Microgrids: Electrical Independence for WPI

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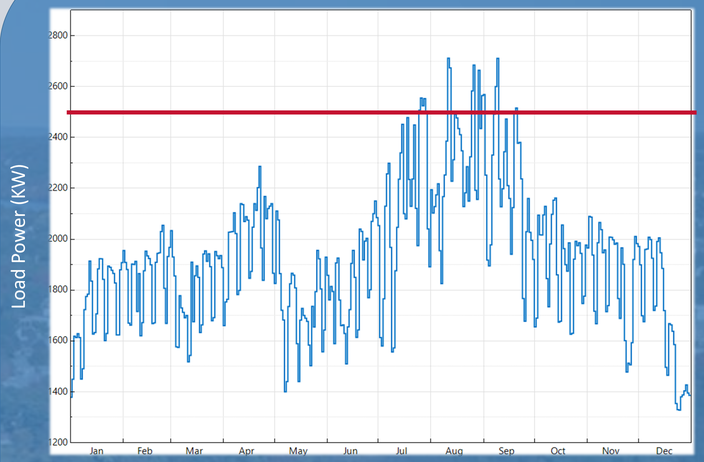
Abstract

WPI is not currently exploring the option of innovating its electric grid, and must sustain any of the outages and increased costs of purchasing from the macrogrid. With the implementation of a distributed energy source WPI has the possibility of saving on its electric bill, along with decreasing its energy use. The primary goal of our project is to decrease WPI's energy costs. Secondary goals of our project include increasing sustainability as well as reliability and efficiency of the WPI grid.

Distributed Energy Resources

We looked into three different energy sources to power the potential microgrid:

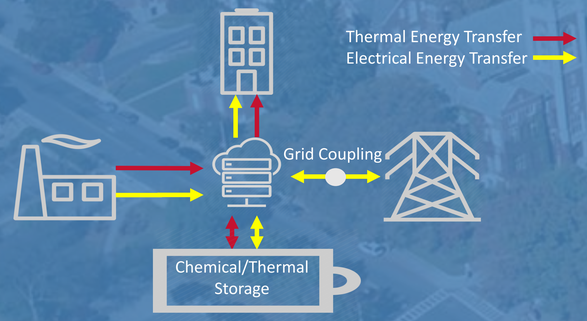
Solar **Wind** **Natural Gas**



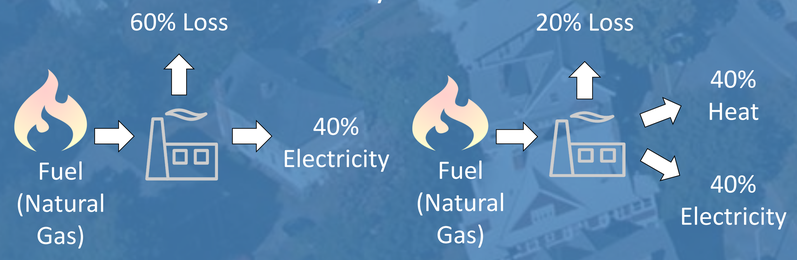
Daily Electricity Load
(04/02/2016 – 04/02/2017)
Average Daily Peak Load: 2.3 MW
Max: 3.7 MW (September)
Min: 1.3 MW (December)
A Natural Gas Generator of 2.5 MW would be the ideal size, slightly above the average load

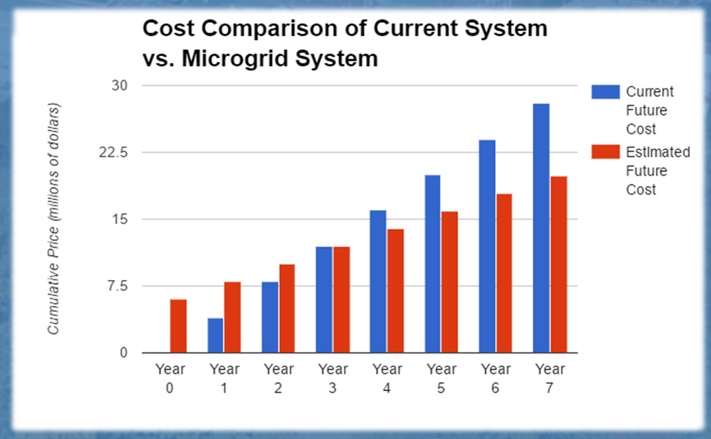
Background

Microgrid: relatively small electrical grids that uses one or more distributed energy resources within the system to provide the potential to operate independently



Co-generation: combined heat & power system which involves the use of a singular power source to simultaneously produce thermal and electrical energy for a system





Calculations

- Calculating Price of Natural Gas Needed
  - $\left(\frac{X(kwh)*3412.142\left(\frac{btu}{kwh}\right)}{1000000}\right)*\left(\frac{Y\left(\frac{dollars}{100000\ btu}\right)}{0.454}\right)$
  - 'X' is the amount of kwh used per month
  - 'Y' is the monthly price of natural gas
- Savings
  - Our model shows savings of around $2 million per year
  - A realistic payback period of 3-4 years
- Energy Storage Systems
  - If WPI were to store extra energy, there might be no need to buy electricity from the macrogrid when above peak load of 2.5 megawatts

Conclusion

We found that a microgrid system was a sound financial investment for WPI and recommend that WPI formally investigate this option.
An environmental and tax study would need to be performed before implementation to examine impact on WPI's community.

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