

## Programme Purpose

Microgrid Research Programme areas

- ✓ Modeling
- ✓ Control & Operation
- ✓ Energy Storage
- ✓ Protection
- ✓ Power Quality
- ✓ Standard-based ICT
- ✓ Networked Control
- ✓ EMS & Optimization
- ✓ Multi-Agents

## MICROGRID RESEARCH TEAM

### Programme Coordinators



### Visiting Professor



### Postdocs



### PhD students

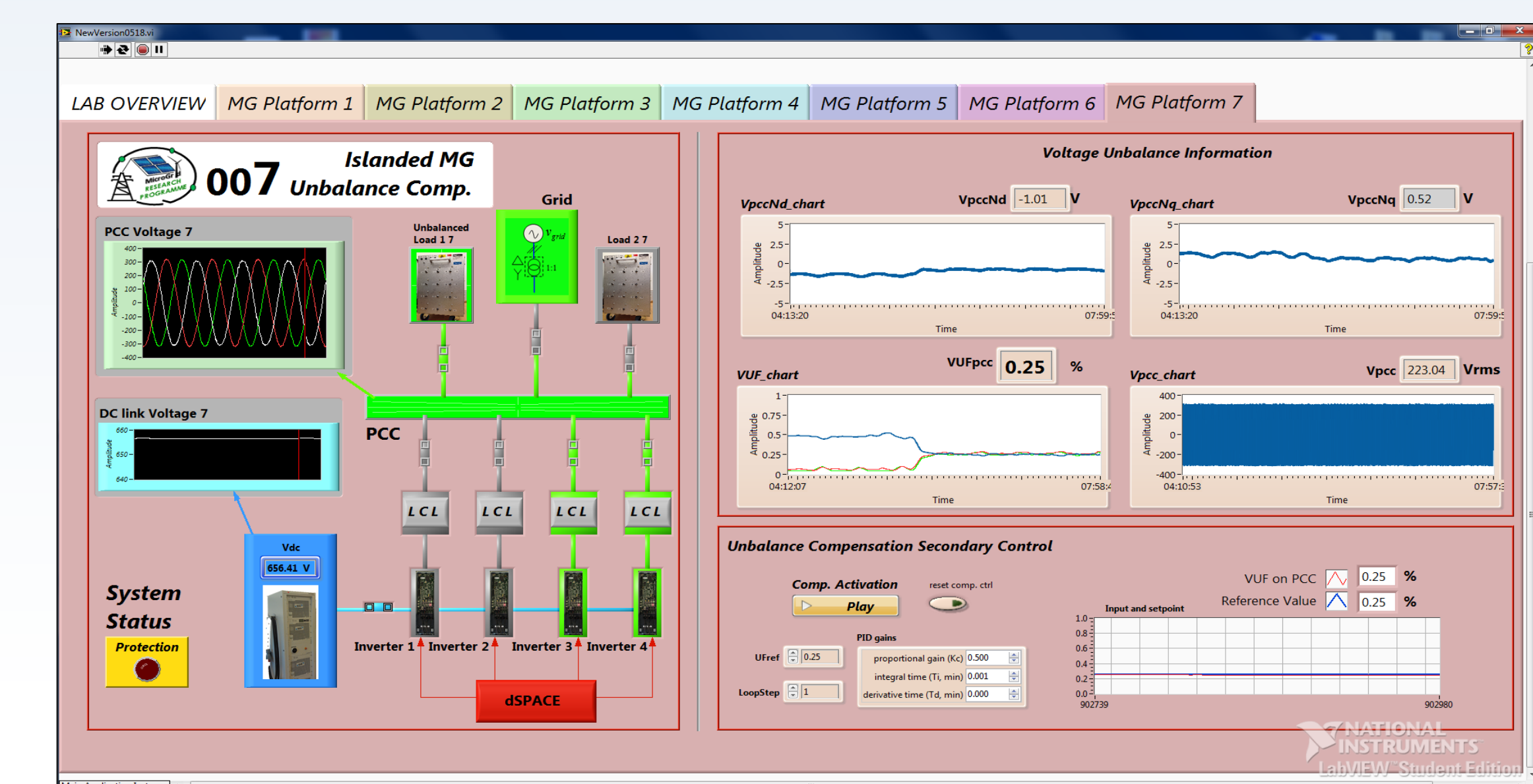


## AC Microgrid Research Laboratory

The MGLlaboratory allows to set multiple flexible configurations such as grid-connected and islanded AC/DC Microgrids as well as multiple Microgrids clusters

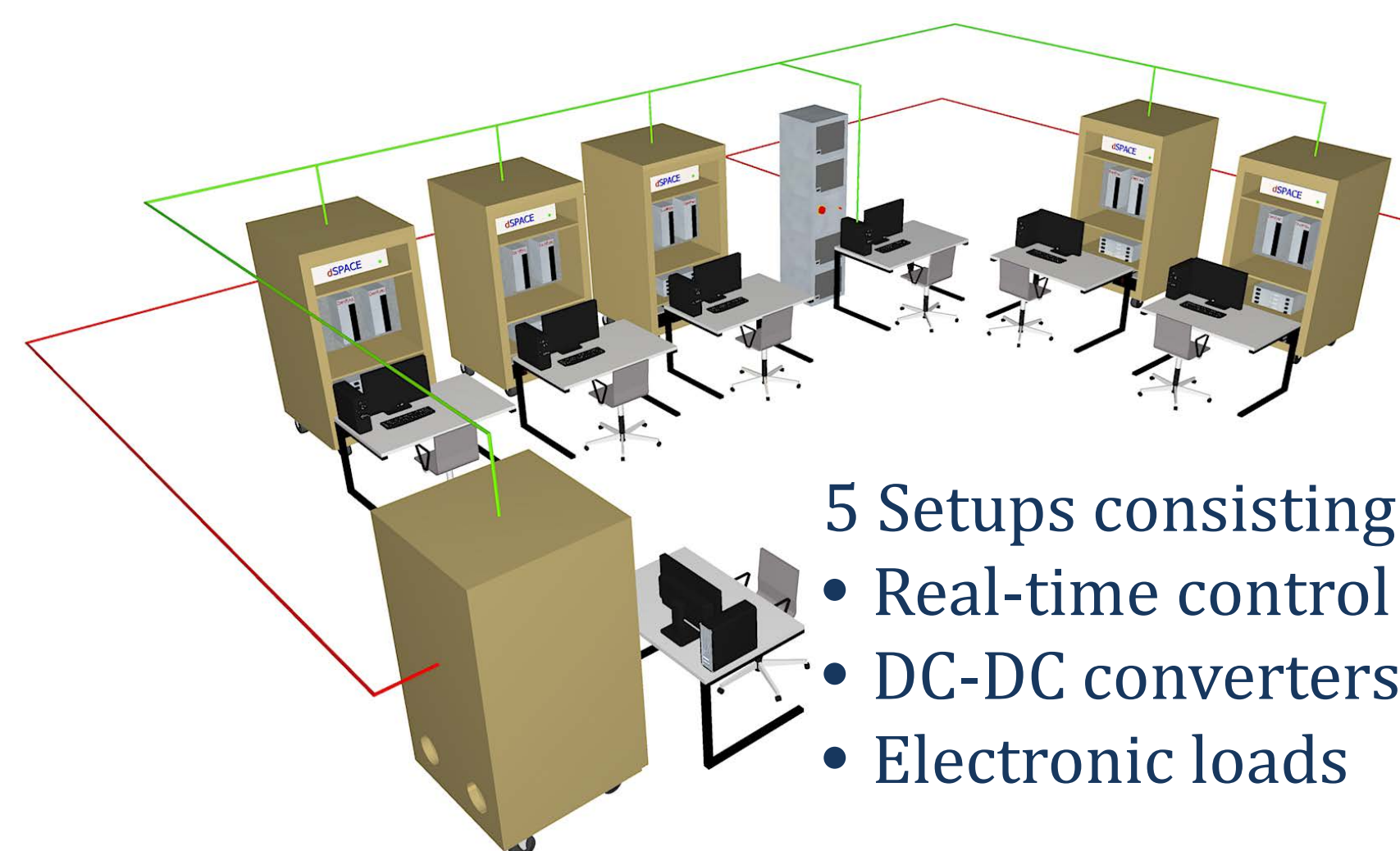
6 Setups consisting of:

- Transformers for grid connected applications
- Real-time control dSPACE platforms
- Motorized change-over switches
- Smart-meters
- DC-AC converters
- Adjustable L-C-L filters



## DC Microgrid Research Laboratory

This laboratory aims to facilitate DC network planning and operational analyses by consolidating experimentally verified models of different types of sources and loads, converter topologies and advanced control strategies.



5 Setups consisting of:

- Real-time control platforms
- DC-DC converters
- Electronic loads

The flexibility of this laboratory allows to research new DC microgrids control configurations and technologies, including energy management systems, able to optimize the energy and power efficiency of industrial and residential applications.

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## Ongoing Projects

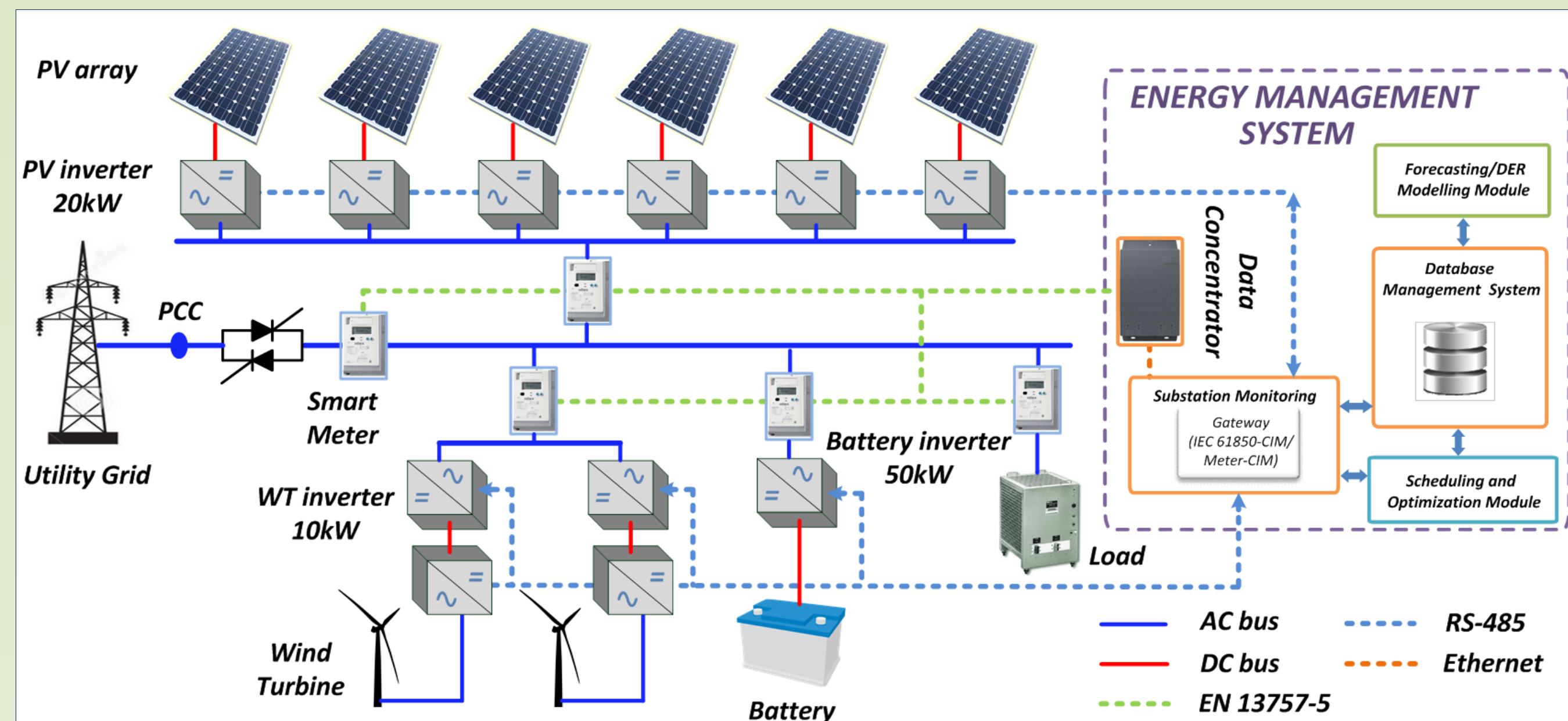
### 1. Microgrid Technology Research and Demonstration – [www.meter.et.aau.dk](http://www.meter.et.aau.dk)

