Senior Project – Electrical Engineering – 2020

Optimization of Union College's Microgrid

Caitlin McMahon Advisor – Prof. Dosiek

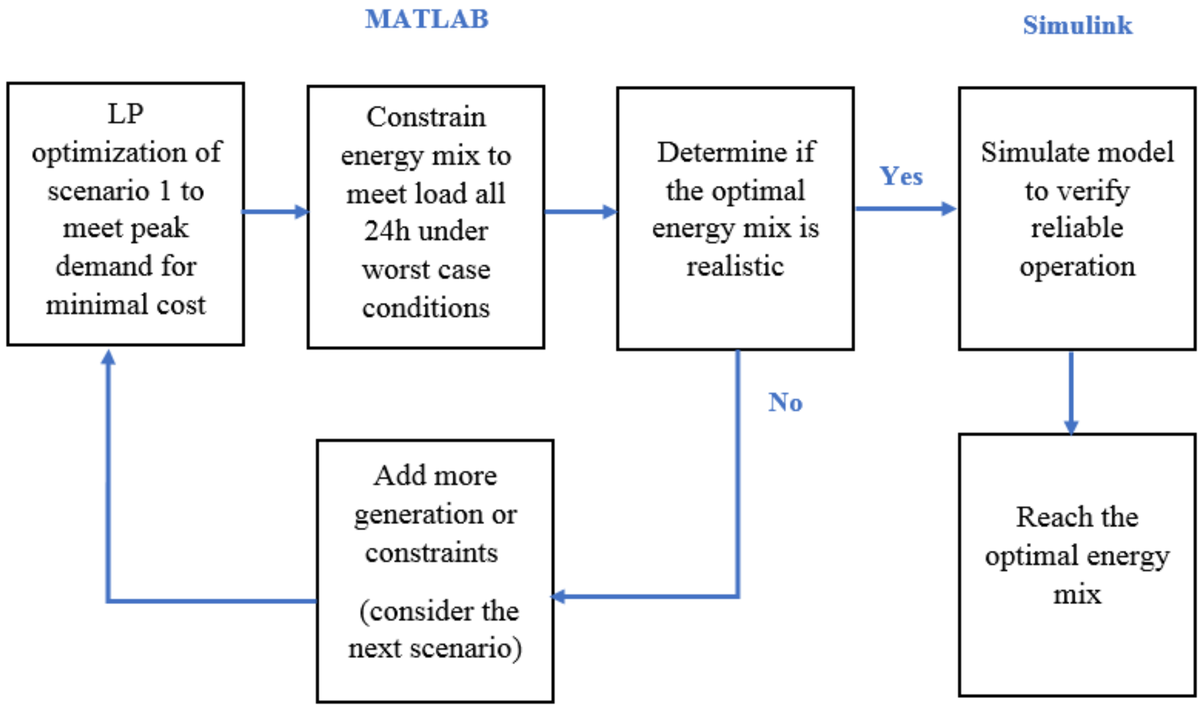
Introduction

Union's microgrid currently supplies about 70 percent of the campus' load with the cogeneration plant, solar photovoltaic (PV) panels and wind turbines. The goal is to be able to supply 100 percent of the load and minimize the cost of additions to the microgrid. MATLAB is used to simulate adding various energy mixes to Union's microgrid and optimize the cost function with constraints.

