Higher Education Energy Planning: Review and Summary

Overview

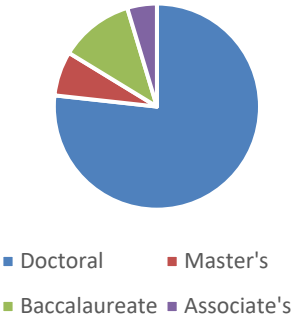
Carbon emissions, energy efficiency, and renewable energy hold increasing prominence in strategic planning efforts of public and private higher education institutions in the U.S. Many institutions have published Campus Energy Master Plans, Sustainability Master Plans, and Climate Action Plans (hereafter referred to collectively as "energy plans") focused specifically on reducing emissions or decreasing energy consumption; or included these issues in their general Campus Plans. To help institutions better understand the scope, features, and approaches covered in these energy plans, Better Buildings conducted a review of 45 such documents developed between 2008-2018 to identify common features and best practices. The results of this review are divided among the tables and sections below, which highlight the outreach & engagement and technical features within the various plans.

KEY TAKEAWAYS

The review of 45 campus energy plans produced the following findings:

- Emissions disclosure and mitigation tactics are more prevalent than campus engagement strategies
- While peer review mechanisms are used, they are uncommon
- Only the most technically robust plans use energy modeling to predict future consumption and expenses
- The most rigorous plans holistically evaluate benefits and level of effort for low-, mid-, and high-cost measures

Reviewed Institutions by Carnegie Classification



Outreach & Engagement Features

Better Buildings aimed to capture how these plans communicate with both with the general public and within the campus. Table 1 includes brief descriptions of each energy plan feature and the percentage of plans including these features.

Table 1. Outreach & Engagement Features

Feature & Description	% of Plans Including Feature
External	
Lists mitigation tactics: publicly discusses strategies for reducing emissions	91%
Emissions disclosure: publishes detailed carbon accounting data	87%
Peer review: uses an outside contractor to develop or review the energy plan	38%
Internal	
Considers user behavior: identifies strategies to improve energy efficiency performance by engaging faculty, staff, and student occupants	60-80%
Campus-based learning: includes campus sustainability research and initiatives as a learning directive	53-64%
Student involvement: involved students in developing the plan	40%-56%*

*Upper bounds include energy plans that only mentioned the measure in question and did not provide significant details.

While emissions accounting and mitigation tactics are broadly included in the energy plans reviewed, peer review mechanisms are less commonly used and almost exclusively involved hiring an outside engineering or consulting firm to develop the energy plan itself. Better Buildings is aware of only two institutions that both developed a plan in-house and explicitly engaged external experts in reviewing it.

Internal engagement measures targeting the campus population are not universal, though most plans have at least some elements. In reviewing internal engagement, Better Buildings focused on student and faculty involvement; programs engaging other segments of the campus population (such as facilities and maintenance) were identified in several energy plans, but not tracked. Though difficult to quantify, such programs seem to have potential for both immediate energy savings and long-term social benefits.

Technical Features

Better Buildings considered the technical features of the energy plans reviewed according to their engagement with energy supply (e.g. energy generation and distribution, district heating and cooling) and energy demand (e.g. controls, modeling, retrofits) measures.

Table 2. Supply- and Demand-Side Features

Feature & Description	% of Plans Including Feature
Supply-Side	
Considers integrated renewables: investigates or plans to install on-site renewable generation capacity	80% - 96%*
Addresses utility procurement: plans for changes in the source carbon emissions associated with grid electricity	60% - 73%*
Considers cogeneration: evaluates or implements combined heat and power	60%
Calculates lifecycle costs of implementation plans combining various portfolios of strategies	40% - 69%*
Develops energy supply and financial models: conducts a rigorous assessment of future campus energy portfolios and their financial performance	11% - 31%*
Demand-Side	
Collects or plans to collect building-level energy use data	82%
Conducts building energy audits or commissioning	78%
Establishes a framework for prioritized building retrofits	73%
Mandates efficiency targets for new buildings	36 - 67%*
Plans for regular, continuous retro-/re-commissioning	51% - 67%*
Plans or considers implementing building energy management systems	42%
Plans or performs building energy modeling	20%*

*Upper bounds include energy plans that only mentioned the measure in question and did not provide significant details.

As shown in Table 2, the energy plans reviewed vary significantly in their technical content. On the supply-side, cogeneration and renewables are standard considerations, but the approach to selecting potential energy, heating, and cooling measures varies widely. Some plans identify detailed returns on investment for individual utility equipment purchases and make recommendations accordingly, whereas others do not discuss utility projects in any detail. Other plans show consideration of lifecycle costs and benefits of several portfolios of utility upgrade options (as opposed to fine-grained equipment-level analysis) and select a plan accordingly. At both the utility and building scale, only the most technically robust energy plans include modeling to predict future energy use and expenses.

Better Buildings observed similar variety in the building energy efficiency measures implemented in campus energy plans. Standard practices include benchmarking individual buildings (or planning to implement building-level energy metering), conducting a single comprehensive energy audit, planning for prioritized retrofits of existing buildings, and mandating efficiency targets for new buildings. Certain details within these basic features vary significantly; for example, efficiency targets spanned performance relative to ASHRAE 90.1 standards and ENERGY STAR® scores in the lower bound, LEED certification in the upper bound, and combinations thereof. Better Buildings noted a reliance on LEED certifications for building performance – while the LEED process is widely recognized and includes energy performance in its criteria, ASHRAE, ENERGY STAR, and Zero Energy buildings present more direct energy performance standards. Better Buildings further identified more thorough energy plans which included planning for continuous re-and retro-commissioning and implementing optimized building energy management systems.

Better Buildings also observed variance in how building efficiency measures were identified and implemented; whereas some plans focus on capital projects like retrofits, others prioritize low-cost operational measures. Better Buildings found that the most rigorous plans took a holistic approach to evaluating the savings benefits and implementation effort for low-, mid-, and high-cost energy conservation measures.

More Resources

The links below offer more guidance on campus energy planning. For more information on this document, contact BetterBuildings@ee.doe.gov.

- Zero Energy University Campuses: A 2018 Progress Update on Reaching Campus Energy Goals NREL
- Campus Utility Systems Master Planning APPA
- Cool Campus! A How-To Guide for College and University Climate Action Planning AASHE
- Examples of Climate Action Plan Structures Second Nature
- Why Review a Climate Action Plan? Second Nature
- SIMAP Carbon & Nitrogen-Accounting Platform from University of New Hampshire Sustainability Institute
- Campus Sustainability Hub AASHE
- Stanford Energy & Climate Plan Stanford University
- Integrated Model for Long Term Campus Energy Planning Michigan State University