Modernizing Facilities and Maintaining Budgets

Energy Retrofits in Local Government Facilities

Edited
by
Donald D. Gilligan
for
The National Association of Energy Service Companies
and
The United States Department of Energy Rebuild America Program

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National Association of Energy Service Companies

The mission of the National Association of Energy Service Companies (NAESCO) is to promote the delivery of comprehensive energy services, including energy efficiency to maximize customer benefits and environmental sustainability by Energy Service Companies (ESCOs).

NAESCO accomplishes this mission by encouraging high standards of quality and integrity among its members, disseminating information about developing technologies and their appropriate applications, participating in legislative and regulatory proceedings which affect energy policy, ensuring the best use of ESCOs in the delivery of energy services, providing opportunities to share and publicize ESCO project successes, and speaking on behalf of the Association membership when its welfare and that of the public requires a single voice.

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Rebuild America is a network of community partnerships comprised of local and state governments, schools, universities, housing agencies, and private businesses that save money by saving energy. These voluntary partnerships, working with the U.S. Department of Energy, choose technical and investment approaches best suited to improving energy efficiency in the buildings they own and operate. Rebuild America supports the partnerships with business and technical tools, and customized assistance.

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Donald D. Gilligan

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Acknowledgments

On behalf of the National Association of Energy Service Companies (NAESCO), I would like to thank the United States Department of Energy, Rebuild America Program for its generous support in funding this case study project. In particular, Mr. Mark Bailey, Assistant Deputy Director at the Department of Energy, and Mr. Daniel X. Sze, National Program Manager, Rebuild America at the Department of Energy, and Mr. Ronald Shelton, Rebuild America Financial Services Manager at Oak Ridge National Laboratory, offered a great deal of encouragement and support throughout this project.

NAESCO also thanks Mr. Donald Gilligan for his work on this publication and his knowledgable integration of industry trends and practices throughout. Ms. Nina Lockhart of NAESCO provided invaluable assistance in gathering information. Ms. Mary Johnson of NAESCO lent her expertise to the overall project, as well as on the final production of this document.

Each of the companies whose projects are included in these case studies contributed a considerable amount of their principals' and employees' time in completing questionnaires, providing preliminary drafts, and being interviewed. While a list of the individuals involved would be too extensive to include here, NAESCO wishes to express its gratitude to each company whose case study appears in this booklet for their willingness to participate in this project.

No statement of fact or opinion in the introduction or in the introductory text accompanying each study necessarily represents the position of the U.S. Department of Energy, Oak Ridge National Laboratory, NAESCO, or any NAESCO member.

Terry E. Singer
Executive Director, NAESCO
September 2001

Foreword

This publication is part of an ongoing project to present case studies of energy efficiency retrofits in facilities in various sectors of the economy. The project is a collaborative effort of the National Association of Energy Service Companies (NAESCO) and the United States Department of Energy Rebuild America Program. By providing an overview of energy efficiency retrofits already in place at municipal facilities throughout the country, the case studies contained in this publication demonstrate the capital upgrades and cost savings available to municipal facilities through performance-based energy efficiency contracting with an Energy Services Company (ESCO). The Introduction contains information on three critical problems facing local governments in managing their building stock. The case studies that follow provide a walk-through of a number of energy efficiency retrofits already in place at municipal facilities, demonstrating that municipalities can fund facility upgrades through performance-based energy efficiency retrofits.

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Introduction

Managers of local government buildings across the country often face three critial problems as they attempt to operate their buildings efficiently and economically.

Local government buildings are old.

Energy costs currently represent 5 to 7 percent of local government annual expenditures.[1] According to U.S. Census figures, almost 80 percent of local government facilities, or almost 295,000 buildings, were built before 1980, when modern standards for energy efficient construction became widespread. These older buildings were built with energy-using equipment – lighting, heating, air conditioning, ventilation, and control systems – that were adequate for their day, but are now obsolete.

While some of these building systems have been replaced or retrofitted (U.S. Census figures report, for example, that about 40 percent of local government building lighting systems now have some energy efficient ballasts), few buildings are up to modern standards. Older systems not only cost more to operate and maintain, but they often provide inferior levels of comfort and do not meet currently accepted standards. For example, drafty, poorly lit, and poorly ventilated workspaces might seem like a minor inconvenience, but these conditions have been shown to lower worker productivity.

Local governments have other priorities for public expenditures.

Even though their buildings need energy efficiency improvements, local government officials have other seemingly more pressing needs for public expenditures. Illustrating these needs is a recent initiative by the National League of Cities (NLC), called the Investing in Communities Agenda. More than 20 national organizations agreed to collaborate with NLC to gain support for investing in communities.

The Investing in Communities mission statement outlines seven key values that form the basis for a long-term investment plan and six priorities for federal action. Among

1 Sze, Daniel, Rebuild America: Partnerships for the Future, *Energy User News*, May, 2001, p. 32.

the six priorities is "providing financing and investment incentives to build and maintain infrastructure;" however, the specified infrastructure is roads, transit systems, water, and sewer systems. Investing in upgrading buildings – particularly the energy efficiency of government buildings – is not a priority.

Rising energy costs and shrinking tax revenues are undermining incremental energy efficiency improvements.

Even though they lacked a mandate and the capital for sweeping improvements, during the 1990s, many local government facility managers were able to make incremental improvements in their buildings' energy efficiency. Energy prices, both for fuel and electricity, were at or near historic lows, so there was relatively little pressure on annual energy budgets. Local government tax revenues were increasing during the economic boom, so there was occasionally a little bit of extra money that could be used for a small retrofit program. Local utilities often had rebate or other incentive programs that stretched local tax dollars to cover a few more improvements.

Unfortunately, the year 2001 has brought sharply rising energy prices and an economic slowdown, which has diminished available local government tax revenues. Facility managers are struggling to keep pace with their energy budgets and have little time – and almost no resources – to undertake even incremental energy efficiency improvements.

Performance contracts delivered by ESCOs can help local governments.

By entering into contracts for *performance-based energy efficiency retrofits* delivered by Energy Service Companies (ESCO), local governments can reduce their energy consumption and associated costs by an average of 25 percent or more, without spending a dollar from their operating budgets. The ESCO designs, finances, installs, and maintains energy conservation measures and high-efficiency equipment in local government facilities. In addition, the ESCO measures, verifies, and reports energy and energy cost savings. It is common for the use of energy efficiency measures and equipment to actually increase comfort and productivity levels in retrofitted buildings. This results primarily from the fact that high-efficiency lighting provides higher quality light, and new HVAC systems improve indoor air quality and temperature control.

