Energy Conservation in Existing Commercial Buildings

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Abstract

Old, outdated buildings with inefficient electrical and mechanical systems pose a problem for owners because of the expense of turning them into energy conserving, healthy, and regulation compliant facilities. The technology is available to make the needed improvements, but financing is usually a problem. The answer to those facing the expense of making improvements that can slow the rapid demise of our natural resources and reduce energy usage is Energy Savings Performance Contracting (ESPC). ESPC is an option for funding infrastructure improvement projects to improve building performance and maintenance rather than wasting dollars on cosmetic changes or improvements that do not solve energy problems. Without taking steps to cut energy usage or to update inefficient existing systems, our adverse effect on the environment will continue. Approaching energy management on a commercial level can effect energy savings, economic savings, pollution reduction, and conservation in the form of upgrading, updating, and upscaling existing facilities.

Introduction

Today our planet faces challenges ranging from pollution to global warming to the increased costs of generating and distributing energy. Our natural resources are more valuable than ever before, and energy conservation has become an established fact in life rather than a political catchword. Major steps to stop environmental destruction due to inefficient, wasteful, and unnecessary consumption of energy are needed to force waste reduction down to a level causing minimal damage to the natural environment.

Transforming wasted energy into economical efficiency through wise use, conservation, and selective focus on making meaningful improvements to existing commercial buildings can make a major difference in the status of our valuable natural resources. Old, outdated buildings with inefficient electrical and mechanical systems can be recycled into energy conserving, healthy, and regulation compliant facilities. Some buildings not so old are also candidates for improvements to their mechanical and electrical systems. The technology to make the necessary improvements is available, but often financial barriers prevent any upgrades from being accomplished. To realize benefits by preventing uncontrolled waste of energy means implementation of energy management programs starting with energy efficient upgrades and retrofits and a means of facing the initial expense. There is a solution to the dilemma of funding improvement projects which enhance building performance and improve building maintenance called Energy Savings Performance Contracting (ESPC).

Need For Conservation

During the 1970's, many energy programs offered quick advice and solutions to meet the immediate crisis of the uncertainty of adequate energy supplies and higher prices. But in the 80's, stable energy prices reduced the focus on efficiency and conservation allowing increases in consumption to run out of control. Now, in the 90's, the amount of energy consumed in commercial buildings in the U.S. was 5.5 quadrillion Btu's. In 1993, existing commercial and residential buildings in the U.S. consumed 36% of the energy used. This percentage can be further broken down into 470 million tons of CO_2 emissions or 34% of the CO_2 emitted in the U.S., according to an "Existing Buildings Research Program Overview" published by the Oak Ridge National Laboratory [1]. Whenever energy efficiency and conservation curb the use of fossil fuels, a reduction in CO_2 emissions will follow as well as other pollutants contributing to acid rain and urban smog. Energy conservation must interface with a facility's pollution control program along with the energy savings steps. Care must be taken to use conservation measures which do not create local pollution problems. Installation of energy efficient technologies can reduce pollution and the cost of environmental protection by lowering energy bills and the emissions associated with energy use such as CO_2, greenhouse gases, and contributors to acid rain. Classroom demonstrations and experiments better prepare future energy managing personnel while increasing awareness of energy issues and solutions.

Energy Conservation Through ESPC

An Energy Savings Performance Contracting (ESPC) is an alternative financing option available for funding infrastructure improvement projects resulting in more than cosmetic changes or modifications that do not solve problems of energy efficiency. It involves a contract between a facility and an energy service company (ESCO) for the development, financing, and implementation of improvements that pay for themselves through energy saved. ESCO's are often private companies which provide comprehensive energy efficiency and/or load reduction services. Used as a means of getting replacement or retrofitted efficient capital equipment, energy savings, and equipment maintenance, the contract is an agreement to split the energy savings between the customer and the ESCO. The customer receives a facility audit, equipment recommendations and installation, project management, monitoring and verification of the performance of the equipment, and guaranteed savings. In exchange, the contract company receives its fee over the length of the contract and from a share of the energy savings. Typical contracts are for 10 years, however, they can be negotiated for periods of up to 25 years. For the customer, there is a guaranteed result in the form of lower energy costs and reduced operations and maintenance costs or better performance, which gives the contract the name. Used as a means for acquiring energy efficient equipment that can reduce facility costs by reducing the consumption of energy, part of an ESPC incorporates maintenance and training in order to prevent damage to new equipment, to guarantee proper usage, and to ensure the anticipated savings. Based on payback of the loan through these savings, a customer receives expertise, new equipment, training, and valuable program assistance.

It makes smart business sense to use an ESPC to take advantage of the many conservation improvements offered: improved diagnostic technologies, more favorable financial assistance, and improvements in the energy efficiency of existing buildings. An ESPC can help resolve environmental problems, aid the economy, and extend the future existence of our threatened natural energy resources, with the guaranteed energy cost savings from improvements to a facility's electrical and mechanical systems paying for the conservation project. Energy conservation through an ESPC is actually a range of professional options through energy audits and assessments of energy usage which are used to identify the specific opportunities for reducing that usage.

