THE CASE FOR INVESTING IN IMPROVED ENERGY PERFORMANCE ON CAMPUS

EPC TOOLKIT FOR HIGHER EDUCATION | APRIL 2009

CLINTON FOUNDATION

CLINTON CLIMATE INITIATIVE

AMERICAN COLLEGE & UNIVERSITY PRESIDENTS CLIMATE COMMITMENT

INDEX

BACKGROUND ON GLOBAL CLIMATE CHANGE 2
CLIMATE CHANGE AND THE CAMPUS 2
THE FINANCIAL IMPLICATIONS OF BUSINESS AS USUAL 3
CONSEQUENCES AND COSTS OF POOR OPERATIONS AND MAINTENANCE 4
LEADERSHIP THROUGH SUSTAINABILITY ON CAMPUS 5
THE IMPORTANT ROLE OF ENERGY EFFICIENCY 6

INTRODUCTION

Higher education institutions – particularly signatories of the American College and University Presidents' Climate Commitment – are motivated to undertake building retrofits for several reasons. These reasons may be relevant to the institution's overall mission and include the following:

1. Need to respond to climate change.
2. Financial implications of business as usual.
3. Consequences and costs of poor operations and maintenance.
4. Leadership through sustainability on campus.

BACKGROUND ON GLOBAL CLIMATE CHANGE

Increasingly, the scientific evidence concludes that the planet is warming at a dangerous and unprecedented rate. Eleven of the twelve years from 1995-2006 rank among the twelve warmest years recorded since 1850, arctic sea ice has shrunk substantially in the last thirty years, oceans have become more acidic due to heating, and global average sea levels have risen in the past ten years at almost twice the rate experienced earlier in the century.[1] The number of extreme weather days, the incidence of heat waves, changes in biological behavior related to temperature, coastal flooding, and the disappearance of coastal wetlands are all on the rise.[2] Of more than 29,000 data series observed by the International Panel on Climate Change (IPCC) in their most recent (2007) report, 89% were consistent with the predicted direction of climate change in response to global warming.[3]

Scientists have determined that this warming is caused by increases in the concentration of heat-trapping greenhouse gases in the atmosphere. Emissions of greenhouse gases (GHGs) have increased markedly as a result of human activity since 1750, increasing by 70% between 1970 and 2004. Concentrations of some GHGs, most significantly carbon dioxide (CO_2) exceed the natural range over the last 650,000 years. The IPCC projects that under current emissions scenarios, global average temperatures will increase by 1.8 to 4.0 degrees Celsius by the end of the century. This is compared to an average increase of 0.74 degrees Celsius between 1906 and 2005.[4] The world's top scientists tell us that in order to avert the worst consequences of climate change, the U.S. and other industrialized nations must reduce emissions by 80% before 2050.[5]

CLIMATE CHANGE AND THE CAMPUS

Colleges and universities have an important contribution to make to the global response to climate change. Although they only produce a small percentage of the world's GHG emissions, they are responsible for a much greater percentage of the world's 'educational' footprint. Most of society's future leaders pass through the halls of higher education institutions. Higher education must provide these students with the necessary knowledge and skills to respond to one of the greatest crises humanity has ever faced. As incubators for research and development, colleges

---

1 International Panel on Climate Change, Fourth Assessment Report: Climate Change 2007: Synthesis Report: http://www.ipcc.ch/ipccreports/assessments-reports.htm (2007), p. 30.

2 Ibid, pp. 30-31.

3 Ibid, p. 33.

4 Ibid, pp. 44, 30.

5 The 80% figure is for the U.S. Global reductions must be in the order of 50%, but because the U.S. emits a disproportionate level of greenhouse gases, it has more to cut. Rachel Warren, "Impacts of Global Climate Change at Different Annual Mean Global Temperature Increases," in Hans Joachim Schnellnhuber, ed., Avoiding Dangerous Climate Change, Cambridge University Press, 2006.

and universities offer an ideal setting to develop workable strategies, systems, behaviors, and technologies that can be applied locally, nationally, and internationally. With involvement from students, faculty, staff, and surrounding communities, these institutions serve as living laboratories for achieving climate neutrality and sustainability.

