ILLINOIS

International District Energy Association
System of the Year Award

2024

University of Illinois Urbana-Champaign District Energy System – Utilities & Energy Services, Facilities & Services

Owner:
University of Illinois Board of Trustees

Type of Ownership:
Public University

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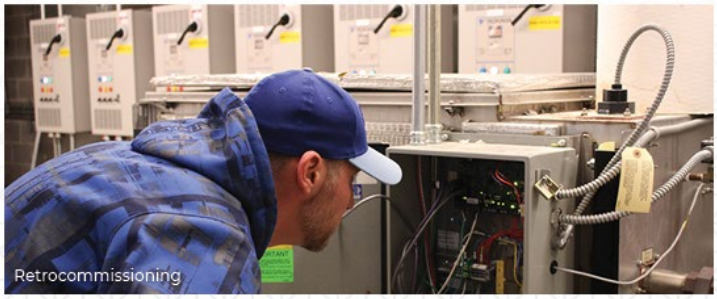
Solar Farm 2.0


Abbott Power Plant


Community Engagement


Retrocommissioning

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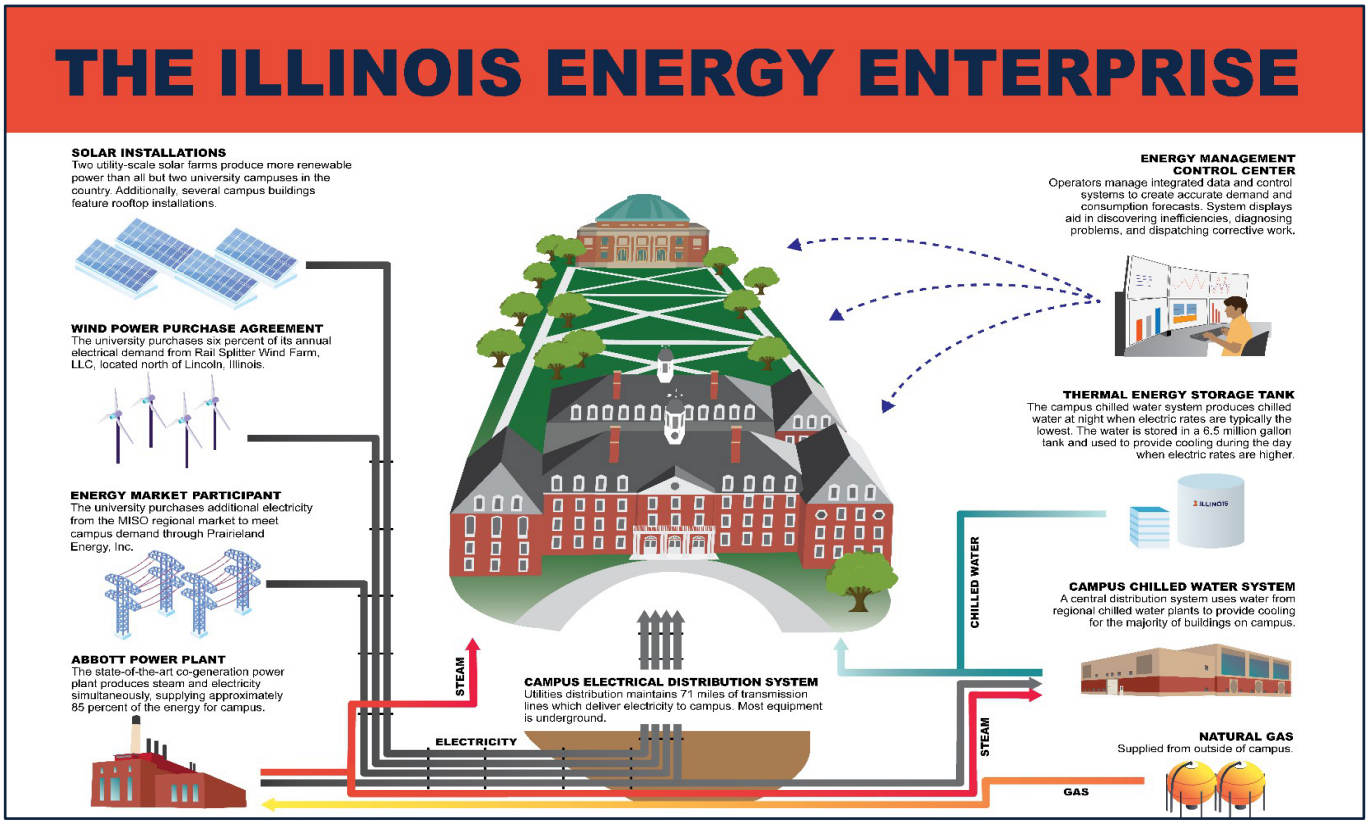
1. SYSTEM DESCRIPTION

The Illinois Energy Enterprise

For over 150 years, the University of Illinois Urbana-Champaign has delivered advanced scholarship, breakthrough discoveries, and meaningful public engagement that decisively changes the world. As the flagship campus for the state, the university provides world-class access to research, instruction, and other educational opportunities to nearly 57,000 students from 48 states and more than 130 countries each year. Over 11,000 full-time employees work on the 6,370-acre campus, encompassing 651 buildings where students, faculty, and staff learn, live, and collaborate.

Utilities & Energy Services (UES) in the Facilities & Services (F&S) unit produces, distributes, and operates campus utilities, ensuring a careful balance between safety, reliability, sustainability, and cost-efficiency. The unit is state-supported and also receives specific project and initiative funding from various sources, including energy conservation grants and Student Sustainability Committee allocations, which allows the university to integrate new technologies and streamline the processes of this $100M per year utility enterprise. Since fiscal year 2008, the university has reduced energy use per square foot by approximately 40 percent (116,433 BTU/GSF) through aggressive centralized conservation programs, targeted capital renewal, and a nonstop commitment to occupant action, exceeding strategic goals.

