

# SIMULATED ISLANDING TEST FOR A PRACTICAL UTILITY-SCALE MICROGRID

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M. H. Bazrafshan, A. Majzoobi and  
A. Khodaei  
University of Denver  
USA

N. Gurung, H. Chen, L. Zhang, M.  
Lelic, and A. V. Guerra  
ComEd  
USA

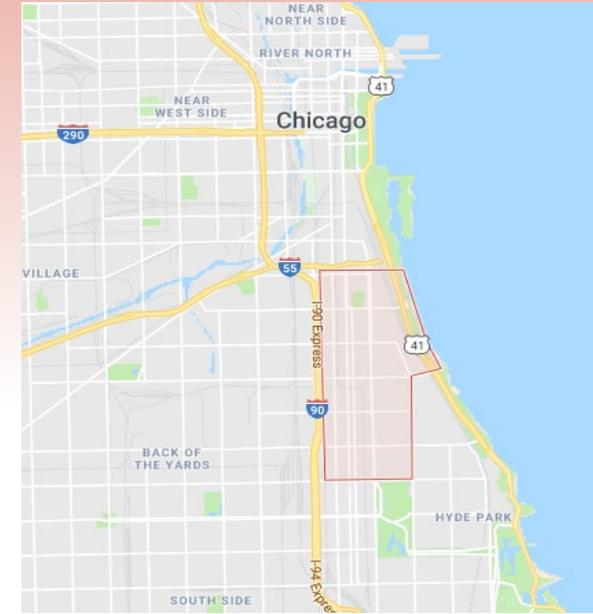
Presented by: Niroj Gurung  
ComEd  
USA

# Outline

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# Project Overview

- DOE-SHINES Microgrid-Integrated Solar-Storage Technology (MISST) project
- Deploys high-power solar PV and a high-power BESS in the Bronzeville Community Microgrid (BCM), South side of Chicago, IL
- Proposed MISST addresses availability and variability issues inherent in the solar photovoltaic (PV) technology
- \$4 Million award from DoE, plus >\$4M cost share from ComEd
- Project duration: 2016-2020



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➤ Commonwealth Edison (ComEd)

