Climate Change & Grid Vulnerability

Energy Efficiency/Conservation and Grid Vulnerability

Pacific Northwest NATIONAL LABORATORY
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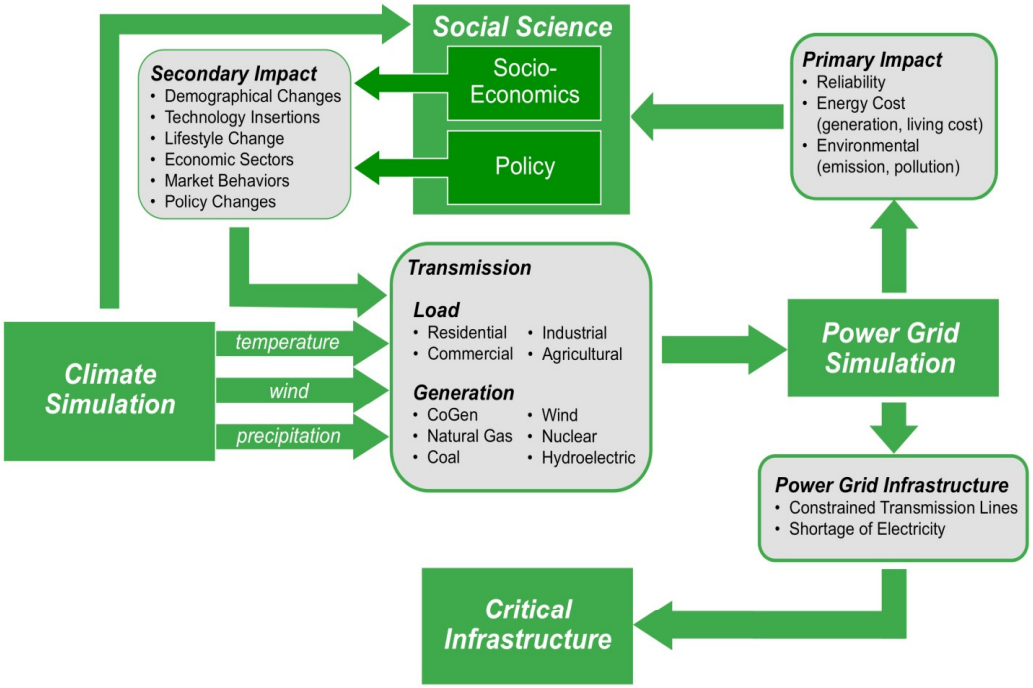

Technical Approach

- Prediction based on past data and future computation and analytical results
- Very high-resolution modeling
  - Spatial – climate (regional, city), social & community (block group)
  - Temporal – power grid (hourly, daily)
- Focus on the combined impact of both social and technological factors on the society
- Highly detailed forecasts of market penetration for key energy using technology—not applied previously with building energy models and grid modeling

Challenges

To address the impact of global climate change on the U.S. power grids and its implications on society and national security. An example of climate change is increased atmospheric temperature, which in turn increases electricity consumption when people turn to fans and air conditioning to find relief from the heat. The increased temperature also affects precipitation, which changes the natural hydrological process and thus hydroelectric generation; it also influences wind electricity generation. Together, these supply and demand changes could adversely affect the U.S. power grids and cause a widespread outage.

Solution

To model and predict global climate change's impact on US power grids and its wider implications for society and its critical infrastructures to prevent a widespread outage. These future scenarios will provide critical information that policymakers and stakeholders can use to formulate a coherent, unified strategy for shaping a safe, secure society.

Technosocial Predictive Analytics Initiative

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Climate Change & Grid Vulnerability

Objective

Develop an innovative trans-disciplinary modeling science to predict the impact of climate change on US power grids and its implications on national security. These future scenarios provide critical assessment and information necessary for policymakers and stakeholders to help formulate a coherent, unified strategy toward shaping a safe and secure society.

Current Practices

A number of recent investigations have examined problems similar to portions of our work but with different approaches and emphases. For example, the State of California has recently sponsored an investigation on the impact of global climate change on building energy usage. The study, which focuses geographically on California, pays great attention to building energy usage but does not consider the impact of electric power stability and social dynamics.

Perhaps the most notable difference is the absence of an interactive visual analytics interface that supports a team of multidisciplinary scientists to collaboratively plan, execute, and assess the modeling work.

Climate Change & Grid Vulnerability Approach

Our platform lets domain scientists collaboratively study the combined efforts of their modeling work toward a common scientific goal.

Beneath our platform's visual interface is a federation of models and simulations that share the resources and model results in a tightly coupled environment. Domain scientists are responsible for initial development of the corresponding problem domain models. The entire research team then collaboratively and collectively exploits various domain models' strengths and fine-tunes the interactions among them using an interactive approach. Our platform's predictive model involves four independent but interrelated components covering the domains of climate simulation, power grid simulation, social science, and critical infrastructure

The Transformational Change

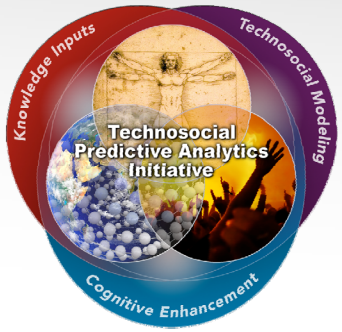
To provide critical assessments and information to help policymakers and stakeholders formulate a coherent, unified strategy toward shaping a safe, secure society.

Outcomes

- Project the consumption of electricity in major load centers in the Western Grid.
- Evaluate the probability of grid failure occurrence, which has both technical components and social components.
- Project the likelihood and potential locations of grid failure.
- Determine what critical infrastructures would be affected.

The Technosocial Predictive Analytics Initiative (TPAI) is taking the next steps to addressing complex, interwoven issues with highly integrated, innovative models to help analysts and policy makers identify and counter strategic surprise.

TPAI supports a multi-perspective approach to predictive analysis through integrated reasoning, drawing knowledge insights from both the natural and social sciences.



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