In many cases, the financing of a *comprehensive, performance-based* retrofit is structured so other capital repairs and improvements needed at a government facility can be folded into the project and paid for out of energy savings. In addition, these projects typically are designed so all project costs, including the ESCO's profit, are paid for by the energy cost savings realized – with an average payback period of seven to 10 years.

ESCOs focus on reducing energy demand and cost, and upgrading deteriorating facilities.

Because ESCOs have experience delivering their services to a wide range of government and private sector customers, they are able to adapt the scheduling of their work to the unique operations of each customer. When working with local governments, ESCOs adjust their schedules to the various uses, daytime and nighttime, of the full range of government facilities. Some buildings are primarily offices, where work done at night means minimal disruption for office staff and maximum productivity for construction crews. Other buildings, such as police stations, fire stations, and jails, are always in use and construction work must be carefully scheduled to cause minimal intrusion into these critical public safety functions. Public hospitals demand even more flexibility, because they combine both office and continuous services spaces.

ESCOs schedule their construction work around the requirements of each type of government facility – office, police station, or hospital – to ensure that the delivery of energy savings does not inconvenience the delivery of critical public services.

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ESCOs deliver the full range of energy efficiency technologies.

The single most common energy efficiency retrofit is the replacement of outdated fluorescent lighting and, where possible, incandescent lights. Today, older T-12 lamps can be replaced with smaller, more efficient state-of-the-art T-8 lamps. Not only are these newer lamps smaller, but their light output is greater, so in a typical application, fewer T-8 lamps are required. An aluminum reflector is used to focus the light where it is needed, thus further increasing efficiency and reducing the need for bulbs. The newer lamps also are equipped with electronic ballasts, operated by a computer chip that generates very little heat, as opposed to the older technology that employs magnetic ballasts containing a heat-generating capacitor. Thus, more efficient lighting not only reduces energy use, it also reduces light-related heat, thus reducing the building cooling load.

In addition to its energy efficiency, new lighting provides a broader spectrum of light (referred to as a higher color rendering index or CRI) and thus higher quality of lighting. The placement of fixtures can also be changed to better service the need for flexible office spaces. For example, few local government facilities were originally built

Lighting retrofits can produce significant energy savings, while delivering a higher quality of light designed to boost worker productivity.

to accommodate computers on the desks of most employees, and the original lighting systems cause a glare on computer screens. Lighting retrofits can significantly reduce this glare, save money, and improve productivity simultaneously.

HVAC equipment also can be retrofitted or replaced with more efficient and economical equipment. While the replacements of boilers or chillers most often do not have the fast paybacks usually associated with lighting retrofits, they can be highly cost effective. When an ESCO is developing a project, it will pull together all of the costs of operating and maintaining older systems, typically from several different areas of a budget – operating costs (energy), maintenance costs, and capital costs. Facility managers are often surprised when they see the total costs of some of their older HVAC systems. And not only are many modern systems more efficient in a one-for-one swap-out situation, modern system design often permits the installation of smaller modular boilers or chillers – rather than a single unit – thus enabling the system to operate more efficiently under partial load conditions.

Facility managers are often surprised when they see the total costs of some of their older HVAC systems.

In addition to delivering increased efficiency, modern chillers equipped with more environmentally friendly and energy efficient hydrochlorofluorocarbons (HCFC) are more environmentally friendly than the ozone-damaging and less efficient chlorofluorocarbons (CFC).

Government building complexes or single large facilities can often benefit from the installation of either distributed generation or combined heat and power (CHP) systems. In some regions of the country where electricity prices are high, on-site generation systems, particularly new microturbines and fuel cells, can be cost effective. The systems can be even more economical in settings where the waste heat from generators can be used for heating and/or cooling. Many facility managers are familiar with CHP under its old name of cogeneration, in which waste heat is captured to heat buildings or domestic hot water. Another current application that is extremely useful on government campuses is the CHP process available with absorption chillers, which use waste heat to create chilled water through evaporation.

Older government buildings often require increased ventilation to meet modern standards for indoor air quality. Lacking modern systems, facility managers have no

choice but to let the ventilation systems run for long hours, sometimes round-the-clock. Modern ventilation systems, especially when coupled with computerized, variable air volume and digital control systems, can provide the required ventilation levels without breaking the facility's operating budget.

Computerized digital control, building automation, or energy management systems (EMS) can also be very useful to facility managers in preparing for competitive deregulated electricity markets. EMS systems, equipped with appropriate utility submetering and analysis systems, can enable facility managers to thoroughly understand their building energy use profiles. Understanding these profiles, in turn, enables managers to shop for electricity supply and choose the best type of supply offer (fixed price, time-of-use or real time price) for their facilities. Recent studies show that facilities that shop aggressively and understand their energy use profiles – most often through the use of computerized systems – can cut their electricity bills by 10 to 20 percent.

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Each of these technologies is available to local governments today, and can be applied in a comprehensive manner to upgrade capital equipment while reducing the cost of facility operations. The case studies presented in this booklet are representative of the work available through ESCOs. For more information, contact NAESCO at 202/822-0950.

Case Studies

Project Highlights

Project	**Ten Eyck Office Building**
Customer	New York State Department of General Services
Customer Contact	John Kelly Ten Eyck Building Manager 40 North Pearl Street Albany, NY 12207 518/474-4468
ESCO	**Sempra Energy Solutions** 101 Ash Street, ML HQ09 San Diego, CA 92101 619/696-4676 619/696-3101 Fax http://www.sempra.com
ESCO Contact	Bob Kennedy Regional Vice President Project Delivery 518/783-8300
Technical Overview	Under the joint sponsorship of Sempra Energy Solutions and the Niagara Mohawk Power Partners Program (PPP), five Energy Conservation Measures (ECM) were installed at the Ten Eyck Office Building.
Annual Energy Savings	About 4.5 million kWh in contract year 6 (ending 2/28/00)
Annual Cost Savings	About $359,000 in contract year 6 (ending 2/28/00)
Facility Description	The Ten Eyck Office Building is a 16-story, 344,000 square foot facility that houses various New York State agencies, including Child and Family Services, Office of Temporary Disability Assistance and the Office of Technology.
Technologies	The five ECMs included new chillers, a "free" cooling system, energy efficient lighting systems, energy efficient motors, and cooling towers.
Contract Term	15 years
Project Cost	$1,948,948
Installation Period	October 1993 through June 1994
Financing	Tax-Exempt Certificates of Participation (COP) issued by the State of New York
Project Type	Energy Performance Contract
Utility Incentives	$892,738
Measurement and Verification Methodology	Engineering calculations, based on measured data, energy management system outputs, and energy bills.

