



Sustainable Transportation Electrification for an Equitable and Resilient Society (STEERS)

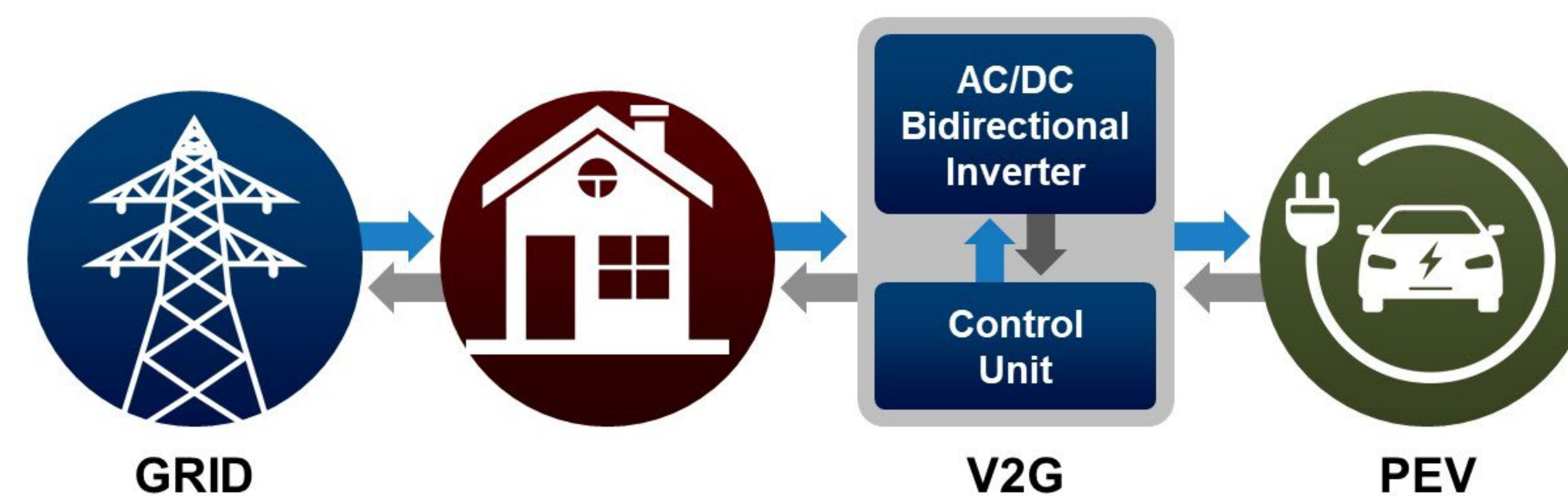
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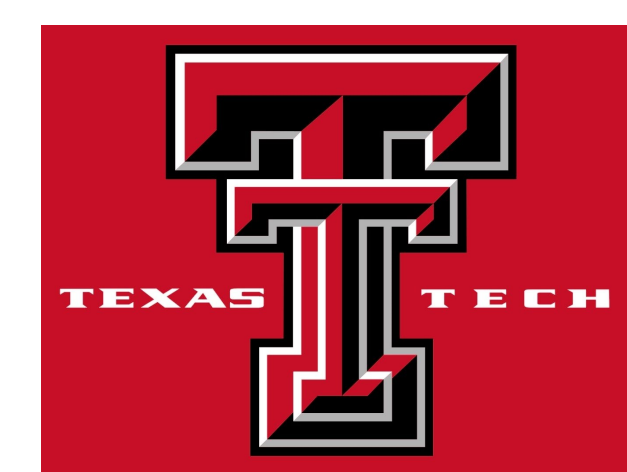
Objective

- Transportation electrification is on the rise, and addressing the new technical and social challenges presented by electric vehicles (EVs) is a crucial need, whose solution spans multiple disciplines.
- It is important to extensively plan and prepare for different scenarios. Solving this problem would have broad impact on the public and regional sustainability
- The ultimate goal of STEERS is to perform the cutting edge convergent research, education and outreach that will help to steer our society to ensure that this transformation is done in a way that is equitable, considering the needs of all, and in a way that makes us more resilient.

