Grid4EU

Large-scale demonstration of Advanced Smart Grids Solutions with wide Replication and Scalability Potential for EUROPE

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« Grid4EU » project

Project "snapshot"

- **Main objective**

  Demonstrate under real operating conditions and in different network environments Advanced Smart Grids Solutions with wide Replication and Scalability Potential with the objective to contribute to remove the barriers for Smart Grids deployment in Europe.

- **A European Smart Grids Project** ***(under EC FP7 negotiation)***
  - Lead by 6 DSOs (covering more than 50% of the metered electricity customers in Europe)
  - 27 partners (Utilities, Energy Suppliers, Manufacturers, Research Institutes)
  - Duration: 4 years (November 2011 - November 2015)
  - Project Coordination: ERDF
  - Technical Director: ENEL
  - Chairman of General Assembly: IBERDROLA

- **Grid4EU Budget**
  - Above 50 M€

- **Planning**
  - Call Publication : 30 July 2009
  - Proposal submit: 4 March 2010
  - Project start date : November 2011

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Objectives

- GRID4EU aims at testing in real operating conditions some innovative system concepts and technologies in order to highlight and help to **remove some of the most important barriers to the smart grids deployment and to the achievement of the 2020 European goals.**

- It focuses on how Distribution System Operators can **dynamically manage electricity supply and demand, which is crucial for integration of large amounts of renewable energy, and empower customers to became active participants in their energy choices.**

- Adopting a systemic approach and being organized around demonstration networks located in six different countries, **GRID4EU has a structure conceived to cover a wide range of technical, economical, societal and regulatory conditions, to maximize scalability and replicability of the solutions and to facilitate knowledge sharing.**

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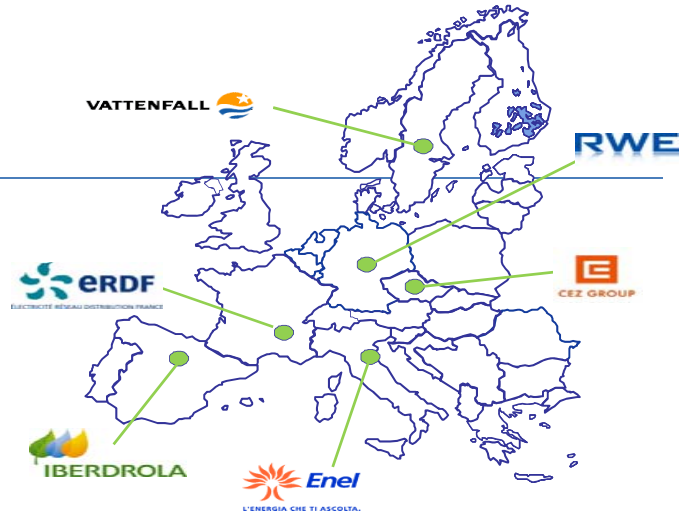
European replication potential



The six demonstration projects have been carefully chosen:

- The scope of each local demonstration has been chosen to allow the Grid4EU project to **cover major part of the distribution value chain, from Transmission System interface, DER generation sites and down to the final customer's usages.**

- The large-scale sized real networks used for local demonstrations will enable to provide valuable elements **to assess the technical, economical, societal and environmental viability of the various concepts and technologies experimented.**

- The locations for the implementation of the local demonstrations has been chosen because they **provide various boundary conditions and enable Grid4EU project to issue more comprehensive final results, in terms of scalability and replicability potential in Europe**.

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Main R&D topics

Primary focus

- Integration of more Renewable Energy Sources in the distribution networks
- Making customers participate actively to electricity markets (Active Demand)

Supporting technologies

- Solutions for MV / LV network Supervision & Automation
- Peak load management solutions
- Use of storage to enhance the capability of the network to accommodate more DG.
- Micro Grids & islanding

Output

- Solutions for Scalability and Replicability over Europe
- Technologies and Standards
- Smart Grids Cost-Benefits analysis

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27 partners from 12 European Union Member States