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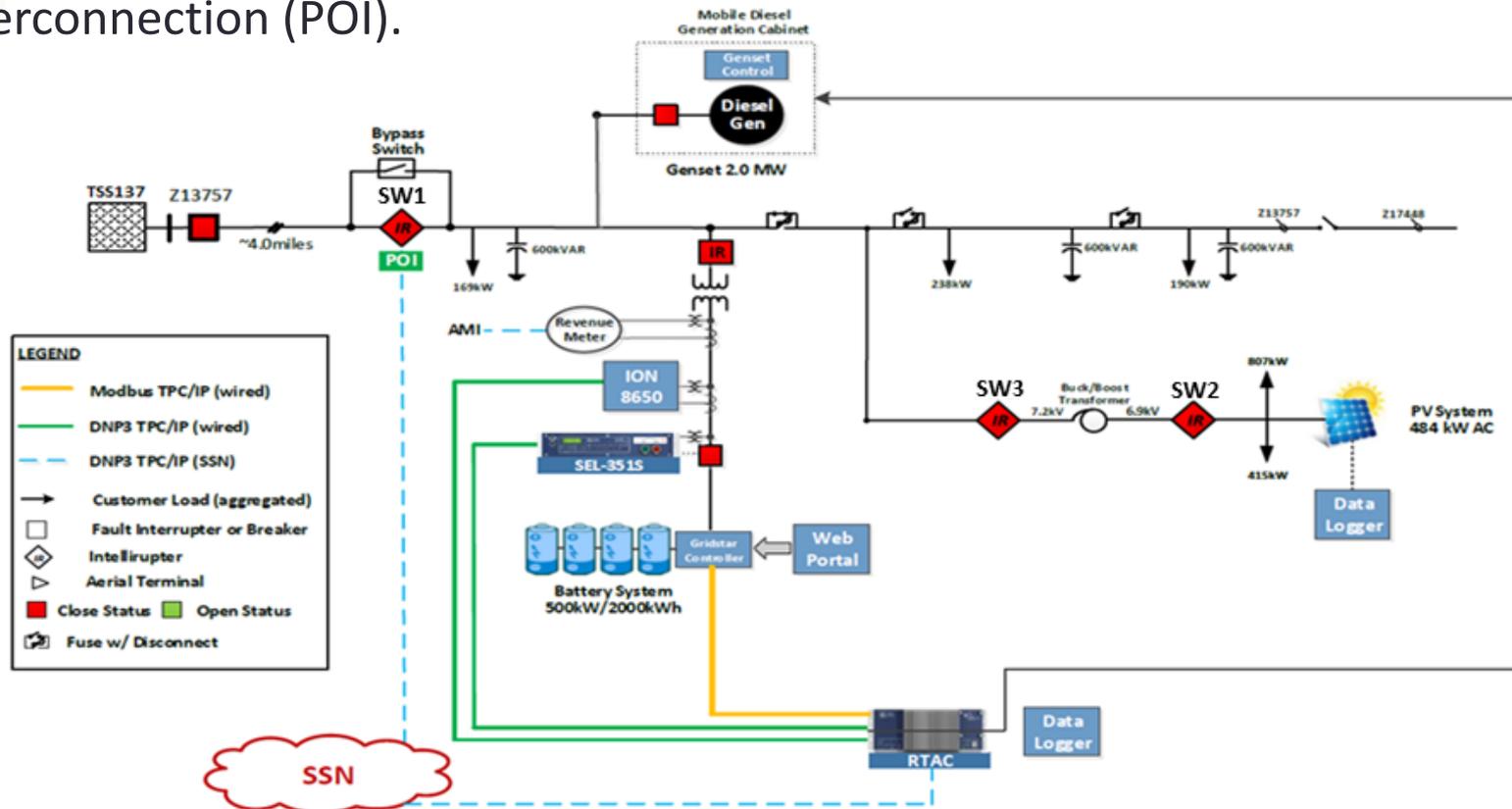
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# Microgrid Islanding Test Setup

- 587 kW DC/484 kW AC, PV system; an aggregate of 17 rooftop PV
- The BESS is a utility-scale front-of-meter 500 kW DC/600 kVA AC system.
- A mobile 2 MW diesel generator is connected to BCM to offset the major portion of the load
- BESS is actively managed to maintain the power exchange through the point of interconnection (POI).



# Test Objectives

- To ensure that POI power flow can be maintained close to zero to emulate planned Islanding by controlling BESS and PV with support from mobile diesel generator
- To ensure the zero power flow at POI can be maintained for sufficiently long time at different possible power factor at POI

Note: The term simulated emphasizes the fact that the microgrid is not electrically disconnected.

