Energy SWATeam

2020 iCAP Objectives

12/12/2019

Objectives:

Our objectives are thus:

1. Maintain or reduce the campus gross square footage.
2. By 2025, commission a comprehensive planning document for meeting the iCAP target of zero GHG emissions by 2050 or before.
3. Reduce total campus consumption by 20% by 2025. Summer and winter peak reduction by 20%.
4. Take measures to integrate iCAP goals into campus operations and lifestyle.

Possible Strategies:

**Objective 1: Maintain or reduce the campus gross square footage.**

Limit the growth in square footage on campus. Consider restricting the allocation of energy to any campus square footage above a baseline.

**Objective 2: By 2025, commission a comprehensive planning document for meeting the iCAP target of zero GHG emissions.**

Commission an Energy Master Plan

Commission a comprehensive planning document (Energy Master Plan) that describes and quantifies the current state of energy supply and demand on campus, evaluates changes in energy supply and demand, and provides options, together with costs and schedules, for meeting the iCAP target of zero GHG emissions by 2050 or before.

The current project-by-project approach will become less effective as we move forward towards the target date. A comprehensive planning document is the best mechanism for quantifying the feasibility and level-of-effort (costs) associated with the “iCAP net-zero by 2050” target and will document a clear and realistic path forward from the current supply/demand to 2050. This planning document will provide a one-stop-shop for clear, well-organized, transparent, baseline statistics (i.e., meter-by-meter power consumption, short-term and long-term trends) that are readily available to all stakeholders. It will also include comprehensive and realistic estimates for future energy supplies from solar, geothermal, and other renewables based on the actual climatic and environmental conditions on campus. By performing comprehensive feasibility assessments for several potential renewable sources at the same time, the document can propose the most efficient plan to achieve our 2050 goals (i.e., land allocation, balance of energy storage/production, daily/seasonal peak attenuation, etc.) and avoid repeating efforts over the next several decades as personnel changes occur for the working groups and iCAP SWATeams. Campus can refer to the baseline metrics to gauge the performance over the next 30 years, and adjust it as needed. The document will also serve as a financial plan, because the staged energy infrastructure improvements will include cost estimates allocated for design, permitting, construction, and operations/maintenance for each proposed project. University administrators can earmark funds now for projects that will be completed 1, 5, 10, or 20 years in the future, in order to follow the preferred track to meet the iCAP net-zero by 2050 target. An outside engineering or energy systems consultant is best qualified to lead the development of this comprehensive planning document, with the Energy SWATeam playing an advisory or consulting role.

The level of detail both from engineering and building design for this document should be comparable to the detailed guidance included in the 2015 Utilities Production and Distribution Master Plan (UPDMP). The new document may be termed the “Energy Master Plan for the Urbana-Champaign campus”.

Options regarding energy supply are rather well-known from the UPDMP. The impact of energy conservation measures are well-known in terms of retro-commissioning of mechanical equipment. Measures to optimize the energy conservation and efficiency of building envelopes are less, so pilot envelope programs must be expedited.

The planning and development of renewable energy technologies (beyond wind and solar) will require a holistic “systems approach” to ensure the energy system across campus runs efficiently and is optimized to the end user.

Set Targets

Set targets to eliminate the use of fossil fuels for energy generation or direct space conditioning by 2050. Provide a target points expressed as a percent of current fossil fuel use, that shows the crossover point of demand reduction and supply from renewable sources that is on a path to meet the “iCAP net-zero by 2050” target.

Use the Energy Master Plan to determine feasible percentages of renewable energy (e.g. solar, wind, geothermal, biofuels and biomass) and nuclear energy to adopt through 2050. After completion of the Energy Master Plan, set 5-year goals incrementally for reduction in fossil fuel energy generation towards “iCAP net-zero by 2050” target.

Set targets such as:

* By 2025, use xx% renewable energy to power campus with at least xx% of total energy produced from renewable sources on campus.
* By 2025, begin to phase out non-renewable energy purchases from the utility grid.

The greatest risk in setting targets is posed by the growing campus square footage.

Reduce Carbon Emissions from Energy Supply

Renewable energy systems for the University of Illinois campus, include, but are not limited to solar, wind, geothermal, biofuels, biomass, and nuclear.

1. Support and encourage the pursuance of grant and research opportunities to support implementation of technologies in these emerging renewable energy markets.
2. Form a sub-committee with Facilities & Services (F&S) involvement to document and summarize the potential viability of specific renewable technology on campus, and put together a plan which starts to prioritize the potential implementation of these technologies.
3. Encourage implementation of other established and early deployment of renewable energy technologies (e.g., anaerobic digester, composting, thermal storage, fuel cells, batteries, heat pumps, reuse of waste heat, carbon capture, smart grids).
4. Explore the possibility of using small modular nuclear reactors for energy generation on campus.
5. Study either abandonment of the Abbott Power Plant steam cogeneration system, or conversion of system to use non-fossil fuel sources, and have a decision by 2030.

