Communications Research Centre Canada – Reducing Operating Costs While Responding to Environmental Challenges

1 Introduction

Between 1993–94 and 1998–99, Communications Research Centre Canada (CRC) at Shirley's Bay, west of Ottawa, Ontario, reduced its energy costs by 41 percent and its water costs by 59 percent. Although the amount of serviced floor space in use and the patterns of water use varied over time, most of the savings can be attributed to a coordinated long-term plan to improve the efficiency of energy and water use through a series of well-conceived conservation measures. The step-by-step approach used by CRC to initiate and carry out its long-term plan can serve as a practical model for other organizations facing environmental challenges.

2 Background

It was clear by the early 1990s that the facilities at the 350-hectare CRC complex needed a mid-life retrofit. Energy and water costs were high and rising, chlorofluorocarbon (CFC) coolant had to be safely eliminated to comply with new environmental regulations, the newer buildings required extra insulation, and an aging chiller in the central heating and cooling plant was due for replacement.

Action was needed, but economic pressures had squeezed capital and maintenance budgets to a point where major building systems upgrades became difficult to finance and implement on an in-house basis. Jean-Maurice Charron, CRC's Manager of Plant Engineering Services, contacted the Federal Buildings Initiative in early 1993 for information and advice on how he could move forward. He learned that the Federal Buildings Initiative's savings financing approach to energy and water efficiency upgrades could help him control the centre's utility bills, replace aging equipment, and improve environmental performance and energy use to reduce greenhouse gas emissions that contribute to climate change.

Figure 1. Cooling unit at the CRC.

3 The Energy Performance Contract

The Federal Buildings Initiative of Natural Resources Canada's Office of Energy Efficiency advocates the use of energy performance contracts with private-sector energy service companies (ESCos) as a cost-effective way for federal departments and agencies to reduce energy and water consumption in their facilities. Through these contracts, ESCos are retained as long-term partners who work closely with their client organizations to design and implement their projects. Typically, ESCos will:

- work with representatives of client organizations to define the goals and objectives of their projects
- gather data on current patterns of energy and water consumption
- identify savings opportunities
- draw up comprehensive project designs to take advantage of the identified savings opportunities
- arrange private-sector financing for the projects
- procure and install new equipment
- train staff in operating and maintaining equipment
- monitor the resulting changes in utility use and report them back to their clients

The revenue streams generated by these projects are typically forwarded to the ESCos in payment for their work, as well as to cover the capital cost of new equipment and financing charges. Future savings are retained by the contracting federal organizations once the pre-determined values of their contracts are paid out or the terms of the contracts have expired.

3.1 A Flexible Approach to Meet Specific Needs

Mr. Charron saw that the inherent flexibility of the Federal Buildings Initiative's savings financing option was well-suited to the CRC's needs. He formed a project team that included Nyle Belkov, Chief Operating Engineer; Ben Stach, then Head of Mechanical Engineering, and Brian Carleton, Energy Contracts Officer. He also made sure that Industry Canada – CRC's custodial department – as well as other tenant organizations were consulted.

The team invited Federal Buildings Initiative officials to visit the Shirley's Bay site and present an overview of the savings financing approach and how it might be adapted to address CRC's specific needs. Once the team accepted that savings financing was an approach worth pursuing, its members collaborated to identify the goals for the project and compile the goals into a briefing submission. A prerequisite for proceeding was to obtain top-level support for the project's objectives. The President of the CRC was favourably impressed by the team's preliminary proposal and informed the Minister of Industry – the federal Minister responsible for the centre – who readily supported approval to proceed.

3.2 A Key Decision: Selecting the Right Energy Service Company

Strong top-level support for the project gave the team the mandate it needed to move forward. It used the Federal Buildings Initiative's implementation document templates to select the most suitable ESCos from the program's list of qualified bidders. By using time-tested documentation to solicit proposals from companies of proven ability, the team could direct its attention toward evaluating project-specific proposals, rather than assessing the claims and project-readiness of unknown firms.