Boldly shaping the world's future through the pursuit of academic and innovative excellence requires aligning energy management activities with every aspect of the university's mission to meet today's emerging challenges and fulfill every facet of its land-grant mission.



Utilities Production and Distribution

UES directs campus utilities through various on-site infrastructure and as an energy market participant. Most notably, these services are provided through wholly owned utilities of Abbott Power Plant, the Campus Chilled Water System (CCWS), a network of steam (9 miles of tunnel) and electrical systems (71 miles including overhead), sanitary and storm sewers (126 miles), natural gas pipelines (31 miles), and a potable water distribution system.

Abbott Power Plant

Abbott Power Plant supplies approximately 85 percent of the campus' energy through cogeneration of steam and electricity, providing reliable and environmentally responsible power for electricity and steam to campus facilities. During low demand for both heating and air conditioning, Abbott typically uses natural gas but can also transition to other fuels if and when necessary. The university continues to work toward minimization of coal use consistent with strategic long-term objectives. Still, during the winter months, when the campus heat load is highest, coal is utilized as a supplemental and reliable fuel source. Extensive underground piping connects campus buildings to the five CCWS production plants. Twenty-one chillers (steam and electric driven) deliver the necessary chilled water to operate building air conditioning systems. A 6.5 million-gallon Thermal Energy Storage (TES) tank, built in 2010, can provide 50,000 ton-hours to help meet the cooling demand on campus.

Sustainable power is significantly incorporated into the campus electrical distribution system through two large-scale on-site solar arrays. In fiscal year 2023, solar output from both arrays supplied 6.6 percent of the campus electricity demand, with Solar Farm 2.0 and Solar Farm 1.0 generating 16,810 MWh and 6,985 MWh, respectively. The solar farms help the campus exceed goals outlined in the campus sustainability action plan, the iCAP (Illinois Climate Action Plan), available at https://icap.sustainability.illinois.edu/. Several small rooftop solar arrays, ground-mounted panels, and a wind power purchase program also contribute to the electric supply.

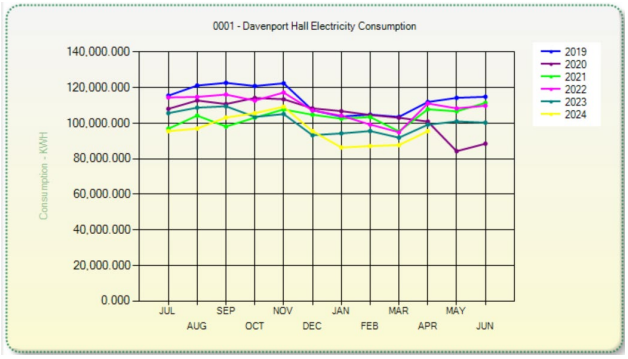
Systems & Controls: Building Systems

The district energy system used on the Urbana campus couples the generation of energy streams with the consumption of those streams to help manage and decrease system demand, thereby reducing costs and emissions. The Energy Management Control Center (EMCC) is at the heart of the Illinois real-time energy-management data enterprise. The EMCC brings all control systems into one area, integrating demand, purchase, and production with enhanced monitoring and automation capabilities. The EMCC ensures that UES will continue providing reliable energy for the university by keeping technical systems operating efficiently. A significant effort is underway to update the majority of existing facility control systems to current standards, improving efficiency and the building environment. Campus facilities are being upgraded to electronic systems, with pneumatic controls phased out whenever improvement projects occur.

Business Operations: Campus Energy Monitoring

Departmental facility and business managers receive energy consumption and cost information through the

Energy Billing System (EBS) and its metering, billing, and reporting components. EBS Web allows users to access their utility bills and to evaluate the impact of changes in building heating, ventilation, and air conditioning (HVAC) programming, including time-based calculations or building-to-building comparisons on energy usage. Business Operations also provides financials for all UES budgets and utility commodity rate setting, including analysis of related capital projects.



Energy Billing System

As a Midcontinent Independent System Operator (MISO) market participant, the university has the ability to preplan its purchases of electricity from the regional grid and arrange the dispatch of the campus assets in an economical manner through the utilization of a hedging portfolio. These purchasing opportunities not only result in significant cost savings opportunities for the university but they also provide additional, stabilized budget certainty for executive financial planners.

Energy Conservation: Innovative Solutions

UES programs and initiatives focus on reducing energy consumption while meeting campus needs.

- Retrocommissioning (RCx) is an in-depth team analysis of a building's HVAC systems and maintenance program designed to configure the optimal operating conditions and the control strategies for energy conservation, sustainability, and occupant comfort. RCx engineers and field technicians review and improve building performance through sophisticated, remote computerized monitoring and on-site maintenance. F&S established the RCx program in 2007 with a single team. Since then, the program has grown in personnel support and scope to address over 90 campus facilities, has achieved over $118M in energy cost avoidance, and has received $17.4M in energy efficiency incentives. Staff expect to analyze and commission 500,000 GSF each year with energy savings projected of between 8,186 MMBTUs and 24,560 MMBTUs/year, which amounts to 10 to 27 percent of the energy consumption in buildings visited.

- Geothermal is another strategy in new and retrocommissioned buildings used where appropriate. An innovative installation for one of the campus' newest buildings, the Campus Instructional Facility, used cutting-edge research from faculty to reduce the up-front installation costs of low-temperature geothermal heat exchange technology and monitor the operational efficiency of the system. Through this collaboration, the project reduced the boreholes required while shortening the payback period from 40 years to 28.

