Project logo

FINAL PROJECT FACT SHEET

EUROPEAN UNION CO-FUNDED PROJECT

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Project acronym:

RESOLVD

Renewable penetration levered by Efficient Low Voltage Distribution grids

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1. SUMMARY

RESOLVD is H2020 research and innovation action coordinated by Universitat de Girona and participated by other six partners: Joanneum Research (Research center, Austria), Smart Innovation Norway (Research center, Norway), Universitat Politècnica de Catalunya (Univ, Spain), Comsensus (SME, Slovenia), Intracom Telecom (Industry, Greece) and Estabanell Energia (SME/DSO, Spain) that aims to contribute to setting the next generation of competitive technologies and services for smart grids. The objective is to improve the efficiency and the hosting capacity of distribution networks, in a context of highly distributed renewable generation by introducing flexibility and control in the low voltage grid.

An innovative advanced power electronics device, with integrated storage management capabilities, will provide both switching and energy balancing capacities to operate the grid optimally. The enhanced observability of RESOLVD, provided through cost-effective PMUs and state-of-the-art short-term forecasting algorithms that predict demand and renewable generation, will permit a reduction of uncertainty in grid operation and an increased efficiency. RESOLVD proposes hardware and software technologies to improve low voltage grid monitoring with wide area monitoring capabilities and automatic fault detection and isolation together with the acting capability supported by optimization algorithms for self-healing and grid reconfiguration. This will allow efficient grid operation and a maximised renewable hosting capacity.

RESOLVD started the 1 October and the kick off meeting took place at the premises of University of Girona the 16-17 October where the foundations of the RESOLVD were established at both technical and managerial level.

2. PROJECT SCOPE

Scope, objectives and concept: The overall objective of RESOLVD is to improve efficiency and the hosting capacity of distribution networks in a context of highly distributed renewable generation by introducing energy flexibility and control by acting on the grid through innovative advanced power electronics devices, with certain storage management capabilities, in low voltage distribution grids. Scientific objectives include (mapped in Figure 1):

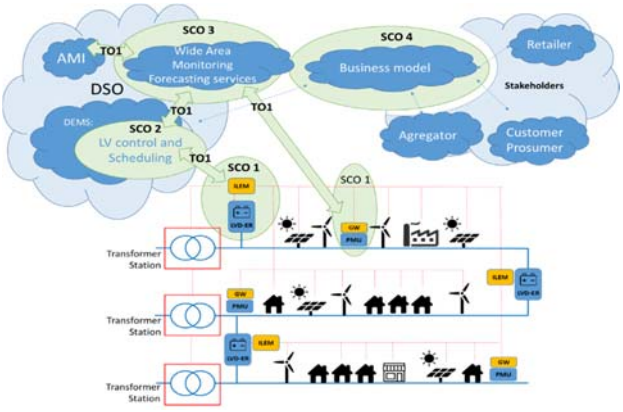

Figure 1 Mapping of scientific and technical objectives (light green) within the LV grid management.

- Design, develop and test a new PMUs and power electronic device to operate the LV grid and provide flexibility through the integration of storage devices (SCO1).
- Resilient and efficient operation of the LV grid, including optimal configuration based on demand and generation forecasting and providing self-healing capabilities (SCO2).
- Enhanced observability of LV grid with wide area monitoring capabilites and early detection of sudden variations in both demand and generation (SCO3).
- Propose and analyse potential and bariers of new business models (SCO4)

The proposal requires integration of software services and new grid infrastructure (PMUs, energy router, etc.) in a data analytics infrastructure, at the same time that assures interoperability with DSO legacy systems (i.e. AMI access, DEM, etc.) and adopts cybersecurity constraints adjusted to stakeholders' participation according to specific business models. Figure 2 presents a conceptual view of the integrated solution.

Methodology: RESOLVD has been conceived under the three layers research model (technology, marketplace, adoption) and it adopts the European conceptual Smart Grid Architecure Model (SGAM)

framework focusing in the field, operation and station zones. Thus, it considers the multi-view approach of the overall system (according to the stakeholders' view) during the whole execution of the project (Business, Functional, Information and Communication) to deal with interoperability issues including the integration with legacy systems. RESOLVD is conceived as a TRL5/6 project and aims to validate the proposed technologies in an integrated and standardisable solution deployed in a real LV grid at the same time that analyses potential business models that will make possible the market adoption of RESOLVD technologies in the mid-term.

Expected innovations and deliverables: The table 1 summarises the expected innovations and their added value for specific target groups with which RESOLVD will promote transversal innovation. These innovations are considered substantial part of RESOLVD but individual exploitation is also possible.