Utilities	Manufacturers	Universities & Research institutes
CEZ DISTRIBUCE	ABB	ARMINES (France)
ENEL	ALSTOM GRID	COMILLAS (Spain)
ERDF	CISCO	KTH (Sweden)
IBERDROLA DISTRIBUCION	CURRENT	KUL (Belgium)
RWE	EMETER	RSE (Italy)
VATTENFALL ELDISTRIBUTION	ITRON	TUD (Germany)
CEZ SA	LANDIS&GYR	
EDF SA	ORMAZABAL	
IBREDROLA GENERATION	SELTA	
	SIEMENS	
	TELVENT	
	ZIV	

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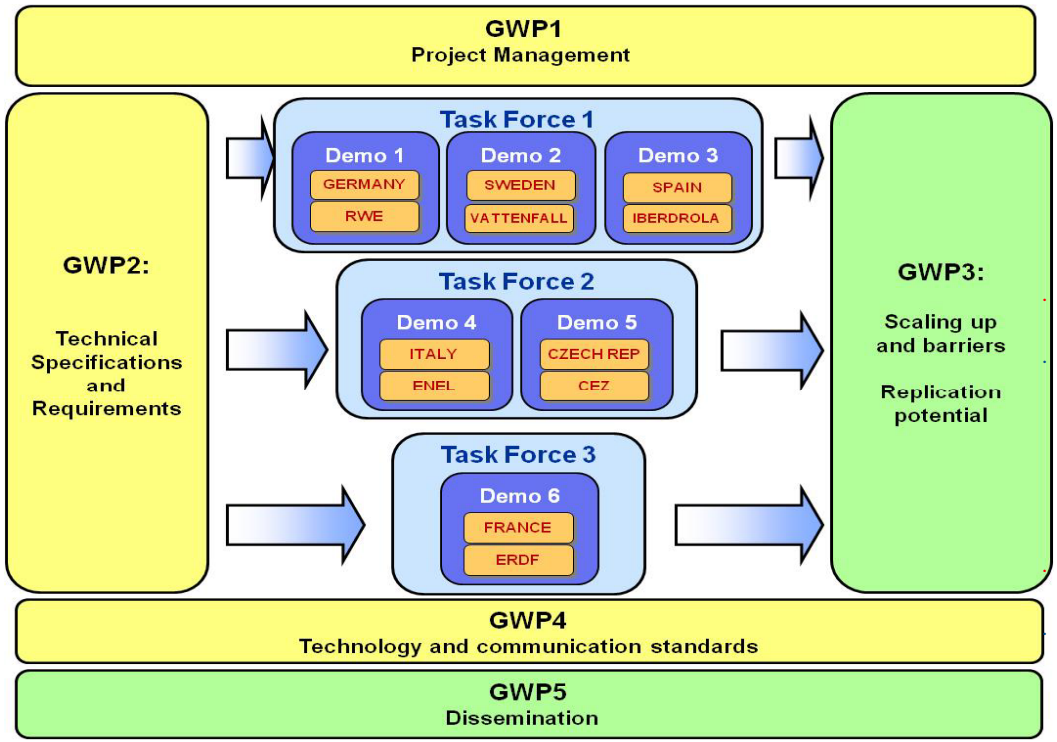
Project structure

6 Demonstrators within 3 task forces + 5 General Work Packages



Task Force 1

How to improve existing distribution networks in order to integrate more DER and Active Demand into the electric system?

Task Force 2

How DER and Active Demand can contribute to increase the flexibility and the resilience of existing distribution networks?

Task Force 3

How to maximize smart districts benefits through the use of future distribution networks architecture and operation?

