

Vermont Loss of Load Exposure



July 12, 2017
VSPC Meeting
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Purpose

Ensure Vermont stakeholders clearly understand loss of load exposure that does not require resolution as determined by VELCO and ISO-NE

Definitions

- **Bulk Electric System (BES):** “... all Transmission Elements operated at 100 kV or higher and Real Power and Reactive Power resources connected at 100 kV or higher. This does not include facilities used in the local distribution of electric energy.”

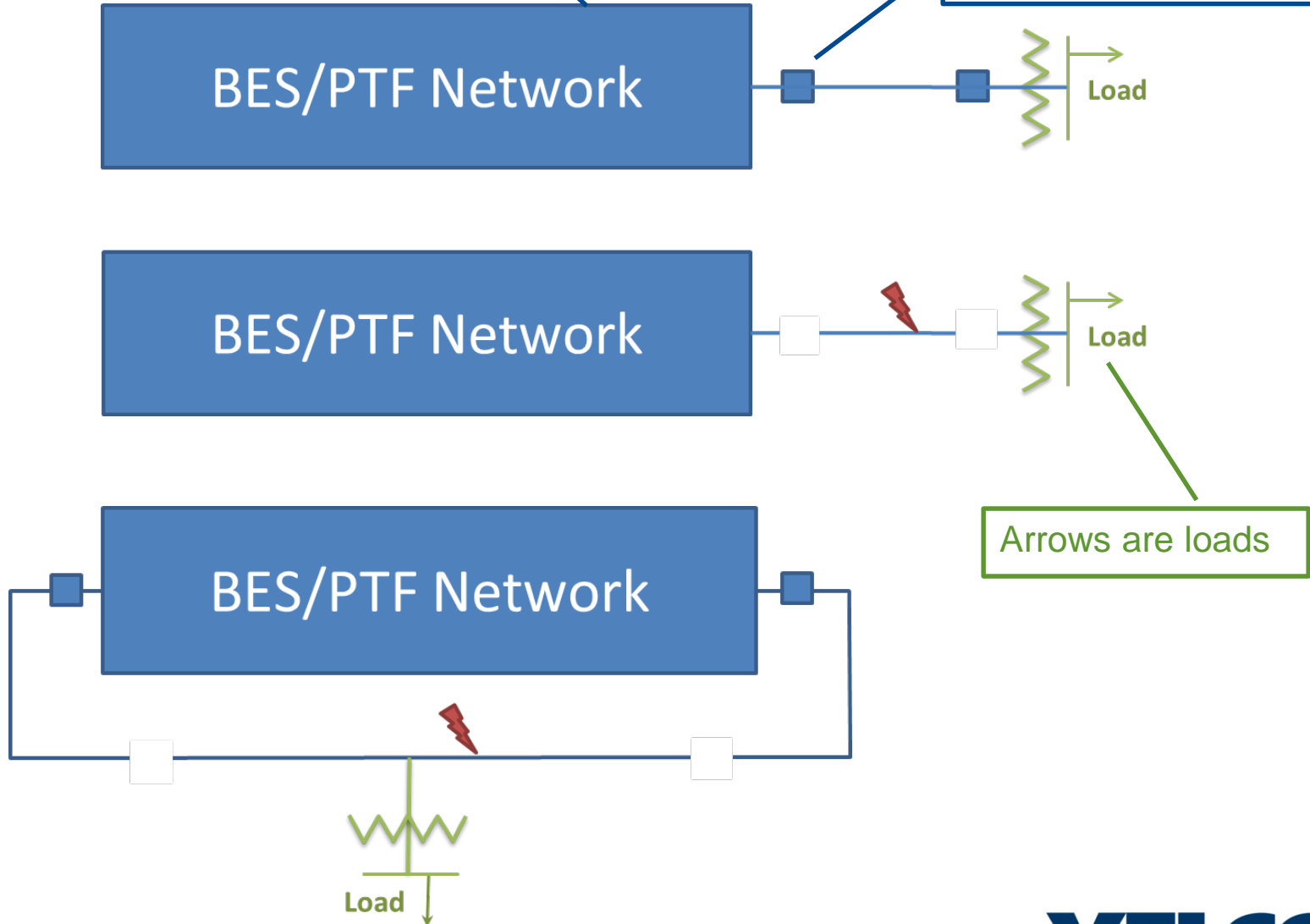
The BES definition also contains several Inclusions and Exclusions.

