Towards Holistic Testing: Development of a Microgrid Controller

Ron Brandt1, Juan Montoya1, Maria Nuschke1, Diana Strauss-Manuel1,2
Contact: ron.brandt@iws.fraunhofer.de
Phone +49 561 7294-103
1Fraunhofer IWS
Institutsteil Energie- und Systemtechnik
Königstr 59
34119 Kassel / Germany
www.energytechnik.iws.fraunhofer.de
2DERlab e.V.
Königstr 59
34119 Kassel / Germany
http://ider-lab.net

Test chain for innovative smart grid developments

Smart grid components and units are being increasingly equipped with functionalities that make them more autonomous in terms of providing grid support. The share of such grid integrated units is increasing and so is the complexity of smart grids. This leads to challenges in terms of ensuring grids stability and security of power supply.

A holistic test chain is introduced as strategy to overcome these challenges and is structured as follows:
1. Simulation-only
2. Controller Hardware-in-the-Loop
3. Power Hardware-in-the-Loop
4. Pure Hardware/Field Test

Advantages of this approach are:
- New control algorithms and procedures can be tested in real-time and in realistic environments
- Efficient and low-cost prototyping is possible
- Products’ faults or non-conformities can be detected and solved efficiently
- Cost- and time-intensive field tests can be prevented

We acknowledge the support of our work by the German Federal Ministry for Economic Affairs and Energy (BMWWi) and the Projectträger Jülich within the project «NETZKRAFT: Netzwiederaufbau unter Berücksichtigung zukünftiger Kraftwerkstrukturen» (FKZ 0325776A).

Furthermore this work is partly supported by the European Community’s Horizon 2020 Program (H2020/2014-2020) under project «ERIGrid: European Research Infrastructure for supporting Smart Grid Systems Technology Development, Validation and Roll Out» (Grant Agreement No. 654113).

Comparative results

The results of the different test stages need to be compared in order to validate the performance of the Microgrid Controller. Fig. 2 shows the comparison of profile data of load and PV as inputs and the state of charge (SOC) of two batteries as resulting outputs.

Comparison of stage 1 and stage 2 results:
- Inputs are identical
- Tendency of SOCs and maximum operation time are very similar
- Performance in stage 2 is comparable to stage 1
- Units ready for next stage testing.