



Utilities Production and Distribution Master Plan



THE UNIVERSITY CITY

The physical profile of today's University of Illinois at Urbana-Champaign campus is one that couldn't have been fully envisioned when it was founded in 1867. The university is its own dynamic and transforming city, with more than 320 main campus buildings, four square miles of farmland, 45,000 students, and 10,000 faculty and staff.

Campus energy usage is the equivalent of 52,400 average U.S. households, and supporting the teaching and research needs associated with the Urbana campus requires a \$100M per year energy enterprise. Providing reliable and economical utilities to campus includes a cogeneration power plant, chilled water system, natural gas pipeline, on-site renewable energy, power purchase agreements, and involvement of the campus as an energy market participant.

To fulfill the strategic goals of the university and ensure excellence, it is imperative that utilities infrastructure be maintained and developed to meet future demands.

Work on the Utilities Energy Production and Distribution Master Plan included three main tasks: evaluate existing Utilities & Energy Services Division services, analyze potential load options, and provide recommendations. **The key question is what will Illinois' energy future be.**

The master plan developed model scenarios for projected growth and associated impacts related to forecasts for steam, electricity, and chilled water. It also examined and evaluated existing production and distribution systems to establish an updated baseline and provide costs to repair, replace, operate, and maintain existing systems.

Several different renewable energy options that would move the campus toward the goal of achieving carbon neutrality were evaluated. Strategic utilities infrastructure planning is essential to ensure energy reliability in the short-term and to accomplish long-term goals.

MASTER PLAN SUMMARY

The master plan states that the University of Illinois is well positioned to continue providing safe, reliable, efficient, sustainable, and cost-effective energy to campus. Energy conservation initiatives have helped greatly improve the universi-

ty's energy profile, reducing the overall carbon footprint of campus by 12.1% since 2010.

Energy production per square foot of space was reduced from 312.3 to 244.2 kBtu/GSF between FY07- FY14, a 24% energy use intensity reduction in facilities. Abbott Power Plant's diversified fuel cogeneration capabilities along with energy conservation efforts are the foundation for the campus energy enterprise.

Sustainability

In 2008, the university signed the American College and University President's Climate Commitment pledging carbon neutrality by 2050 or the earliest possible date.

The Illinois Climate Action Plan (iCAP) was presented in 2010 as the institutional action plan to establish and achieve goals.

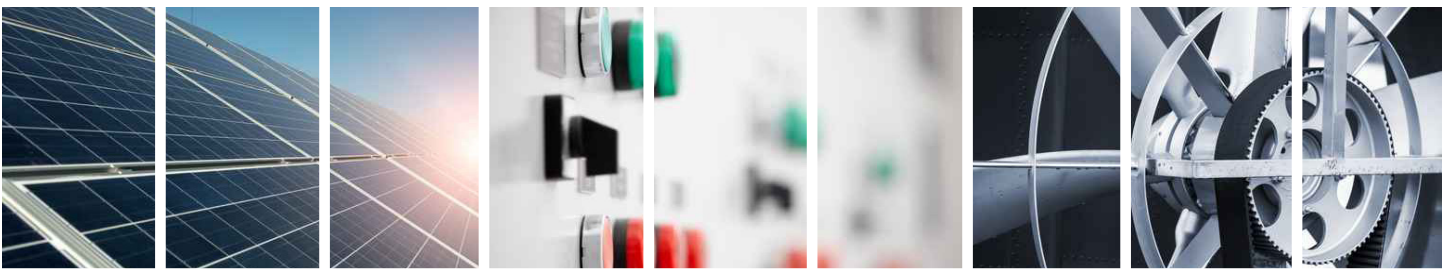
The master plan assists with evaluating how the university can best achieve iCAP targets for renewable energy and building energy reduction.