Four firms from the Federal Buildings Initiative's qualified bidders list of ESCos were invited to perform “walkthrough” energy and water audits of CRC's facilities. Two of these firms went on to submit preliminary concept reports to the team, both emphasizing that CRC could save significant amounts of energy and water.

Staff from Public Works and Government Services Canada and a private consultant helped develop a set of criteria to evaluate the proposals. Each member of the project team reviewed the proposals. The scores that each team member assigned to the proposals were tallied to yield composite values and final ratings.

Next, both ESCos made oral presentations on their proposals. Brian Carleton, Energy Contracts Officer, recalls the oral presentations as a useful exercise. “They were sales pitches, of course, but they provided us with a good idea of what the individuals we would be working with were like,” he says.

Honeywell Limited was selected for the contract, primarily because it was willing to invest more in the project than the other firm. On this basis, Honeywell was invited to conduct detailed baseline audits of energy and water consumption throughout CRC and facilities owned by others and to draw up a detailed energy feasibility study and concept report.

4 The Project

Honeywell worked with the team members to design a plan for 35 of the 70 buildings at the Shirley's Bay campus. The final plan included all of the site's major buildings, but none of the small, little-used facilities, some of which were slated for demolition.

A $3.5-million, 6.5-year-term energy performance contract was negotiated. It was customized to include a performance guarantee premium of $249,000, as well as $224,000 in third-party finance interest charges and $330,000 in non-guaranteed extras. Honeywell guaranteed post-construction cost savings of $530,000 per year and projected that total energy consumption would decline by about 40 percent and water consumption by 30 percent once the proposed measures were fully implemented. In year three of the contract, CRC exercised its option for accelerated paydown, thereby reducing interest paid to $48,000 instead of the forecasted $224,000.

The design for the project included the following measures:

- **replacing an aging chiller in the central heating and cooling plant** to safely eliminate environmentally harmful CFCs from the facility while sparing the centre's capital budget an up-front expense of over $100,000;
- **replacing high-pressure boilers with low-pressure boilers** to reduce nitrogen oxide (NO_x) emissions – in particular nitrogen dioxide (NO_2) and nitric oxide (NO) – in anticipation of future environmental regulations. With advanced controls automation, this measure allowed for further operational cost reductions of $245,000 annually.
- **reviewing and recalibrating cooling distribution patterns** to improve efficiency and indoor comfort;
- **upgrading chilled water line drainage** to reduce maintenance costs for the system piping and rust build-up and eliminate standing water;
- **adjusting the building system on-off scheduling** to follow patterns of actual use by employees;
- **installing energy-efficient lighting**, adjusting lighting levels where appropriate and replacing outdated fluorescent fixtures with T-8 bulbs and electronic ballasts;
- **focusing on water-saving measures** by installing new water meters; Honeywell is also working with major tenants to minimize waste;
- **installing small package boiler units** in several locations to make it possible to shut down the central heating and cooling plant during the summer when heating requirements are minimal; and
- **replacing electric heaters with oil furnaces** in several small outlying buildings to reduce heating costs.

In addition, the CRC-Honeywell energy performance contract included the following non-guaranteed extras: steam metering, cooling tower and chill water portion of the contract.

Figure 2. Steam metering at the CRC.

4.1 Employee Education

Formal instruction in the field of environmental systems was delivered by Seneca College of Applied Arts and Technology. In addition, Natural Resources Canada's "Dollars to $ense" energy efficiency workshops gave operations staff an opportunity to learn more about energy efficiency, specifically identifying energy savings opportunities, designing and implementing energy management plans, and monitoring and tracking.

Training for building systems operations staff has had a positive impact on overall performance. It has also established training standards by which to upgrade capabilities and qualifications of building operators.

