



# Hosting Capacity Criteria, Inputs and Thresholds

Stakeholder Workshop #2

June 16, 2020



# PRESENTER



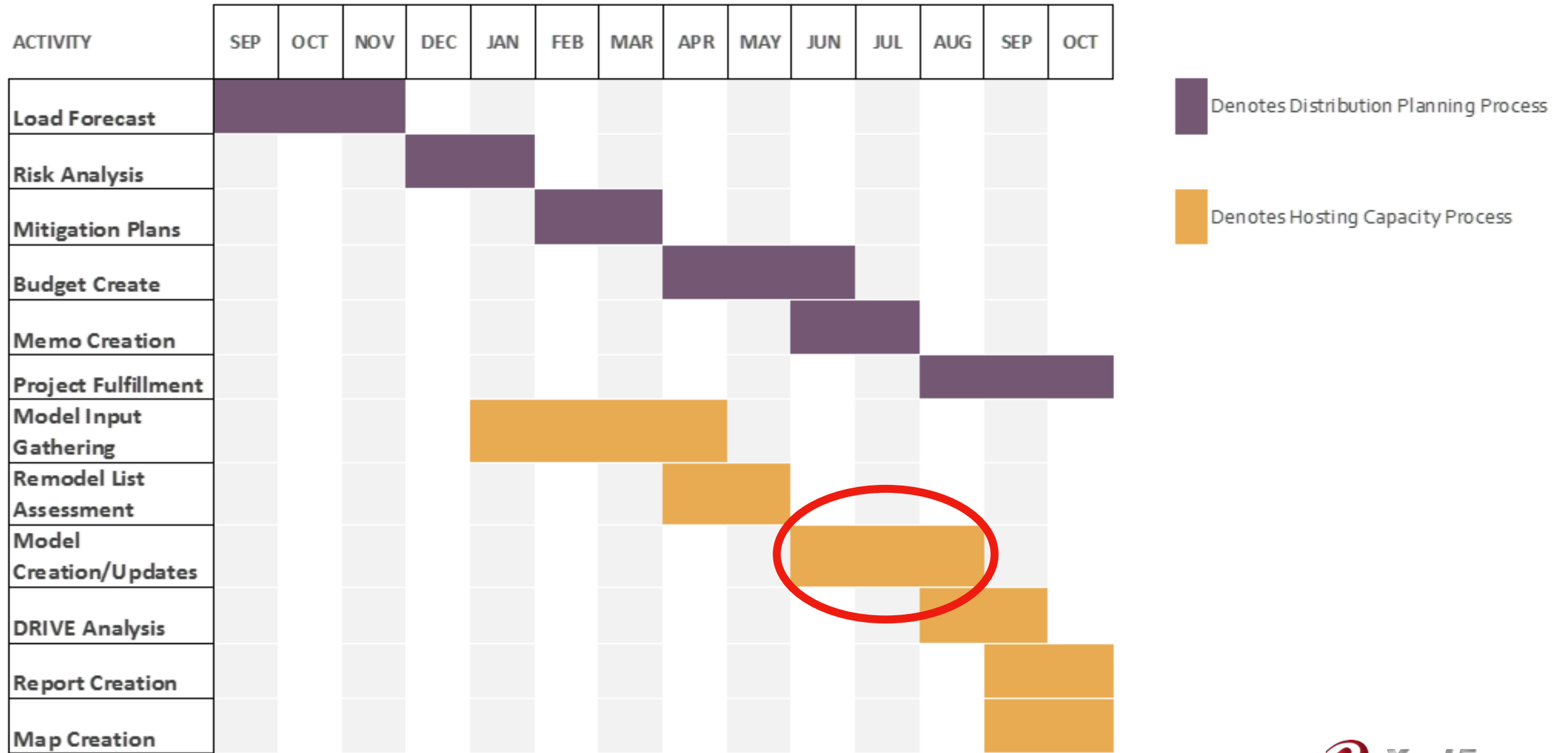
**Chris Punt, Xcel Energy - DER Integration Manager**



