

# SIRFN Capability Summary

## TECNALIA, Spain

### Introduction

TECNALIA Research & Innovation test facilities for smart grids are organised around **INGRID - Tecnalia Smart Grids laboratory and interoperability center**.

The key research and testing activities of this lab are: advanced power system architectures, microgrids for buildings and districts, new power converters for grid connection, smart metering and grid automation, electric mobility (infrastructure, V2G), demand side management and demand response

In practical, the facilities consist basically on a set of interconnected testing platforms which are shown in the attached layout and listed below :

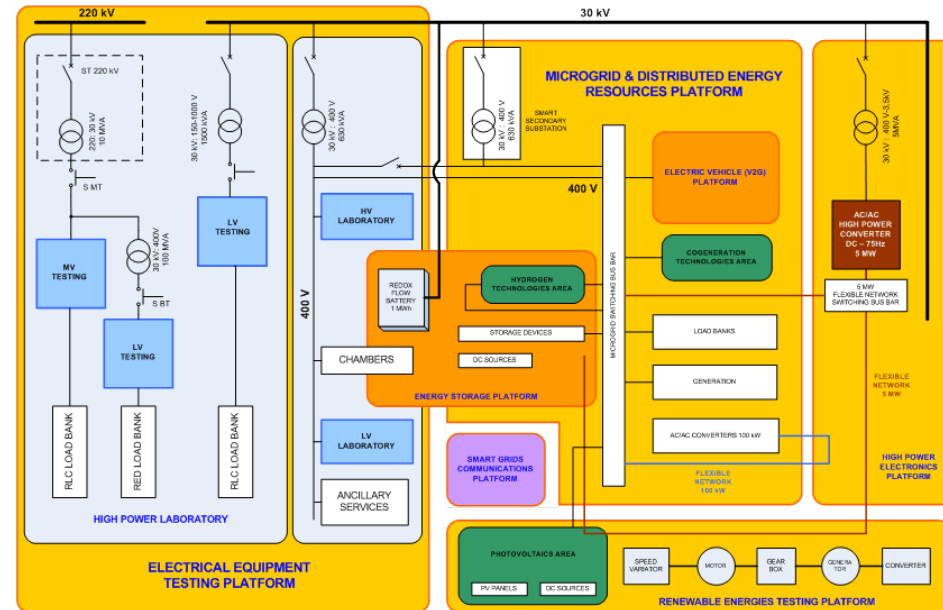
1. Electrical equipment testing platform (includes high power lab and MV&LV lab)
2. Microgrid and Distributed Energy Resources (DER) testing platform
3. Energy storage platform
4. Smart grids communication platform
5. Renewable energy testing platform
6. Electric Vehicle testing platform
7. Power electronics and energy conversion platform

In addition to it, INGRID – Tecnalia Smart Grids lab, is an accredited laboratory according to EN ISO/IEC 17025 and a member of IEC/TC57 (“Power systems management and associated information exchange”), CENELEC/TC210 (“EMC”), Group of Notified Bodies under the EMC Directive (ECANB), and many Technical Committees of AENOR (Spanish Association for Standardization and Certification)

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# Renewable Energy and DER Integration

Desired Level of SIRFN Participation: 2

SIRFN Site Focus Area Lead(s):

- 1 = Low 2 = Med 3 = High

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## Description of Activities

### Inverters

Conformity Assessment Tests in compliance with standards and regulations:

- CE Marking and RD 1663 (Spain)
- DIN VDE 0126-1-1 (Germany)
- Guide for the Network Connection - formerly DK5940 (Italy)
- EN 50438 & EN 50178
- Other Markets

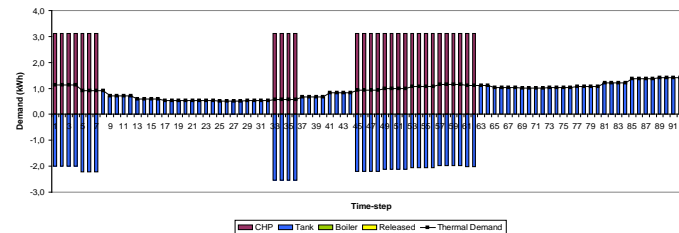


### Optimal DER dispatching

To calculate the optimal operation of a microCHP system considering:

- Energy demand forecasting
- Dynamic market tariffs
- Country regulation
- microCHP technical capabilities

Prototype controller under installation in the Kubik experimental building. 5kW<sub>e</sub> and 12kW<sub>t</sub> gas engine