# Unity Power Factor Load

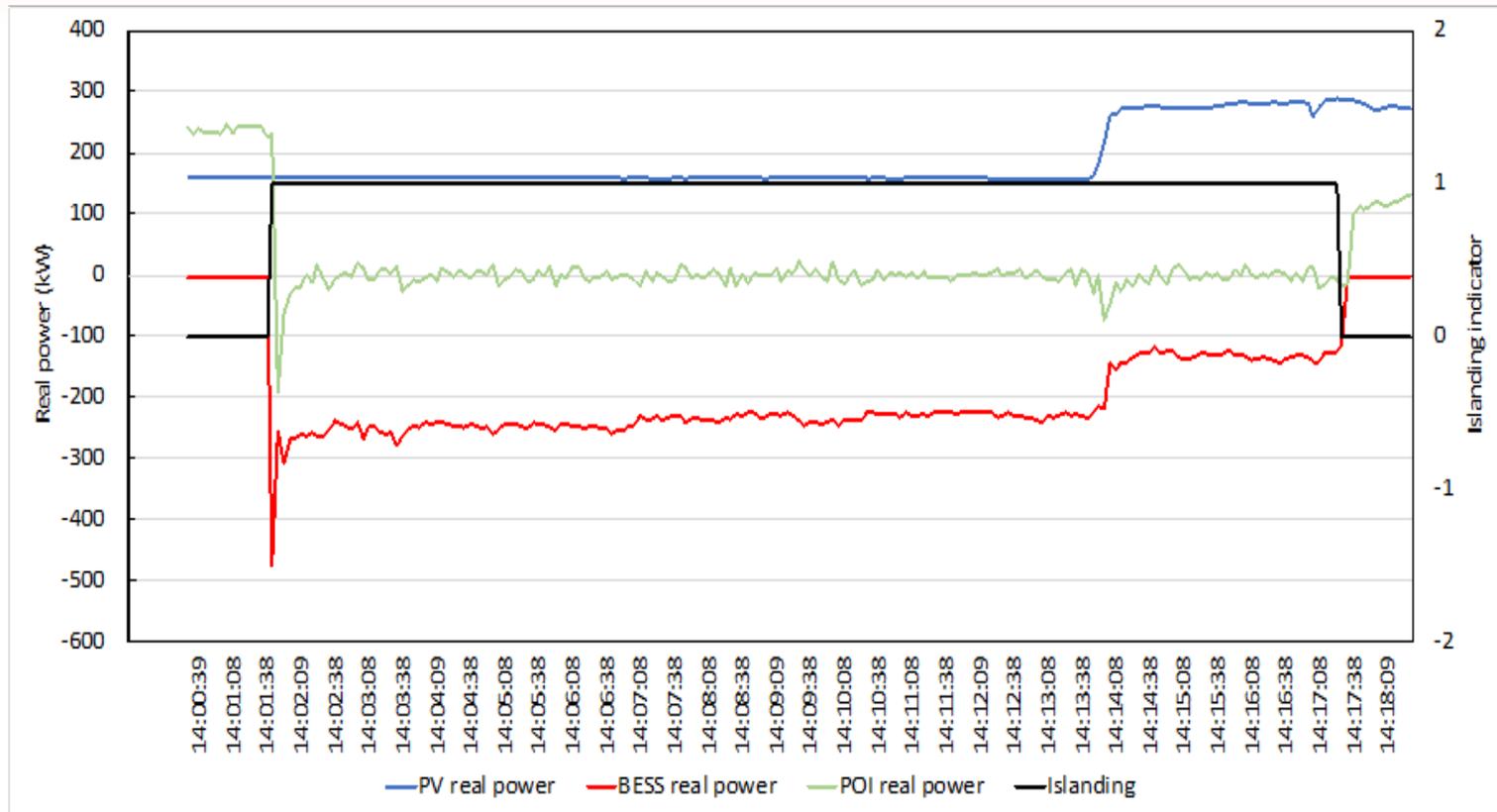
- The diesel generator is used to offset most of the load.

## Initial Condition:

- PV real power  $\sim 150$  kW
- POI real power  $\sim 250$  kW
- BESS real power  $\sim 0$  kW

## Islanding Enabled:

- PV real power  $\sim 150$  kW
- POI real power  $\sim 0$  kW
- BESS real power  $\sim 250$  kW



