unwanted behavior in the protections, thus improving network operation	Improvement of transformation centers operations, possibility to develop complex synchronization check algorithms on both sides of the switch.	Ability to perform an early analysis of the quality of the installation without need of complex installations and power supply cuts and allowing a continuous monitoring over time of the entire system.
	DSOs.	DSOs.	DSOs.	DSOs.

OTHER PROJECTS

RENOVAGAS

Proceso para la generación de gas natural renovable

Development of a 15-kW synthetic natural gas production plant: hydrogen will be produced in an electrolyser and then it will be introduced in a methanation reactor with a biogas stream for the production of synthetic natural gas

Years	Project total cost	Website	Coordinator's country	Coordinator
2014-2017	2.2 M€	http://www.cnh2.es/investigacion/proyectos-finalizados/renovagas/	Spain	CNH2

Types of technologies and services tackled	Partners	Countries involved
STORAGE & POWER-TO-X	7	1

KER	New Catalyst for Methanation
	Supporting the development of Power-to-Gas and reducing costs by looking at the effects of admixtures of H_2 and Natural Gas in the gas grid
	Integration of more renewable generation in the market thanks to a large-scale storage option, and decarbonisation of the gas and heating systems
	Electriciy and Gas utilities through the integration and greening of their repsective grids and society as the development is a climate intiative

OSIRIS

Optimización de la supervisión Inteligente de la Red de Distribución

Guarantee of the correct operation of the remote management infrastructure from the point of view of communications, allowing to assess the status of the electrical infrastructure given that it has opted for a communication technology that overlaps the electrical infrastructure, so that they are interrelated

Years	Project total cost	Website	Coordinator's country	Coordinator
2014-2016	10 M€	http://www.proyecto-osiris.com/	Spain	Ministry of Industry of Spain

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS	7	1

KER	LV PLC diagnosis
	To identify the communications problems in the LV grid to define an algorithm capable of identifying the smart meter generating noise and the other meters involved
	Better smart meter management
	Customers and DSO

OTHER PROJECTS

SECUREGRID

New Cybersecurity Technologies and Data Analytics for Electric Substations

Development of new knowledge in the field of cybersecurity applied to Intelligent Electronic Devices (IEDs) and substations, definition of the degree of security that an IED can achieve for each of the security requirements

Years	Project total cost	Website	Coordinator's country	Coordinator
2016-2018	4 M€	http://www.clusterenergia.com/securegrid	Spain	ZIV

Types of technologies and services tackled	Partners	Countries involved
GRID	**7**	**1**

KER	SecureGrid Security Model	Electronic Devices with a higher degree of cybersecurity
	Provision of clear infomation about what security capabilities in electronic devices could be required by utilities.	Reduction of the risk that the electronic equipment (IED) and, by extension, the electrical installations in which they are deployed suffer a cyberattack.
	Check cyber-attacks and get data.	Increase of the security level of electrical networks, and reduction of the risk of cyberattacks.
	Equipment manufacturers.	DSOs.

STORE

Storage Technologies in Canary Islands

Installation and testing of different storage technologies in Canary island

Years	Project total cost	Website	Coordinator's country	Coordinator
2009-2013	7.9 M€	*N.A.*	Spain	ENDESA GENERACION

Types of technologies and services tackled	Partners	Countries involved
GRID, STORAGE & POWER-TO-X, POWER GENERATION, MARKET	***N.A.***	**1**

KER	Improvement primary regulation in islands
	Improve primary regulation behavior of islands, avoiding load shedding events
	Dramatic reduction in load shedding events in islands
	Electrical island system and customers

OTHER PROJECTS

Sweden

CLOUDGRID

Transnational Cloud for Interconnection of Demonstration Facilities for Smart Grid Lab Research & Development

Assessement of some of the challenges of the future European power grid from the perspective of i) Grid System Stability, ii) Ancillary Services and Energy Management System and iii) Converter interoperability

Years	Project total cost	Website	Coordinator's country	Coordinator
2016-2019	2.3 M€	www.eranet-cloudgrid.eu@se.se	Sweden	ABB

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS, GRID, STORAGE & POWER-TO-X, POWER GENERATION, MARKET	***N.A.***	**4**

