Allocation of battery energy storage systems (BESS) to mitigate FIDVR in the Con Edison Transmission Systems

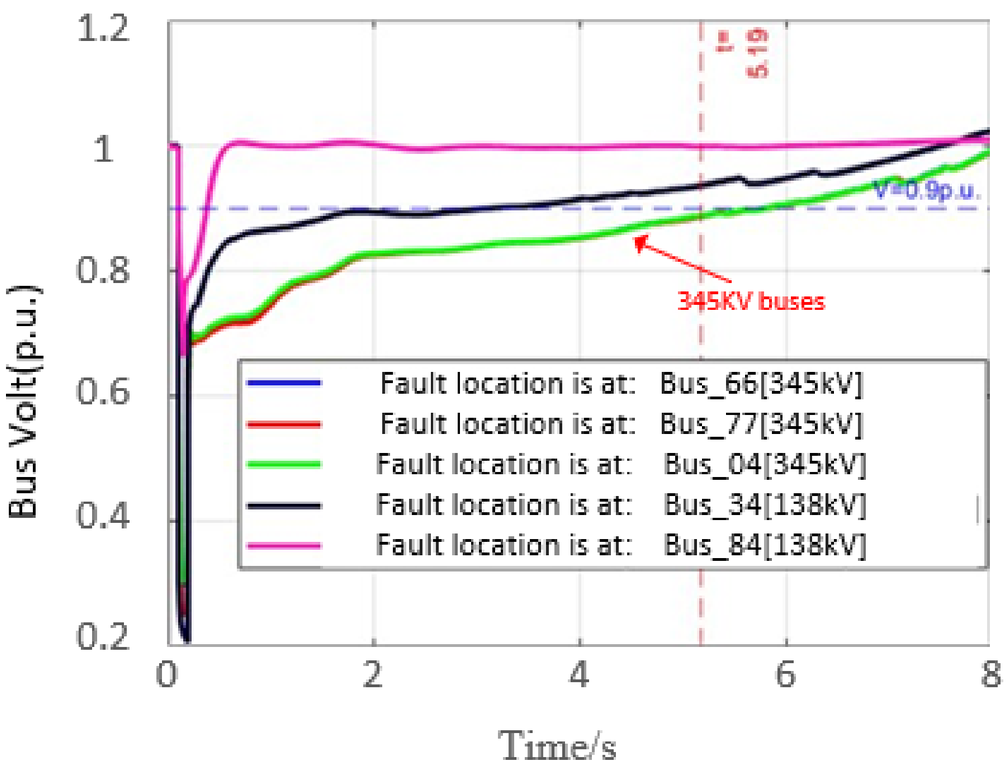
ChangChen[1], Resk E Uosef[3], Matthew Koenig[3], Constantine Spanos[3], Yilu Liu [1,2]
[1] The University of Tennessee, Knoxville [2] Oak Ridge National Laboratory
[3] Con Edison Company of NY

Background

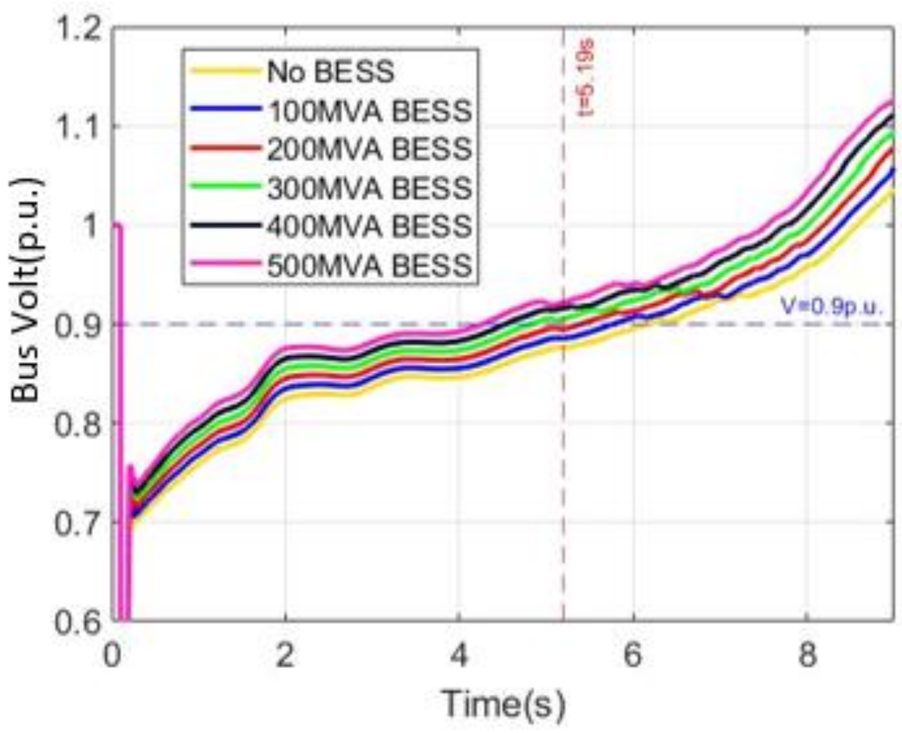
- Fault-Induced Delayed Voltage Recovery (FIDVR) is an unexpected time delay in the recovery of voltage to its nominal value following the normal clearing of a fault. Typically, the delay can last seconds to tens of seconds, which has attracted attention as a significant issue in power systems.
- Inverter-based renewables such as battery energy storage systems (BESS) show the potential to provide voltage support during FIDVR events.

