Green Revolving Funds in Action: **Case Study Series**

Stanford University

The Building Energy Retrofit Programs

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Summary

Location: Stanford, California

Full-time student enrollment: 15,319

Combined gross square footage of all buildings on campus: 13,600,000

Endowment: $13.8 billion as of Aug. 31, 2010

Type: Private

Stanford University's Energy Retrofit Program was created in 1993 to target resource reduction and conservation focused projects on campus. Fahmida Ahmed, Associate Director of the Department of Sustainability and Energy Management, says that Stanford has been investing in sustainability and energy-efficiency since the late 1970s, longer than many colleges and universities in the United States. In keeping with that tradition, Stanford University's President John Hennessey highlights sustainability as a core value of the institution, and the campus operates two green revolving funds.

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History

Background of Sustainability on Campus

Stanford University's Energy Retrofit Program was created in 1993 to target resource reduction and conservation focused projects on campus. Fahmida Ahmed, Associate Director of the Department of Sustainability and Energy Management, says that Stanford has been investing in sustainability and energy-efficiency since the late 1970s, longer than many colleges and universities in the United States. In keeping with that tradition, Stanford University's President John Hennessey highlights sustainability as a core value of the institution, and the campus operates two green revolving funds.

Initiating the ERP

Prior to 1985, Stanford University received energy rebates from local utilities that helped to finance energy-efficiency upgrades in campus buildings. However, when the university installed a natural-gas powered combined heat and power plant, it became the primary energy producer for its buildings and was ineligible to receive such rebates.[1]

In order to continue to fund energy-efficiency projects on campus, Stanford administrators sought to develop an internal rebate structure similar to that of the local utility. They reasoned that the money the campus could save from reduced operating expenses would eliminate the need for energy rebates, and thus provide a cost-effective way for the school to continue updating aging infrastructure. Out of these deliberations, the Energy Retrofit Program (ERP) was created in 1993, with the purpose of capturing the utility savings that came from the installation of more efficient technologies and reduced utility budgets.[2]

The ERP received its seed funding from the Utilities Division due to the direct impact energy savings would have on the campus' utility budgets. The fund was initiated with strong administrative backing from the Provost and the University President at the time.

Operations

Project Proposal, Approval, and Repayment Overview

Potential projects are funded and carried out through the ERP, from proposal to completion, according to the following process:

1. A project manager submits a funding request for ERP approval, identifying the rough cost, energy savings, and payback.
2. The ERP manager reviews the request.
3. Upon review of the project, the ERP manager sends a letter of commitment to the project manager.
4. When commitment has been obtained, the competitive bidding process begins; this process is overseen by the project manager and Stanford's Procurement Office.
5. Once the bidding process is complete and the winning bid is awarded, the project undergoes the construction phase, overseen by the project manager.
6. At the end of construction, the project is inspected by the ERP manager to track individual project performance by comparing metered consumption before and after project implementation; this step also ensures that the objectives of the project have been achieved.
7. After the project has been completed, the ERP manager and a utilities analyst transfer funds from SEM to the individual project's budget.

Stanford's on-site cogeneration facility provides electricity, steam, and chilled water to campus buildings. Operating as its own utility, Stanford is also able to offer rebate programs comparable to local public utility companies, a factor which helped to support the creation of the ERP and the WBERP.

Proposing Projects to the ERP

Any group affiliated with a campus department or housing unit that receives utilities service through the department of Sustainability & Energy Management (SEM)—a group that includes energy coordinators, facilities engineers, building managers, consultants, and contrac-

tors—is eligible to submit a project proposal to the ERP for funding. In choosing among applications, the ERP seeks projects that have a simple payback period of five years or fewer, and also demonstrate a strong return on investment.[3] The ERP also takes into consideration the location of projects, a consideration that ensures a fair distribution of funding evenly throughout the campus and across Stanford departments.