Higher education institutions will be strengthened by taking the lead on cutting-edge research, action, and demonstration projects that will catalyze investment and drive the development of new markets. Higher education is a $318 billion industry[6] in the U.S. that employs millions, and spends billions on energy, water, and infrastructure. By investing in projects to make campuses operate more efficiently and sustainably, colleges and universities can be at the forefront of the transition away from a fossil-fuel intensive economy.

Since buildings can account for the vast majority of a college or university's carbon footprint and represent 30-40% of global energy use[7], comprehensive energy efficiency building retrofits are a logical first step towards achieving carbon neutrality. Efficiency projects generate savings from reduced utility and operations and maintenance (O&M) costs, and free up funds that can be invested in other sustainability initiatives. Moreover, schools can take advantage of contracting mechanisms that eliminate the need to draw on the capital budget to fund the retrofit, while also mitigating risks to the institution.

THE FINANCIAL IMPLICATIONS OF BUSINESS AS USUAL

Higher education institutions' budgets are under pressure from increased and volatile energy costs and their long-term financial planning is hampered due to the difficulty of reliably forecasting future operating costs. Utility expenditures represent a significant amount of money in most campus budgets – between $2.00 and $2.30 annually per square foot of building space[8]. Often, funding for energy comes from the general operating budget that is also used for salaries, fringe benefits, services, and supplies. The competition for the available and usually inadequate budget creates natural institutional conflicts. As one component of a broader budget, the costs for electricity, natural gas, oil, and water are not stable, and general trends suggest that utilities costs across the board will continue increasing with time.

Over the past 10 years, utility prices have become more volatile than in previous decades. In 2008, the price of oil rose to record levels in the summer only to crash in the fall. Since 1999, electricity prices have increased each year with the exception of 2002.[9] Over the past few years, electricity prices have risen at higher rates than the overall inflation rate for the first time since the 1970s oil crisis. Most long-term forecasts project fossil fuel prices to increase, as oil and natural gas reserves are further depleted, the global economy emerges from recession, and demand growth accelerates in developing nations. As new laws and regulations are passed to reduce non-renewable energy consumption, utility costs will be pushed even higher and regulations that set a price for carbon emissions and/or require utility companies to generate a certain percentage of their electricity from renewable sources will apply additional upward pressure on energy

6 The American College & University Presidents' Climate Commitment: http://www.presidentsclimatecommitment.org/html/why.php

7 United Nations Environment Programme, Sustainable Construction and Building Initiative: http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=502&ArticleID=5545&l=en

8 BOMA International, 2008 Experience Exchange Report, as quoted on: http://www.allbusiness.com/real-estate/commercial-residential-property/11714760-1.html

9 U.S. Department of Energy, Energy Information Administration: http://www.eia.doe.gov/cneaf/electricity/epm/table5_3.html

prices. In response to these trends, many organizations have set financial goals to stabilize and/or reduce their energy costs by increasing energy efficiency and diversifying their sources of energy generation to include renewables. Thus, a president or chancellor's commitment to carbon neutrality may be well aligned with the chief financial officer's long-term budgeting goals.

Energy efficiency building retrofits and renewable energy investments can reduce operating expenses and limit exposure to volatile utility rates. Energy conservation measures alone can reduce energy consumption by 20 to 50 percent depending upon current conditions and the aggressiveness of the upgrades. However, many institutions are wary of the required high up-front capital expenditures. Yet energy performance contract (EPC)'s project financing mechanisms can fund the implementation of energy efficiency measures without requiring a substantial capital outlay or increases in existing levels of annual operating expenditures. New financial mechanisms are also now available that allow for the implementation of renewable energy systems without requiring an allocation of capital budget funds.

CONSEQUENCES AND COSTS OF POOR OPERATIONS AND MAINTENANCE

Many campuses have significant deferred maintenance and a historic underinvestment in the O&M of buildings and water and energy-related infrastructure. The amount of capital required to address all deferred maintenance issues on campuses across the country is estimated at more than $36 billion.[10]

Poor physical infrastructure can contribute to sub-optimal daily operations that negatively impact occupant health and comfort. Poor heating, ventilation and air condition (HVAC) equipment and duct work can lead to sub-optimal indoor air quality standards for humidity control, outdoor air ventilation, and CO_2 levels, which can cause nausea, claustrophobia, fatigue, drowsiness, asthma, headaches, and breathing difficulties among building occupants.[11]

On the other hand, properly maintained buildings create an environment in which occupants love to work and learn. Improvements to HVAC systems can improve air circulation and provide better humidity control. Proper humidity control has been found to reduce school absenteeism rates by as much as 40 to 50%.[12] Lighting retrofits can improve visibility for students, faculty, and staff.

