



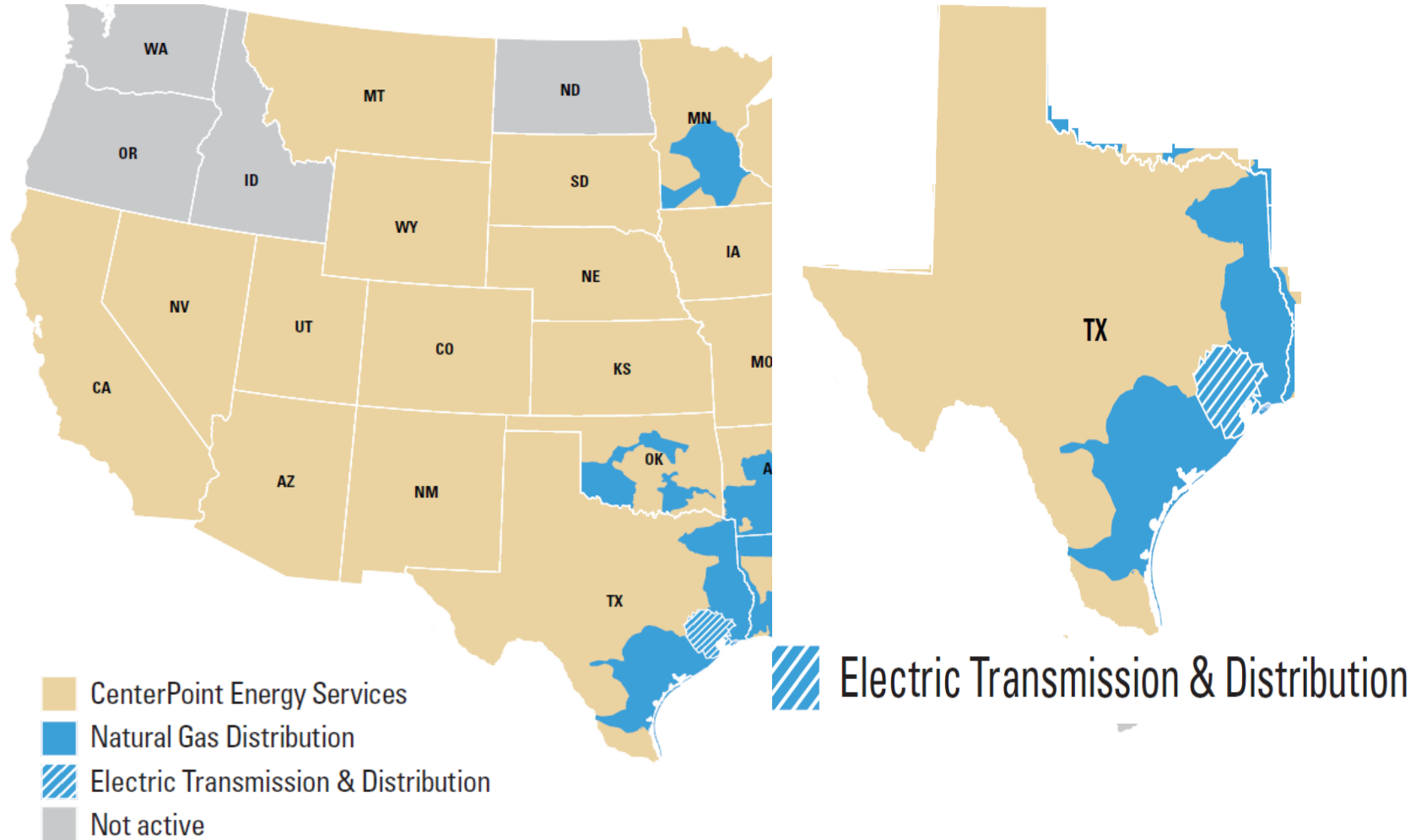
Reverse Power Application for DER Islanding Protection