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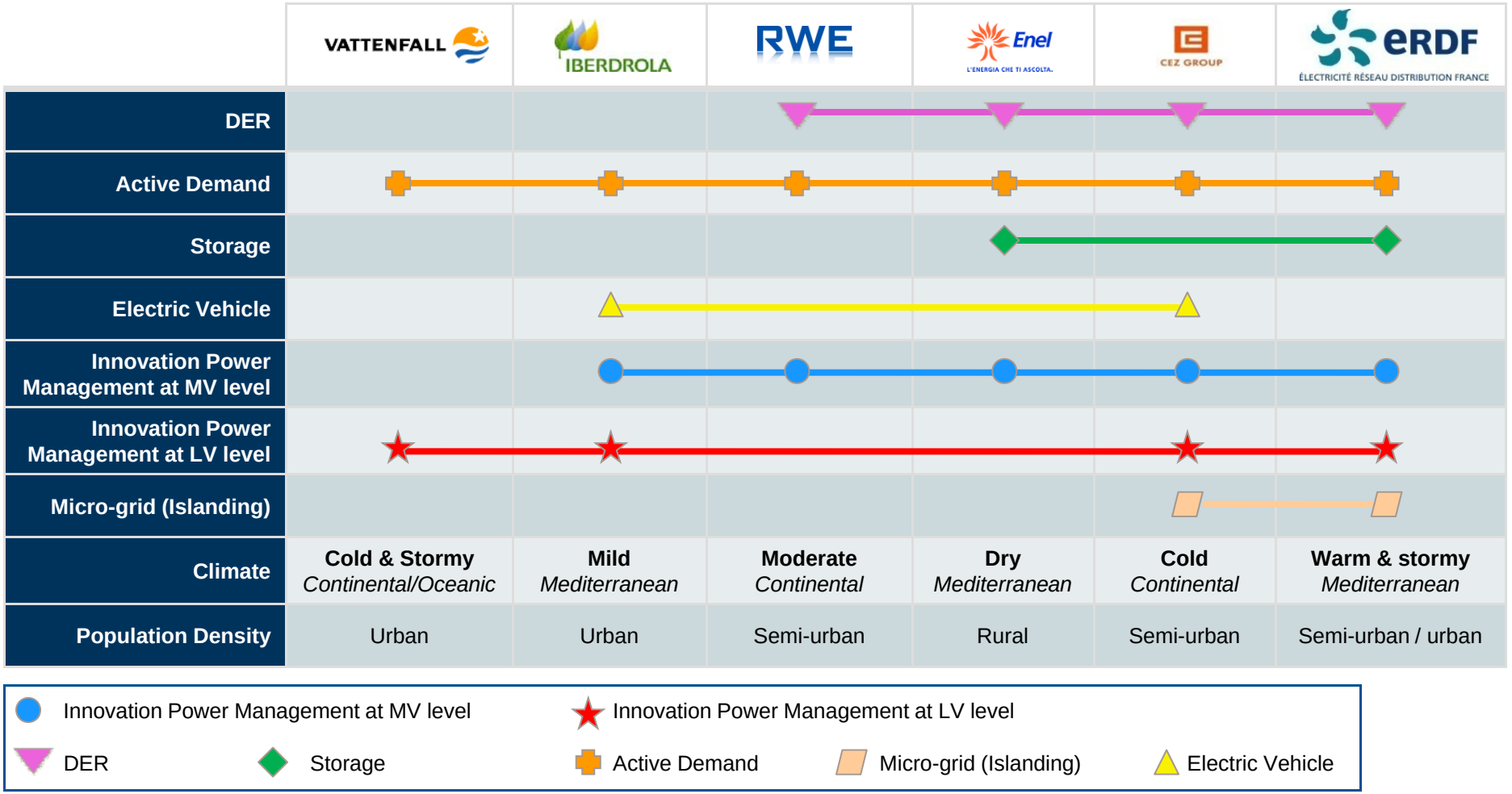
Local demonstrations – Interactions and synergies



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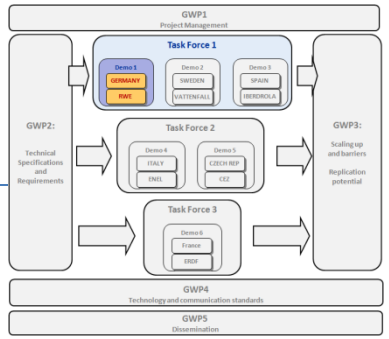
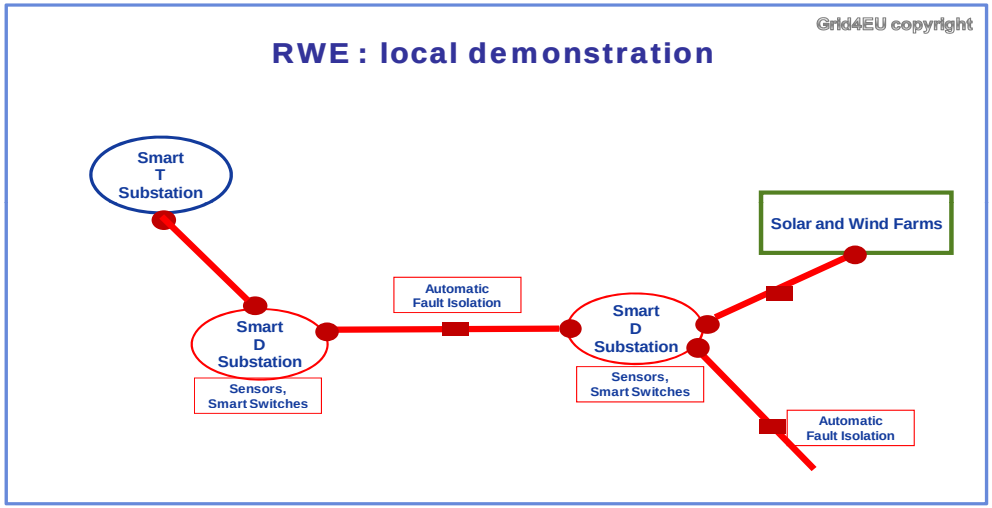
RWE Demonstrator



