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Innovation Action

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

D10.2 Constructed and operational HIL computing platform			
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Executive summary

1.1 Scope of deliverable

Developing hierarchical controllers for distributed power systems requires deploying a hybrid platform where virtual models for the power system can interact in real-time with the actual controllers to be installed in the final application, using the same interconnection mechanisms as in the real life. In the FLEXITRANSTORE project, an active substation and an active distribution node (ADN), both of them based on battery energy storage systems (BESS), are controlled by a hierarchical control system that should regulate the overall performance of the system, starting from the regulation of the BESS voltages and currents at the point of connection, and ending with the optimal participation of the BESS-based system in suitable electricity markets. Therefore, a hardware-in-the-loop (HIL)lab has been deployed in the LUA facilities to design, program and test the final hierarchical control system that will be installed in the real demonstrators located in Cyprus (WP5) and in Greece (WP6). Moreover, such a HILlab will act as a demonstrator itself, since it will be able to evaluate the performance of the systems developed in the project under generic and controlled operating conditions, being such generic operating conditions not easily reproduced in the real life.

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 and general approach to the overall structure, and the specific technical details imposed to the main building blocks are included in the complete report.

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.

1.3 Key activities

Task 10.2, mainly devoted to reproduce the systems, grid and contour operating conditions of the demonstration sites in order to create a virtual environment to simulate the control algorithms and operational procedures of the active substations, project partners made most of the information available for LUA. Within WP10, running in parallel with WP4, different scenarios for further analysis have been set up.

1.4 Key results/Main findings

Task 10.2 deals essentially with the virtual programming of the HIL platform. Loyola has duly covered some significant steps:

- Definition of the Cypriot transmission area and distribution systems to be RT-modeled, as well as the ADN components (PCS), with a simplified Cypriot transmission system fully defined.

- Definition of the Greek transmission area and WPP to be RT-modelled, as well as the AS components (PCS), with the Greek transmission area of interest fully defined

1.5 Conclusions

This report has presented la final structure and implementation of the HIL simulation platform developed in the FLEXITRASTORE system to program del virtual power system where the hierarchical control structure for the ADN and the active substation are developed, being both of them based on BESS. The functional zones of the HIL lab has been presented and its corresponding functions has been described.

The controllers and communication systems used in this cabinet will be equal to the final ones to be installed in the real demonstrators deployed in the real demonstrators, which allows evaluating the performance of the hierarchical control system under generic operating conditions before installed in the field.

.To wrap up this report, it is worth to remark that the HIL lab developed in the FLEXITRANSTORE project has original features that make it an essential tool to develop distributed control systems. In contrast to many real-time simulation lab used by the TSO, which use to be devoted to evaluate the performance of protection relays and other systems, generally focused on post-mortem and testing analysis, the HIL lab developed in the FLEXITRANSTORE project aims to integrate all the necessary systems to close control loops at different scales of the power system. This allows developing and testing wide area control