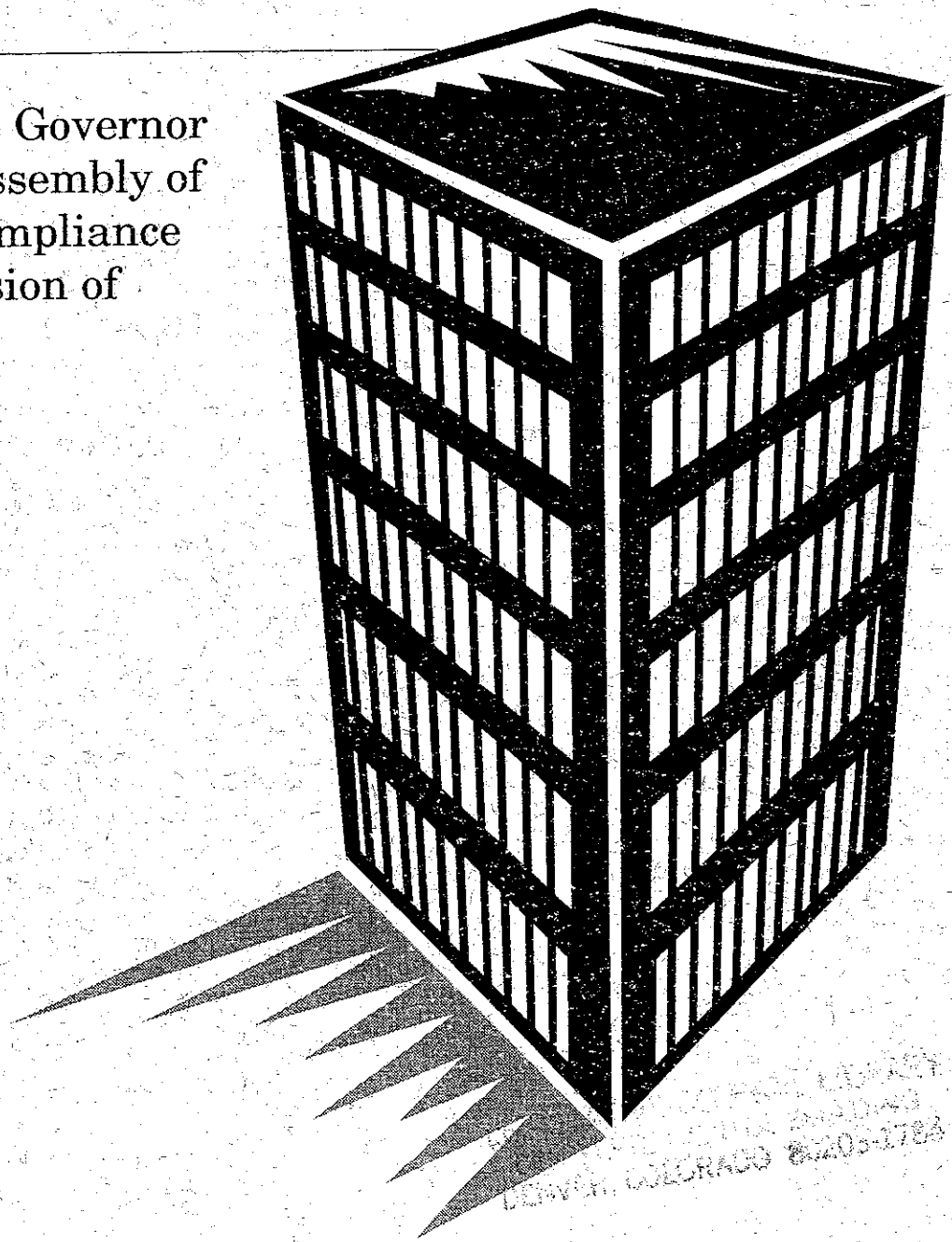
Cutting Energy and Costs at State Buildings: Opportunities for Saving Millions

A Report to the Governor and General Assembly of Colorado in Compliance with the Provision of HB 93-1052



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Prepared by General Support Services in Conjunction with the Governor's Office of Energy Conservation

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Preface

This report is written for the Governor and the General Assembly as required by HB 93-1052 (specifically, 24-30-1904 CRS). The State Legislature authored HB 93-1052 to develop a program to promote conservation and the efficient use of renewable resources in state buildings. In response, the Governor's Office of Energy Conservation (OEC) funded the position of an Energy Conservation Engineer in the Department of Personnel/General Support Services, State Buildings Programs to build the capacity for the development of energy management plans for selected state agencies.

This report chronicles the work carried out since HB 93-1052 was signed; summarizes the data and findings regarding the effectiveness, cost-efficiency, and overall feasibility of a program for state-owned buildings; and offers recommendations for implementing energy conservation opportunities.

For the purposes of this report, "state building" refers to any building owned and operated by the state for public purposes, *including* the Department of Higher Education. Higher Education was excluded from the definition of state building used in HB 93-1052.

The report was prepared by the staff of the Office of Energy Conservation and State Buildings Programs.

Executive Summary

The State of Colorado will spend $40 million on energy bills this year. Previous studies reach the same conclusion as this report—that 10 to 15 percent savings, or ***between $4 and $6 million*** annually, are achievable through simple, cost-effective energy conservation projects. The savings from these projects would pay back the State's investment in these conservation projects, in most cases within six years, which is comparable to a 16 percent internal rate of return. These are proven technologies and strategies now commonly used by both the public and private sectors around the country. Many of these changes also will improve the physical condition and value of state buildings, while improving the comfort of their occupants. While this information has been available for a decade or more, the State has not pursued these conservation projects largely due to funding constraints.

To capture the potential savings of energy conservation projects, the State should:

- ***Use an integrated design process, adhere to the latest energy standard for new commercial buildings, and use energy life-cycle costing in all new construction.*** Using these practices may require a slight increase in capital construction costs, but those costs will typically be recouped within six years in energy bill savings. Agencies should meet these standards when planning new facilities, and the State should be willing to pay the incremental costs associated with meeting these standards.
- ***Develop and implement energy management plans for individual state buildings.*** Energy Management Plans identify energy conservation opportunities and create strategies for implementation. The plans can be developed by state personnel or private sector contractors.
- ***Train building personnel to operate buildings efficiently.*** The operation and maintenance of buildings and building systems can affect building energy use by 5 percent or more. The State should establish a training program for building staff, along with appropriate incentives. This can be accomplished using state personnel or private sector contracts.
- ***Track energy use and costs in all state facilities.*** The State needs to use meters to better track energy use in state buildings to identify the best opportunities for energy conservation projects as well as to verify success. Metering also will help in more accurately planning the budget requests for utility costs.
- ***Provide financing options for meeting the front-end costs of energy conservation retrofits or higher incremental costs in new construction.*** It is this last recommendation, financing options, that addresses the single most important barrier to implementing energy efficiency. While energy conservation can save the State millions of dollars a year over the long-term, it is difficult for state agencies to budget for such projects when these requests are weighed against the more immediate needs of our state government and shrinking federal support. However, funding options are available today that were not available in the past. Options such as performance contracting, issuing bonds, or establishing an energy conservation fund offer innovative opportunities to implement energy conservation projects without requiring line-item funding for an agency. The General Assembly needs to simplify the process of using these alternative funding options to encourage individual state agencies to use them.

