Innovations in Energy Resilience: New Approaches for States

- Moderator
 - Dan Lauf, Energy Program Director, NGA
- Speakers:
 - **Dr. Stephen Flynn**, Founding Director, Global Resilience Institute, Northeastern University
 - Tomás Rodríguez, Economic & Policy Analyst, Illinois Commerce Commission
 - David Meyer, Senior Advisor, Office of Electricity, U.S. Department of Energy





Concern: Natural Disasters and Resilience

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This map denotes the approximate location for each of the 14 separate billion-dollar weather and climate disasters that impacted the United States during 2018.

Source: NOAA National Centers for Environmental Information (NCEI) U.S. Billion-Dollar Weather and Climate Disasters (2019). https://www.ncdc.noaa.gov/billions/



How NGA Defines Resilience

Resilience is the ability to:

Withstand disasters better; Respond and recover more quickly; and Excel under new conditions



State Energy Risk Assessment & Planning Tool (SRAP Tool)

Self-assessment led by Governor's Offices, completed with input from other agencies and state officials.

Energy and infrastructure focus, with five sections:

- Establishing Effective Governance
- Evaluating Risk
- Assessing Vulnerabilities to Critical Infrastructure
- Mitigating Economic Consequences
- Strengthening Community Ties

Results include final score and qualitative results





Global Resilience Institute

at Northeastern University

The Resilience Imperative and the Energy Sector

Stephen E. Flynn, Ph.D. Professor and Founding Director <u>s.lynn@northeastern.edu</u>

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Why Resilience?

A hyper-connected world translates into a greater risk of cascading failures



SHIPPING ROUTES

GLOBAL ROADS

AIR NETWORKS

Internet of Things (IoT) 26 billion connected devices by 2020

Understanding the Interdependency Challenge



National Aeronautics and Space Administration. NASA Science News. Severe Space Weather - Social and Economic-

Impacts. June 2009 at http://science.nasa.gov/science-news/science-at-nasa/2009/21jan_severespaceweather/



Puerto Rico: Post-Hurricane Maria







More Consequential Disasters

The World Bank estimates \$300b - \$500b in annual worldwide economic losses



"Isaac's Storm" – 1900 Galveston Hurricane





- Deadliest natural disaster in U.S. history
- Cat 4 hurricane struck Galveston, TX on 9 Sep 1900
- Estimated 8,000 dead
- Every house in the city sustained damage, with at least 3,600 destroyed
- Because of the destruction of the bridges to the mainland and the telegraph lines, no word of the city's destruction was able to reach the mainland



CONNECTED DEVICES





- While connections often bring benefits, they also create dependencies and interdependencies.
- What used to be local shocks are increasingly likely to have far-reaching and costly consequences.









source:Forbes

CONNECTED CARS



millions

now

2020

253

CONNECTED LIGHTS millions

Infrastructure 22%

Home / Appliances 47%

source: Deutsche Bank Cisco

2020

SAP

informationisbeautiful.net

11111011 2014

source: Gartner, Forbes, Cisco, average

Sources: Forbes, Gartner, SAP. / https://informationisbeautiful.net/visualizations/the-internet-of-things-a-primer/

Resilience is a Competitive Advantage

People and companies that have a **choice**....

will choose to **live and invest in those communities and enterprises that are resilient** and

abandon those that are not



Resilience is the ability to prepare for and adapt to changing conditions and withstand and recover rapidly from disruptions. Resilience includes the ability to withstand and recover from deliberate attacks, accidents, or naturally occurring threats or incidents.

— U.S. Presidential Policy Directive 21 (2013)



Resilience in Practice . . .



The elevated house that the owners call the Sand Palace, on 36th Street in Mexico Beach, Fla., came through Hurricane Michael almost unscathed. Credit: Johnny Milano for The New York Times



An Island of Resilience . . .



Goldman Sachs Headquarters

200 West St. New York, NY



In a Sea of Fragility . . .

Goldman HQ is dry and has electric power, but . . .

