

# Secure the Electrical Power Grid: Smart Grid versus Smart Attacks

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## Security issues of the power grid

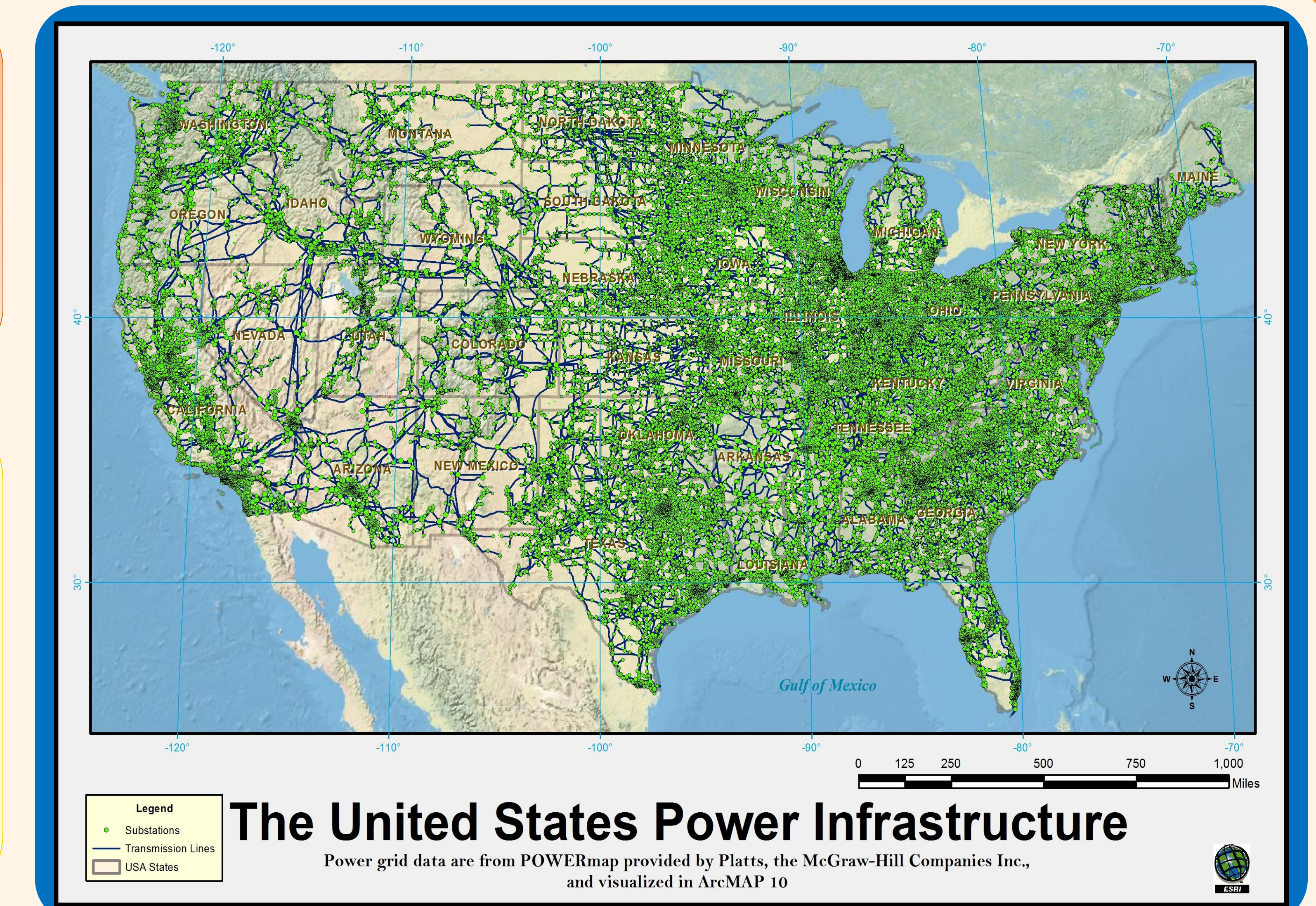
- Structural vulnerability of power grid infrastructure;
- Large scale cascading and blackouts from critical failures (e.g., physical and cyber attacks);
- Increasing access point to the grid (e.g., communication/data networks) from malicious attackers ;
- Complex attack scenarios and defense strategies.