- Energy Performance Contracting (EPC) is a capital project delivery method utilizing an accredited Energy Service Company (ESCO) to provide all the services required to design and implement a comprehensive energy-saving project at the customer facility. The process begins with an initial energy audit and continues through a long-term guarantee of project savings via an Energy Performance Contract. The Urbana campus has now executed over $100M of EPC projects with a pool of prequalified ESCOs, starting with the College of Veterinary Medicine facilities in 2010, which resulted in an estimated cost avoidance of $1.4M annually. To date, 17 energy-intensive, research-focused buildings have benefited from the EPC delivery method, resulting in guaranteed savings of over $6M annually and an estimated

20-year cost avoidance exceeding $200M. A sixth EPC project, currently under construction, will optimize chilled water operations, saving over $800K per year in utility costs. EPC investments are projected to be $95.6M from FY23–FY26, with an anticipated $5.96M/year energy savings, a $27M reduction of deferred maintenance, as well as a receipt of $1.37M of energy rebates.

- F&S professionals also help customers find suitable financial support for energy reduction efforts through a Revolving Loan Fund and other methods in collaboration with the Office of the Provost, including grant opportunities and standard and custom incentives for items such as lighting and HVAC enhancements.

System Snapshot: University of Illinois Urbana-Champaign		
	Hot Water, Steam, or Combined Heat/Power System	**Chilled Water System**
Startup Year	1940	2000
Number of Buildings Served	147	136
Total Square Footage Served	17,548,950 sg ft	16,518,717 sq ft
Plant Capacity	1,025,000 lb/hr steam 79.2 MW electricity	50,000 tons of production and 50,000 ton-hours chilled-water storage
Number of Boilers/Chillers	6 boilers, 2 gas turbines with 2 heat recovery steam generators	19 electric chillers and 2 steam turbine chillers
Fuel Types	Coal, natural gas, and No. 2 fuel oil	Electric and steam
Distribution Network Length	9 miles of tunnel and 9 miles of direct buried pipe	27 miles of pipe
Piping Type	Direct-buried ductile iron, insulated carbon steel, and high-density polyethylene	Ductile iron, HDPE, carbon steel, and PVC pressure pipe
Piping Diameter Range	2 to 16 inches	4 to 54 inches
System Pressure	In plant 850, 325; distribution, 150, 50 (psig)	100 supply and 60 return (psig)
System Temperatures	350 steam, 180 condensate (Deg F)	42 supply, 58 return (Deg F)
System Water Volume	N/A	4,500,0000 gallons in campus loop and another 6,500,000 gallons in storage tank

2. DEMONSTRATED EFFICIENCY

Energy Use Goals and Trends

The university began tracking the performance of the Energy Utilization Index (EUI) in 2007. The EUI is an industry-standard metric adopted to set goals and assess energy conservation progress towards those goals. The 2010 iCAP established reduction goals by comparing future EUI values against the baseline year of 2008. Table 1 below depicts the calculated EUI and tracks progress toward the original iCAP reduction goals of 20 percent by fiscal year 2015, 30 percent by fiscal year 2020, and 40 percent by fiscal year 2025. The 2020 iCAP has extended those goals to 45 percent by fiscal year 2030, 50 percent by fiscal year 2040, and 60 percent by fiscal year 2050.

