

U.S. Department of Energy

**Quadrennial Energy Review
Technical Workshop on**

Resilience Metrics for Energy Transmission and Distribution Infrastructure

April, 29th, 2014

777 North Capitol St NE Ste 300, Washington, DC

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Quadrennial Energy Review
Technical Workshop
On**

Resilience Metrics for Energy Transmission and Distribution Infrastructure

Purpose

The purpose of this technical workshop, “Resilience Metrics for Energy Transmission and Distribution Infrastructure,” is to explore existing technical research and modeling on resilience metrics, discuss the applicability of existing metrics to energy infrastructure, and identify areas for further research and development of new metrics. The information shared at the technical workshop will feed into the analysis conducted by the U.S. Department of Energy (DOE) and other federal agencies for the purpose of preparing the Year One Quadrennial Energy Review (QER) Report.

To better inform analysis conducted for the QER, there is a need for greater clarity regarding definitions and metrics for energy sector “resilience.” Definitions for resilience differ according to which aspects of the energy system are being described, what outcomes are being addressed, and what time scales are being referenced.

This workshop will explore applying resilience definitions as they apply to different vulnerabilities (e.g., in the context of climate change, cyber, and physical attacks) and, in particular, related metrics that have been proposed or applied in each context. Presentations by expert participants will highlight the extent to which data are available to support decision-making for the metrics discussed as well as the quality of that data in terms of its geographic and temporal fidelity. Ultimately, output from this workshop will help define a set of metrics for use in quantitative and qualitative analyses of transmission, distribution, and storage infrastructure for the QER.

The technical workshop will bring together a diverse group of experts from industry, academia, and government to discuss how the DOE, serving as the QER Task Force Executive Secretariat, can best leverage its efforts and resources to enable existing research to inform QER analysis. In order to maintain a clear focus and maximize participation, the technical workshop will be used to tap participants’ diverse knowledge, expertise, and perspectives; distill themes and organizing concepts; and identify areas for further research.

The result of this workshop will lay the groundwork for policy analysis and future research and development programs within the federal government to achieve the goals of the QER, as outlined in the Presidential Memorandum of January 9, 2014. Outputs from this workshop are also intended to inform work of the Council on Climate Preparedness and Resilience and the Infrastructure Resilience Working Group.

Background

The initial focus for the QER will be our Nation's infrastructure for transporting, transmitting, storing and delivering energy. Elements of our current infrastructure are challenged by transformations in energy supply, markets, and patterns of end use; issues of aging and capacity; impacts of climate change; and cyber and physical threats.

Any vulnerability in this infrastructure may be exacerbated by the increasing interdependencies of energy systems with water, telecommunications, transportation, and emergency response systems. High quality infrastructure can spur economic growth, attract new businesses, and enable the development of business models and industries that are dependent on these underlying public goods. The first Quadrennial Energy Review Report will serve as a roadmap to help address these challenges and opportunities of our evolving energy system.

The DOE will take into account previous analytical work on the United States energy infrastructure as well as comments from industry, government and academia and private citizens. The public comments will inform the QER's efforts to outline specific sets and types of vulnerabilities and to define potential solutions to these vulnerabilities.

Technical Workshop Process

Unlike meetings consisting only of presentations, this technical workshop is intended to be a creative dialogue between DOE and participants to explore existing work on resilience metrics.

The following guidance is offered on the technical workshop process:

Prior to the Technical Workshop – Participants are asked to review the DOE background memorandum attached to this Game Plan. In addition to providing any materials that you think DOE should be made aware of, you should begin thinking about how your work on resilience metrics could be used to assess energy infrastructure within the context of the QER goals. DOE asks that you come prepared to answer the discussion questions contained within the agenda and to offer any research or information you believe is relevant to the QER process. Providing any materials in advance of the technical workshop is welcome and will be shared with other workshop participants.

During the Technical Workshop – During the workshop, invited speakers will present their views and recommendations to DOE. Other workshop participants will be encouraged to discuss what the speakers have presented as well as offer your own perspectives and recommendations to improving the resilience metrics to be used in the QER.

After the Technical Workshop – In the near term, the results of this workshop will be compiled in a draft report. The draft will be circulated to all participants who will have 2-3 weeks to provide comments. Longer term, the results of this workshop will guide DOE in the development of the first QER report.