## Motivations

- Cascading failures and large-scale blackout (e.g., 2003 North America blackout, 2012 Northeast India blackout)
- Cyber penetration of power grid;
- Unique characteristics of smart grid security;
- Visualization with GIS for decision-making support system.

## Challenges

- Complex dynamics of grid failure behavior;
- Lack of close-to-reality models of cascading failure;
- Computational issue on large-scale power grid;
- Integration of grid topology and intrinsic power system characteristics (e.g., power flow analysis).



## Key innovations of our research

### From the security perspective:

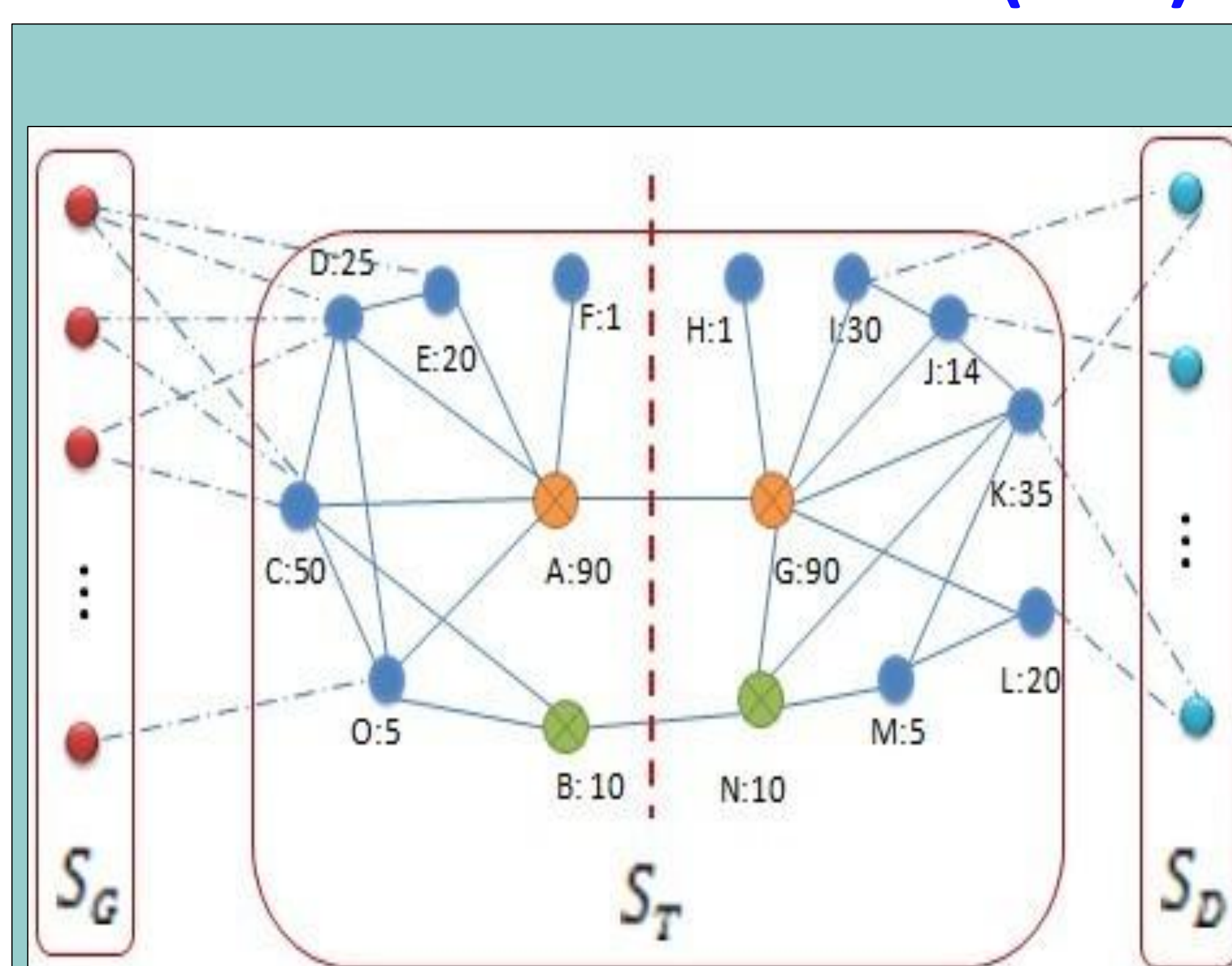
- Complex power grid failure behavior;
- Comprehensive security models and algorithms;
- New vulnerability assessment metrics;
- Complex attack and defense strategies.