Contributions

- This study designs a basic FIDVR controller and compare the control effects under different BESS locations for the Con Edison of New York PSS/e model.
- Simulations are carried out with different locations of 3-phase short circuit. The case with the largest voltage drop is considered as the base case for the BESS allocation simulations.
- calculated the voltage improvement with the help of BESS being installed at different locations and with different sizes.



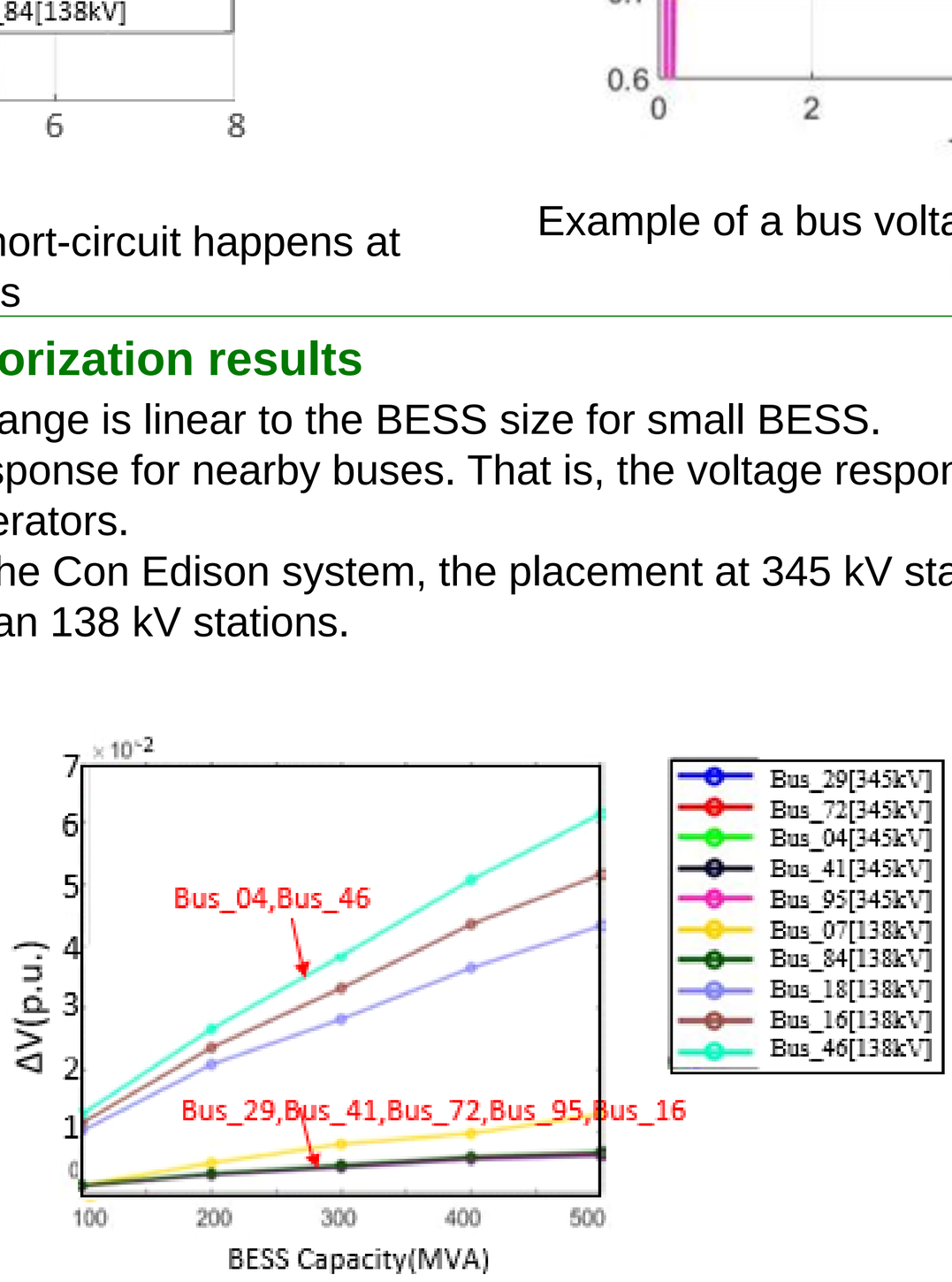
Example of a bus voltage when short-circuit happens at different buses



Example of a bus voltage when different sizes BESS installed

Anomaly detection and categorization results

- it is observed that the voltage change is linear to the BESS size for small BESS.
- Generators affect the voltage response for nearby buses. That is, the voltage response at buses can be supported and enlarged by the nearby generators.
- Given the local configuration of the Con Edison system, the placement at 345 kV stations appears to provide more leverage for BESS responses than 138 kV stations.



Relationship between voltage change ΔV and the BESS capacity when BESS is installed at a location