Glenn Callaghan

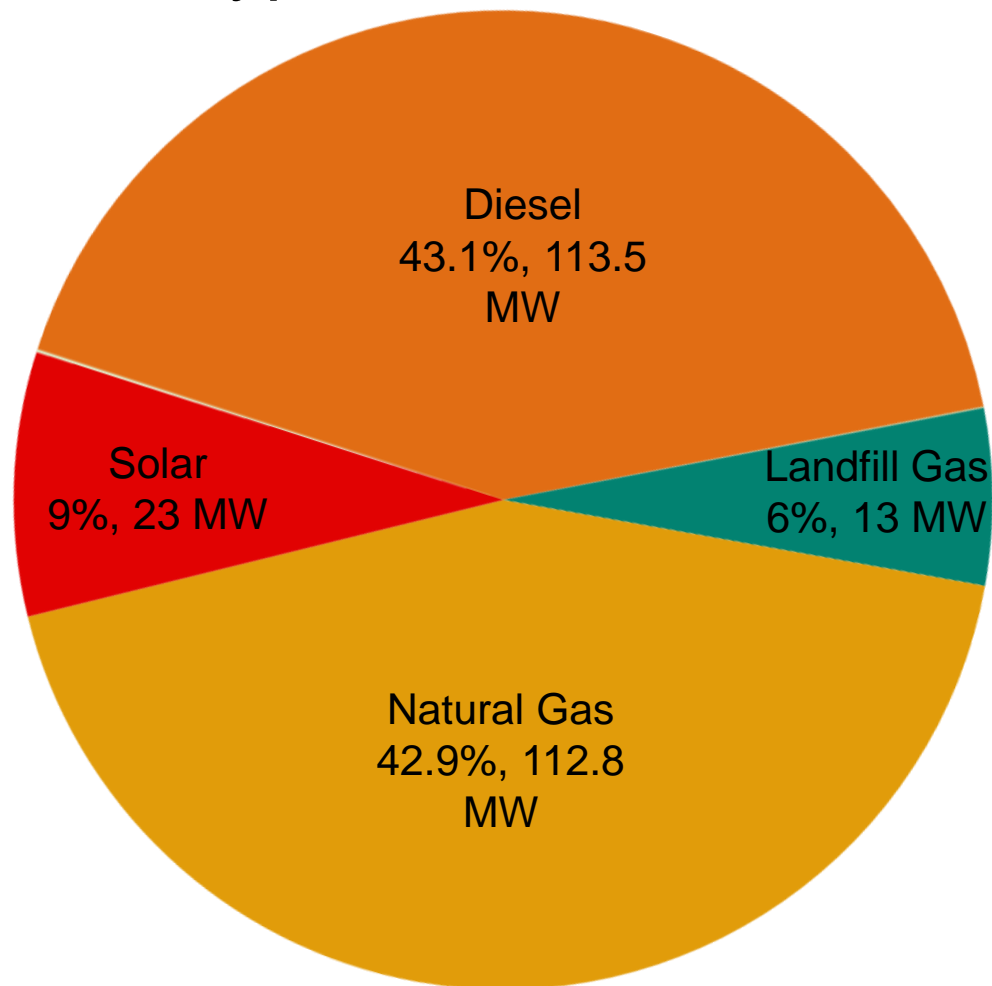
03/25/2019

Background

- 2,44
- 28,8
- 3,68
- >18

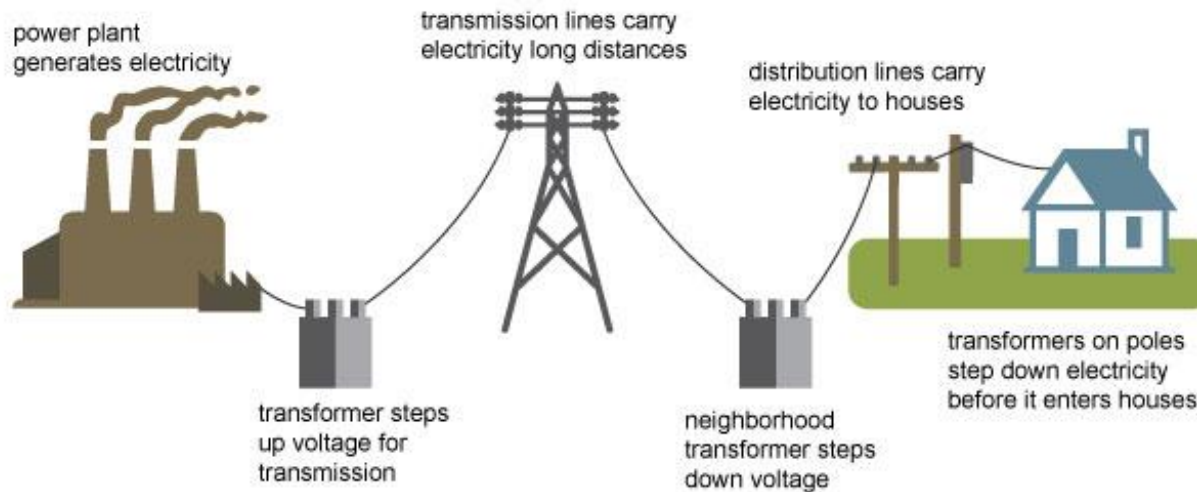


- Installed DER types at CenterPoint Energy



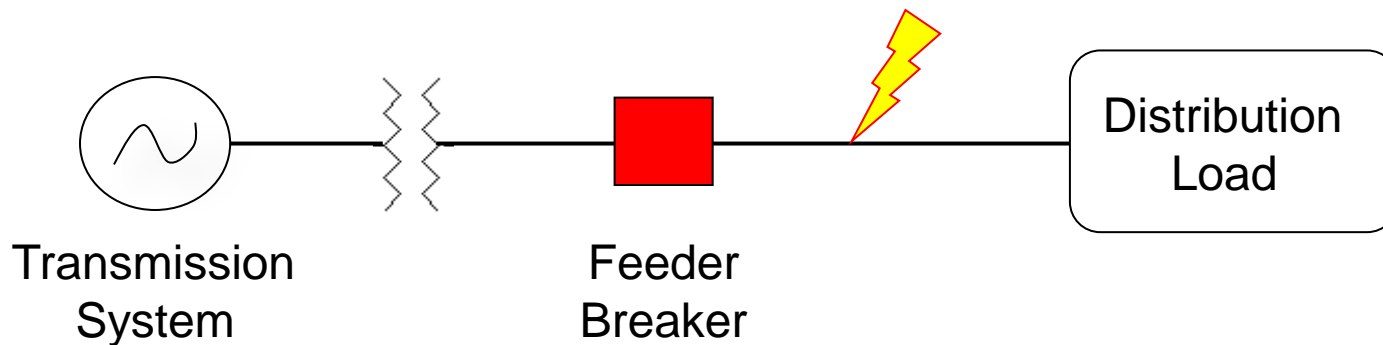
- Utility distribution systems are primarily radial systems designed with single source of power from transmission network.

Electricity generation, transmission, and distribution

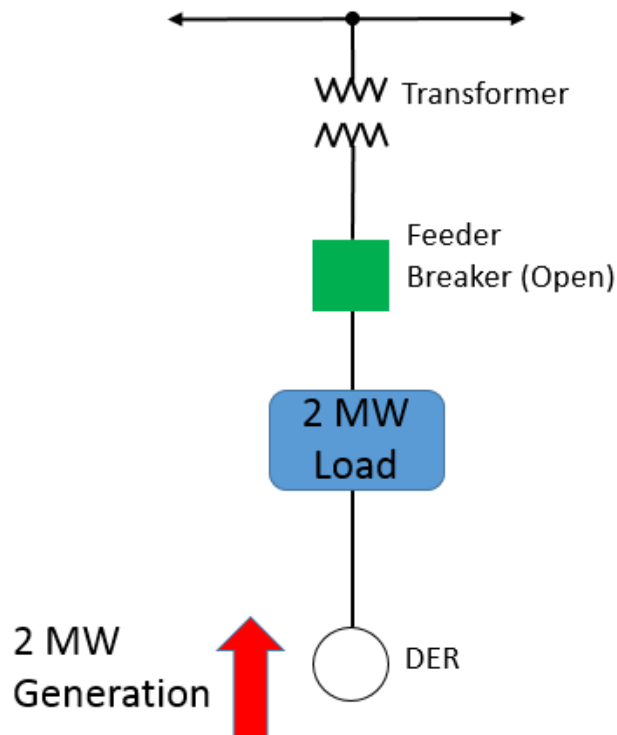


Source: Adapted from National Energy Education Development Project (public domain)

- Utility distribution feeder restoration schemes presume that the distribution feeder is de-energized when the distribution feeder breaker opens.