# OBJECTIVES

- **Discuss:**
  - Drivers of feeder model updates for Hosting Capacity Analysis
  - Inputs and assumptions in DRIVE (Distribution Resource Integration and Value Estimation)
  - Threshold values used in DRIVE
- **Discuss and gather feedback**
- **Discuss next steps**

# DRIVE Process Step



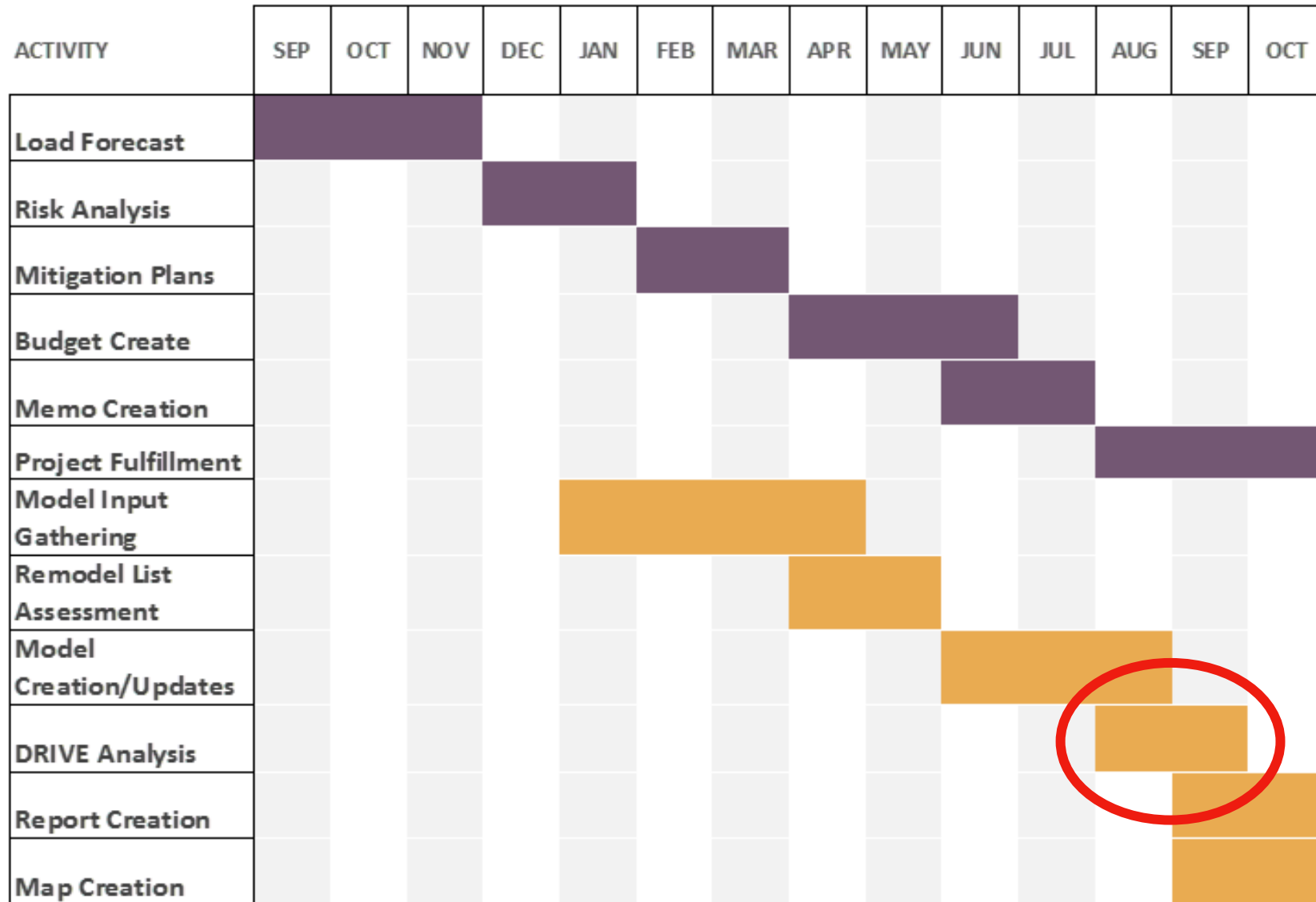
# Feeder Modeling Updates

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 Process Step



■ Denotes Distribution Planning Process

■ Denotes Hosting Capacity Process



# DRIVE and Impact Study Alignment

- **We align the thresholds used in DRIVE with the ones we use in our System Impact Studies for interconnection**
  - Allows for better consistency in results
  - 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**
  - Example: HCA determines when an issue is likely to occur vs. a detailed analysis at a specific location
  - Example: Breaker Relay Reduction of Reach



# DRIVE Inputs and Assumptions

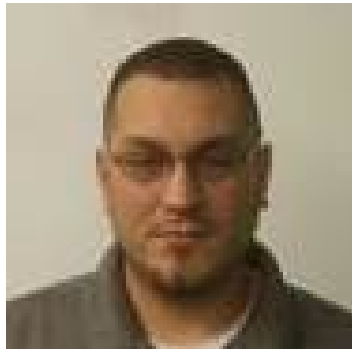
- **Year ahead feeder configuration**
- **Peak load power flow case**
- **Daytime Minimum Load power flow case**
- **Distributed Energy Resource**
  - 100% output
  - New DER is PV
  - New DER at 98% power factor (absorb VARs)
  - 100% output change for over-voltage and voltage deviation
  - Centralized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