- **Pool Transmission Facility (PTF):** Networked transmission facilities owned by Participant Transmission Owners
Generally 115 kV and above with some grand-fathered 69 kV facilities and several exclusions, such as merchant facilities, public policy facilities, and so on
- **Consequential Load loss:** All Load that is no longer served by the Transmission System as a result of Transmission Facilities being removed from service by a Protection System operation designed to isolate the fault
- **Non Consequential Load Loss:** Non-Interruptible Load loss that does not include: (1) Consequential Load Loss, (2) the response of voltage sensitive Load, or (3) Load that is disconnected from the System by end-user equipment

Examples of consequential load loss N-1

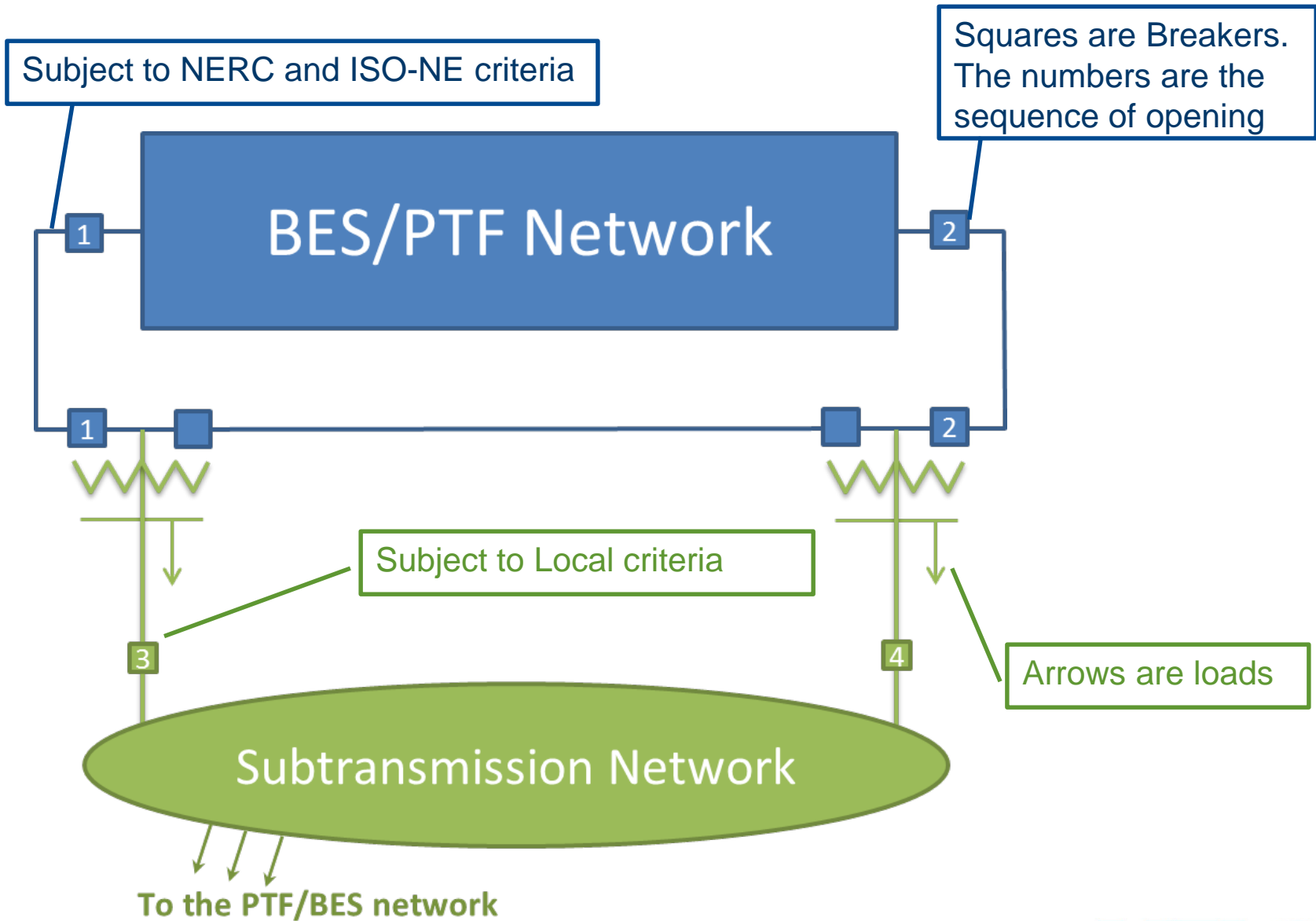
Subject to NERC and ISO-NE criteria

Squares are Breakers.

