Energy and Climate Change: Risk and Opportunity

Summary by Jason Rauch

Panelists
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William Leahy, *COO, Institute for Sustainable Energy, Eastern Connecticut State University*

THE SITUATION AT TUFTS UNIVERSITY

Sarah Hammond Creighton outlined Tufts University's commitment to meet the Kyoto Protocol and participate in the Chicago Climate Exchange. Climate change is a worthy goal as the actions taken to achieve greenhouse gas reduction have far-reaching impacts. Planning for adaptation to climate change is essential too. Actions to take on climate change incorporate facilities, health services, food services, emergency planning, and investments.

Sustainability, energy, and climate change issues are also related to security issues. Tufts lost grid power for two weeks over a summer, which turned an emergency into a crisis. This event raised awareness of energy security issues, and the benefits of distributed power generation.

Campus and facility planning should take into account the issues of climate change. Future increase in cooling demands due to increased average temperatures necessitates designing air conditioning into new buildings. The increased precipitation due to climate change has implications for water management techniques. These and other factors associated with climate change affect how life-cycle costs are estimated.

Financial planning also incorporates issues of energy and climate change, as it associates with investment risk. Fuel prices can fluctuate widely, increasing the vulnerability and risk of energy costs. Using renewable energy and distributed power generation enhance the energy security of the university and therefore should be taken into account when calculating life-cycle costs of switching to those strategies.

In addition to adaptation, mitigation is critical to dealing with climate change. The Kyoto Protocol commitment is to reduce greenhouse gas emissions 7 percent below 1990 levels by 2012. New buildings need to be designed better, retrofit of old buildings

is a challenge that must be faced, and procurement of fuels both on and offsite needs to be addressed. Though transportation is an issue, it only accounts for 7 percent of Tufts' greenhouse gas emissions, so it is not the central focus of Tufts' approach to achieving sustainability. Buildings are a much higher priority.

On the green building front, Tufts has built a demonstration photovoltaic system and a solar thermal hot water system. For existing buildings, temperature regulation has been improved with more sophisticated heating and cooling controls. Water use has been reduced 20 percent below 1990 levels through innovations in toilets, faucets, showers, and irrigation. Lighting, a "low hanging fruit," has been changed campus-wide, including in the president's office, to fluorescents. Occupancy sensors, including vending misers, have also been used for energy reduction. Steam traps have been installed. These measures have been implemented on a larger scale in a new LEED silver-certified residence hall at Tufts.

Steam traps, though providing a big reduction in energy use, highlight the issue of faculty and student participation in sustainability operations. Users often have very good ideas, but sometimes there is a disconnect between ideas and practical operations. No one has come in requesting steam traps, but the idea of photovoltaics often comes up.

Energy contracts are a big risk to the university. Does the university want the lowest price or the greatest stability? Of course, the administration states they want both, but this is not a trivial question. Price stability lowers the risk, but is often more costly. At Tufts, the electricity supply is contracted out from TransCanada through December 2010. Tufts decided to go with this particular supplier because about 80 percent of the electricity was provided by hydropower, which provides price stability because it comes at a fixed cost. This purchase has also helped Tufts approach its greenhouse gas reduction target.

In terms of student awareness and activism, students passed by 80 percent a referendum to raise student fees so the university could purchase green power. Behavior modification for power savings has been successful via Tufts' "Do it in the Dark" competition. New employees and students receive an informational brochure about what they can do about climate change and energy efficiency.

ENERGY CONSERVATION EFFORTS AT EASTERN CONNECTICUT STATE UNIVERSITY

The Connecticut legislature issued 38 recommendations for reducing greenhouse gases, one of which was the Green Campus Initiative. This was a challenge to universities in the state to achieve renewable energy targets. Eastern Connecticut State responded by distilling the opportunities for energy reduction/renewable energy use to 12 categories.

Buying green power helps, but Eastern Connecticut State has also adopted energy conservation approaches: a photovoltaic system tied to a LED lighting system; and a geothermal heating and cooling system.

New construction utilizes LEED energy performance codes that are tied to the latest version of ASHRAE (American Society of Heating, Refrigeration and Air-Conditioning Engineers) and the International Energy Conservation Code (IECC). Whenever these codes are updated, so are the new construction guidelines. Natural lighting in new construction has been utilized as well.