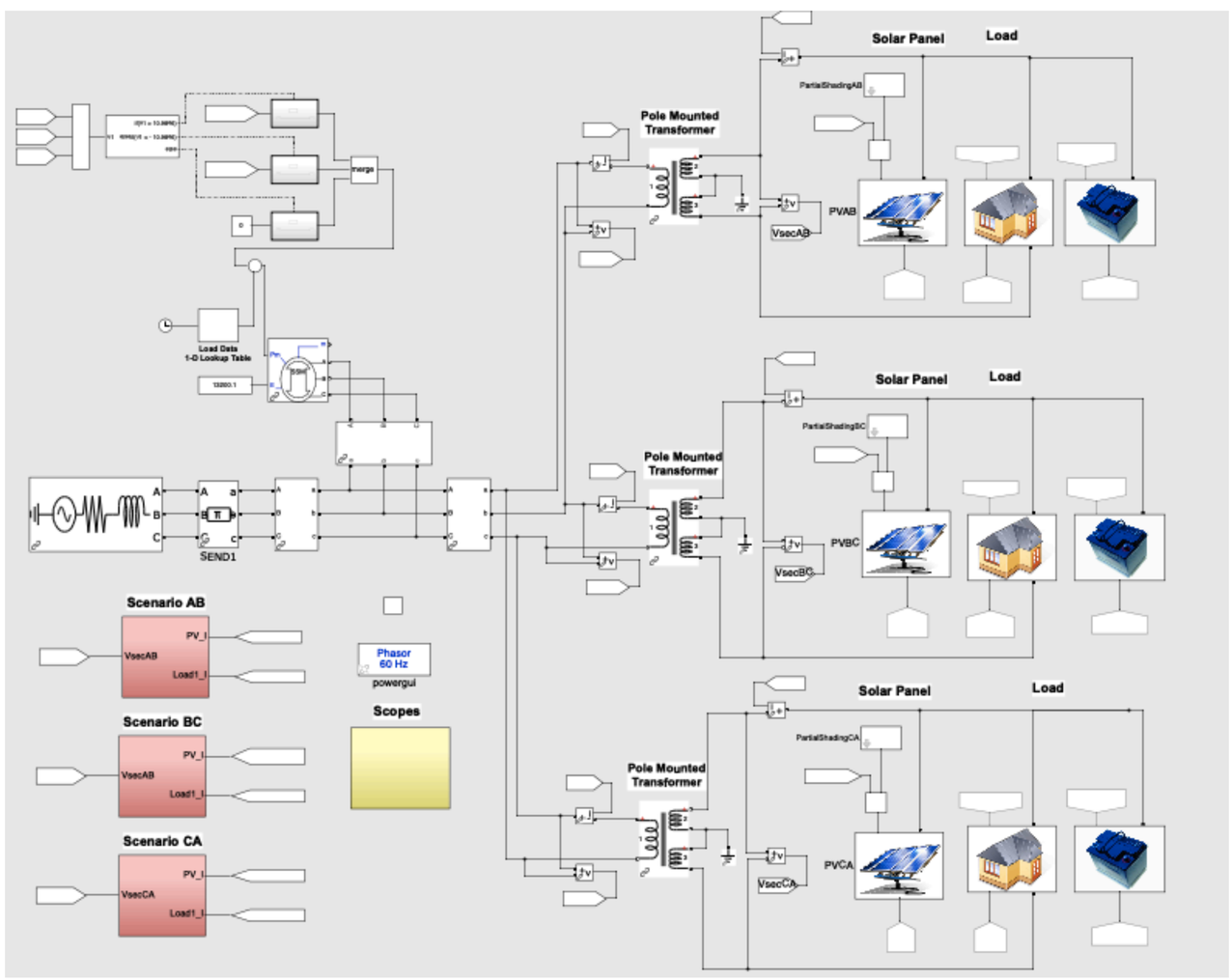
Goals & Requirements

1. Find low-carbon, least-cost generation mix that **realistically** and **reliably** meets Union's peak demand under worst case conditions. ✔
2. The cost of additions must be under $12 million. ✔
3. The program must run in under 20 minutes. ✔