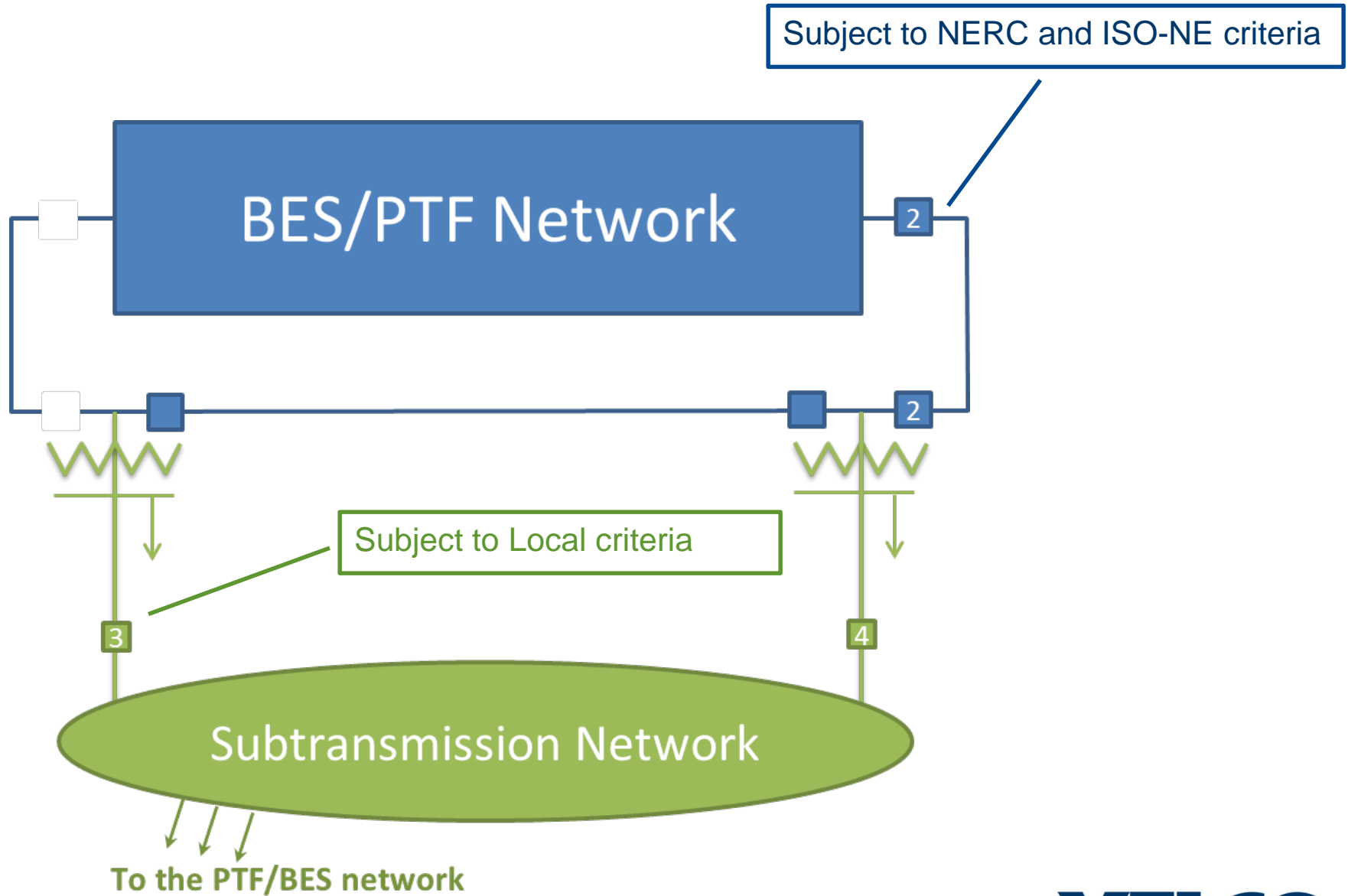


Arrows are loads

Examples of consequential load loss N-1-1

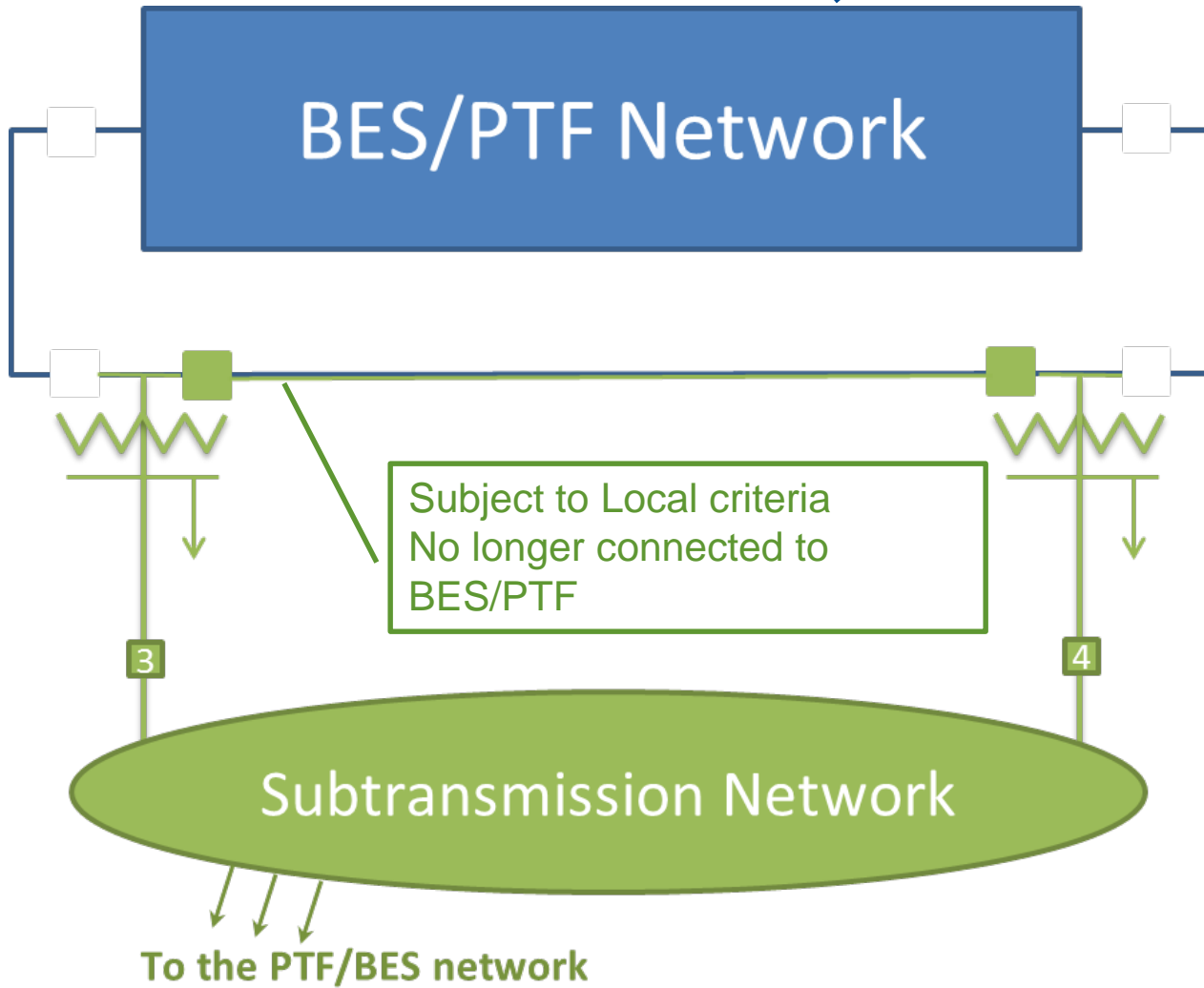


Examples of consequential load loss N-1-1



Examples of consequential load loss N-1-1

Subject to NERC and ISO-NE criteria

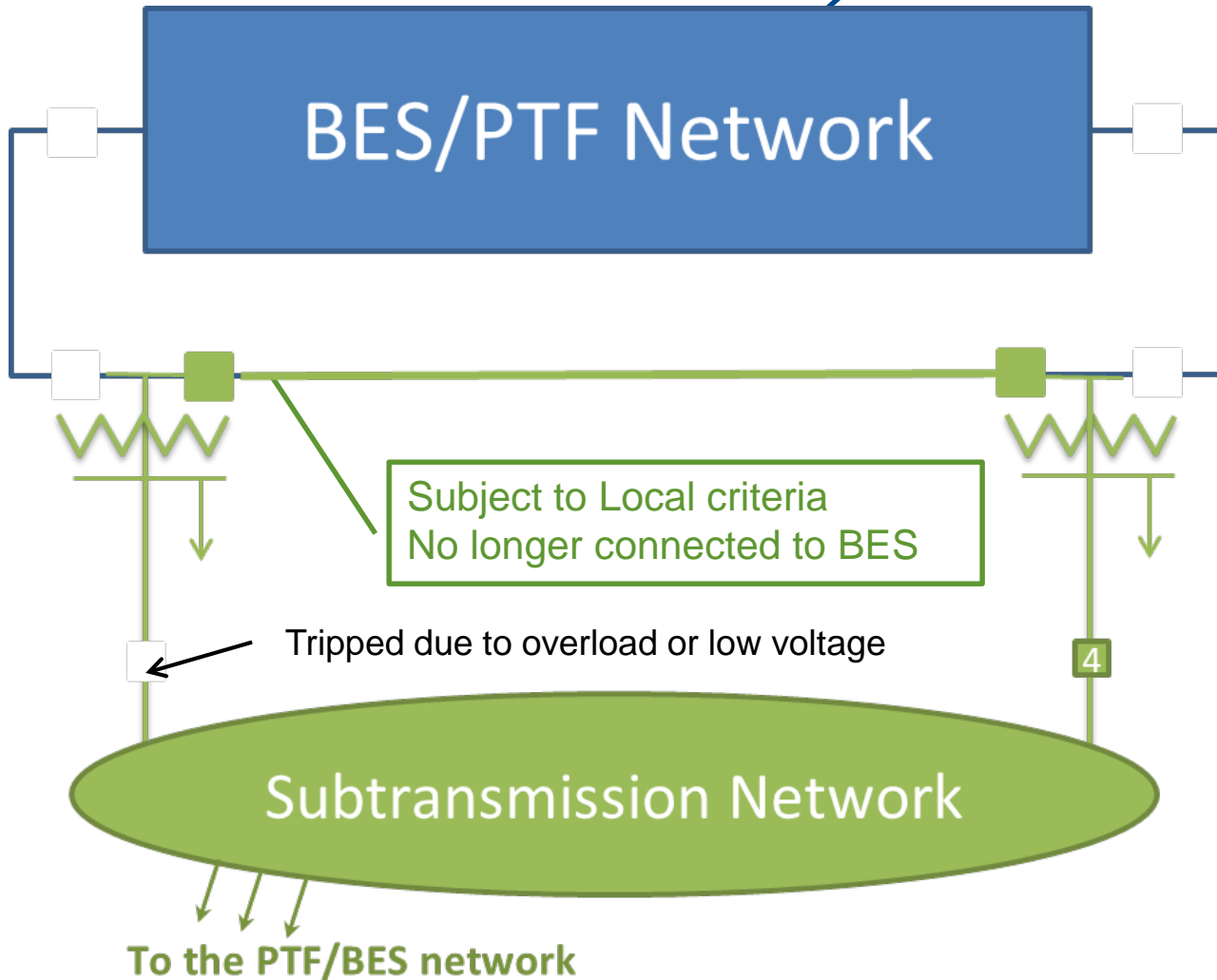


Subtransmission Network

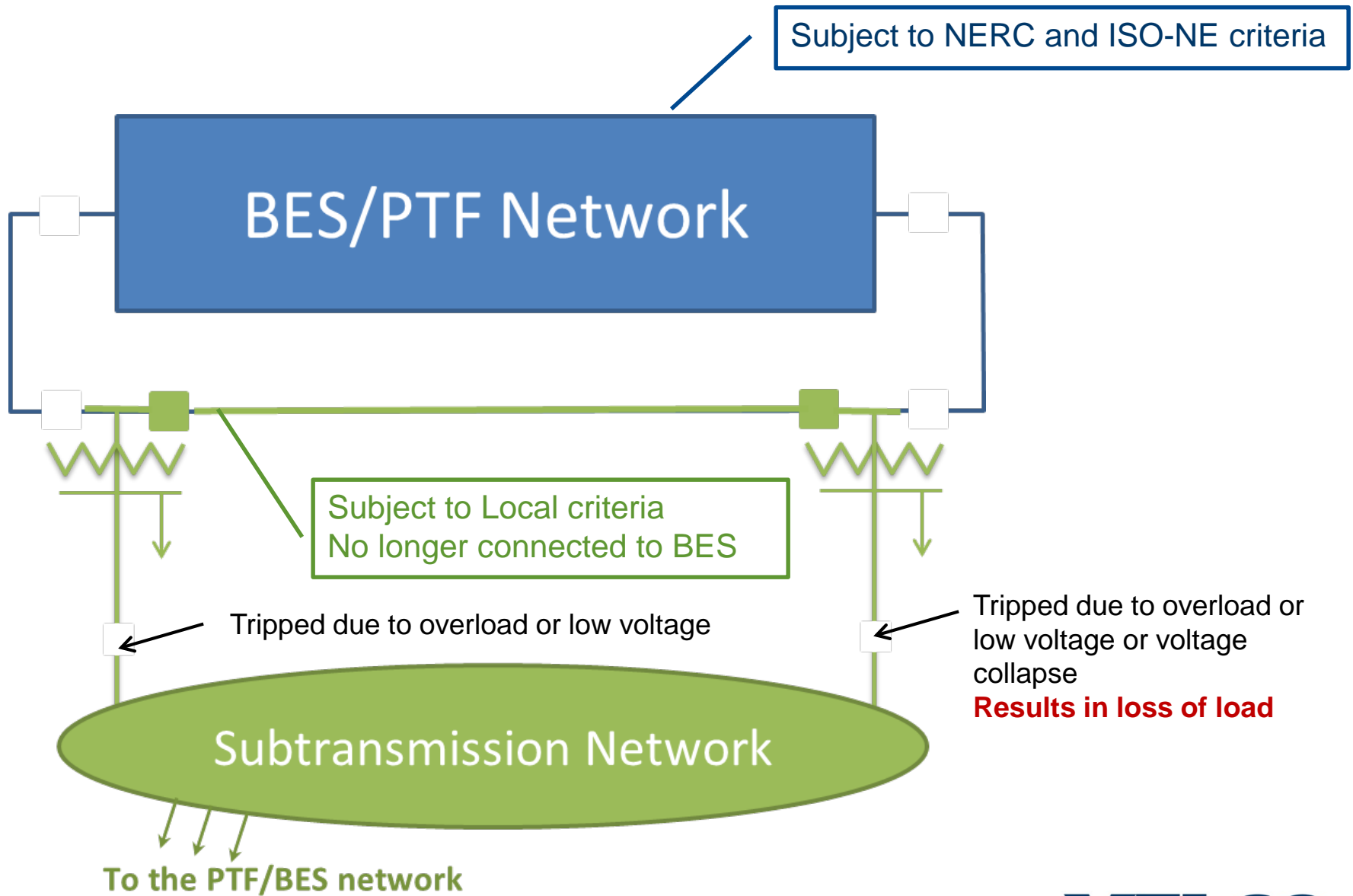
To the PTF/BES network

Examples of consequential load loss N-1-1

Subject to NERC and ISO-NE criteria



Examples of consequential load loss N-1-1



How NERC and ISO-NE criteria are applied

- NERC criteria establish performance requirements for the BES
- ISO-NE criteria are applied to the PTF and supplement NERC and NPCC criteria
 - PTF is mostly used to allocate regional/local costs
 - Utilities can mitigate loss of load concerns at their cost when ISO-NE determines that costs should be localized

NERC Load interruption requirements

- Consequential load loss is acceptable for all events
- Non-consequential load loss is also acceptable except where noted below

Category	Description	BES Level	Non-Consequential Load Loss allowed
P0	No contingency	All	No
