

Objective

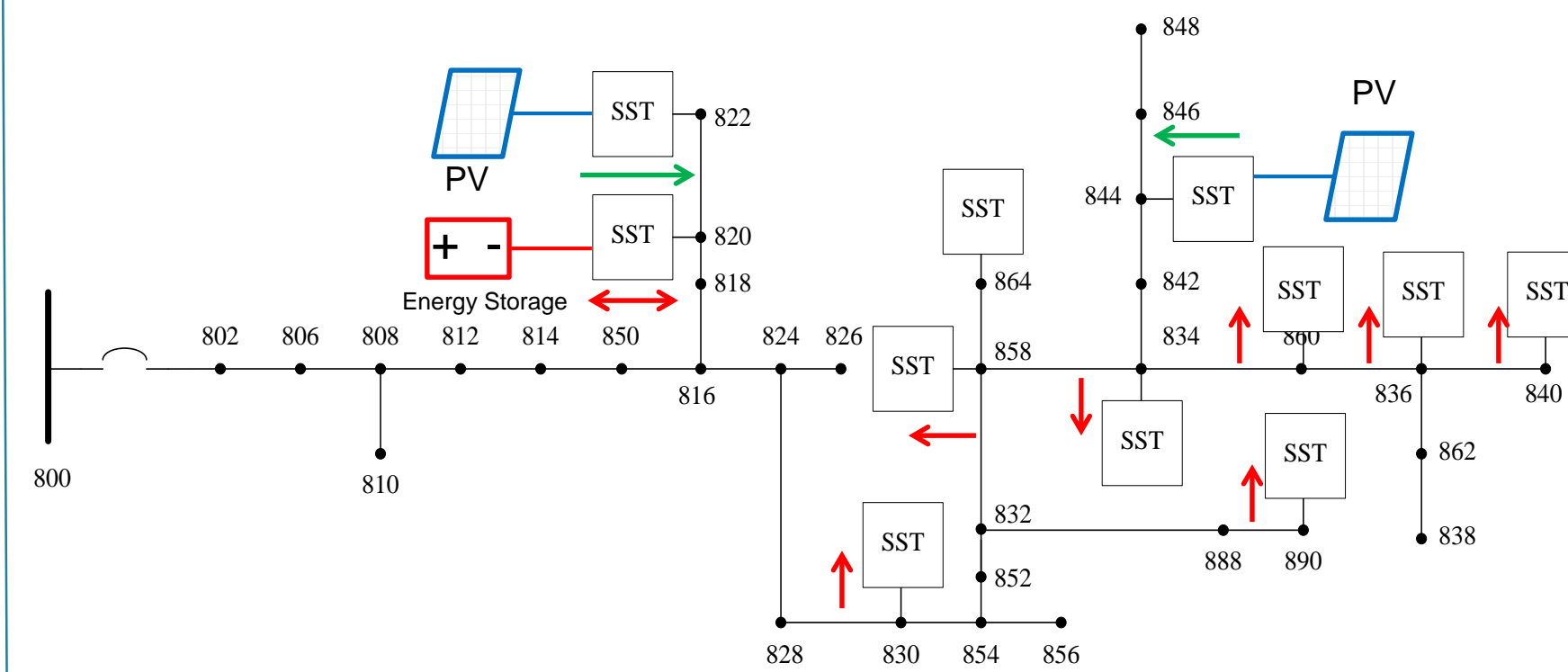
Comprehensive design and demonstration of the controls and interactions of the SST, loads, Distributed Energy Storage devices (DESD), Distributed Renewable Energy Resources (DRER) in LSSS using Hierarchical control strategy.

Background

- Years 7 and 8 focused on developing the functionality of the tested and its components.
- The following tasks were successfully demonstrated :
 - Validation of ability of SSTs to enable 100 % penetration
 - A control scheme to determine a master SST that would maintain a constant frequency voltage
- Year 9 focuses on the following tasks:
 - Autonomous power sharing between the SSTs in LSSS
 - Implementation of Hierarchical Control strategy in LSSS

