



Vaasan yliopisto
UNIVERSITY OF VAASA



Österbottens förbund
Pohjanmaan liitto

Regional Council
of Ostrobothnia

SESP

WP2

Task 2.4 Study about microgrid control

Jagdish Kumar

Research objectives

- To design a microgrid central controller (MGCC) for harbour area smart grid
- MGCC should balance power inside harbour microgrid by charging and discharging the battery energy storage
- MGCC should enable islanding detection and resynchronise with grid
- To validate the performance of MGCC with hardware-in-loop (HIL) test

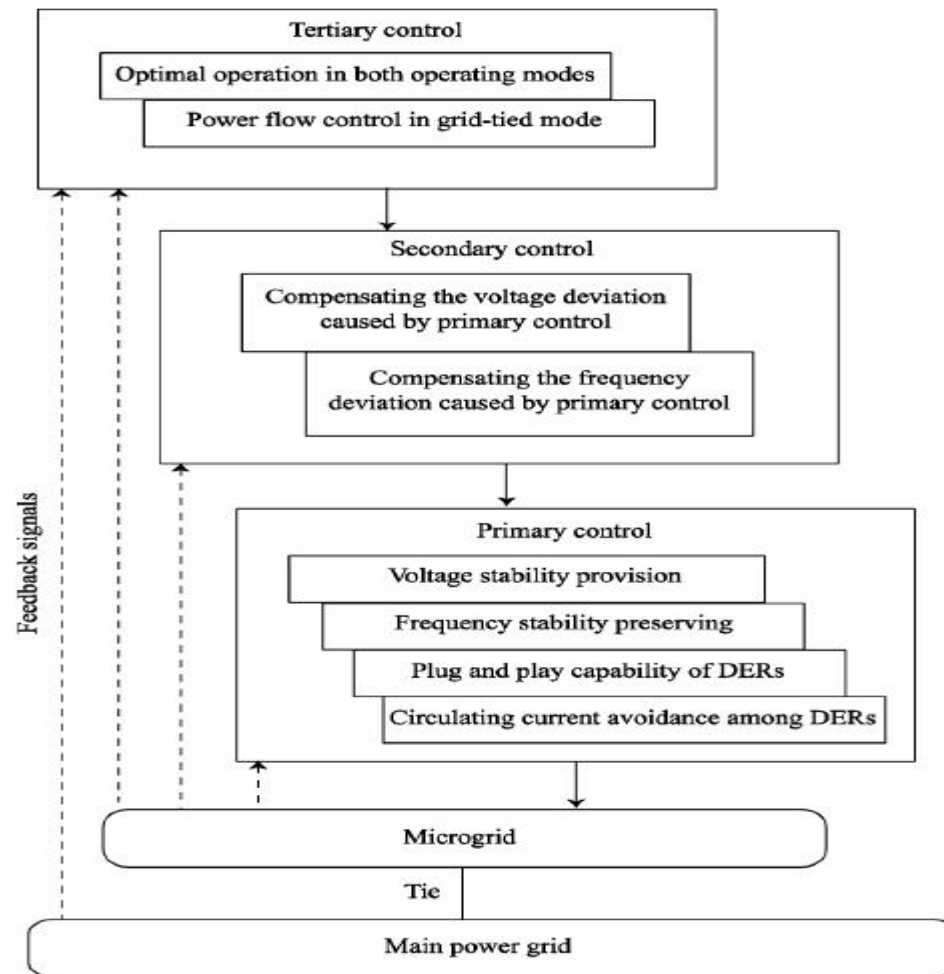


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 - ∨ Hierarchical control levels of a microgrid
 - ∨ Energy management control architecture
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- Battery energy storage connected with grid and load
- Results
- Conclusion and future work

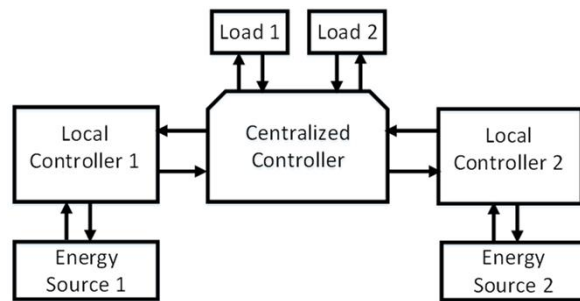


Hierarchical control levels of a microgrid Literature review- (1/2)