Case Study #1	TEN EYCK OFFICE BUILDING Albany, New York

Sempra Energy Solutions

The Ten Eyck Office Building in Albany, New York was a 20-year-old facility badly in need of a new HVAC system. An energy performance contract, delivered by Sempra Energy Solutions, provided the new HVAC system and other needed building improvements. The cost of the improvements was paid entirely from energy savings, with some additional cash flow to the building owner each year.

Project Information

The New York State Office of General Services (OGS) wanted to upgrade the mechanical systems, lighting systems, and building envelope of the Ten Eyck Office Building, without spending taxpayer dollars. It also wanted to take advantage of demand side management (DSM) incentives offered by the electric utility that served the building (Niagara Mohawk's Power Partners Program or PPP) to encourage building owners to upgrade to energy efficient building systems. The selected ESCO was Sempra Energy Solutions, which developed the project for OGS.

The project is repaying more than its full cost from energy savings (OGS has a positive cash flow) and taking full advantage of utility subsidies. Sempra designed the project around the replacement of six 20-year-old air-cooled chillers and related equipment with modern cooling and ventilation components, including:

New Computer Chillers

Sempra installed two new 300-ton water-cooled centrifugal chillers to replace six 100-ton air-cooled chillers. Also, two new cooling towers were installed in conjunction with the new chillers and are used in free cooling mode (described below). The new chillers were designed to operate at an efficiency below .65 kW per ton, which was about half the rate of the chillers that were replaced. The new cooling tower fans and the new condenser pumps are producing significant savings compared to the previous air-cooled reciprocating chillers.

Free Cooling for Computers

Previously, mechanical refrigeration was utilized year round to provide cooling for computer equipment. Sempra installed a "free" cooling system that produces chilled water for computer cooling when the outdoor temperature is below 45 degrees Fahrenheit. The "free" cooling system uses one or both of the new cooling towers and a flat plate heat exchanger, and eliminates the need for mechanical cooling during many of the facility's operating hours.

Lighting

Approximately 4,594 fixtures in the building were modified. The primary lighting retrofit consisted of the conversion of existing 34-watt tubes and 2-lamp magnetic ballasts to 4-lamp electronic ballasts driving two tandem-wired fixtures each containing two new T-8 tubes. Single lamp fixtures were similarly converted with tandem wiring where possible. In addition, the existing unused but still energized single-lamp ballast was disconnected to provide additional savings. Also, approximately 140 incandescent fixtures were replaced with either a screw-in fluorescent lamp or a high-efficiency halogen lamp.

Evaporative Towers

To provide heat rejection of the condenser water loop serving the heat pumps and DX cooling equipment, the building was originally equipped with a 14-cell rooftop "dry cooler." With no evaporative cooling effect, these units operated inefficiently, resulting in a high consumption of fan power and greatly elevated condensing temperature for the cooling equipment. Sempra replaced the dry cooler with two closed-loop evaporative type towers. While the previous dry cooler was unable to maintain condenser water temperatures below 100 to 110 degrees during the peak summer cooling season, the two new evaporative towers are providing a maximum of 92 degree condenser water at all times.

High-Efficiency Motors

Approximately 56 motors were replaced with new high-efficiency motors, which reduce peak demand and provide significant kWh savings.

Other Improvements

Sempra also provided a number of other retrofits outside the scope of the Niagara Mohawk PPP, including the expansion of the existing microprocessor-based energy management system, and gasketing of all exterior windows and doors to minimize air infiltration.

Ongoing Relationship with the Building

In addition to installing these major improvements, Sempra provided a number of minor improvements (such as a new entry vestibule) and system adjustments (such as balancing the air distribution system), which contributed to the energy savings and enhanced the comfort of building tenants. Sempra technicians and engineers visit the Ten Eyck building several times each year to make sure the installed equipment is working properly and determine if any changes in building operations warrant adjustments in the equipment.

Because the New York OGS must occasionally alter, renovate, or modernize tenant spaces to meet changing requirements, Sempra regularly analyzes all the changes that affect energy usage and documents those changes where necessary. When the alterations maintain or enhance the original savings, Sempra provides a corroborating analysis. When the alterations eliminate an original energy-saving device or operational procedure, Sempra documents replacement energy savings from other equipment or operational strategy implemented after the original project construction.

Savings Verification

Under the terms of the Niagara Mohawk PPP and to satisfy the New York State OGS that the projected savings are real, Sempra provides an Annual Savings Report to the utility and the state. The Annual Savings Report is a formal document based on a measurement and verification protocol agreed to by all parties before the project was built.

As determined in the project Measurement Acceptance Form, annual kWh savings for Ten Eyck are determined with a utility bill comparison of the current electrical consumption to a pre-construction baseline year (March 1991 through February 1992) after adjustments for weather.

The adjusted baseline year is the sum of the non-weather-related electricity consumption and the adjusted weather-related electricity consumption. First, Sempra uses a regression analysis to separate out the baseline year's weather-related electricity consumption from its base electricity (non-weather related) electricity consumption. Then, weather adjustment factors are used to adjust the baseline year's electricity consumption to reflect the report year's weather.

The Annual Savings Report is then prepared by comparing the report year's electricity consumption from the adjusted baseline year's electricity consumption.

Customer Comment

"We now have a 16-story office building with an energy efficient, state-of-the-art mechanical system that saves energy, pays for its associated costs and offers a long-term positive cash flow."

James Wilson, R.A.
Director of the New York Office of Special Services during the project (now retired)
Ten Eyck Office Building

Project Highlights

Project	**Ann Arbor City Hall (Michigan)**
Customer	City of Ann Arbor
Customer Contact	David Konkle, Energy Coordinator
ESCO	**CMS Viron Energy Services** 216 NW Platte Valley Drive Riverside, MO 64150 800/475-3500 816/741-3500 816/741-6476 Fax http://www.viron.com
ESCO Contact	Sales: Ken Hedrick 248/952-0162 Technical: Laura Thompson 816/741-3500
Annual Energy Savings	785,993 kWh 30,457 CCF
Annual Cost Savings	$52,503
Technologies	Lighting and lighting controls Energy management system Conversion of HVAC system from dual duct to constant volume VAV
Facility Size	Seven floors, about 73,798 square feet
Contract Term	10 years
Project Cost	$345,000
Installation Period	Spring 1996 through September 1996
Financing	Third Party Finance Company
Project Type	Performance Contract/Guaranteed Savings
Utility Incentives	$12,000
Measurement and Verification Methodology	Option C Utility Bill Analysis of International Performance Measurement and Verification Protocols (IPMVP)

Case Study #2	ANN ARBOR CITY HALL Ann Arbor, Michigan

CMS Viron Energy Services

As is the case with many municipal facilities, critical building systems in Ann Arbor City Hall had not been updated since the building was built. An energy performance contracting project enabled Ann Arbor to significantly improve occupant comfort while reducing energy expenditures, and the building upgrades were entirely paid for with energy savings.