## PRESENTER



**Ed Shannon, Xcel Energy - Principal DER Engineer**

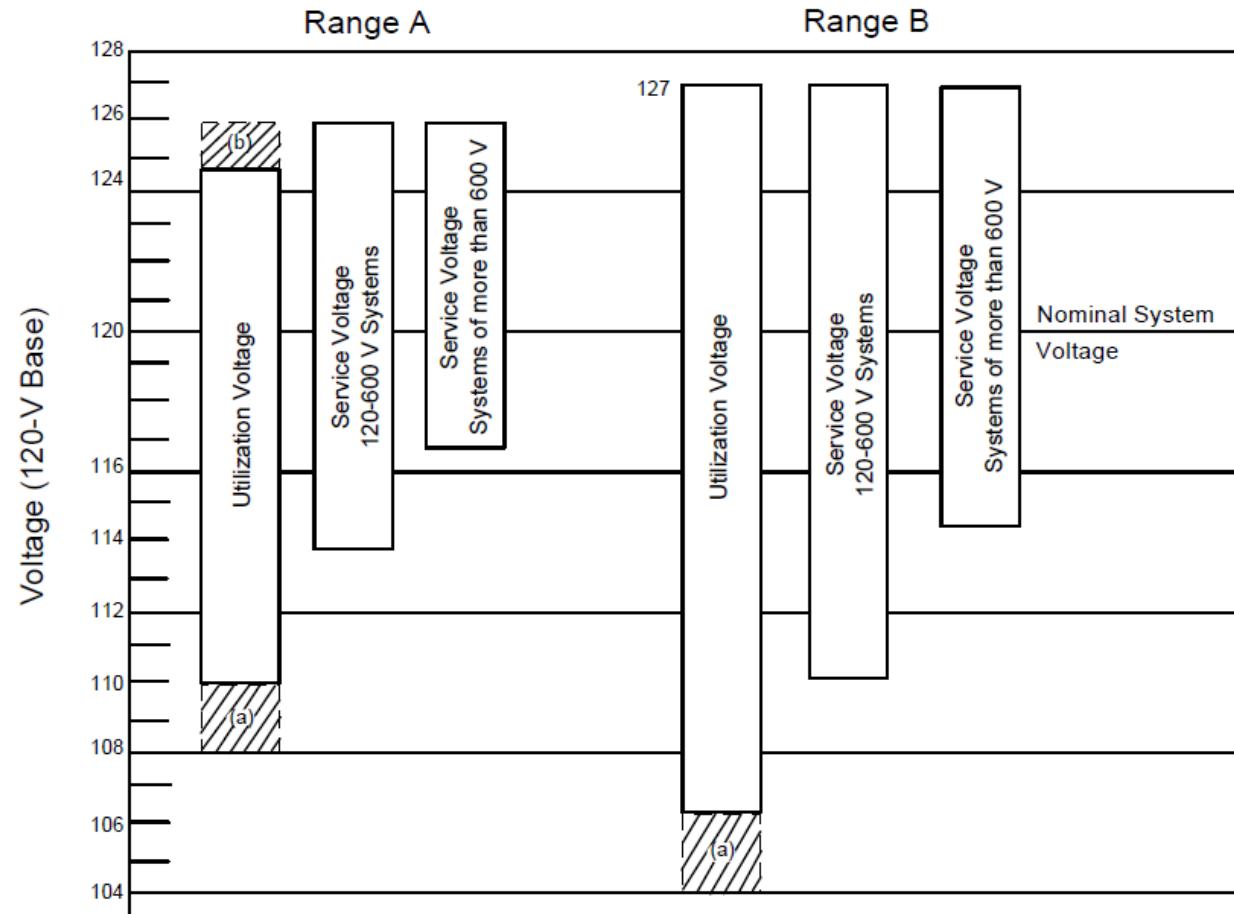


# Threshold – Primary Over-Voltage

**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



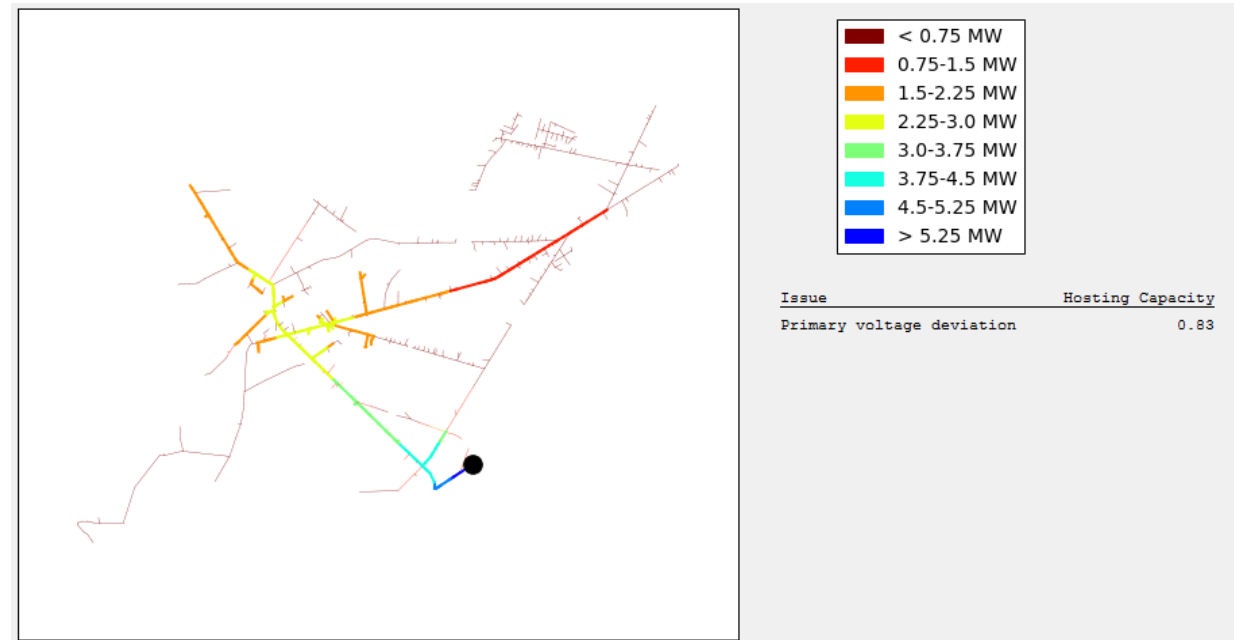
# Threshold – Primary Voltage Deviation

**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\*

\*Applying IEEE 1453-2015 for Determining the Voltage Deviation Limits for Medium Voltage Distribution Connected Photovoltaics for Step-Changes in Voltage and Ongoing Voltage Deviations due to the Passing of Clouds - Docket No. E002/M-13-867