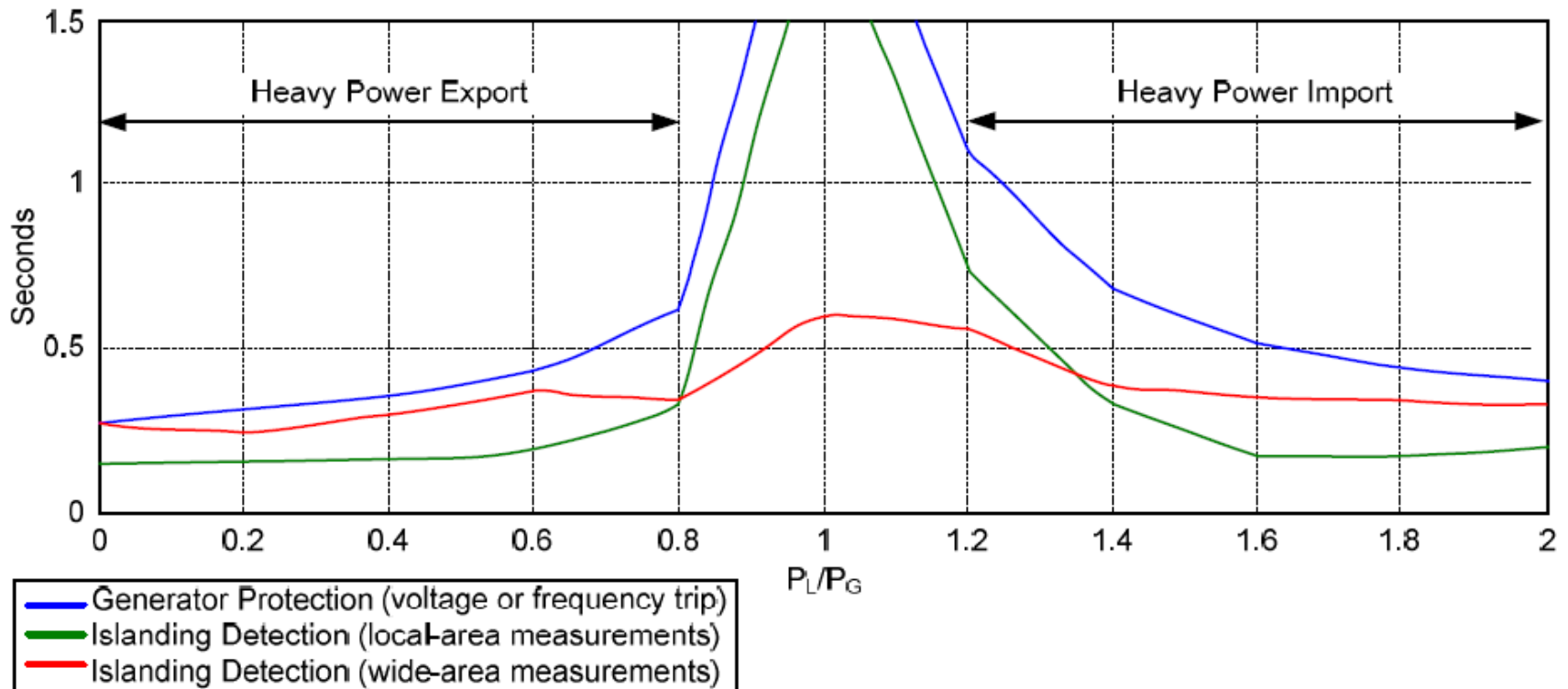


- A DER may be capable of energizing distribution feeder when the utility-owned breaker operates.

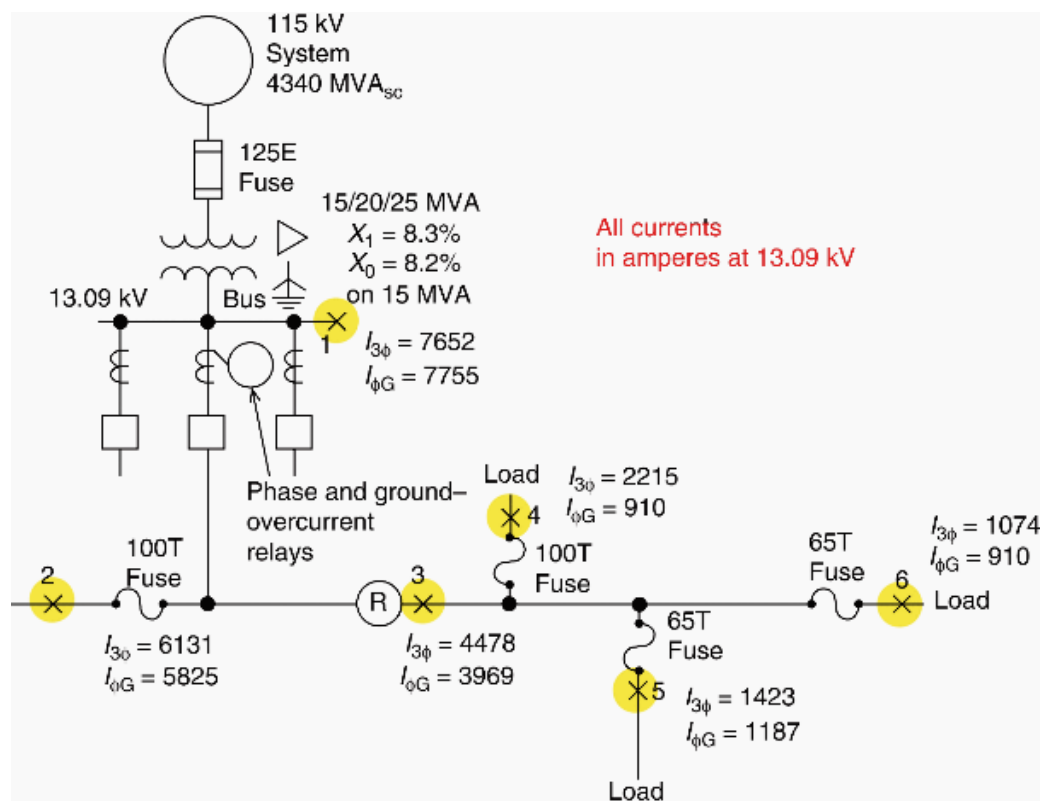


In this example, DER generation matches distribution feeder load. However, CenterPoint Energy adheres to the philosophy that islanding is possible at a generation level of 1/3 the distribution feeder load.