This Sino-Danish project deals with research, development and demonstration of a full-scale microgrid.

- The work will be carried out by AAU and Tsinghua University in China.
- Project Partners: Kamstrup A/S (leading smart meter manufacturer in Denmark) and Shanghai Solar Energy Science & Technology (top company in photovoltaics and power electronics market in China)

The plan of this project is structured into 4 frameworks:

1. Microgrid design and Control
2. Power Quality



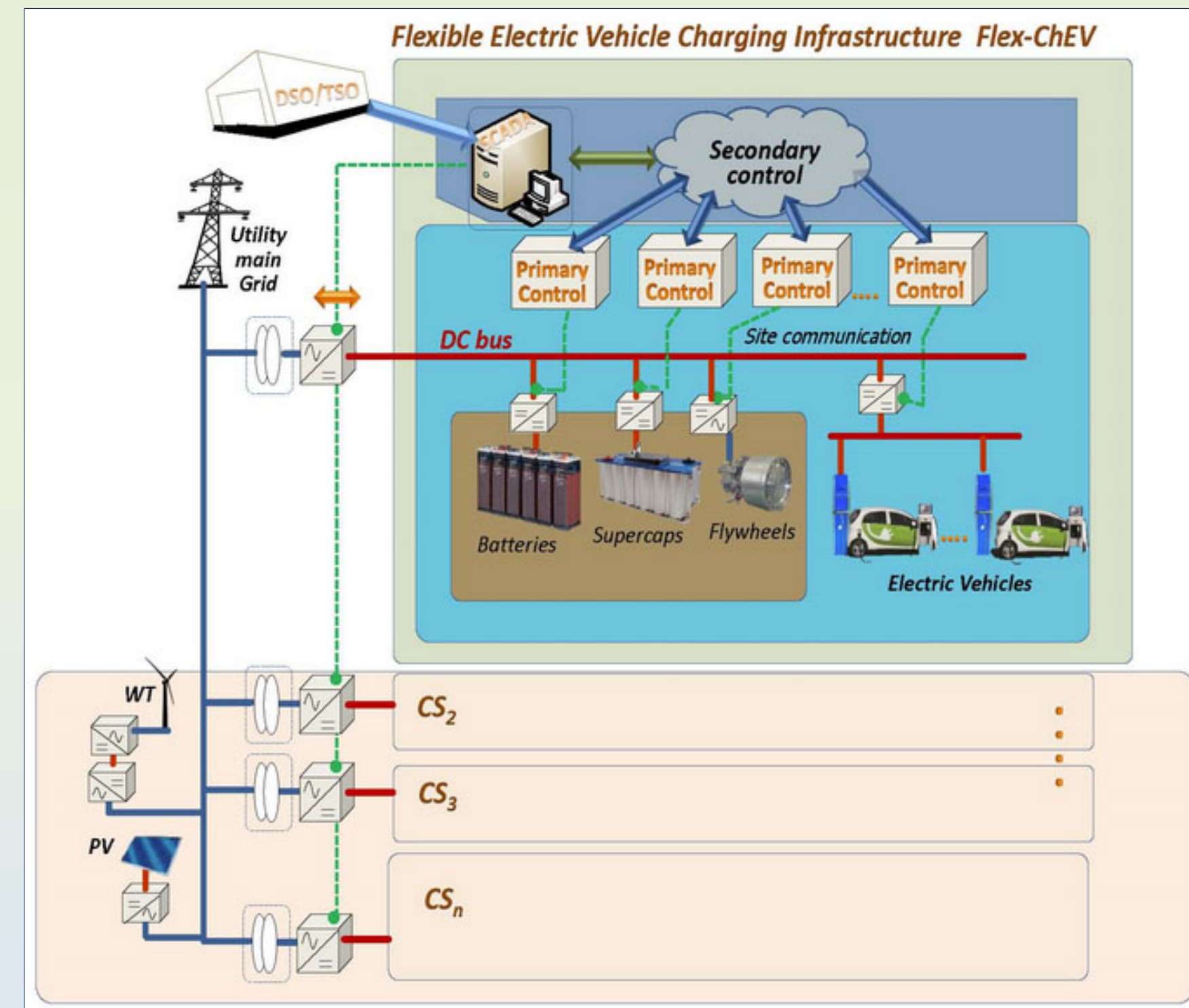
3. Energy Management System
4. Communication and SCADA

