

Protecting the Nation's Energy Infrastructure Building a Resilient Grid

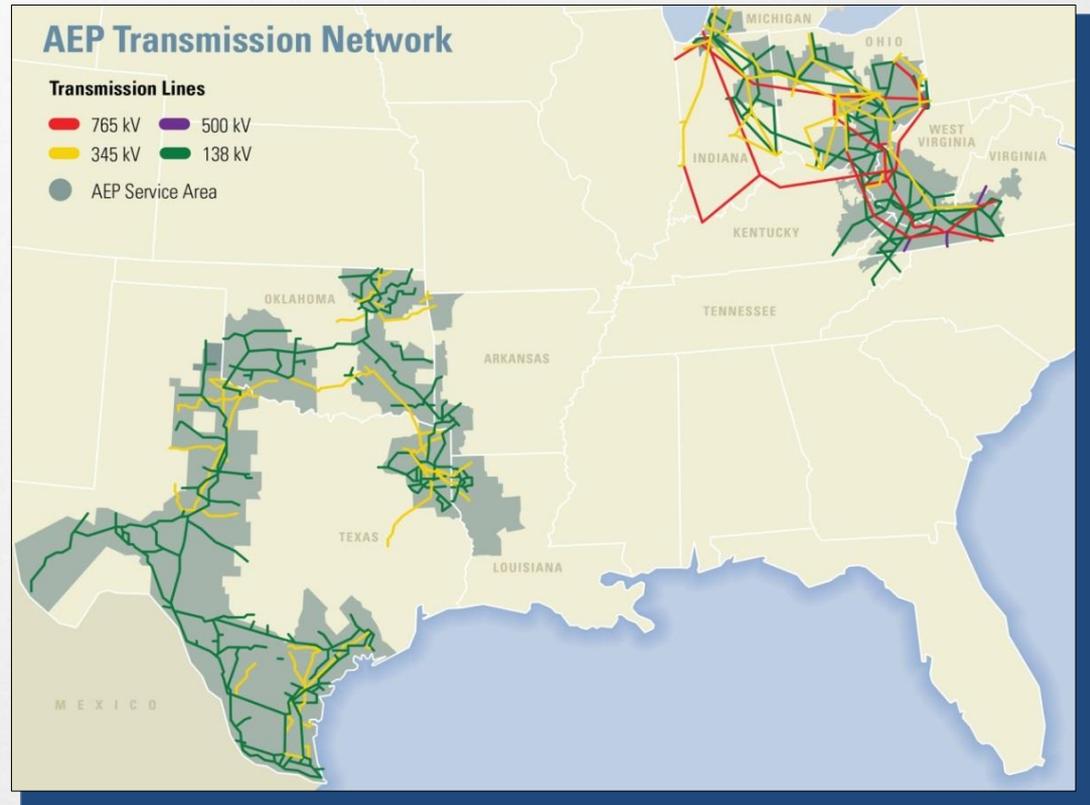
NCSL Legislative Summit
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Introduction to AEP Transmission

- Among largest electric utilities in the USA
 - > 5 million customers
 - > 250,000mi² service area in 11 states
 - > 39,000mi transmission
 - > 215,000m distribution
 - Four RTO/ISOs



We **power** life's possibilitiesSM



Resiliency – Definition?

Resiliency encompasses many things

- Presidential Policy Directive 21:
 - Prepare for/adapt to changing conditions
 - Withstand/rapidly recover from disruption: deliberate attack, accident, or naturally occurring threats or incidents
- Resilience, in context of critical infrastructure

The ability of a facility/asset to anticipate, resist, absorb, respond to, adapt to, and recover from a disturbance (Resilience: Theory and Applications, ANL, 2013)



No consensus yet on appropriate measures or metrics for grid resiliency

Resiliency is not Reliability

- Resiliency and Reliability are different things
- Reliability is a measure of service
 - High probability, low consequence
 - Not risk based
 - Deterministic – yes/no
 - Focuses on impact *to grid*
- Resiliency relates to risks & consequences
 - Low probability, high consequence
 - Risk based (resilient to something)
 - Confidence is specified (not yes/no)
 - Focuses on impact *beyond grid*



