case study

Using Paybacks to Fund Energy Efficiency in Higher Education

University of California

ENERGY EFFICIENCY PROGRAMS SYSTEM-WIDE AND AT UC DAVIS CAMPUS

In 2008, the University of California initiated a $280 million strategic energy plan encompassing 900 energy efficiency projects across the university system. The goal of the program is to reduce system-wide energy consumption by 10% or more by 2014, using the year 2000 as the baseline measure. According to Dirk van Ulden, associate director of energy and utilities at the university, the program achieved about 70% of its goal by the end of 2010, including "a gross cost avoidance of $21 million and a GHG emission reduction of 93,000 metric tons."

Students Driving Sustainability

The energy efficiency program is part of the university's Sustainable Practices Policy, which was created in 2007 as a response to demands from students, who insisted that the university had social responsibilities beyond educating students in a classroom. The strategic energy plan was formed as one response to these demands.

Using Contractors to Identify Energy Efficiency Activities

Contractors and subcontractors were the key individuals who "roamed all the campuses, looking for opportunities to conserve energy and maybe rebuild some systems to make them more efficient," according to van Ulden. After originally recommending 3,000 projects, the team ultimately settled on 900 activities based on a project's ability to deliver maximum returns in a reasonable time frame.

Self-Funding Program Enabled Initial and Ongoing Investment

The University set up the requirement that the strategic energy plan be a "self-funding effort", though it was predicated on an initial loan. In this case, $280 million was borrowed to pay for the improvements, with the loan repaid from the savings generated by the projects. In order to guarantee that this financing model would work, the University determined that the bond debt service for individual projects could not exceed 85% of the avoided energy costs. Van Ulden explains: "For every $100 that we saved, the project could not cost more than $85."

The fact that the project is self-funding was critical for its adoption. The UC campuses were able to capitalize on their ability to borrow money at a low rate and make the necessary improvements without competing with any other program for limited fiscal resources.

Strategic Partnerships with Utilities by Leveraging System-Wide Activities

Another critical component that allowed the university to create aggressive goals is its relationship with the utilities. Utilities had worked with individual campuses in the past on efficiency projects, but the system-wide effort meant they could create a uniform incentive program across the board.

The advantages to this approach, described by van Ulden, lowered administrative costs for the utilities and increased the incentive structure for the university. The standardized application process for each project allowed the utilities to offer an amount per kWh saved that is "50%–60% above what they would give normal customers." These savings help enable quicker payback of the debt incurred by the initial projects, reducing their overall cost.

The Challenge of Taking a System-Wide Approach

One of the challenges the program faced, according to van Ulden, was gaining buy-in from all 10 campuses and five medical centers that

Photo by Kathreen Fontecha/California Lighting Technology Center UC Davis

The lighting in the parking structures at UC Davis provided an opportunity to implement cutting edge technology.

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comprise the UC system. Each has a unique identity as an institution, and they typically operate autonomously. In addition, some campuses were concerned about the impact of the project on their debt ceiling. However, because their campuses would accrue the 15% cost savings exceeding the cost of investment, it was easier to persuade them to get involved.

Before the system-wide strategic energy plan was introduced, the UC Davis campus already had energy efficiency initiatives in place to exceed efficiency code requirements by at least 25%. Therefore, they were engaged by the program from the start, but they still found significant advantages in participating in the system-wide approach. For example, Sid England, assistant vice chancellor for UC Davis, states that the emphasis on a reduced carbon footprint, rather than just operating cost savings, came largely from this initiative.

Implementing New Technologies

The program helped the University system achieve goals beyond reducing its operating costs and carbon footprint. Van Ulden also believes that the university can help lead market transformation through their implementation of new technologies in the commercial buildings sector.

In order to meet the stringent requirements for payback on investment, van Ulden says that their strategy is to consider the overall payback of a combination of projects, with advanced technologies considered along with "very cost-effective programs" to achieve the 85% avoided energy costs.

UC Davis has taken the lead on these projects. The campus' California Lighting Technology Center helped UC Davis achieve the aggressive goal of reducing the energy used for lighting by 60% over the next five years—resulting in 32 million kWh per year and over $3 million in savings, and a carbon footprint reduction of approximately 6.5%. The cost of $39 million requires a longer payback than most of the UC efficiency projects, approximately 15 years, but will help demonstrate the efficacy of the new technologies.

One lighting project they pursued with unexpected benefits was to refit their parking garages with bi-level lighting that gauges the occupancy in the building and reduces lighting in an unoccupied garage to 50%. The technology also proved to be an unexpected security asset. According to England, "If there's anybody in the parking structure moving around, the lights start popping up."

Efficiency Projects with the Greatest Return

Since the strategic energy plan has been implemented, certain technologies and systems have emerged that offer high returns for investment. The university reports that HVAC systems and retrocommissioning are the efforts that yield the greatest returns, with paybacks in retrocommissioning in one to three years.