**Objective 3: Reduce total campus consumption by 20% by 2025. Reduce summer and winter peak consumption by 20%.**

Energy Codes and Standards

Ensure compliance with required energy codes and facilities standards regarding energy. Begin the energy code compliance efforts immediately.

For new campus and auxiliary buildings, (1) major retrofits that require energy code compliance, and (2) for buildings in design, require the project team to provide electronic input files for Energy Cost Budget (ECB) energy models and energy performance models using conventional modeling software. ECB modeling input files must be provided in the Schematic Design phase, and performance modeling input files must be provided during Design Development phase. A deliverables checklist for the project may be used to verify delivery of input model files.

Compliance with facility standards must be demonstrated using C101.5. 1, 2 or 3. Compliance path 4 permits any statement on stamped drawings by an architect or engineer to demonstrate compliance under State law (which we deem to be too lenient).

<https://www.energycodes.gov/sites/default/files/documents/4_2015%20IECC_Illinois%20Specific%20Amendments_12-23-2015.pdf>

ESCO and retrocommissioning.

Increase funding for Energy Performance Contracting and retrocommissioning efforts. These have proven to be the most effective means to date to reduce energy consumption in campus buildings.

* Mandate retrocommissioning efforts to auxiliary (non-state-owned) campus buildings (e.g., Housing, Athletics, and Research Park areas).
* Complete a large-scale energy conservation project (such as RCx or Energy Performance Contracting) in 50% of the university-owned buildings over 50,000 GSF within the University District by FY25 and 100% by FY40.
* Provide additional deferred maintenance funding and earmark additional funds toward energy conservation projects.
* By 2025, provide additional $10 million per year for ESCO and retrocommissioning.

Building Energy Modeling.

Develop a reference database of calibrated energy models for campus buildings with F&S, Engineers, and Unit Facility Managers who may know their building systems the best. This may be the product of student classroom projects, or assigned to a qualified consulting firm. The calibrated energy models will be used to prioritize which buildings to retrofit, and to determine the preferred level of improvements (envelope vs mechanicals) for each building.

Building Envelopes.

Develop internal campus expertise in building envelope retrofit and recommissioning.

* Between 2020 and 2025, apply building envelope retrofit to at least 5 campus buildings, with a target of at least 35% energy improvement.
* Develop funding (one-time or revolving) to pay for energy improvements to building envelopes over and above the funding available through deferred maintenance.
* Require Building Envelope Commissioning (BEC) and mechanical commissioning (and recommissioning if necessary) for all building projects. Empower the BEC agent to intervene at all stages of design and construction to ensure the measures taken for energy performance meet the modeled target performance.

**Objective 4: Take measures to integrate iCAP goals into campus operations.**

Energy conservation must become commonplace in campus operations and part of campus life. Study the energy implications of various campus operations. Integrate iCAP goals into campus operations.

1. Given the large quantities of energy consumed by Petascale and other supercomputing facilities, study how to meet the university supercomputing needs at 10% of the current Petascale consumption.
2. Determine how the utility report cards currently issued to campus units could be improved in order to provide information to reduce consumption.
3. Ensure that units provide to F&S a formal program to report the change “in residence” of space, including retirements, transfers, projects with associated units being transferred and/or space being vacated etc. F&S and Division of Research Safety will then need to look at the building infrastructure (e.g., fume hoods, chemicals, …etc.) to make sure energy is not wasted. The shutting-down effort may include draining the water system (plumbing and fire suppression) against freezing. This may require prioritization of building space by each unit.
4. Study allocation of energy for space conditioning and productivity, with the allocation of energy per unit that follows a declining trend to meet the iCAP net-zero 2050 target. Allocation of energy may be done on a unit basis, in a way that mirrors the handling of funds and space under the Budget Reform.
   * + Use historical energy consumption to set a baseline for buildings completed prior to 2009 (the date of adoption of the Illinois State Energy Code as a building requirement).
     + For buildings constructed after 2009, set the baseline using ECB and performance modeling, as described above. The baseline for allocation should be the Facilities Standard—80% of ECB.
5. Work with the Education SWATeam to hold listening sessions or workshops to receive input from faculty, staff, and students about the future of Campus’ energy system. Experts in the campus community may have ideas and recommendations that could help shape the future development of the energy system.
6. Work with the Education SWATeam to encourage energy conservation on campus. Focus on behavior during peak periods in the summer and winter.