Goals and Methodology

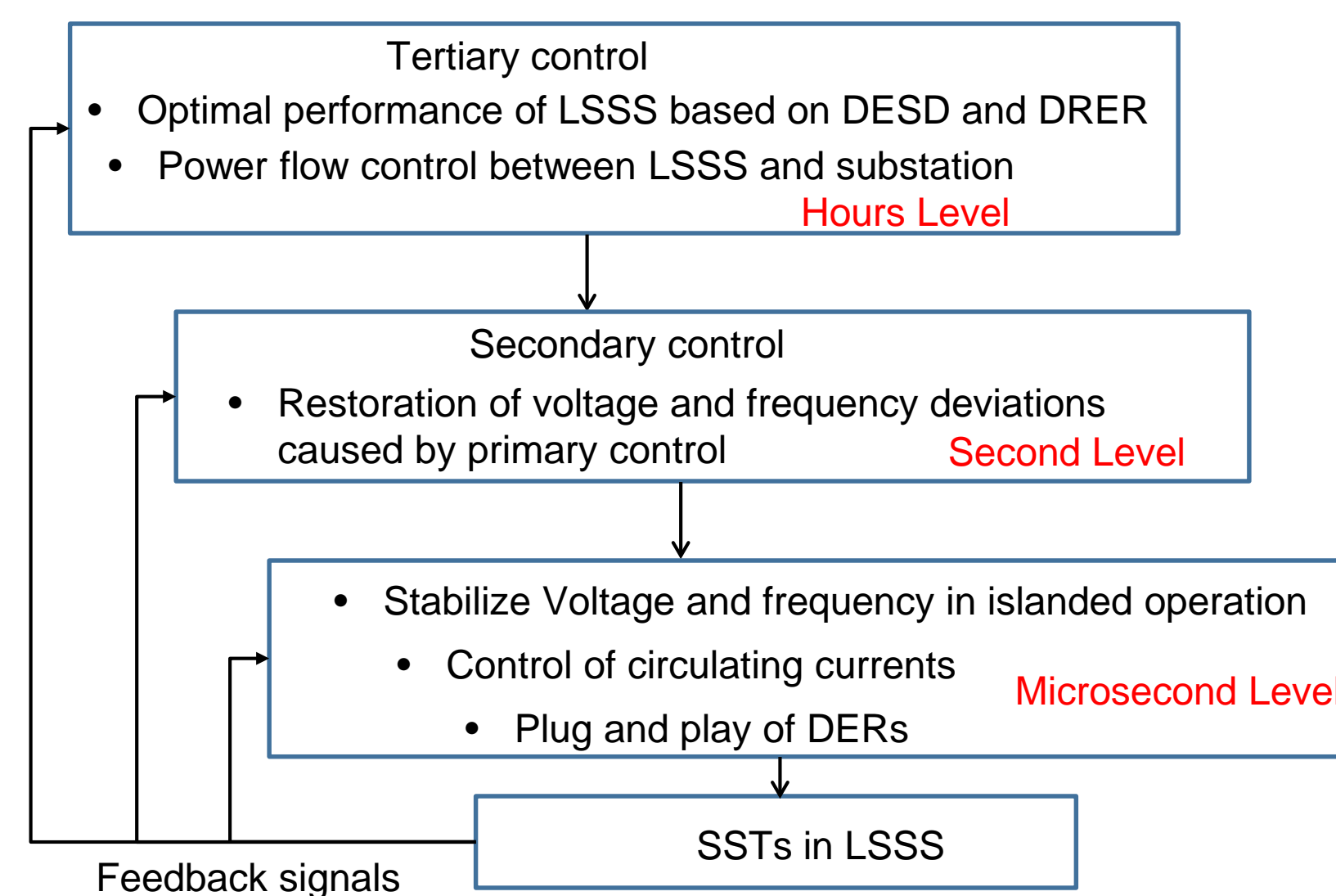
GOAL: Working of Autonomous LSSS in Islanded mode of operation



- : Nodes where power flow is into the grid
- : Nodes where power flow is out of the grid
- ↔ : Nodes where power flow is in and out of the grid