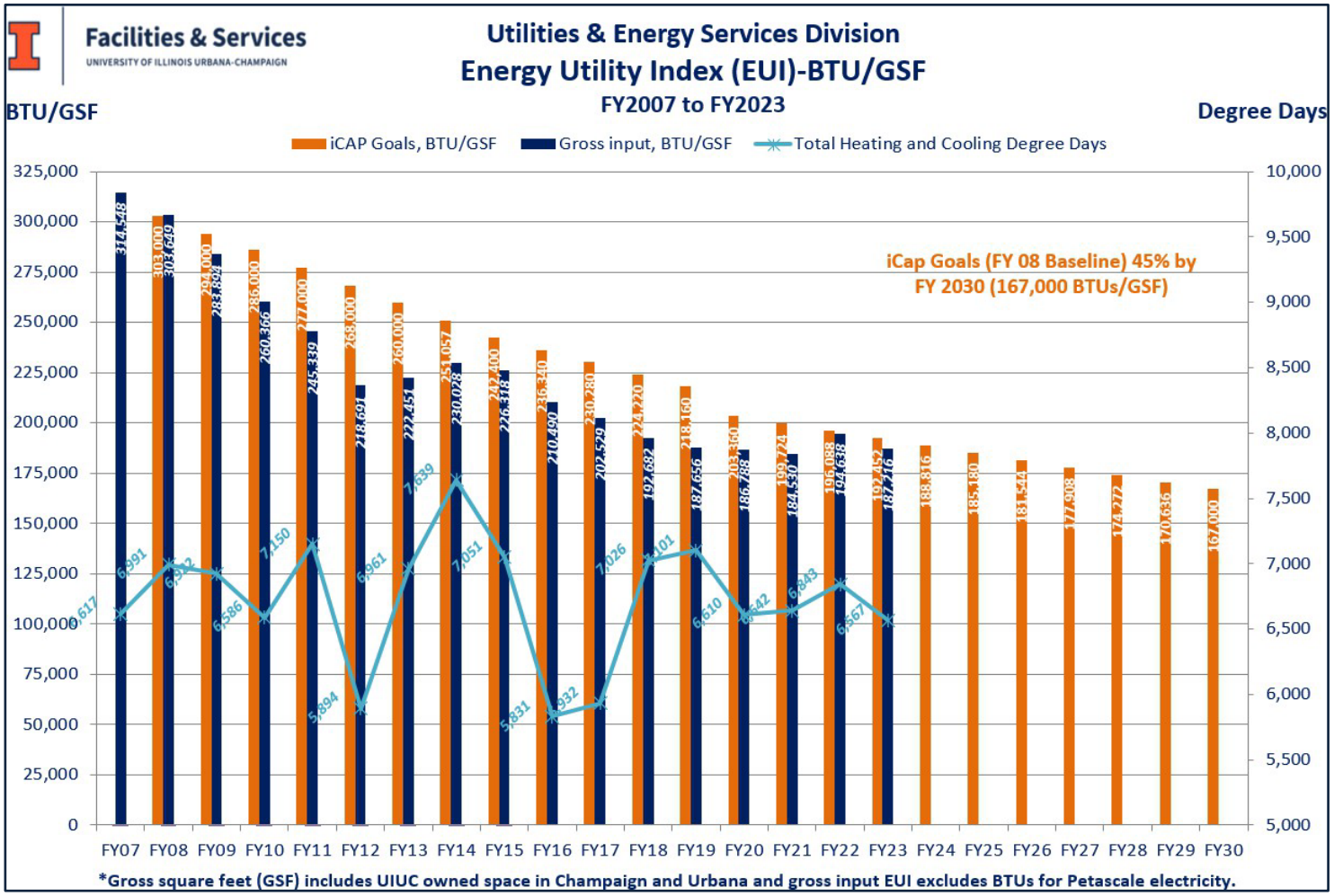


Table 1 – Energy Usage Trend

The Urbana campus remains on track to achieve the 2030 goal of a 45 percent reduction in energy usage compared to the fiscal year 2008 baseline. In fiscal year 2022, there was a slight increase in EUI primary due to necessary cooling demand. Cooling degree days were 17.6 percent higher compared to fiscal year 2021. As a result, chilled water usage increased by 9.7 percent and electricity increased by 8.0 percent.

Abbott Power Plant and Chilled Water System

Campus Chilled Water System

Abbott's efficiency varies based on the time of the year, the overall campus demand for both steam and electricity, and the need to generate excess electricity (beyond what is cogenerated). As such, the overall plant efficiency (Energy In/Energy Out) varies throughout the year, with a low of around 60 percent to a high that exceeds 80 percent. The annual average is right around 70 percent. The efficiency of the chiller plants also varies based on the time of year, outside air temperature, and the equipment being operated. The chiller efficiencies range from a low of around $0.6 kW/ton to a high of around $0.73 kW/ton throughout the year. Equipment-specific efficiencies are calculated and displayed in the plant digital control systems, and operators use those calculated efficiencies when determining and defining the dispatch to maximize efficiency and minimize costs. Operators also closely monitor cooling water temperatures to help maximize the efficiency of the chillers.

UES is developing and integrating a system-wide chilled water optimization program. This initiative will examine chiller, cooling tower, and pump efficiencies and calculate dispatch strategies that further promote system efficiency with an anticipated cost avoidance of 15 percent or greater.

3. DEMONSTRATED AVAILABILITY/RELIABILITY

The university maintains several utility infrastructure installations that serve critical research and instructional facilities throughout the campus. The core mission of the university could not be achieved without the reliable, responsible, and ready staff and systems in UES.

Except for a very small portion of overhead high-voltage electric conductor, the utilities distribution network is maintained as underground infrastructure. In-house professionals regularly repair and construct the systems to achieve prompt, efficient, and consistent service. Internal teams of engineers, pipefitters, and electricians work closely with facility managers and researchers to ensure that building outages do not adversely impact the important activities of university administrative and academic units.

Abbott Power Plant is staffed 24/7 by Operating Engineers. Their constant diligence in plant operations have demonstrated a perfect availability record by handling production anomalies immediately and without service interruption.

CCWS plants are staffed eight hours daily, five days weekly. During off-shift and weekends, one operator is assigned to monitor the systems via remote digital control systems. Due to the system's redundancy, the CCWS has also performed to near-perfect availability.

Chilled Water System	Steam System
FY23 99.99902% RELIABLE	FY23 100% RELIABLE
FY24 (To date) 100% RELIABLE	FY24 (To date) 100% RELIABLE
Electric System	**Water System**
FY23 = [1 – 5 hrs/(8760 hrs x 370 customers)] x 100 = 99.99985 %	FY23 99.85668% RELIABLE
FY24 = [1 – 15.5 hrs/(6600 hrs x 370 customers)] x 100 = 99.99937%	FY24 (To date) 99.99841 % RELIABLE

4. DEMONSTRATED RESILIENCY

Robust Combined Heat and Power Plant

- Fuel flexibility continues to provide one of the key components of the resilient operations at the university's combined heat and power plant. Throughout the years, Abbott has maintained the ability to burn natural gas, coal, and fuel oil, helping to ensure the reliable production and delivery of steam to campus. This fuel flexibility helps to protect the university from price volatility and periodic delivery constraints. Fuel flexibility has proven critical these past two winters when the delivery of gas to the campus was constrained during critical peak winter days, and the ability to burn alternate fuels proved essential to the dependable delivery of steam to campus when that steam was needed most.