P1	Single element	All	No, footnote 12
P2	Line open without a fault	All	No, footnote 12
	Bus fault	EHV	No
	Internal Breaker fault	EHV	No
P3	Multi-element contingency generation outage plus a single element outage	All	No, footnote 12
P4	Multi-element contingency caused by a breaker failure	EHV	No
P5	Multi-element contingency caused by a relay failure	EHV	No

NERC Footnote 12 under Table of the TPL-001-4 standard

12. An objective of the planning process is to minimize the likelihood and magnitude of Non-Consequential Load Loss following planning events. In limited circumstances, **Non-Consequential Load Loss may be needed throughout the planning horizon to ensure that BES performance requirements are met.** However, when Non-Consequential Load Loss is utilized under footnote 12 within the Near-Term Transmission Planning Horizon to address BES performance requirements, **such interruption is limited to circumstances where the Non-Consequential Load Loss meets the conditions shown in Attachment 1. In no case can the planned Non-Consequential Load Loss under footnote 12 exceed 75 MW for US registered entities.** The amount of planned Non-Consequential Load Loss for a non-US Registered Entity should be implemented in a manner that is consistent with, or under the direction of, the applicable governmental authority or its agency in the non-US jurisdiction.

Attachment 1 of the TPL-001-4 standard

- Attachment 1 outlines a stakeholder process to ensure that the use of non-consequential load loss is reviewed with the affected stakeholders including regulatory bodies
 - Specifies process requirements similar to Vermont stakeholder engagement process
 - Meetings are open
 - Notice in advance of meetings
 - Information about the proposed non-consequential load loss
 - Procedure for submitting questions or concerns and receiving responses
 - A dispute resolution process

ISO-NE treatment of load loss

- ISO New England presented Draft Load Interruption Guidelines to the Reliability Committee on November 17, 2010 and later sent Guidelines to the PAC and the Reliability Committee on December 1, 2011 for comment [http://www.iso-ne.com/static-assets/documents/committees/comm_wkgrps/prtcpnts_comm/pac/reports/2011/load_interruption.pdf]
- ISO New England later circulated draft study in 2012 – “*Overview of Consequential Load Interruption in New England*” to establish a high-level benchmark of the magnitude and number of consequential load shedding in New England and ultimately established recommended thresholds based on the study and presented in 2013 to the ISO/TO Executive Committee – “*ISO-NE Planning Technical Guide-Load Interruption Guide*”

ISO-NE Load Interruption Thresholds Considered for Regional Need

Comparison of ISO Max. Load Interruption Recommendations ^{1,3}		
Description	Consequential ⁶	Non-Consequential ² + Consequential
	ISO-NE	ISO-NE
N-1 single-element (line, transformer, or generator)	100 MW	NC not Allowed
N-1 multiple-element (bus section, breaker failure, or DCT)	300 MW	NC not Allowed
N-1-1 single-element / single-element	300 MW	300 MW
N-1-1 single-element / multiple-element	500 MW ⁵	500 MW

Table Notes:

1) ISO-NE Presentation dated 11/17/2010:

http://www.iso-ne.com/static-assets/documents/committees/comm_wkgrps/prtcpnts_comm/pac/reports/2011/load_interruption.pdf

2) Reference Non-consequential Load Interruption Restrictions in 2010 ISO presentation (slide 8).