- Several whitepapers exist that encourage differing types of local DER islanding protection. However, there are always limitations and inherent time delays to each option as generation and load get closer to matching.

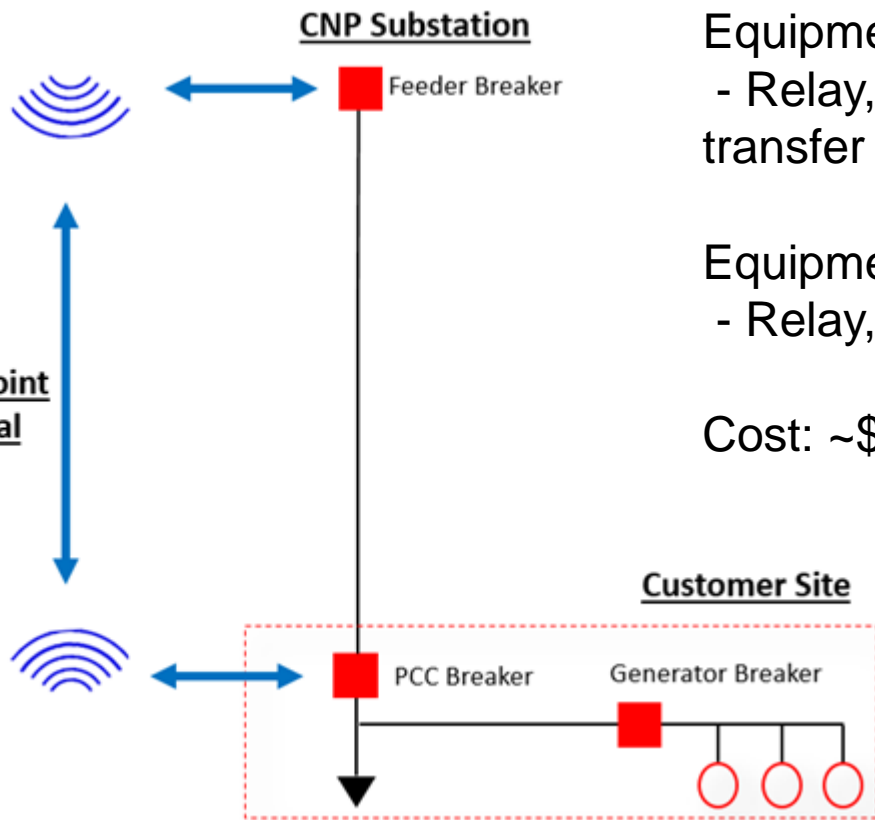


- The distribution feeder is traditionally protected by overcurrent relays and fuses. These are set to coordinate according to the transmission source which is normally much stronger than the DER short circuit capacity.



- CenterPoint Energy adheres to the PUCT Substantive Rules by requiring Direct Transfer Trip for any DER greater than 2 MW.
- CenterPoint Energy does not find it prudent to rely on DER local islanding protection for DERs smaller than 2 MW if there is an unintentional islanding risk on the distribution feeder. Therefore, CenterPoint Energy also requires Direct Transfer Trip for any DERs that cause the aggregate generation of a distribution feeder to exceed 1/3 of the distribution feeder minimum load.