### 2. Flexible EV Charging Infrastructure – [www.flexchev.et.aau.dk](http://www.flexchev.et.aau.dk)

This project is focused on theoretical development and experimental verification of a new generation of fast HEV charging stations (CSs). Its principal functionality is to use dedicated ESS within the station to compensate the adverse effects caused by charging, as seen from the grid.

Expected Results

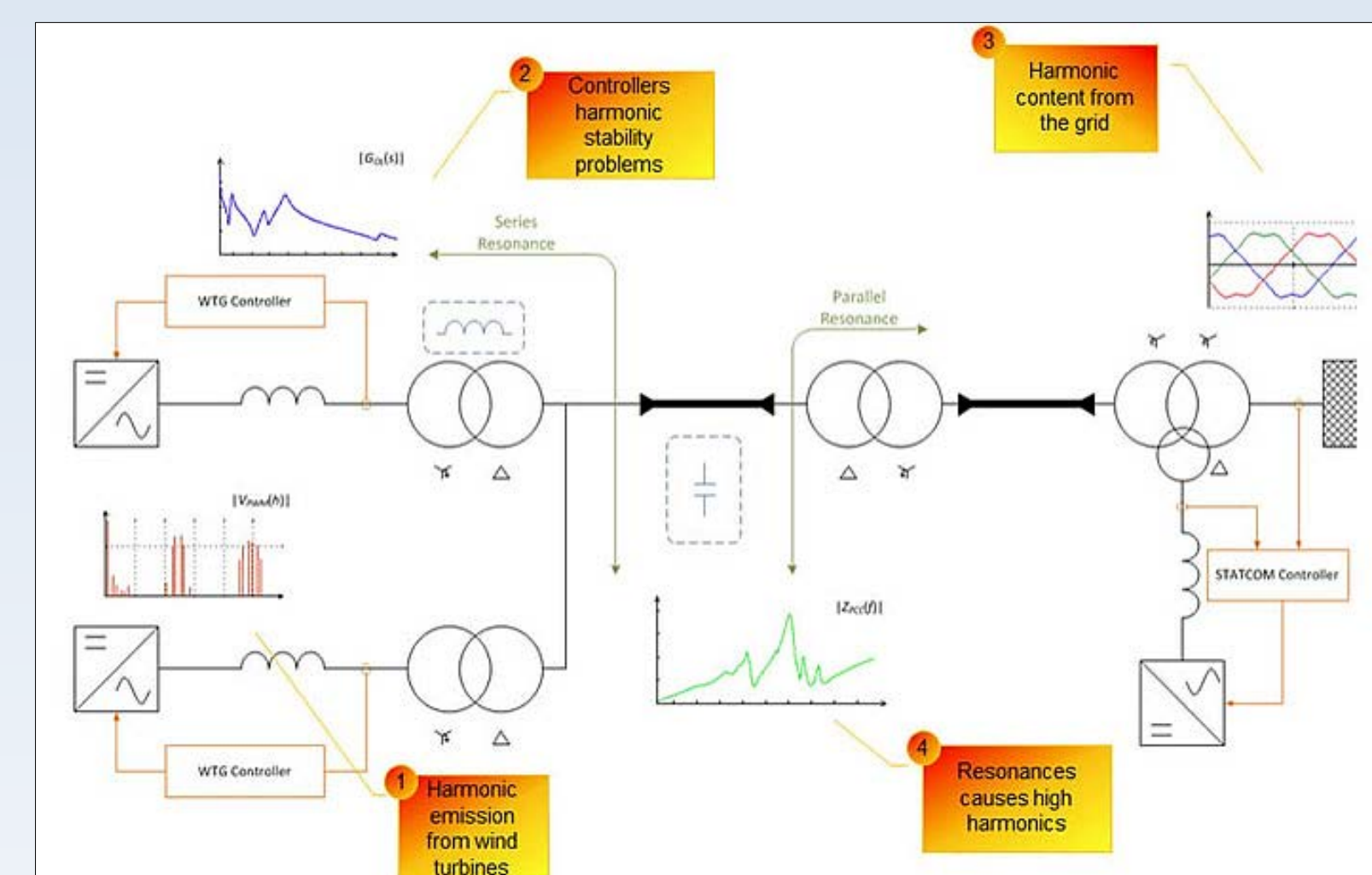
- Creation of a suitable environment for large-scale acceptance of HEV fleets
- Provision of business cases for CS operators and manufacturers
- New ancillary services and prototype business instruments for the future flexible power market.
- Suitable technologies, architectures and standards for fast HEV CSs.



### 3. Active Filter Functionalities for Power Converters in Wind Power Plants – [www.apf.et.aau.dk](http://www.apf.et.aau.dk)

The project intends to analyse and develop active filtering solutions for mitigation of harmonic amplifications due to resonances in the Wind Power Plant electric circuit.