This report outlines:

- Previous studies of energy conservation opportunities in state buildings.
- Recent activities of the State Buildings Programs and Office of Energy Conservation in response to HB 93-1052.
- Opportunities for conservation in new buildings and major renovations.
- Opportunities for conservation in existing buildings, including the development and implementation of energy management plans, improving the operation and maintenance of buildings, staff training needs, and incentives.
- Barriers and solutions, including tracking and predicting energy use, funding options, and purchasing strategies.

This report concludes with specific recommendations addressing the issues outlined above.

Specific inquiries should be addressed to Wade Buchanan, Director of the Office of Energy Conservation.

BACKGROUND

Introduction

In the current fiscal year (1995-96), the State of Colorado will spend approximately $40 million to heat, cool, ventilate and light its buildings. This report reaffirms the findings of a number of previous studies—the State could save 10 to 15 percent on its yearly energy bill, or ***between $4 and $6 million*** annually, through simple, cost-effective energy conservation projects. This savings corresponds to a 16 percent internal rate of return.[1] These are proven technologies and strategies now commonly used by both the public and private sectors around the country. The resulting lower utility bills would pay back the State's investment in these conservation projects, in most cases within six years.

This report outlines specific actions the State can take to capture these savings, including some basic changes in how it uses line-item budgets, allocates construction funds, and uses cost-effective and energy-efficient products, as well as more aggressive strategies such as establishing funds or funding mechanisms to pay for improvements and training. Many of these changes also will improve the physical condition and value of state buildings, while improving the comfort of their occupants. And conservation projects could provide valuable employment opportunities for some Colorado firms.

Two conclusions stand out:

1. Energy efficiency has not been a priority in designing buildings or renovating state facilities.
2. In order to realize most of these savings, the State must be willing to accept higher front-end costs when building new facilities or renovating existing facilities.

These are investments many private sector firms already have realized are wise and add to their bottom-line profits over the long-run. These investments will cut state expenditures over the long-term as well. This report outlines several options for financing these investments.

[1] The internal rate of return is the interest rate at which the present worth of future net cash flows is zero. The methodology is described in numerous engineering economics texts, including: Eugene L. Grant, W. Grant Ireson and Richard S. Leavenworth, *Principles of Engineering Economy, Sixth Edition,* John Wiley and Sons, New York, NY, 1976. The 16 percent internal rate of return is based on the following assumptions: a $36 million one-time investment; annual savings potential of $6 million (15 percent of the total energy bill); escalation in gas and electricity prices, excluding inflation, over the next 15 years as projected by the U.S. Department of Commerce, National Institute of Standards and Technology; a 15-year time period to accrue savings based on the average life expectancies of energy efficient equipment; and no increase or decrease in maintenance and other future operational costs compared to standard equipment.

Previous Studies

Over the last 20 years, at least five studies or reports have examined the potential for energy conservation in Colorado state buildings. All studies point to the same conclusion—***the State could save millions of dollars in utility costs each year through readily available energy conservation technologies.***

A report was prepared in 1975 by the Vice Chancellor for Administration and Planning at the University of Colorado at Boulder, *A Proposal for Financing Energy Conservation in Existing State Supported Buildings*. This report concluded that low energy costs and an emphasis on lowering construction costs resulted in buildings that wasted large amounts of energy.

In 1981 the Department of Mechanical Engineering at Colorado State University completed a report, *Development of an Energy Use Formula for State Institutions*. This study attempted to create an accurate and efficient mathematical model to project utility consumption and costs for budgeting utility line-item appropriations. It concluded that the Joint Budget Committee (JBC) formula generally predicted within plus or minus 20 percent of actual utility use, but tended to underestimate energy use. The recommended model projected utility use within 3 percent of actual consumption, considerably more accurate than the JBC formula. According to JBC staff, no such model to predict energy use is currently used.

Two reports were completed in 1990. The first was by the Joint Center for Energy Management and CAER Engineers, Inc. entitled *Feasibility Study for Capitol Energy Improvement Bonding Project*. This report was commissioned to identify the savings potential of energy conservation projects in state buildings, for future use in a proposed statewide conservation program. It concentrated on energy consumption in nine of the larger state departments, studying 400 buildings under the jurisdiction of 30 different agencies. These departments spent approximately $9.5 million dollars a year on energy in 1989. An in-depth study indicated an energy savings potential of about 23 percent of the total utility cost by implementing various energy conservation measures. The report predicted the investment would be returned within 4 1/2 years through savings in energy bills.

The second report, completed in 1990, was by Engineering Economics, Inc. entitled *Capital Energy Improvements Bonding Program Project Management Issues*. It recommended that the Office of Energy Conservation help departments and agencies identify energy saving opportunities; fund consultants; manage, monitor and evaluate energy management plans; and provide technical assistance. It also discussed how bonds have successfully been used to finance energy conservation projects in California, Iowa, Montana and, locally, at Colorado State University in Fort Collins. The report recommended the State proceed with the sale of bonds to finance energy conservation projects, and that bond payments could be structured so that part of the energy savings return could be shared with agencies for future projects. A permanent review of ongoing and future construction projects at state facilities also was recommended so energy saving opportunities could be identified during the design and bid stage of large construction projects.

The Office of Energy Conservation and Department of Administration presented findings of the two 1990 reports to the Capital Development Committee in 1990. At present, no actions have been taken on the recommendations.

Finally, in 1992 the State Auditor completed a report, *Energy Conservation in State Buildings*, and presented it to the Legislative Audit Committee. The report reviewed the status of state energy conservation activity. It pointed out the lack of a unified energy management program for state facilities, recommended individual agency energy management plans, listed potential energy conservation measures, reviewed various financing mechanisms, and discussed the role of the Office of Energy Conservation. The report identified the need for a comprehensive energy management program for state facilities, and gave information on available resources at that time, including specific recommendations to assist agencies in developing energy management plans. It estimated that a $13 million investment could produce annual savings of $3 million.

Some recommendations by the State Auditor have been partially implemented. For the most part, however, these recommendations were superseded by HB 93-1052 in the subsequent legislative session.

Recent Activities in Response to HB 93-1052

During the 1993 session, the General Assembly adopted HB93-1052. This bill called for the creation of a state building energy management fund to be developed through public and private contributions. These funds were to be used to develop specific energy management plans for select state facilities. The legislation appropriated no state funds for this effort.

As its contribution to the state building energy management fund established by HB 93-1052 (specifically, 24-30-1905 CRS), the Office of Energy Conservation funded an energy conservation engineer for two years with the State Buildings Programs to develop energy management plans or audits for state agencies. Since 1993 the engineer has identified initial opportunities with 12 agencies to save an estimated $1.3 million dollars per year with an investment of $7.6 million.

Because some of the engineer's recommendations did not require capital investments, agencies have already acted to save nearly $107,000 annually. In cases where capital investments were necessary but funds were not available, agencies are beginning the process of performance contracting—using future energy savings to fund energy conservation projects. Energy Service Companies are using $5 million of their own money to pay for energy conservation projects that will save nearly $852,000 each year. One agency is using internal funds to implement a $256,000 project that will save an estimated $36,000 per year. Grants and rebates from existing incentive programs through the Office of Energy Conservation, Public Service Company of Colorado and others have helped to offset some of these initial costs. Remaining projects identified by the engineer but that are not yet being implemented would cost a total of $2.3 million and could save the State an additional $420,000 per year. Recommendations made later in this report would make it easier to fund these projects and capture these savings.

