



European Research Infrastructure supporting Smart Grid Systems Technology Development, Validation and Roll Out

TRANSNATIONAL ACCESS PROVISION

RESEARCH INFRASTRUCTURE DESCRIPTION AND TRANSNATIONAL ACCESS CONDITIONS

TECNALIA Research & Innovation



Grant Agreement No:	654113
Funding Instrument:	Research and Innovation Actions (RIA) – Integrating Activity (IA)
Funded under:	INFRAIA-1-2014/2015: Integrating and opening existing national and regional research infrastructures of European interest
Starting date of project:	01.11.2015
Project Duration:	54 month

Project co-funded by the European Commission within the H2020 Programme (2014-2020)

1 Research Infrastructure

Name of Infrastructure/Installation	Smart Grid Technologies Laboratory (SGTL)
Location	TECNALIA - Derio, Bilbao, Spain
Web Site	www.tecnalia.com

2 Description of the Research Infrastructure

The core of the **Smart Grid Technologies Laboratory (SGTL)** is a low voltage three-phase microgrid formed by different generation and storage devices and several loads, with a manageable power of around 200 kVA. Main elements of the microgrid are: generators (PV, diesel, wind turbine, etc.), network simulators, storage devices (flywheel, battery banks, ultracapacitor-based UPS, etc.), loads (resistive, inductive, capacitive, electronic loads), and power converters; a microgrid management system controls the operation of the infrastructure to run according to certain strategy, physically connects/disconnects the elements, and changes the microgrid topology, by means of a switching cabinet. The facility allows the research and development on the connection, integration and validation of DER technologies, assessment of the impact on the network, and the investigation on operation and control strategies of the entire microgrid.

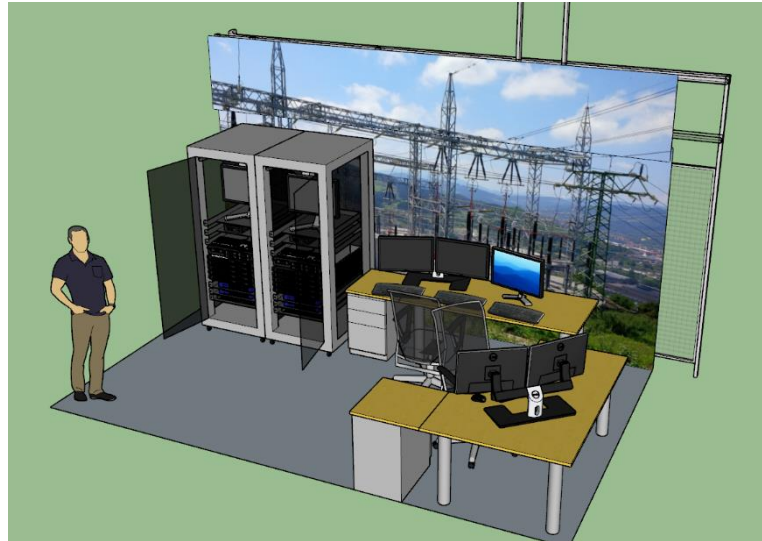


In addition, integrated in the microgrid there are four special platforms to reinforce the capabilities in the specific fields of **cybersecurity**, high power electronics, electrical vehicle, and **smart metering**:

- **Smart Grid Cybersecurity Lab:** the platform emulates the real software-hardware communication environment of a primary substation of the distribution grid. It is formed by two sections: (1) the “substation section” contains several IEDs installed in substations for protection and control of breakers, transformers, etc., the Substation Control Unit (SCU), the local substation SCADA, and communication devices; and (2) the “control centre section” contains the main SCADA, communication devices and servers (authentication and timing). Both sections are connected by an Ethernet network (VPN connection). The main SCADA of the Control Centre allows the substation supervision and control, and the management of the IED configurations. The SCU operates also as RTU. Two different acquisition schemes are implemented: direct electrical connections to IEDs, as well as the emulation of several Merging Units (sampled values sent through Ethernet).

