Microgrids Opportunities within Spain's Smart Grids initiatives

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Angel Díaz Gallo <u>angel.diaz@tecnalia.com</u> Director of Smart Grids Business Area TECNALIA TECNALIA is the first applied research centre in Spain and one of the most important in Europe with around 1.500 staff, 116 million Euro turnover and over 4.000 clients.

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ENERGY AND ENVIRONMENT// Challenges and Research Lines



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Content

- 1. Smart Grids market in Spain
- 2. Reference of main SG initiatives
- 3. Opportunities for microgrids projects
- 4. Conclusions



Global smart grid market opportunity



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TOP TEN COUNTRIES FOR FEDERAL SMART GRID INVESTMENT, 2010



SOURCE: Zpryme Research & Consulting





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Figure 11 — Budget of R&D and demonstration SG projects start



Figures 13 - Investments in R&D and demonstration SG projects across Europe

Source: Joint Research Centre - European Commission







Electricity, source: European Commission

SG benefits will total between €19 and 36B, generating value of 2 to 3.5 times the investment needed for their development

For each stakeholder, investments and efforts need to be aligned with benefits



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- Smart grids → combination of traditional facilities with state-of-the-art ICTs technology
- 2. Compliance with legislation = opportunity
- 3. 60 M€ project investment
 - Roll out of (200,000+27,000) smart meters
 - HV/MV/LV: 1,100 secondary substations and 3 rural primary substations
 - Integration of DG and EVs
- 4. Improved energy and environmental efficiency
- 5. Driver project for Basque companies
- 6. Reference project worldwide





Smart secondary substations:



1,100 secondary substations will be upgraded to provide the following services:

- 235 with remote management (level 1 basic)
- 700 with remote management and monitoring (level 2 – monitoring)
- 165 with remote management, monitoring and automation (level 3 – automation)



PRICE: "Smart Grid Project in Henares Region"

PRICE (Proyecto de Redes Inteligentes en el Corredor del Henares) is a joint Demonstration Project led by IBERDROLA and GAS NATURAL FENOSA, consisting in the deployment of a global intelligent electrical network solution for their power distribution systems in a shared geographic area, in order to get the experience and knowledge in deploying and managing intelligent power systems.







Figure 1: PRICE geographic area

❑ Monitor, automation and remote control the MV/LV power network, improving its observability, operation and maintenance.

□ Improve the integration of already existing distributed generation (73.300 kW).

□ Forecasting and monitoring system for distributed generation based on state estimation.

□ DSVC system for voltage stabilization in MV feeders and LV generators.

□ Specification of the Distributed Generation Control Center

□ Contribution to interoperability and common open standards.

500.000 inhabitants involved 200.000 customers > 1.500 MV/LV secondary substations Urban, Semi-urban and Rural network topologies Budget: 34 M€ (excluding smart meters cost) Large collaboration: 21 partners Execution period: 2011-2014



PRICE Project



Plataforma Española de Redes Eléctricas



Inventario de microgrids existentes en España





Gijón: Univ. Oviedo (250 kW) Donostia: 1 Vizcaya: GE (45 kW) ISARE (400 kW) **ORMAZABAL (630 kW)** TECNALIA (200 kW) Navarra: Huesca CENER (312 kW) 👝 Valdabra (610 kW) INYCOM (740 kW) Soria: Zaragoza: CIEMAT (489 kW) Barcelona: CIRCE 1 (365,5 kW) **IREC (200 kW) CIRCE 2 (15 kW)** Madrid: Acciona (10 kW) **Gas Natural Fenosa** Valencia: (350 kW) **ITE (105 kW)** Ciudad Real: CNH 1 (11 kW) CNH 2 (19 kW) **19 Instalaciones** Sevilla: 5,0 MW gestionados Univ. Sevilla 1 (6 kW) Univ. Sevilla 2 (200 kW)

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TECNALIA's microgrid platform



Power Sources:

- Diesel Generator (2x55kW)
- µTurbine (50kW)
- Pacific Power Sources programmable network simulator- (2x62.5kVA/50kW)
- PV single phase (0.6kW and 1.6kW)
- PV (3.6kW three phase)
- Wind Turbine (single phase 6kW)
- Ballard Fuel cell (1 kVA)
- DC power source (125 kW)

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Static Switch:

Islanded – Grid connected

Main switching board:

- Three busbars (Three phase)
- Most devices can be connected to any busbar

Tests switching board:

 Concentrates all load banks at a single connection

Communication network:

• Ethernet, WiFi, RS 485 & RS 232, TCP/IP, ModBus...

Storage:

- Flywheel (250kVA)
- Ultracapacitor bank (48V 2.8MJ)
- Battery banks (48V-1925Ah and 24V-1120Ah)

Controllable load:

- Resistive load bank (150kW & 55kW)
- Reactive load banks (up to 200kVARr reactive or capacitive)

Other:

- Line simulator (R & X)
- DC Network, Rectifier and PM1000 Inverters (2x100kW)
- Hidrotec
- EV platform
- Kubik

Conclusions on the inventory

- 19 installations / 5 MW
- Purpose: pilot projects / demo / experimental platform
- Most of them can work connected or isolated
- All of them are private distribution networks connected to the main grid (utility) in a single point
- There is a regulation under discussion (net balance) that can mean a great opportunity for microgrids deployment in Spain
- Several laboratories have developed experimental capacities for technology testing
- Some of them are even working under real conditions



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Thank you for your attention



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