Energy Master Plans – For ACUPCC

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ACUPCC signatories have committed to moving to climate neutral facilities. To accomplish this, the commitment calls upon each institution to "initiate the development of a comprehensive plan to achieve climate neutrality as soon as possible."[1]

The comprehensive plan should detail all the necessary steps leading to the end goals. For facility energy systems, this is an Energy Master Plan, integrated with a Facility Master Plan and the Transportation Plan.

A Comprehensive ACUPCC Plan for the Facilities

"The world we have created today as a result of our thinking thus far has problems that cannot be solved by thinking the way we thought when we created them."
Albert Einstein.

The commitment and drive for a sustainable program needs to start from the top: the President made the commitment and needs to ensure that it is carried out. Forming a sustainability committee and conducting a greenhouse gas emissions assessment is a good beginning[2]. Once the greenhouse gas assessment is completed, major decisions need to be made on the next big step, how to develop a comprehensive plan to move toward climate neutrality. The President and major players from the institution should read at least a couple of books on The Natural Step (TNS) to familiarize themselves with a highly successful, worldwide sustainability framework and the experiences of various sustainability programs undertaken within the last 15 years. Although TNS does not provide guidelines for sustainable building energy systems, the framework provides a guide for the preparation of a coherent plan of action.

The total energy used for the buildings and facility accounts for approximately 64% of the total greenhouse gas emissions of most institutions. Transportation for people, materials and food represents about 36% of the total greenhouse gas emissions[3] and is the other major area that will require a detailed plan to be developed and integrated with the EMP.

A vision for a sustainable future is an important aspect of any sustainable plan. Let us envision a scenario for a time say 20 years in the future when successful ACUPCC plans have been implemented for most colleges and universities and many other facilities have also been moved toward climate neutral. These facilities will have become generators of electricity rather than electric users and they will consume very little gas and oil.

In our future vision, the electric utility company is the energy supplier for most transport, recharging electric cars and trucks during the night and providing the electricity for running trolleys, busses and trains during the day. It will re-distribute more electrical energy than it generates, re-directing energy from various facilities and

parts of communities throughout the day and night, primarily electrical energy from the climate neutral facilities such as colleges and residences, to transport and high energy intensive buildings such as hospitals and pharmaceutical and manufacturing facilities.

The US electricity grid would not be strained during peak cooling or heating conditions, in fact the electricity grid would have a relatively constant load throughout the year and throughout the day and night less than 30% of the current peak load. This will reduce the amount of greenhouse gas emissions from both power plants and transport systems by over 80%, a significant improvement on any current greenhouse gas reduction protocol.

While this may seem futuristic, optimistic and even far-fetched for some, it is really one simplified vision of what comprehensive planning for the future should attain.

How an Energy Master Plan Works with the ACUPCC

"Nothing helps ensure success better than success."
Anon

An EMP program begins with short-term projects with less than a one-year payback and the return on investment averages approximately 125%. Historically, these savings average 17% of the total energy and maintenance budget. These early rewards need to be re-invested in longer-term projects that have an average of a 3 year payback. These project savings average a further 22% of the total energy and maintenance budget so the energy and maintenance bills can be reduced by an average of 35% within 5 years[4]. It has been demonstrated that keeping to a long-term plan that begins with highly successful projects is much easier than constantly having to justify capital outlays for a program that has a history of producing results that are constantly less than predicted and short-lived.

An EMP is a comprehensive energy plan for the facility that is integrated into the total energy systems of the institution. The plan is a comprehensive, step-by-step plan for the whole facility building energy systems. EMPs are produced by expert engineers who are skilled at providing successful energy conservation plans for universities and who have also developed new protocols for successful sustainable projects. Focus should not only be on the long-term planning from day one, but also provide the short-term plans very quickly so projects can be undertaken right away to start showing positive returns on investment ASAP.

The success of an EMP or sustainable program is derived from being a comprehensive and inclusive plan. Integrating the Facility Master Plan (FMP) with the EMP provides a comprehensive facility energy plan and integrating the Transport Master Plan (TMP) provides a comprehensive plan for all the major greenhouses gas emissions.

While the focus always remains on energy and greenhouse gas emissions, other essential performance criteria are required to be included into the program to assure a successful sustainability program[5]. A sustainability program, as documented in many TNS stories, can also be labeled a long-term success program, where the university's

primary goal and objective of providing an excellent learning environment are met and sustained over a very long life cycle while achieving the further objective of being climate neutral.

High Performance Buildings

The primary objectives of most colleges or universities are teaching and research. Providing a high performance indoor environment can improve occupant performance and test scores by up to 20%[6] and these results can last for the life cycle of the building. The primary purpose of building mechanical and electrical systems is to provide a safe, healthy and comfortable indoor environment. Too often however, there are complaints of discomfort as well as worse situations such as sick building syndrome and mold growth.

A sustainable building is not a high performance building if the safety, health or comfort provided by the building for the occupants is mediocre or poor. Providing a safe, healthy and comfortable environment will not only promote a better occupant experience and performance, but it is the overriding performance requirement for all high performance buildings and their energy systems.

Sustainable Buildings

The first and explicit dictionary definition of sustainable is "able to be maintained"[7]. Maintainability of the buildings and their energy systems is a crucial aspect for every climate neutral facility so that a facility maintains its high level of performance in energy efficiency and occupant productivity throughout an extended life cycle. The current trend of designing complex systems that are difficult and expensive to maintain and so quickly fall into deferred maintenance is not a sustainable solution. The facility must be able to assure that it maintains a high level of performance in every aspect and so designing for inexpensive preventive maintenance is a priority.