- As a part of long-range utilities master planning efforts, the campus has continually invested in improved energy efficiency projects for production at Abbott Power Plant and the CCWS. A controls upgrade for one of the electric turbines saved 17,000 MMBTU/year. The conversion of another turbine at Abbott saved an additional 40,000 MMBTU/year due to the energy savings associated with running a backpressure turbine compared to a condensing turbine.
- The university also maintains equipment diversity and redundancy, and at least N+1 redundancy for all critical production assets. Continued investments in the maintenance of these systems is also a key component of maintaining the N+1 availability for all critical systems.
- The campus operates and maintains two black start generators, which enable a restart of Abbott Power Plant and service to the campus without a connection to the grid.
- As a market participant in MISO, the electric interconnect with the regional grid is sized to allow for the purchase of all power necessary to operate the campus from that method exclusively. This interconnect is fed bi-directionally, so that even if one of the feeds is lost, the other feed is sized and configured to handle campus' entire electric load.
- The direct digital controls system that is used to operate and control both the power plant and the chiller plants is installed on a stand-alone fiber network. This dedicated network insulates the production systems from the campus networks and provides an additional layer of protection from potential cyberattacks.

Flexible Chilled Water System

Thermal Energy Storage Tank

- The CCWS is comprised of five different plants and a 6.5 million gallon thermal storage tank. The system has 47,000 tons of installed chilling capacity, with another 8,000 tons of cooling available from the TES tank. The system has N+1 capacity available at all times.
- The installed chiller capacity includes 10,000 tons of steam turbine driven chiller. The steam driven chillers and TES tank have proven to be essential assets during peak electric demand days, allowing the university to lower the electric demand on campus by shifting loads off electric driven chillers during peak demand periods.

Durable Energy Distribution Systems

- There are 52-miles of medium voltage electrical-distribution systems in underground ductwork and manholes; this includes two substations, 12 distribution centers, 28 load centers, 460 transformers, 92 emergency generators, and approximately 300 miles of electrical cable.
- The majority of the electrical distribution system is composed of conduit buried in a concrete encased duct, helping to ensure that potential interruptions related to weather conditions, or other outside influences, are eliminated. All critical buildings have dual feeds along with two transformers to help further reduce the risk of a building outage related to an equipment failure. Lastly, the electrical distribution network on campus is split into two fully redundant buses. These electrical buses are cross-connected and configured to automatically switch over and feed the other bus in case of a failure or disconnect, adding another layer of protection and redundancy to electrical infrastructure.
- Extensive underground piping connects 138 campus buildings to the five CCWS production plants and TES tank. Twenty-one chillers (steam and electric) deliver the necessary chilled water to operate building air conditioning systems. All of these distributed generations assets are connected by a robust looped distribution network to help ensure there is never an interruption of service to the campus buildings.
- The campus steam distribution system includes over nine miles of tunnels and another nine miles of direct buried pipe. Steam is distributed at both 50 and 150 psi, helping to ensure that adequate pressure is available to even the most remote buildings on campus. The steam system is looped to help ensure continuous service to all buildings at all times. The steam and condensate piping system includes vaults, structural elements, PRVs, traps, valves, condensate return units, and condensate meters.
- UES operates a high-pressure natural gas transmission system that includes an 8” 700 psi main system running from Monticello (Kinder Morgan) to Curtis Road and Neil Street in Savoy, Illinois; a 10” 400 psi main system running from Curtis Road and Neil Street to Abbott Power Plant (about two miles; and a 100 psi plastic piping campus distribution system).

- The University of Illinois public water system (FACILITY #0195500) consists of 48 miles of direct buried piping that serves over 70,000 people in the 347 buildings supplied.
- Campus also utilizes a series of underground sanitary and storm sewer systems.

5. Environmental Benefits

Sustainability efforts are at the core of the university's commitment to its mission and making a global impact across the state, nation, and world. Employees, students, and community members all help to define, implement, and support the university's successful and dynamic, multidisciplinary approach, which strives to achieve objectives aligned with renewables, energy conservation, waste management, active transportation, and enhanced sustainability education, innovation, and research.

- **Combined heat and power (CHP) advantages** – The operation of the CHP system on campus helps to reduce CO2 emissions by over 100,000 tons every year when compared to electricity purchased from the regional grid, and it reduces NOx emission by over 500 tons a year.
- **Emissions control systems** – The university has operated a Chiyoda flue-gas desulfurization system in conjunction with electrostatic precipitators for the past 40-plus years at Abbott Power Plant. This system removes well over 90 percent of the sulfur dioxide from the coal that is burned. It also reduces mercury emissions in the flue gas to levels that are almost non-detectable and a fraction of the proposed limits by the Environmental Protection Agency (EPA). These systems continue to be the best-in-class for flue-gas desulfurization and particulate removal today, and UES is not aware of any other university in the country that owns and operates a similar system.
- **Asbestos removal** – An asbestos removal line item has been included in the budget of the power plant for the past 10 years. These funds have been used to remove and replace asbestos throughout the facility, as well as ensure that all asbestos containing materials are properly labeled.
- **Reduced reliance on fossil fuels** – Coal usage has been reduced significantly over the past 10 years, resulting in lower overall CO2 emissions for the campus. While the coal assets are essential to our reliable delivery of steam to campus, the university has made a substantial effort to reduce the amount of coal burned annually. Through a multifaceted approach, F&S has helped the university reduce air emissions by approximately 47 percent since 2010 (150,618 metric tons CO2 + CO2e).
- **Chemical management** – The university has worked diligently to remove or minimize the risk of chemical exposure for employees. The vast majority of chemicals used by UES are delivered and stored in bulk containers, eliminating the need for employees to handle any of the chemicals directly. Staff have also reduced the concentrations of some of the potentially more hazardous chemicals, such as acid and caustic, to help lower exposure risks for employees.
- **Lead cable replacement and PCB removal program** – UES has maintained an active program to replace all lead cable in the campus electrical distribution system. In addition, all electrical gear containing oil with PCBs is being replaced.