The General Services Administration (GSA) found that its green buildings demonstrated a 27% higher occupant satisfaction than the national average.[13] The Lawrence Berkeley National Lab collated the results of four studies investigating the link between air ventilation and school performance, concluding that improved ventilation rates can increase aspects of student performance by 5 to 10%.[14] A similar survey of research found that measured performance (identified as speed or accuracy) improved 4 to 16% upon the removal of sources of indoor air

---

10 R. Rose, D. Cain, J. Dempsey, R. Schneider, "Buildings…The Gifts That Keep on Taking: A Framework for Integrated Decision Making." APPA. 2007.

11 D. Birr and P. Donahue, "Meeting the Challenge – How Energy Performance Contracting Can Help Schools Provide Comfortable, Healthy, and Productive Learning Environments." Prepared for the US EPA and NAESCO.

12 C.W. Bayer, S.A. Crow, and J. Fischer, "Causes of Indoor Air Quality Problems in Schools: Summary of Scientific Research", Prepared for U.S. Department of Energy, January 1999.

13 "Assessing Green Building Performance: A Post Occupancy Evaluation of 12 GSA Buildings", GSA Public Buildings Service, Office of Applied Science, June 2008; 14 – 15. US Green Buildings Council: http://www.usgbc.org/ShowFile.aspx?DocumentID=4308.

14 Lawrence Berkeley National Lab, Indoor Air Quality Scientific Findings Resource Bank: http://www.iaqscience.lbl.gov/performance-rates-school.html.

pollution.[15] Other studies have found relationships between improved temperature control and student performance, the removal of volatile organic compounds (VOCs) and mold and occupant health, and lighting quality and occupant productivity.[16] In sum, building retrofits that target energy efficiency improvements – from HVAC systems to lighting to insulation – can reduce deferred maintenance backlogs while simultaneously creating a more productive and healthy environment for learning and working.

LEADERSHIP THROUGH SUSTAINABILITY ON CAMPUS

Mission statements of colleges and universities often focus on two goals – educating students so that they can enjoy productive lives, contribute to society, generate knowledge and facilitate critical discussion, and secondly, driving research that will serve social progress. The educational and social aspects can both be served by undertaking building retrofit projects.

EDUCATIONAL

Leading society to reverse climate change fits squarely into higher education's educational, research, and public service missions. With more than 17 million of tomorrow's architects, engineers, attorneys, business leaders, scientists, urban planners, spiritual leaders, journalists, advocates, and politicians currently attending the nation's 4,000+ colleges and universities, a relevant, challenging and inspiring education plays a crucial role in transforming today's fossil fuel economy into tomorrow's low-carbon economy. In particular, addressing energy efficiency in the built environment requires the whole systems thinking that students will need to meet the challenge of creating a more sustainable balance between human society and the natural systems.

Higher education institutions must provide students with the necessary knowledge and skills to contribute to this transformation. The on-site retrofit or renewable project can serve as a powerful teaching tool in its own right. Projects that reduce emissions on campuses set an example for students, showing them how a low-carbon economy can function. Campus retrofits can also offer students the opportunity to learn about the concrete actions and skill sets required to reduce emissions in a cost-effective and economically responsible way.
A single building is an example of the relationship between the systems of human society and the natural environment. An operating building has a "metabolism"; it consumes resources and energy and creates a waste stream. The physical building components each have a lifecycle; they have embodied energy and resources that relate to their origin and they have the potential to be reincorporated into material cycles at the end of their useful life. All of these energy flows and material cycles are perpetually interacting with the larger human and natural systems of the campus, city, bioregion, and ultimately the global environment.

Seeking improved efficiencies in a building's "metabolism" is inherently interdisciplinary. A project to improve the energy efficiency of building operations is an opportunity for problem-based learning that infuses an aspect of ecological literacy into traditional disciplines and vocational curriculum. Many colleges and universities are developing curriculum, service-projects, and job-training programs around their larger green-campus initiatives. By taking proactive steps to inventory and reduce carbon emissions, colleges and universities can take their academic mission beyond the classroom and actively engage students in creating a more sustainable society.