Risks Vary

- Threats vary by location
 - Natural disaster/severe weather, e.g., hurricane, tornado, derecho, ice, flood, wildfire, earthquake, pandemic
 - Space weather: geomagnetic storms
 - Human threats, e.g., cyber/physical attacks, electromagnetic pulse
- Vulnerabilities vary
 - System characteristics
 - Geographic & economic variations
- Consequences vary
 - Requires comprehensive analysis
 - Probability of consequence is a function of vulnerabilities & threats



Elements of AEP's Resiliency Strategy



Advancing U.S. Grid Resiliency with Strategic Sparing Service - Grid Assurance LLC



Need for Resiliency

- Superstorm Sandy in 2012 and physical attack on Metcalf Substation in 2013 highlight the need for grid resiliency measures
- Escalating concern by policymakers
 - FERC approves the NERC-developed CIP-014-1 (Physical Security) reliability standard and highlights importance of resiliency measures as component of physical security planning
 - DOE's April 2014 Transformer Report cites degree of customization, limited inventory, lack of transport, and reliance on overseas manufacturing as factors contributing to long lead time for spare large power transformers
 - DOE's April 2015 report on the Quadrennial Energy Review warned that "current programs to address the vulnerability may not be adequate to address the security and reliability concerns associated with simultaneous failures of multiple high-voltage transformers."
- Current industry efforts focus on coordination & communication
 - EEI STEP, SpareConnect, transformer database, & transport plan documentation

Grid Assurance LLC - Grid Resiliency Services

- Grid Assurance will provide grid resiliency services:
 - Optimized Inventory of Spares: Grid Assurance will own an inventory of spare grid equipment, such as transformers, circuit breakers, and other long lead time equipment, that will be optimized to backstop its subscribers' critical assets
 - Secure Warehousing of Spares: Spare equipment will be maintained domestically at strategically located, secure regional warehouses
 - Release of Spare Inventory Following Qualifying Event: Subscribers will have right to call upon spare equipment following a “qualifying event” (broadly defined to include coordinated physical attack, electromagnetic pulse, solar storm, severe weather event, earthquake, cyber attack, *etc.*). Grid Assurance will offer deployment logistics support and may provide optional delivery service.