Transfer Trip at CNP for DER

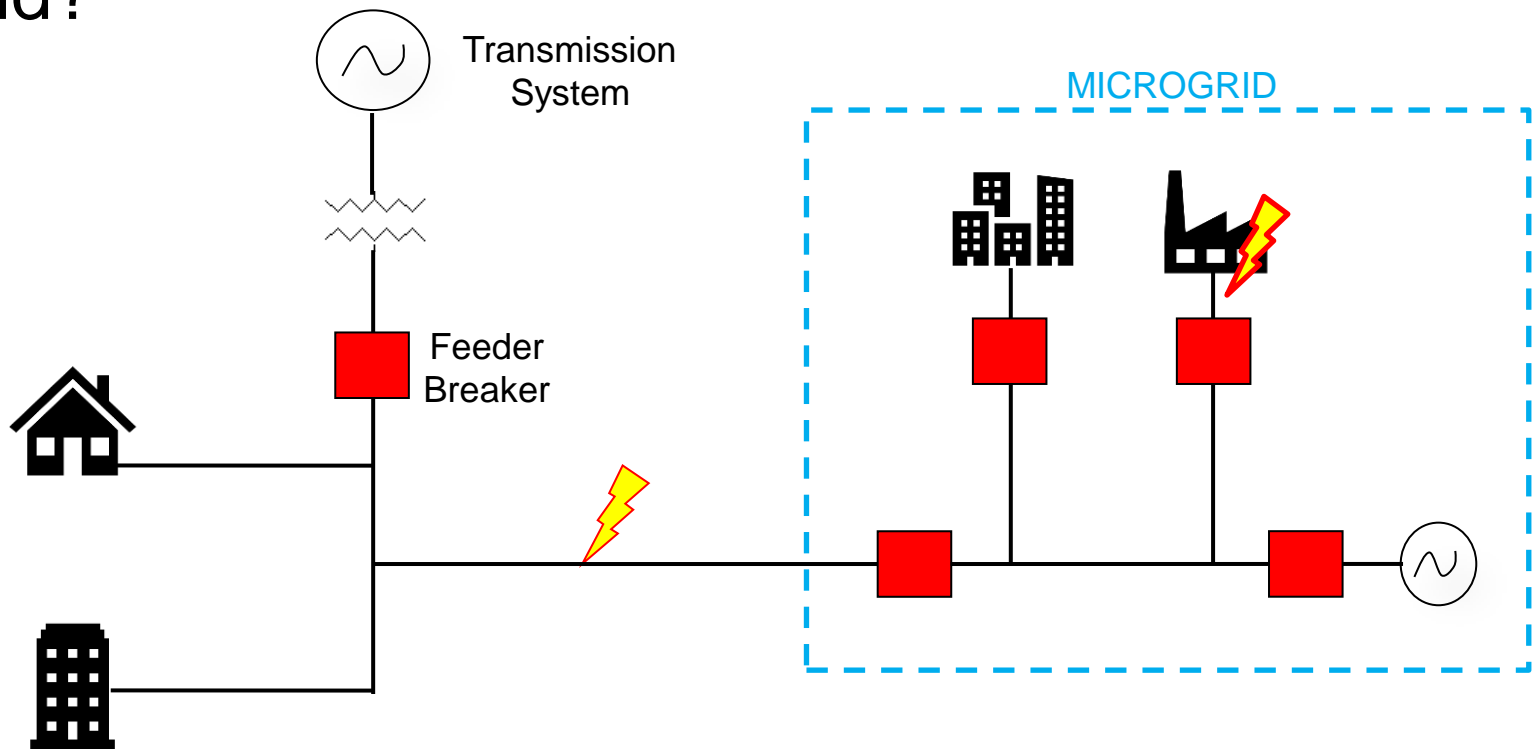


Equipment Installed at CNP Substation:
- Relay, radio, antenna pole, radio antenna, transfer trip panel, CCVT (3V0)

Equipment Installed at Customer Site:
- Relay, radio, antenna pole, radio antenna

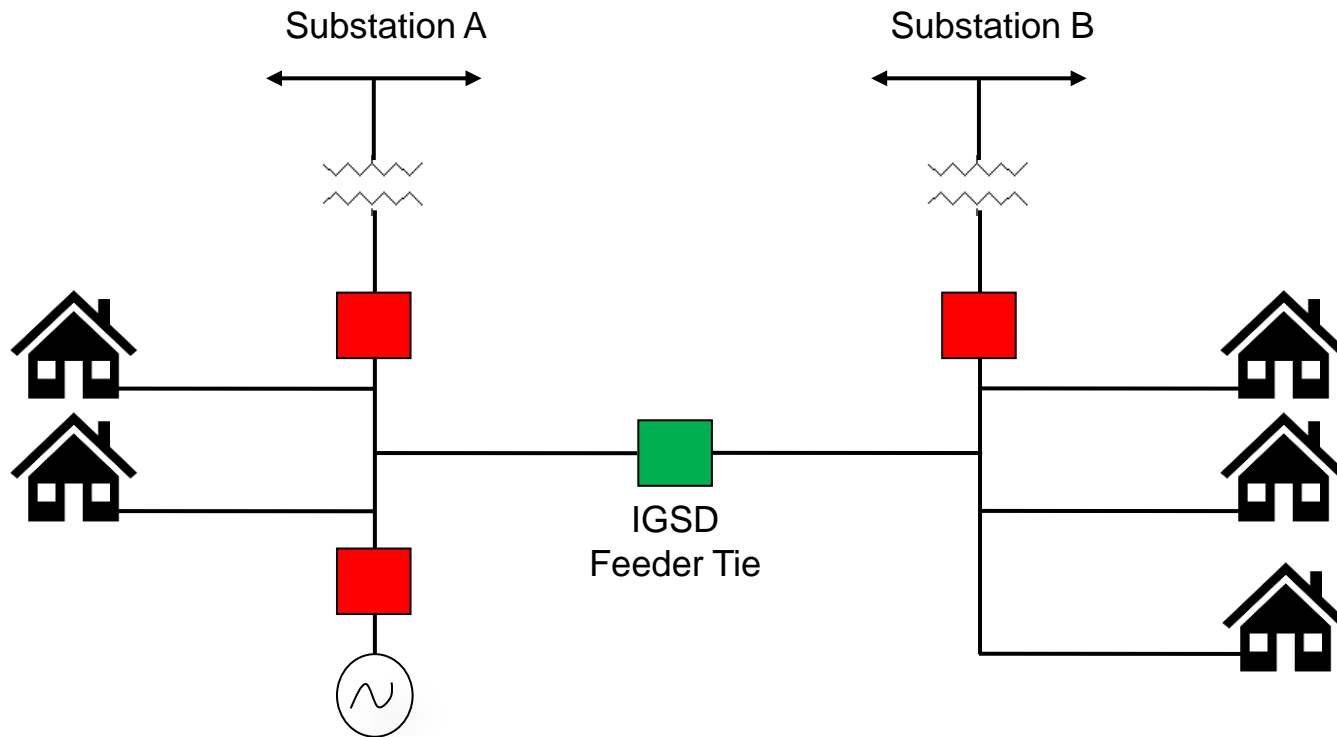
Cost: ~\$120,000 - \$200,000

- How is a microgrid different than an unintentional island?