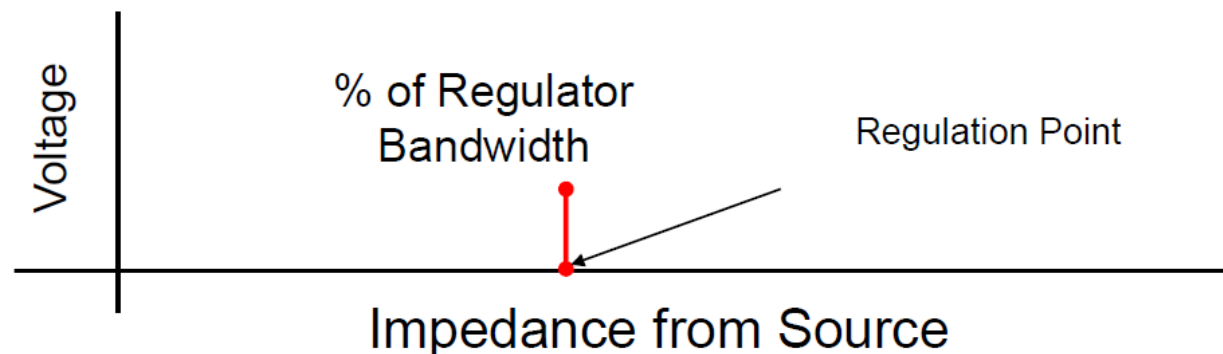


## Threshold – *Regulator Voltage Deviation*

**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%

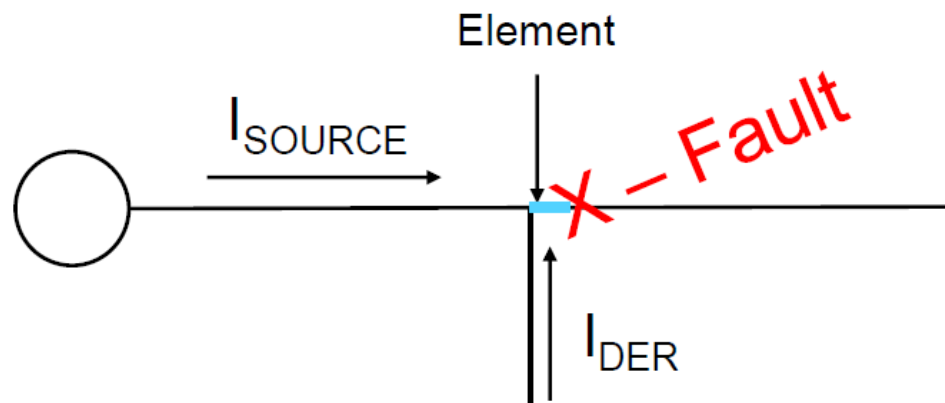
**Basis:** Not to exceed normal equipment ratings

