Introduction

In 2010, the United States consumed 3.271 TW of power (for comparison, the world consumed 15 TW of power), and that figure is rising. Increasing demands for electricity put higher levels of stress on a critical piece of the nation's infrastructure, the electric power grid. The integration of renewable energy sources such as wind and solar, which deliver intermittent power to the grid, requires more intelligent methods of electricity distribution. We seek an efficient calculation that reveals how to distribute electricity across a transmission grid in a way that minimizes losses through optimal generator scheduling that could be integrated into the operation of a “smarter” grid.

Methods

- Model cost of operating power grid with cost function.
- Minimize cost function using parallelized Lagrangian Relaxation on New York Blue
- Introduce renewable energy sources to the simulation by incorporating generators with intermittency
- Simulate three future energy scenarios (DOE 20% Wind, Google Clean Energy 2030 and the Solar Grand Plan) by varying the proportions of renewable energy incorporation and expected demand

The Solar Grand Plan, which had the most intermittency, had the highest cumulative cost, or total cost, through 2030. DOE 20% Wind, which had the least intermittency, had the lowest cost.

Summary

- Future energy scenarios and a NYCA power grid were simulated, and the corresponding unit commitment problems were solved.
- Computing results indicate that parallel computing can significantly reduce the computational time.