Strategic Energy Planning:

A Step Zero Approach

by Mark Webb, P.E., CEM, and Joe Sugg, P.E.

With sharp increases in the costs of natural gas and fuel oil over the last few years, facility managers have begun facing significant new challenges to successful implementation and operation of energy-related capital projects. Consider the case of a university that installed a new $7 million natural gas engine-driven central chiller plant in 2003, which now sits idle due to the high cost of natural gas. As a result, the new plant had to be expanded to include electric chillers to reduce operating costs.

Unfortunately, many educational institutions are now struggling with similar unexpected capital expenditures. However, these surprises can be avoided through strategic energy planning.

A New World

Historically, owners have used a two-step process for completing energy-related capital projects. Step 1 is commonly referred to as a project development or feasibility study phase, in which scopes of work, schematic engineering designs, detailed cost estimates, energy calculations, and related documents are developed for a given project. For example, if a chiller plant is beyond its useful economic life, a project will be developed to replace the existing chiller plant, usually with a similar plant that minimizes the initial capital cost. Once Step 1 has been completed, the owner typically moves to Step 2, referred to as the implementation phase, in which the project is constructed.

Before mid-2003 this was a reasonably effective way to complete a project. Energy prices had remained relatively stable for the previous 15 to 20 years, so an owner could calculate a simple economic payback based on a "snapshot" of the current price at any given time with reasonable assurance that the variables in this formula would remain consistent over the life of the project. Now, however, the cost of natural gas and fuel oil have rapidly increased, and they are not likely to come back down anytime soon, if ever. In fact, most experts predict that the costs of fossil fuels generally will continue to rise even though there may be periodic price fluctuations. As a result, the traditional two-step process may lead to projects with poor outcomes.

In addition to the energy price issue, environmental compliance has also changed permanently. For example, in September 2006, the U.S. Environmental Protection Agency (EPA) began to enforce significantly more strict emission limitations on fossil fuel-fired sources via the Industrial Boiler MACT Rule. Additionally, in September 2007, California Gov. Arnold Schwarzenegger signed into law the "Global Warming Solutions Act," which attempts to limit greenhouse gas emis-

***Mark Webb (mwebb@syska.com) is vice president, energy services, at Syska Hennessy Group, Inc., Princeton, New Jersey. Joe Sugg (jsugg@scu.edu) is assistant vice president, university operations, at Santa Clara University, Santa Clara, California. This is their first article for* Facilities Manager.**

If the facility department can develop a capital project that complements and strengthens the university's disaster recovery plan, the project has a much better chance of approval, regardless of the simple economic payback, as it helps to mitigate the overall risk on the campus in the event of a natural disaster.

sions. In attendance at the signing of this law were the governors of Arizona and New York, leading many to believe that this type of legislation will soon be passed in other states.

As a result of these order-of-magnitude changes in the energy environment, owners and facility managers can no longer rely on the traditional two-step project development and implementation process and the tried-and-true formula for simple payback without risking significant and costly miscalculations.

A Step Zero Approach

Owners and facilities managers who have recognized the realities of the new energy environment are taking an important step back—or Step Zero—developing a strategic energy plan *before* project development and implementation. They simply refuse to spend millions of scarce capital dollars on an energy-related project until they have fully analyzed all the factors and trends that may affect their project, including the energy market; environmental legislation; renewable energy sources, such as solar energy and biomass; financial incentives, such as tax credits, rebates, and grants; and creative project financing options.

The following are some of the key questions that should be investigated during development of a strategic energy plan:

1. Should I make a significant capital investment without a strategic energy plan?
2. What are the long-term energy costs forecasts?
3. When do my contracts for electricity, natural gas, and fuel oil expire?
4. Should I have multiple fuel flexibility?
5. Should I consider new renewable/sustainable technologies (solar, biomass)?
6. What are the upcoming environmental regulations?
7. What are our future campus expansion plans?
8. Are there any financial incentives, tax credits, or rebates available?
9. Do we have the necessary multi-disciplinary (engineering, project finance) expertise in-house?
10. What impact would this project have on the institution if it were to fail?

The other critical success factor for development of a world-class strategic energy plan, as well as any energy-related capital project, is a strong relationship between the facilities department and the institution's chief financial officer. The CFO may be the one individual on the entire campus who completely understands the institution's strategic direction, operation, priorities, financial condition and, in particular, key performance indicators. The facilities department must understand these key performance indicators, whether they are Btu (British thermal unit)/student, Btu/square foot, cost/square foot, or utility cost/student.

Presenting the Business Case

Once the key performance indicators are fully understood and a strategic energy plan is developed, the facilities department can develop a solid business case for any project request that goes well beyond the traditional simple payback analysis. This comprehensive business case will analyze the life-cycle cost of the project, reflect the institutional key performance indicators, complement the long-range campus plan, and support the overall strategic vision of the university. As a result, the facilities department is likely to gain more approvals for their capital projects and become much more effective in their ongoing efforts to renew the physical plant — while avoiding costly miscalculations.