" how an innovative multi-agent system can improve MV network operation and facilitate integration of Distributed Generation "

- Localization Germany, Reken (North-Rhine-Westphalia region)
- Local geography : plain
- Population Density : Semi-urban
- Climate : moderate continental
- Network characteristics : MV



- Test of advanced MV network operations using a multi agent system.
  - This will enable to get a clear picture of the current situation in the grid (measurement of different operating parameters).
  - The local agents will act on remote-controllable switches to optimize the local grid-topology or to react to grid failures
  - A control centre will ensure the supervision and the coordination of the system.

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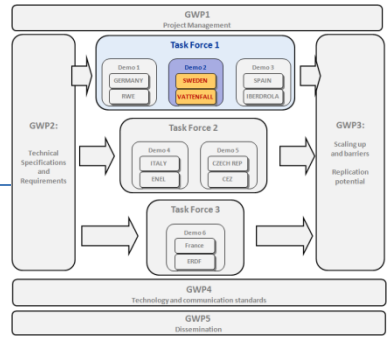
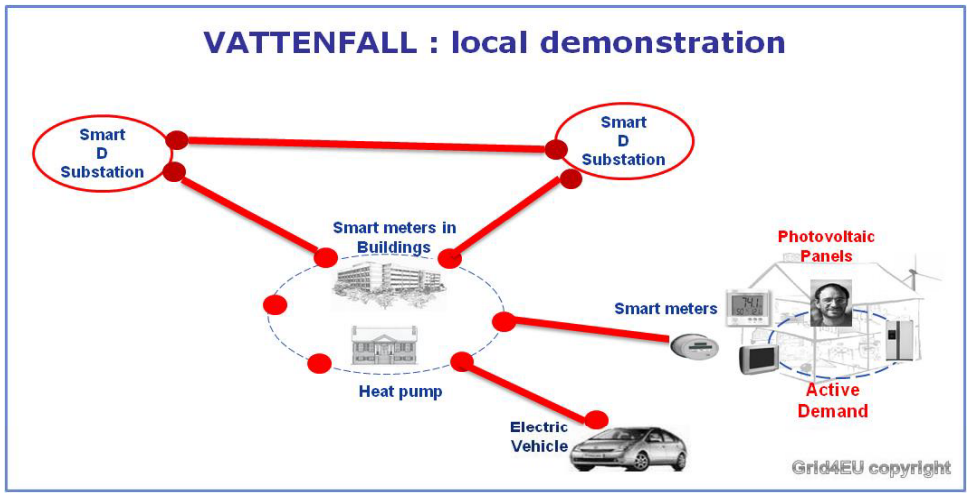
VATTENFALL Demonstrator



" how to use smart metering data to improve network operation and facilitate the increase of DER, EV and Active Demand in the LV network"

- Localization : Sweden, Stockholm suburbs
- Local geography : plain / Seaside
- Population Density : urban, rural
- Climate : cold, sometimes stormy continental/oceanic influenced climate
- Network characteristics: LV, mature, winter local peak
- 5 – 10 000 customers with smart meters, hundreds of secondary substations, 5 DER



- Demonstrate that the use of data collected by the existing and future AMR equipment located at customer sites and coupled with new equipment in the secondary substations will enable the development of LV network operating centers (with similar options as for the MV network SCADA systems). This will:
  - enable connection of small-scaled distributed generation
  - allow the available extended power quality information serving as an input for energy efficiency activities for DSO's and their customers (aggregators & retailers)
  - support network operations and customer information exchanges which have thus the potential to reduce the commercial and technical network losses.
  - provide the necessary tools for increased use of DER, PHEV/EV and AD in the existing LV network, with power quality improvements for the consumers

