Have Mandatory Reliability Standards Improved Reliability?

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Taking Stock

Perspective on Panel Questions:

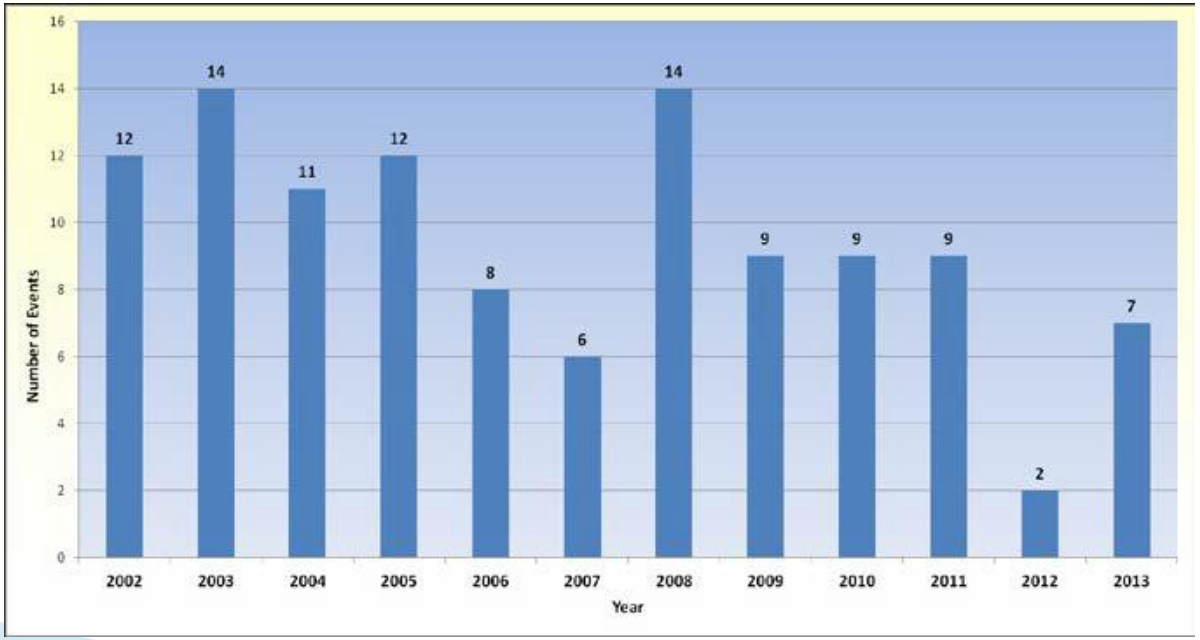
- Mandatory reliability standards have had little measurable impact on reliability.
- Load loss reduction, and its value, have been small.
- Relatively few outages can be avoided/reduced by reliability standards.
- Mandatory reliability standards are not "free." There are costs of infrastructure, and potential sub-optimal resource allocations.
- We should focus more on actual outage causes and work backwards, applying a true cost-benefit analysis.
- Low probability-high impact risks are exceptions and should be considered separately.

NERC's Improvement Claim

- NERC empirical claim for improved reliability:

"… the number of BPS transmission-related events resulting in loss of firm load, other than events caused by factors external to the transmission system's actual performance (*i.e.*, weather-initiated events), decreased from an average of ten per year over a ten year period (2002 – 2011) to seven in 2013." NERC Five-Year Performance Assessment, Docket RR14-5, 7-21-14, pages 2-3 (NERC measure similar to FERC measure in its Strategic Plan, 3-14, page 22).

- Data here:



Significance of the Reduction

- Assume, *arguendo*, NERC's claim of reducing annual non-weather transmission-related firm load loss events from 10 to 7.
- The average firm load loss per event is 1,200 MW and the average outage duration is 2.9 hours (NERC's State of Reliability 2014 report, Figures 4.2 and 4.3).
- So at 3 avoided outages per year, the annual reduction in outage MWh is 1,200 MW of average firm load loss x 2.9 hours of average outage x 3 avoided outages = 10,440 MWh.

The Value Proposition

- What is the value of a 10,440 MWh reduction in firm load loss?
- Applying a Commission-accepted Value of Lost Load (VOLL) of $3,500/MWh, the value of the avoided load loss is $36,540,000.
- By way of comparison, the annual budget for statutory functions for NERC and the Regional Entities is $184,777,000 (Docket RR14-6, Att. 1).
  - Compliance costs incurred by the Registered Entities presumably a multiple of this amount.

What More Could Be Accomplished?