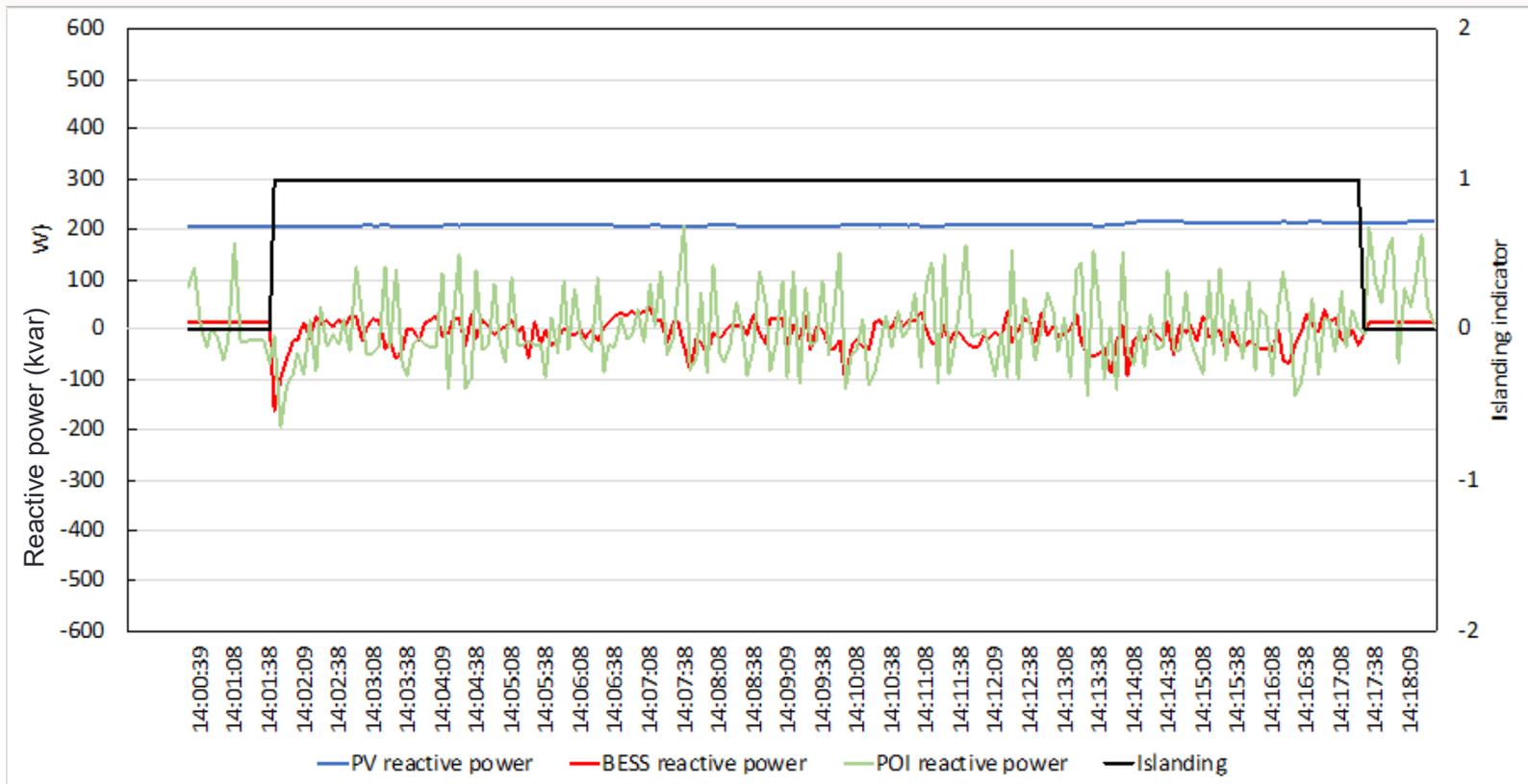
# Unity Power Factor Load (cont'd)

## Initial Condition:

- PV reactive power  $\sim 200$  kvar
- POI reactive power  $\sim 0$  kvar
- BESS reactive power  $\sim 0$  kvar

## Islanding Enabled:

- PV reactive power  $\sim 200$  kvar
- POI reactive power  $\sim 0$  kvar
- BESS reactive power  $\sim 0$  kvar



