PRESENTER

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OBJECTIVES

• Discuss:
  o Drivers of feeder model updates for Hosting Capacity Analysis
  o Inputs and assumptions in DRIVE (Distribution Resource Integration and Value Estimation)
  o Threshold values used in DRIVE

• Discuss and gather feedback

• Discuss next steps
Remodeling a feeder means creating a new model of our distribution system that reflects its most current state at the time of our analysis

• **2019 efficiency improvement**: Rather than remodel feeders every year whether they changed or not, we decided to remodel at least every three years, and annually if certain criteria are met:
  - Load deviations of 500kW
  - The addition of a solar garden or other large generation: notably this includes solar gardens (1MW or less)
  - Large capacity projects, feeder cuts, load transfers, etc.

• **We apply updated loads to all models** before performing the analysis regardless of remodeling being required
DRIVE and Impact Study Alignment

• We align the thresholds used in DRIVE with the ones we use in our System Impact Studies for interconnection
  o Allows for better consistency in results
  o Provides another reference point for DRIVE thresholds

• Not all available DRIVE thresholds are used in System Impact Studies or are directly correlated due to differences in the way the studies are performed
  o Example: HCA determines when an issue is likely to occur vs. a detailed analysis at a specific location
  o Example: Breaker Relay Reduction of Reach
DRIVE Inputs and Assumptions

• Year ahead feeder configuration
• Peak load power flow case
• Daytime Minimum Load power flow case
• Distributed Energy Resource
  o 100% output
  o New DER is PV
  o New DER at 98% power factor (absorb VARs)
  o 100% output change for over-voltage and voltage deviation
  o Centralized growth
  o Constant Current
DRIVE Thresholds

- Primary Over-Voltage
- Primary Voltage Deviation
- Regulator Voltage Deviation
- Thermal for DER Output
- Additional Element Fault Current
- Breaker Relay Reduction of Reach
- Unintentional Islanding
Ed Shannon, Xcel Energy - Principal DER Engineer
Threshold – *Primary Over-Voltage*

**Description:** Feeder voltage at any location on the feeder not to go above a specified voltage magnitude

**Value:** 105% (126 Volts)

**Basis:** ANSI C84.1 Range A
Threshold – *Primary Voltage Deviation*

**Description**: Feeder voltage at any location not to change by more than a specified amount for aggregate DER tripping

**Value**: 5%

**Basis**: IEEE 1453-2015 and Xcel Energy Whitepaper*

Threshold – *Regulator Voltage Deviation*

**Description:** Voltage observed at any regulating device not to change by more than a specified amount of the regulating devices bandwidth

**Value:** 50% of the regulator bandwidth

**Basis:** Moderate value – internally chosen
Threshold – *Thermal for DER Output*

**Description:** Power flow through any element not to exceed a percentage of the elements normal rating

**Value:** 100%

**Basis:** Not to exceed normal equipment ratings
Threshold – *Additional Element Fault Current*

**Description:** Feeder fault current not to increase by more than a percentage of fault current prior to generation

**Value:** 10%

**Basis:** Reliable coordination & protective device interrupt rating
Threshold – Breaker Relay Reduction of Reach

**Description:** Breaker fault current not to decrease by more than a percentage of fault current prior to generation

**Value:** 10%

**Basis:** Guaranteed Fault Detection

![Diagram](image)
Threshold – *Unintentional Islanding*

**Description:** Power flow through specified elements not to be reduced by more than a percentage of minimum load power flow

**Value:** 100% at feeder breaker and reclosers – meaning total generation equals Daytime Minimum Load  
– *moving to 80% (generation/load) in 2020 analysis*

**Basis:** To reduce the potential of a temporary islanding condition – 80% aligns with current Xcel Energy interconnection practices
Advanced Settings

• Maximum Tap Regulators in Over/Under-Voltage Analysis - Enabled
• Maximum DER Penetration = 10MW
• Minimum Penetration Increment for Analysis = 100kW
• Fault Current Magnitude = 1.2 PU
• No advanced inverter functionality enabled at this time
Feedback and Questions

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Next Steps
Min and Max Hosting Capacity – *Explained*

- Minimum Hosting Capacity – The Maximum Amount of DER that can be accommodated anywhere on the feeder
- Maximum Hosting Capacity – The Maximum Amount of DER that can be accommodated at one point on the feeder
Threshold – Reverse Power Flow
As last used in the 2019 HCA

**Description:** Any reverse power flow through specified elements

**Value:** 100% at Breaker - *disabled*

**Basis:** To highlight where reverse flow is occurring
DRIVE Thresholds

- Primary Over-Voltage
- Primary Under-Voltage
- Primary Voltage Deviation
- Regulator Voltage Deviation
- Thermal for Load
- Thermal for Gen
- Reverse Power Flow*
- Additional Element Fault Current
- Breaker Relay Reduction of Reach
- Sympathetic Breaker Relay Tripping
- Unintentional Islanding
- Operational Flexibility
- 3VO
- Flicker

Notes:
The Thresholds Xcel Energy applies in its HCA analysis are highlighted.
* Last used in 2019.