Major accomplishments by the Office of Energy Conservation's engineer include:

- Development of energy management plans for the Colorado Council on the Arts, Colorado State Veterans Center, Adams State College, Colorado State Nursing Home, and Capitol Complex. Each plan recommends no-cost operation and maintenance measures as well as potential energy conservation investments, including cost/benefit analyses and potential funding sources.
- Assistance in cutting natural gas bills at specific agencies. One beneficiary was Adams State College which, as a result, saved approximately $59,000 last year in annual gas purchases. Western State College and Capitol Complex also intend to pursue these savings.
- Assistance in securing alternative funding for energy conservation measures in specific facilities. This includes pioneering "performance contracting," or financing projects through future energy savings.
- Development of preventive maintenance programs for Red Rocks Community College, Colorado State Veterans Center, and the Judicial/Heritage Complex.
- Development of guidelines for purchasing new equipment such as energy-efficient light bulbs, computers, copy machines and air filters throughout state government.
- Demonstration of new or unique energy conservation technologies, including the use of cost-effective renewable energy systems at several state facilities.

COMPLETED PROJECTS

Tax Refunds	One-time Savings	One-time Cost
Mesa State College	$ 635	$ 342
Department of Transportation	$ 3,098	$ 1,668
Department of Military Affairs	$ 1,097	$ 591
TOTAL ONE-TIME SAVINGS	$ 4,830	TOTAL COST $ 2,601

Rate Changes	Annual Savings	One-time Cost
Front Range Community College	$ 10,063	$ 15,482
Department of Transportation	$ 34,443	$ 51,347
Department of Military Affairs	$ 2,060	$ 3,169

Direct Purchase of Natural Gas	Annual Savings	One-time Cost
Adams State College	$ 59,182	$ 0

Energy Conservation Measures	Annual Savings	One-time Cost	
Governor's Residence	$ 421	$ 1,600	(Donated)
Council on the Arts	$ 537	$ 718	
TOTAL ANNUAL SAVINGS	$ 106,706	TOTAL COST $ 72,316	

PROJECTS IN PROGRESS

Performance Contracts	Annual Savings	One-time Cost
Adams State College	$ 195,453	$ 1,055,758
Auraria Higher Education Center	$ 184,615	$ 1,200,300
Department of Military Affairs	$ 188,900	$ 850,000
Judicial/Heritage Center	$ 93,000	$ 489,000
Western State College	$ 130,000	$ 1,200,000
TOTAL	$ 791,968	$ 4,795,058

Institutional Conservation Program projects	Annual Savings	One-time Cost
Adams State College	$ 35,804	$ 160,147
Auraria Higher Education Center	$ 24,649	$ 106,619
TOTAL	$ 60,453	$ 266,766

Agency Funded Projects	Annual Savings	One-time Cost
Veterans Center, Florence	$ 36,087	$ 256,345
TOTAL PROJECTS IN PROGRESS	$ 888,508	$ 5,318,169

UNFUNDED PROJECTS

Unfunded Projects	Annual Savings	One-time Cost
Capitol Complex	$ 376,434	$ 2,131,209
Veterans Center, Homelake	$ 13,925	$ 50,436
University of Northern Colorado	$ 30,987	$ 113,414
TOTAL UNFUNDED PROJECTS	$ 421,346	$ 2,295,059
GRAND TOTAL ALL PROJECTS	$ 1,309,854	$ 7,613,228

Progress made by state agencies to cut energy costs, identify potential funding sources, improve operation of facilities and develop energy management plans are outlined in this report. The details of the engineer's efforts and specific energy management plans are available upon request from the Office of Energy Conservation.

FINDINGS AND RECOMMENDATIONS

Opportunities in New Building Construction and Major Renovations

New construction offers by far the most cost-effective opportunities to incorporate energy efficiency and renewable energy technologies in state buildings. However, these opportunities often are lost due to emphasis on the initial costs of state buildings. Depending on the type of building, increased energy efficiency can cut utility bills of new buildings by 11 to 17 percent at an added cost of 1 to 2 1/2 percent of overall design and construction costs, according to preliminary estimates by ERG International Consultants, Inc. under contract to the Office of Energy Conservation. The state would typically recoup the investment in new buildings in six years and benefit from energy savings throughout the life of the equipment. Similarly, using renewable energy technologies in their most cost-effective applications can provide payback periods well within the recommended time of 10 years.

Besides cutting energy costs, there are many other benefits of energy-efficient buildings. The buildings are usually more comfortable for employees and can result in increased productivity and reduced absenteeism, according to several recent studies.[2] Energy-efficient buildings often use higher-quality equipment which offers extended lifetimes and less maintenance, further reducing operating costs and the requirements of maintenance staff.

This report identifies six specific options for improving energy efficiency in new buildings or major renovations of existing ones.

1) Use an Integrated Design Process

An integrated design process integrates the expertise of the entire design team, including architects, mechanical and illumination engineers, landscape architects, and other professionals, into the initial planning stage of a building to design a more energy-efficient and cost effective building.

An integrated design approach is critical to the energy efficiency and cost-effectiveness of a new building. Conventionally, a building's size, shape, overall appearance and position on the site are determined by the architect. Then the design is turned over to mechanical and illumination engineers to determine how to heat, cool, ventilate and light the building. At this point, it is too late to incorporate energy-saving strategies that would change the preliminary design so opportunities are usually limited to simple equipment specification changes.

However, an integrated design process allows the entire design team, including architects, engineers and other building professionals, to be involved in the *initial* planning stage of a building. The illumination engineer has the opportunity to suggest design elements, such as window

[2] Dianna Barnett and William Browning, *A Primer on Sustainable Buildings,* Rocky Mountain Institute, Snowmass, CO, 1995; William Browning and Joseph Romm, *Greening the Building and the Bottom Line: Increasing Productivity Through Energy-Efficient Design,* Rocky Mountain Institute, Snowmass, CO, 1994.

placement and roof design, that would take advantage of daylighting to offset electric lighting needs. The mechanical engineer can suggest ways to reduce cooling or heating requirements by orienting the building to take advantage of morning sun or by shading the building to minimize the cooling needs. The result is a bright and well-lit building that remains warm in the winter and cool in the summer and is resource- and cost-efficient.

It does not necessarily require a larger budget to design and construct new energy-efficient facilities. If an integrated design process is used, increases in energy efficiency in one system can reduce equipment needs in other systems. For example, an energy-efficient lighting system generates less unwanted heat, so a smaller capacity, lower-cost cooling system can be installed. This can result in little or no net increase in the cost to design and construct the building, yet significantly reduce future operating costs. In other cases, the net cost may be higher, up to 2 1/2 percent more. But even this increased cost is justified because future energy savings pay for the added cost within six years.

Integrated design is an increasingly common practice in the private sector, and its benefits are well accepted. Colorado State University in Fort Collins is considering including integrated design principles in its traditional design process. The Office of Energy Conservation and several independent consultants headquartered in Colorado can assist the state in developing an integrated design process.

2) Use Energy Life-Cycle Costing

Energy life-cycle costing is a method of evaluating the cost related to energy efficiency of equipment or construction materials by considering all costs incurred over the product's lifetime, including initial cost, maintenance cost, salvage value and demolition cost. Energy life-cycle costing can be extended to compare entire designs of new buildings. When properly applied, it can ensure the state will make cost-effective investments in new construction. It also would allow renewable energy technologies to be evaluated alongside traditional technologies.

In 1979 the Legislature amended Colorado Revised Statute 24-30-1304 to require all new construction projects, major renovations or additions to use life-cycle costing for energy consuming equipment and materials. While energy life-cycle costing is required by law, the current state construction bidding process effectively discourages compliance. Even when energy-efficient equipment is specified in the design process, it often is eliminated during the construction phase if project costs begin to escalate. To capture the long-term savings for the State that energy efficiency can provide, executive and legislative decision-makers must be willing to accept the higher capital costs, which these strategies often require.