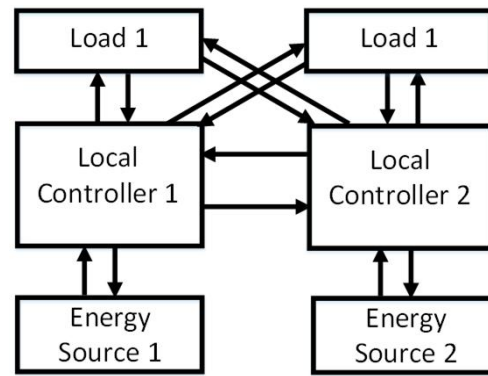


A. Bidram and A. Davoudi, "Hierarchical structure of microgrid control system," *IEEE Trans. Smart Grid*, vol. 3, no. 4, pp. 1963–1976, 2012

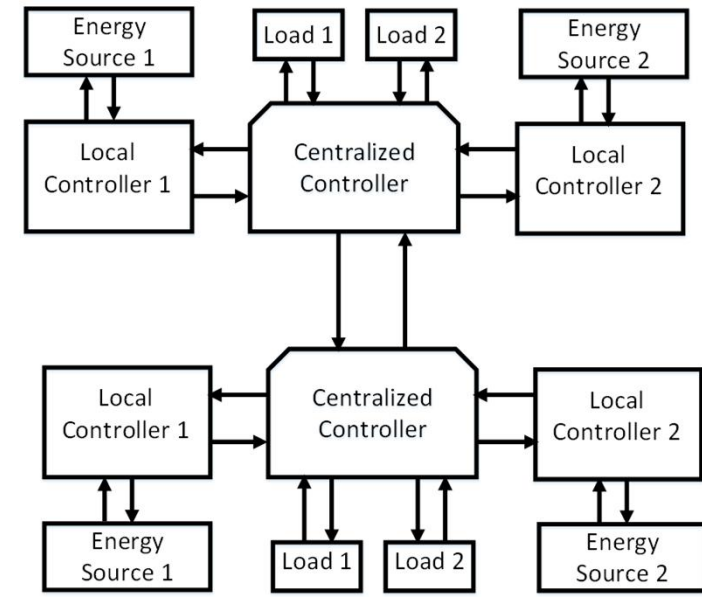
Energy management control architecture- Literature review (2/2)



(a) Centralised



(b) Distributed



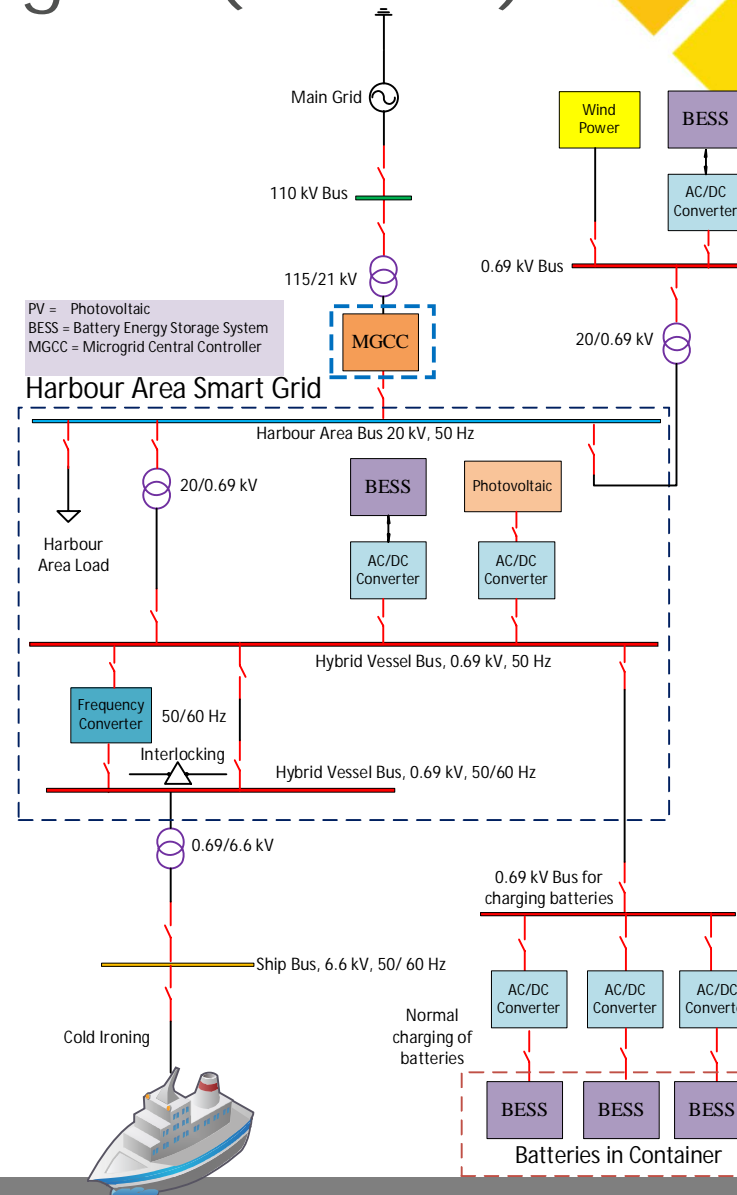
(a) Hybrid

Source: L. Olatomiwa, S. Mekhilef, M. S. Ismail, and M. Moghavvemi, "Energy management strategies in hybrid renewable energy systems: A review," *Renew. Sustain. Energy Rev.*, vol. 62, pp. 821–835, Sep. 2016

