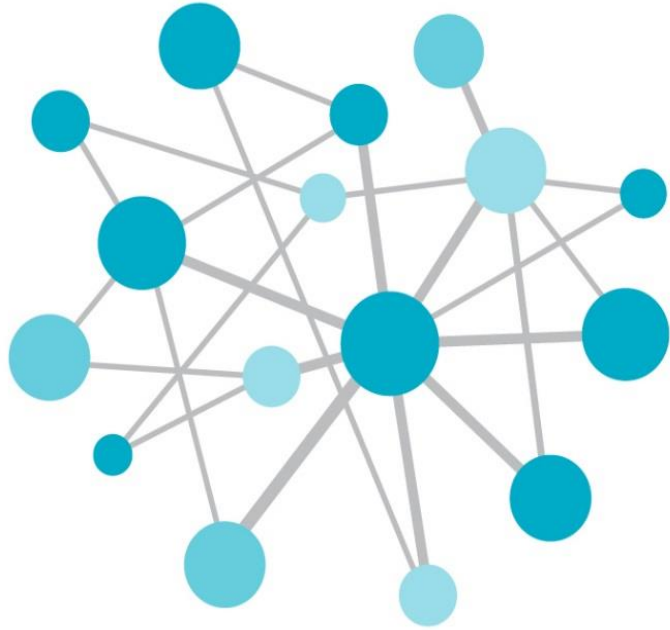




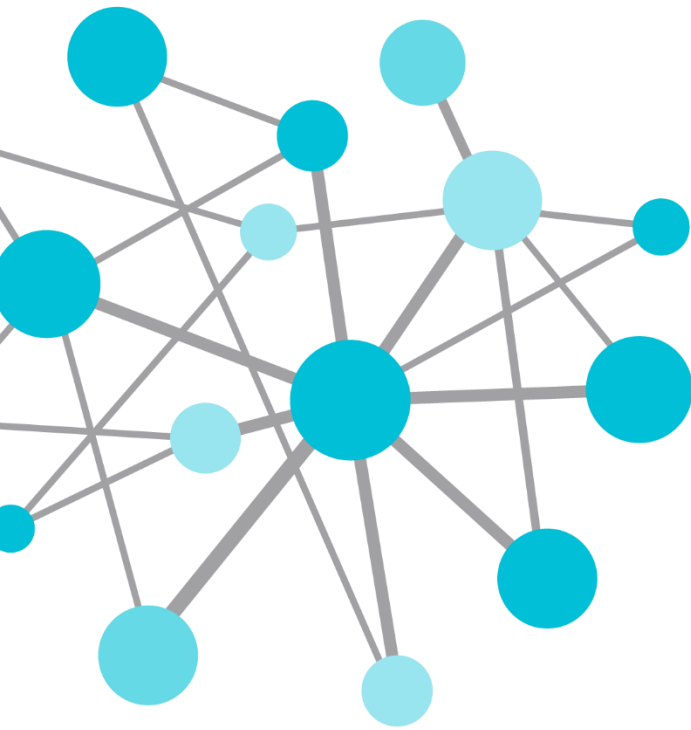
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October 29, 2014 - Washington, DC



Enhancing the Resilience of Critical Infrastructure: Analytical Insights from Real Time and Geospatial Data

Joe Adduci
Argonne National Laboratory
Global Security Sciences Division
Risk & Infrastructure Science Center

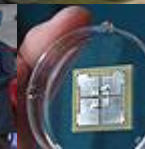
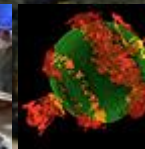
Steven Sarnecki
VP, Public Sector
OSIsoft

David Hislop
Manager
Outage Analysis Technologies
PJM Interconnection

Terry Martin
Energy Sustainability
Esri Federal Defense

About Argonne

- \$675M operating budget
- 3,200 employees
- 1,450 scientists and engineers
- 750 Ph.D.s
- Early ESRI User (3 digit ESRI ID)