# Lagging Power Factor Load

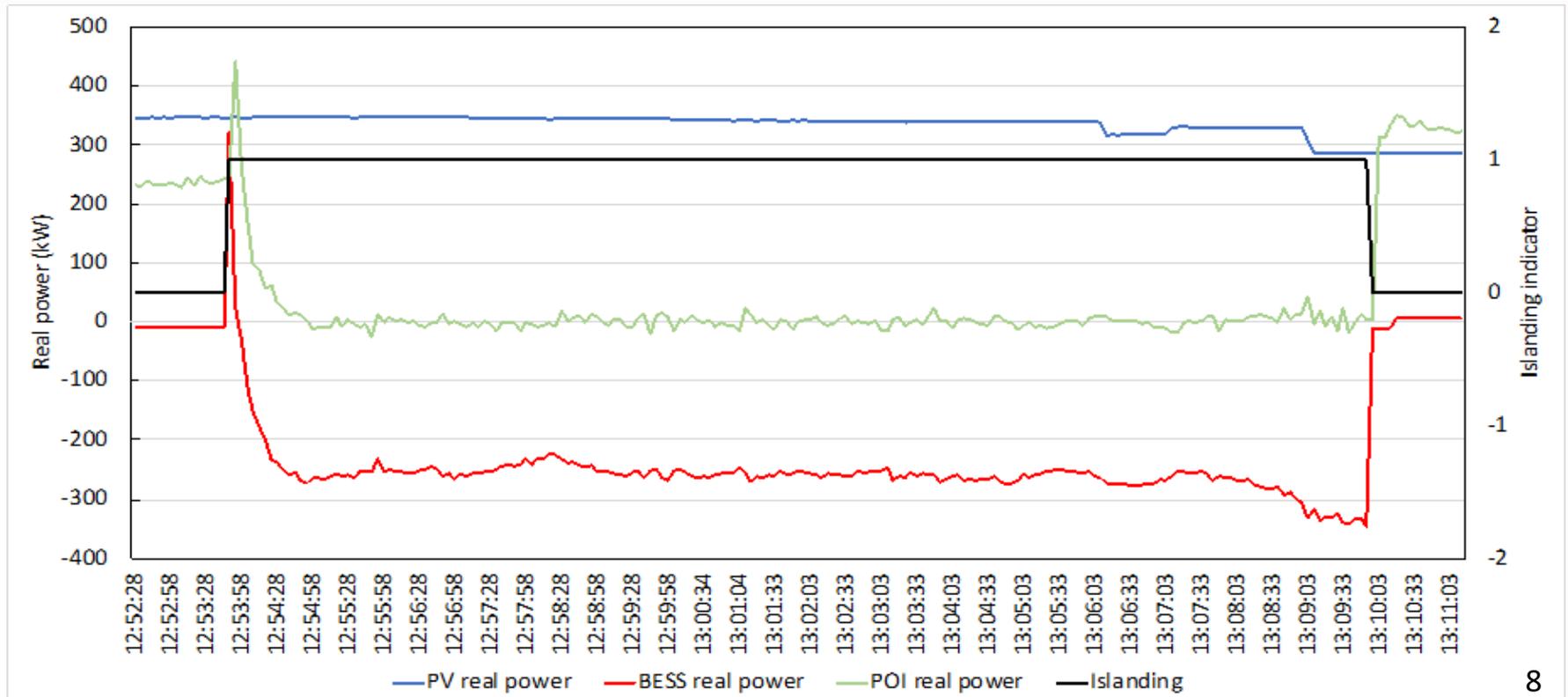
- The diesel generator is used to offset most of the load.

Initial Condition:

- PV real power  $\sim 350$  kW
- POI real power  $\sim 230$  kW
- BESS real power  $\sim 0$  kW

Islanding Enabled:

- PV real power  $\sim 350$  kW
- POI real power  $\sim 0$  kW
- BESS real power  $\sim 250$  kW