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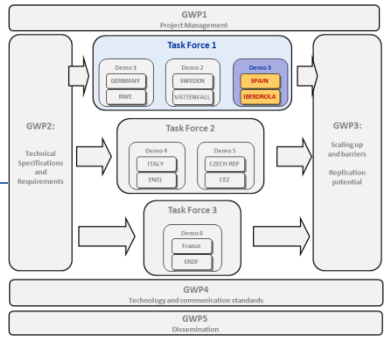
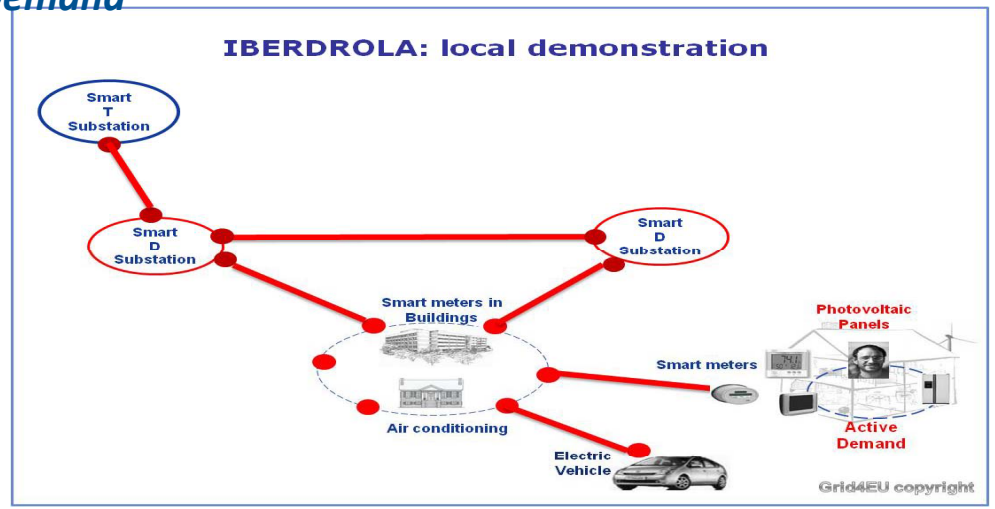
IBERDROLA Demonstrator



" how integration between smart metering and remote control can support Distributed Generation and Active Demand"

- Localization : Spain, Castellón
- Local geography : plain
- Population Density : urban
- Climate : mild Mediterranean
- Network characteristics : LV : MV, old, summer local peak
- Up to 200 clients with smart meters, up to 20 secondary substations



- Demonstrate that smart metering solutions with intermediate concentrators located at secondary substations will open new possibilities for distribution operators, in particular when the interconnection between telecontrol and smart metering systems is envisaged:
  - all secondary substations are then linked with the central system management, with short response times (seconds) from the meter to the high-end system
  - this will provide an adequate support for active demand, with an emphasis on electric vehicles in urban environment and the further integration of distributed generation
  - additionally, it will allow massive and cost-effective MV automation and/or supervision, with functionalities such as fault detection, and automatic restoration
  - finally, implementation of low voltage lines supervision will enhance the utilization of these assets, for which the utility has little visibility nowadays

