

Resilience Framework DOE Whitepaper

vermont electric power company



IEEE PES

Industry Technical
Leadership Committee

Background

- DOE has a MOU with IEEE PES
- They have worked together on technical issues through the Industry Technical Leadership Committee which Chris Root is a member
- DOE was looking for technical non-commercial input on resiliency and where to go in the future
- 11 industry experts wrote this whitepaper for DOE, Chris was the final reviewer
- It is a public document and on the IEEE PES Technical Resource Center

Highlights

- Reliability and Resilience are related but different
- There is not one definition of resilience
- Paper addresses natural disasters, space impacts, EMP, cyber and physical impacts
- Gives definitions, context, potential mitigation measures and has several utility examples
- Makes some suggestions on some regional metrics for resilience
- Identifies some areas of future research

Resilience vs Reliability

- Reliability

- NERC definition is about

- Adequacy- ability to meet demand
 - Operational reliability-ability of the electric system to withstand sudden disturbances such as short circuits or unanticipated loss of components
 - Measured in SAIDI, CIADI and SAIFI

- Resiliency

- FERC definition-The ability to withstand and reduce the magnitude and/or duration of disruptive events, which includes the capability to anticipate, absorb, adapt to, and/or rapidly recover from such an event

Elements of Resiliency

- NERC's view
 - **Pre-disturbance resilient state**
 - **PHASE 1-** Disturbance progress (event happening)
 - **PHASE 2-** Post Disturbance degraded state- (assessment and response stage)
 - **PHASE 3-** Restoration Stage- (getting customers back on)
 - **Post restoration state**
- **Pre- and Post- event conditions may not be the same**

Framework to Enhance Resilience

- Prevention
- Protection
- Mitigation
- Response
- Recovery

Resilience Metrics

- Storm Resilience
 - Speed of recovery during the first 12 hours of a storm from customers without power (IEEE Draft)
- Non-Storm (gray sky) focuses on robustness and the ability to withstand most normal weather and equipment events

New and Emerging Technologies

- Integrated T&D planning with storage and DER's
- Real time monitoring on the distribution system
- Expansion of communications systems further into the distribution system.
- Data analytics and new tools for analysis
- Visibility of distribution system conditions from the transmission operators

Summary

- Good industry view of resilience
- Good examples at end of paper
- Would like to share this with VT regulators

ANY QUESTIONS or COMMENTS?