5 Project Results

From the beginning, the project has generated solid savings. Utility costs began to drop almost immediately. During the 27-month construction phase, for example, cumulative savings totalled $1.1 million. By 1998–99, the unadjusted value of energy savings was over $500,000 per year. Although the total amount of serviced floor space varied somewhat from year to year between 1993–94 and 1998–99, total annual energy consumption fell from 3.243 gigajoules per square metre (at a cost of $30.57) in 1993–94 to 1.766 gigajoules per square metre ($18.03) in 1998–99. This corresponded to a net energy savings of 46 percent and a dollar savings of 41 percent.

The impact of the water conservation component of the project was even more dramatic. Measured water consumption fell from 133 730 cubic metres (costing $200,918) in 1993–94 to 59 138 cubic metres ($81,667) in 1998–99, a volume reduction of 56 percent and a dollar savings of 59 percent. It is important to note that conservation measures alone did not fully account for the savings. By 1993–94 senior operations staff had begun to suspect that the water consumption meters were not recording actual water consumption accurately. Their suspicions were confirmed as soon as the meters were replaced; recorded consumption in 1994–95 dropped to 87 380 cubic metres ($130,118), a savings of 35 percent. The additional water savings that were realized through to 1998–99 are due to a range of other standard energy performance contract-related water conservation measures, as well as complementary in-house efforts to reduce consumption.

The CRC's energy performance contract has reduced energy and water costs dramatically and will continue to deliver lower operating costs. Several factors have contributed to the overall success of the project:

- The Manager of Plant Engineering decided at the outset to form a project team of qualified operations staff. Team members cooperated to define their energy, water and environment-related needs and expec-

tations for the project. They also considered how the Federal Buildings Initiative's savings financing option could be tailored to address the needs of CRC.

- Support from the federal Minister of Industry, the President of the CRC and the union gave the project team members the authority and momentum they needed to act decisively.
- Team members had developed firm ideas concerning their priorities, before qualified ESCos appeared on the scene to conduct preliminary audits and prepare initial project proposals.
- CRC recognized the importance of choosing the right ESCos. Project proposals were evaluated systematically using clear selection criteria, and on-site presentations gave the committee members an opportunity to become acquainted with the individuals who would be at the centre of their negotiated partnership.
- Tenant organization buy-in for the project has boosted its overall success. Several tenants have implemented savings measures of their own, in tandem with those put in place as part of the centre-wide project.

5.1 Improved Efficiency Can Help the Environment

The environmental benefits of the Honeywell Limited energy performance contract have been significant. The safe elimination and ability to capture CFCs in accordance with federal policy guidelines is an important issue that was addressed by installing a new chiller, R134-A, which does not deplete the ozone layer.

As planning for the project progressed, measures to control NO_x emissions also emerged as an important environmental issue. The replacement of high-pressure boilers with low-water content units and low NO_x emissions, was an important element of the final design of the project. This measure was specifically intended to meet anticipated NO_x emissions performance guidelines.

More recently, the Government of Canada has announced ambitious greenhouse gas emissions targets from its own operations; a reduction to 31 percent below 1990 emissions levels will be required by 2010. Communications Research Centre compliance with the new emissions targets will be facilitated by the 46 percent reduction in annual energy consumption that had already been achieved between 1993–94 and 1998–99.

The building systems team of CRC has accepted the challenge of integrating evolving environmental performance guidelines into the multi-year energy and water efficiency management plans. A more proactive approach is now taken. As Brian Carleton notes, “Within the building systems group, we're now much more aware of energy-related issues and especially government decisions that might affect us down the road.”

5.2 Consolidating Savings through Residual Opportunities

The building systems team is currently focused on taking advantage of residual opportunities; in particular, small-scale “soft” measures, which cost very little to implement but offer significant potential for increasing savings over the long term. Soft energy efficiency measures now being put into place include installing motion sensors and Employee Awareness campaign to use computer power management features.