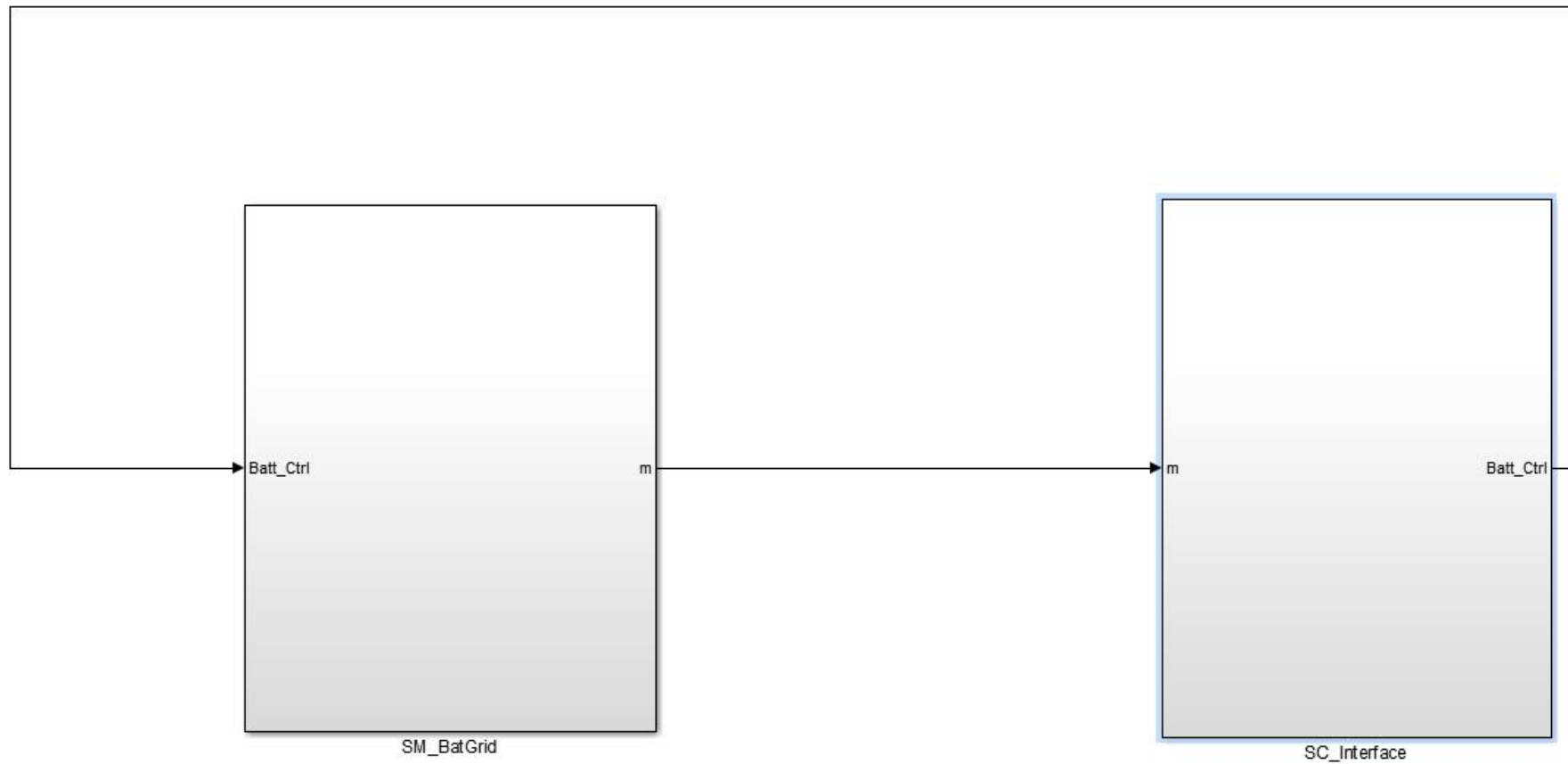
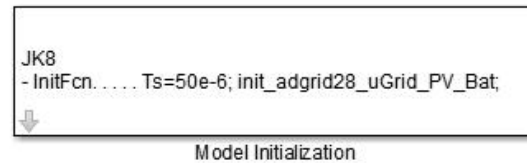
Microgrid central controller for harbour area smart grid (HASG)