6. SUSTAINABILITY EFFORTS

Renewable Energy

The university is proud of its sustainability initiatives to meet the Climate Leadership Commitments, including being carbon neutral as soon as possible and building resilience to climate change in the local community. Since 2015, The EPA has recognized the university as a Green Power Partner for its production and acquisition of electricity from clean, renewable sources. The partnership encourages organizations to purchase green power to reduce environmental impacts associated with conventional electricity use. The U of I is ranked 30th of all EPA Green Power Partners nationally with 46,698 MWh/year of usage.

Total campus greenhouse gas emissions have been decreased by more than 32 percent (183,809 MTCO2E) from the iCAP baseline, and achieving the lofty standards in the plan has positioned the university as a sustainability leader within higher education and among its leading research university peers.

Solar Farm 2.0 Tours

Solar Farm 2.0

The 54-acre, 12.3 MWdc bifacial solar array with a tracking system was energized in January 2021. The site has already produced 56.6 GWhs of energy for use by the campus. The installation was built with zero waste construction and is also the home to an ongoing multi-university research study about pollinator plantings under solar arrays. Last summer, sorghum, soybeans, and red clover plots were established by the Sustainably Colocating Agricultural & Photovoltaic Electricity Systems (SCAPES) research team. This work represents some of the initial steps this group has taken to initiate photovoltaic field research plots on the campus. Additionally, the solar farm serves as a public site for campus community tours. The university has also collaborated with Illinois State University to produce a virtual reality solar tour for K-12 students in Illinois.

Solar Farm 1.0

A 21-acre, 5.87 MWdc fixed-panel solar array was energized in December 2015 on south campus and has produced 57.6 GWhs of energy since inception. The first on-site utility-scale array at the university generates approximately 7,000 MWh/year, the equivalent of about 700 homes, or two percent of the annual power needs of the campus.

Medium and Small Scale Solar Energy

Numerous rooftop and ground-mounted solar installations are active throughout campus property. The sites range from the 278,000 kW rooftop array on the Electrical and Computer Engineering (ECE) Building to photovoltaic panels at Allerton Park & Retreat Center and Wassaja Hall. These installations began with the Business Instructional Facility in 2009 and continue to be installed with new construction or major renovations whenever feasible. These smaller-scale installations are contributing over 575 MWh/year of electricity.

Wind Power Purchase Agreement

An agreement with Rail Splitter Wind Farm, LLC, to purchase 8.6 percent of the wind farm production and associated Renewable Energy Certificates (RECs) from a wind farm north of Lincoln, Illinois, was signed in November 2016. This PPA includes the delivery of wind energy to campus when the resource

is prevalent, and it provides 25,000 MWh/year.

Energy Savings

To strengthen the RCx program's impact, a complementary preventative maintenance program was established to preserve and improve upon gains wherever possible. The focus of these Recommissioning (ReCx) visits is to reduce energy consumption while also evaluating building mechanical systems, which includes reviewing current codes and identifying noncompliant items so they operate safely and efficiently, as well as improving the building's environmental conditions for the occupants. ReCx teams have delivered evaluations for 1.25M square feet of campus space, a 10 to 25 percent decrease in energy per building, and a total of 23,000 to 60,000 MMBTU/year reduction.

Centralized Energy Conservation Programs

As a part of long-range utilities master planning efforts, the campus has continually invested in improved energy efficiency projects for production at Abbott Power Plant and the CCWS. A controls upgrade for two turbines at Abbott saved 57,000 MMBTU/year due to the energy savings associated with running a backpressure turbine compared to a condensing turbine.

7. WORKPLACE SAFETY/EMPLOYEE TRAINING

ZERO ACCIDENT ZAP PERFORMANCE

Safety is the top priority and a core organizational value where staff strive to protect the health and welfare of employees, customers, the community, and each other. Abbott Power Plant's injury record is exemplary, with over five years of no-days-away injuries and a DART rate of 1825+. Also, UES has a comprehensive Incident Investigation program. All occurrences, including near misses, are investigated, driving at root cause identification and implementing permanent corrective actions. Results of investigations are shared across the organization as best practices. Safety alerts are often generated at the onset of the investigation, heightening awareness across the unit. Lessons learned are shared to prevent similar incidents from occurring.

Robust Personal Protective Equipment (PPE) Program

- Safety glasses (prescription lenses)
- Safety footwear
- Hard hats
- Hearing protection including routine medical monitoring for those working in high noise areas

Emergency Preparedness

- Regular AED, CPR, and bloodborne pathogens training for all staff
- AED and bleed kits in multiple locations regularly inspected by internal and external staff
- Eyewash/emergency showers/fire extinguishers regularly inspected
- Routine emergency drills performed in conjunction with local fire and police departments and multiple business units
- Local fire departments notified for every entrance/exit of a confined space

Recurring OSHA Programs

- Lockout/tagout
- Hot work
- Confined space
- Hazardous communications
- PPE
- Elevated work and height assessments

Employee Participation/Bolstering Safety Awareness

- June Safety Month – employees participate in weekly safety trainings and compete with knowledge to win safety-based prizes
- Safety discussed at the beginning of daily work meetings – employees are able to bring site issues up for immediate discussion
- Contractor Safety Orientations / New Hire Safety Orientations – provided to all contractors and colleagues (sessions highlight site hazards, program requirements, and what PPE is required)
- Training Coordinator position – streamlines operator development and consistency
- Asbestos removal policies
- Zero Accident Performance (ZAP) motto
- Abbott intranet portal – easy access to standing operating procedures, job hazard assessments, and safety data sheets

8. CUSTOMER RELATIONS STRATEGY

Campus Engagement

The current version of the iCAP, includes 56 specific SMART (specific, measurable, achievable, relevant, and time-based) objectives, organized into eight themes: Energy, Transportation, Land & Water, Zero Waste, Education, Engagement, Resilience, and Implementation; UES leads or co-leads many of these objectives, including a few customer-focused initiatives outlined below.