3) Cascading Load Loss including voltage collapse is **not allowed**.

4) For NERC TPL P3 events non-Consequential load loss is not allowed (Table 1)

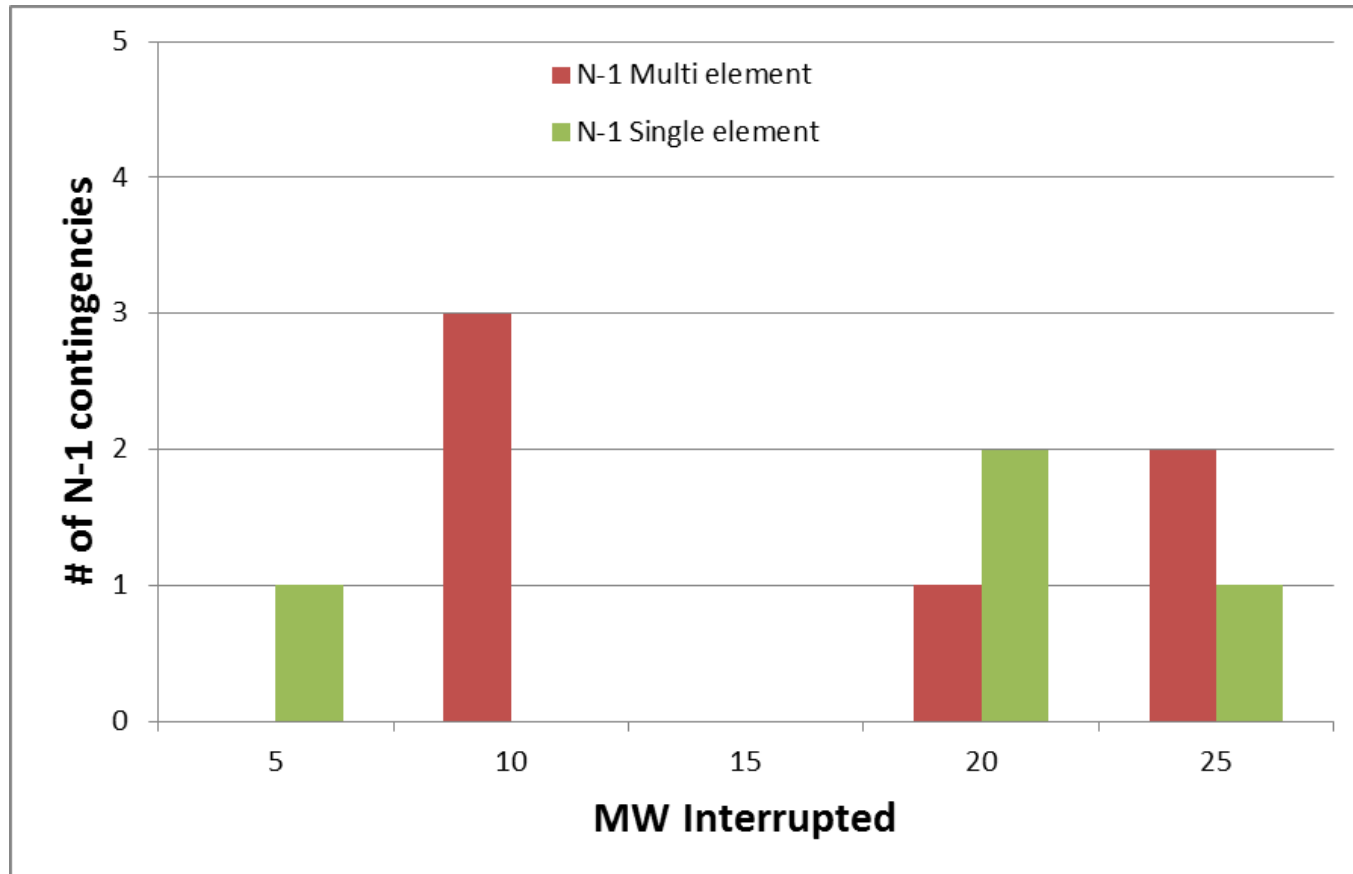
5) ISO-NE Consequential Limit for N-1-1 single-element/multiple-element from 2013 presentation "ISO-NE Planning Technical Guide- Load Interruption Guide".