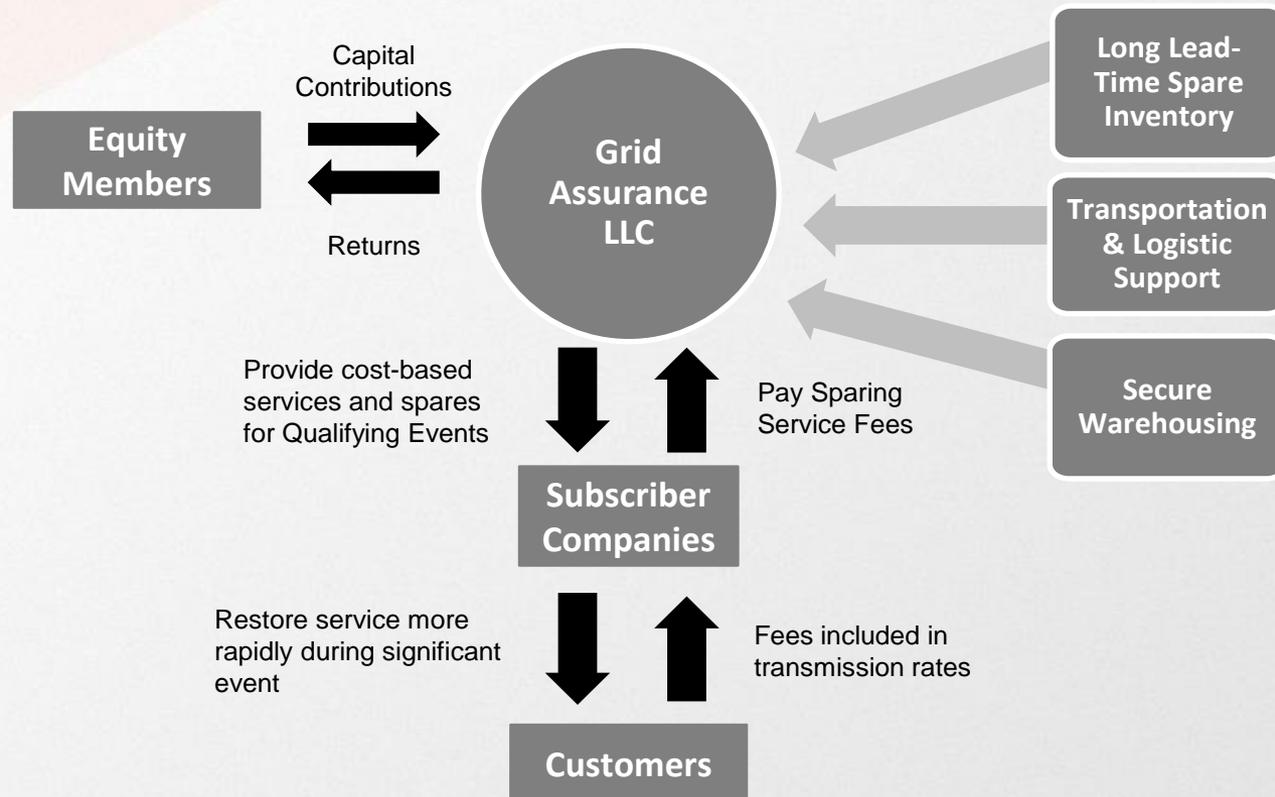
Relationship with Subscribers

- Subscribers of Grid Assurance will be transmission-owning utilities
- All subscribers will execute a standard subscriber agreement with Grid Assurance that will contain terms and conditions of sparing services provided
- Cost-based fee structure:
 - Subscription Fee: Subscriber will pay an allocated share of Grid Assurance's costs, which will be updated through a formula.
 - Equipment Purchase: Subscriber that calls upon inventory will purchase the asset at the original cost paid by Grid Assurance.



Grid Assurance Overview

- Provide transmission owners a cost-effective solution to improve resiliency of the bulk electric system.
 - This is achieved through expedited access to long lead-time equipment inventory.
 - Grid Assurance will maintain a large-scale, optimized inventory of critical equipment at secure warehouses that can be readily deployed after a Qualifying Event.



Grid Assurance Services

Optimized Inventory

- Subscribers will participate in **pools of inventory applicable to** their systems
- Level of **inventory will be optimized** to lower Subscriber costs
- Inventory will be **actively managed** to mitigate risk of obsolescence
- **Warranties that are transferable** to Subscribers with the appropriate length, costs and terms

Secure Warehousing

- Secure, cost-effective storage that is away from Protected Equipment
- Strategic, geographically diverse locations

Transportation & Logistics Support

- Create and maintain **pre-determined logistics plans** to reduce deployment time
- Coordinate/facilitate **transportation capabilities**
- May **own or lease equipment and vehicles** that could be available to transport inventory
- Optional delivery services may be provided on a fee basis

