



INFRASTRUCTURE: TED TALKS

THURSDAY: SESSION 2 TRACK 3

SESSION CHAIRS

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SESSION ABSTRACT

Risk as the Yardstick of Resilience

Stephen Unwin, Stephen D. Elliott, and Julia Rotondo, Pacific Northwest National Laboratory Hannah Rabinowitz, Department of Energy, and Alexandra Young (National Renewable Energy Laboratory)

As more attention is given to hazards and threats that impact the United States, federal agencies have begun to focus on increasing their resilience to these disruptive events. Infrastructure investments can be costly and federal agencies are already facing over \$180 billion in deferred maintenance costs. Investing in infrastructure, maintenance, and training can help increase resilience, but decision makers require a way to evaluate which investments will have the greatest impact. Quantified risk provides a leveled basis for direct comparisons of otherwise disparate factors, including elements of safety, business performance, and resilience. The U.S. Department of Energy's Federal Energy Management Program (FEMP) seeks to strengthen the ability of federal agencies to manage the resilience, efficiency and security of the energy and water systems that support their critical missions. Pacific Northwest National Laboratory, in partnership with the National Renewable Energy Laboratory, has supported FEMP in development of the web-based Technical Resilience Navigator (TRN). The TRN is a tool for the risk-informed prioritization of a site's resilience gaps as well as the risk-reduction assessment of potential resilience solutions. In this white paper we discuss the relationship between risk and resilience, provide a brief overview of the TRN capabilities, and describe FEMP's assistance of federal sites in use of the tool to pursue enhanced energy and water resilience.

Gas-Electric Model for Interdependent National Infrastructure (GEMINI)

Mike Nygaard, Lawrence Livermore National Laboratory

As the nation's electric power system continues to shift away from higher-emissions fuels, large amounts of gas-fired generating facilities continue to be built without sufficient assurance of reliable fuel delivery. Greater reliance on just-in-time fuels poses new challenges for the resilient, reliable, and secure operation of the electric grid. Nowhere in the country is this issue more apparent than in New England, where more than 50% of the region's electric generation is fueled by natural gas.

LLNL has developed a trans-shipment model to assess the impact of user-specified all-hazards contingency events on the pipeline system in New England. Using near-real time data scraped from pipeline electronic bulletin board websites, the model calculates the ability of the remaining pipeline system to deliver fuel to generators under a range of post-event flow scenarios. Using near-real time data



provides an operational view for analysts to simulate the pipeline system as it exists today, not as it would exist in the planning horizon.

The resulting fuel availability data from each of the post-disruption flow scenarios is passed to an electric loss of load probability (LOLP) simulator, where it is used to limit the dispatch of any generators that cannot get their full daily fuel supply. Simulating the ability of the region's generators to meet demand over the coming weeks provides analysts with a quantitative estimate of the increase in regional blackout risk stemming from the pipeline system contingency events.

Given the importance of natural gas as a fuel for home heating, a major source for electric power generation, and a feedstock for heavy industry, it is critically important to understand the near-term impacts of a major disruption to the gas pipeline system. The GEMINI model allows for rapid, operational identification of critical pipeline facilities to protect, and provides analysts with rapid impact forecasting abilities when responding to a crisis.

Using GIS to Integrate Community Profile Analysis, Critical Infrastructure Information, and Inundation Mapping to Support Consequence Analysis and Dam-Related Planning Activities

Molly E. Finster, Carmella Burdi, and Kyle Pfeiffer
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Dam incidents can occur without notice, as in the case of a catastrophic failure of a dam's infrastructure, or they can occur over time, such as overtopping from a sustained rainfall event. Jurisdictions have access to detailed data describing the potential reach and extent of flooding impacts resulting from various dam incidents, using modeling tools like DSS-WISE. Jurisdictions also need to understand the communities downstream of a dam to ensure effective emergency planning and informed decision making. Conducting a risk- and data-informed community analysis can help jurisdictions gain a greater understanding of the unique population characteristics and location features within their inundation area.

The use of GIS-based mapping to visualize a modeled inundation area, along with a broad range of population and community characteristics, such as demographics, economics, housing data, social factors, and critical infrastructure, provides an easily understandable tool for emergency planners and dam owners and operators. Presenting data together can help identify and explore areas of a community at greatest risk. Overlaying spatial-temporal inundation layers with critical infrastructure and community layers can provide a better understanding of how much time there is to make operational decisions or order protective actions.

Insights gained from integrating and analyzing inundation modeling, community, and infrastructure data together in a single GIS mapping product can help planners gain a better understanding of the consequences their community partners may face and establish context for assessing the potential impacts of an operational action or dam-related incident, which is critical to making modeling results actionable. The visual nature of this type of product can also facilitate communication with decision makers and support outreach to community partners.



NGTransient: A Hydraulic Pipeline and Optimal Control Model for Simulating Pipeline Disruptions and Impacts on Electric Power Generation

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Jordan Jalving and Victor Zavala, University of Wisconsin-Madison

Understanding and maintaining operational resilience in interstate natural gas transmission pipelines is crucial to maintaining gas delivery to operators of gas-fired electric generators. Transmission pipelines are subject to physical and regulatory constraints, along with financial constraints and obligations to customers. Gas pressures and flows at delivery points must be maintained at the required conditions of the plant to ensure continuous operation of electric generators. We present the NGTransient hydraulic pipeline model to estimate the impacts of gas pipeline disruptions on power generation using a model of dynamic flow and pressure.

Commercial Routing Assistance Tool: Enhancing Resilience through Route Restrictions Visualization
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According to the American Trucking Associations, when measured by weight, commercial trucks move 71% of nation's freight each year. From furniture to food, and medicine to medical supplies, most products American consumers or businesses purchase are delivered by one of the 3.5 million U.S. truck drivers. As the COVID-19 pandemic evolved, a patchwork of well-intentioned, state-level restrictions had emerged. They have impeded interstate commerce and the rapid delivery of critical food, medical and sanitation supplies. As truckers work to move products throughout the country, they are often confronted with closed rest areas, local curfews, and in some cases, 14-day quarantines. With the support of the Department of Homeland Security's (DHS) Cybersecurity and Infrastructure Security Agency (CISA), Idaho National Laboratory (INL) designed, developed, and deployed a capability for truckers and other commercial drivers in the U.S. to understand restrictions that they might encounter as they travel across the country. The Commercial Routing Assistance (CRA) tool merges coordinated and vetted data streams, plots multiple automated or custom routing options, and visualizes the wide variety of state regulations and actions that a driver would encounter along a route. With the CRA, commercial operators can plan vehicle movements across multiple states quickly, particularly during emergencies.