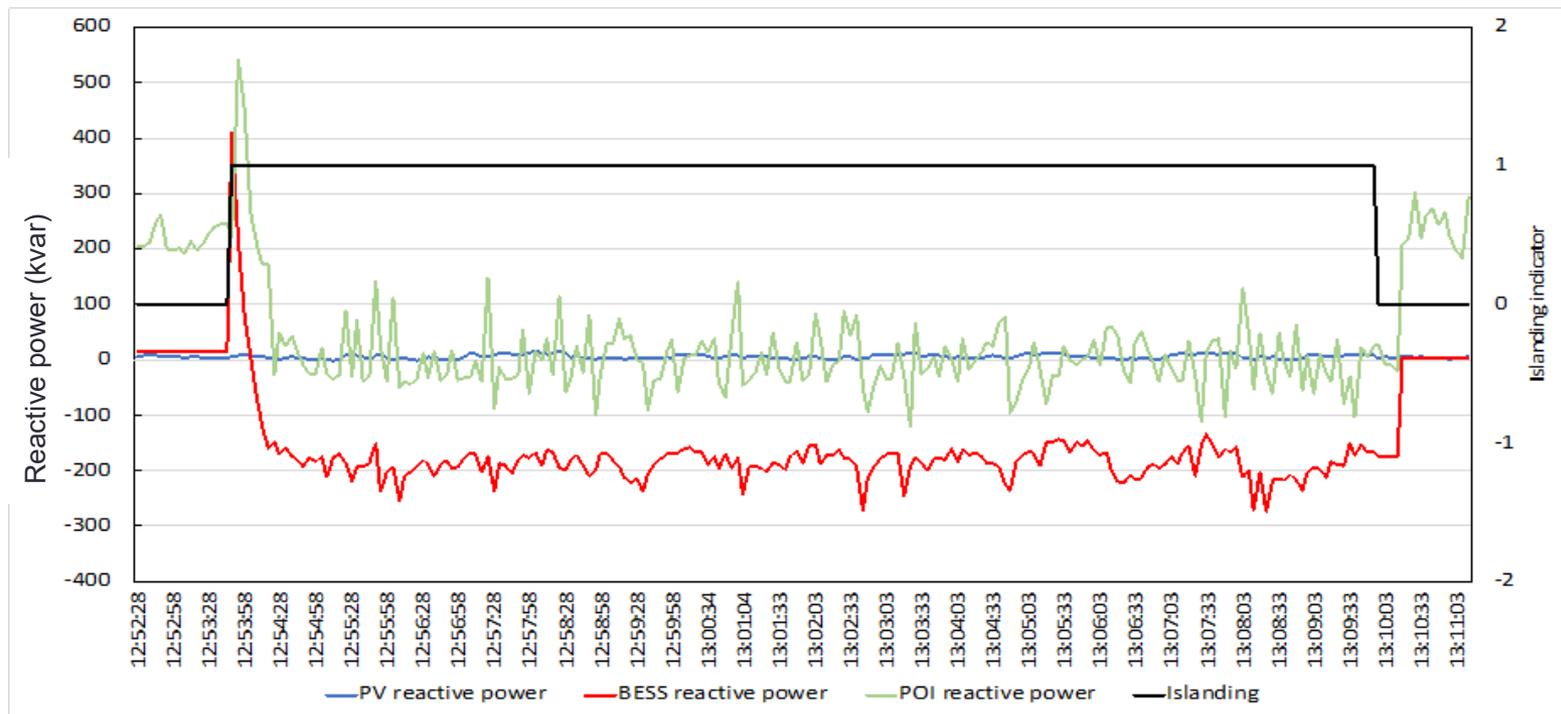
# Lagging PF Load (cont'd)

## Initial Condition:

- PV reactive power  $\sim 0$  kvar
- POI reactive power  $\sim 200$  kvar
- BESS reactive power  $\sim 0$  kvar

## Islanding Enabled:

- PV reactive power  $\sim 0$  kvar
- POI reactive power  $\sim 0$  kvar
- BESS reactive power  $\sim -200$  kvar