The ERP operates with two proposal deadlines per academic year: one on October 15th and one on January 15th. Having two separate implementation periods increases flexibility for project managers when scheduling new project work, as they are not beholden to one time of the year to introduce new projects. Having two implementation periods also maximizes the advantageous periods of winter and summer breaks, when such construction will cause less interruption for student and academic life. Having the deadlines occur over two fiscal years—Stanford's fiscal year ends August 31st— decreases the number of projects that can be billed in one year. Two distinct application periods also shortens the length of time in which the university can begin to accrue energy savings from those projects proposed during the first implementation period.[4]

Over the course of its life, the ERP has a strong track record of supporting new projects. "As long as a project demonstrates its benefit to the campus and meets our payback criteria, it will be funded," said Gerry Hamilton, Associate Director of Facilities Energy Management. "There are only a few all the way through [the funding process.]"

In-House Support

The ERP Guidelines note that the fund is designed to "blend the abilities of many different groups within Facilities."[5] Nearly all staff members who support the ERP are employed by Stanford; seeking staff internally streamlines the effectiveness and speed of how the ERP operates.

A dedicated ERP Manager oversees the complete fund process, from approving project proposals, to working with applicants to reach energy savings targets, to reviewing invoices during the construction process to ensure that the project remains on budget. Upon completion of construction, the ERP manager conducts a walk-through with the project applicant to ensure that the intent of the project was achieved. The ERP manager is assisted by the Sustainability & Energy Management team, which provides technical guidance for projects and conducts research on new strategies and technologies for future installation.[6]

Project construction also utilizes the internal Stanford staff. Upon the approval of a proposal, university craft shops bid on the opportunity to implement them.[7] This competitive bidding process helps keep project costs low and ensures that contracting opportunities remain within the university.

Source of Funding

"We expect energy savings to persist for many years after the project is completed," said Senior Energy Engineer Scott Gould. "We are diligent to ensure that the savings will last for the life of a project."

Unlike many revolving funds, the ERP is annually replenished through funding from Stanford's central administrative budget. Though the ERP's fund isn't directly paid back through cost-savings, as is seen traditionally in green revolving funds, its structure is similar to that of a traditional revolving fund because the amount of funding that is allocated by Stanford is adjusted every fiscal year and dependent upon the energy savings accumulated by the ERP's past projects. In this way, the ERP is able to be sustainable for years to come.

The ERP divides projects from the applicant pool into four areas of campus specialization: Academic Zones, the School of Medicine (SOM), Residential and Dining Enterprises (R&DE), and Department of Athletics, Physical Education and Recreation (DAPER). These four categories were devised based on these departments' status as the largest consumers of energy the Stanford campus. Table 1. demonstrates the weighted percentages that the ERP takes into consideration when they are allocating funds for potential projects. The weighted percentages reflect the proportion of total campus electrical consumption that these departments individually consume.

Table 1.[8]

Project Funding Limits

GROUP	% OF TOTAL ELECTRICAL CONSUMPTION
Academic Zones	57%
SOM	17%
R&DE	14%
DAPER	4%

Like many public utility incentive programs, SEM charges a small consumption-based fee based on electrical, steam, and chilled water utility recharge rates calculated from the previous year's energy savings to all of its utility rate payers. These utility rate payers— which include the various schools, departments, and business units operating at Stanford— provide additional money to fund future ERP projects.

Performance

The Energy Retrofit Program (ERP)

Year created: 1993

Size: $619,000 annually

Source of capital: Department of Sustainability & Energy Management

Average payback period: 3.07 years

Administrator: Program Manager (Facilities), Sustainability and Energy Management

Largest project financed: $50,000

Average return on investment: average payback 3.3 years

Collectively, the ERP has produced a total annual savings of 13,782,798 kWh. Since the fund's creation, it has grown to $1.42 million and tallied cost savings of approximately $3.02 million.[9] The fund has completed 360 projects since its creation, with an average simple payback period of 3.07 years.[10]

Green Lights Program

Since the creation of ERP, 124 of its projects have focused on lighting upgrades and retrofits.[11] One of the fund's most successful projects came about by participating in the Environmental Protection Agency's (EPA) Green Lights Program. Stanford signed onto the Green Lights Program in 1995 and committed to retrofit 90 percent of the fluorescent lighting on campus within a 5 year time period.[12] As a collaboration between the university and the EPA, Green Lights sought to install more energy-efficient T8 lamps to replace the existing T12 lights and electronic ballasts. These lighting upgrades were installed in academic, residential, and administrative buildings on campus. The projects that took place in academic zones were funded through rebates given by SEM.[13]

