RESILIENCE FOR "BLACK SKY" DAYS:
KEY ISSUES AND NEXT STEPS

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Bottom Line Up Front

- PUCs and utilities are making great progress in strengthening resilience against Sandy-scale events
- My focus today: events worse than Sandy ("Black Sky Days"), which will:
  - Present extraordinary problems for public safety and power restoration
  - Create new challenges for commissioners in determining which investments are prudent and cost-effective
- SAIDI, SAIFI and other reliability metrics offer the foundation for progress, but fall short of what we need to assess and strengthen resilience for Black Sky Days
  - Informal dialogue and consensus-building between PUCs, utilities and other stakeholders offers a uniquely valuable means to fill this gap

My Background/Biases

- Assistant Secretary of Defense for Homeland Defense, 2009-2013
- Responsible for Missions Assurance ("DoD's resilience")
  - DoD depends on the grid for over 95% of its electricity needs
  - NARUC is a vital partner for national defense
- Helped lead DOD's response to Superstorm Sandy
  - ***Harsh*** lessons learned for power restoration

Sandy as the Starting Point

- Sandy has spurred terrific improvements in disaster preparedness, including power restoration planning
  - This progress is critically important, yet insufficient
- FEMA Administrator Fugate: “We need to understand that as bad as Sandy was, that may not be the benchmark that we need to limit ourselves to. There are threats and potential disasters that could be even larger.”
  - Natural and manmade hazards

Implications for Defining Resilience

- PPD 21: “the ability to prepare for and adapt to changing conditions and withstand and recover rapidly from disruptions,” including deliberate attacks, accidents or naturally occurring incidents.”

- An even better starting point for post-Sandy grid resilience: the definition in NARUC’s *Resilience in Regulated Utilities* (November, 2013):

“Robustness and recovery characteristic of utility infrastructure and operations, which avoid or minimize interruptions of service during an **extraordinary or hazardous event.”**

My Focus: Black Sky Days

- Black Sky Days are extraordinary and hazardous catastrophes utterly unlike the blue sky days during which utilities typically operate

- BSDs pose resilience challenges above and beyond those of Sandy, the Derecho Storms of 2012, or other recent major Outage Events

  - Severe threats to public health and safety (and intense political pressures!)
  - Cascading failures of critical infrastructure will create unprecedented problems for power restoration

- Options that Commissioners and staffs may want to consider (many PUCs are already doing):

  - Informal dialogue with utilities on new analytic efforts and assessment tools
  - Deeper collaboration with State emergency managers

What are Prudent, Cost-Effective Investments against Black Sky Days?

- The Interruption Cost Estimate (ICE Calculator): excellent for what it does, but "not meant to be applied to major outages or blackouts longer than 8 hours."

- Challenges for supplementing ICE and other existing CBA tools:
  - Estimating the value of lost load during a long term event
  - Assessing the value of lost load from a customer perspective
  - Differentiating the value of the lost load across different types of customers (rate design and rate spread issues)
  - Accounting for the difficulty of predicting Black Sky events

- Resilience vs traditional rate-making principles
  - "Known and measurable?"
  - "Used and useful" for electric service?

Backup Slide 1: N-20 (versus N-1)

- Reliability modeling does not account for enough physical (or cyber) damage to critical components
  - Substations, HVTs, transmission lines, etc.
  - Adequate redundancy and other reliability solutions for normal disasters will likely fall short in catastrophes
- Network analysis and other methodological tools: from reliability to resilience

Backup Slide 2:
Accounting for Cascading Infrastructure Failure

- The paradox for resilience: the sectors most vital to support power restoration will themselves be severely disrupted, especially in a long-term, wide area outage
  - Communications
  - Transportation
  - Fuel for power generation
    - Black start and emergency power generators
    - Other generating capacity
  - Lifeline infrastructure
- The wild card: power restoration in a chemical or radiological environment
- Challenges for resilience metrics
  - What should we expect of electric utilities, and how should we measure it?
  - Opportunities for integrated, cross-utility resilience

Backup Slide 3: What Constitutes a Black Sky Outage?

- Total number of people who lost power
  - Sandy: 8-10 million
  - August 14, 2003 Blackout: 45 million in United States, 10 million in Canada
- Total number of States experiencing outages
  - Sandy: 17 States, as far west as Michigan (multiple FEMA Regions)
  - 2003 Blackout: 8 States and Ontario
- Outage Duration!!
  - Sandy: 13 days to restore power to 95% of customers
  - 2003 Blackout: 2 days
  - Katrina: After 25 days, only 75% of customers had their power restored before Rita struck and created additional outages