RECOMMENDATIONS

The master plan provided nine universal recommendations:

- Enhance best-in-class diversified cogeneration power plant
- Limit campus growth to net zero gross square feet (GSF)
- Expand current energy conservation programs in conjunction with Retrocommissioning (RCx)
- Aggressively promote the use of energy reduction strategies in new capital projects and ensure full functionality with enhanced commissioning
- Increase the electric import capacity
- Purchase additional renewable energy projects and power purchase agreements
- Provide heat recovery and energy reduction strategies on all new capital projects
- Add variable speed chillers to central system
- Re-evaluate and apply best of industry energy supply utilizing future advanced technology and innovations for plant repowering in the 2030-2040 time frame

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RECOMMENDATIONS

Enhance best-in-class diversified cogeneration power plant

Cogeneration uses steam to both heat and power campus and produces less than half of the carbon emissions of electricity purchased from the regional grid. Due to fuel prices and conservation initiatives to reduce steam demand on campus, Abbott Power Plant has been able to reduce coal consumption by almost 50% since 2009.

Limit campus growth to net zero gross square feet

Campus growth has the single greatest impact on greenhouse gas emissions and greatly affects energy and carbon reduction strategies presented in the study. The master plan recommends maintaining the existing campus square footage profile at 22,173,000 GSF. Doing so will reduce the need to build additional utilities infrastructure, manage the cost associated with acquiring and installing new utility assets, and keep the university within current air permitting regulations. A net zero growth space policy has been incorporated into the Campus Administrative Manual.

Expand the current energy conservation programs in conjunction with Retrocommissioning (RCx)

The university has successfully reduced energy use in existing buildings. Energy conservation is one of the best returns on investment for campus, with project payback periods and energy savings guarantees through two RCx teams, Energy Performance Contracting, campus-wide lighting retrofits, and incorporating LED technologies. The average energy usage reduction, following RCx work to improve the operation and maintenance of building systems, is 28% with an estimated total cost avoidance of \$30M since the start of the program in FY08.

Aggressively promote the use of energy reduction strategies in new capital projects and ensure full functionality with enhanced commissioning

The university is a national leader in sustainable building design by updating its requirements to LEED® Gold certification for all major renovations and new construction projects more than \$5M, applying these techniques to both new construction and historic preservation. LEED certified facilities on campus and those in process comprise more than 2.3M gross square feet of green building design. *LEED® is a registered trademark of the U.S. Green Building Council.*

Increase the electric import capacity

The university faces limits on importing electricity from the grid due to the current setup of Ameren's transmission and distribution system. Feasibility studies are being performed to assess the potential to increase the 60MW import limit to help address peak energy demands on campus. At times

in the summer, Abbott Power Plant must generate 20MW to assist in meeting peak demand while staying below the 60MW import limit.

Purchase additional renewable energy projects and power purchase agreements

By the end of 2015, a 20.8 acre Solar Farm is expected to provide approximately 2% of the electricity demand for campus, helping to meet renewable energy goals outlined in the iCAP. One of the benefits of installing a solar array is that it matches the profile for when campus needs energy the most, something more difficult to achieve with wind power. UES also purchased Renewable Energy Credits to fulfill current iCAP renewable energy goals and is continuing to evaluate options for a wind power purchase agreement.

Provide heat recovery and energy reduction strategies on all new capital projects

Air-to-air heat recovery systems are required by the university's Facilities Standards. As a part of the LEED certification and deferred maintenance process, heat recovery wheels have been installed in multiple facilities on campus.

Add variable speed chillers to central system

Bringing more facilities online as a part of the campus chilled water system can be accomplished by replacing existing chillers with larger-capacity chillers when equipment reaches the end of its useful life. Chiller replacement should utilize variable speed chillers to improve system efficiency.

Re-evaluate and apply best of industry energy supply utilizing future advanced technology and innovations for plant repowering in the 2030-2040 time frame

Utilities & Energy Services will continue to develop greater efficiencies whenever practical, incorporating advancements in technology – often to respond to growing research needs. The \$10M Thermal Energy Storage system provides additional cooling capacity for campus when electrical prices are lower. This system came online in part to help meet the energy requirements of the National Petascale Supercomputing Facility.

The last major review of production and distribution systems on the Urbana campus occurred in the 1990s, focusing on heating, electrical, and cooling needs. Those efforts helped establish the Central Chilled Water System, brought about the addition of two gas turbines at Abbott Power Plant as well as the new Campus Electrical Substation and Distribution System.

