2018 OPERABILITY ASSESSMENT

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What is an Operability Assessment?

An Operability Assessment is a study of the IESO's ability to **effectively** and **reliably** operate the power system **into the future** based on our real-time operating experiences.

Assessment Objective: Recommend changes to power system design or market mechanisms, processes and/or tools to address operability **concerns**

What major changes are expected in future?

- Increased penetrations of Distributed Energy Resources (DERs)
  - Reduce power system transfers and grid demand
  - Inverter-based DERs behave differently than traditional synchronous generators
- Long-term outages and retirement of nuclear generators
  - Reduce power system responses after a transmission fault

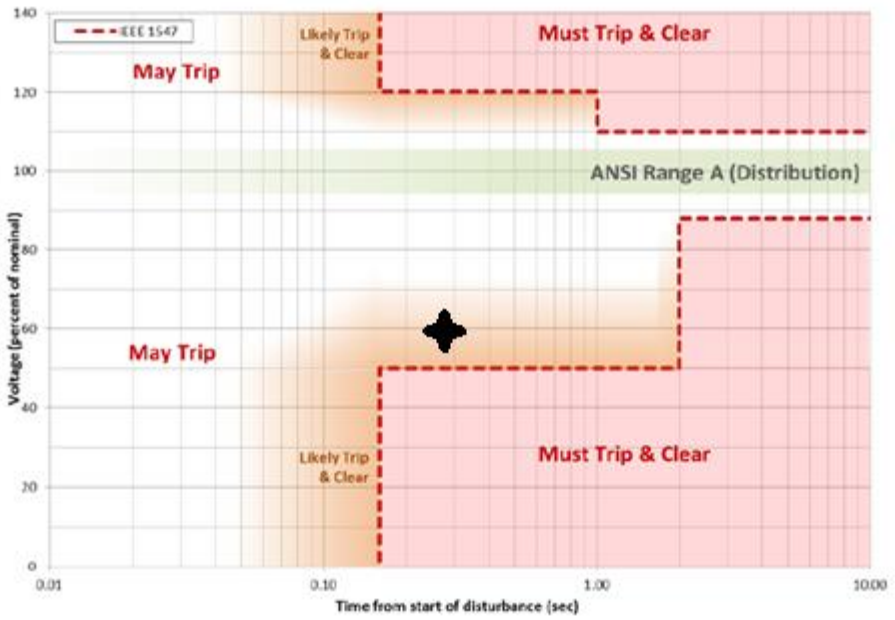
Why did we do this assessment?

- We have already seen instances of reduced power system responses after a fault
  - Observed as part of our regular monitoring required by NERC balancing standards
- New knowledge from other system operators:
  - 2016 California Bluecut forest fire caused a transmission fault; triggered an unexpected 1200 MW solar generation loss
  - 2017 California Canyon forest fire caused two transmission faults; triggered an unexpected 900 MW solar generation loss