15 Ibid.
16 Ibid.

SOCIAL

Higher education institutions educate the world's future leaders and workforce, are neighbors and often leaders in a community, and are expected to set standards for responsible, ethical, and social behavior. A school that teaches sustainability holds little credibility in its students' eyes if it is not moving its own operations to more sustainable practices. Investing in improved energy performance and renewable energy is a powerful demonstration of substantive leadership.

As the U.S. and some other high GHG per capita-emitting countries have been slow in their response to climate change, higher education institutions – as recognized centers of intellectual leadership – can lead the way in demonstrating the comprehensive actions required to address global warming. Higher education should implement measures that show how responding to climate change can create economic opportunity, confounding the conventional wisdom that there is a tradeoff between economic growth and environmental protection. Cost-saving and job-creating building retrofits offer a perfect example of such measures.

Many colleges and universities play an economic development role in their communities through the transfer of knowledge gained in the laboratory to local entrepreneurs, the support of business incubators, and the provision of vocational job training programs. An institution can use retrofit projects to strengthen and solidify its relationship to the local community. Retrofit projects can provide new labor opportunities in construction and contracting, generating steady sources of income that can fuel spending in the local area. These jobs cannot be moved to locales with lower labor costs. A lower utility bill, moreover, reduces the "leakage" of dollars out of a community to a utility company, allowing for more spending locally, further fueling economic growth. Retrofits are thus a particularly attractive investment for a community in today's difficult economic climate.

Retrofit projects also create opportunities for joint action on sustainability activities. In many communities, schools and municipalities can team up on green projects to:

- Jointly procure "green" and energy efficient products.
- Engage in integrated waste disposal and management activities.
- Co-invest in clean district energy projects.
- Create "green collar" job training programs to coordinate with projects that require local labor.

THE IMPORTANT ROLE OF ENERGY EFFICIENCY IN A COMPREHENSIVE CLIMATE NEUTRALITY PLAN

A small but growing number of schools are seeking energy solutions with renewable sources such as on-site biomass, geothermal, solar, wind, off-site renewable energy platforms, and the purchase of renewable energy credits (RECs) and carbons offsets. Immediate investments in energy efficiency should be considered in the planning process for a comprehensive energy and sustainability strategy. Building retrofit projects offer a "no regrets" type of investment that comes with a payback through decreased utilities bills and frees up funds that can be allocated to other sustainability projects. In addition, any supply-side investments should be made to meet the appropriate level of demand. Put another way, campuses should make sure that any supply-side investments are "right-sized." It is better to purchase a smaller, less expensive photovoltaic system that meets the demand needs of an energy efficient operation than a larger, more expensive system sized to meet the energy demands of an inefficient operation.[17]

Investing in energy efficiency can yield savings that can be utilized to fund broader sustainability initiatives that do not have a direct and measurable economic return. For example, a school seeking Leadership in Energy and Environmental Design for Existing Buildings (LEED-EB)[18] certification may use energy savings from an EPC to help pay down the cost of other improvements that create LEED credits, such as project costs attributable to the use of recycled materials. Similarly, if an institution chooses to buy carbon offsets to go carbon neutral, energy efficiency improvements can both free up the funds to purchase them while simultaneously reducing the amount of emissions required to be offset.

Even without a need for energy efficiency to subsidize other actions, EPC's self-financing structure allows a school to move forward without necessarily having to secure new grants, use endowments, or access other sources of project equity. Renewable projects that need no equity contribution to move forward are typically less desirable than efficiency projects because even the cheapest source of purchased renewable power is typically more expensive per kilowatt/hour (kWh) than the cost to save a kWh through investments in energy efficiency.

Simply put, efficiency improvements will almost always be the most logical first step in a comprehensive climate action strategy. When done correctly, these investments will always pay back, freeing up funds that can later be invested in other activities, while simultaneously reducing the amount of required investment for activities related to the school's overall energy resource strategy or carbon neutrality plan.

17 The caveats to "right sizing," are when a large system may provide the energy needs of future growth (e.g. to accommodate additional dormitories or classrooms on a campus) and when local utility regulations allow for an economically viable sale of excess energy to the grid through "net metering."

18 The United States Green Building Council has established a system for certifying buildings as "green," or sustainable. This system is called Leadership in Energy and Environmental Design (LEED) and includes certification of Existing Buildings.