

BES Radial Exclusion Low Voltage Level Criteria

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BES Definition SDT

SLC

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Problem Statement

To satisfy FERC Order 773-A, additional factors beyond impedance must be considered to demonstrate that looped or networked connections operating below 100 kV should not be considered in the evaluation of Exclusion E1.

FERC Order 773/773a

FERC Order 773-A

Page 20, Paragraph 28...In the Final Rule, the Commission held that radial systems with elements operating at 100 kV or higher in a configuration that emanate from two or more points of connection cannot be deemed "radial" if the configuration remains contiguous through elements that are operated below 100 kV.

FERC Order 773

Page 95, Footnote 139...this footnote provides some parameters for the SDT to consider as a technical justification to include some low voltage loops (typical of distribution feeders) under the E1 exclusion:

- Voltage
- Impedance
- Proximity
- Length of Conductor
- Interconnected Transmission System

Procedure

3 Step Process

- ❖ Review the regional voltage levels that are monitored on major interfaces, paths, and monitored elements in the operation of the various interconnections
- ❖ Study the physics of the loop flows through the low voltage loops (typical for distribution feeders) and determine various situations from worst case to practical situations
- ❖ Review design considerations that the industry uses to prevent loop flow through low voltage loops

1 - Regional Criteria

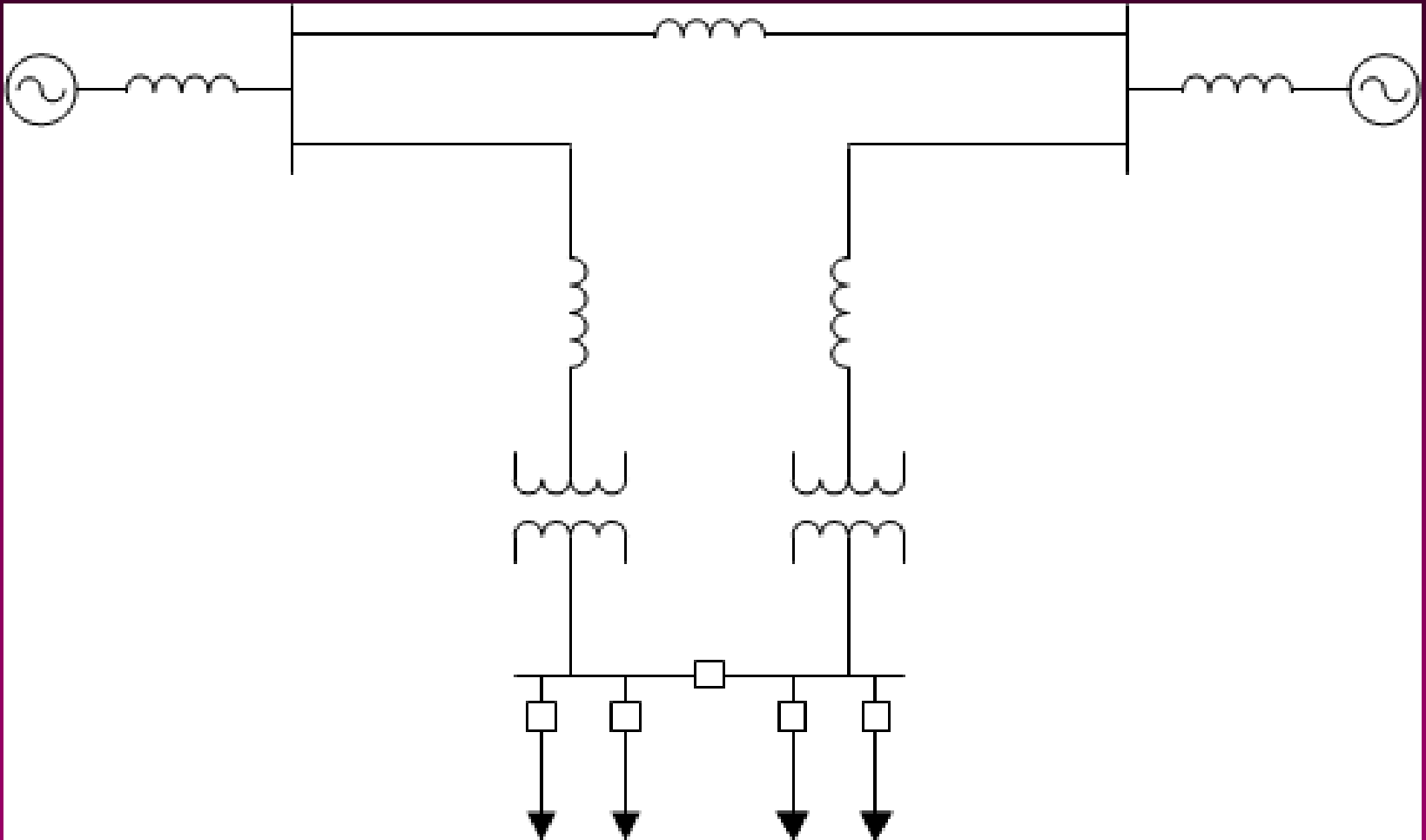
- ❖ WECC Minimum Voltage Levels
 - Paths, SOLs, modeling
- ❖ Eastern Interconnection Voltage Levels
 - Defined Interfaces, SOLs, IROs, modeling
- ❖ ERCOT
 - Monitored Elements, SOLs, IROs, modeling
- ❖ Sub-transmission Voltage Levels

2 – Loop Flow

- ❖ Study the physics of low voltage loop flow
- ❖ Worst case scenarios
- ❖ Loop flow across low side bus
- ❖ Loop flow across low side lines
- ❖ % of high side flow transferred to low side for N-1
- ❖ Low voltage loop flow based on typical conductor ratings.

2 – Loop Flow

❖ Parametric study



3 – Design Considerations

- ❖ Owners and operators design to prevent low voltage loop flow
- ❖ Protection and control schemes
- ❖ Interlocking schemes/reverse power
- ❖ Supply continuity considerations

Voltage Considerations

- ❖ 55 kV
- ❖ 44 kV
- ❖ 34.5 kV
- ❖ 22 kV
- ❖ 12 kV
- ❖ 4 kV

Chose 30 kV as a bright-line

based on initial discussions by sub-team; more discussion and analysis is needed.