

# The University of Illinois Energy Mix Micro-reactor Group Meeting

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**ILLINOIS**

# Outline

- 1 Overview
- 2 Campus Energy Needs
  - Electricity
  - Steam
- 3 Systems
  - Abbott
  - Solar Farm
  - Power Purchase Agreement
  - Chilled Water
- 4 Current Work

# Overview

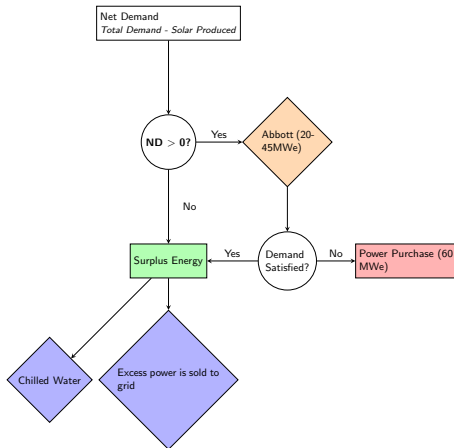


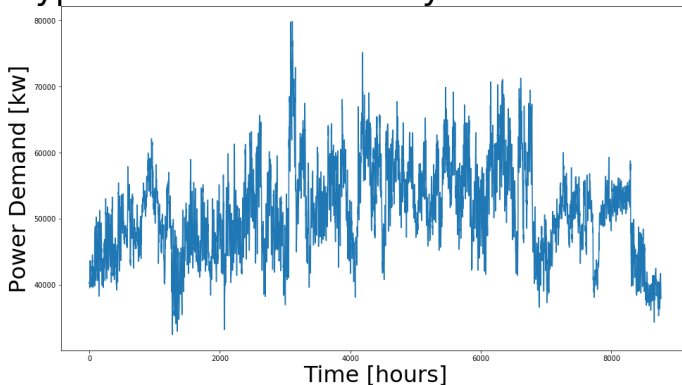
Figure: The University of Illinois Energy Prioritization



# Outline

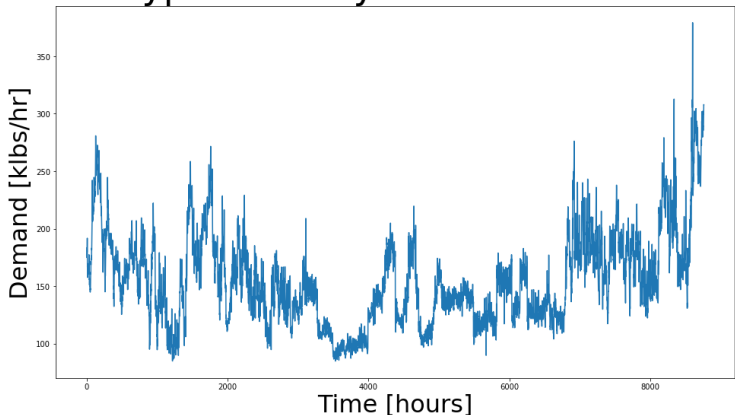
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## Typical Annual Electricity Demand at UIUC



The typical yearly electricity demand for UIUC. Average need is about 45 MWe, peaks near 80MWe.

## Typical Yearly Steam Demand



The typical yearly steam demand for UIUC. Typical need is about 150 klbs/hr, peaks in the winter over 300klbs/hr.



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# Abbott Power Plant



## Quick Facts [1]

- 1 Cogeneration Plant (electricity is a “byproduct” of steam production).
- 2 Capable of producing 85 MWe (maximum capacity).
- 3 Capable of producing 800 Klbs/hr of steam (maximum capacity).



South side of Abbott Power Plant.



## Quick Facts [7]

- Lifetime capacity factor of 16.8%.
- Rated to produce 4.8 MWe
- Soon to be expanded to 12.1 MWe