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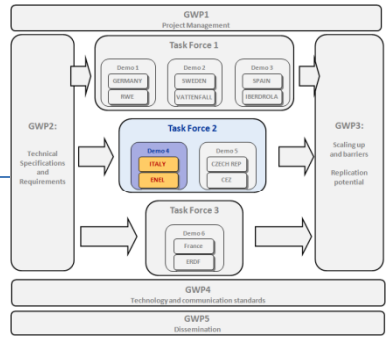
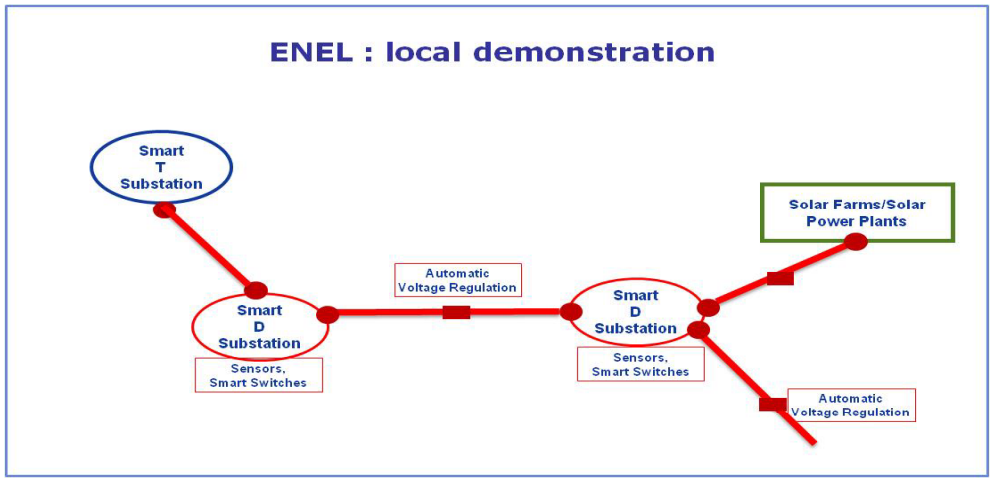
ENEL Demonstrator



" how to increase MV network hosting capacity of Distributed Generation by having generators participating in voltage control"

- Localization : Italy, the region Emilia Romagna, area of Forli – Cesena
- Local geography : plain/ Mountain
- Population Density : rural
- Climate : Mediterranean climate
- Network characteristics : MV, mature
- Hundred of secondary substations, 5 DER



- Validate that Active Control and Demand Response of DER on the MV network is an efficient way of increasing the network's hosting capacity of intermittent renewable distributed energy resources
  - Implementing Voltage Control (at all nodes) and Power Flow Control in the MV network
  - Implementing an "always on", standard-based communication solution connecting all the relevant nodes in the network, including DER locations
  - Reviewing the MV network DER connection criteria (taking into account the connected power, the plant typology and the network situation)
  - Managing efficiently and reliably the Disconnection of DER units in the event of unwanted islanding operations
  - Testing different solutions for DER dispatching on the MV network, including the use of electricity storage

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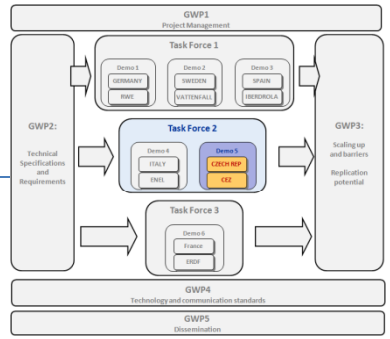
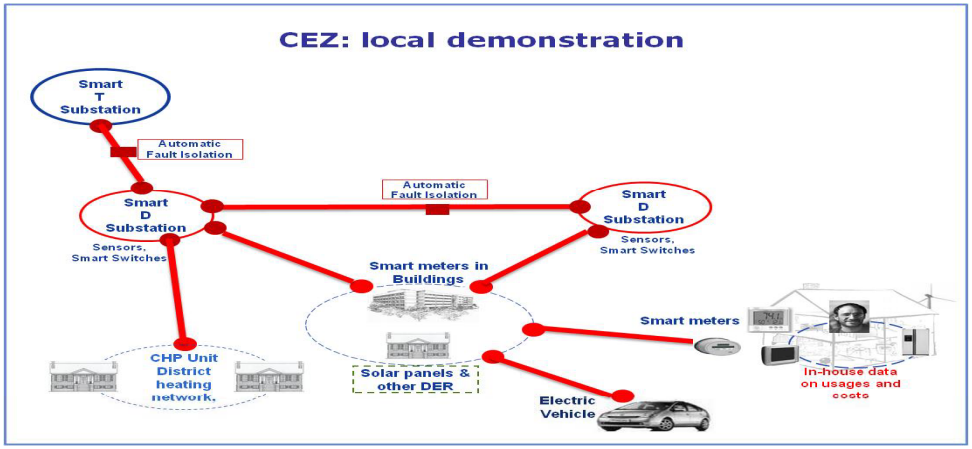
CEZ Demonstrator



" how smart metering and CHP units can be used to run automatic islanding operations"

