SMARTLAB

Smart Grid Laboratory of EDP

November, 2018
Agenda

1. Context
   The constant challenges of the evolution of SmartGrid technologies

2. The SmartLab - Overview
   Main characteristics

3. The SmartLab - Implementation
   Technical description and projects

4. Summary
   Main benefits and future developments
EDP Labelec has been EDP Group's benchmark laboratory partner in ensuring the compliance of SmartGrid equipment.
**Smart Lab Context**

The constant challenges of the evolution of SmartGrid technologies

---

**Key Aspects:**

- **Global Investment:** 300 k€
- **Timeframe:** Between 2015-2017

---

**Smart Metering Lab (2014 - 2017)**

- Automated Meter Reading (AMR)
- Specifications
- New technologies validation
- HAN, WAN, LAN
- Advanced smart metering
- Demand-response
- HEMS
- Communication protocols
- Automation

**SmartLab (2017 - ?)**

- Micro-grids
- Electric-Vehicles
- Storage
- IoT
- Cyber-security
- Performance and robustness
- Debugging field tests
- Integration
Smart Lab Context
The constant challenges of the evolution of SmartGrid technologies

1. : Variable real loads

2. and 3. : Network Li-ion and Supercaps Storage (Sensible Project)

4. : StorageLab

5. and 6. : Interconnection SmartLab-StorageLab

7. : Smart Lab / Smart Home systems

8. : PV system
Agenda

1. Context
   The constant challenges of the evolution of SmartGrid technologies

2. The SmartLab - Overview
   Main characteristics

3. The SmartLab - Implementation
   Technical description and projects

4. Summary
   Main benefits and future developments
Smart Lab Overview
Main characteristics

Resources

- Single phase testbench with 40 positions
- Three phase testbench with 20 positions
- 6 Portable Test Equipment
- Climatic chamber for temperature stress tests

Functionalities

- LV\MV Meter Calibration *
- Clock Verification *
- External Metering System Verification – Industrial and Commercial *
- Hardware Verification

* Accredited tests by the portuguese accreditation body
**Smart Lab Overview**

**Main characteristics**

**Resources**
- 400 Smart Meter positions (flexible configuration, from 50 to 400)
- 4 full equipped Secondary Substation
- Field condition simulation, including 1 km LV network cable
- 8 network analyzers (fixed and portable). Monitoring system

**Functionalities**
- Integration, Compatibility and Data Security End-to-End tests
- Smart Grid infrastructure capability to withstand noise and attenuation
- Performance and fine tuning of the communication solution
- Control and Supervision of communication infrastructure
Smart Lab Overview

Main characteristics

Resources

- 4 Power Supplies associated with automated tools for firmware validation
- 3 "Smart Home" installations with microgeneration (PV), residential storage systems
- 50 m of real LV cable

Functionalities

- Unitary performance testing
- Control and validation of new firmware versions
- Functional and performance tests of HEMS systems
- Performance tests of LV storage systems
Agenda

1. Context
   The constant challenges of the evolution of SmartGrid technologies

2. The SmartLab - Overview
   Main characteristics

3. The SmartLab - Implementation
   Technical description and projects

4. Summary
   Main benefits and future developments
Smart Lab Implementation
Technical description

4 complete LV networks and secondary substations;

400 Smart meters (4 sets);

Loads up to 16A per phase and in some positions selected up to 60A per phase

Attenuation introduced by attenuator filters
Smart Lab Implementation
Technical description

Sinoptic system with control and supervision of the state of the complete infrastructure
**Objectives:** To validate in a controlled scenario (lab) all the equipment and systems developed in the scope of Sensible project prior to the installation on the field.

**Tests at the SmartLab:**
- Equipment automation and protection
- Operation in different scenarios
- Integration with the ICT infrastructure
- Residential (HEMS).

**Duration:** 6 months
• Development and building of testing skills for innovative solutions (storage, smart grids, smart homes)
• Development of FAT and commissioning procedures according to international (US & Europe) guidelines
• Development of consultancy services in smartgrids/smarthomes solutions
Laboratorial activities were divided into four major vectors in order to ensure full compliance for the demonstrator.
Laboratorial activities were divided into four major vectors in order to ensure full compliance for the demonstrator.
**Objectives**: Assessment of charging/discharging performance of a 2nd life battery prototype and benchmark with a commercial battery.

**Tests at the SmartLab**:
- cycling, aging, use cases, programmable use cases for PV production and load profiles.
- Interoperability tests: inverter + batteries + use case scenarios.
- test of demand side management algorithms.

**Duration**: 4 months
Objectives: Validation of a new tool used by the DSO to perform the remote FW upgrade on smart meters

Tests at the SmartLab: Three (3) LV networks were made available in SmartLab (1 concentrator per network) each containing about 50 smart meters of the same model. These updates were carried out remotely by the DSO (EDP Distribuição).

Duration: 2 weeks
Agenda

1. Context
   The constant challenges of the evolution of SmartGrid technologies

2. The SmartLab - Overview
   Main characteristics

3. The SmartLab - Implementation
   Technical description and projects

4. Summary
   Main benefits and future developments
Smart Lab Summary
Main benefits and future developments

- In projects with technical complexity as SENSIBLE, laboratorial validation is a key quality step for the deployment of the real environment demonstration.
- Advanced smartgrids and smarthomes require appropriate ICT infrastructure to enable grid services to DSO – integration and interoperability tests are crucial.
- Uniform protocols to test different energy storage technologies and capacities are a powerful tool to standardize laboratorial activities.
- As system complexity increases, as increases the laboratorial resources and test tools to guarantee the adequate evaluation of the technical solutions impact on the system as a whole.
The SmartLab upgrade will integrate the substation simulation of equipment and functionalities based on IEC 61850.
Smart Lab Summary
Main benefits and future developments

Key Aspects:
- Global Investment: 650-700 k€
- Timeframe: Between 2019-2021

BaU Activities
- Testing and Validation of Merging Units;
- Training of O&M Personnel;
- Testing and Validation of new Solutions;
- Design of SAS System Specifications;
- Stress and Performance Tests;
- Qualification and Inspection of SAS Equipment;
- Cybersecurity tests;
- Incident reproduction and analysis;

2019
Phase 1
- Simplification of DSQ SAS Project Template
- Interoperability tests between IEDs from different manufacturers
- Implementation and Validation of IEC61850 SAS Projects
- Implementation and Validation IEC61131

2020
Phase 2
- Logical and Functional Interoperability Validation
- SAS project implementation and Laboratory Validation
- Solution for electrical interchangeability
- Solution for physical interchangeability

2021
Phase 3

2022