Distributed Energy Resources - Limitation

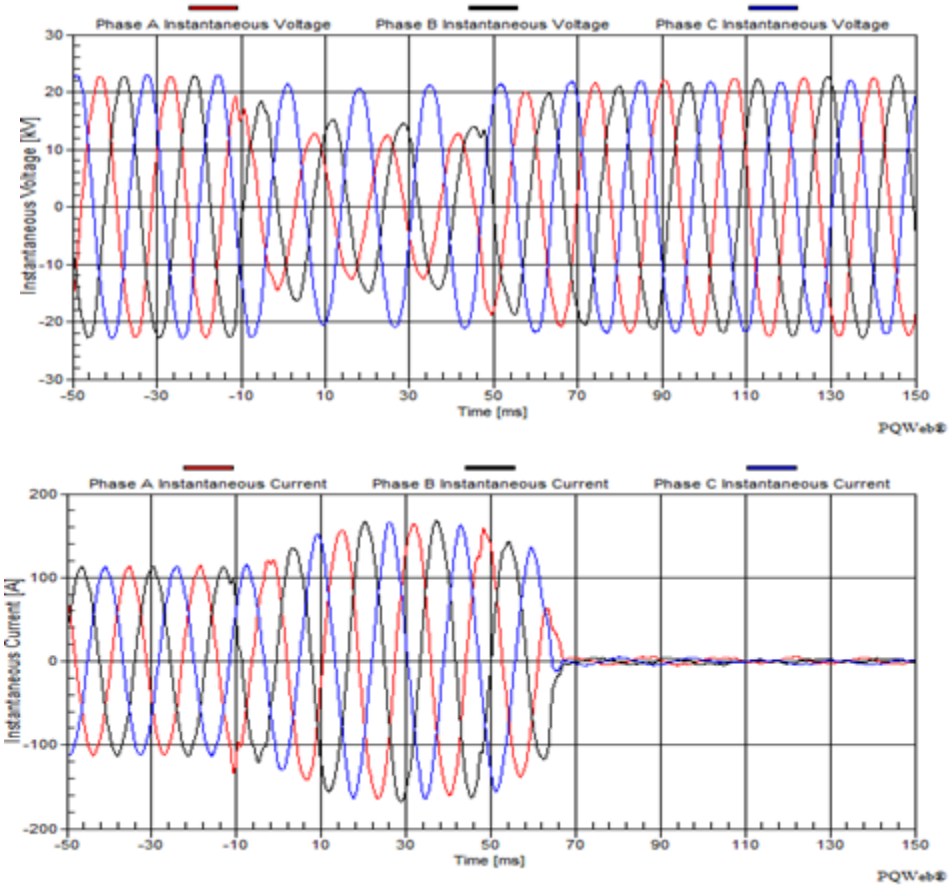
- Voltage Ride-Through Capabilities – Performance during and after a fault

Figure 1: IEEE Standard 1547 Voltage Sensitivity



Distributed Energy Resources - Limitation

- DER trip due to a fault



What did we study?

- Developed study conditions/scenarios that incorporated the following items:

	2025
DERs – IESO driven FIT and LRP projects	All inverter-based projects ≥ 100 KW in-service at high outputs
Pickering NGS	Retired
Bruce and Darlington NGSs	Up to 4 units will be out of service for long-term outages
Low grid demands	As low as **8500 MW**

- Studied how the power system responds during and just after a transmission fault

What power system responses were assessed?

- **Single Largest Contingency** - A large number of DERs may trip following a transmission fault, resulting a new single largest contingency that needs to be respected

- **System Inertia** - High penetration of DERs will lower the system inertia of the IESO-controlled grid

- **Primary Frequency Response** - High penetration of DERs will lower frequency response provided by Ontario

What did we find?

- Under certain system conditions, ¾ of DER production in Ontario will trip due to the effects of a transmission fault
  - The sudden loss of a single Darlington unit is typically Ontario's 'Single Largest Contingency' (SLC) today
  - If the fault occurs at Darlington, a Darlington generator and DERs will trip, causing a new and very large SLC for Ontario

What did we find?

- We will have sufficient traditional synchronous generators (i.e., hydro-electric and/or nuclear) to support System Inertia and Primary Frequency Response after a transmission fault

What do we need to do?

1. Change voltage trip settings on inverter-based DERs:
   - Work with the Ontario Energy Board (OEB) to modify the Distribution System Code (DSC) by adopting the new Canadian Standards Association rules on DER performance
   - Engage local distribution companies and DER owners

DER size (MW)	Percentage of total installed capacity (%)	Number of DER facilities
≥ 10	50%	134
≥ 5.0	66%	192
≥ 1.0	67%	204
≥ 0.5	76%	721
0.5 > DER ≥ 0.1	24%	3721

What do we need to do?

2. Consider increasing occasionally Operating Reserve as an interim measure
   - Needed when loss of DERs is SLC for a transmission fault
3. Investigate Transmission solutions, if needed
4. Continue regular monitoring of how the system responds to transmission faults
   - Quarterly for primary frequency response
   - Annually for system inertia

2018 Operability Assessment – Next Steps

- Collaborate with OEB, LDCs and DER asset owners to change voltage trip settings
  - *What does this mean to DER asset owners?*
    - Likely to be an OEB implementation plan with direction from IESO and coordination from LDC
    - No reduction of output capability
    - No change in equipment
    - Less interruptions due to transmission and distribution faults
- Issue 2018 Operability Assessment report in Q1 2019

Questions