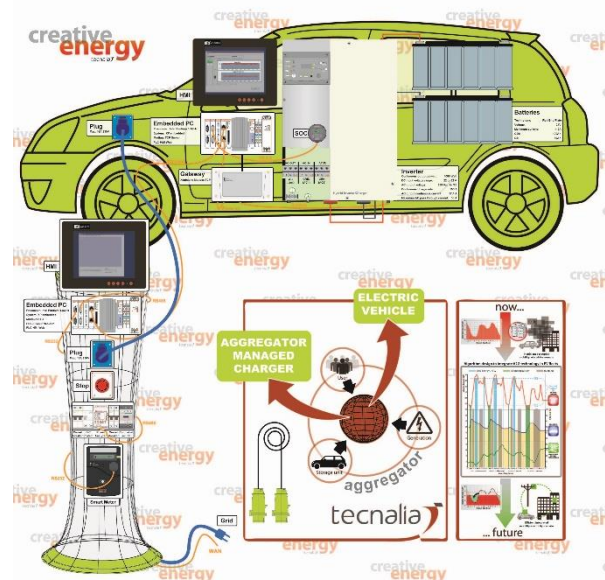
Implemented protocols: IEC 61850, IEC 60870-5-104, IEC 60870-5-103, Modbus TCP,

Modbus RTU, DNP3-TCP, HTTP/HTTPS, NTP/SNTP, LDAP/LDAPS, Web Services (SOAP 1.2, WSDL 1.1), FTP, SSH, Telnet.



- **High power multilevel converter for tests (THOR):** medium voltage neutral-point-clamped converter with a modular design. Each individual converter module has a nominal power of 1.25 MW. Up to 4 modules can be parallel connected to achieve a nominal power of 5 MW. It has a programmable output with a range in AC up to 3300VAC (20 to 70Hz) and in DC: up to 5000V. THOR has been designed promoting the flexibility, thus facilitating the use of this drive in different functionalities such as fully programmable voltage source, grid emulator or current source.

- **Electrical Vehicle Platform (EV-ON):** system for testing EV charging communication protocols (mainly IEC 61851, ISO 15118, and partly CHAdeMO). The system is formed by a bi-directional inverter, embedded PC, grid analyzer, smart meter, battery storage and PLC/GPRS communications.



- **Smart Metering Communication Platform:** system for research and certification of smart metering communication protocols especially focused on power line communication (PLC) technologies. The entire communication stack is covered, from low layers (like PRIME) to application layers and data model (like DLMS/COSEM). A fully configurable installation reproduces the last mile of distribution network, from the secondary transformer to the meter

cabinets. This system allows to change the length and type of the electrical lines, the network topology, the number and type of meters, the network loads, and the network noise and attenuation, in such a way that not only individual meters can be tested (so-called “conformance”) but also entire meter systems (so-called “performance”).



3 Services offered by the Research Infrastructure

In the Smart Grid Technologies Laboratory of TECNALIA, the architecture and management system of the microgrid and the singular features of the mentioned platforms provide the following services (but not limited to):



- Development, optimization and testing of **smart grid operation and control algorithms**.
- Analysis of **grid connected inverters**, behaviour in **islanding** situation and potential for **contribution to grid stability**.
- **Cyber-attacks emulation**, assessment of responses of equipment (RTUs, SCUs, IEDs,...) and information systems (SCADAs) to cyber-attacks, testing of cyber-attacks detection tools, etc.
- Management of electric vehicles connected to the grid: design and implementation of algorithms to manage the battery according to price signals and user criteria; **charging optimization and V2G strategies** in complex network scenarios associated to massive deployment.
- Individual **conformance testing of smart meters** and evaluation of the **performance of entire smart meter systems** under different network configurations (different length and type of the electrical lines, network topology, number and type of meters,

network loads, network noise and attenuation).

- Implementation of algorithms to fit a **DC source** in order to behave like a renewable resource.
- Characterization and testing of **AC/AC or DC/AC converters**, active filters, STATCOMs, energy storage systems, etc.