The Green Lights Program completed its objective in1998, one year ahead of schedule.[14] The program had an annual cost savings of $764,740 and produced energy savings of 9,114,932 kWh/year.[15]

Larger Projects Outside of the ERP's Financial Capacity

The ERP was initially created to handle small-to-medium sized projects at the university. However, the limited scope neglected larger projects offering potential for significantly higher returns, but requiring a much more capital investment. "We started running into the issue of what if we had a very large building and wanted to do a whole-building retrofit? How would we handle that?" said Hamilton.[16]

To address these funding needs, the university developed a second program to target large scale energy-efficiency and resource reduction projects on campus: the Whole Building Energy Retrofit Program (WBERP). The WBERP focuses on projects that are a "whole magnitude larger and require significantly more oversight," said Hamilton.

"If you're getting started in a lab building, the opportunities are limited to large or quite large projects, or no projects. [These projects] require a huge financial commitment, beyond the scope of the ERP," said Hamilton.[17]

The next section will explore the WBERP and the larger-scale projects that it supports.

Table 2.
The Whole Building Energy Retrofit Program (WBERP)

Year created: 2004

Size: $30 million in total debt commitment

Source of capital: Stanford University

Average payback period: 4.4 years

Administrator: Vice President of Land, Buildings, & Real Estate

Largest project financed: $7.4 million (Beckman Center for Molecular and Genetic Medicine)

Average return on investment: 23%

Developed out of the ERP

While many early energy retrofits were undertaken by Stanford's ERP, the university developed the WBERP to implement large-scale, multi-million dollar energy retrofits beyond the scope of the existing ERP's available funds. The WBERP was started in 2004 by the university's Vice President of Land, Buildings, and Real Estate.

The program was created to address two major points: 1) to investigate and create opportunities to implement energy-efficient technologies in all existing energy-use systems, instead of focusing on specific end-use opportunities like lighting or motor retrofits; and 2) to create a team composed of Stanford University staff—

including the SEM and in-house construction managers—along with external contractors and consultants, who could develop large-scale energy savings projects on campus.[18]

The idea for the fund originated after Stanford Utilities (now SEM) conducted a 12-Building Energy Study, which looked at the campus's largest electrical consumers by building. The study found that the 12 buildings use 33 percent of campus' energy. The study also found that by addressing efficiency projects, the campus could save over $4 million dollars annually in avoided energy costs, with a projected an estimated simple payback period of four years or less.[19]

Initiating the WBERP

In 2004 Stanford University's Provost allocated $15 million to create the WBERP.

"Since initial WBERP projects demonstrated good payback, the University decided to reinvest energy cost savings into additional projects." said Joseph Stagner, Executive Director of the Department of SEM. The program was allocated another $15 million in 2010. Stanford estimates that the total program expenditures will approach $30 million once the last retrofits are completed. As seen in the ERP, the energy savings from funded projects translate into cost savings from lowered utility bills, which revolve back to replenish the WBERP.

How the WBERP Operates

Stanford University buildings are individually metered, which Senior Energy Engineer Scott Gould credited for facilitating the identification of the top 25 energy-consuming buildings on campus. Next, the university identified the 25 most energy-consuming buildings as being eligible to apply for funding from the WBERP. The WBERP program manager then prioritized the buildings within that list to identify the projects with the shortest payback. Other factors, such as the age of the building and construction impact to occupants, were also taken into consideration.[20]

While these considerations are important in deciding the order that projects receive funding, there are other factors at play on the Stanford campus. One such factor is the important influence a Project Manager can exert to lobby for moving a specific project higher on the list of priorities.[21]

"There is an opportunity for the building managers to influence [their rank]. Their participation and support is critical for project success. We want buildings to take initiative, to say 'Hey, put ours on queue," said Hamilton.[22]

As of February 2011, half of the 25 selected buildings had already undergone construction, with the remaining buildings awaiting future funding.