Vision & Approach



- Electrification of transportation powered by renewable sources of generation is an anticipated reality that requires expertise in many domains
- A diverse, convergent team of engineers, educators, social scientists, and stakeholders working together in the Texas region

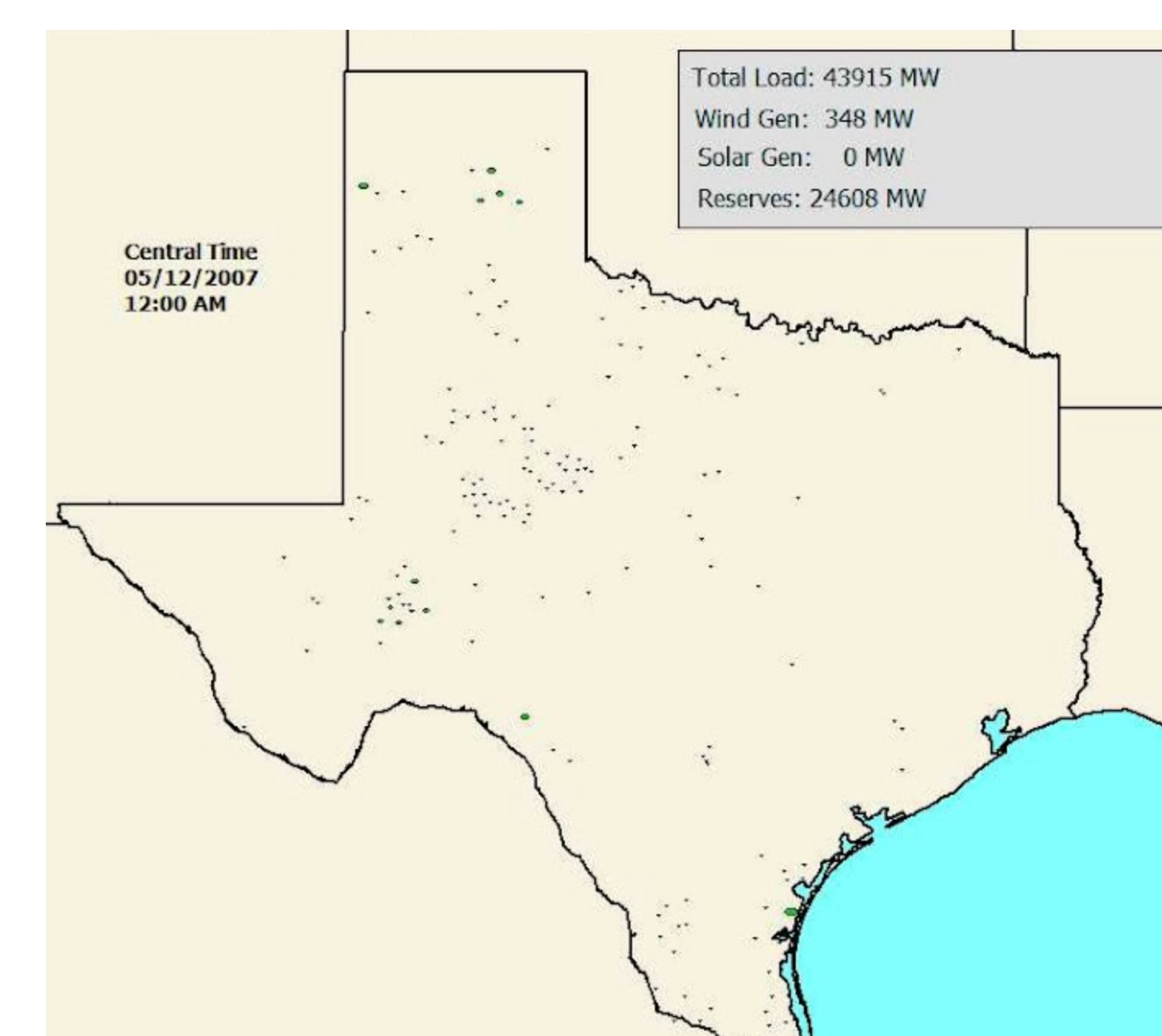
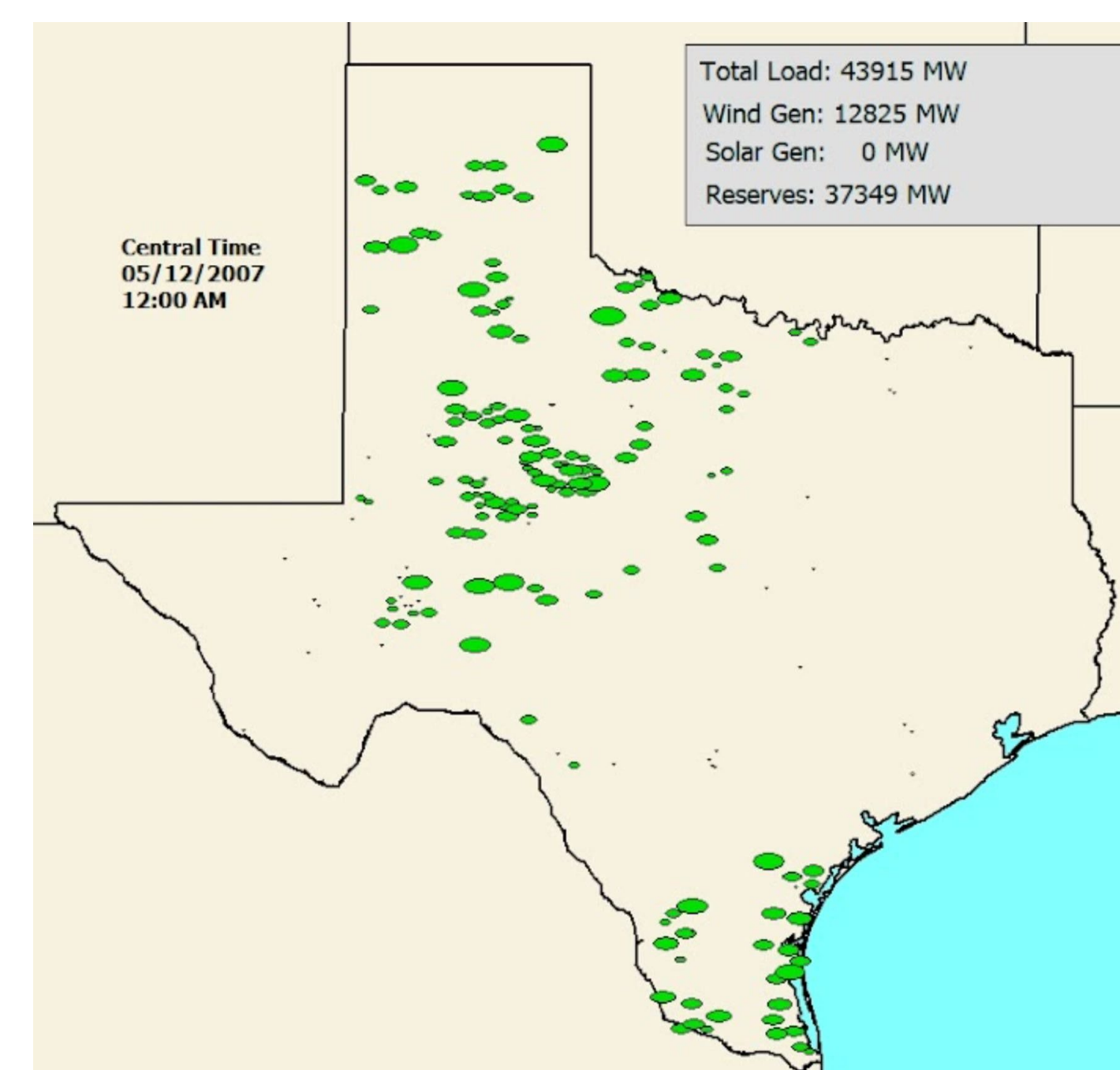


