UIUC Clean Energy Transition Plan

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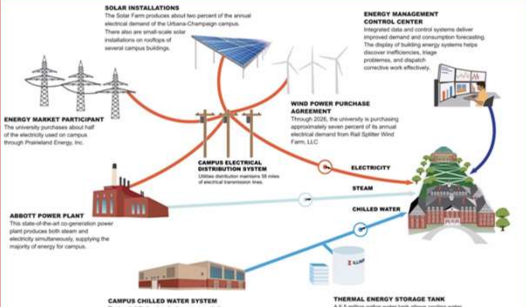
Conclusion: The University will need to implement a diverse collection of energy conservation and generation techniques. These recommendations are outlined below.

Our Goal

- Create a scoping document for a new clean energy transition plan for the UIUC
- Document will be reviewed by F&S and presented to an external engineering consulting firm as a basis for energy transition
- Our goal was not:
  - Considering carbon emissions from transportation
  - (Officially) considering a budget- committee will advocate our cost to the university
  - Planning in depth technical details, this will be done by consulting engineers

Our Approach

- Study existing UIUC campus plans; Use as a basis
- Interview subject matter experts on:
  - Their energy system expertise
  - Energy conservation/generation techniques
  - Campus specific energy generation/transmission/use
- Incorporate ideas from successful energy plans of peer institutions
- Implement clean energy generation techniques into plan



Source: University of Illinois iCAP

Future Work

- Each technology listed has the potential to be improved upon with more time and research
- Micro-nuclear reactors will not be commercially available for at least 8-10 years. This is a relatively new technology and currently has too high of a start-up and licensing price to be actively implemented.
- Solar power can be improved with the improvement of batteries and the amount of energy that can efficiently be stored for use during non-generation hours.
- Geothermal energy would need a campus-specific, geological land survey to determine a viable area for a large scale implementation of geothermal energy

Conservation

Conservation is underempathessied in current campus plans. There needs to be a much greater focus on this, especially in the short term, while generation technologies are developing.

Preventing Additional Energy Loads:

- New building constructions should be avoided as much as possible
- Any new buildings need to follow strict sustainability/energy efficiency standards:
  - Platinum LEED certification
  - Roof structured to support possible future solar projects
  - Efficient lighting system (sensors, scheduling, bulb efficiency)
  - Heat recovery chillers for chilled water and heat recovery wheels
  - Chilled water for air conditioning, hot water for heating
  - HVAC sensors and scheduling
  - Recycled/recyclable building materials, preferably from local manufacturers, to reduce transportation emissions
  - Highly insulated building envelope (efficient windows, adequate insulation, white reflective roofing to keep the building cool

Source: US Green Building Council

Current Building Conservations:

- Expand existing retro-commissioning team
  - Current team has been successful
    - Over $100 Million saved since started in 2007
    - Average 25% energy reduction per building project
  - Updates include:
    - Surveying the building for key issues (that can be addressed during the project or noted for future extensive renovations)
    - HVAC and lighting schedules and sensors
    - General maintenance
- Large mechanical renovations
  - Currently lots of deferred maintenance (old mechanical equipment wasting lots of energy)
  - Replace these with efficient equipment
  - Can be done in sequence with steam transition

Source: Energy Air

Policy Changes

One significant policy change would be through promoting future building efficiencies by encouraging all new construction projects to implement existing building strategies that promote net-zero functionality. We can additionally study existing buildings to see if there are viable ways to renovate current systems.

In addition, we would encourage the university to make institutional changes such as valuing long-term sustainability over short-term profitability by making significant investments into renewables, even if not economically lucrative in the short term.

Policies should be made to encourage individual departments to save energy wherever possible through social and financial incentives, while also giving individual departments within the university more responsibility and autonomy to determine energy policy.

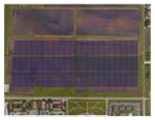
Generation Techniques

Nuclear

A realistic, long-term solution:

- Current progress is being made on campus to research and test the viability of micro-nuclear reactors
- Micro-nuclear is emission-free, reliable and boasts the potential to be portable and fully factory fabricated
- Advancements in technology indicate that the effects of nuclear radiation and the quantities of nuclear waste would not significantly damage ecosystems and inhabitants

Source: Idaho National Laboratory



Source: UIUC F&S

Source: Edison International

Solar

Solar Farms:

- Existing Solar Farms 1.0 and 2.0 are proven indicators that solar can be a functional generation resource for the campus
- Solar farm 3.0 is actively being considered, however there are certain drawbacks:
  - Solar is not effective during non-peak hours (during night hours and period of low insolence), thus is not reliable as a standalone resource
  - Adding more panels may lead to a surplus of generated energy, which would not be efficiently sustained by currently available storage technologies:

Storage:

- Current storage technologies are expensive and dangerous (i.e: leading technology lithium-ion batteries are expensive and have tendencies to explode)
- We should devote research to alternative storage technologies:
  - Improved storage technologies would significantly increase the capacity and reliability of solar technology, thus allowing us to implement them on a larger scale

Conversion from Steam to Hot Water Heating System

- Campus heating is currently reliant on steam from Abbott through the burning of fossil fuels
- Steam is outdated and much too hot for the building heating needs
- Hot Water System would allow for the electrification of heating, thus allowing the use of renewables to power it
- Downside: Infrastructure conversion will be expensive, potential to use some existing infrastructure
- Implement on smaller scale in the most compatible buildings, and spread to the remainder of the campus over time

Source: SunTech

Geothermal

High potential for success:

- Extremely efficient
- Low operational costs

Implement on a building by building basis based on compatibility:

- Underground space and geology
- Access availability for future repairs
- Heating/cooling load of a building

Case Study: Data from the Campus Instructional Facility in the coming years can be used to help determine the widespread feasibility of campus geothermal.

Air Source Heat Pumps

- Technology that utilizes heat transfer from the outside air
- Less efficient than geothermal, but much easier to implement
- Implement in centralized location or direct building connection

Source: Ameren Illinois

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