- Localization : Czech republic, area of Liščí Kopec, (part of Vrchlabi city, north-east of the Czech republic)
- Local geography : Mountain
- Population Density : semi-urban
- Climate : cold, snowy and icy continental climate
- Network characteristics : LV/MV, old, winter local peak
- 1900 customers with smart meters, up to 10 secondary substations, DER (CHP)



- Demonstrate that existing distribution networks having smart metering and CHP Units can be upgraded to allow for automatic islanding while ensuring enough power provision
  - full Smart meters deployment, including launching of an information customers web portal
  - installation of generation capacity of 1,2 MW in DER (CHP Unit)
  - automation of the existing MV and LV grid
  - running of automatic islanding operations capable of ensuring enough power provision to the covered area during the islanded periods

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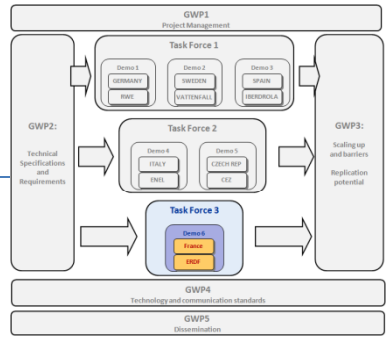
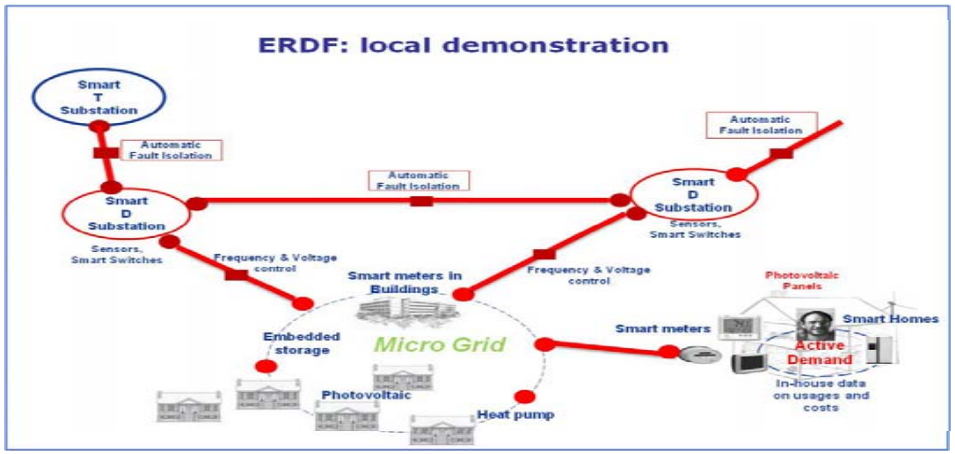
ERDF Demonstrator



"how to develop a Smart District concept, integrating active demand management, remote control and cell energy management "

- Localization : France, Nice suburbs
- Local geography : Plain
- Population Density : semi-urban / urban
- Climate : warm, windy and stormy Mediterranean climate
- Network characteristics : LV / MV, mature, area with a weak HV supply
- up to 1500 customers with smart meters, 200 customers with solar roof tops, 100 customers with storage and load management capabilities for the study of islanding, hundreds of secondary substations, hundreds of DER (PV)



- Test and assess the benefits, for smart district networks designers, of AMM system and infrastructure, telecommunication networks and power electronics. This will enable a new era for Distribution network designers and managers combining the following functions:
  - active demand side management where customers can take advantage of new tariff schedules developed by retailers and aggregators, with the possibility of load steering through the smart meters and/or the suppliers "energy boxes", etc.
  - use of network tele-control technologies allowing an improved continuity and quality of supply, thanks to the resulting enhancement of the LV networks monitoring and control, combined with the full automation and control of the MV network,
  - cell energy management giving the smart district ability to manage and pilot its demand to face distribution network or global electricity system's constraints, especially at peak hours,
  - cell power management allowing local safe islanded operations to face emergency situations, taking advantage of results already obtained within the "More Micro grids" European project.