3) Use an Energy Standard

As an effective but simple way of meeting the life-cycle costing requirement, the State Buildings Programs encourages all new building designs to meet the nationally-accepted energy standard ASHRAE/IES 90.1-1989. This standard was developed by a joint effort of the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE) and the Illuminating

Engineering Society of North America (IES). It is based on current energy costs, use of market-proven energy-efficient technologies, the cost of designing and constructing buildings, and life-cycle costs. This energy standard is reviewed and updated using a consensus process, so future modifications of the standard can and should be used as they become available.

This standard prescribes minimum insulation levels for walls, roofs, floors and windows. It also establishes maximum lighting energy intensities for different types of building activities and prescribes minimum efficiencies for mechanical systems. If needed, it has a more flexible alternative that forgoes the individual system requirements as long as the entire building meets the minimum energy performance level. Again, the design is often changed during the construction process to keep the project within budget. This often means that energy-efficient materials, systems, and equipment specifications are changed to less-expensive conventional equipment.

The University of Colorado at Boulder already requires compliance with ASHRAE/IES 90.1-1989 in all new buildings.

4) Specify Energy-Efficient Design, Materials, Systems and Equipment

A key to energy-efficient new buildings is their equipment specifications. One of the most important is energy-efficient lighting. Simply changing specifications for standard fluorescent lights to energy-efficient fluorescents can reduce lighting energy costs by 30 percent. In addition to the cost benefits, efficient fluorescent systems improve the overall work environment with improved color quality and silent, flicker-free operation. Compact fluorescents can be used instead of conventional incandescent lamps, cutting energy costs by 75 percent while extending equipment lifetime ten-fold. Similar advancements are available for outdoor lighting. Even exit signs can offer significant energy savings. One type of exit sign uses one-tenth as much energy and lasts more than 10 years, nearly eliminating the safety hazard of burned-out exit signs and reducing the present need for maintenance staff to replace bulbs every three months. In addition, new building design offers the opportunity to incorporate daylighting, using proper placement of windows to take advantage of daylight, and limit the use of electric lighting during daylight hours.

The mechanical systems that heat, cool and ventilate a building also can be re-specified to higher efficiency equipment that often delivers improved comfort. Energy management control systems can control mechanical systems to respond to changing building schedules and operate at peak efficiency throughout the changing seasons.

A well-insulated building shell will keep mechanical system use to a minimum for the entire life of a building. Because it is difficult and often impossible to add insulation to an existing building, it is critical to insulate walls, roofs and foundations to optimum levels during building construction. Improvements in windows also offer better energy performance, improving comfort year-round by limiting the amount of light or sun that enters the space. By requiring the use of these technologies—either specifically or through the ASHRAE standard—the State can ensure the lowest energy bills well into the future.

To further simplify the specification process for all state buildings, standardized bid specifications could be developed to identify specific minimum-efficiency electrical and mechanical systems for all new state facilities.

5) Use Renewable Energy Technologies Where Cost-Effective

There are many opportunities for renewable energy in new facilities. The Colorado Division of Parks and Outdoor Recreation discovered that using solar power (photovoltaics) to generate electricity is very cost-effective, particularly in remote areas where electricity is not readily available. Another state agency that often needs to generate electricity at remote sites is the Colorado Department of Transportation (CDOT). Thin black photovoltaic panels are used to provide power for flashing warning signs, railroad crossing signals and safety call boxes. CDOT has found photovoltaics to be an excellent resource for such applications because the systems are simple, portable and reliable.

Photovoltaics in State Parks

Through a separate partnership between the Office of Energy Conservation and the State Division of Parks, photovoltaic systems were installed at four park entrance stations this year. Photovoltaics power indoor lighting, an all-night outdoor light to provide security and illuminate instructional signs, two-way radios and other security equipment. An AC outlet also was installed for plugging in power tools, tape players and other equipment. The total cost of the four entrance station systems was $4,900—**$38,000 less** than the cost to extend power lines to the entrances. More importantly, the lights increase safety.

Another solar technology, known as the transpired solar collector, preheats ventilation intake air. This simple system has a payback period of three years or less in new buildings, yet lasts for decades. This solar technology would be ideal for state buildings with high ventilation requirements such as heated vehicle dispatch areas. The best opportunity for incorporating such technologies into new buildings would be through the integrated design process outlined above.

6) Install Meters to Monitor Energy Use

A number of state facilities still are constructed without proper meters, making it impossible to track energy use accurately. All new facilities should have meters to monitor energy use and to identify further energy saving opportunities. This is discussed in more detail in *Tracking and Predicting Energy Costs* later in this report.

Recommendation No. 1

When constructing new buildings or making major renovations to existing buildings, the State should use an integrated design process, adhere to the latest energy standard for commercial buildings (ASHRAE/IES 90.1-1989), and use life-cycle energy costing as required by law. The State also should use the most efficient equipment and renewable energy technologies wherever they are cost-effective. And the State should require all new buildings to be metered. These recommendations would ensure that the State use the most cost-effective energy equipment and designs, resulting in the lowest possible utility costs over the lives of its buildings.

The Executive Branch can and should require state agencies to use an integrated design process, follow the ASHRAE standard, use life-cycle energy costing, and give full consideration to available renewable energy technologies when developing facility master plans. However, executive and legislative decision-makers also must be willing to accept the higher front-end or capital costs, which these strategies often require in order to achieve even greater savings over the long-term.

Estimated Recommendation Costs and Benefits:

As discussed above, using an integrated design process, the ASHRAE standard and life-cycle energy costing can add up to 2 1/2 percent to the front-end costs of a new building or renovation, though in most cases the costs will be significantly lower. Similarly, utilizing cost-effective renewable energy technologies adds to front-end costs. The amount is dependent on the technology and the application. ***In all cases the State will recoup these added front-end costs through lower utility bills—in most cases in the building's first decade.*** Savings will continue to accrue to the State over the life of the building. Actual savings will vary building-to-building.

Opportunities in Existing Buildings

Energy conservation opportunities in existing buildings are broken into the following five areas:

- Existing energy management plans
- Future energy management plans
- Building operation and maintenance
- Staff and training needs
- Incentives

Existing Energy Management Plans

An energy management plan is a comprehensive study of energy use in an existing facility and can be an important first step in developing a comprehensive long-term strategy to reduce energy costs in that facility. As defined by CRS 24-30-1903, an energy management plan for state buildings may include the following:

- Building improvements, or extensive studies of such improvements, that are designed to reduce energy consumption or allow the use of an alternative energy source in such buildings.
- Building energy management plans and audits that identify energy uses and needs, identify technical resources, set measurable goals and objectives for reducing energy use, identify specific energy management measures, and set target dates for implementation.
- Provisions for additional flexibility in the use of utility line-item appropriations to fund current and future energy conservation measures through energy savings.
- A pilot program demonstrating a specific new energy conservation technology.

As mentioned at the beginning of this report, the Office of Energy Conservation funded an energy conservation engineer with the State Buildings Programs for two years to develop energy management plans or audits for state agencies. In this short time, the engineer worked with 12 agencies and identified energy-saving opportunities that could save an estimated $1.3 million dollars each year with an investment of $7.6 million. Some agencies already have acted on the recommendations, and these actions should result in almost $900,000 savings annually to the State, even if no further action is taken. The remaining unfunded projects total $2.3 million and could save the State an additional $420,000 per year.