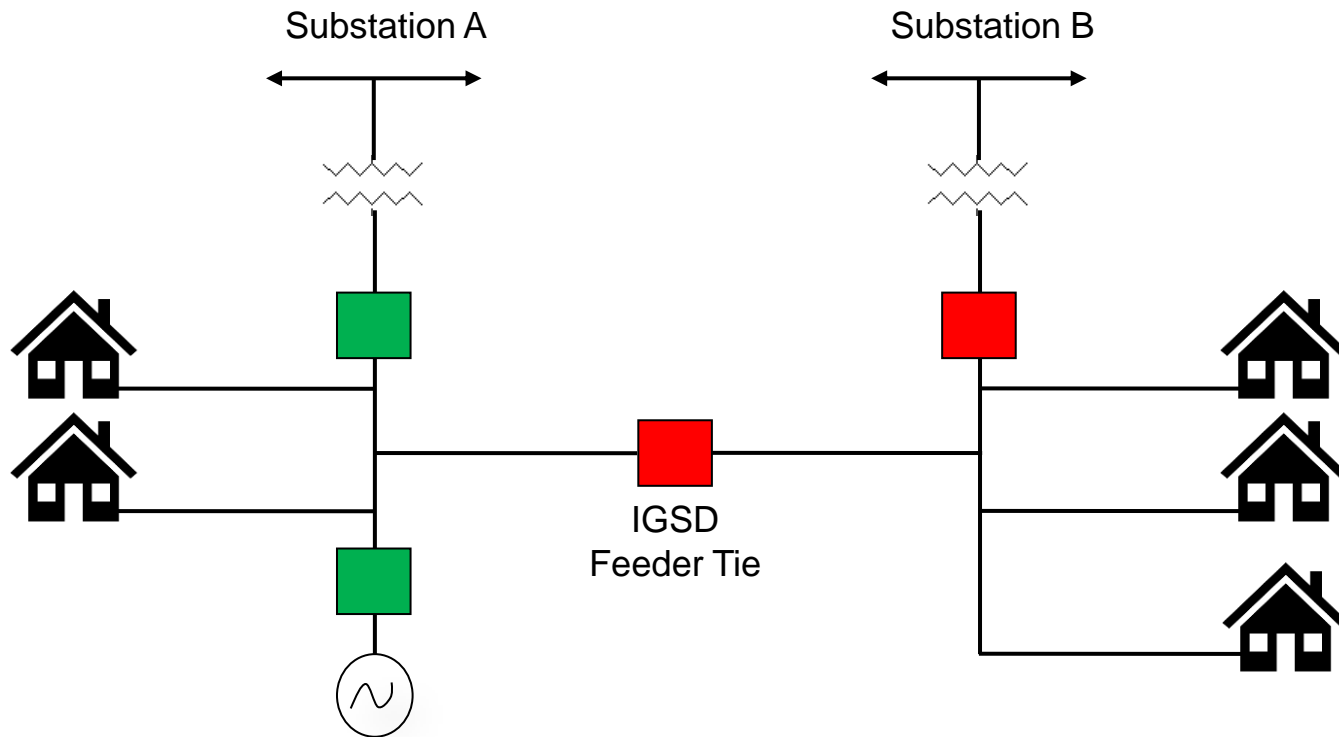


- Not all utilities require Direct Transfer Trip. Are CenterPoint Energy's concerns valid?
- The screening criteria is too restrictive.
- The cost of Direct Transfer Trip is too expensive.
- The timeline for Direct Transfer Trip is too long.
- The point-to-point configuration of Direct Transfer Trip is too restrictive. Unable to generate on another feeder.