Opportunities For New Energy Management

Energy is conserved when waste is avoided or efficiency is improved. An investment in energy efficient improvements can help reduce the need for new power generation to answer the country's demand. Some typical examples of efficient retrofits or replacements are lighting, HVAC retrofits, efficient motors, variable speed drives, insulation, and heat recovery systems. Lighting system operations alone can account for 35% of total energy use in commercial buildings, offering a quick reduction in energy consumption and are included in nearly every energy conservation project. Active methods of achieving reductions are replacing incandescent lamps with compact fluorescent lamps, using improved components in existing fluorescent fixtures, and installing dimmers or light controls. Illuminated exit lights offer additional energy savings. An example of a passive reduction that can be achieved is the use of daylighting as a complement to the electrical system. Lighting also affects production and human performance, health and safety, and employee mood. Interrelated features of lighting improvements are effects on heating and cooling loads and humidity control. Paybacks on these types of improvements are immediate where an ESPC is concerned. A quick and easy upgrade focusing only on lighting due to the immediate payback is not acceptable. This type project misses the opportunity to include upgrades and remodeling that may not save energy, but cover other modifications that prove difficult to finance, such as for ADA requirements [2].

Mechanical system efficiency is also important. In terms of equipment, poor maintenance, leaks, uninsulated pipes and steam lines, and dirty evaporators and condensers may go undetected and result in inefficient operation. Equipment sizing is a factor to consider. Many older buildings have additions added to the original structure or have undergone remodeling. Ductwork, return grills, and airflow may not be working properly for the changes made and be causing an imbalance in the buildings mechanical systems. Combustion emissions released due to inefficient HVAC systems are a major cause of pollution generation affecting indoor air quality. Pumps, fans, chillers, and boilers influence conservation opportunities. Existing buildings may not be equipped to handle occupant's needs, such as computers and modern office equipment, and may indicate a need for rewiring to save energy and for safety. Reduction in operating hours along with more efficient equipment has a direct effect on energy usage.

The building envelope, including insulation, double paned windows and entryways, roofing materials, weather-stripping, and air exchange is another area. Leaks related to weather or material deterioration and causing damage may be a maintenance problem that can be added to an upgrade package. Payback on these improvements may take longer, but should be a necessary consideration in any systematic, integrated approach. A part of energy management involves monitoring building conditions. With the availability of computer applications, building systems can be controlled, monitored, and assessed to reduce energy consumption. By concentrating the control of many areas and pieces of equipment in a central location, building operation can be tailored to satisfy occupant demands and provide optimal building comfort without waste [3].

Federal mandates such as the National Energy Policy Act of 1992 (NECPA) and Executive Order 12902 encouraged energy efficiency by establishing energy reduction goals for government agencies, as well as methods to meet the goals. The Executive Order required energy consumption be reduced by 30% by the year 2005, using 1985 energy usage as a base, and 50% by 2030 [1]. Use of an ESPC is a means of achieving the goals since government funds are not used to implement energy conservation measures and ESCO's assume the capital costs of the installation. Outside the government, facilities managers seeking ways to cut costs and reduce waste while achieving energy efficiency looked to local utility companies for help funding projects through rebates. One reason for getting away from rebates is the progressive deregulation of the electric utility industry, in part caused by NECPA opening up competition within the industry [4]. The disadvantage of deregulation may be the effect it may have on current conservation spending. Utilities may not choose to support conservation projects due to increased competition for consumers. Trickling down, contractors may begin leaving out the most efficient replacement equipment. There may be a feeling of little incentive to be efficient. With the need to fund energy reduction projects and to meet federal energy savings requirements, many facilities are looking to performance contracting as an alternate and less risky financing means. Those same facilities are in greater need than ever of having qualified personnel to help make those decisions.

Conclusions

The integrity of the natural environment calls for the wise use of energy in a manner consistent with the judicious use of the world's remaining natural resources. Current and past economic policies regarding energy are a major cause of problems involving environmental impact, energy supply, and energy demand. Approaching energy management on a commercial level is of equal or greater importance to developing residential energy conservation projects. Pollution reduction solutions companion the energy savings as well as the economic savings. Commercial energy improvements and savings impact energy waste minimization to a greater degree through prudent management practices, including conservation in the form of upgrading, updating, and upscaling existing facilities. By targeting energy and environmental students, their skills would be enhanced through participation in these types of projects. The diverse methods of energy improvement in existing buildings offer practical experience and materials and course development while advancing the recognition of technical improvements to reduce waste energy problems.

There are many ways to minimize energy consumption and cost. Determining high performance and efficiency through wise improvement selections can offer the best solutions. An Energy Savings Performance Contract is one answer to cutting lighting costs, lowering heating and cooling bills, and improving maintenance of systems through conservation and efficiency and staying within an existing budget while guaranteeing our future. It is an answer to helping an existing building achieve maximum energy and environmental production.

References

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