> ***Judicial/Heritage Center Plan***
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> A recent energy management plan developed by the Office of Energy Conservation's engineer shows the Judicial/Heritage Center could save $93,000 a year with a $489,000 investment in lighting improvements, a new chiller and a computerized control system to operate mechanical systems. The complex intends to use performance contracting to fund the project.

The specific plans developed for state agencies are not included here in the interest of saving space and reducing printing costs. They have been shared with appropriate agency staff and also are available on request from the Office of Energy Conservation buildings staff.

Recommendation No. 2

Individual state agencies and institutions of higher education should implement the state building energy management plans and follow up on the energy audits that were conducted in preparation for this report and in compliance with HB 93-1052. While portions of these plans already have been implemented, affected agencies should include the remaining recommendations from these plans and audits in their facility master plans. The Legislature should consider funding these plans because experience shows they will result in significant and ongoing savings to the State.

Estimated Recommendations Costs and Benefits:

The Office of Energy Conservation and the State Buildings Programs identified $2.3 million in potential retrofits to selected state facilities that have not yet been implemented. These would be one-time costs to the State. ***The OEC estimates these measures will cut the State's annual energy bill by an additional $420,000, for an overall estimated payback period of less than six years.*** After the original investment is paid back, savings will continue to accrue to the State for the life-cycle of the recommended retrofits.

Future Energy Management Plans

Experience strongly suggests the State would be wise to develop and implement energy management plans for all its facilities. This could be accomplished either with State personnel or private sector contracts, or with a combination of both. This would be a significant undertaking, and in any case would require a new state permanent full-time employee (FTE) position to oversee the development of all energy management plans in addition to the personnel and/or contractual support required to develop each facility plan.

A new FTE position could be created with the State Buildings Programs for a senior engineer to oversee the development of energy management plans, with the following additional assignments:

- Establish and implement statewide guidelines and standards;
- Review, approve and monitor state agency energy conservation plans;
- Provide assistance to small agencies that lack expertise in energy conservation;

- Help agencies through each step of the funding process to take advantage of outside expertise and financing;
- Help agencies apply simple cost-cutting strategies to reduce utility costs (examples include finding billing errors, switching to lower cost rate schedules, and soliciting competitive gas pricing);
- Provide information on energy conservation techniques and potential funding sources;
- Review and verify agency estimates of energy savings; and
- Review and prioritize statewide energy conservation improvement projects for review by the Capital Development Committee.

Some agencies and institutions of higher learning, such as the University of Colorado and Colorado State University, already have energy managers to oversee the development and implementation of energy management plans. Even these agencies could benefit from oversight and assistance of a permanent State Buildings Programs energy conservation engineer. Other agencies should be encouraged to hire energy managers, perhaps following the example of the Department of Corrections to fund the position through the utility line-item.

Dept. of Human Services Program

The Department of Human Services started an energy management program in 1983. The energy management program has reduced annual utility costs from $5 million in fiscal year 1984 to $3 million in fiscal year 1995, expressed in 1988 dollars. Over this period, an investment of $4.3 million has produced savings of $13.5 million.

A mentorship program could encourage larger agencies with in-house technical expertise to help smaller facilities.

Recommendation No. 3

The State should develop the capacity to perform energy audits and to develop and implement energy management plans for all remaining state buildings. This could be accomplished either with State personnel or private sector contracts, or with a combination of both. In either case, a senior engineer would required to oversee the entire process.

Option A: Using State Personnel

The State could create one or more energy management engineering positions to perform energy audits and to support state agencies in developing energy management plans. These positions could be created either within the State Buildings Programs or within those agencies which own and operate large numbers of buildings.

Estimated Recommendation Costs and Benefits:

Energy management engineering positions would be senior engineering positions. Costs to the State would include salary, benefits, standard office support, travel and other modest expenses. ***Experience shows these costs likely will be recouped in less than a year after recommendations have been implemented, through low-cost or no-cost energy-efficiency measures alone.***

Option B: Using Private Sector Contracts

The State could contract with private energy service companies to provide a package of services for all or selected state agencies. Services would include in-depth audits of facilities, plans to implement cost-effective retrofits, project designs, purchasing, installation, construction management, financing, energy-savings monitoring, follow-up maintenance, and long-term training for maintenance staff. These services could be paid for through future energy bill savings.

Estimated Recommendation Costs and Benefits:

Costs to audit state buildings and develop energy management plans can range from one cent per square foot for a preliminary review to 20 cents per square foot for a thorough, work-order level plan. ***All costs could be paid through future savings.***

Building Operation and Maintenance

Implement New Operation and Maintenance Practices

The easiest way to achieve immediate energy savings in existing state buildings is to implement new operation and maintenance practices. These cost little or nothing to implement, yet often can save five percent or more in building energy costs and extend the life of equipment. This is the first step toward achieving an overall 10 to 15 percent savings in utility bills. New operation and maintenance practices might include turning off equipment when not needed, such as lights, fans and office machines; tuning equipment to operate at peak efficiency; caulking windows and doors to reduce air leakage; and insulating hot water pipes. Another common strategy, called "temperature setback," involves resetting thermostats to allow the temperature to drift 10 degrees downward during evenings and weekends in the winter heating season when the building is unoccupied.

However, operation and maintenance practices can be difficult to maintain over the long-term because they require ongoing participation by maintenance staff as well as occupants. Staff training is needed to communicate the tremendous benefits that operation and maintenance practices can achieve, develop expertise in operating equipment efficiently, and sustain operation and maintenance efforts from year-to-year. (See the *Staff and Training Needs* section for training recommendations.)

Initiate Preventive Maintenance Programs

Preventive maintenance involves keeping equipment tuned and well-maintained to avoid unnecessary breakdowns and costly unscheduled equipment replacements. Preventive maintenance involves routine equipment maintenance such as lubricating motors, changing air filters and replacing equipment at scheduled intervals. Preventive maintenance saves money on equipment in the long-run, unlike the standard practice of "reactive" maintenance where items are replaced or repaired only when they fail. Studies show buildings with effective maintenance programs use less energy. The cost of a preventive maintenance program is small compared to the energy, operation, repair and replacement costs of poorly maintained equipment.

Preventive Maintenance Programs

The State Buildings Programs evaluated various preventive maintenance methods and tools to recommend to agencies. As a result, Red Rocks Community College and the Colorado State Veterans Center implemented non-computerized preventive maintenance programs.

However, with the exception of some of the larger institutions, few state facilities have effective preventive maintenance programs. Due to work scheduling, lack of funds, or lack of trained staff, agencies may not focus on preventive maintenance. Our studies suggest that agencies need better information and expertise to develop effective preventive maintenance programs. Agencies also need resources to train personnel and implement successful programs. Smaller agencies have difficulty developing programs due to limited staff and expertise, so a statewide preventive maintenance program could help them maintain their facilities. (See the *Staff and Training Needs* section for training recommendations.)

Judicial/Heritage System

The Judicial/Heritage Complex installed a computerized preventive maintenance system for $450. "It virtually eliminates downtime," said Joe Lopez, Facilities Planning Manager, Colorado Judicial Branch. When equipment has failed, documentation of quality preventive maintenance enabled the complex to get insurance claims of $62,000 on motor replacements and $19,000 on a transformer.

Staff and Training Needs

Simple operation and maintenance procedures and preventive maintenance opportunities often are not implemented due to lack of expertise. Training programs for appropriate agency staff could help overcome this problem.