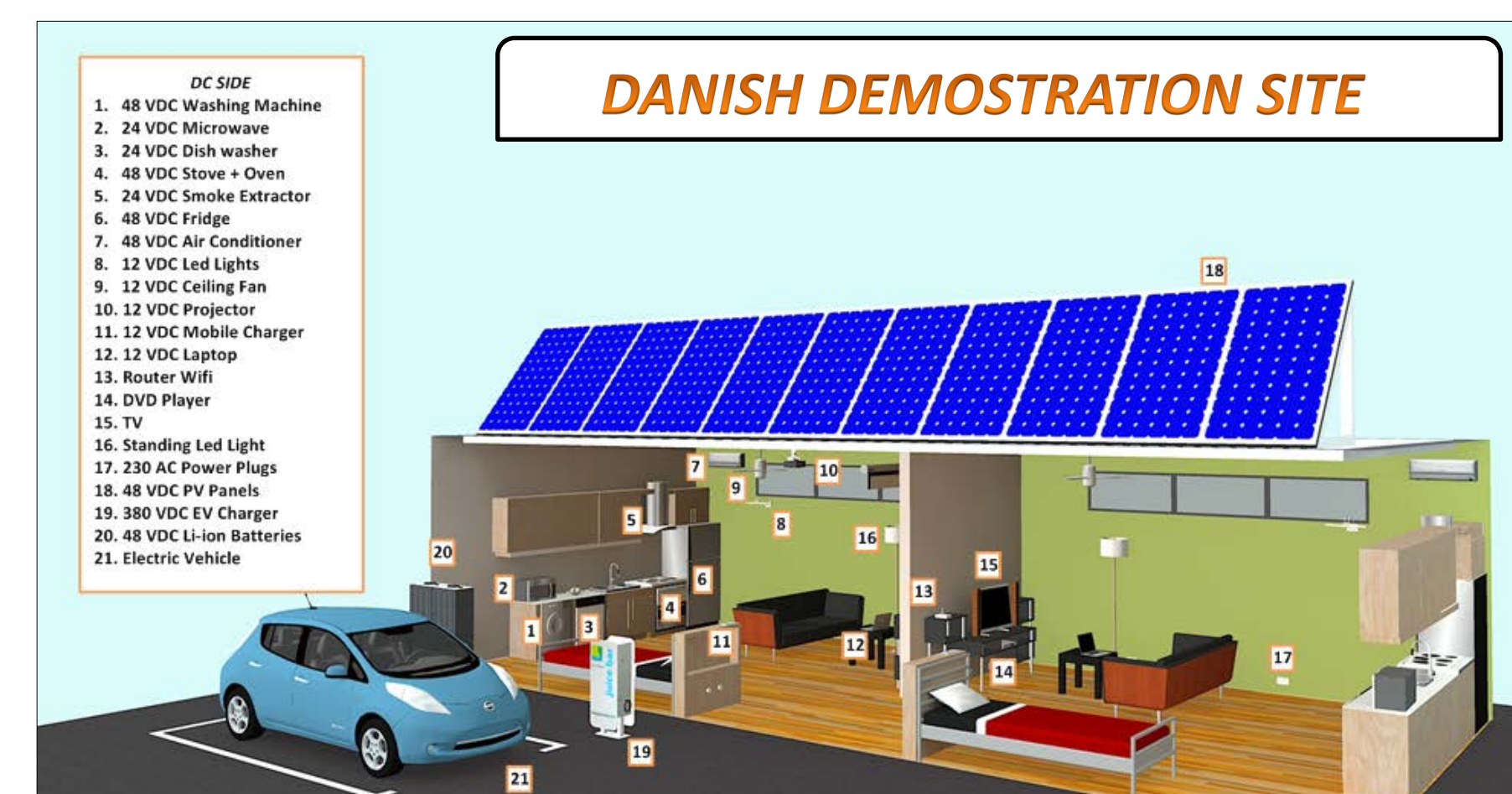
- A key aspect is the proposal of adding active filtering functionality to the STATCOM devices already present in WPP (mainly employed for reactive power compensation).
- Finally, a full scale demonstration in a real wind power plant will be attempted.



### 4. Intelligent DC Microgrid Living Laboratory – [www.idclab.et.aau.dk](http://www.idclab.et.aau.dk)

The objective of this project is to research new DC microgrids configurations and technologies, including control, communications and energy management systems, able to optimize the energy and power efficiency of industrial and residential applications. Research and implementation of energy solutions will be presented and demonstrated in these living labs:

- Residential DC Microgrid Living Lab, at Aalborg University (Denmark), aimed to research, test and demonstrate DC distribution systems for one family house.
- Commercial Building DC Microgrid Living Lab, at North China Electrical Power University (China), aimed to research, test and demonstrate DC distribution systems for commercial and industrial buildings.