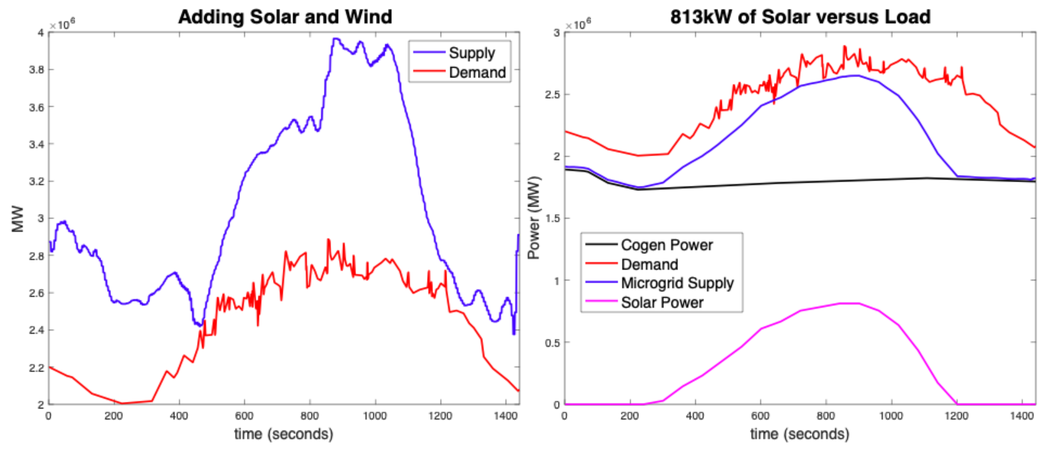
Functional Decomposition

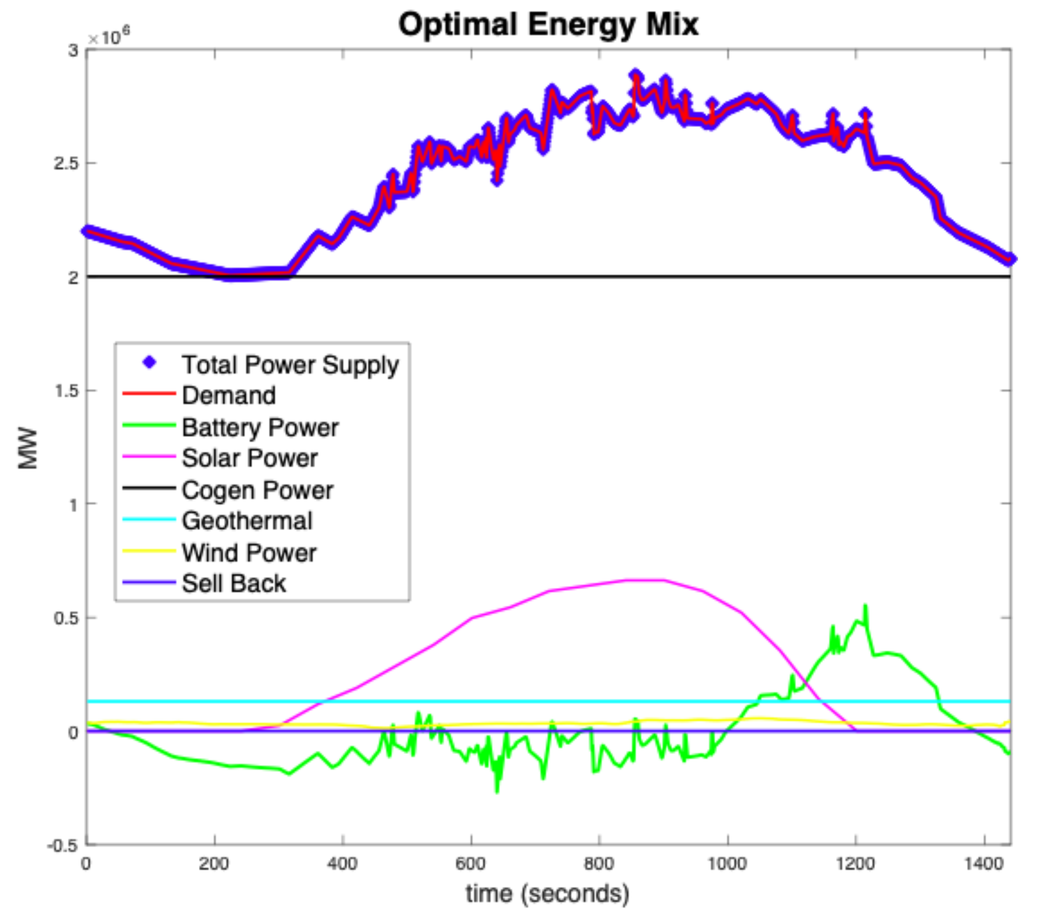


Simulink Design



Results





Total cost: $5,913,891

Solar: 813kW (maximum of 750kW added)

Wind: 61kW (maximum of 25kW added)

Storage: 4.5MWh lithium ion battery storage

Geothermal: 130kW

Cogen: controlled to around 2MW

This has been validated by simulating it in Simulink.

Future Work

Use HOMER for validation, use actual wind/solar power data, and improve the Simulink model to drive the source power to zero, rather than slightly above or below.

Acknowledgements

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