The Purpose and Performance of the WBERP

Stanford's WBERP differs from the ERP primarily in the way projects are scoped: while ERP projects are based on the benefit of installing a piece of equipment or end-use of a project, WBERP projects are identified through a detailed building level engineering analysis. This analysis is conducted to explore multiple energy-saving measures with the purpose to keep energy savings projections and total project costs as accurate as possible.

Past WBERP projects, like the 28,000 gsf Stauffer Chemistry building, incorporated higher efficiency chilled water, steam, and electrical systems as well as lighting upgrades.

Due to the intricacy of this process, successful assessment of WBERP projects requires that potential projects go through a multi-phase review. Phase I requires Project Managers to produce a qualitative list of energy measures, while Phase II requires the production of an investment grade analysis that is primarily data-driven. Upon completion of Phase I and Phase II, the Program Manager requests that the WBERP project budget cover the costs of implementation. Only when Phase I and II are successfully completed and funding is secured can construction begin. "This process ensures that costs are controlled and that only practical measures are implemented," said Hamilton.[23]

The WBERP Team

The WBERP has many different groups that aid in the development of a project. A project team, consisting of a program manager, facilities manager, engineering consultant and contractor as needed, assists in implementation. The initial projects undertaken by the WBERP focused on HVAC system retrofits in the campus lab buildings Stauffer 1 and Stauffer 2, which contain the Chemical Engineering and Chemistry labs, the Gilbert Biology building, and the Beckman Center for Molecular and Genetic Medicine.

Due to the magnitude of the projects undertaken by the WBERP, extensive oversight is provided throughout the implementation process. "There is direct involvement with the whole building and the project manager, which is supported by energy engineers. It brings in a lot of resources, both at the building management level as well as tapping into facilities support staff," said Gould.

A Closer Look: The Stauffer Chemistry Buildings

The Stauffer Chemistry buildings, the first project to be completed by the WBERP, finished construction in June of 2007. The project resulted

in a 35 percent drop in electricity use, a 43 percent decrease in steam use, and a 62 percent decrease in chilled water use for the building. HVAC retrofits decreased energy costs by 46 percent within the first year, and the buildings' carbon dioxide emissions were reduced by 762 metric tons per year.[24] The total cost of the project was $621,945 for Stauffer 1, which included an $180,000 rebate, and $985,033 for Stauffer 2, which included an $113,000 rebate.

WBERP projects have had varied costs, ranging from $300,000 in George Forsythe Hall, a data center facility, to $7.4 million in the Beckman Center for Genetic and Molecular Biology. For the buildings identified as the 12 highest energy consumers, all retrofits are scheduled to be completed by 2013. The result will be an estimated annual savings of $4.2 million and a projected reduction of these buildings' energy consumption by 28 percent.[25]

Gerry Hamilton stressed that schools with their own funds should not be discouraged by the longer timeline that large-scale energy projects require. "Because these projects are bigger, they just take more time. It's more about getting a project team [and] construction team together, and doing implementation. Even though greater financial resources are required, the rewards are there to justify the project staff required to do the implementation."

"The Stauffer Chemistry Building Retrofits saw decreases in carbon emissions, electricity use, steam use, and chilled water use due to installing energy-efficient technology in 2007."

Two Different Programs to Target Large- and Small-Scale Sustainability

With two programs active on the Stanford University campus, all magnitudes of project can be considered for funding. "ERP and WBERP are effective and complementary methods of tackling both small and large scale projects simultaneously," noted Fahmida Ahmed.

Stanford's Joseph Stagner credits the success of these two programs to the insight of the university's senior administrators.

"Stanford's major capital Whole Building Energy Retrofit Program and minor capital Energy Retrofit Program are strategic initiatives launched by senior campus leadership over the past decade to identify and pursue energy efficiency opportunities at the university," said Stagner. "This proactive, systematic approach assures that no stone will be left unturned and that potential projects from across the entire university will be identified carefully, prioritized adeptly, and pursued vigorously."

Endnotes

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12 Stanford News Service – News Release: Stanford joins EPA's "Green Lights" partnership. http://news.stanford.edu/pr/95/950424Arc5268.html. Accessed April 7th, 2011.

13 Ibid. 5.

14 Ibid. 2.

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16 Ibid. 1.

17 Ibid. 23.

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25 Ibid 24.