Project Information

City Halls across the country host countless meetings to consider budgetary concerns. At one of these meetings in Ann Arbor, Michigan, City Hall leadership decided to take a unique and creative approach to a much-needed, critical facility upgrade. The city's resulting performance contract has permitted the completion of an extensive $345,000 upgrade paid for with $525,000 in guaranteed energy savings.

Facility Needed Renovations

"This facility was depending on technology from the early 1960s," explained David Konkle, Energy Coordinator for Ann Arbor. "The systems were inefficient, and it was difficult to get replacement parts."

At Ann Arbor's request, CMS Viron Energy Services performed a feasibility study, which showed that the city could fund a major upgrade through a performance contract. A subsequent comprehensive energy study from CMS Viron detailed and recommended specific energy conservation measures. The resulting contract guaranteed that Ann Arbor would save at least $52,503 each year for 10 years. This yearly savings would allow Ann Arbor to make payments on a loan and finance an extensive upgrade to implement the energy conservation measures.

Lighting Project Improved Working Conditions

In spring 1996, CMS Viron began the upgrade of the seven-story City Hall building. The project, which CMS Viron completed with the help of Ann Arbor's maintenance staff and local subcontractors, features an extensive lighting modernization. New T-8 lamps, electronic ballasts, and specular reflectors replaced T-12 fluorescent lights and magnetic ballasts. The new system provides better color rendition, no 60-hertz light vibration, and 10 to 30 percent more light with half the energy used and fewer maintenance costs, according to Konkle.

Additionally, the lighting modification eliminated an antiquated switching system. Previously, lights could only be turned on and off in the building through switching circuit breakers in electrical closets on each floor. Lights were usually left on well into the evening until a cleaning crew finally turned them off. Employees working at night needed to first obtain a key to the electrical closet and then throw the appropriate breaker to turn on lights.

With the upgrade, City Hall now has switches throughout the building, which are linked to the energy management system to automatically control lighting. Additionally, motion sensors were installed at each elevator entrance to activate an after-hours light system. The after-hours system, which is also controlled by the new switches, turns on lights in an area for one hour and flashes a warning five minutes before deactivating lights.

CMS Viron also added motion sensors in restrooms and public conference rooms for day and night activity. When these sensors detect motion, the new system keeps the area lighted until motion is no longer detected. In this way, lights are only used as needed, which further reduces energy consumption. The modification has also decreased the building's chiller load for lower air conditioning costs in summer.

Recycling an Important Consideration

The old lights and ballasts were properly disposed of by sending them to a recycling center. The bulbs contained mercury, and many of the ballasts held PCBs.

New Controls Improve Occupant Comfort

While the lighting modifications please City Hall office employees, maintenance staff likes the new energy management control system. The system links mechanicals in the facility and controls the chiller, boiler, pumps, fans, and lights. Forty temperature sensors relay information back to the main controls. The result is a more comfortable building, lower costs and fewer complaints from office workers.

The upgrade also involved converting dual-duct, constant air volume mixing boxes to variable air volume. In making this conversion, CMS Viron replaced old pneumatic actuators with new electric, "infinite control" actuators in more than 43 constant air volume mixing boxes. Each variable air volume box can be programmed from the energy management system.

Customer Comment

"Overall, the performance contract has worked out well. We're averaging $5,000 in savings each month. And, people in the office enjoy the upgrades. They know that the city is energy conscious, and they've become more aware themselves – which is just what an energy coordinator likes to see."

David Konkle
Energy Coordinator
City of Ann Arbor

Project Highlights

Project	**Allegheny County Buildings**
Customer	Allegheny County, Pennsylvania
Customer Contact	Tom Kelley Allegheny County Senior Administrator
ESCO	**NORESCO, L.L.C.** One Research Drive Westborough, MA 01581 888-NORESCO 508/614-1000 508/870-9707 Fax http://www.noresco.com/
ESCO Contact	David Rowland Senior Vice President 215/887-7100 Beth Greenblatt Director of Marketing 508/614-1068
Technical Overview	Under a master Energy Savings Performance Contract (ESPC), NORESCO is providing comprehensive services for more than 100 of Allegheny County's facilities in four phases. NORESCO has guaranteed a total savings of more than $13.7 million over 10 years for the pilot project and the first two phases of the program, and is currently working with the County's energy task force to study and implement additional savings opportunities in Phase III.
Annual Energy Savings	Pilot Project: 2.1 million kWh plus 5,600 MCF of gas Phase I: 6.7 million kWh plus 8,990 MCF of gas Phase II: 11.8 million kWh plus 14,607 MCF of gas Phases I and II also save a combined 90 million gallons of water
Annual Cost Savings	Pilot Project: $150,000 Phase I: $740,828 Phase II: $487,308 Phase III: under development
Facility Description	County government, 100+ buildings, more than 4.3 million square feet
Technologies	Lighting, chiller replacement, cooling tower replacement, window replacement, energy management systems, steam systems repairs, sprinkler piping, kitchen equipment, laundry equipment, toilets, flow restrictors, showerheads
Contract Term	10-year ESPC
Project Cost	Pilot Project: $980,000 Phase I: $4.6 million Phase II: $3.3 Million Phase III: under development
Installation Period	Summer 1998 – ongoing
Financing	NORESCO arranged financing and, in compliance with Pennsylvania's Guaranteed Energy Savings Act 57, Title 62 (formerly known as Act 29), guaranteed that total energy savings in each of the 10 program years would exceed the cost of capital equipment and labor.
Project Type	Guaranteed ESPC
Utility Incentives	N/A
Measurement and Verification Methodology	Verification of the energy savings is accomplished with individual protocols developed specifically for each improvement. Using calculation methodology detailed in the project energy audit report, NORESCO established the critical values that must be trended to verify that savings are being achieved. Typical verification methods employed include end-use metering, computer monitoring, data loggers, and engineering calculations.

Case Study #3	ALLEGHENY COUNTY BUILDINGS Allegheny County, Pennsylvania

NORESCO, L.L.C.

Allegheny County in Pennsylvania was looking for a way to reduce operating costs and take advantage of new, energy efficient technologies. Under a performance contract with NORESCO, the county was able to upgrade its equipment and pay for it entirely out of the energy cost savings.

Project Information

Allegheny County expects to save nearly $13.7 million in operating costs over the next 10 years. The new energy saving equipment and retrofits required to realize these savings will not cost county taxpayers a penny, because NORESCO arranged to finance them entirely from energy cost savings. Energy to be saved from the pilot project through Phase II of the project will exceed 20 million kWh of electricity, 29,000 MCF of gas, and 90 million gallons of water per year. The projects will be implemented at a range of municipal facilities, including a juvenile detention center, skating rink, courthouse, office building, and jail.