Some energy-efficient technologies, by their design and complexity, may require more maintenance. Many institutions do not have trained personnel to properly maintain these systems. Consequently, equipment may be neglected or even disconnected, failing to deliver projected performance. As new equipment is installed, maintenance personnel need to be trained to maintain the equipment at optimum efficiency.

Incentives

Experience in both the public and private sectors shows that individuals and agencies would be far more likely to implement operation and maintenance practices, or larger scope energy conservation measures, if they or their agency could directly benefit from the financial savings. If agencies could retain a portion of the savings, and accrue savings over the years, they could use the funds for further improvements. Agencies would see this advantage as a great incentive to cut energy costs.

Once accurate utility allocations are made (see *Tracking and Predicting Energy Use)*, the utility line-item can be used more creatively. If the utility line-item is frozen at the pre-retrofit level, at least for a little longer than the estimated payback period, the savings at the end of each year could be deposited in an agency-specific trust account to fund future improvement projects.

Recommendation No. 4

The State should train and provide appropriate incentives for building personnel to operate new and existing systems to achieve the greatest possible energy savings, as well as to recognize potential cost-effective applications for renewable energy. This could be achieved with state personnel or through private sector contracts.

Option A: Using State Personnel

The State could create an in-house program to train state personnel in operation and maintenance procedures that save energy and an incentive program for facility personnel to reduce energy use in their buildings, and utilize renewable energy technologies wherever cost-effective.

Estimated Recommendation Costs and Benefits:

A rough order of magnitude cost for an effective training program is estimated to be $1 million. A more accurate cost can be derived with further investigation. Experience suggests a solid training and incentives program can reduce energy costs by about five percent. The maximum program would include buildings totaling 20 million square feet for ***an estimated annual savings of $1 million (or a payback period of about a year)***. Effective programs can be implemented for less, but the benefits will be proportionately smaller.

Option B: Using Private Sector Contracts

The State could contract with a private firm or firms to offer training programs for maintenance personnel in agencies and facilities not involved in performance contracts. It is not yet clear how an incentive program for state employees might be implemented through private contracts.

Estimated Recommendation Costs and Benefits:

The costs and benefits of a training program run by a private firm under contract to the State likely would be comparable to those for a state-run program. Again, the ***costs could be paid through funding from future savings of participating agencies.***

Barriers and Solutions

Even with the development of energy management plans and better operation and maintenance activities, significant barriers to energy efficiency in state buildings remain. Specifically, more information is needed about energy use in state buildings, and adequate strategies must be identified to fund energy-efficient technologies.

Tracking and Predicting Energy Use

The basic operating principle of any energy management plan is "if you cannot measure it, you cannot manage it." Being able to measure the energy consumed by each building is essential for any successful plan. Verifying and documenting savings can only be accomplished with actual meter readings.

However, OEC's engineer found very few state agencies track utility consumption or review utility invoices on a regular basis. Compounding this problem is the lack of meters on individual buildings. A majority of state facilities still do not have separate building utility meters for electricity, gas or steam. This is particularly the case with buildings fed from one central power plant or grouped together in a campus-type environment. This makes it impossible to determine the actual amount of energy consumed in each facility.

Capitol Complex Metering

Nine buildings in Capitol Complex Facilities have a single meter between them for electricity, gas, and steam. At a cost of $75,000, Capitol Complex Facilities hopes to install meters in each building to monitor energy use and identify and correct potential problems before they occur. Metering capability will affect virtually all energy and utility-related systems and assist energy conservation efforts in the future.

According to Joint Budget Committee staff, utility allocations are made on the basis of the previous year's allocation and, with a few exceptions, have not changed since the mid-80s. Over-expenditures in the utility line-item must be made up from the operating line-item. Some agencies requested and were granted supplemental utility appropriations, making a case that their operating line-items could no longer absorb increasing utility expenditures.

This tendency to underfund utility line-items prevents state agencies from taking advantage of an otherwise useful provision of state law which allows them to use cost savings in the utility line-item to fund energy-efficient retrofits.

Better energy accounting would allow the State to establish a baseline of consumption and verify utility savings from energy reduction programs. The State also could do a better job of spotting variations in energy use patterns that can be caused by billing errors or unusual load changes, and determining if proper utility rate schedules are being used to achieve the lowest rates. And tracking can help identify maintenance problems as they begin to develop, potentially preventing costly and premature equipment replacements. Actual usage and costs can help predict costs for

the next fiscal year to improve the accuracy of utility allocations. The task of tracking can be completed at the agency level as long as training and information on the importance of monitoring energy use are provided.

Recommendation No. 5

The State should develop better tools to track energy use and costs in existing state buildings. Tracking energy use in specific buildings will allow the State to identify the best opportunities for savings as well as to verify successes. Effective use of other recommendations in this report will not be possible without these measures. Specifically:

a) The State should meter individual state buildings so that energy use can be tracked. This often will involve more than one meter per facility—one each for electric, gas and steam service. The Office of Energy Conservation and the State Buildings Programs could develop a method for agencies to determine those buildings for which metering will be cost-effective. These recommendations then should be included in agency facility master plans.

b) Each agency should use an accounting program to determine baseline energy use and to track consumption patterns. The Office of Energy Conservation could recommend appropriate software and train agency personnel in its use.

c) The Office of State Planning and Budgeting could review the current formula for predicting and allocating utility expenses in state agencies to ensure it is as accurate as possible. Any updated formula should be used to determine each agency's annual budget request.

Estimated Recommendation Costs and Benefits:

Metering costs per building will vary between $1,000 and $7,500, depending on the specific building. Software for tracking energy use would cost less than $1,000 per agency. Less than two person-hours per month per building would be required to process the information. The Office of Energy Conservation could provide training with existing resources. The Office of State Planning and Budgeting and the Office of Energy Conservation can develop and implement a formula for predicting utility expenses with existing resources. ***Without these measures, the benefits of other recommendations in this report cannot be optimized.***

Funding

Every report that has studied energy use in state buildings has concluded the state's reluctance to pay relatively high up-front costs is the key impediment to implementing cost-effective energy strategies. Implementing energy conservation and renewable energy projects requires significant

financial resources to achieve optimum savings, and these simply have not been a priority for decision-makers. There are no existing funding sources specifically for energy conservation retrofits and energy management projects in state buildings. Those funding options that are available are too limited or inflexible to achieve potential savings.

For instance, the current law allows state agencies to use their utility line-item budget for energy conservation retrofits. However, as pointed out above, those budgets are notoriously underestimated, making it nearly impossible for more agencies to take advantage of this option. Similarly, it is difficult for energy conservation projects to compete for controlled maintenance funds. Requests for these funds are prioritized by life safety, disruption of program, deterioration of building or equipment, and other factors. In the last two controlled maintenance funding cycles, for example, only one-fourth of the requests included any energy conservation projects, and the total portion of funds directly affecting energy conservation is considerably less.

Finally, some federal grant money has been used in the past to fund retrofits to some state facilities. As with most federal funds, however, these grants are shrinking or disappearing altogether.

Nevertheless, there are at least two effective options for funding energy efficiency in existing state buildings the state should consider. One is to create a separate energy conservation fund with state resources. The other is to use private sector contracts—called performance contracts—to achieve large-scale investments.