# Building Automation

Desired Level of SIRFN Participation: 2

- 1 = Low 2 = Med 3 = High

## Description of Activities

### Aggregated control over domestic appliances

- Algorithms for the direct control of groups of HVAC equipment
- Characterisation of the HVAC consumption
- Algorithms for the direct load control of shiftable appliances

### Load forecasting

- Building level forecasting
- Relevant input for energy management applications
- Both heat and electricity consumption
- Use of weather forecast data
- Different approaches: Neural networks, conventional regression methods

### Optimisation of HVAC operation

- The operation of HVAC systems presents huge improvement margin
- Energy bill reduction
- Automatic parameterisation of the HVAC control system as a function of real time measurements and weather projections
- SCADA for monitoring of the HVAC consumption
- Application for capturing the comfort of building occupants

SIRFN Site Focus Area Lead(s):

Eugenio Perea

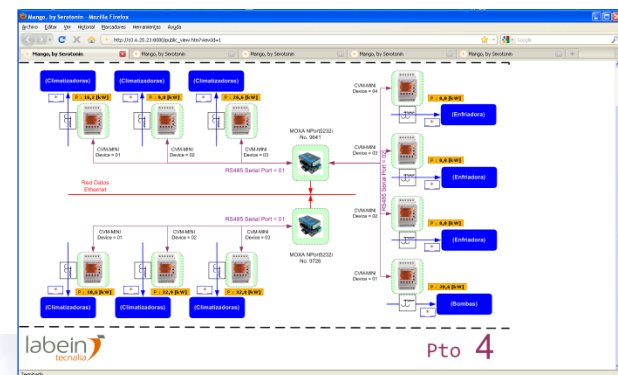
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# PEV Integration

Desired Level of SIRFN Participation: 3

- 1 = Low 2 = Med 3 = High

## Description of Activities

### TECNALIA Electric Vehicle interoperability centre

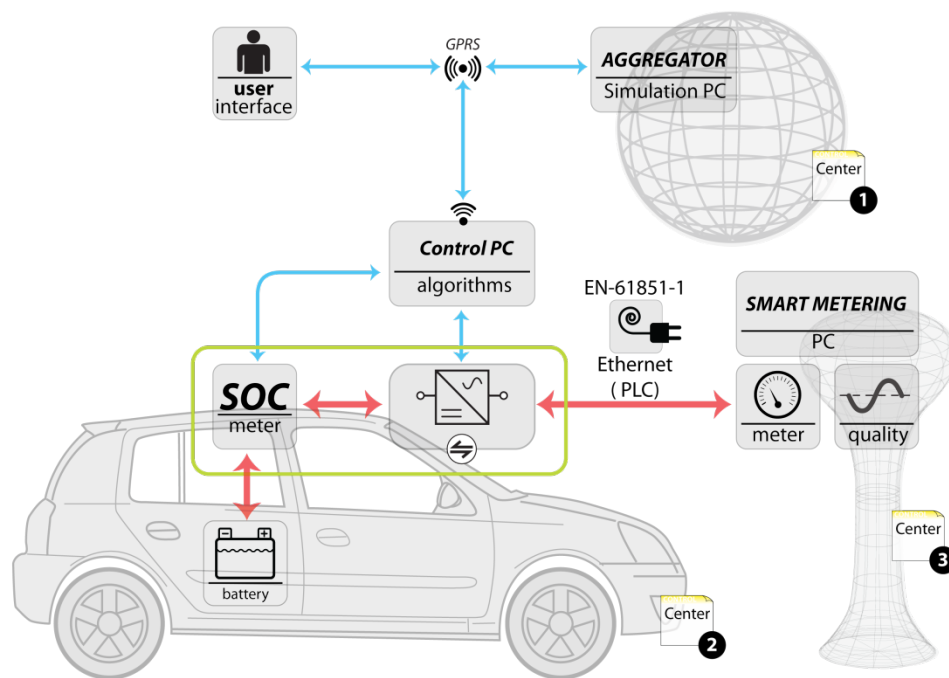
- Development of algorithms and management tools to optimise the charging of the EV considering the battery capabilities and external constraints (market condition grid availability, provision of ancillary services, etc.): smart charging and V2G strategies
- Large effort in standardization, agreement, infrastructure investment and technical skills in order to assess individual and global performance of the equipment that allow EVs to be charged.
- TECNALIA already offers some services for assessing compliance for EV and their charging infrastructure:
  - Low Voltage and EMC Directives
  - 61851: Charging Systems for EVs
  - IEC 15118: EV communication interface
  - EN 61439-7 Low-voltage switchgear and controlgear assemblies, also for EV.