Pilot Project

The pilot project, which is saving about 2.1 million kWh of electricity and 5,600 MCF of natural gas each year, included a number of technologies at the Shuman Juvenile Detention Center. NORESCO undertook various upgrade projects, such as installing an EMS; retrofitting the lighting system; replacing aging CFC-based chillers with less environmentally harmful, more efficient chillers; refurbishing the cooling tower; installing a new refrigerator condenser and gas kitchen equipment; and installing energy efficient lighting and windows at adjacent health department offices.

Phase I

Phase I is designed to conserve about 40 million gallons of water, 6.7 million kWh of electricity and 8,990 MCF of gas each year. It encompassed a range of technologies at a number of facilities, including lighting, plumbing, and cooling towers. Almost 20,000 lighting fixtures at the county's five downtown Pittsburgh facilities were retrofitted. New energy management systems and controls were installed at the county's four Kane Regional Medical Centers and the North Park Ice Skating Rink. Programmable thermostats were installed at other North Park facilities. North Park's water distribution system was also repaired. The Kane Centers and Shuman Juvenile Detention Center also replaced inefficient equipment. For example, more than 600 water-saving toilets, 1,100 faucet restrictors, 31 low-flow showerheads, and front-load washers were installed. The county courthouse got a brand new cooling tower. Finally, a cogeneration study was performed for the downtown facilities and airport industrial park complex.

Phase II

Phase II is expected to save more than 11.8 million kWh of electricity, 14,607 MCF of natural gas and 50 million gallons of water each year. Phase II also encompasses a range of technologies at numerous facilities, including replacing or retrofitting more than 12,000 inefficient lighting fixtures at the new Allegheny County jail and 48 park and recreation facilities; installing a new energy management system with direct digital controls (DDC), retrofitting more than 1,800 windows with 1/2-inch Lexan, installing a water meter for the cooling tower, repairing the condensate piping system, converting the kitchen air handling unit to a variable air volume system at the jail, and adding a chemical feed unit to the steam system to ensure preservation of the pipes at the jail; installing a new air handling unit for the print shop and battery back-up and emergency lighting for a laboratory at the county office building; installing new DDC energy management systems at the county courthouse and county office building; adding new sprinkler piping in an air supply tunnel within the county courthouse; and repairing a steam valve, cleaning ducts in the tunnel, and rehabilitating the air supply system at the county courthouse.

Customer Comments

"There's a lot of interesting technology out there, and we're taking advantage of it through a guaranteed savings arrangement that involves no risk to taxpayers. We had an independent third-party engineering consultant review the contract and validate the projected energy savings. And NORESCO bears the financial risk if, by some chance, the entire cost of capital equipment is not covered by the energy cost savings."

Tom Kelley
Senior Administrator
Allegheny County

Project Highlights

Project	**Mercer County Green Lights Program**
Customer	County of Mercer, New Jersey
Customer Contact	Jim Naples 609/989-6505
ESCO	**TRC eNERGYSolve** (successor to SYCOM Enterprises) 27 Worlds Fair Drive Somerset, NJ 08873 732/748-9600 508/870-9707 Fax
ESCO Contact	Brandon Sutcliffe 732/748-9600
Technical Overview	Comprehensive retrofit of a complete inventory of county facilities under a guaranteed savings performance contract.
Annual Energy Savings	21,509,529 kWh
Annual Cost Savings	$1,540,391
Facility Description	72 facilities (43 state facilities, 29 county) including: health care, public schools, correction facilities, court buildings, city halls, libraries, water treatment plants, police departments, special services schools, a community college, various government buildings and complexes, the police headquarters, a radio station, court facilities, and laboratories.
Facility Size	Approximately 3,114,008 square feet
Contract Term	Lighting projects: 10 years Mechanical projects: 15 years
Project Cost	$14,905,834 (after publicly bid labor and material)
Installation Period	June 1996 through October 1996
Financing	Pooled financing gross lease under state/county agreement, which enabled the smaller participating agencies to reap the benefits of the lower tax-exempt financing, which would not have been available for individual smaller projects.
Project Type	Performance Contract/Guaranteed Savings
Utility Incentives	$20,484,812 from Public Service Electric & Gas Company (PSE&G), based on $/kWh payment for measured and verified savings over 10 to 15 years.
Measurement and Verification Methodology	International Performance Measurement and Verification Protocols (IPMVP)

Case Study #4	MERCER COUNTY GREEN LIGHTS PROGRAM Mercer County, New Jersey

TRC eNERGYSolve

Mercer County, New Jersey wanted to retrofit its full portfolio of facilities to save energy and lower environmental emissions. A comprehensive energy performance contract project developed and implemented by TRC eNERGYSolve (successor company to SYCOM Enterprises) provided the retrofits. TRC also pioneered a program that enabled the county to actually capture the cash value of the Emission Reduction Credits produced by the project.

Project Information

SYCOM Enterprises (now part of TRC eNERGYSolve) was selected as the exclusive ESCO for the County of Mercer based on the extraordinary unspecifiable services (EUS) provision of the New Jersey State public bidding laws. An Attorney General's opinion qualified TRC eNERGYSolve under the EUS provision of state public bidding laws.

Contract and Project Marketing

In October of 1993, the County of Mercer entered into a contract with TRC eNERGYSolve to provide energy services for their facilities. TRC eNERGYSolve proceeded to audit all county facilities and prepare proposals. The county then extended its Green Lights Energy Conservation Program to cities, townships, educational institutions, and water/wastewater facilities and state facilities within the county. TRC eNERGYSolve marketed the program to these entities, conducted audits, and prepared financial proposals for all those interested.

Project Financing

As the project developed, local and state government agencies decided on project financing mechanisms. Tax-exempt lease financing was used for the sets of projects. Bonds were issued for both projects under the County in order to pay for the installation of energy conservation measures (ECM).

Pooled Financing Through a County Authority

TRC eNERGYSolve and the county then began working with the Mercer County Improvement Authority (MCIA) to arrange for a pooled financing of all the identified projects. MCIA entered into lease agreements with the following nine participants: Mercer County Detention Center, Mercer County Geriatrics Center, Mercer County Community College, Mercer County Special Services School, Trenton Public Schools, Ewing Public Schools, the City of Trenton, the City of Trenton Water Department and Hamilton Township. MCIA issued $7,290,000 worth of County-Guaranteed Green Lights Lease Revenue Bonds to pay for the installation of the ECMs.

No Shared Savings

For the MCIA projects, each participant in the pooled financing is responsible for lease payments for the 10- or 15-year contract term. The lease payments are made 100 percent from the utility incentives and energy savings.