6) All Consequential Load Interruption Levels are based on 90/10 load levels



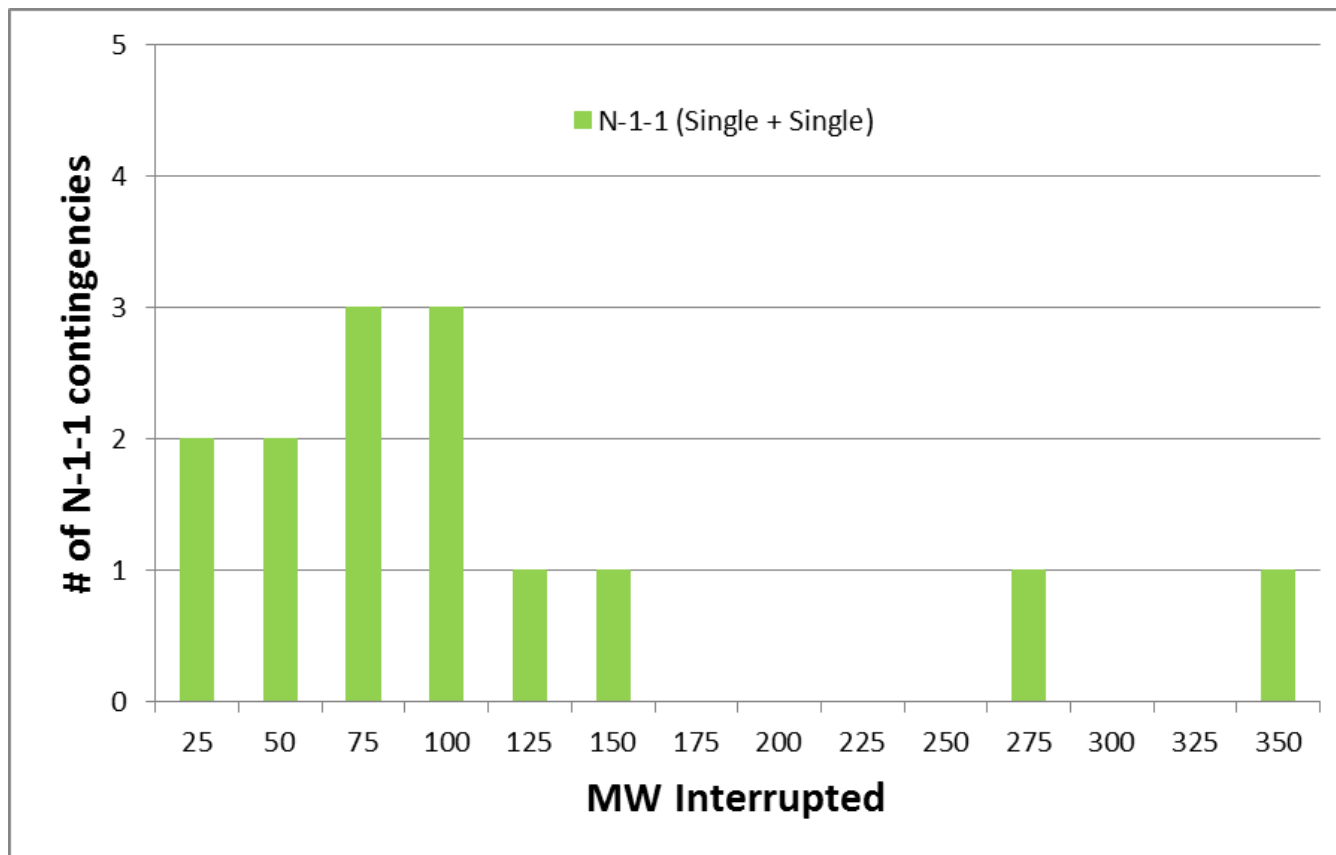
VELCO's Analysis

- Studied N-1 single-element and multi-element contingencies and quantified amount of load interrupted



VELCO's Analysis Continued

- Studied N-1-1 single-element and single-element contingencies and quantified amount of load interrupted



VELCO is in compliance with NERC and ISO-NE standards

- VELCO has not used non-consequential load loss to meet NERC performance standards
 - Loss of load is allowed for some contingency events
- Islanded parts of the BES/PTF network do not require upgrades
- Loss of load due to subtransmission system failures is considered consequential loss of load
- Loss of load greater than 300 MW is currently being mitigated by the Connecticut River project
- No mitigation proposed for losses of load less than 300 MW