### From the power grid perspective:

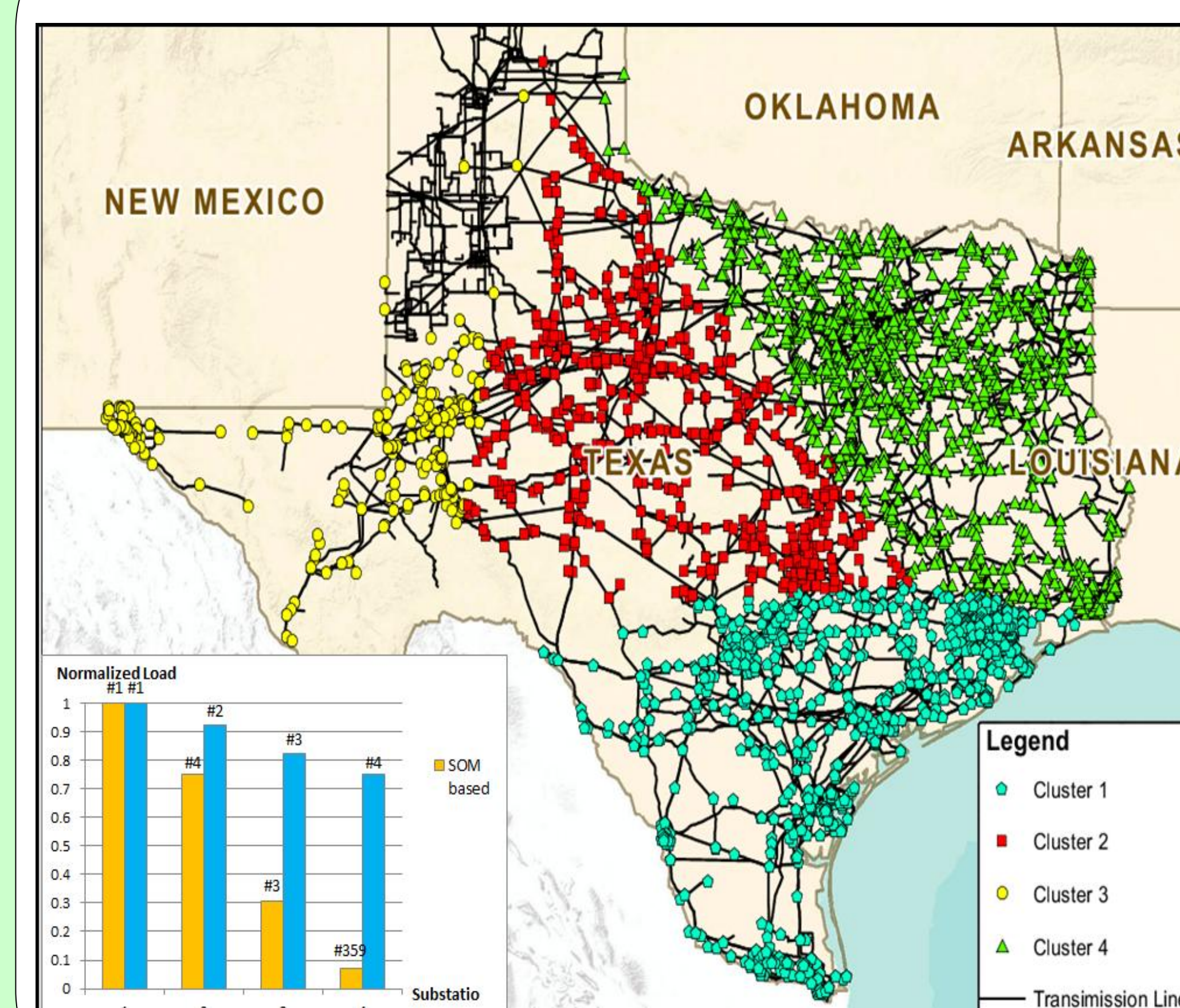
- Integration of network security with power system analysis;
- Power flow analysis with network topology;
- Power system dynamics and fault analysis;
- Visualization of power grid with GIS.