Utility Incentives

TRC eNERGYSolve also qualified each project under a PSE&G incentive program that pays a standard $/kWh rate for measured and verifiable savings. The utility incentives are expected to total about $20,484,812 over the life of the projects.

State Financing Through a State Authority

The state decided to find alternate financing outside of the MCIA program for their facilities through the New Jersey Economic Development Administration (EDA). The state entered into a three-way contract with EDA and the county. TRC eNERGYSolve provided the same services under its contract with the county as described above for the following state facilities: the Ashby Building, Document Controls Center, Department of Environmental Protection, Health and Agriculture, Labor and Industry, Millhill Building, State Police Headquarters, Roebling Building, Taxation Building, and the Justice Hughes Complex.

TRC eNERGYSolve Managed the Project

Once the financing was in place, TRC eNERGYSolve prepared the bid specification for the labor and material for each project and put the specifications out for public bid on behalf of the county. The goals of this procedure were to promote economic growth within the community, while saving taxpayer dollars through reduced energy costs for the public facilities. TRC eNERGYSolve oversaw the selected contractors through the installation of each project to make sure the projects were installed on time and in accordance with the utility incentive program guidelines.

Environmental Benefit

TRC eNERGYSolve was also able to bank Emission Reduction Credits (ERC) based on the savings in pollution resulting from measurement of the energy efficiency projects under this program. These ERCs will prove to be an important developmental tool in attracting new business or retaining current business within the county.

TRC eNERGYSolve used the Mercer County Green Lights project to pioneer a new type of environmental benefit – ERCs – that is one of the products of an energy efficiency project. This aspect of the project involved about 18 months of work by TRC eNERGYSolve, as well as the cooperative effort of New Jersey State regulators, environmental groups, EPA, regional air quality NGOS, United Jersey Bank (UJB), and PSE&G.

Pilot Project

TRC eNERGYSolve initiated the pilot project by completing a lighting retrofit of the UJB facilities and installing end-use metering equipment as required in the utility contract. By March 1993, the project was producing measured and verified savings.

Utility Calculated NO_x Reductions

Meanwhile, PSE&G developed a protocol for calculating the NOx emission rate from the Pennsylvania/Jersey/Maryland Power Pool (PJM). Total NO_x reduced is calculated by multiplying the kWh savings by the PJM emission rate for the appropriate time period. The project created a reduction of 2.74 tons of NO_x.

State Accepted Application

TRC eNERGYSolve applied to the New Jersey Department of Environmental Protection (NJDEP) to bank the emission reductions. Eleven months later, the application was accepted. UJB, TRC eNERGYSolve, and PSE&G all agreed to donate the credits to Mercer County for development purposes. The credits will be available for use by businesses in the county when NJDEP completes a rule to regulate credit trading and use.

County Reaped the Benefits

On January 10, 1995, then Mercer County Executive Bob Prunetti held a press conference at the headquarters of UJB in Princeton to announce the formation of an Emission Reduction Bank – the first of its kind in the nation. The bank holds ERCs to spur development in the county while allowing the region to attain air quality goals.

Project Yielded Substantial Savings

As a result of its energy efficiency partnership with TRC eNERGYSolve, Mercer County has reduced energy costs in many of its own facilities and has banked ERCs for future use. Mercer County is saving about $1.5 million annually and has reduced its energy use by about 21,500,000 kWh each year. In addition, it has reduced its peak energy consumption by about 5.5 megawatts. TRC eNERGYSolve has been the County of Mercer's energy efficiency representative for the past five years and has assisted the County in procuring more than 2 megawatts of energy savings, which equate to approximately $20 million in direct taxpayer savings, according to the company.

Customer Comments

"TRC eNERGYSolve [doing business as SYCOM Enterprises] was initially retained in 1993 to install energy efficiency measures in two county facilities. The success of this installation led to the development of a program with a much wider scope: municipalities, school districts, state facilities, water authorities, and additional county buildings. The success of the second phase of our program is directly attributable to the technical and management expertise demonstrated by [TRC eNERGYSolve] on a daily basis. As a result of [TRC eNERGYSolve's] efforts, Mercer County was awarded numerous commendations including the prestigious 1997 *Energy User News* Award for energy efficiency and the EPA's 1999 Green Lights Government Partner of the Year Award."

James T. Naples
Assistant Director
Mercer County Budget Office

Project Highlights

Project	**Fort Bend County, Texas** **County-Wide Energy Services Project**
Customer	Fort Bend County, Texas Richmond, Texas
Customer Contact	Gilbert D. Jalomo, Jr. Fort Bend County Purchasing Agent
ESCO	TAC Americas, Energy Solutions 1650 West Crosby Road Carrolton, TX 75006 972/323-4893 972/323-5498 Fax http://www.csi-controls.com
ESCO Contact	Debra Martinez or Drema Crist
Technical Overview	Comprehensive retrofit of a county's facilities
Annual Energy Savings	4,963,501 kWh 9,417 kW
Annual Cost Savings	$176,602 (guaranteed)
Facility Description	Eleven county facilities, including courthouse and offices

Facility Name	**Facility Type**	**Building Area**
County Clerk's Office	Office	8,610
Travis Building	Office	108,321
County Courthouse	Public Order	30,345
Jane Long Annex	Public Order	31,590
Precinct 4 Building	Public Order	13,580
Juvenile Detention Bldg.	Public Order	38,130
George Memorial Library	Education	85,785
First Colony Branch Library	Education	19,379
Missouri City Branch Library	Education	18,066
Needville Branch Library	Education	5,976
Stafford Branch Library	Education	4,880
Fairgrounds Office	Office	4,120
		Total 368,782

Technologies	Lighting Chiller replacement Energy management system
Contract Term	10 years
Project Cost	$1,479,383
Installation Period	October 1997 through August 1998
Financing	Cash from county general fund balance
Project Type	Performance Contract/Guaranteed Savings
Utility Incentives	N/A
Environmental Benefits	The electricity saved by Fort Bend County's retrofits prevents over 3,700 tons of carbon dioxide (CO_2), nearly 28,800 Kg of sulfur dioxide (SO_2), and 12,400 Kg of nitrous oxides (NO_x) from being released into the atmosphere. That is the environmental equivalent of taking 254 cars off American highways or planting nearly 350 acres of trees.

Case Study #5	County-Wide Energy Services Project Fort Bend County, Texas

TAC Americas, Energy Solutions

Fort Bend County, Texas had a set of aging county facilities that were using more energy than necessary and were uncomfortable and inefficient in which to work. TAC Americas, Energy Solutions developed and delivered a comprehensive energy performance contract project that renovated the energy systems in the county facilities, with the entire project cost paid from energy savings.