In particular, van Ulden cites projects that improve the energy performance of laboratories as having the greatest impact, since laboratories are such intensive energy users. ■

University of California Statewide Energy Partnership stats

UC System

10 campuses and 5 medical centers

Total Building Square Feet
Approximately 10 million

Cost of Energy Efficiency Improvement
$80 million as of 12/31/2010

Project Start Date
1/1/2009

Project Completion Date
In progress

Scope of Improvements
Lighting, HVAC control upgrades, motor, chiller and boiler replacements

Products and Technologies
T-8 fluorescent lighting (latest generation), LED and induction lighting, demand control in laboratories, CAV to VAV conversions, central plant upgrades

Process Improvements
Increased building occupant awareness, automated control systems, continuous commissioning

Cost Reductions and Paybacks (as of December 2010)
Energy savings (cost): 7%

Energy Use Reductions:
155 million kWhs and 8 million therms

Energy Savings (Use): 8%
Payback: Less than 7 years

UC Davis Campus

Investment
$44,000,000

Partnership Incentive
$10,145,965

Cost Reductions and Paybacks
kWh Savings: 34,846,232

Therm Savings: 2,364,940

Energy Savings (Use): 18%

kWh Savings: $2,981.830

Therm Savings: $2,152,832

Payback: 6.7 years

Methodology:

Data Section I (pages 10–15):

The data used to track the retrofit and renovation market activity were compiled from the McGraw-Hill Construction (MHC) database of construction projects. Through the Dodge Network, MHC publishes approximately 700,000 reports annually, covering all project types (e.g., nonresidential, residential, nonbuilding). From this pool of projects, MHC draws the Construction Activity Service (CAS) Database, which pulls project information on a monthly basis from the Dodge Network data on projects that have started construction. This database of start projects goes back to 1967. These data are used for analytical purposes, and they form the basis for all of the analysis of market activity represented in this section.

Data Section II (pages 16–39):

In 2009, Siemens and MHC published the *Greening of Corporate America Report,* which featured market research conducted in February and March 2009. Respondents included 203 corporate executives from firms with annual revenues of $250 million and above, which represent over 75% of the then $36 trillion U.S. equities market. These firms include a diverse range of sectors, including manufacturing, pharmaceutical, construction, computer technology, retail, real estate, insurance, energy and natural resources. 78% of the respondents were C-level executives (e.g., CEO, CFO) and the remaining 22% were respondents holding responsibility in the area of corporate sustainability. The survey investigated the broad patterns of corporate sustainability.

The same sample formed the basis for a new research survey conducted in December 2010 presented and analyzed in this report. MHC conducted this study to assess behavior, opinions and perceptions among upper management in corporate America of sustainability and energy efficiency activities in particular.

A sample of 120 corporate officers and high-level managers were contacted, with 50 sustainability officers and 70 general corporate contacts (over 50% were at the vice president level or higher).

To be an eligible respondent, the corporate officers had to meet the following criteria.

- Company revenues of at least $250 million in 2010
- One of the following roles: C-level or head of department division or business unit, vice-president, director of a department division or business unit, or a supervising manager
- Responsibility in at least one of the following areas:
  1. Selecting and installing more energy-efficient products and practices
  2. Setting budgets and getting financing for corporate sustainability initiatives
  3. Establishing benchmarks and performance measures for sustainability initiatives
  4. Promoting the company's corporate governance, ethics, stewardship, or philanthropic activities

Data Sidebar (pages 58–67):

Analysis in this section was conducted using data collected from 2009 to 2010. Some of these data were previously released in different forms in the following studies: *2009 Greening of Corporate America Report*, *Business Benefits of Green Building SmartMarket Report*, and *Green Retrofit and Renovation SmartMarket Report*. However, the results in this study aggregate and analyze these data as a way to help the industry understand—and help influence—the business case for investing in energy efficiency upgrades to existing buildings.

In November 2010, MHC published the *Business Benefits of Green Building SmartMarket Report*, which featured some results of a market survey conducted from July through September 2010. This research investigated the impacts perceived in 150 Energy Star labeled/LEED EBO&M certified buildings under management by CB Richard Ellis (CBRE), interviewing the building managers, building owners and tenant companies. The research was conducted in partnership with CBRE and the University of San Diego.

In October 2009, MHC published the *Green Retrofit and Renovation SmartMarket Report*, which featured some results of a market survey conducted from May through June 2009 with building owners and tenants. 61 building owners and tenants who had conducted green retrofits completed the survey, which was drawn from a sample of 738 office and retail existing commercial buildings managed by CBRE. Respondents were screened on the basis of whether they had owned or occupied space in a building that was at least five years old and that had completed or planned to complete a renovation project that addressed at least two green areas.