No employees due to disruption of transportation system

Little ability to telecommute due to region wide power outages



Baking Resilience into Economic Development

- Blending development priorities with resilience imperatives
- Adapting codes and incentives to support innovative resilience designs



ABOVE: Rather than trying to prevent seawater from entering the city, this proposal welcomes the water and repurposes the outer streetscapes to a new urban seashore. <u>bostonplans.org</u> Led by Stephanie Goldberg AIA & Mark Reed AIA, Boston



Opportunity Zones

A historic opportunity for investing in pre-disaster mitigation, and advancing societal resilience on a national scale





Financing Resilience Solutions: Nationwide Opportunity Zones

North Dakota

South Dakota

Nebraska

Estimated \$6.1 trillion in unrealized equity capital

Explore the map: www.qoz.org/about

NGA

8,764

Opportunity

Zones

Opportunity Zones Overview

- The Opportunity Zones tax incentive will provide \$300b to \$500b in tax-advantaged private investment in low-income urban and rural communities nationwide.
- OpZones were established by Congress in the 2017 Tax Cut and Jobs Act by incorporating the bipartisan "Investing in Opportunities Act," co-sponsored by Tim Scott (R-SC) / Cory Booker (D-NJ).
- IRS Final Rules to governed "Qualified Opportunity Funds" issued on April 17, 2019
- On Dec 12, 2018, President Trump directed federal agencies to steer spending to Opportunity Zones.



If they hold the investment for at least ten years and up to 2047, they pay no taxes on the capital gains from that investment.





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at Northeastern University

Questions?

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The Need to Synthesize Our Knowledge About Enhancing Grid Resilience

NGA 2019 Energy Policy Institute

Minneapolis, MN

David Meyer

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Grid Reliability and Grid Resilience

All electric service outages

Working Definitions --

Reliability: "Maintain the delivery of electric services to customers in the face of routine uncertainty in operating conditions"

Resilience: "Ability to prepare for and adapt to changing conditions and withstand and recover rapidly from disruptions"

Source: GMLC (2017)

Reliability Events

- Short duration (less than 24 hours)
- Small footprint (fewer than 25,000(?) people affected)
- Minimal or no physical damage to electric system
- Low impacts on public

No clear boundary here, without broadlyaccepted metrics

Resilience Events*

- Duration more than 24 hours
- Larger footprint (more than 25,000(?) people affected)
- Significant physical damage to electric system, other infrastructure
- More severe impacts on public
- ⁶ Sometimes called "major" reliability events

Reality Check

- The electricity community knows much more about enhancing grid reliability – cost-effectively -- than it does about enhancing grid resilience.
- > We have been studying grid reliability for decades.
- We have developed an extensive body of codes, standards, "good practices," and rules of thumb – for grid reliability.
- Comparatively little such <u>distilled expert knowledge</u> exists today about grid resilience.

We need to develop it – and the need is urgent, because the threats to grid resilience are serious and growing. How can we best do that?



The Need for Synthesis

- Fortunately, the cupboard is not entirely bare. Much has been written about resilience in the past few years – but there is still little agreement about what we know and don't know.
- Analysts from several offices at DOE have formed a team we call the *Grid Resilience Group*, aided by experts from our national labs and from consulting firms.
- We are focusing on synthesizing resilience concepts and information, identifying and filling key gaps, and fabricating products and information that decisionmakers will use.
- But we can't do this alone to succeed, this synthesis will have to be pursued collaboratively and systematically by a broader community of analysts and users.



Current Resilience Group Projects -- 1

- Our core project is to develop and flesh out a conceptual framework that state and local officials can use to make decisions about how to improve grid resilience at the distribution level.
- We know we will have to loop on this version 1.0 is likely to be rather skeletal. But by doing that, we will learn what key gaps need to be filled, so that we and others can address them.
- We also know that we need to listen from the start to the prospective users -- i.e., people like you -- about what this tool should look like. We will create a diverse group of user-advisers.
- In parallel, we are pursuing several other projects (next slide) designed to aid and inform the development of the tool.



Current Resilience Group Projects -- 2

- On July 9, we published two RFIs to collect whatever is available now on resilience-related codes, standards, best practices, etc. We will probably issue some kind of summary or compendium of what is submitted. The RFIs will also help reveal key gaps that remain to be addressed.
- We are developing a Transmission Resilience Maturity Model (TRMM), jointly with EPRI and NATF, for use as a self-assessment tool by transmission owners. If this project goes well, we would like to turn to development of a similar model for owners of distribution facilities.
- We are preparing systematic case studies of recent major resilience events – six studies are in preparation now, and more will be added later.
- Additional projects will probably be initiated soon, to the limit of our resources.



Version 1.1

February 20

Comments? Questions?

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