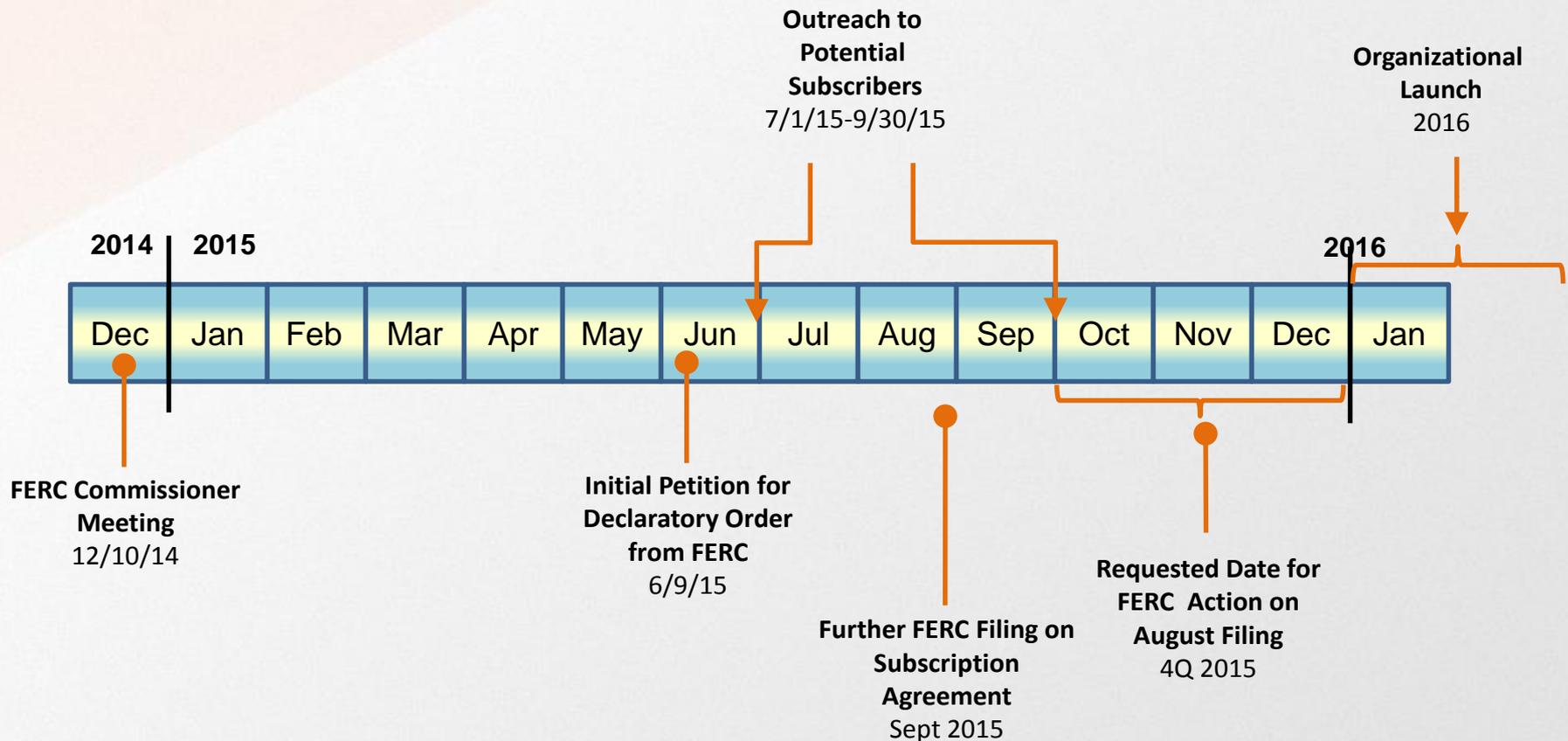
Petition to FERC for Declaratory Order

- Broader participation provides greater benefits
 - More robust inventory of spare equipment
 - More robust network of warehouses and supplier arrangements
 - Economies of scale and diversification will reduce subscriber fees
- To address potential regulatory uncertainties that could deter utility participation, Grid Assurance is seeking declarations on
 1. Use of Grid Assurance sparing service as a resiliency element of CIP-014-1 compliance, and
 2. Inapplicability of FPA 203 to transfers of unenergized spare equipment
- Grid Assurance also asks the Commission to acknowledge the resiliency benefits this type of industry-lead spare inventory initiative can provide.



Timeline

- The goal is to launch the Grid Assurance organization at the beginning of 2016. Several key milestones must be met to achieve this goal.



State Legislators

- Subscribers will seek necessary state approvals prior to proceeding with obtaining services from Grid Assurance
- Grid Assurance will demonstrate the value proposition to its subscribers prior to their commitment

Grid Resiliency is Multi-Faceted

- Existing transmission network arrangements are inherently resilient
 - Older assets more troublesome; modern practice applies lessons learned
 - Component hardening does not equal resiliency
 - A Common Misconception
 - Apply hardening selectively based upon *risks*
 - Focus effort (and money) in a prioritized manner
 - Resiliency framework encourages an overall system approach
 - Apply resiliency solutions to specific instances/systems
 - Requires analysis & modeling
 - Define goals & metrics
 - Analyze risk (vulnerabilities, threats, consequences)
 - Evaluate potential improvements
 - Tailored solutions needed; One size does not fit all
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