Abstract: Analysis of the effects of climate change on planning and operations of SERC's power system, Y1

The U.S. power sector, considered the largest contributors to the emissions of greenhouse gases (GHG) in the country, faces several vulnerabilities related to climate change. On the demand side, increasing temperatures may result in shifting demand patterns.
On the generation side, thermoelectric power plants -- which generate roughly 85% of the electricity in the U.S. -- could be affected by climate change through several pathways. For example, decreased water availability and increased water temperatures could reduce the capacity and efficiency of thermal units that use once-through cooling. Additionally, increased air temperature and humidity could reduce the capacity and efficiency of thermal units that use re-circulating cooling. These threats become even more critical because of the nature of energy infrastructure planning, investment and operation. Planning horizons can span several decades - the typical service life of most energy assets - and associated investments can extend into the billions of dollars. All these factors make it essential for planning agents in the power sector to take into account the risks imposed by climate change into their decision making process in order to ensure a reliable and affordable electricity supply.

In this work we use an integrated multi-model framework to analyze the potential effects of climate change on two dimensions of the power sector: the planning of the expansion of the generator fleet, and the real time operation of this fleet. We combine projections of electricity demand and simulations of thermal power plant curtailments under twenty different climate change scenarios into two Mixed Integer Linear Programming (MILP) model: a capacity expansion (CE) model, and a unit commitment and economic dispatch (UCED) model. We use these models in a study case of the Southeastern Electric Reliability Council (SERC) Reliability Corporation. Both models are computationally-intensive, requiring computer capacity above the one available at the Engineering and Public Policy's cluster (a set of five machines with typically 8 cores and 64 GB fo RAM), which is used by more than fifty graduate students. Therefore, we would like to request access to the Bridges PSC resources in order to perform this analysis.