KER	Simulation of the impact of RES on the stability of dynamic power systems	Ancillary Service Benefit and Risk Analysis (ASBRA)	Emulation of HVDC Cables using Hardware in the Loop technique	Demand control tool for building
	To analyse the future situation in Switzerland and Europe after integration of large amounts of RES and nuclear decommissioning. To develop new protocols and standars on how to manage the development of electric power systems in the presence of massive amounts in RES integration.	A method to evalute the benefits and risk associated with providing ancillary services, linking technology to economics.	Methodology for the design and the laboratory implementation of a HVDC cable emulator with a Power Hardware in the Loop approach.	Set of solutions (methodology, software and hardware) focusing to demand side management platform elaboration for optimal energy management strategies, topicality of smart metering & control including deployment of the price responsive demand.
	Since the results are disseminated also in the international reseach community, they can be interpolated and adjusted to solve similar problems of other places with similar objectives.	Decrease the cost for grid operation, avoid or delay grid investment. Cheaper power system and less impact on the environment. Lower prices, higher awareness of the power system. Power system more efficient, optimized market participation for the provider.	The proposed methodology eases the emulation exploiting the flexibility of Harware in the Loop systems and avoiding the need to use many km of real cables for preliminary testing.	New business models for aggregators. More efficiently use and save earth resources. Opportunity for implementation more challenging and complicated mathematical solutions based on artificial intelligentce achievements.
	TSOs, governments, research community.	User, customer, producer, grid owner, society.	Research centers, universities, certification laboratories and technology providers.	Final consumer, and the whole power system participans: Aggregators, DSOs, TSOs.

OTHER PROJECTS

LVM

Low Voltage Monitoring

LVM

Monitoring of low voltage network to increase security and reliability in the networks and to decrease SAIDI, SAIFI and CAIDI

Years	Project total cost	Website	Coordinator's country	Coordinator
2016-2017	*N.A.*	*N.A.*	Sweden	Vattenfall Eldistribution

Types of technologies and services tackled	Partners	Countries involved
GRID	**3**	**1**

KER	Digitization of processes and proactive dialogue with customers
	Development of a new functionality that digitizes processes and enables proactive dialogue with the customer, therefore opening the possibility to monitor power quality
	Increase of network reliability (decrease of SAIDI / CAIDI / SAIFI) and of power quality. Decrease of the need for ocular troubleshooting of faults in LV grid and for patrols along overhead lines in large geographical areas. Decrease of network losses.
	DSOs

SMART GRID GOTLAND

SMART GRID GOTLAND

Increase of the capacity of renewables, improvement of power quality and reliability and creation of customer opportunities to participate in demand side management

Years	Project total cost	Website	Coordinator's country	Coordinator
2012-2017	13.8 M€	http://www.smartgridgotland.se/	Sweden	Swedish Energy Agency

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS, GRID, STORAGE & POWER-TO-X, POWER GENERATION, MARKET	**7**	**2**

KER	Smart Customer Gotland	Just curtailment of wind power during grid disturbances	Smart Meters	Grid automation
	Analysis of consumer behaviour, technological possibilities of multi-utility smart metering, possible business models for Smart metering system and data security&protection aspects.	Algorithm to minimize wind production curtailments during disturbances and grid faults.	Set of functions originally developed for operation and maintenance of the metering system, to build up an operational surveillance of the LV grid and to provide outage information to customers.	Provision of information from various devices in the grid, about faults and load flows, to foster reconnection process.
	Limitation of effects of power shortages and grid bottlenecks, decrease of energy bills.	Automated process which could lower technical safety margins and avoid losses of up to 4GWh per year.	Shorter outages, more satisfied customers, cheaper restoration.	Cost efficient alternative to conventional grid reinforcements.
	Consumers and grid operators.	Wind power producers.	Consumers and grid operators.	Grid operators and consumers.

OTHER PROJECTS

Switzerland

3D DSS

3D Decision Support System for power line planning

3D DSS

Development of a 3D Decision Support System that supports finding the "best" path between two points for a new overhead line. Social, enviromental and economical aspects are considered

Years	Project total cost	Website	Coordinator's country	Coordinator
2014-2017	*N.A.*	https://netzausbau.ethz.ch/	Switzerland	ETH Zurich

Types of technologies and services tackled	Partners	Countries involved
GRID	**4**	**2**

KER	Tool to increase efficiency in line planning and increase acceptance for grid projects
	Support the finding of the "best" path between two points for a new overhead line.
	Increase in acceptance for line projects, more efficient planning, less delays in the necessary grid expansion.
	Society.

HYBRID HVAC / HVDC OVERHEAD LINES IN SWITZERLAND

HYBRID HVAC HVDC

Examining major issues along the value chain of hybrid AC/DC overhead transmission in Switzerland: technical aspects of hybrid AC/DC transmission, power system integration aspects, economic aspects and social issues

Years	Project total cost	Website	Coordinator's country	Coordinator
2014-2018	0.9 M€	http://www.nfp70.ch/en/projects/electricity-supply/hybrid-overhead-power-lines	Switzerland	ETH Zurich

Types of technologies and services tackled	Partners	Countries involved
GRID	**7**	**1**