## 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

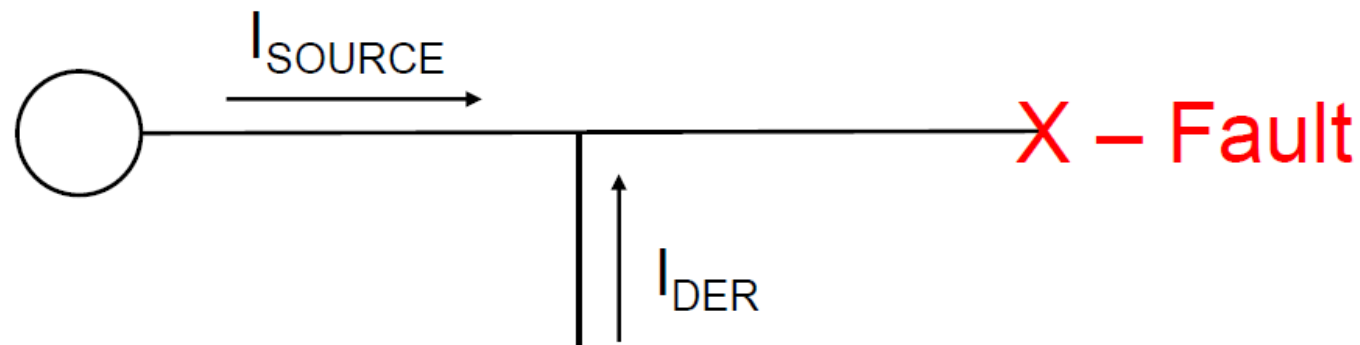


## Threshold – *Breaker Relay Reduction of Reach*

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

**Value:** 10%

**Basis:** Guaranteed Fault Detection





## 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**



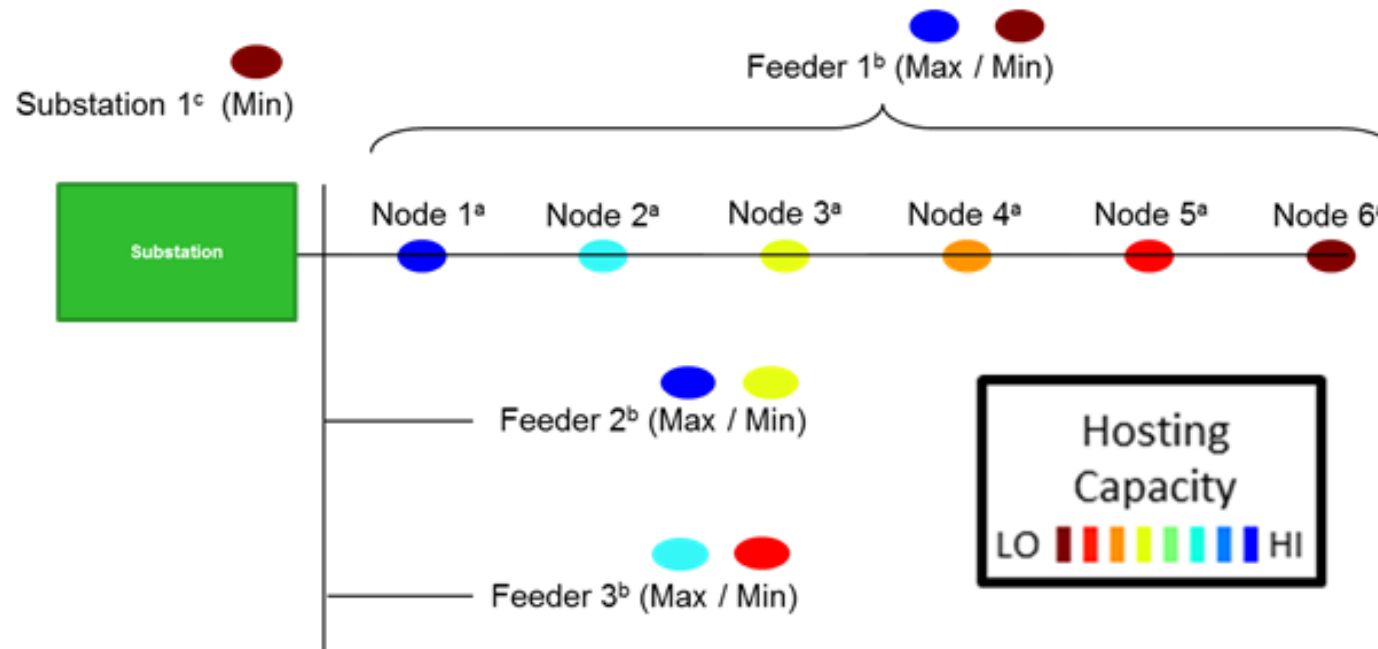
# Feedback and Questions

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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.*