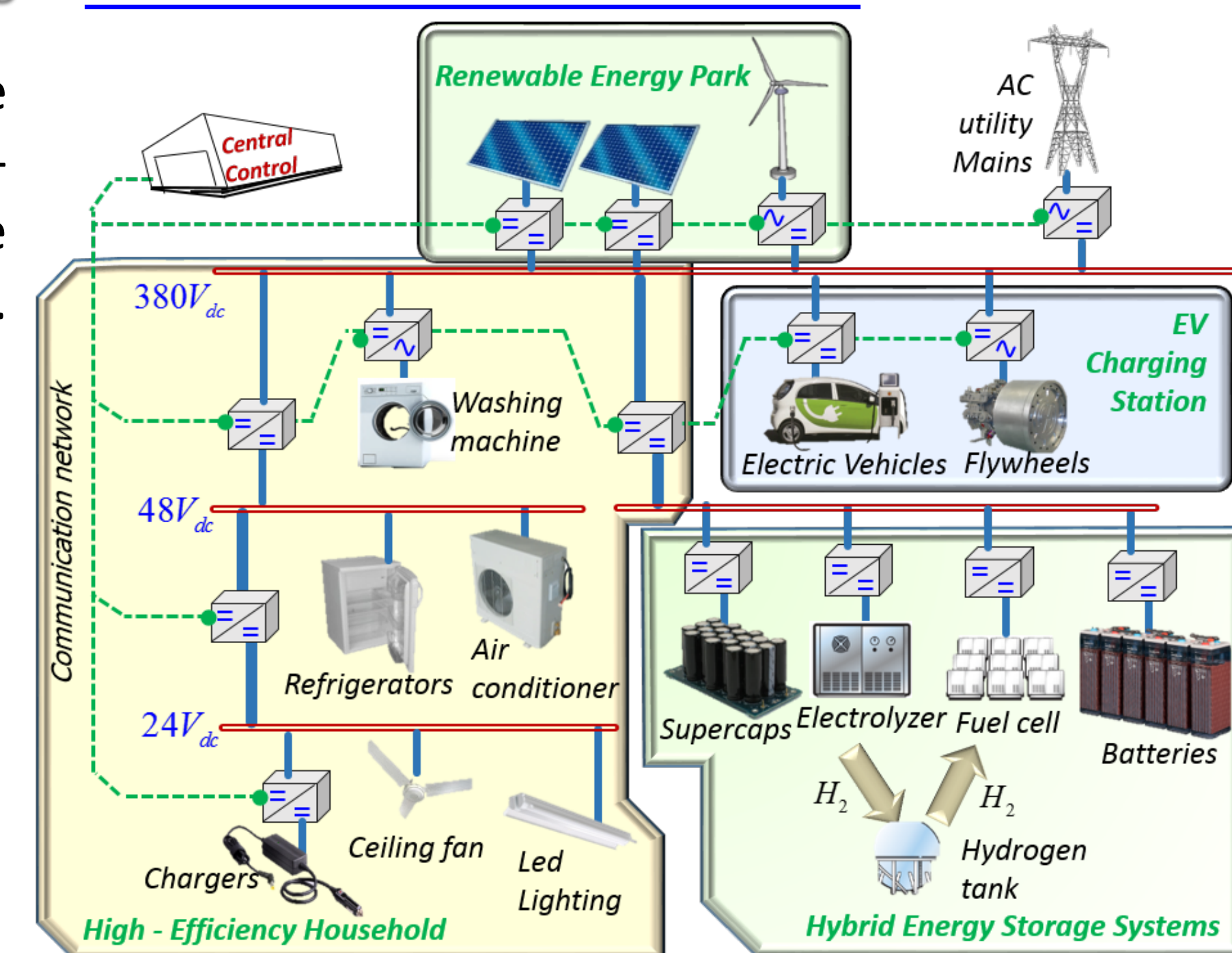


### 5. Future Residential LVDC Power Distribution Architectures – [www.residentialvdc.et.aau.dk](http://www.residentialvdc.et.aau.dk)

This project aims to propose an architecture able to cope with the on-going trends in electricity production and consumption at end-user level in a more reliable and efficient manner according to the Smart Grid Strategy.



- Project Partners: NEOGRID, KK-Electronics, Kamstrup A/S, INESCTEC (porto), CPES, AAU



The DC bus is the “dorsal spine” of any DC distribution system, therefore, its voltage stability and control should be considered as a critical issue.