Project Information

Fort Bend County is saving taxpayer money by cutting energy bills. TAC Americas, Energy Solutions helped the county improve building comfort and save more than $176,000 in annual utility costs with a comprehensive energy management project.

TAC replaced aging mechanical equipment and inefficient lighting in 11 county buildings, including the county courthouse. TAC worked with Fort Bend to maintain the historical integrity of landmark buildings and to ensure that daily county operations were not interrupted. The county's electric service is more reliable thanks to TAC's power factor correction, and the centralized EMS and direct digital controls included in the project make it easier for facility staff to maintain comfortable facilities and low utility costs.

The TAC Americas, Energy Solutions project at Fort Bend County included the replacement of two 170-ton chillers and an aging cooling tower. TAC installed direct digital controls and an I/Net energy management system to allow remote monitoring and facility management. The project also included a comprehensive lighting retrofit and the replacement of condenser coils in the HVAC system.

Fort Bend was so pleased with the project that they granted TAC Americas, Energy Solutions a second project in 2000. TAC is currently in the monitoring phases of the Fort Bend County Jail system.

Savings Verification

TAC adheres to Section 4.3 of the International Performance Measurement and Verification Protocol (IPMVP) for energy monitoring, labeled "Option C: Whole-Facility or Main Meter Measurement Approach." The company believes this approach eliminates uncertainty in energy savings, because it looks at energy use before versus energy use after a project. Metrix™ Utility Accounting System is used to track data and generate savings reports, and weather information is provided by the closest North American Hourly/Special Surface Observation Site to the project location.

TAC accounts for both energy and dollar savings as part of its performance contract. The energy savings realized by Fort Bend County during a given month are calculated by subtracting the current month's amount of energy consumption from the corresponding baseline month's energy consumption.

The dollar savings are calculated by first applying the current utility rate to the current month's energy usage. The same rate is then applied to the base month's energy. Finally, savings figures are obtained by subtracting current dollars from base dollars. It is extremely important to note that calculations are based on real rates paid to the electric and gas companies. If a customer is charged a different electrical service rate in different facilities, TAC's savings calculations take this into account to avoid inflated savings reports. Savings calculations are performed separately for natural gas and electricity, and are added together to give the total energy cost savings during that month.

Baseline adjustments account for factors out of TAC's control, such as weather, days occupied, building area, and equipment type. Perhaps the most significant adjustment that TAC makes to usage data involves actual operational days, because rarely do holidays and weekends exactly match the baseline year.

Customer Comments

"TAC has continued to impress us with their attention to detail and commitment to customer service."

Gilbert D. Jalomo, Jr.
County Purchasing Agent
Fort Bend County

"As a public servant, I understand the importance of making good sound decisions on behalf of our taxpayers. I know we have made the right decision in working with [TAC]."

Milton Wright
Sheriff
Fort Bend County

Financing an Energy Efficiency Project[1]

Overview

A local government building or facility manager sponsoring an energy efficiency project developed and implemented by an ESCO will have to deal with the issue of how the project is financed. Project financing should be approached with the same level of proactive effort as developing the technical aspects of the project. It is particularly important for the project sponsor to understand the basic financing options, and then determine which option is preferred within his or her local government organization.

Fortunately, there are a number of attractive financing options available to credit-worthy local governments, including lease financing through a specialized leasing company or local or regional bank, public financing with bonds issued by the local government or through participation in a state-sponsored financing pool, cash payments from the local government's general funds, or utility demand side management incentives or other forms of utility contribution.

The energy efficiency project financing market is mature and established, so credit-worthy local governments can expect that a number of companies will compete for their business. Today, the difference in interest between various types of financing is not as pronounced as it was five or 10 years ago, so the financing option used should not affect the economic viability of the retrofit technologies employed in the project. Furthermore, most financing companies and many ESCOs have standard financing contracts and other documentation available, so the customized drafting and legal work is kept to a minimum.

Whatever financial option is used, repayment of project costs can be tied directly to the level of energy saved by the project.

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1 NAESCO, *The Energy Efficiency Project Manual—The Customer's Handbook to Energy Efficiency Retrofits: Upgrading Equipment While Reducing Energy Consumption and Facility Operations and Maintenance Costs*, 1997, pps. 29-32.

ESCO-Financed Project Structures: Guaranteed Savings and Shared Energy Savings[2]

Guaranteed Savings

The customer finances the design and installation of the project in return for a guarantee from the ESCO that the project's energy savings will cover the customer's debt service. Guaranteed savings agreements also require that the ESCO maintain the project over its life.

If the project savings fall short of the amount needed for debt service, the ESCO pays the difference. If the savings, as measured and verified, exceed the guarantee, the customer shares the excess savings with the ESCO on the basis of a pre-established formula.

Guaranteed Savings/Pay-From-Savings[3]

- Guaranteed savings projects where the customer pays down its obligation in variable amounts that change each payment period, calculated as a percentage of actual savings as they occur.
- The project term varies, expiring only when the project loan is fully paid.
- Interest rates tend to be high, in the range of rates for unsecured bank loans.
- Project agreements tend to be shorter (usually seven years or less) and the savings share upon which payments are based is relatively high.
- This structure tends to be favored by customers lacking capital but able to rely on predictable patterns of energy use.

Shared Energy Savings

Shared savings projects are increasingly less common than those based on guaranteed savings. In these projects, the ESCO finances the project, usually borrowing the money from one or more third parties. The customer then agrees to pay the ESCO

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2 Both shared energy savings contracts and contracts based on a guarantee of energy savings will assume that the energy use baseline remains consistent during the contract term, with the assumptions that went into its original calculation. Similarly, it will be assumed that the cost of energy remains consistent with the projected costs on which projected energy savings are based. If baseline changes occur during the contract term, the guarantee or share must be adjusted accordingly.

3 The guaranteed savings/pay-from-savings structure is relatively uncommon.

a share of the savings from the project. The customer enjoys an immediate net benefit once the project begins to save energy (and, therefore, operating costs) because the ESCO alone has made an out-of-pocket investment.

The ESCO uses its payments from the customer to repay its debt (or recoup its investment), conduct equipment maintenance, monitor savings, and earn a return. As with guaranteed savings projects, the ESCO measures energy savings throughout the term of the project agreement.

Common Approaches to Energy Efficiency Project Financing

There are many sources of capital available to finance energy efficiency projects and an ESCO should be able to help facility owners sort through the types of financing available and select the most cost effective source. One of the many advantages of using an ESCO is the specialized nature of the project design. Every aspect of the project, including financing, can be customized.

Leases[4]

Leases are used as a substitute for debt to create hybrid project structures (e.g., ESCOs may use *guaranteed leases* – analogous to debt-based guaranteed savings projects).