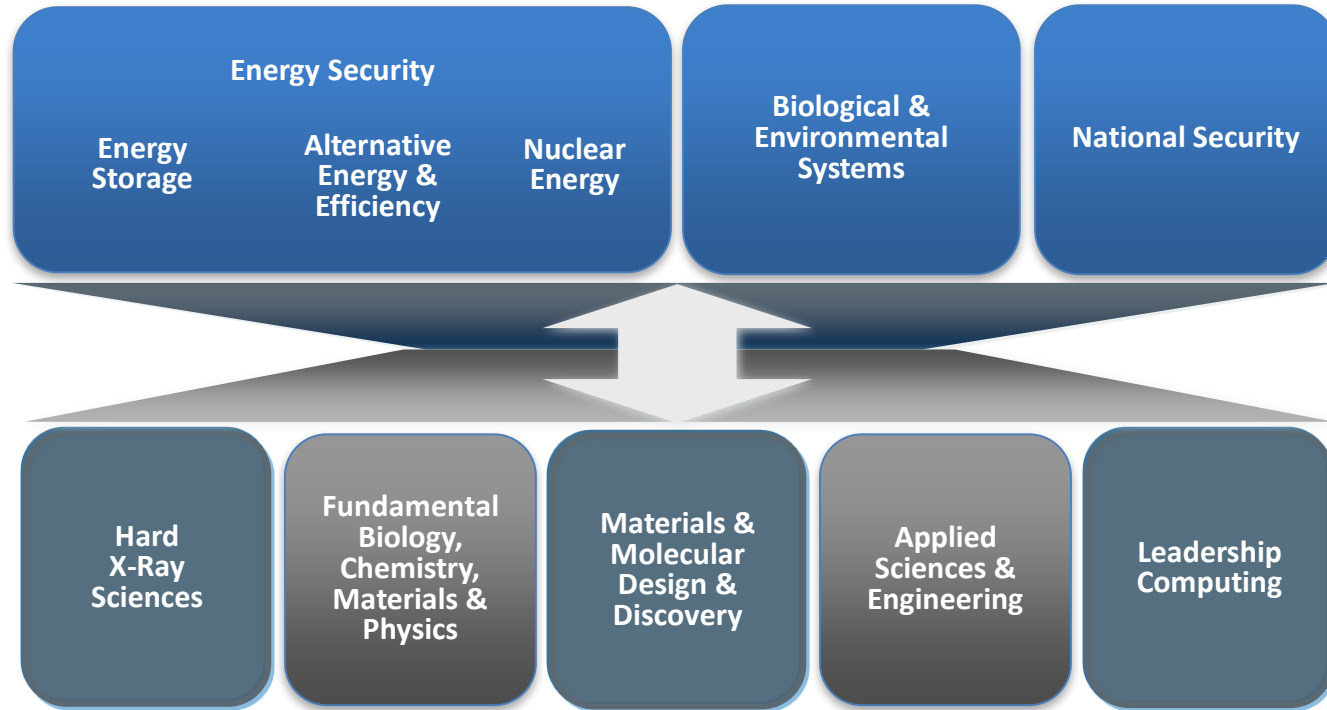


We are a Direct Linear Descendent of Enrico Fermi's Metallurgical Laboratory and the beginning of the Manhattan Project



Argonne's Core Capabilities and Major Initiatives

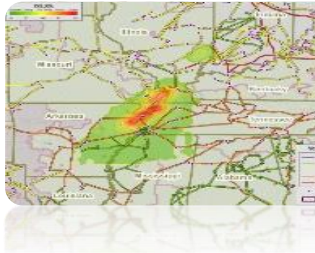
Use Inspired Science and Engineering...



... Discovery and Transformational Science and Engineering

Risk and Infrastructure Science Center (RISC): Core Research Areas

- **Infrastructure Science:** Conduct research and analysis to enhance infrastructure resilience and reduce the risk of disruption or destruction from climate change, natural hazards, accidents, or security threats. Inform the resilient design of future cyber and physical infrastructure to build assets, systems, and networks that are capable of withstanding future threats.
- **Cyber Analysis and Operations:** Provide operations, subject matter expert, and research support for the development and implementation of advance cyber security solutions. Conduct focused analysis of the intersection of cyber and physical risks.
- **Threat Analysis:** Conduct near-real-time, all-source analysis by fusing intelligence with complex data sets and multi-disciplinary expertise. Deliver highly sophisticated, scientific analysis through actionable products, portals, and tools.
- **Emergency Preparedness:** Develop and apply methodologies and technologies to assist emergency managers, planners, and responders in preparing for, responding to, and recovering from manmade or natural disasters.



