

Study Committee B3 Substations and Electrical Installations Paper ID_11001

PILOT PROJECT GRID SCALE BESS IN EGAT SYSTEM

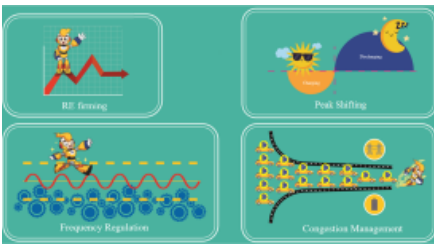
Suriya PRUNGKHUNMUANG, Jaruru PIPHATMONGKOLPORN, Wasin APHICHATO
Electricity Generating Authority of Thailand (EGAT)

RES situation in Thailand



- Ministry of Energy aims to increase Renewable Energy to 20% of Thailand total generation capacity.
- High amount of wind and solar power production penetrate to the region of Chai Badan substation and Bamnet Nangong substation.

BESS as a solution



RE Firming (as a primary function)

Reduces RE's intermittent output power during high power demand.

Peak Shifting (as a secondary function)

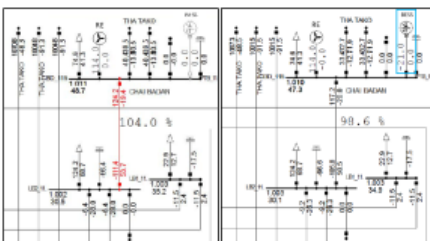
Support the grid during night peak time by release residual energy from RE firming.

Frequency Regulation

Inject residual power with fast response to the grid network during emergency situation.

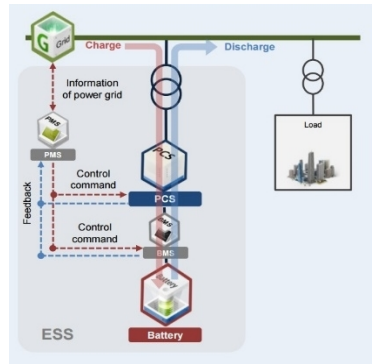
Congestion Management

Absorb some RE power and solve the overload in the transmission line between Chai Badan and Lop Buri 2 (LB2) substation.



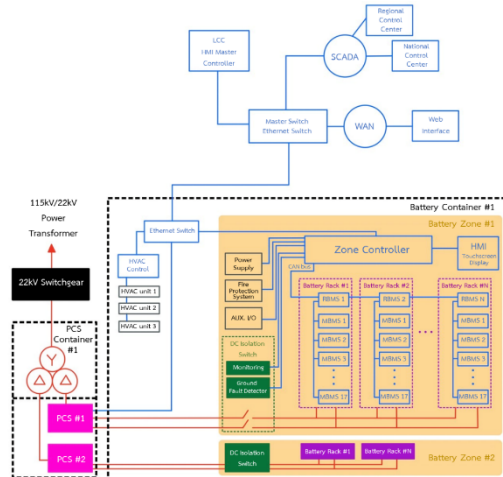
Single Line Diagram

- The system round-trip efficiency (RTE) is guaranteed at 84.45% for both substations.



Control and Monitoring

- Real time
- Hierarchies: battery cell, module, rack, zone, container, and whole BESS system
- The results from all level monitoring are displayed in the Human Machine Interface (HMI).



Study Committee B3

Substations and Electrical Installations

Paper ID_11001

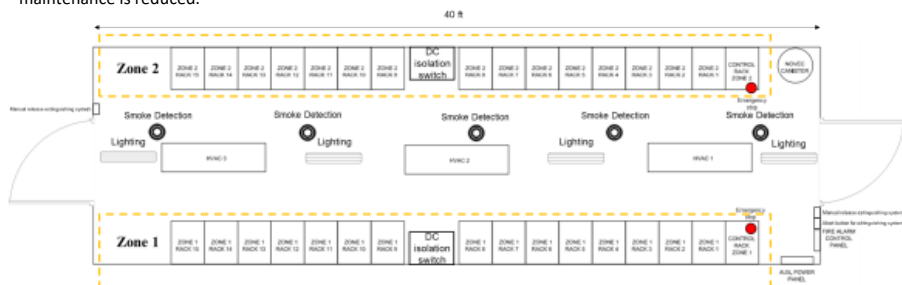
PILOT PROJECT GRID SCALE BESS IN EGAT SYSTEM

continued

BESS Components

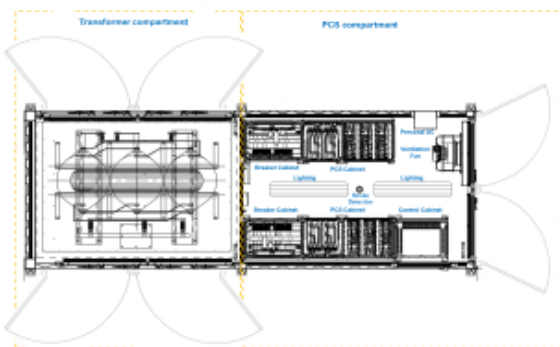
Battery Container

- 40 ft standard sea freight container
- Divided into two parallel zones, for limit damage from unpredictable situation.
- HVAC for control ambient temperature inside container for an operation of battery, 23 ± 3 °C
- Smoke detectors and Air Sampling Device (ASD) for early detecting fire hazard.
- NOVEC as a suppression agent for reducing the heat energy from any thermal event
- Modularizing the battery container into zone, rack and module benefits that the faulty element can be selectively cut from the system. The remaining elements are able to continue operating with decreased capacity, and the complexity in maintenance is reduced.



PCS and Transformer

- Convert electric power between DC and AC
- The voltage on the AC side : $525 V_{ac}$
- The minimum voltage on DC side: $780 V_{dc}$
- IGBT switch PWM inverter
- Protection including overvoltage, undervoltage, overcurrent and high temperature.
- Three main purposes of transformer: isolating the BESS from the power grid, limiting fault damage, and stepping up/down voltage
- Delta-wye connection
- Dry-type transformer with force air cooling method



Switchgear Container

- Connects 22 kV transformer to a step-up grid transformer

Safety Primary Concerns

- 3-meter separation distance between adjacent containers for safety in operation and maintenance from effect of radiation heat transfer.
- 2-meter elevation from the ground because the area is prone to flooding.
- Fire protection system conforms to NFPA 855 standard.
- Water sprinkle nozzle inside container connected to Storz connection for connection of truck water hose from the first responders is provided in each container.
- Door limit switches protect electrical hazard. Opening these doors during operation will result in tripping the system out for safety purpose.