Capital Lease

This is the most popular lease form for financing energy efficiency projects. The energy efficiency equipment usually is owned by a leasing company, to whom payments are made. The customer must encumber its balance sheet with the debt obligation, but also enjoys the cost reduction achieved through lower financing costs and the tax benefits from the equipment's depreciation. Such leases are usually in the form of lease-purchase instruments, with the transfer of title at the end of the lease occurring on the basis of a previously agreed-upon nominal amount.

Operating Lease

This is a less commonly used financing structure. Operating leases are not reflected as debt obligations on a customer's balance sheet and the lessor normally receives the benefit of depreciation on the equipment. The transfer of equipment at lease's

4 When deciding upon a lease, or other project financing structure, the customer is well advised to seek counsel from a certified public accountant on the most advantageous tax structure for the project, given the customer's tax status and financial situation.

end is more genuinely optional, since it is based on fair market, rather than a stipulated value. The lessor thus risks having to reclaim and dispose of the equipment. This tends to limit the kinds of equipment eligible for these leases and to increase the lease cost to the customer.

Municipal Lease

These are the most common forms of lease used by state and local government entities. They may be treated by the agency lessee as either capital leases or operating leases and are procured at a lower cost, compared to other lease forms, due to their favorable tax treatment.[5]

Master Lease

Master leases may be used where a property owner or manager is seeking to implement a number of projects at various times and locations. The master lease uses schedules to add multiple projects over an extended period of time, each of which has different termination values and terms. These leases can be structured as capital, operating, or municipal leases.

Certificates of Participation

Certificates of Participation (COP), in essence, are Master Leases divided among a number of investors rather than a single large investor. Investors receive a fractional undivided interest in specified lease payments. In this way, a nonprofit financing corporation or joint powers of authority may be created at the instance of the leasing entity to function as the "lessor." The lessor obtains funding in the transaction by preparing and selling COPs in the lease. This "certification" facilitates the sale of the lease to a larger number of investors, with the governing board of the government agency remaining fully accountable to the public for its decisions related to the lease obligation.

Purchase-of-Savings and Utility Financing (Utility Demand Side Management)

Financing may be available for energy efficiency projects under a utility demand side management (DSM) program. Here, the ESCO, under contract with a utility, provides funds for the project by, in effect, purchasing the project's energy savings at a price based on measured units saved. The ESCO resells the savings to a utility under the utility's DSM program. The ESCO uses the utility's payments to reduce financing and construction costs, permitting the customer to retain a more attractive share of savings. The ESCO can combine a utility's purchase of savings with

5 Fees for arranging municipal bonds are higher than those for private debt.

a guaranteed savings structure, as well. In recent years, as the energy industry has begun to move in the direction of deregulation and, thus, increased competition, DSM bidding programs have become largely a thing of the past.

Energy services are being provided to customers through other types of programs and customer financing vehicles. Support for energy efficiency during restructuring in energy markets is primarily taking place through the collection of funds under a systems benefit charge. These funds are distributed through a competitive mechanism, such as a standard performance contract. The states of New York, California, Texas, and New Jersey have had varying degrees of success with this approach.

Equipment Rebates

These are a form of utility rebate offered to customers in an attempt to soften the impact of price premiums associated with energy efficient products. They are usually payable in fixed amounts corresponding to particular categories (in some cases, particular models) of equipment. In the context of a comprehensive energy efficiency retrofit, an equipment rebate program can be use to reduce the project's cost of materials.

Appendix A

Source List for Additional Information

Source List for Additional Information

The Alliance to Save Energy
1200 18th Street, NW, Suite 900
Washington, DC 20036
Phone: 202/530-2215
Web Site: http://www.ase.org

American Council for an Energy-Efficient Economy (ACEEE)
1001 Connecticut Avenue, NW, Suite 801
Washington, DC 20036
Phone: 202/429-8873
Web Site: http://www.aceee.org

Building Owners and Managers Association (BOMA) International
1201 New York Avenue, NW, Suite 300
Washington, DC 20005
Phone: 202/326-6323
Web Site: http://www.boma.org

National Association of Counties
440 First Street, NW
Suite 800
Washington, DC 20001
Phone: 202/393-6226
Web Site: http://www.naco.org

National Association of State Energy Officials (NASEO)
1414 Prince Street, Suite 200
Alexandria, VA 22314
Phone: 703/299-8800
Web Site: http://www.naseo.org
(See NASEO's web site for a current list of State Energy Offices)

National Governors' Association
444 North Capitol Street
Washington, DC 20001-1512
Phone 202/624-5300
Web Site: http://www.nga.org

National Council of State Legislatures
1560 Broadway, Suite 700
Denver, CO 80202
Phone: 303/830-2200
Web Site: http://www.ncsl.org

Public Technology, Inc.
1301 Pennsylvania Avenue, NW
Washington, DC 20004-1793
Phone: 202/626-2400
Web Site: http://www.pti.org

Sustainable Buildings Industry Council
1331 H Street, NW, Suite 1000
Washington, DC 20005
Phone: 202/628-7400
Web Site: http://www.sbicouncil.org

U.S. Environmental Protection Agency, Office of Radiation and Indoor Air
Web Site: http://www.epa.gov/iaq

ENERGY STAR Program
Phone: 888/star-yes (782-7937)
Web Site: http://www.energystar.gov

Appendix B

Additional Resources for Energy Efficiency Services and Performance Contracting

Additional Resources for Energy Efficiency Services and Performance Contracting

Breathing Easy: Using Energy Performance Contracting To Improve Indoor Air Quality in Schools.

The Energy Efficiency Project Manual – The Customer's Handbook to Energy Efficiency Retrofits: Upgrading Equipment While Reducing Energy Consumption and Facility Operations and Maintenance Costs.

The Energy Services Industry: Revolutionizing Energy Use in the United States.

Meeting the Challenge: How Energy Performance Contracting Can Help Schools Provide Comfortable, Healthy, and Productive Learning Environments.

Reducing Operating Costs and Improving the Facility Infrastructure: Energy Efficient Capital Upgrades in Colleges and Universities.

Reducing Operating Costs and Improving Patient Comfort: Energy Efficiency Upgrades in Hospitals and Medical Centers.

Reducing Operating Costs and Improving the Student Learning Environment: Energy Efficient Capital Upgrades in K-12 Schools.

School Solutions: How to Save Money and Improve Indoor Air Quality Using Energy Performance Contracts.

All of the publications listed above are available from:

NAESCO
1615 M Street, NW, Suite 800
Washington, DC 20036
Phone: 202/822-0950
Fax: 202/822-0955
Web Site: http://www.naesco.org