Designing buildings and systems that have a long life cycle and are constructed from materials that present minimum disruptions and harm to the environment and are recyclable is another primary aspect of a sustainable design. Providing sustainable energy systems and energy sources for the facility is usually the primary objective of sustainable programs. Energy for construction and building operation usually accounts for approximately 64% of the total energy used by most institutions[8]. Energy is used to construct the building, manufacture all the furniture, fixtures and fittings, maintain the building and provide the indoor environment.

Energy systems that require less energy to operate and use renewable energy and that are able to generate more energy than needed for operation should be the primary objective so the facility is able to repay the embedded energy of construction and operations over a 25 year period. We have also developed the scenario that a sustainable institution is one that is an electrical energy producer during periods of peak cooling and heating so that the electrical utility is relieved of the stress during these periods, the institution recovers money from the utility during conventional utility peak periods

Expanding the EMP End Goals to Assure Success

Creating a climate neutral facility for the building energy systems, or a zero carbon footprint, is an excellent goal but it cannot stand alone, isolated from other integral performance factors.

Energy + Maintenance + Productivity: E + M + P = Energy Master Plan

An Energy Master Plan is a detailed short, medium and long-term step-by-step plan integrated with a Facility Master Plan and a Transport Plan that takes an institution to a climate neutral position while also optimizing other maintenance and occupant comfort and productivity.

Why Sustainability is Bad for Business

Today's construction industry, worth over $1Trillion annually[9], is based on poor design and inefficient construction together with totally reworking the same building at least 4 times within 100 years to keep designers and contractors busy. There are several major projects we have witnessed that have been poorly designed and poorly modified by the same designers 3 or 4 times within the space of 25 years. A sustainable design is bad for the design business because there is very little work from a successful project for 50 years. There are no expensive upgrades or retrofits every 10 to 20 years, and no major reworking and change-out of systems every 25 years, as there are with current designs.

A sustainable facility will reduce the Owner's construction and building operating costs by over 80%. Designers, contractors, maintenance personnel and energy companies lose this money. A sustainable facility spends 50% less on construction and building remodeling and alterations.

A sustainable facility Owner sells electricity to the electric utility company instead of buying electricity from them, and buys less than 15% of the oil and gas it used to buy. A sustainable facility also spends 65% less on operation and maintenance[10].

With sustainable, high performance buildings, the $1Trillion design and construction industry loses 35% of its business and will need to become more efficient to keep competitive. Maintenance companies lose 65% of their business and will need to become more competitive and efficient.[11] The electric utility becomes a re-distributor of energy for many buildings and will only be required to generate about 30% of the electricity currently generated. Oil and gas companies will sell 85% less fuel, and car and bus manufacturers and dealers will make 80% less on maintenance and spare parts, a major part of the their business.

Drastically reducing the cost of running the institution is a minor advantage of a sustainable program compared to the unprecedented improvement in the quality of the indoor environment and the learning/teaching experience. The consequent increase in test scores and the improvement in the working environment for teachers, students, researchers and all the institution operating personnel, everyone involved with the institution, can be worth ten times the operating savings. The biggest losers are other

colleges and universities that do not follow a path to sustainability. A better teaching experience draws better teachers; a better learning experience draws more students; a better research experience draws better researchers.

We can go on listing benefits, but you get the idea. While the institution steadily becomes a high performance, sustainable facility, drastically reducing operating costs, income from additional students further improves the bottom line of a sustainable path.

Summary

The ACUPCC is a great opportunity for colleges and universities to assert their leadership toward climate neutrality. The many other huge benefits of sustainability should not be underestimated. Not only will the energy and operating and maintenance bills be eliminated saving the institution millions of dollars annually, the increase in test scores of up to 20% and the improvement in the whole campus environmental quality will not only pervade everyone within the campus and the academic competition but it will also flow out into the local community and yet further still.

Better still, the large amounts of money saved can be reallocated for upgrading teaching equipment and hiring more teachers and assistants as the institution grows and expands at a higher rate than competitors. A sustainable institution will be a highly successful institution in many ways. After the first 3 or 4 years, the fringe benefits of a comprehensive sustainability program will start to be understood as not only energy reduction, but also a vast improvement in the indoor environment, providing a very safe, more healthy and comfortable environment.

A sustainability plan is another term for a long-term success plan, and the institution that leads the way toward a sustainable future will be more successful and competitive than other institutions that hesitate and lag behind. As the world of academics becomes ever more competitive on a global scale, sustainability will become important not only for success but also, eventually, for survival.

Footnotes:

[1]American College and University Presidents Climate Commitment
http://www.presidentsclimatecommitment.org/html/commitment.php
[2] American College and University Presidents Climate Commitment
http://www.presidentsclimatecommitment.org/html/commitment.pdf
[3] http://www.architecture2030.org/media/2010_handout.pdf
[4] Maisey, Grahame E. *Energy Master Planning for New and Existing Buildings*, 2008 http://www.wbdg.org/resources/emp_hvac.php, Also, results from plans already assessed.
[5] ibid
[6] Kats, Gregory, *Greening America's Schools, Costs and Benefits*, 2006 www.cap-e.com
[7] Microsoft Word
[8] http://www.architecture2030.org
[9] *Building From the Ground Up*, April 2006, abf Journal, Issue 4, Vol. 3.
[10] Interview, Grahame E. Maisey, BSC website, 2008
[11] http://www1.eere.energy.gov/femp/sustainable/sustainable_basics.html