Energy Conservation Incentive Program (ECIP)

Started in 2013, the ECIP encourages occupant action at the building-level by recognizing the top energy reduction facilities on campus each year, compared to the previous year. In the initial years of this program, ECIP winners were provided a financial award that reflected their energy cost reductions. With a new Integrated and Value-Centered

Budgeting model, all colleges with energy reductions receive the benefit from those reduced costs.

Electrical Grid Response Strategies

The elevated risk of power disruptions in the future required UES to develop new, proactive operational strategies focused on “shedding load,” when necessary, to reduce energy consumption campuswide and limit the university’s energy demand from the grid during these advisory and warning periods. UES is collaborating with academic and administrative units to help to identify lower priority facility areas and items that would be able to be immediately shut down without concern or detriment to research, educational, or engagement activities. UES has created an Event Day Action Plan form to ensure these energy demand reductions are executed in a safe manner when an outage notification is received from MISO and Ameren. Individual reduction strategies (for lighting, computers and electronic equipment, motors, and general items) are also emphasized during the process.

Beat the Peak

The amount of energy the university consumes during the highest rate of demand on our regional electric grid helps to determine the campus’ annual utility rate. This peak period traditionally occurs in July or August. When peak energy occurs for our region, F&S activates a campuswide communication campaign to encourage immediate conservation efforts to the greatest extent possible. Email messages sent each year directly ask the entire campus community–a distribution list of approximately 80,000 people–to conserve energy usage because of excessive summer heat, freezing conditions, or before long periods of being away from the campus. This campaign is also extended online and across social media for the duration of the alert.

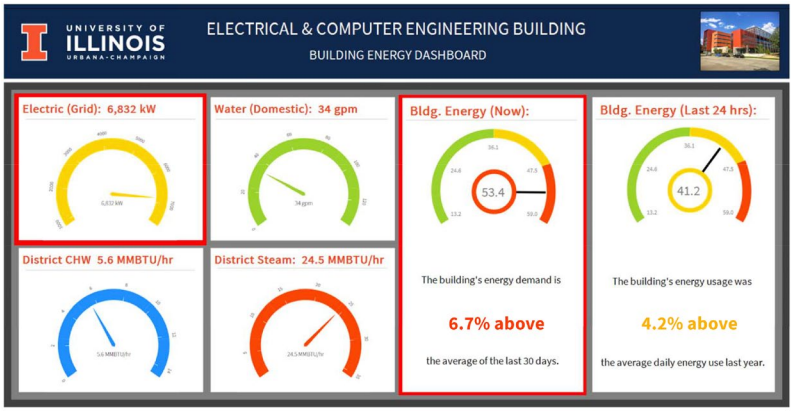
International Laboratory Freezer Challenge

U of I Freezer Challenge Award Recipients

For the last six years, the university has been honored with an award for achieving significant energy conservation results in the International Laboratory Freezer Challenge. From January to July 2023, researchers on the Urbana campus collectively earned a third “Winning Streak Award” by operating their labs with efficient and sustainable cold-storage sample management practices to improve energy efficiency, reduce costs, and protect sample integrity while earning competition points. The program continues to grow and last year, 94 labs combined to save an estimated 479,792 kilowatt-hours (kWh), or the equivalent energy usage of 43 typical U.S. homes annually.

F&S INSIDER and Social Media Engagement

Many utilities-related feature stories have been featured prominently in F&S’ online magazine the INSIDER, available at https://fs.web.illinois.edu/Insider/tag/utilities-energy-services/. Stories there highlighted energy performance contracting, retrocommissioning at the State Farm Center, and a celebration of a campus 'net zero energy' building, among others. UES notifications and information are also vertically integrated across organizational and campus social media channels.



Building Energy Dashboards

UES keeps and maintains electricity consumption data for most Urbana campus buildings. A web page dashboard enables users in these selected buildings to view and track their electricity on a real-time basis. The dashboard is written in web browser-agnostic code (html5) so that it can be viewed on most web browsers and/or embedded or included on the buildings digital signage.

9.0 COMMUNITY INVOLVEMENT

Active Participant in Campus Research

Over the past 10 years, F&S has developed an active role in the campus research community. Collaborations with units and teams on campus have supported millions of dollars of research funding for projects on the Urbana campus. UES has played an important part in helping to support research related to carbon capture, micronuclear, energy storage, biofuels, and geothermal.

Carbon Capture

Abbott Power Plant has facilitated several carbon-capture research projects funded by the Department of Energy, in partnership with researchers from the Prairie Research Institute. First, staff coordinated with Linde Gas North America to test three technologies for reducing aerosol particle concentrations in flue gas. This work is intended to help make solvent-based carbon capture technology more economical on a commercial scale. The second project strived to advance the early development of a CO2 absorption technology at 40 kilowatts following successful proof-of-concept and lab-scale research. This technology uses a novel biphasic CO2 absorption process that involves applying a proprietary solvent developed by Illinois State Geological Survey researchers for post-combustion CO2 capture. This method could dramatically improve energy efficiency, lower the equipment cost and footprint, and maintain operational simplicity. Third, a 500 kW carbon capture system engineering design and feasibility study was completed over the past few winters. This project tested new absorbents and carbon capture system modifications that focused on increasing the efficiency and lowering the cost of removing CO2 from flue gases.

Illinois Geothermal Coalition

The Illinois Geothermal Coalition is a group of corporations, nonprofits, geothermal professionals, and researchers seeking to establish Illinois as a leader in geothermal energy. Through sharing experiences with new technology, implementation of existing and future technologies, support for the various geothermal efforts by members, and utilization of the campus as a living learning laboratory, this coalition is collaborating to strengthen and advance the implementation and design of geothermal energy systems in the Midwest.