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# Microgrids

Desired Level of SIRFN Participation: 3

- 1 = Low 2 = Med 3 = High

## Description of Activities

- Design of microgrids to optimise the efficiency of power systems in urban and remote areas
- Study the impact of microgrids in distribution systems. Connected and isolated mode.
- Testing of different microgrids components: protection, inverters, switches, ...

### Development of microgrid management systems

- Smart control system for coordinated and autonomous management of energy generation, consumption and storage systems.
- It brings the renewable energy generation closer to consumption points.
- It reduces losses, improves the electric system dispatchability and permits a better integration and higher penetration of renewable energy sources.

SIRFN Site Focus Area Lead(s):

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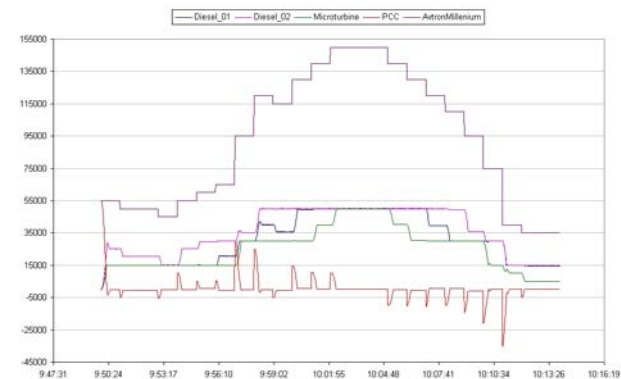
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# Distribution Automation

Desired Level of SIRFN Participation: 3

SIRFN Site Focus Area Lead(s):

- 1 = Low 2 = Med 3 = High

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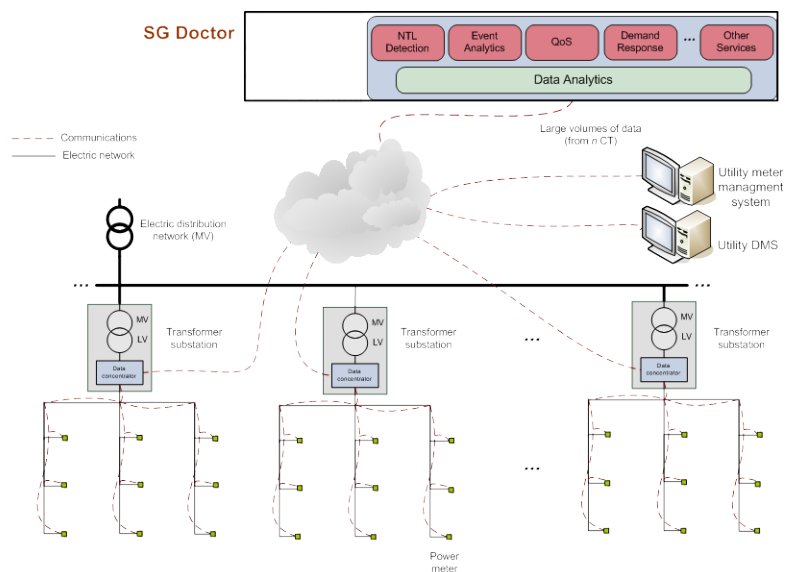
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## Description of Activities

Platform for smart grids interoperability conformance and performance

- Practical implementation and testing of protocols:
  - o IEC 61850 (architecture and data models for grid automation),
  - o PRIME (PLC technology for smart grids services)
  - o IEC 61400-25 (wind farms monitoring and control)
  - o DLMS/COSEM (energy smart metering)
- Comprehensive smart metering test bed
- Interoperability testing of smart grids equipment (sensors, data concentrators, home energy boxes, ...)
- LV/MV PLC equipment.
- Modelling and characterization of electrical networks for PLC communications.
- Testing of communications and interoperable functions associated to demand response, electric vehicle intergration, and distributed generation management.
- Development of tools for using the data from the Smart meters beyond the "easy billing":



# Summary of Capabilities for Simulation and Testing

## Electrical equipment laboratory:

- Power Laboratory
- High Voltage Laboratory
- Low Voltage Laboratory
- Environmental Testing Laboratory
- Power Electronics Laboratory



## Microgrid & DER integration lab:

### **Power Sources:**

- Diesel Generator (2x55kW)
- $\mu$ Turbine (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)

### **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

## Scope of Products Tested

- Distribution Transformers
- Instrument Transformers
- Prefabricated Substations
- LV & MV Switchgear
- Boards, Cabinets and Enclosures
- Fuses
- Insulators and Bushings
- Measurement, Protection and Control Equipment
- Safety Equipment and Materials
- Cables and Accesories
- Capacitors
- Surge Arresters
- Overhead Connectors
- Insulating Materials
- PV Modules
- Inverters
- Power Electronics Equipment