In order to upgrade old buildings, the first task is to assess their energy use needs. The old adage "you can't manage what you don't measure" holds true. Metering, life-cycle analyses, and building surveys are all critical. For example, after an energy survey of a building on campus, its heating system was retrofitted with a ground-source heat pump. With just this one upgrade, the building's performance score jumped from an Energy Star score of 30 to 80.

A campus inventory of baseline information is key. Once this information on energy use and costs is collected, these metrics can be benchmarked against others. In this benchmarking, it is important to use a metric people understand. Miles per gallon is easily understood, Btu's per square foot less so. As such, for buildings without submetering, Bill Leahy and his group developed a walk-through survey to rate a building's energy use. Each aspect of the building's energy consumption is scored. The scores are added up, and the sum score can be compared to other buildings to identify which buildings are most in need of improvement. This intra-university comparison of buildings provides an easy metric to quickly assess which buildings have the greatest potential for improvement and which are already energy efficient. This is helpful when working with limited budgets for building improvement.

Figure 1 Walkthrough Scoring System

Evaluate Major Energy Consuming System

- Lighting & Lighting Controls
- Building Envelope
- Building Systems and Controls

Scoring

1. Inefficient / Quick Payback / Retrofit
2. Inefficient / Capital Project / Renovation
3. Neutral Position or application does not apply
4. Relatively Efficient / Diminishing Return
5. State of the Art / Very Efficient

It is also important to keep abreast of the latest technology. For example, only four years after it was constructed, a building required a lighting upgrade. The new lights, T5 lamps, use half the energy of the four year-old T8 lamps.

DISCUSSION

Fuel Contracts

Tufts commits to 18-month contracts on heating fuels. Now Tufts is trying to address how to link the bill to a hedge for stability. In contrast, the University of Vermont is purchasing fuels on the market rather than locking in a contract because it has saved money relative to other institutions in the area.

What is the end goal? Is the goal price stability or a gamble for the lowest price? This illustrates the need to broaden the scope of the end goal. Universities are credit worthy customers, so they can get a good deal if they look around. But before purchasing energy, the universities have to know what they want. The way in which energy is purchased has changed in the past decade, so the role of sustainability directors is not to be experts, but to know how to ask the right questions.

Condensate Meters and Steam Traps

Installing steam traps increases the level of metered condensate. Condensate metering is often used to assess the cost of steam, so the cost for the steam increases just by installing the steam traps. Alternate meters exist (steam flow meters), but are more costly and would require capital investment to change over. Tufts actually contracted out to a company to install steam traps.

Complete thermal submetering has good benefits. Serious consideration should be given to installing meters in any new construction project.

One caveat is that meters require a step-up in operations capacity to read and inspect them. At Tufts, a window was left open over the weekend of a large snowstorm. The snowstorm caused $700,000-$800,000 in damage. Metering, coupled with monitoring alarms, can save money.

Life-Cycle Cost Analysis

The issues of energy, risk, and climate influence many assumptions. What are the factors that go into a LCA? For instance, what are the assumptions of the future cost of fuel, and what are the costs of risk and the savings of reliability?

We need to put enough data in front of decision makers so that they can make good decisions. The energy and finance people need to have a better dialogue. And when performing an LCA analysis, performing a scenario analysis of high and low projections would be useful.

Financing

Linking energy and finance also relates to hedging the operating budget. At Tufts, Creighton's group tries to bring a specific financial instrument to the table when proposing an idea or making a decision. But it is difficult to decide how to take certain actions if you don't know what the financial strategy is.

Climate neutrality is an emerging market. For instance, Sterling Planet is a company that deals in renewable energy credits (RECs) and carbon credits.

This example points out the opportunity energy savings and renewable energy can play in a funding opportunity for the university. If you change the conversation in this way, from one of environmental stewardship to that of bringing in income to the university, you influence who comes to the table (e.g. this brings in the finance people). The market of RECs and carbon credits provide a way to reach carbon neutrality efficiently.

In Connecticut, the Renewable Portfolio Standard provides an entity with the opportunity to sell energy efficiency. However, if you bank the credits for energy efficiency, you give up the opportunity to sell the RECs.

It is critical to try to take a more comprehensive approach to sustainability instead of tackling one project at a time. This will bring more stakeholders to the table.