Distribution of the GenX Optimization Model

By: Saad Ayub, Richard Zhu

Introduction

- GenX is a highly-configurable, open source electricity resource capacity expansion model that offers improved decision support in planning improvements
    - Originally developed by Jesse Jenkins and Nestor A. Sepulveda
    - Maintained by a team at MIT Energy Initiative and Princeton U. ZERO Lab
- Uses a constrained linear or mixed integer linear optimization model to determine the portfolio of electricity investments and operational decisions to meet electricity demand in one or more future planning years at lowest cost,
    - Variables: Operational constraints, resource availability, and environmental, market and policy constraints

Existing Work

- The model completes an optimization of the original problem, then uses MGA (Method for Generating Alternatives) to more fully explore the parameter space near optimality to allow for more informed decisions by policy designers
- A variety of efforts have been made to optimize and improve the model
    - Previous effort was via a modified Benders Decomposition, breaking the tasks into sub-periods and multithreading each daughter task
    - Multithreading in this way was able to reduce time complexities significantly, though did not address memory constraints in any way
    - Current effort by GenX team is to distribute the Benders Decomposition

Distribution and Multithreading of Monolithic Model

- To better compare a distributed, multithreaded Benders Decomposition model for MGA, GenX will be distributing and multithreading their non-decomposed model (i.e. the “Monolithic” version) for a direct comparison of time cost for a given number of cores, threads, etc.
- The present work has successfully multithreaded the Monolithic model, and has partially completed the distribution of the MGA tasks. Issues persist with combining the multithreaded code with the distribution as well.

Improvements in Computation Time

- The time improvements for generating alternative solutions via the improved Monolithic method would be expected to reflect the improvement gained from using Benders decomposition for a single optimization run.
    - The parallels in expected overhead cost and addition of parallel computations of the problem give a basis for this comparison
- Future work would include testing this hypothesis after completing the implementation of the improved Monolithic model