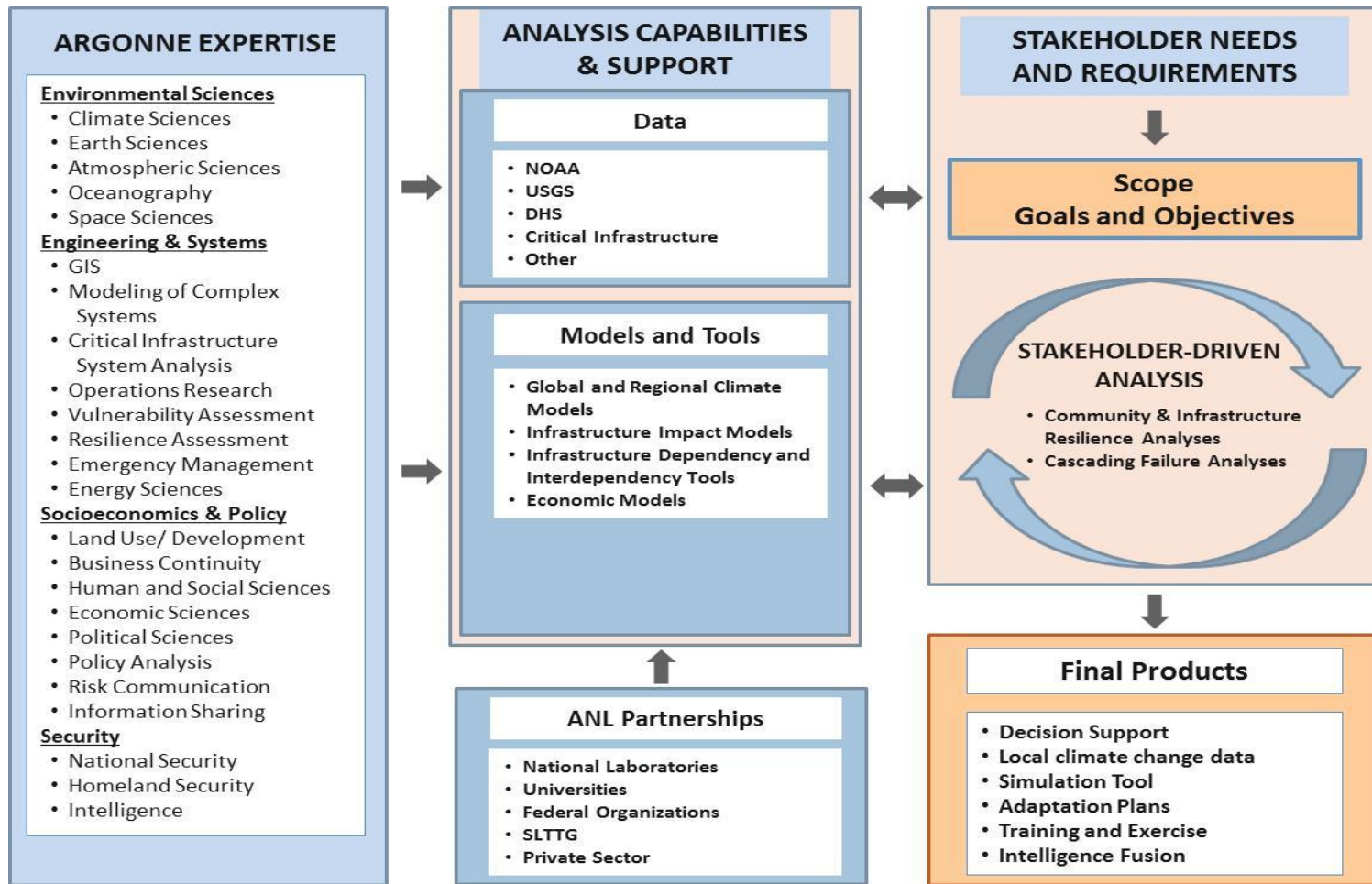
Argonne is using downscaled climate data to drive infrastructure impact models