Energy Conservation Fund

The definition of capital construction in CRS 24-30-1301 includes efforts to "effect conservation of energy resources." Yet, just as controlled maintenance projects had difficulty competing with capital construction projects prior to establishment of a separate budget, energy efficiency projects have the same problem now. One solution might be to create a third category of construction, defined as Capital Energy Conservation Improvements in CRS 24-30-1301. This would allow energy projects to compete on a level playing field. Projects could be prioritized on a statewide basis to ensure funding of the most cost-effective projects. A variation on this approach might be to create a revolving fund with a one-time appropriation of state resources. This fund could be used to finance cost-effective retrofits, and it could be replenished or paid back through the savings achieved. While the initial investment would need to be fairly substantial, proper management of such a fund would ensure a permanent and ongoing source of funding for large energy conservation projects.

Another source of funding is the issuance of bonds to provide the initial capital. Bonds provide capital at a lower interest rate than private sector funding sources. Energy savings from each project would be used to pay off the bond. Further information on bonding is available in the aforementioned Energy Economics Inc. 1990 report.

Performance Contracts

A second option for funding energy efficiency is called "performance contracting." Performance contracting provides a way for the State to make facility improvements without increasing its budget. The dollars to be saved through greater efficiency become the resource to finance energy conservation projects, enabling energy conservation projects to be self-funded.

In a performance contract arrangement, state agencies contract with an energy service company (ESCo) which pays all up-front costs. These costs include an energy audit, project design, equipment purchase, installation, construction management and follow-up monitoring, as well as long-term training of maintenance staff. In return for its investment, the ESCo gets a fixed share of future energy savings during the specified contract period, usually five to ten years. At the end of the term, the State retains the equipment and receives all savings through the duration of the equipment's life.

Performance contracting offers many advantages:

- It provides an almost unlimited source of funds at no up-front risk to the State. Private companies invest their own resources, and the State is obliged to pay them back only if savings actually are achieved.

- Energy savings are guaranteed over the contract term, usually 5 to 10 years. Because profits depend on these savings, energy service company experts stay involved to ensure systems continue to achieve savings estimates.

- It is a comprehensive approach that maximizes savings. All cost-effective retrofits are implemented simultaneously to take advantage of the cost benefits resulting from optimizing systems. For example, if a lighting retrofit is done at the same time as a cooling system retrofit, a smaller capacity cooling system can be installed because the lights generate less unwanted heat. This can significantly reduce initial project costs.

- One contract handles multiple subcontractors and numerous equipment purchases throughout the auditing, design, installation and contract management phases of the project. The procurement and contract management burden is on the ESCo, not the State. This saves significant time and effort on the part of numerous state employees. It also provides a single point of contact in the event of a contract dispute with one or more of the subcontractors.

- A broad range of technical experts are available through ESCos to conduct audits, design systems, oversee installation, verify savings and train maintenance staff. The ESCo is directly involved with the building's performance throughout the long contract term and provides long-term, on-site operation and maintenance training to staff.

Even though energy savings are guaranteed to pay for the entire project, costs need to be kept in check. The Office of Energy Conservation and General Support Services are developing guidelines to ensure costs are comparable to existing state awards, other state and local government bids, nationally published cost data, or local practice. Additional costs particular to performance contracts include legal fees and interest on tax-exempt financing. These added costs are offset by

the savings generated from the virtually unlimited number of projects that can be implemented without awaiting funding allocations.

A two-step contractual process makes it easy for an agency to explore various performance contracting options before committing to the entire package. The first step authorizes the ESCo to conduct an energy audit to evaluate the cost benefit of potential projects and set forth potential options and terms for project financing. If audit results do not meet the terms established by an agency, the ESCo forfeits payment, making this step a no-risk commitment for the agency.

Capitol Complex Performance Contract

Capitol Complex Facilities used performance contracting to complete a $193,000 lighting improvements project in the Capitol and Centennial buildings. Without requiring any up-front investment from the State, the $42,000 per year savings paid for the project over a five-year period ending in December, 1995. The Department of Military Affairs and several universities also intend to use performance contracting. The total cost outlay will be approximately $5.5 million, yielding savings of about $827,000 annually.

If the audit produces desirable recommendations, an agency has the option to proceed with the second step—the performance contract. This step usually involves intensive negotiations while the agency and ESCo select projects to implement and agree on financial arrangements. Numerous other issues are addressed and included in the contract, including: delineation of duties for both the ESCo and agency to perform routine and emergency equipment maintenance procedures; standards for interior temperatures and light levels; methodologies to determine energy savings and associated payments to the ESCo; schedules for installation; and specifications and quantities of each type of equipment to be installed. A well-documented contract will mitigate any risk to the State.

The Office of Energy Conservation, General Support Services and the Office of the Attorney General are working together to develop a model contract and procurement methodology for future performance contracts. In the process of helping the Department of Military Affairs negotiate a performance contract, several potential legislative changes were identified that would make performance contracting an even more effective option for state agencies. For example, the existing statute on lease/purchase agreements needs to be modified to address performance contracts. Also, the audit contract requires an agency to temporarily encumber funds to cover the cost of the audit, usually more than $50,000, until a performance contract is signed. A separate fund is needed to cover this temporary encumbrance and to pay for the few audits that are not rolled into performance contracts. (See more detailed recommendations below.)

Prior to negotiating a performance contract, a "condition survey" may be necessary to determine the condition of existing equipment and systems. An agency needs to know the "working order" of its equipment in order to establish a basis for a contract. (If not already performed, this would require up-front costs.)

Recommendation No. 6

The State should make it easier to finance capital construction and controlled maintenance projects related to energy use. Funding options are detailed below:

Option A

The State could create a separate energy conservation capital fund to finance audits for and installation of energy-efficient equipment, energy-related renovations, and renewable energy technologies in state buildings. This fund could be: a separate part of the Capital Construction Fund; it could be created with a one-time appropriation from the General Fund; a transfer from another fund; or through the issuance of bonds. It then could be sustained by paying back to the fund a portion of the money saved on utility bills through energy-efficiency measures and avoided utility costs due to renewable energy production.

Estimated Recommendation Costs and Benefits:

An energy conservation capital fund could be created with any size appropriation or transfer of funds. ***Savings to the State will be proportional to the size of the fund.*** If this fund is used for measures with lifetimes of 15 years and average simple payback periods of 6 years, it would be comparable to an internal rate of return for the fund of 16 percent. (See footnote on page 1 for details.)

Option B

Modify existing law governing performance contracting in state government to:

a) Ensure energy saving revenues derived from performance contracts are returned to a separate energy conservation capital fund, as proposed above in *Option A,* or to another fund or funds specifically designated for the purpose. This provides an incentive to individual agencies, and accrued savings can be used to fund future energy conservation projects.

b) Define the process, terms and standards to be used by state agencies entering into performance contracts and update similar existing legislation for local governments. Performance contracting involves hybrid procurement and contract vehicles such as those used for design/build projects (when projects are designed and built simultaneously). Standard policies, procedures and documents are needed to meet the varied circumstances presented in performance contracts and provide clear guidance to agencies to ensure compliance with procurement and legal requirements, as well as maintain high contractor performance standards.

c) Amend Colorado Revised Statute 24-82-801 and Long Bill Headnotes pertaining to "utilities" to permit lease/purchase or installment purchase agreements in excess of $50,000 for purchase of energy-efficient equipment through performance contracts. Purchases would be paid through the existing utility line-item, which agencies are authorized to use for payments to ESCos. One problem with the line-item lease-purchase is that payments to an ESCo could potentially exceed the spending cap in the situation of higher-than-anticipated cost

savings, even though excess funds are available in the utilities line item. Another problem is guaranteed savings contracts involve an unconditional municipal lease-purchase type of obligation to a finance company, which is backed by the ESCo's contractual guarantee to the State for a guaranteed energy savings amount. In the event of a dispute, the State is potentially double-obligated on utilities appropriations during the six-month arbitration period if the savings do not materialize. A back-up source of spending authority is necessary in the event of the need to pay both the utility supplier and the bank while resolving performance disputes with the ESCo (guarantor). The estimated cost of funds difference is three or more percentage points.

d) Ensure that an energy conservation capital fund or other encumbered funds are available for paying energy audit costs if a state agency decides not to enter into a performance contract based on the audit. The audit is the first step undertaken by the ESCo to identify and evaluate potential energy-saving retrofits. The audit agreement ensures that the ESCo will identify cost-effective retrofits within a specified payback period, to eliminate the State's risk of paying for an audit that has no value. In order to enter into this agreement, however, funds need to be encumbered. If a performance contract is signed after the audit is completed, the cost of the audit can be incorporated into the overall project cost to be paid through future savings. The fund is only needed to temporarily cover the initial encumbrance and to pay for audits that identify cost-effective retrofits within a specified payback period but which, for whatever reason, do not result in performance contracts.