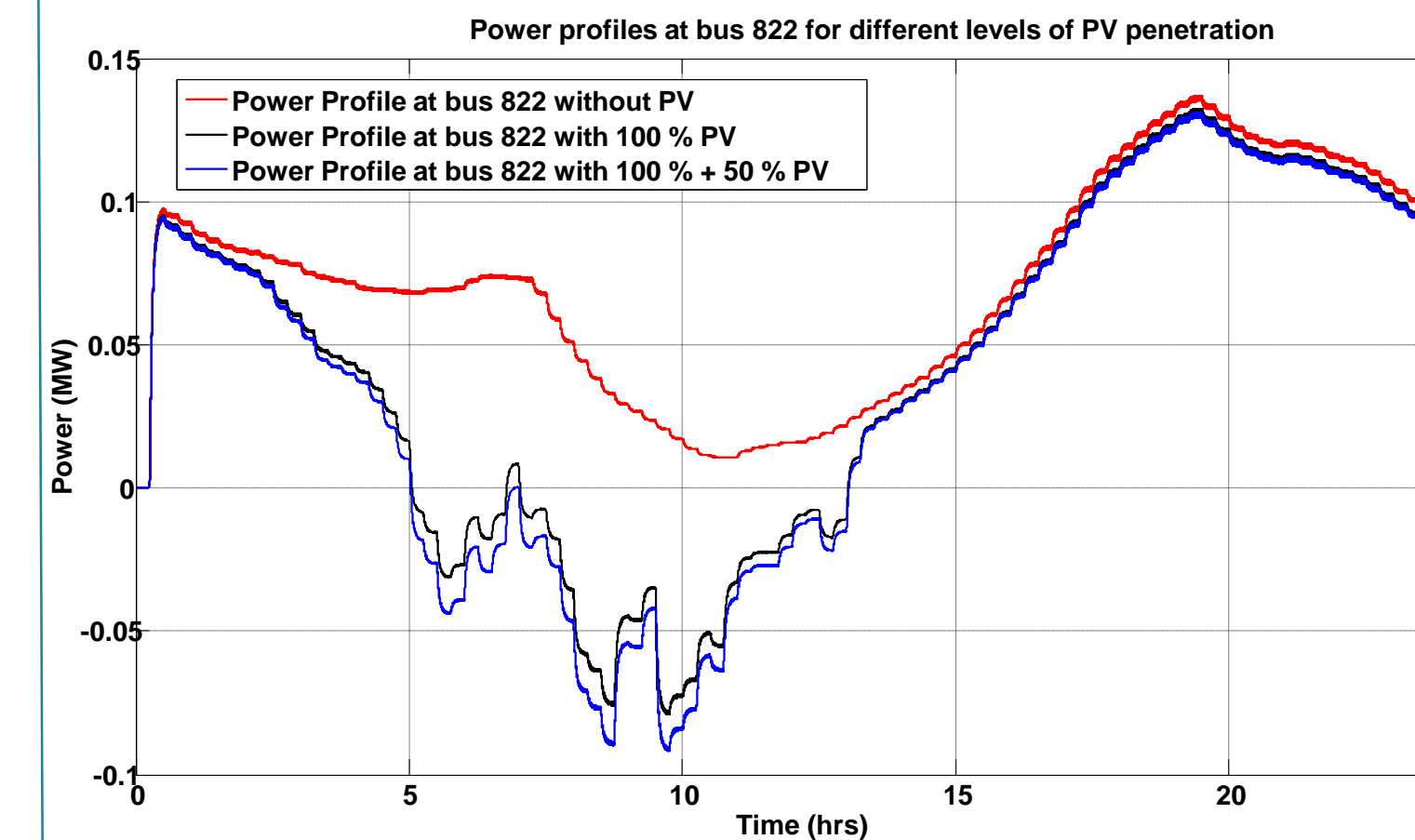
METHODOLOGY : Implementation of Hierarchical Control Structure in LSSS

To achieve the above stated goal the following hierarchical control structure is to be employed in LSSS.



Results

Seamless Bidirectional Capability of SST in Grid Connected LSSS



Technical Challenges

- Stability concerns pertaining to power and voltage unbalance in the system
- Development of more robust and advanced PSCAD models to achieve the autonomous operation of LSSS in islanded mode

Future Work and Impact

- Future directions may include developing more robust PSCAD SST models that could achieve the specified goal objective
- Implementation of Distributed frequency control
- A comprehensive testbed inclusive of all functionalities would be ready for Y10.

References

1. Phani Marthi, M.L.Crow, "Implementation of Droop Control in LSSS for Islanding Applications", NSF FREEDM Site Visit, 2016.
2. X. Yu, X. She, X. Ni and A. Q. Huang, "System Integration and Hierarchical Power Management Strategy for a Solid-State Transformer Interfaced Microgrid System," in *IEEE Transactions on Power Electronics*, vol. 29, no. 8, pp. 4414-4425, Aug. 2014.
3. FREEDM Systems Center Y8 Volume 1 Annual Report
4. FREEDM Systems Center Y9 Volume 1 Annual Report
5. X. Yu, F. Wang and A. Q. Huang, "Power management strategy for plug and play DC microgrid," *2012 3rd IEEE PES Innovative Smart Grid Technologies Europe (ISGT Europe)*, Berlin, 2012, pp. 1-7.

Partners