Transfer Trip – Point to Point Limitation

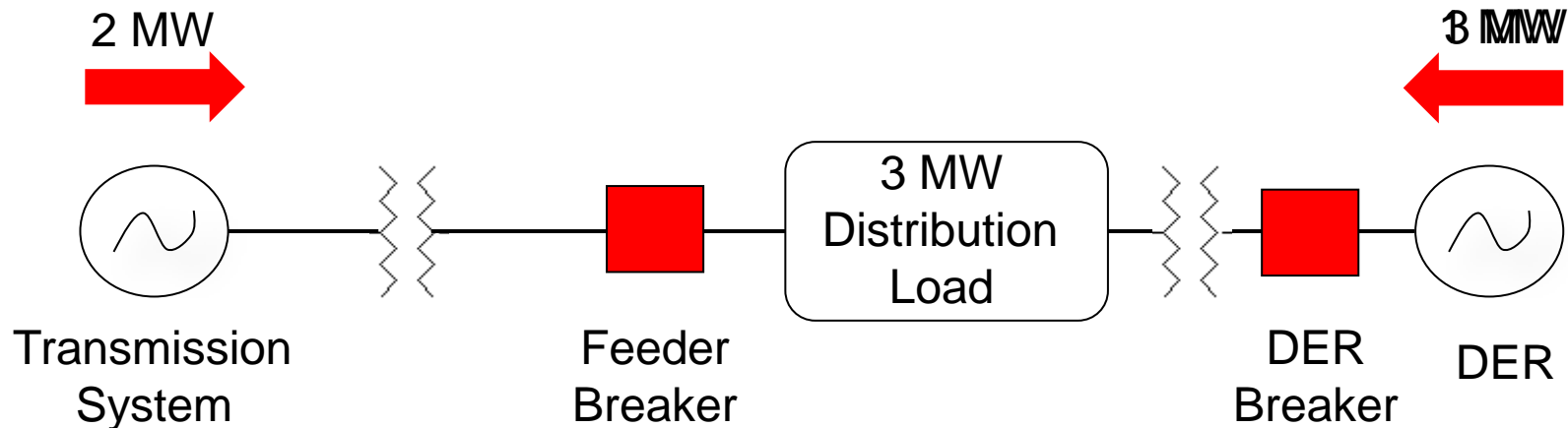


Transfer Trip – Point to Point Limitation



Reverse Power Proposal

- Local Protection
- Not point-to-point
- Inexpensive, short install timeline

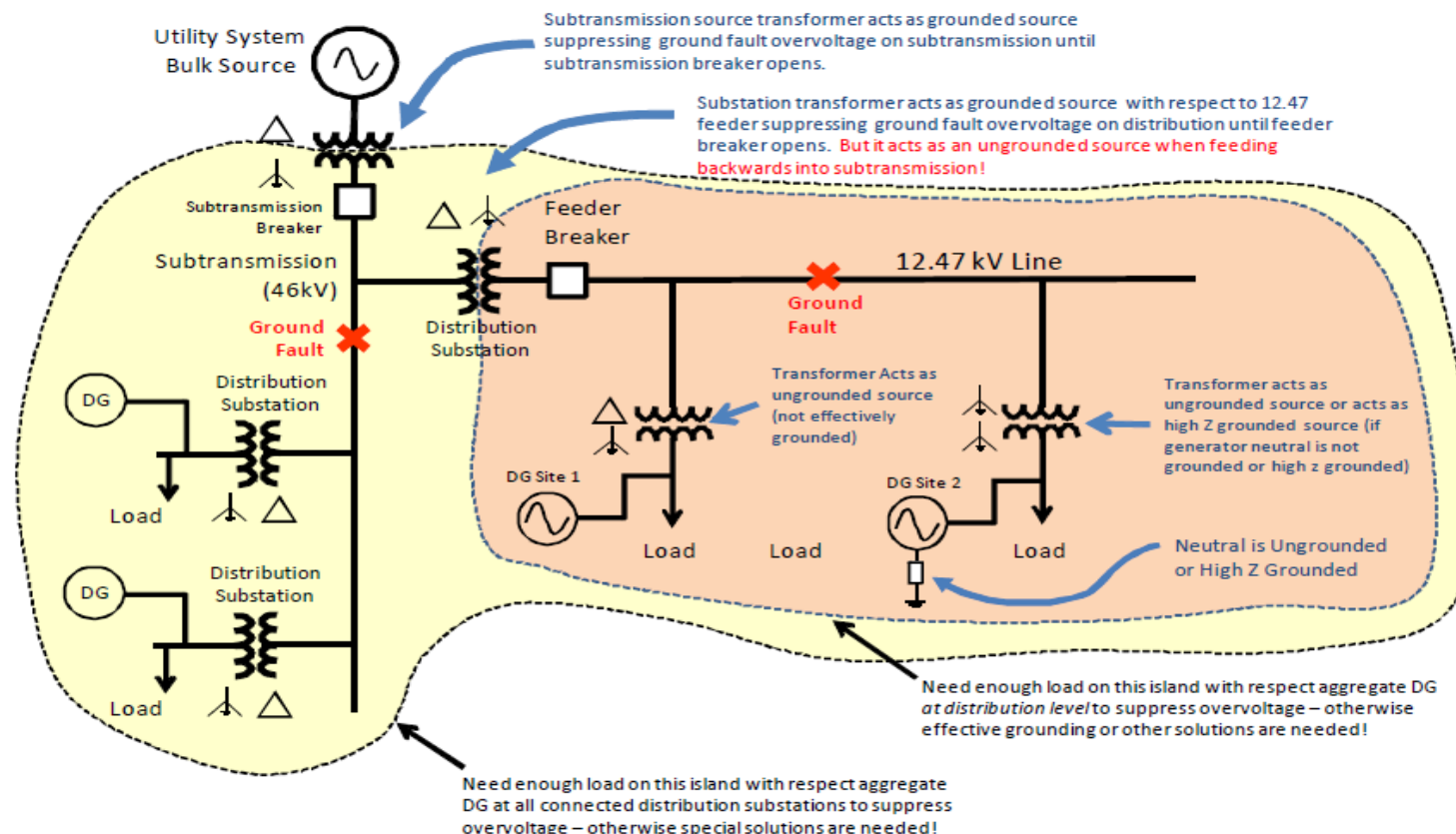


- Some DERs are primarily used for back-up power.
- Unintentional islanding requires DER to support distribution feeder load.
- Can CenterPoint Energy define a threshold of reverse power that limits customer export but doesn't require Direct Transfer Trip?

- CenterPoint Energy has had historical partnerships and studies with EPRI.
- After communicating with EPRI team, CenterPoint Energy was informed that many of these issues are being studied under current base research.
- EPRI recommended participation in P200 Distribution protection research.
- Additional items outside of general research could be studied independently with Self Directed Funds.

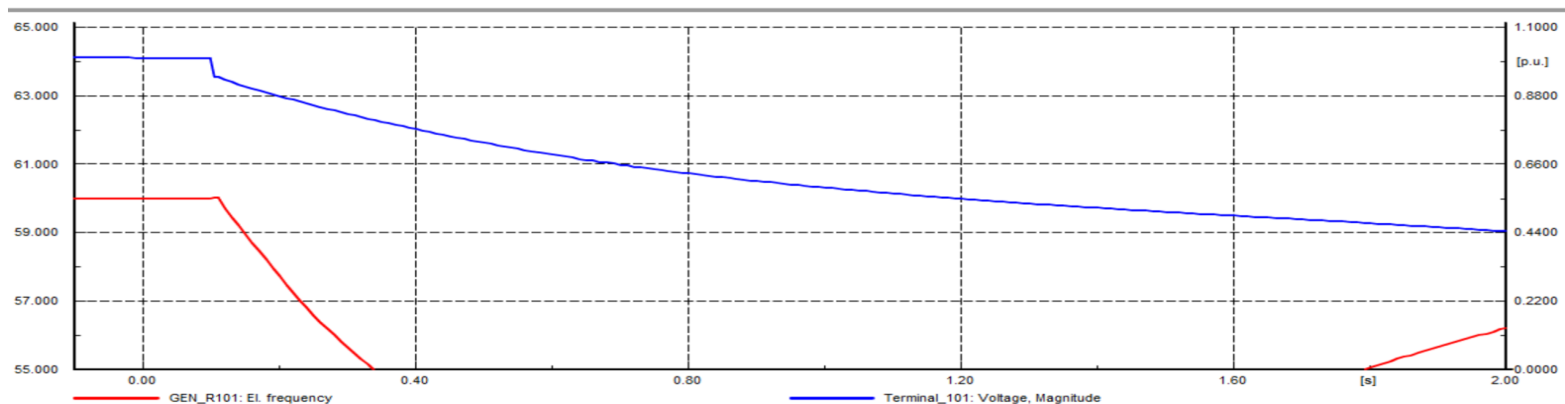
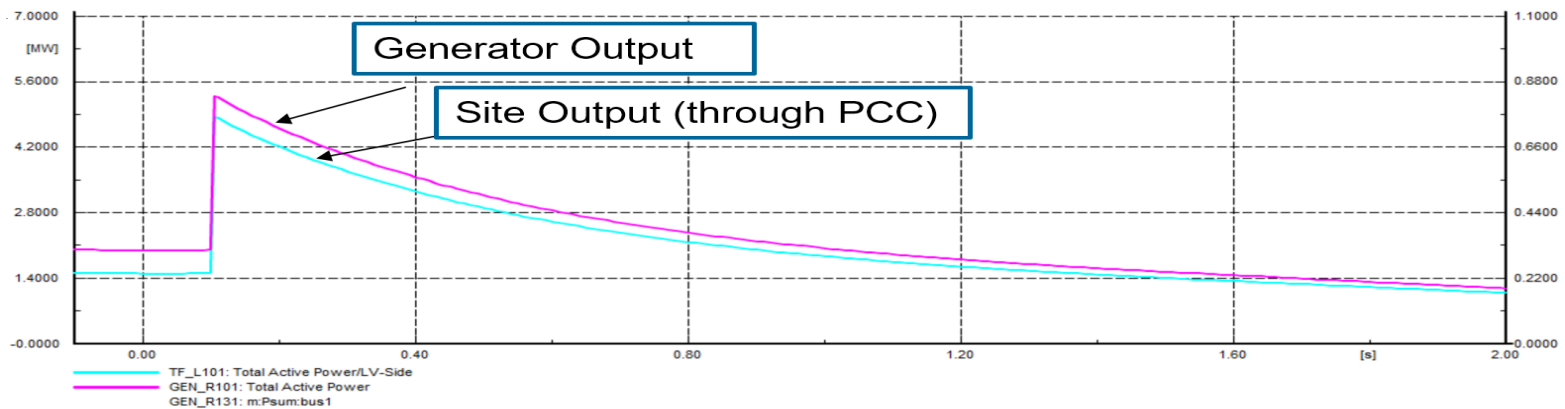
- 2017 and 2018 EPRI P200 research results were applicable to CenterPoint Energy.