The following are the objectives of microgrid central controller (MGCC):

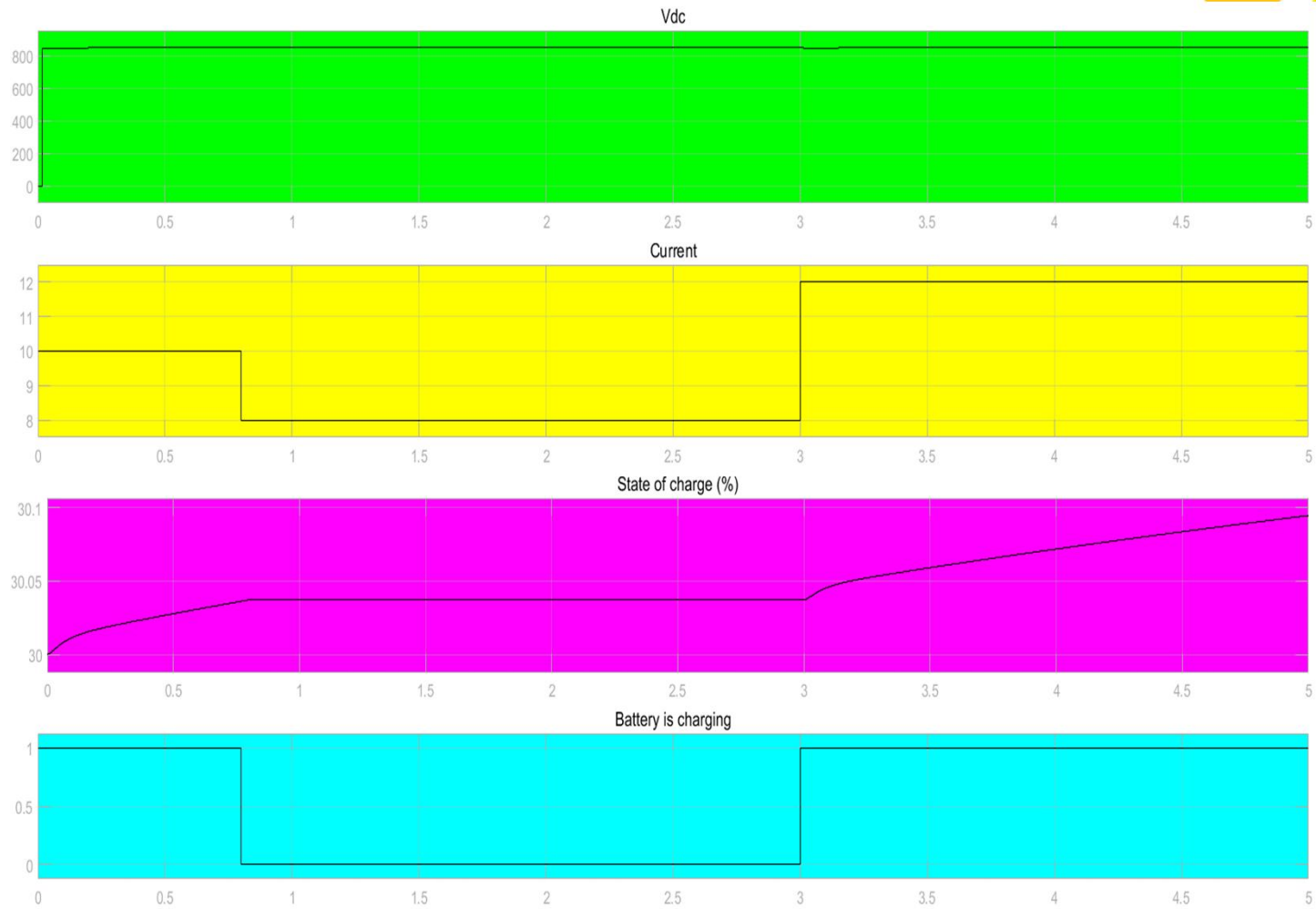
- Voltage and frequency regulation
- Controlling the power flow
- Load demand sharing and DER coordination
- Resynchronization of the microgrid with the main grid



Battery energy storage connected with grid and load



Results



Conclusion and future work

- Microgrid grid central controller (MGCC) works as a secondary controller to coordinate among multiple energy resources
- Tertiary control is beyond the scope of the research objective
- The functionalities of MGCC for islanding detection and resynchronisation with grid will be considered for future work
- In future work, hardware-in-loop test will be performed to validate the performance of MGCC

Thank you!!