## Research methodology and results

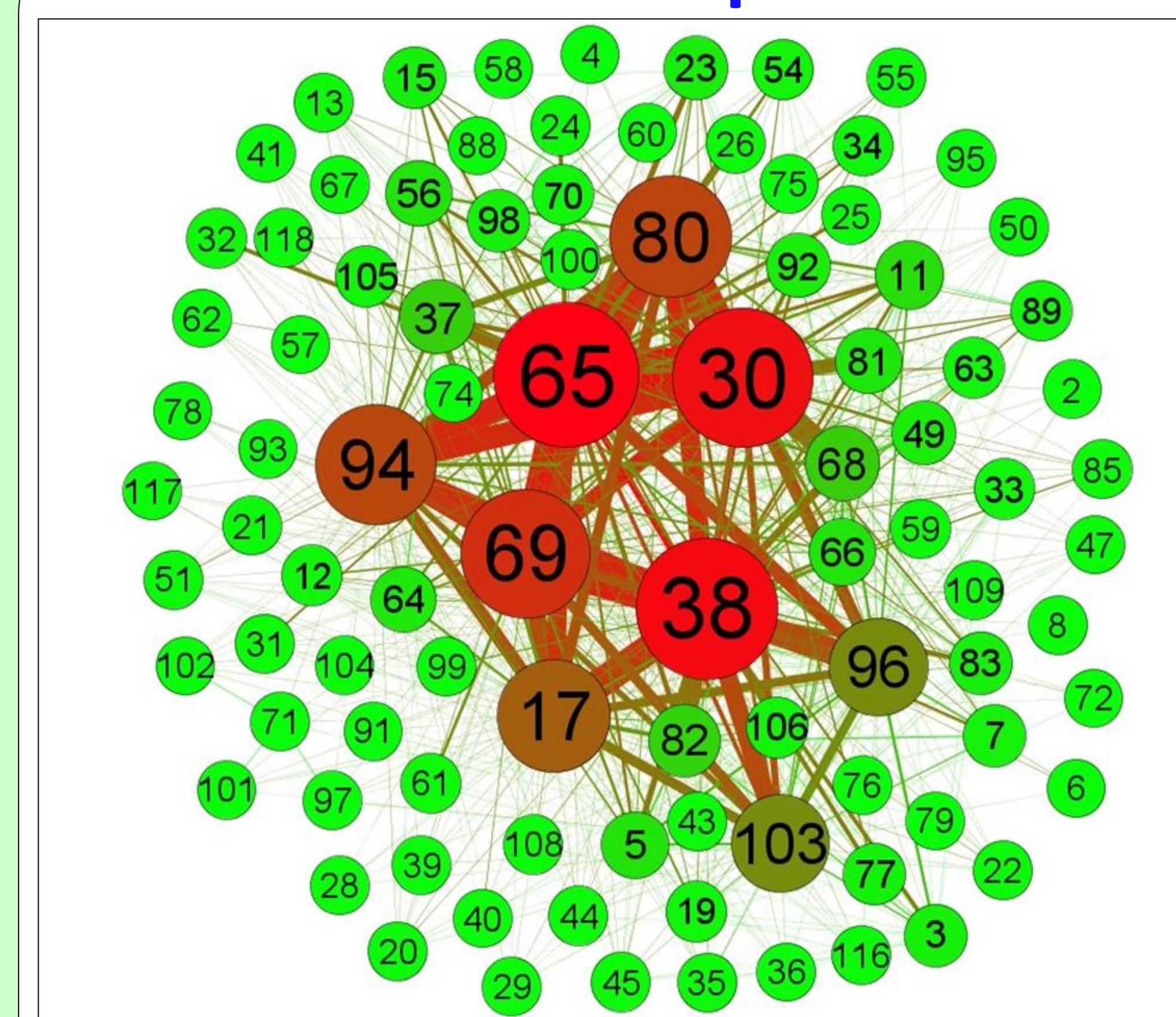
### Load Distribution Vector (LDV)



### Cluster-attack of Texas Grid



### Risk Graph



### GIS Demonstration Platform