# Leading Power Factor Load

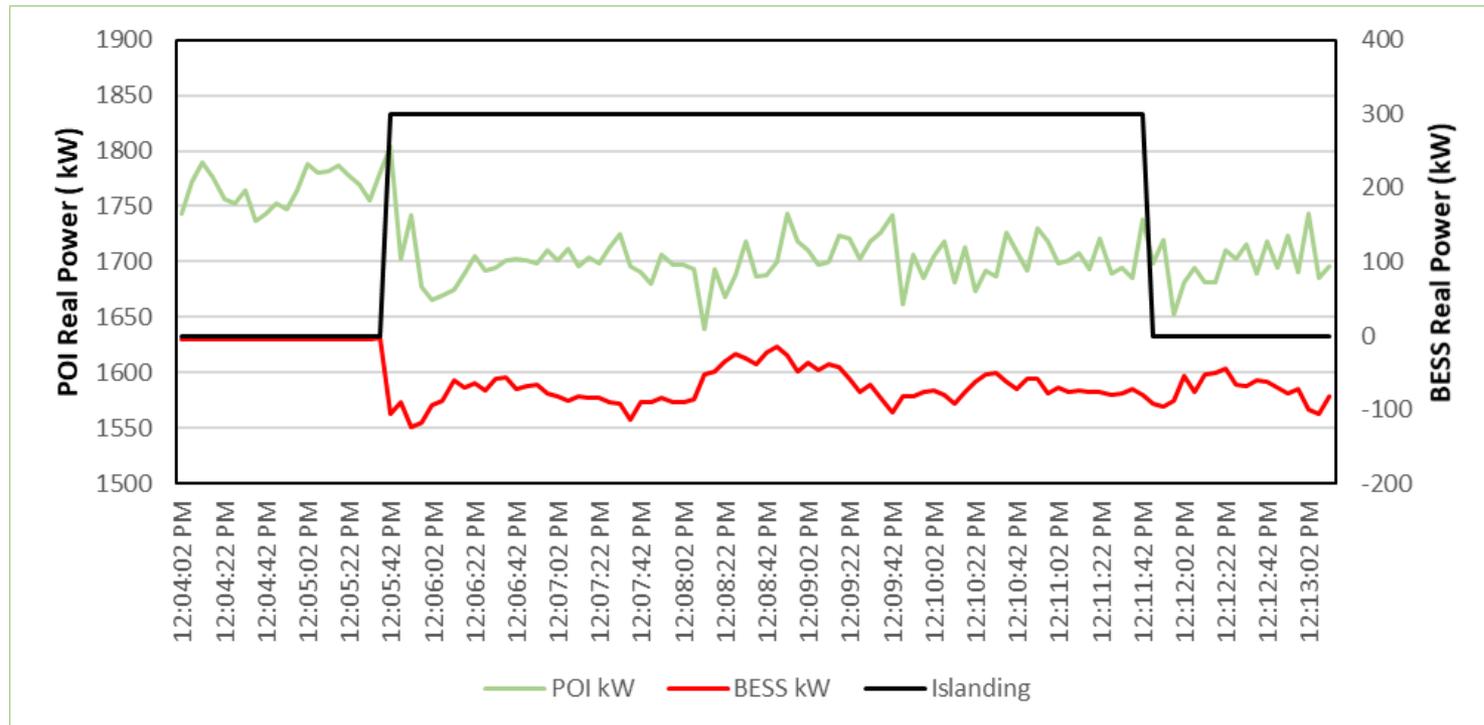
- The diesel generator is not used to offset the load
- BESS is controlled to maintain the constant offset value at POI

Initial Condition:

- POI real power  $\sim 1750$  kW
- BESS real power  $\sim 0$  kW

Islanding Enabled:

- POI real power  $\sim 1700$  kW
- BESS real power  $\sim -50$  kW



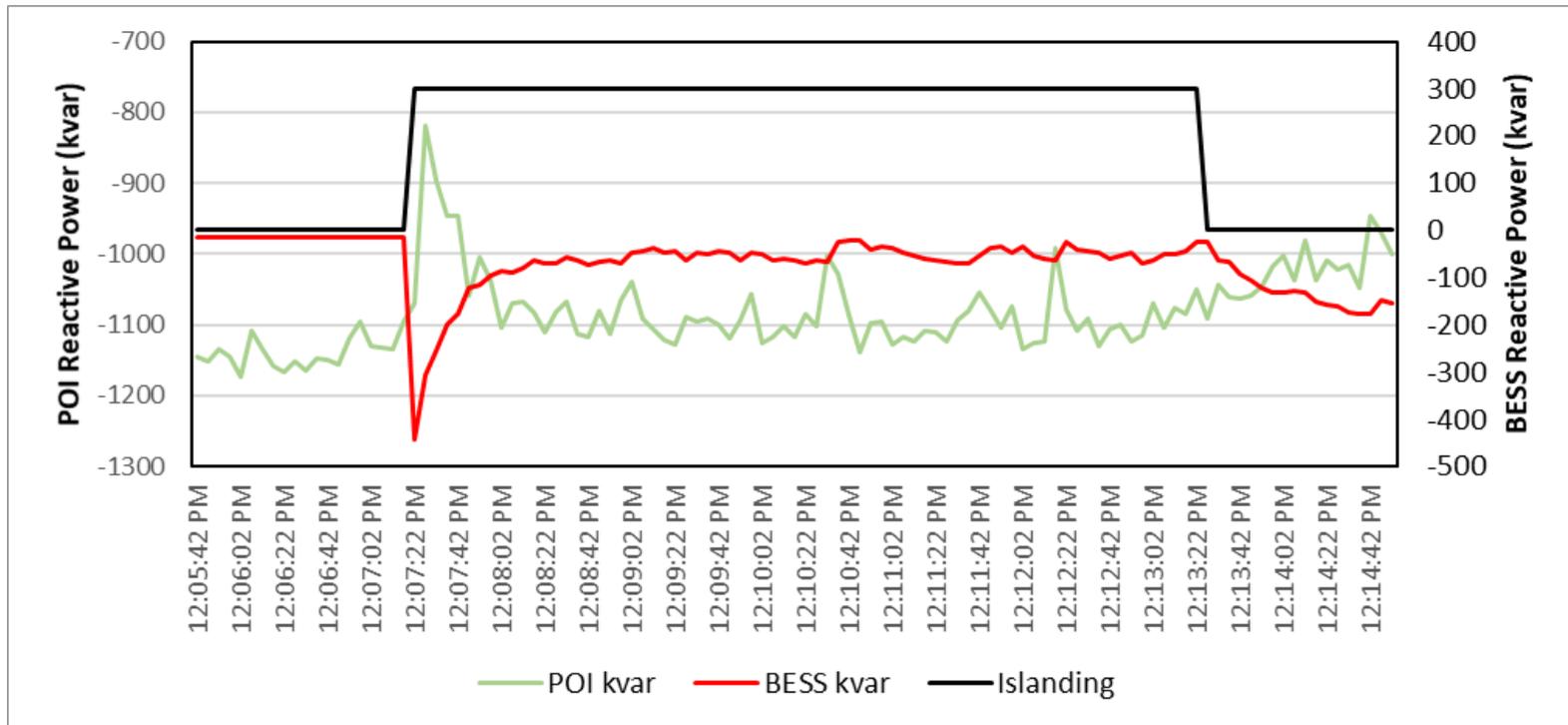
# Leading PF Load (cont'd)

Initial Condition:

- POI reactive power  $\sim$  -1150 kvar
- BESS reactive power  $\sim$  0 kvar

Islanding Enabled:

- POI reactive power  $\sim$  -1100 kvar
- BESS reactive power  $\sim$  -50 kvar



# Conclusion

- The results demonstrate the successful emulated islanding test on the newly-developed BCM of ComEd.
- POI power was maintained closer to zero by actively managing the power output of BESS; the test was performed at leading, lagging and unity power factor load at POI. PV and Diesel generator were utilized to offset the loads
- In the next stage of this project, a controllable diesel generator will be directly controlled to zero out POI flow and form an actual island by opening the POI breaker.

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*Thank you*

Niroj.Gurung@ComEd.com