UIUC Solar Farm

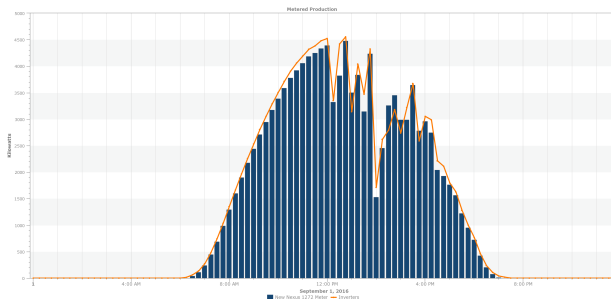
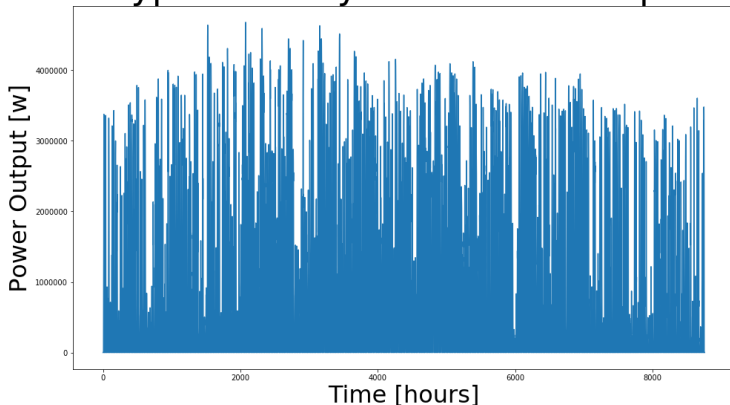


Figure: Actual solar farm data from AlsoEnergy [4]

## Typical Yearly Solar Farm Output



**Figure:** The typical power output of the UIUC solarfarm over a year.

## Power Purchase Agreements

### Quick Facts [6]:

- Power purchase agreement (PPA) with Rail Splitter Wind Farm
- PPA requires UIUC to buy 8.6% of the energy produced by the wind farm.
- Fixed price of 4 cents/KWh
- Sometimes sold back at loss.  
e.g. A windy night when demand is low but the wind farm is producing a lot of electricity.

## Chilled Water

### Quick facts [2]:

- The energy consumption from chilled water is felt as electricity\* demand.
- The only method of energy storage on campus.

\*There are also steam driven chillers that are not currently being used.

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## Current Work

- Finding the optimal size of a reactor to minimize the cost of electricity and steam.
- The method will use RAVEN (Rabiti, INL), and will be based on a paper [5] that sized a reactor for a similar grid system.

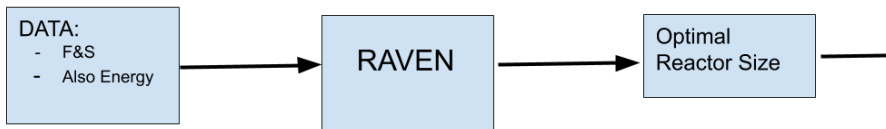
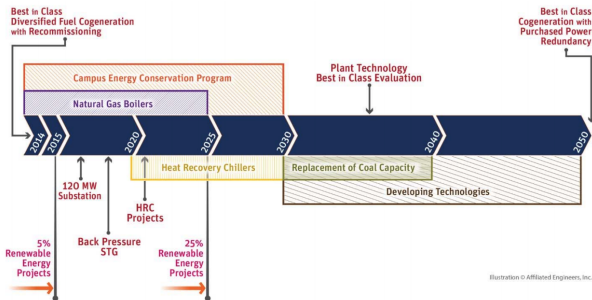


Figure: Work Plan.

F&S intends to retire the coal boilers by 2030 and replace them with “Developing Technologies,” according to the Utilities Master plan [3]. Without new technologies available, the current plan is to replace this capacity with more PPAs and natural gas [3]. However, small nuclear power was mentioned as a possible “developing technology” which could be considered if ready in time.



**Figure:** Current trajectory suggests that campus should “Re-evaluate and apply best of industry energy supply utilizing future advanced technology and innovations for plant repowering in the 2030-2040 time frame.” [3].

## References I

- [1] Abbott power plant.
- [2] Campus chilled water system.
- [3] Affiliated Engineers, Inc.  
Utilities production and distribution master plan.
- [4] AlsoEnergy.  
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<http://s35695.mini.alsoenergy.com/Dashboard/2a5669735065572f4a42454b772b714d3d>.
- [5] T. E. Baker, A. S. Epiney, C. Rabiti, and E. Shittu.  
Optimal sizing of flexible nuclear hybrid energy system components considering wind volatility.  
212:498–508.
- [6] Steve Breitweiser.  
Wind power: University of illinois at urbana-champaign.
- [7] Morgan White.  
Solar farm fact sheet.