LCE-04-2017

Innovation Action

flexitranstore

An Integrated Platform for Increased FLEXIbility in smart TRANSmission grids with STORage Entities and large penetration of Renewable Energy Sources

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 774407

D10.1 Design of the Operational HIL Computing Platform			
Report Identifier:	D10.1		
Work-package, Task:	WP 10	**Status – Version:**	Summary
Distribution Security:	PU	**Deliverable Type:**	R
Editor:	LUA		
Contributors:	ICCS, SCHN, ABG, JEMA, STER, IPTO, CTSO, NESTER, OST, EAC		
Reviewers:	IBEX, ICCS		

Quality Reviewer:	LUA		
Keywords:	Simulation Lab, Computing platform, RT-simulation, Hardware-in-loop, Power systems simulation, Control, SCADA, Battery energy storage systems, Power conversion, Renewable energy, Electricity Transmission-Distribution		
Project website: www.FLEXITRANSTORE.eu			

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Executive summary

1.1 Scope of deliverable

This report describes the basic design of a real-time hardware-in-the-loop (HIL) power system simulation platform called Computing and Control Laboratory to evaluate commercial Battery Energy Storage System (BESS) controllers. The main goal for the computing and control lab is to establish a demonstration and evaluation platform for testing proposed first, second and third level controllers of BESS using any system topology besides focusing on network topology in demonstration sites.

The computing and control lab creates new, intelligent and improved decisions by utilization of the grid interactive BESS in order to enable operation of the power system through an Active Substation (AS). The objective of the laboratory is the simulation of the BESS-integrated active substations in Cyprus and Greece. The design of the laboratory to simulate the ASs (Active Distribution Node (AND)-BESS in Cyprus and Wind Power Plant (WPP)-BESS in Greece) are oriented both to work autonomously (by distributed control) and with system operators (by centralized control) in order to monitor the system and control the active substations by assigning appropriate set points.

This developed ''virtual power system'' will be used during the demonstration phase of the project, comparing the operational magnitudes and indicators of the remotely monitored demonstrators with the ones resulting from the virtual (laboratory) environment.

1.2 Concept and methodology

This document aims to set the basis for the design of the computing and control lab under implementation in the University of Loyola Andalucía.

The different sections include the general approach to the overall structure, and the specific technical details imposed to the main building blocks.

From a conceptual design that is already identified in the project proposal, the definition of this document and its contents result from gathering of requirements and the fluid scientific-technical communication between different skilled researchers from different partners within WP10.

Refinement of the current design status is expected after technical progress provides further outcomes.

1.3 Key activities

The activities described in this document are related to design of the different building blocks, and their physical and logical integration, including sufficient level of detail about technical specifications on all of them. The general concept underlying the design of computing and control lab together with a general approach to the involved main relevant building blocks are included in this period developments.

Main activities were initiated, essentially devoted to extend previous LUA's infrastructures with main pieces of equipment for the computing and control lab specified. The conception of the computing and control simulation lab has progressed, and the technical discussion has focused on the control architecture that would be developed, simulated in LUA's premises, and finally delivered and deployed through WPs 5, and 6, in Cyprus, and Greece, respectively. All main equipment and control hierarchy have been thoroughly discussed and agreed upon.

The different components of the lab as well as their high level preliminary communication links for receiving and sending required information and appropriate commands, respectively. The following thirteen main blocks were considered in the initial design:

- BESS BMS,
- BESS controller,
- 1st Level controller,
- 2nd Level controller,
- 3rd Level controller,
- Transmission system operator (TSO) simulator,
- Distribution system operator (DSO) simulator,
- Supervisory control and data acquisition (SCADA),
- Wide area measurement system (WAMS),
- Substation monitor,
- Residential demand simulator,
- Weather simulator, and
- Wind power plant.

1.4 Key results/Main findings

Main result of this Deliverable is the LUA Lab that was completely set-up.

1.5 Conclusions

The following give the correlations between the various components of the HIL computing platform. The data exchange between the various components as well as the format and the type of data will shape the requirements for the definition of the architecture of the Flexible Energy Grid (FEG) Platform, which is currently underway. The FEG platform will provide the technical basis to support the valorisation of flexibility services and its initial design will include:

- Applications (Toolbox) related to specific power system flexibility resource and services (demand response, grid assets efficiency…).
- Business Models to govern the operation of the applications.
- Data management and IT architecture that accommodates all the functionalities.
- Interfaces with external databases.

Combined with the conceptual architecture of the FEG platform and what the project needs to do in order to follow the BRIDGE guidelines the conclusions are categorized as follows:

- Expected developed modules are reviewed based on the usage description and relevant software which may be used through development procedure.
- Used datasets are presented to clearly define the type of data that are needed and who in particular is going to provide what and to whom.
- For the applications and services layer, it is important to define the various quantifiable measures that the platform will provide.
- The definition of the use case flow makes clear, which type of data is used by which application of the platform, how each application needs to get the required data and what are the access rights of each user to specific data categories.