Workshop Agenda

Time	Activity	April 29, 2014
8:30-9:00am	Registration	
9:00-9:15 am	Workshop Purpose <ul style="list-style-type: none"> • Welcome, Introductions, Purpose and Agenda <i>Karen Wayland, EPSA</i>	
9:15-10:15am (1.0 hour)	Energy System Resilience Metrics – Overview and Data Assessment <i>Discuss energy-sector resilience metrics that have been developed and are most commonly used; review data availability and data quality.</i> <ul style="list-style-type: none"> • RAND – Literature review and data assessment • Respondents – Questions <p>Discussion Questions:</p> <ul style="list-style-type: none"> • What resilience outcomes are you or your stakeholders most concerned about? • What are your or your stakeholders' needs for resilience metrics? <ul style="list-style-type: none"> ○ What analysis are you doing that must take resilience into account? In what context (risk assessment, investment analysis, etc.) How are you doing that? • Are existing metrics adequate from quantitative and qualitative standpoint? • What resilience metrics are currently codified in Federal or state regulations, and are they adequate? • What specific metrics should be considered? • How does federal government resolve major differences in application of resilience metrics for each vulnerability? 	
10:15 – 10:30 am	Break	
10:30 – 12:30 pm (2.0 hours)	Energy Infrastructure Resilience & the QER <ul style="list-style-type: none"> • Sandia – Structure and development of a resiliency metric framework • Sandia – The application of that framework in the development of energy sector specific metrics. • Respondents – Questions? 	

	<p>Discussion questions:</p> <ul style="list-style-type: none"> • What problems need to be solved? • What can't we do today that we should be able to do, in terms of measuring resilience? • What parts of existing energy resilience today are unacceptable to us? • Have we determined what the priority areas are for future work? If not, what are they? • What is needed to fill-in identified gaps, refine proto-type metrics and prepare for the 10-11 June Workshop? • For near-term QER analysis, how can we handle gaps in resilience metrics development – are there proxies or qualitative ways to consider resilience in areas where we don't yet have widely-accepted, quantitative metrics?
<p>12:30-1:30pm</p>	<p>Lunch (On Your Own)</p>
<p>1:30 – 3:00 pm (1.50 hours)</p>	<p>Sector Specific Metrics – Working session <i>Catalogue sector-specific metrics for electricity, oil and natural gas infrastructure; identify gaps and areas for improvement.</i></p> <p>Presentations from various industry representatives on sector-specific considerations and associated metrics:</p> <ul style="list-style-type: none"> • Presentations on existing research/metrics from Electricity Industry <ul style="list-style-type: none"> ○ Emanuel Bernabeu, PhD, Dominion Virginia Power ○ J. Mark Drexel, P.E., ConEdison • Presentations on existing research/metrics from Gas Industry <ul style="list-style-type: none"> ○ Anders Johnson, Kinder Morgan ○ Christina Sames, American Gas Association • Presentations on existing research/metrics from Oil Industry <ul style="list-style-type: none"> ○ Bernie Vaughan, Retired BP ○ Julia Phillips, Argonne National Lab <p>Discussion Questions:</p> <ul style="list-style-type: none"> • What are the associated metric(s) the federal government should use to measure progress towards achieving greater resilience? Is there any missing research or application of resilience

	metrics not already discussed that can be shared?
3:00- 3:30 pm <i>(30 mins)</i>	Wrap-Up/Review of Group Discussion: <ul style="list-style-type: none">• Discussion of next steps: <i>Karen Wayland, EPSA</i>
3:30 pm	Adjourn

Expected Outputs

The technical workshop on resilience metrics will provide DOE staff with significant information that will inform the critical analysis being conducted to write the first QER Report.

Key outputs from this technical workshop will include the following:

- Identify the types of energy-sector resilience metrics that have been developed and are most commonly used,
- Discuss and reach agreement on the adequacy of existing metrics, both quantitative and qualitative,
- Identify options for improved metrics, working towards the establishment of a common taxonomy for characterizing energy sector resilience, and
- Solicit input from participating experts on the above topics, and identify areas for further focus in preparation for the Stakeholders Workshop on 10-11 June

Principal participant roles:

- *RAND Corporation* will present initial findings from a review of the literature on resilience metrics, especially as that concept pertains to distribution, transmission, and storage segments of energy systems.
- *Sandia National Laboratories* will present their progress to-date on developing a long-term roadmap on resilience metrics for electric power, gas, and oil infrastructure and their proposed uses.

Location

The session will be held on be held April 29th, 2014 at:

Metropolitan Washington Council of Governments
777 North Capitol St NE Ste 300, Washington, DC 20002.

Contact Information

Technical Workshop Logistics:

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