STEERS Team: Texas Tech, UTSA, Rice University, Texas A&M

STEERS Description

Supra-aggregations of connected urban-rural systems that compose the Texas electric grid (ERCOT)

Convergent research and education for sustainable transportation electrification in regions, focused on the Texas region, both under normal (blue sky) conditions and severely stressed (black sky) conditions

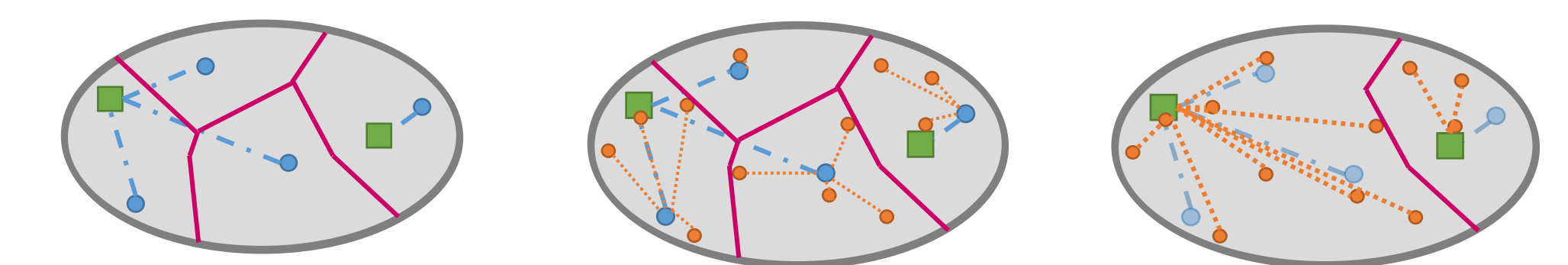


Geographic data view of wind generation capabilities in Texas

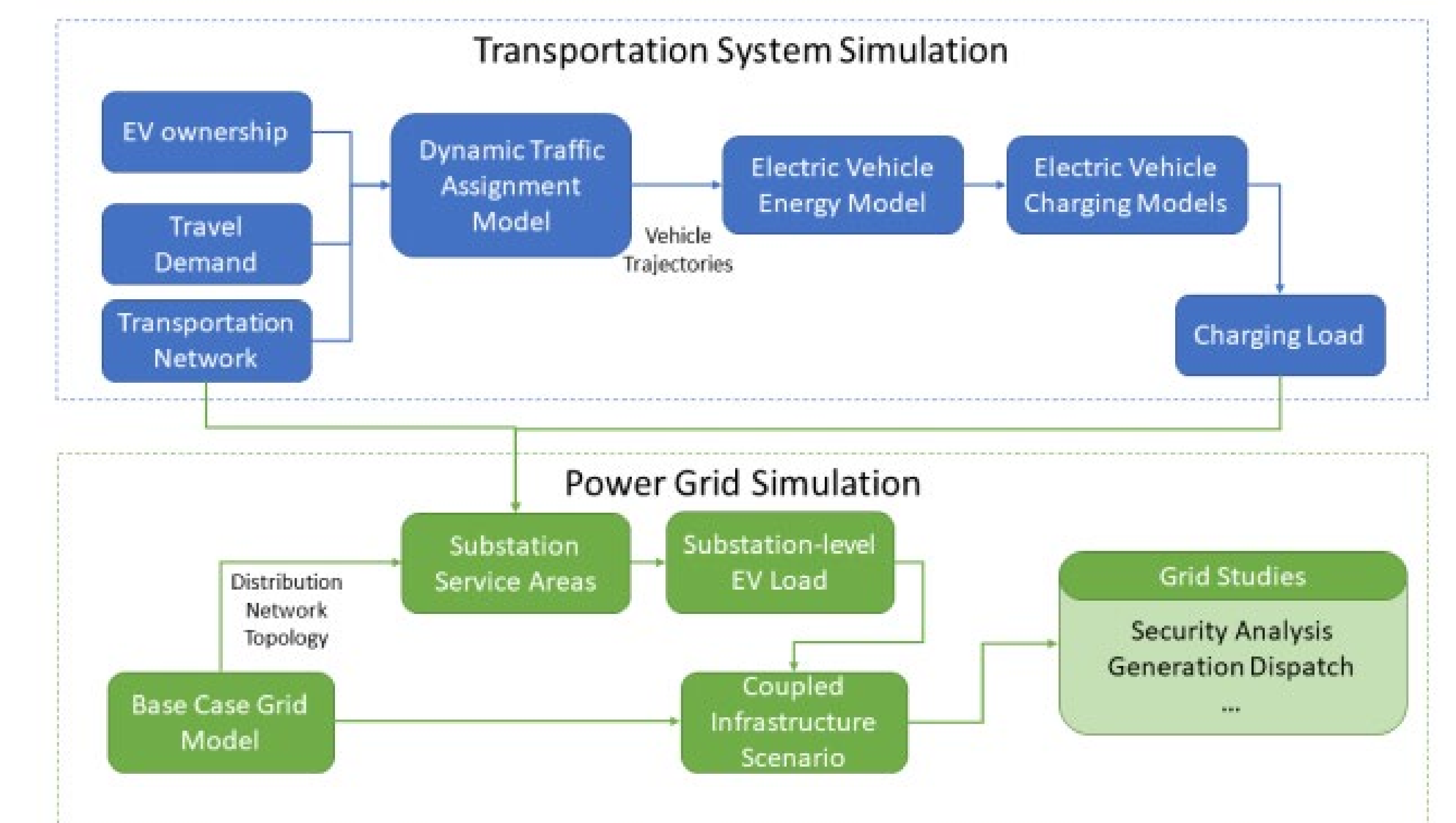
Electric Vehicle Modeling

Identify/assess transportation and electric networks interactions

- Estimate charging demand in each location and time and map the demand to the buses of electrical grid
- Establish distribution-level service areas
- Assign transportation nodes to distribution nodes
- Represent EV charging load on transmission level



Creating coupled models of transportation and electrical networks



Optimal power flow time step simulation run with EV loads

Motivation for Coupled Infrastructure Studies of Electrical and Transportation

Transmission Impacts

- Changes in peak demand impact line loadings
- Component aging and increased resistive losses
- Overheating can cause fires and safety issues

Economic Impacts

- A change to peak demand, with new demand patterns and more transmission congestion
- Increased sensitivities to additional loads as the system is operating closer to its limits
- Locational marginal prices will be higher and more sensitive during peak hours

Key Publications

- [1] Wert, J. L., Safdarian, F., Wallison, D., Jung, J. K., Liu, Y., Overbye, T. J., & Xu, Y. (2023), "Spatiotemporal Operational Emissions Associated with Light-, Medium-, and Heavy-Duty Transportation Electrification," *IEEE Transactions on Transportation Electrification*.
- [2] Wert, J. L., Chang, H., Safdarian, F., Overbye, T. J., & Xu, Y. "The Economic and Technical Impacts of Houston's Electric Vehicles on the Texas Transmission System: A Case Study," *2022 IEEE Kansas Power and Energy Conference (KPEC)*.
- [3] J. L. Wert et al., "Coupled Infrastructure Simulation of Electric Grid and Transportation Networks," *2021 IEEE Power & Energy Society Innovative Smart Grid Technologies Conference (ISGT)*, 2021, pp. 1-5.