- Eliminating all non-weather firm load losses in 2013 would be worth perhaps only $85 million (7 outages x 1,200/MW x 2.9/hours x $3,500 VOLL).
- And most circuit outages are beyond the influence of standards:

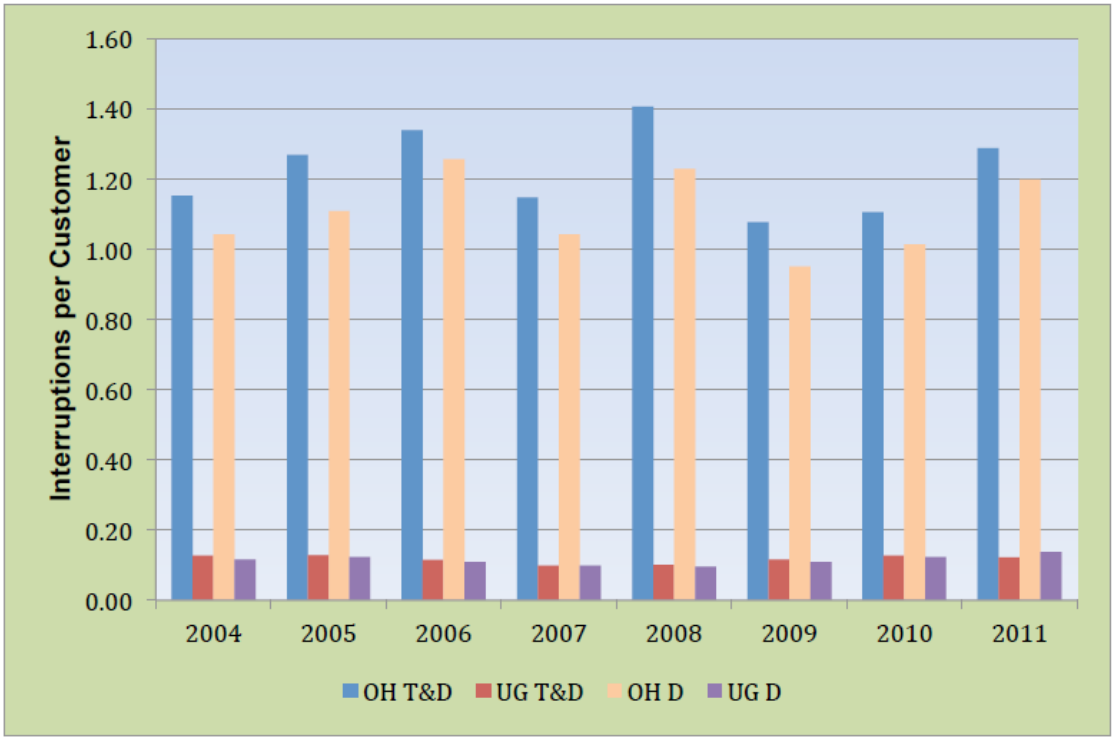
Table 3.1: TADS Outage Events by ICC (2009–2013)

Initiating Cause Code	2009	2010	2011	2012	2013
Lightning	789	741	822	852	814
Unknown	673	821	782	710	712
Weather Excluding Lightning	534	673	539	446	434
Human Error	291	305	291	307	280
Failed AC Circuit Equipment	257	277	306	261	248
Failed AC Substation Equipment	266	238	289	248	192
Failed Protection System Equipment	229	234	234	226	188
Foreign Interference	199	173	170	170	181
Contamination	96	145	132	160	152
Power System Condition	112	74	121	77	109
Fire	92	84	63	106	130
Other	107	84	91	104	64
Vegetation	29	27	44	43	36
Vandalism, Terrorism, or Malicious Acts	4	6	5	10	9
Environmental	5	11	5	4	8
Failed AC/DC Terminal Equipment	1	2	0	0	0
All TADS Events	**3705**	**3917**	**3934**	**3753**	**3557**

Transmission Outages Swamped by Distribution Outages

- Not only are transmission circuit outages largely beyond the influence of reliability standards, but the vast bulk of all service interruptions arise on the distribution -- not transmission -- system.
- EEI data:

Figure 3.3 System Average Interruption Frequency Index



Sub-Optimal Resource Allocations; Reliability Incentives

- With mandatory standards, Registered Entities:
  - Have less discretion to focus on one reliability risk versus another.
  - May devote excessive resources to transmission-level risks relative to distribution-level risks.
  - May take operational risks to avoid smaller outages.
- Registered Entities have reliability incentives independent of mandatory standards:
  - Regulatory sanctions for outages.
  - Utility personnel must "eat their own cooking" – more so than any other industry.

Why Such Imbalance in Benefits Relative to Costs/Risks?

- Standard development and compliance have not focused on cost-benefit analysis.
- There is no projection of avoided load loss from a potential standard, or relating value of avoided load loss against costs/risks of a standard.
- NERC "Cost Effective Analysis Process" is flawed.
  - Need for standard is assumed; only question is whether standard as drafted is reasonable given assumed need.
  - *E.g.,* CEAP Project 2007-11 report, 4-9-14, page 7: Standard approved despite industry view of "…little incremental reliability benefit from the standard…."
- No validation of pervasive audit approach versus, *e.g.,* self-certifications and random audits.

Conclusions

- Any load loss reduction value from mandatory reliability standards has been small, and any future incremental value of mandatory reliability standards also would be small.
- The major causes of transmission-related outages are beyond the influence of standards.
- The major causes of outages are at the distribution level, not the transmission level.
- Mandatory reliability standards involve costs and sub-optimal resource allocations.
- True cost-benefit analysis is warranted.

Exception: Low Probability-High Impact Risks

- By their nature, such risks cannot be adequately assessed by their frequency in causing past outages.
- Possible catastrophic load loss.
- Need to consider separately but also should keep in perspective: There has been no reported load loss from a cyber, geomagnetic disturbance, or physical security event.

Thank you.