Table 1 Expected innovations as deliverable products and stakeholders

Innovations and deliverable products/service	Added Value	Interest target	TRL (start-end)
Low voltage wide area monitoring system composed by: - Low cost synchrophasors and power quality measurement devices with control capability - Gateway device allowing grid elements communication to control centre - Wide area monitoring system services for detection and classification of events	Allow for system level grid observability in real-time, support grid event (fault) detection, classification and localization, and together with control capabilities enable to establish self-healing strategies.	DSO, microgrid operators, service providers	TRL5-TRR6
Decision Support Toolkit: Decision for efficient low voltage operation that includes services for: - Generation and demand forecasting - Multivariate statistical monitoring. - Short-term scheduling services.	Increase of network observability. Optimal grid scheduling in terms of efficiency and increase of RES hosting capacity. Fast fault location and isolation.	DSOs, Prosumers & Ancillary services	TRL3-TRL6
New power electronic device capable to locally manage energy with the following components - Power conversion system - Intelligent Local Energy Manager - Battery management system - Heterogeneous storage.	High efficient power electronic based on novel semiconductors (SiC, GaN). Power Conversion System based on heterogeneous storage. Local energy management algorithms.	DSO, microgrid operators	TRL3-TRL6
Cyber Security: A ecurity Architecture for ICT-enabled low voltage distribution, including requirements engineering and risk assessment. Software security components that fill gaps between security requirements and current implantation.	RESOLVD will provide best practices and reference architecture for securing smart services in LVD. These could also be transferred to other IoT applications.	DSOs, ancillary service providers, industry	TRl3-TRL6
Distributed software platform, integrating ESB and data handling (acquisition, visualisation, analytics) platform to guarantee access to data, interoperability and centralised acces to software services.	No standard products in market at present. Customized system to collaborate with local DMS and AMR.	DSOs	TRL4-TRL6
Integration methodology of the developed technologies and services into an existing low voltage grid.	Translating the project results into a real application and practical methodology that can be applied in other practical scenarios.	DSOs, service providers	-
New Business models focused on low voltage energy management, including: - Business model canvas for two-sided digital platforms - Structured workshop methods	Novel business models addressing potential arising from the technologies (battery control) to be connected into the grid.	DSOs, customers, ancillary service providers	-

3. PROJECT TECHNICAL DESCRIPTION & IMPLEMENTATION

Implementation: RESOLVD has been planned (Gantt in Figure 3) as a 36 months R+I project distributed in 9 work-packages. Scientific and technological activities include specification (**WP1**), development (**WP2**, power electronics; **WP3**, software services; **WP4**, integration platform) and validation (**WP5**) of the proposed technological achievements. **WP6** is focused on the exploitation (business models analysis, standardisation)

and innovation, **WP7** is devoted to dissemination and communication activities, **WP8** addresses coordination and management issues and **WP9** deals with ethic issues. Figure 2 maps these WPs with the conceptual vision of the project. The following **milestones** have been defined and planned (Figure 3):

M1: Individual software and Hardware specifications.
M2: Power electronics prototype.
M3: Platform Design.
M4: Network observability subsystems tested
M5: Final hardware prototype of power electronics
M6: Platform development including data handling services.
M7: Overall system integrated and communicating (cyber)securely with the platform.
M8: Overall system integrated and validated in a relevant environment.
M9: Final report on exploitation and dissemination including conclusions on new business models.

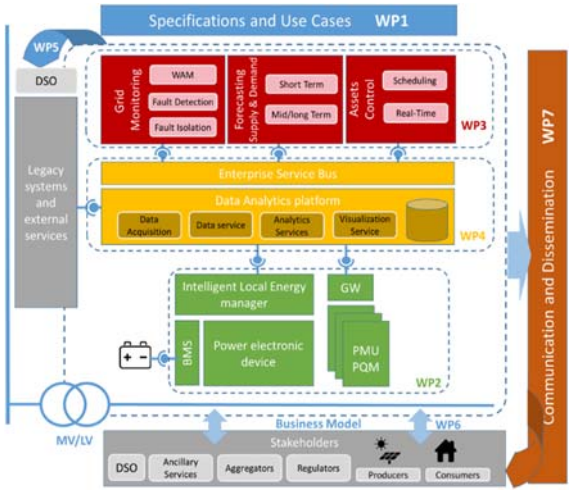

Figure 2 Conceptual implementation and WP interaction
(Red/Pink squares are computing services, Yellow/Brown represents the integration software platform and Green represents hardware)

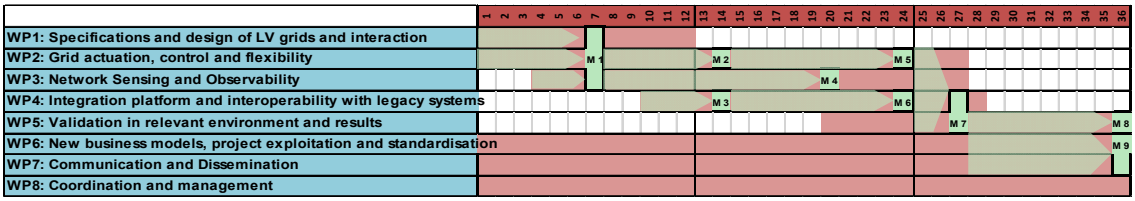

Figure 3 Project Gantt and milestones

4. RESULTS ACHIEVED

At the kick off RESOLVD technologies aim to impact on the overall energy system by improving performance, efficiency and capacity of low voltage networks. Expected contribution of RESOLVD to these overall objectives has been quantified in terms of KPIs measurable at the validation site (Table 2).

Table 2 Expected impact of RESOLVD at the kick off stage

Expected impacts measured at the validation site	KPI	Expected contribution
Maximisation of the use of actual infrastructures (%) through and active energy management and balancing at LV level.	CAPEX OPEX	3%
Reduction of DSO planning uncertainty by means of demand and generation forecasting and application of robust optimisation methods for grid planning.	OPEX	20%
Improved quality of supply (EN 50160 standard) by an improved daily operation of LV grid to facilitate flexibility management and maximal RES generation	Voltage variation	1%
Reduction of losses through local use of energy (“zero km” paradigm)	%	25%
Increase RES hosting capacity in LV, facilitating evacuation of non-locally consumed generation	%	25%
Reduction of energy not supplied from DER due to improved network	%	1%
Reduction of demand peak, measured at the transformer.	%	25%

5. IMPACT

KPI proposed for RESOLVD (Table 2) are common for any DSO and LV grid. Thus, although technology validation is expected in a single real environment, the expected improvements in terms of KPIs will be general enough and technology replicable and deployable in other power systems. However, socio-economic impact will be constrained to regulation policies and acceptation of market transformation to adopt new business models.