This approach requires a change in mind-set from a narrow view of project development and implementation ("Step 1, Step 2 …") to a broader view of outcomes when developing infrastructure renewal projects and capital budgets:

- Think "Strategic"—not "Tactical"
- Think "Life-Cycle Costs"—not "Simple Payback"
- Think "Investment"—not "Cost"
- Think "Long-Term Forecasts and Predictions"—not "Snapshots"
- Think "Risk Mitigation"—not "Luck / Hope"
- Think "CFO Business Case"—not "Capital Project Request"

As an example of this new way of thinking, many institutions are now implementing business/disaster recovery plans in the event of a natural disaster. According to the U.S. Federal Emergency Management Agency (FEMA), approximately 22 states have a significant probability of being impacted by a flood, an earthquake, and/or a hurricane. If the facility department can develop a capital project that complements and strengthens the university's disaster recovery plan, the project has a much better chance of approval, regardless of the simple economic payback, as it helps to mitigate the overall risk on the campus in the event of a natural disaster.

For example, the installation of electric self-generation typically has a poor simple economic payback period. However, if the installation helps the university to recover more quickly after a natural disaster by being independent from the electric

utility grid, then the project will stand a much better chance of approval and funding.

Case in Point: Santa Clara University

The facilities department of Santa Clara University (SCU), California, reflects this new way of thinking. SCU is a Jesuit Catholic university located in the city of Santa Clara, adjacent to San Jose. As a relatively small institution, SCU cannot put "big numbers" on the board about energy consumption or savings. However, the process SCU uses may be valuable to other institutions, regardless of its size, in developing or tweaking their energy strategy.

SCU 's strategic energy plan shares certain goals with most academic institutions:

- Reduce costs by managing energy use
- Reduce costs by managing energy commodity costs
- Sustain business operations by also managing availability
- Reduce greenhouse gas emissions

In developing a strategic energy plan, SCU first examined energy use, analyzing energy consumption in the form of HVAC, lighting, plant optimization, and miscellaneous equipment in the academic buildings. This has guided common-sense initiatives almost across the board to manage energy consumption.

Following are some of the examples of SCU's conservation measures and associated savings (as a percentage of total energy savings):

Many universities, including SCU, have serious initiatives in the area of reducing greenhouse gases and implementing sustainability policies and projects.

- Lighting (30%): retrofits, sensors, controls
- Equipment (20%): chiller, variable frequency drives (VFD), energy management system (EMS), mini-plant
- Maintenance practices (10%): planned maintenance, plant optimization (re-commissioning)
- Building design (15%): envelope, daylight, ventilation
- Operation practices (20%): scheduling, load shedding, seasonal adjustments
- Culture (5%): temperature, lights

SCU's energy management system enables the facilities department to monitor performance and maintain a continuous effort to improve efficiency as conditions change.

Overall, the university has reduced demand charges by 3 percent and reduced cost per square foot by 8 percent over the past six years, even while the growing campus has expanded 27 percent in total building area and increased enrollment 11 percent.

The university is also taking actions to manage energy costs. Currently, SCU is working on several major initiatives: photovoltaics, ice storage, and distributed cogeneration, taking advantage of new technology generation and heat recovery systems, such as microturbines, and possibly fuel cells and small capacity absorption chillers.

Sustainability Initiatives

Beyond efforts to reduce the amount and cost of energy, the university must also look ahead to ways of mitigating cost and availability fluctuations. One helpful approach has been the university's sustainability policy, which champions a number of sustainability initiatives, including energy conservation. A significant outcome has been the realization that energy needs can be met while reducing dependency on fossil fuels.

For example, the university now gets 48 percent of its energy from non-fossil fuel sources, including 5 percent from university-owned wind generation. This provides new opportunities to refocus the long-term strategic energy plan by diversifying energy sources to help en-

sure availability of supply, as well as mitigate the impact of a fluctuating market.

Many universities, including SCU, have serious initiatives in the area of reducing greenhouse gases and implementing sustainability policies and projects. It is evident that many institutions are doing more than just passing policy language—they are actually developing, approving, and funding actual capital infrastructure projects to support a sustainable campus. In addition to being good stewards of the environment, another major driver is that of competition for students, many of whom value an institution that has an aggressive and visible sustainable program. As a result, many colleges and universities are implementing major infrastructure renewal projects such as photovoltaics, fuel cells, water conservation, and energy management systems.

Understanding Needs and Goals

A prelude to developing the long-term strategic plan is to understand the university's needs and goals, so the facility department studied SCU's energy needs (as a percentage of total) to support various stages of operations in the event of a long-term utility outage resulting from a natural disaster:

- Emergency operations: 20%
- Critical operations: 10%
- Initial business recovery: 20%
- Sustained business recovery: 30%
- Full Operation: 20%

The study also looked at how energy needs in a "business as usual" mode:

- Base load: 30%
- Sustained load: 45%
- Peak load: 25%

The Long-Term Plan

Translating these requirements into a long-term strategy is guided by cost, reliability, environmental impact, and regulatory mandates. Actions focus on ways to mitigate cost and availability fluctuations, expand sources and means of providing energy, and ensure energy for business recovery after a major disaster.

Overall, SCU's long-term energy strategy strives to:

- Reduce dependency on fossil fuels
- Reduce dependency on the grid
- Balance cost, environment, risk, and business recovery
- Leave flexibility for future unknowns

SCU has proven that one can manage both energy consumption and energy cost. While continuing to improve those results, the university also sees the need to have a much more comprehensive strategy for the future—one that will ensure Santa Clara University remains a viable and competitive university.

That is the value of a strategic energy plan: the all-important "step back" that looks toward the future.