Illinois Microreactor Demonstration Project

Illinois Microreactor Demonstration Project Conceptualization

Faculty in the Department of Nuclear, Plasma, and Radiological Engineering (NPRE) received funding to develop an energy model for the campus and test the integration of micronuclear technology with the district heating system. The project has the potential to make the campus the first to demonstrate how microreactor systems integrate with existing fossil fuel infrastructure to accelerate the decarbonization of existing power-generation facilities, introduce a safe and climate-conscientious solution for next-generation energy markets, and provide the critical training necessary for the emerging clean-energy focused workforce. If implemented and connected to Abbott Power Plant, this system could produce 12.9 percent of the total energy demand on campus, with 137,867 MWh/year steam and 11,945 MWh/year power. The technology could reduce campus emissions by 27,500 tons/year.

Project-Based and Experiential Learning

- F&S has developed several partnerships with professors and departments across campus. UES works each semester with classes in engineering, physics, sustainability, and liberal arts, providing tours of the energy systems and sharing information on topics such as renewable energy, energy markets, and sustainability.
- The energy system also serves as a "Living Learning Laboratory," providing real world examples of engineering systems that are incorporated into classroom projects and assignments, helping students to see and understand how the engineering concepts apply in actual working systems.
- UES has also helped host and supervise several senior design projects that focus on solving real-world problems. These projects typically involve clearly defining the problem, identifying solutions, developing and testing those solutions, and then documenting the findings in a paper and presentation.

Facility Tours

UES regularly hosts tours of Abbott Power Plant, CCWS, and the solar farms for the campus community. Those tours have also included federal and local officials, as well as international delegations:

- U.S. Secretary of Energy, Jennifer Granholm, toured Abbott and Solar Farm 2.0.
- U.S. Senator Dick Durbin and former U.S. Congressman Rodney Davis toured at both Abbott and Solar Farm 2.0.
- Dignitaries from South Korea who are responsible for the operation of the national power generation systems in their country.

In total, UES hosts well over 1,000 visitors each year on tours of the power plant, chiller plant, and solar farms. These opportunities are open to anyone through an online registration form at https://fs.illinois.edu/tours, and groups of up to 50 can request a visit to observe the operations.

Outreach with Community Groups

- Since 2015, Abbott Power Plant has collaborated with Associate Professor of Civil and Electrical Engineering (CEE) in the Grainger College of Engineering, Ashlynn Stillwell, to host “Girl Power” with the Girl Scouts of Central Illinois. The interactive event highlights science, technology, engineering, and math (STEM) education and features tours of facility operations, and hands-on demonstrations for water, energy, electricity, chemistry, and physics. Girl Scouts of Central Illinois serves about 10,000 girls across 38 counties.

Girl Scouts STEM Event

- UES works with other local community groups by hosting tours and informational sessions at Abbott Power Plant and the solar farms. These groups have included Boy Scout troops from across the county, the local Jack and Jill of America, Inc. chapter, University of Illinois Extension offices, and municipalities.
- Abbott has also collaborated with the Kappa Delta sorority for the past 10-plus years to host an annual lunch fundraiser that benefits the Crisis Nursery. Calling itself an "Island of Safety," Crisis Nursery is the only emergency-based child care facility in Champaign County that is always open to families in need, without fees or income eligibility. The nursery's mission also aims to prevent child abuse and neglect by offering this free resource.

10. AVAILABILITY/RELIABILITY WORKSHEET

IDEA SYSTEM OF THE YEAR WORKBOOK -- CENTRAL PLANT AVAILABILITY AND RELIABILITY

Organization:	**University of Illinois Urbana-Champaign**
Data provided by:	**Data Historian - eDNA**
Name:	**Rob Roman**
Title:	**Director of Utilities & Energy Systems**
Email:	roman@illinois.edu
Telephone:	**217-300-5810**

Availability (%) = 1 - [Total hours of unplanned plant outage / (total hours in period) X (number of production units*)]

Reliability % = 1 - [Customer hours of unplanned and interrupted service / total annual customer hours]

**boilers, HRSGs, chillers, TES tanks, power generators*

① **Enter your data in the yellow cells.**

② **Email this completed spreadsheet with your IDEA System of the Year submission to jason.idea@districtenergy.org**

DISTRICT HEATING

AVAILABILITY	2023	2022
Total hours in period	8760	8760
*Number of production units**	8	8
Unplanned plant outage hours	0	0
	100.000%	100.000%

RELIABILITY	2023	2022
Total customer hours in period	8760	8760
Unplanned customer outage hours	0	0
	100.000%	100.000%

DISTRICT COOLING

AVAILABILITY	2023	2022
Total hours in period	8760	8760
*Number of production units**	21	21
Unplanned plant outage hours	0	0
	100.000%	100.000%

RELIABILITY	2023	2022
Total customer hours in period	8760	8760
Unplanned customer outage hours	0	8
	100.000%	99.909%

POWER

AVAILABILITY	2023	2022
Total hours in period	8760	8760
*Number of production units**	10	10
Unplanned plant outage hours	0	0
	100.000%	100.000%

RELIABILITY	2023	2022
Total customer hours in period	8760	8760
Unplanned customer outage hours	15	7
	99.829%	99.920%

OVERALL--ALL SYSTEMS AS APPLICABLE

AVAILABILITY	2023	2022
Total hours in period	8760	8760
*Number of production units**	39	39
Unplanned plant outage hours	0	0
	100.000%	100.000%

RELIABILITY	2023	2022
Total customer hours in period	8760	8760
Unplanned customer outage hours	15	15
	99.829%	99.829%