- Infrastructure models (e.g., Epfast [Electric], Ngfast [Natural Gas], Polfast [Petroleum], Restore©) coupled to climate models to assess climate hazards
- Identifies downstream impacts generated by the disruption of infrastructure systems (e.g., from storm surge, drought, heat wave)
- For example, Argonne is using the EPFast model to investigate the impacts of mid-century increased ambient temperature on Maine's electric grid.
 - Determine impacts on the capacity of power plants, transmission lines, and transformers, and growth in demand.
 - Determine implications on overall grid performance via load flow simulation.
 - A temperature change of 3 - 5° C is projected to occur in inland Maine.
 - The temperature change is expected to influence operational characteristics of power plants and transmission lines as well as level of demand.

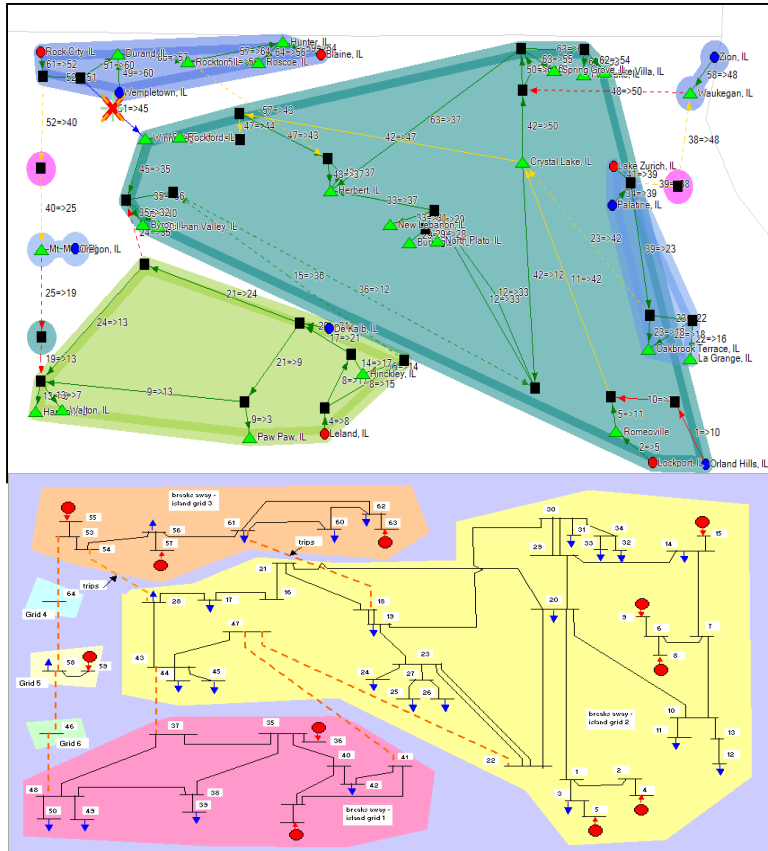
Center for Integrated Resiliency Analyses

Multidiscipline Virtual Center Integrating:

- ***Climate Modeling:*** Changes in climate may greatly affect our infrastructure and social systems. For example, changes in regional temperature and precipitation patterns may greatly affect our existing and future power system infrastructure. Modeling these changes offers insight into how climate change may affect communities and migration patterns.
- ***Infrastructure Assessment:*** To manage risks to infrastructure systems, CIRA draws on advanced modeling and simulation technologies and subject matter experts in diverse systems including power, water, transportation, and telecommunications to enhance climate change resilience.
- ***Social Science Modeling:*** Social dynamics play a role in ecological and economic topics such as climate change, resource scarcity, and epidemics. All of these social domains are interconnected in complex ways and, as a result, one type of problem frequently forms the context for, and alters the dynamics of, another. CIRA will exploit Argonne's integrated social science modeling capabilities to improve understanding of how social factors influence a community's resiliency.
- ***High-Performance Computer Systems Modeling:*** Modeling and simulation look at ways to analyze and understand interactions and feedback mechanisms between societal and physical processes. CIRA will use Argonne's experience in modeling, simulation and visualization to perform computational experiments for both physical and social systems using high- performance computing tools at the Argonne Leadership Computing Facility.

