Sandia National Laboratories

Hydrogen, Fuel Cells, and Resiliency

Dr. Joseph Pratt

San Francisco Fleet Week 2015

Center for Humanitarian Assistance and Disaster Response

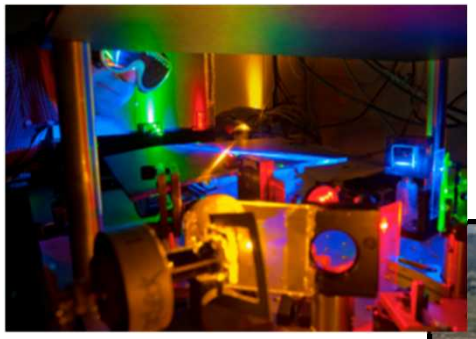
Senior Leader Seminar

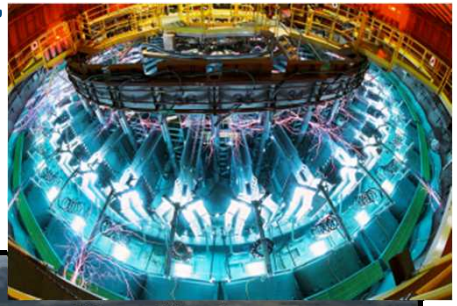
October 8, 2015

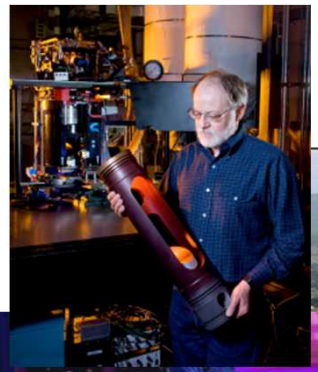
Sandia National Laboratories

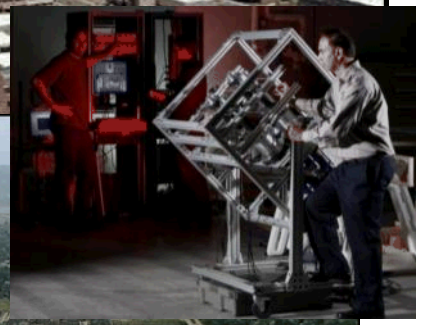
"Exceptional service in the national interest"

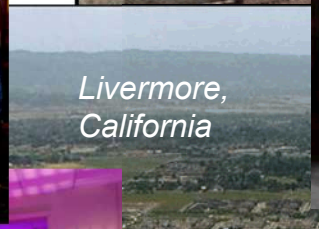
- Largest national lab in US
  - Department of Energy (DOE)
  - ~10,000 employees
  - ~$2.3 B/yr
- Missions
  - Energy and climate
  - Nuclear security engineering
  - Defense systems
  - Homeland security
- Locations
  - Albuquerque
  - Livermore
  - Also Nevada, Hawaii, DC











Technical depth in hydrogen and fuel cells enables impactful solutions

Sandia's Hydrogen and Fuel Cells Program R&D Areas

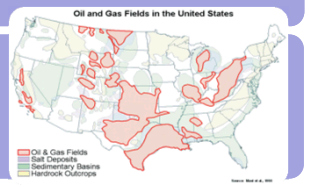
Hydrogen Effects in Materials, Components, and Systems

Fuel Cell Membranes

H2FIRST

Hydrogen Fueling Infrastructure Research and Station Technology

Geologic Storage Science and Technology

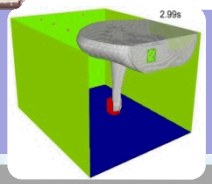


Storage materials synthesis and characterization

Thermochemical Hydrogen Production from Biomass

Solar/thermal hydrogen production

Market Transformation



HyRAM
HYDROGEN RISK ASSESSMENT MODELS

Quantitative Risk Assessments

Grid Integration and Infrastructure Resiliency

Dynamic Systems Analysis
High-performance Computing, Uncertainty Quantification

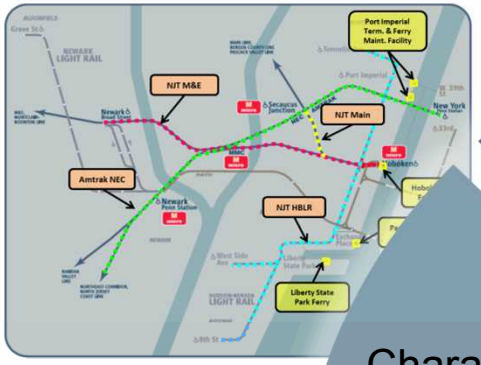
Public-private partnerships accelerate adoption of new technology

Fuel cell mobile light

Fuel cell port power

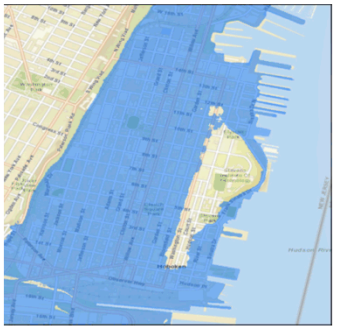
Reducing industry investment risk through targeted business case evaluation of actual use in new markets

Resiliency analysis maximizes resource effectiveness



Define System & Resilience Metrics

Define High Level Goals

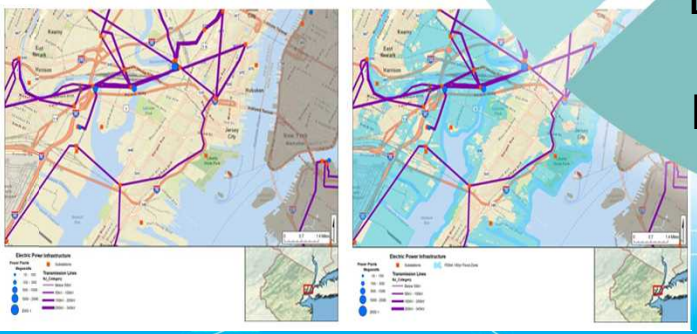


Characterize Threats

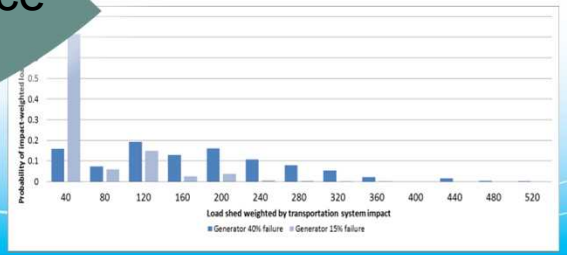
Define & Apply System Models

Evaluate Resilience Improvements

Determine Level of Disruption



Calculate Consequence



Hydrogen can enable resilient energy infrastructure

Transportation

H_2 to Trans.

Heat

Managed as an integrated energy system
H2 production and storage enables:

- Sustainability (clean energy)
- Resiliency
- Reliability
- Flexibility

Trans. to Power

Heat to H_2

Power

Power to H_2

Gas / H_2

Looking forward to more discussion…

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