4 Brief description of the organization managing the Research Infrastructure

TECNALIA Research & Innovation is the first privately funded Applied Research and Technological Development Centre in Spain and one of the leading ones in Europe, with a staff of 1400 experts (including 200 Doctors). TECNALIA's offer includes different activities: technological services, testing and certification, R&D&I projects, transfer of industrial property, business promotion, business diversification, innovation management and foreign support. TECNALIA covers a broad range of sectors, and it is organized in 6 Business Divisions: Sustainable Construction, Energy and Environment, Industry and Transport, ICT-European Software Institute, Health, and Technological Services.

The Smart Grids Area (in the Energy and Environment Division) is focused on advanced power system architectures, integration of distributed energy resources (DER) in the network, demand side management, electric mobility, communications for smart grids and smart metering applications.

TECNALIA is very active in national and international platforms and networks relevant for ERIGrid, (EERA, ISGAN-SIRFN, EUREC, FUTURED, etc.), contributing to the development of common visions, roadmaps and strategies for the energy sector and having an excellent perspective and vision of the future challenges. This networking structure is complemented by a large experience in national and international research projects on decentralised energy and smart grids. In addition to the SGTL infrastructure offered in ERIGrid, TECNALIA has a high power laboratory, a high voltage laboratory and a low voltage laboratory for equipment testing, being an accredited laboratory according to EN ISO/IEC 17025 for many testing activities.

5 Transnational Access conditions offered by TECNALIA

All the offered experimental systems included in the SGTL are in the same building in Derio, near Bilbao, Spain.

For **safety reasons**, for **critical applications**, the users are not expected to operate the systems by themselves; even when safety instructions will be provided, tests will be carried out by staff of TECNALIA. For **the rest of applications** and after ad-hoc training, the user group will have full access to the related facilities for the duration of the stay (with the support of TECNALIA's researchers and laboratory technicians when necessary). The **scheduling of the experiments** will be agreed and booked prior to the stay according to the availability of the involved staff and equipment. Administrative documentation for the access (contract, non-disclosure agreement, etc.) will comply with ERIGrid common indications.

In addition to the general corporate services (Internet connection, canteen, etc.) and the support and advice on accommodation and transportation to TECNALIA's infrastructure, the access being offered includes supervision and help of TECNALIA's staff:

- As a complement to the pre-access contacts between the user group and TECNALIA, the stay will start with an introductory meeting with a senior researcher for confirming the stay conditions

(confidentiality, safety indications), scheduling the activities, explaining the on-site procedures, clarifying the logistics and technical details.

- Preparatory work: a laboratory technician will assist the users for the installation of the devices, electrical connections, use of the specific instrumentation, preparation of a test procedure (if necessary) on the basis of the users requests, and programming of the experimental conditions.
- TECNALIA's researchers will support the realisation and follow-up of the experiments.
- TECNALIA's researchers will support the results interpretation, data processing and analysis, and test report preparation

In principle, a typical stay of 1 month is foreseen for a single user group but this period could be extended depending on the concrete user project. The user group (usually 2 persons) can use the infrastructure for the defined time.

Reimbursement of expenses:

User expenses for the Transnational Access are paid by ERIGrid (EU H2020 Programme). This includes travels to SGTL (TECNALIA) by plane, accommodation, daily subsistence, and daily transportation during the stay.

For the user projects taking place in SGTL, TECNALIA will refund the stay expenses when the stay is finished: the user must declare the incurred expenses and present the invoices/receipts to TECNALIA in order to get the refund.

Logical expenses must be made by the user: travels will be made in economy class and conventional hotels (not luxury) or equivalent accommodation will be used. As an indication (it is not a daily allowance), a maximum subsistence fee of 150 €/person must be considered per day. Lunch will be provided at TECNALIA's canteen free to the user.

6 Contact details for Research Infrastructure

<p>Smart Grid Technologies Laboratory (SGTL) - TECNALIA Address: Parque Tecnológico de Bizkaia. Astondo Bidea, Edificio 700 – 48160 Derio, Spain Website: www.tecnalia.com</p>			
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