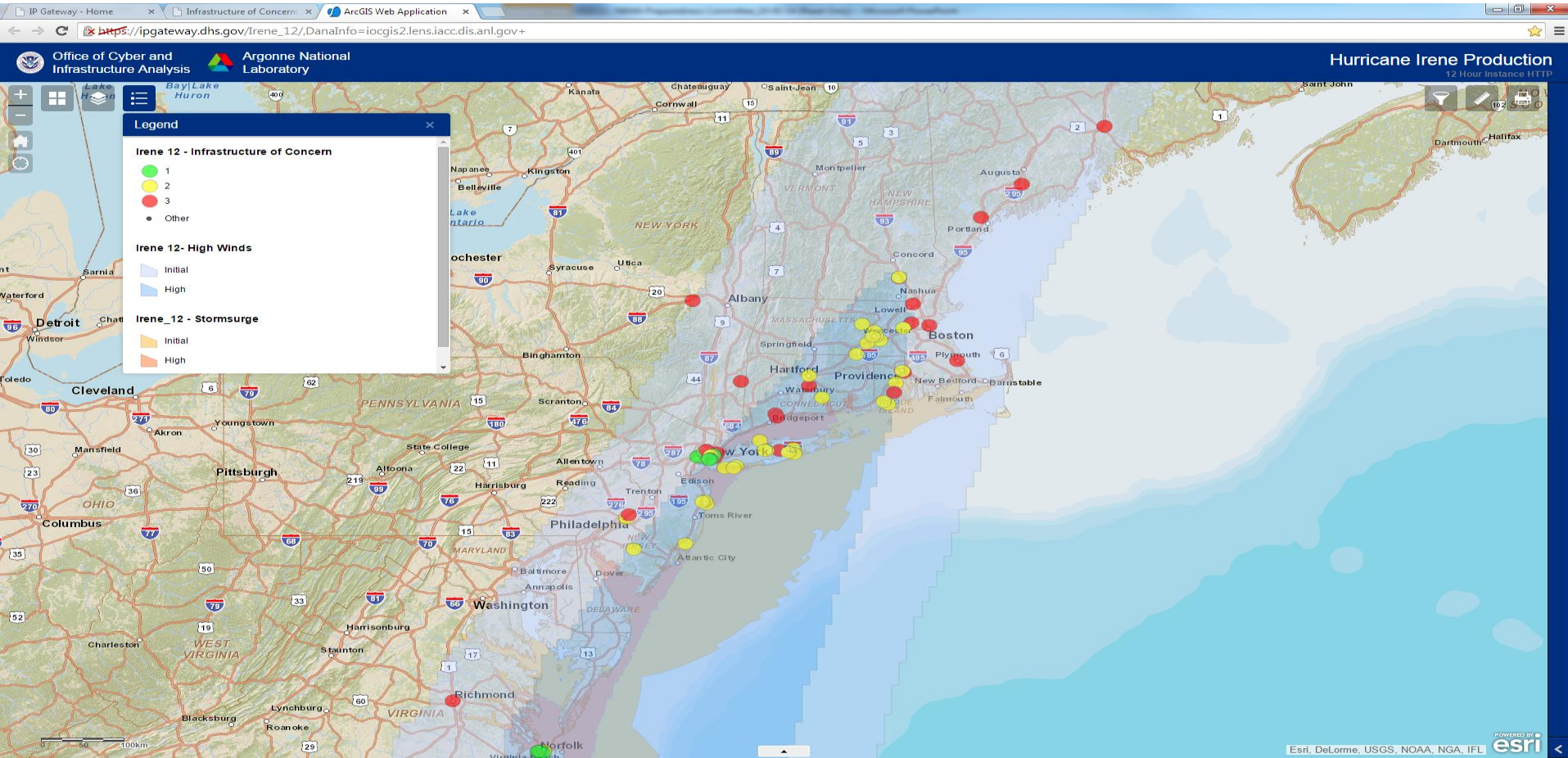


Impact Model Example: Epfast

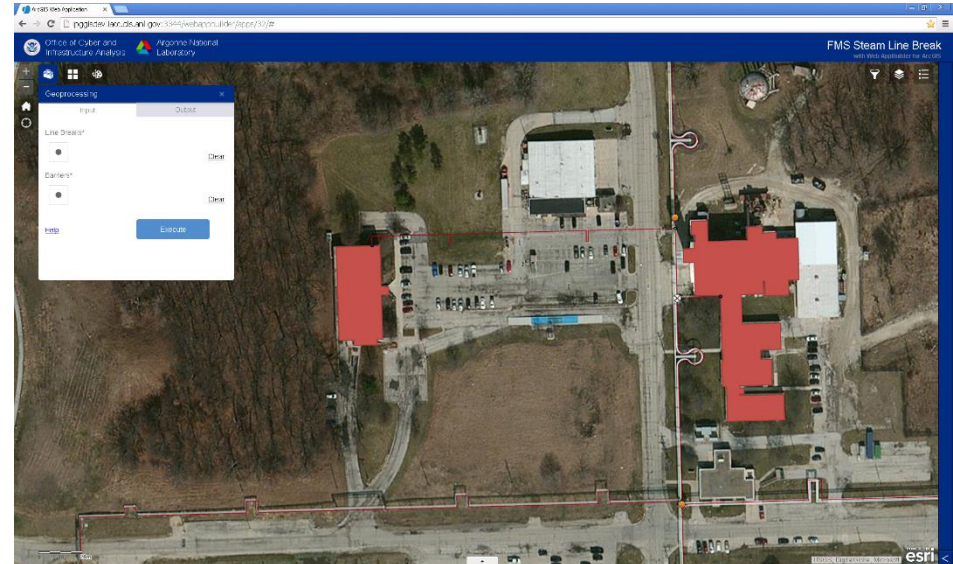
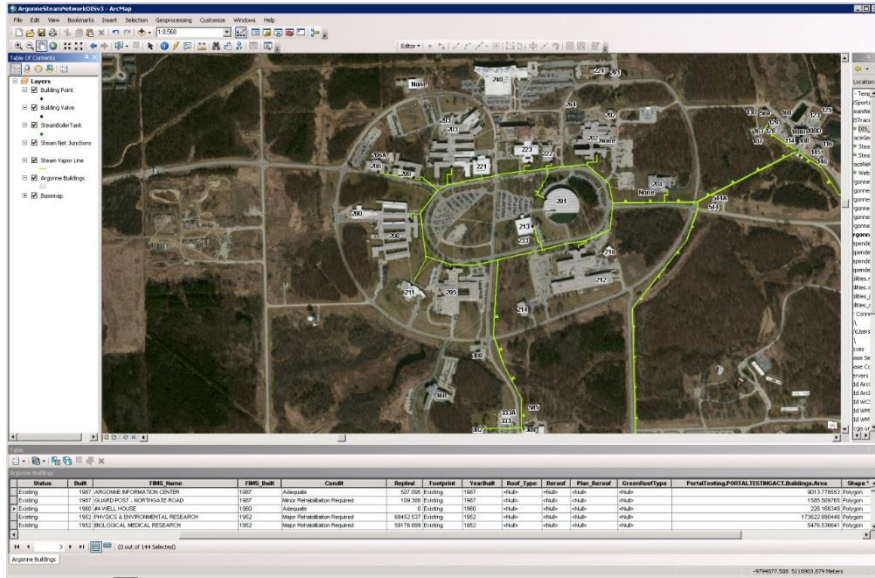


- Linear, steady-state model provides a quick estimate of impacts on the immediate and downstream substations due to:
 - Uncontrolled islanding
 - Single or multiple transmission line outages
 - Single or multiple substation outages
 - Plant siting and line reinforcement studies
- Can be used to assess various climate change hazards:
 - Storm surge impacts to critical nodes
 - Heat waves
- Graphical and tabular HTML – formatted outputs
 - Amount of load reduction per substation
 - Number and size of island grids formed
- Applications
 - FEMA Region V – Improved Nuclear Device Analysis
 - FEMA-DOE New Madrid Seismic Zone Study
 - DHS Regional Resiliency Assessment Program
 - Bureau of Land Management Solar Energy Zone Transmission Study

Web Based Portals for Modeling and Analytics: National



Web Based Portals for Modeling and Analytics: Local



Web Based Portals for Modeling and Analytics: Local