KER	Facilitate the realisation of hybrid AC/DC overhead lines in Switzerland
	Increasing the transfer capacity without the need for new transmission corridors.
	Capacity increases on certain transmission sections at a higher public acceptance.
	Society

OTHER PROJECTS

NEXUS

Nexus Energy System Modelling Platform

NEXUS

Development and integration of a modeling platform that enables the study of complex and interdisciplinary questions about the impact of technical, socio-economic, and political decisions on the performance of the future energy system

Years	Project total cost	Website	Coordinator's country	Coordinator
2016-2019	1.3 M€	http://www.esc.ethz.ch/research/research-projects/Nexus.html	Switzerland	ETH Energy Science Center

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS, GRID, STORAGE & POWER-TO-X, POWER GENERATION, MARKET	**8**	**1**

KER	Methodology for the analysis of the mutual influences of large-scale centralized and small-scale decentralized flexibility providers
	To understand where system flexibility should be procured optimally.
	Better utilization of decentralized flexibility to maintain system reliability. Ability to securely integrate more renewable energy systems. New business models and revenue streams for flexibility providers.
	End-users.

United Kingdom

HYBRIDISED LAES

Liquid Air Energy Storage with Enhanced Frequency Reponse Capabilities Demonstration Plant

HYBRIDISED LAES

Demonstration of deployment and trials of a high power high energy Liquid Air Energy Storage (LAES) system connected to the distribution network for the provision of frequency and reserve services and peaking power, and hybrised with load banks, super-capacitors and flywheels enabling sub second response frequency regulation services

Years	Project total cost	Website	Coordinator's country	Coordinator
2014-2019	10.8 M€	*N.A.*	United Kingdom	Highview Power

Types of technologies and services tackled	Partners	Countries involved
CONSUMERS, GRID, STORAGE & POWER-TO-X, MARKET	**2**	**1**

KER	Hybridisation of Liquid Air Energy Storage for the provision of enhanced ancillary services
	To prove the use of resilient energy storage technologies for the provision of enhanced ancillary services.
	Use of sustainable energy storage technologies that do not use toxic or rare materials and do not have recycling issues, thus reducing the environmental impact. Reduction of the cost to operate the system and of the cost paid by end consumers.
	End user, network operator.

OTHER PROJECTS

SMARTER NETWORK STORAGE

SMARTER NETWORK STORAGE

Understanding of how energy storage could be used to defer traditional network reinforcement. Evaluation of additional benefits that can be stacked to maximise the value that storage delivers, making it a more cost-effective alternative

Years	Project total cost	Website	Coordinator's country	Coordinator
2013-2016	21 M€	http://innovation.ukpowernetworks.co.uk/innovation/en/Projects/tier-2-projects/Smarter-Network-Storage-(SNS)/	UK	UK Power Networks

Types of technologies and services tackled	Partners	Countries involved
GRID; STORAGE & POWER-TO-X; MARKET	**4**	**1**

KER	Techno-economic demonstration	Business models and the associated business case	Regulatory and legal framework recommendations
	Methodology and evaluation of the impact of storage characteristics on security of supply; optimisation of storage for multiple applications and on energy allocation	Identification of multiservice business models for storage integration with a focus on the valuation and remuneration schemes of the system services brought by storage	Potential solutions to legal and regulatory barriers that affect the deployment and utilisation of electricity storage for distribution networks reinforcement deferral
	More sustainable networks, lower overall electricity costs, decrease in CO_2 emissions	Commercial benefits can be derived from the result as it identifies suitable commercial arrangements that can be replicated in other cases where storage is used for network investment deferral	Benefits will depend on whether the recommendations are implemented and whether barriers to the adoption of storage for network reinforcement deferral can be tackled
	End users	End Users, DSOs, Energy suppliers	End users, DSOs, Energy suppliers, Storage project developers

WISE-PV

Whole system impacts and socio-economics of wide scale photovoltaic integration

Investigation of drivers and opportunities to facilitate an increase in the role of solar energy in UK energy futures. The proposal also focuses on the role that UK industry could play in providing innovative PV technologies to lead global uptake of solar PV

Years	Project total cost	Website	Coordinator's country	Coordinator
***2013*-2016**	*N.A.*	http://www.energy.manchester.ac.uk/research/solar/wise-pv-project/	UK	The University of Manchester

Types of technologies and services tackled	Partners	Countries involved
POWER GENERATION	**5**	**2**

KER	A multi-disciplinary analysis of UK grid mix scenarios with large-scale PV deployment
	Assessment and comparison of 4 future UK grid mix scenarios with increased photovoltaic (PV) installed capacity with respect to a benchmark "Low PV" scenario, from 2016 to 2035
	PV Integration in a cost-effective and efficient manner
	Users, Market

ETIP SNET

EUROPEAN TECHNOLOGY AND INNOVATION PLATFORM

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