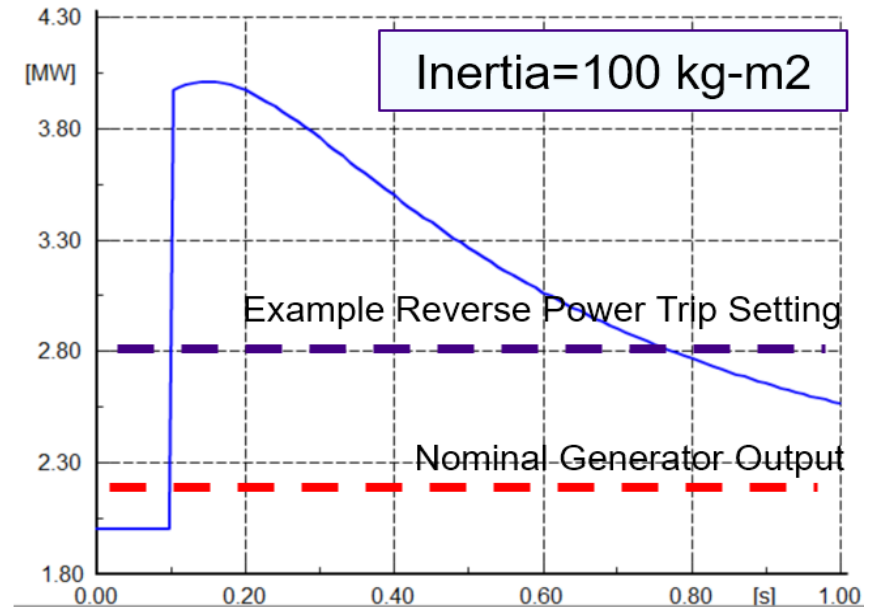
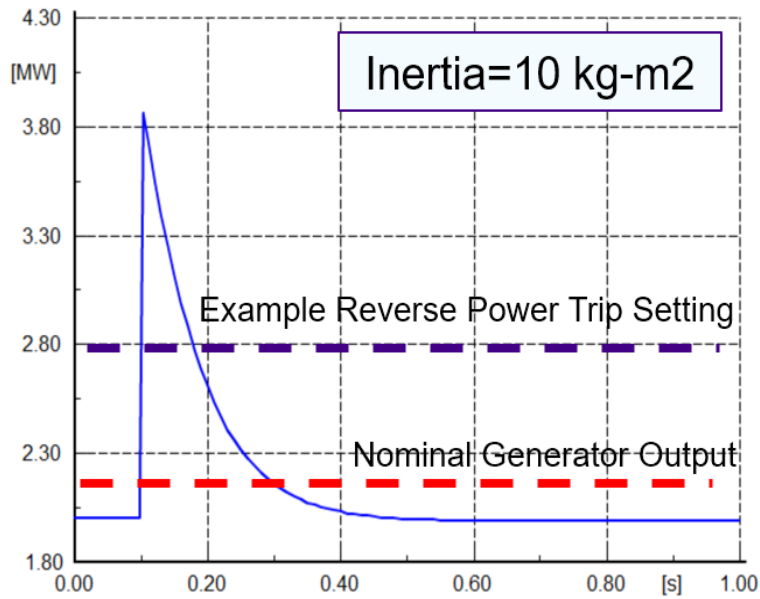
Ground Fault Overvoltage Issues



- Unique challenges for CenterPoint Energy still needed to be addressed.
- Developed a scope of work for a supplemental study and funded with Self Directed Funds.
 - Simulation to be performed in PSCAD and models provided to CenterPoint Energy.
 - Results to be provided in PowerPoint slide format.

- EPRI provided detailed simulation results for multiple scenarios applicable to CenterPoint Energy system.





- EPRI agreed to formally write up results in a technical paper format.

Protection Impacts of Distributed Energy Resources

Investigation of Selected CenterPoint Energy Distribution Feeders

EPRI-1111-11

- CenterPoint Energy has leveraged the EPRI research to develop an innovative protection scheme for islanding protection utilizing reverse power element.
- The cost reduction and increased DER penetration has already had significant results:
 - 45 proposed sites in the near term
 - Approximate customer cost savings of \$9 million

- CenterPoint Energy continues to receive requests for rotating generation as customer co-generation. Available margins for capacity and reverse power protection will continue to decrease.
- CenterPoint Energy is working with EPRI and utilities across the nation to identify cost-effective means of islanding protection as an alternative for Direct Transfer Trip.
- CenterPoint Energy is leveraging its existing smart grid technology and ADMS to develop communication-based islanding protection.