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Major contribution to EEGI

- **The EEGI (European Electricity Grid Initiative) is:**
  - A European industrial initiative which aims to structure research, development and demonstration activities on Smart Grids
  - Officially **launched in June 2010** after two years of preparation with all stakeholders (industry, research centers, governments, regulators, ...)
  - A roadmap that defines over **10 years of R&D requirements**
  - Key Performance Indicators (KPI)
  - A **program of 2 billion Euros** (Industry + national public funds + European funds)

EEGI Roadmap for Distribution Network Functional Projects

Smart Grids Functionalities	Project	YEAR										Total Costs	2010-2012
		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019		
Active Demand Response and integration with Smart Homes	D1	ADDRESS			Active Demand Response							190	--
	D2	BEWARE Smart Homes/Smart Grids			Integration with Smart Homes							120	--
Smart Metering Infrastructure & Data Processing	D3	OPEN METER Existing Deployment			Smart Metering Infrastructure							150	150
	D4	Existing Deployment	Smart Metering Data Processing									20	20
Integration of RES, storage and EV	D5	Active Distribution Network			Integration of small DER							90	90
	D6	Active Distribution Network	Integration of medium DER									150	150
	D7	STORAGE TECHNOLOGY			Integration of storage technologies							60	--
	D8	ELECTRIC VEHICLES			Integration of Electric Vehicles							100	100
Planning, monitoring and control	D9	Active Distribution Network			Monitoring and control of LV networks							100	100
	D10	Active Distribution Network	Automation and Control of MV networks									90	90
	D11		New methods and systems support									80	80
Integrated communication Infrastructure	D12	Active Distribution Network			Integrated Communications Solution							50	50

Appendix

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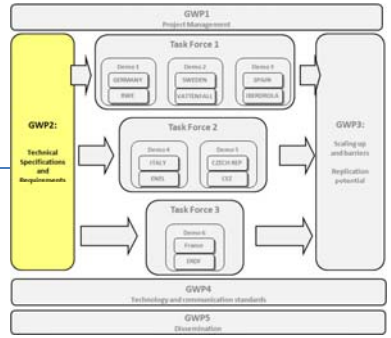
GWP2 : Technical Specification & Requirements



- Make the overall technical coordination of the Demonstrations in order to maximize the added value of the joint impact at EU level, exploiting the complementarities while preserving objectives and specificity of the different approaches.

- Share and define a set of Key Performance Indicators (KPI) demonstrating the success of the Project at National, Regional and EU level, identifying tools and/or methodologies for KPIs evaluation.

- Identify, with a pro-active and reactive approach, the barriers faced by each Demonstrator and propose, whenever possible, common solutions.

- Share rules preserving the confidentiality and ownership of data and information coming from the Demonstrations.

- Monitoring stakeholders' acceptance.

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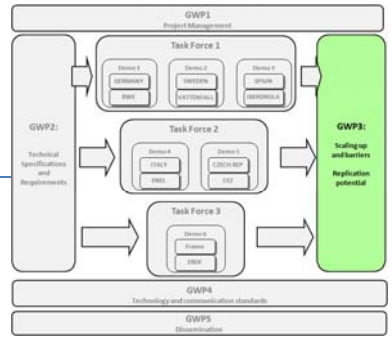
GWP3 : Scaling-up and Replication



- Assess the local impacts of each demonstration quantified by the KPIs and supported by the demonstrations carried out in the six regions
- Model customer acceptance and market potentials of the generation/ retail business models in the relevant demonstrations
- Infer scaling up and replication rules for the six demonstrations
- Cross compare results in order to make replication robust at EU 27 level
- Identify barriers to scaling up of the obtained results and operational solutions to remove them
- Conclude on scaling up rules in support of the replication of the demonstration results at EU 27 level.

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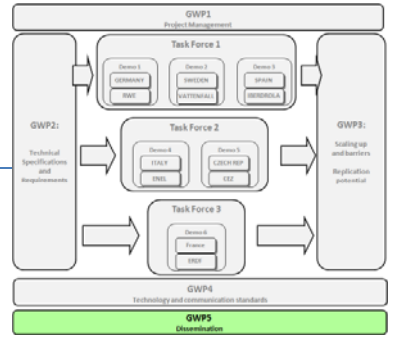
GWP5 : Dissemination



- Knowledge Use and Dissemination Plan

- Dedicated Workshops
  - Regulators
  - European DSOs
  - Professional bodies
    - Manufacturers, ICT providers,
    - Research Centres,
    - Retailers, Consumers associations

- International audience
  - ISGAN :
    - Uses cases and Standards