Estimated Costs and Benefits:

Performance contracting is virtually risk-free to the building owner, since all risks and up-front costs are assumed by the private contractor. While ESCos charge a reasonable percentage above actual expenses for overhead and profit, ***this added cost usually is more than offset by the benefits of guaranteed energy savings, a comprehensive approach to retrofits, and reduced administrative requirements and encumbered funds.***

Purchasing Strategies

Although not a financing option, the direct purchase of natural gas is a viable method of reducing utility costs. Natural gas is purchased directly from an independent supplier, and the local utility is used only to transport the gas. The local utility "transports" the gas and sometimes serves as a back-up supplier. Direct purchase of natural gas may be a viable option to reduce energy costs for agencies that purchase large amounts of gas. The State Buildings Programs energy conservation engineer helped agencies evaluate the potential benefit of direct purchase of natural gas and then helped several agencies solicit proposals. Many of the larger facilities have entered into agreements with local suppliers including the University of Colorado at Boulder, Colorado State

University and the Department of Institutions. Adams State College also entered into a contract for direct purchase of natural gas. An analysis was completed for the Department of Human Services for the direct purchase of gas. It is possible the State could solicit proposals for a statewide gas contract on behalf of all state agencies.

Additionally, electric rate schedule changes can be implemented to reduce energy costs. Interruptible rates, time-of-day rates and demand rates all offer an institution the mechanism to cut energy costs, although energy use will generally remain unaffected.

The State contracted with a private firm, Utility FactFinders Service, to review energy bills. Fourteen agencies participated to find billing errors or identify alternative rate schedules to reduce utility costs. The results of this work are found in the earlier table *Energy Conservation Projects Funded.* Similarly, Public Service Company of Colorado representatives will help clients review rate structures.

Summary of Recommendations

Recommendation No. 1

When constructing new buildings or making major renovations to existing buildings, the State should use an integrated design process, adhere to the latest energy standard for commercial buildings (ASHRAE/IES 90.1-1989), and use life-cycle energy costing as required by law. The State also should use the most efficient equipment and renewable energy technologies wherever they are cost-effective. And the State should require all new buildings to be metered. These recommendations would ensure that the State use the most cost-effective energy equipment and designs, resulting in the lowest possible utility costs over the lives of its buildings.

The Executive Branch can and should require state agencies to use an integrated design process, follow the ASHRAE standard, use life-cycle energy costing, and give full consideration to available renewable energy technologies when developing facility master plans. However, executive and legislative decision-makers also must be willing to accept the higher front-end or capital costs, which these strategies often require in order to achieve even greater savings over the long-term.

Recommendation No. 2

Individual state agencies and institutions of higher education should implement the state building energy management plans and follow up on the energy audits that were conducted in preparation for this report and in compliance with HB 93-1052. While portions of these plans already have been implemented, affected agencies should include the remaining recommendations from these plans and audits in their facility master plans. The Legislature should consider funding these plans because experience shows they will result in significant and ongoing savings to the State.

Recommendation No. 3

The State should develop the capacity to perform energy audits and to develop and implement energy management plans for all remaining state buildings. This could be accomplished either with State personnel or private sector contracts, or with a combination of both. In either case, a senior engineer would required to oversee the entire process.

Option A: Using State Personnel

The State could create one or more energy management engineering positions to perform energy audits and to support state agencies in developing energy management plans. These positions could

be created either within the State Buildings Programs or within those agencies which own and operate large numbers of buildings.

Option B: Using Private Sector Contracts

The State could contract with private energy service companies to provide a package of services for all or selected state agencies. Services would include in-depth audits of facilities, plans to implement cost-effective retrofits, project designs, purchasing, installation, construction management, financing, energy-savings monitoring, follow-up maintenance, and long-term training for maintenance staff. These services could be paid for through future energy bill savings.

Recommendation No. 4

The State should train and provide appropriate incentives for building personnel to operate new and existing systems to achieve the greatest possible energy savings, as well as to recognize potential cost-effective applications for renewable energy. This could be achieved with state personnel or through private sector contracts.

Option A: Using State Personnel

The State could create an in-house program to train state personnel in operation and maintenance procedures that save energy and an incentive program for facility personnel to reduce energy use in their buildings, and utilize renewable energy technologies wherever cost-effective.

Option B: Using Private Sector Contracts

The State could contract with a private firm or firms to offer training programs for maintenance personnel in agencies and facilities not involved in performance contracts. It is not yet clear how an incentive program for state employees might be implemented through private contracts.

Recommendation No. 5

The State should develop better tools to track energy use and costs in existing state buildings. Tracking energy use in specific buildings will allow the State to identify the best opportunities for savings as well as to verify successes. Effective use of other recommendations in this report will not be possible without these measures. Specifically:

a) The State should meter individual state buildings so that energy use can be tracked. This often will involve more than one meter per facility—one each for electric, gas and steam service. The Office of Energy Conservation and the State Buildings Programs could develop a method for

agencies to determine those buildings for which metering will be cost-effective. These recommendations then should be included in agency facility master plans.

b) Each agency should use an accounting program to determine baseline energy use and to track consumption patterns. The Office of Energy Conservation could recommend appropriate software and train agency personnel in its use.

c) The Office of State Planning and Budgeting could review the current formula for predicting and allocating utility expenses in state agencies to ensure it is as accurate as possible. Any updated formula should be used to determine each agency's annual budget request.

Recommendation No. 6

The State should make it easier to finance capital construction and controlled maintenance projects related to energy use. Funding options are detailed below:

Option A

The State could create a separate energy conservation capital fund to finance audits for and installation of energy-efficient equipment, energy-related renovations, and renewable energy technologies in state buildings. This fund could be: a separate part of the Capital Construction Fund; it could be created with a one-time appropriation from the General Fund; a transfer from another fund; or through the issuance of bonds. It then could be sustained by paying back to the fund a portion of the money saved on utility bills through energy-efficiency measures and avoided utility costs due to renewable energy production.

Option B

Modify existing law governing performance contracting in state government to:

a) Ensure energy saving revenues derived from performance contracts are returned to a separate energy conservation capital fund, as proposed above in *Option A,* or to another fund or funds specifically designated for the purpose. This provides an incentive to individual agencies, and accrued savings can be used to fund future energy conservation projects.

b) Define the process, terms and standards to be used by state agencies entering into performance contracts and update similar existing legislation for local governments. Performance contracting involves hybrid procurement and contract vehicles such as those used for design/build projects (when projects are designed and built simultaneously). Standard policies, procedures and documents are needed to meet the varied circumstances presented in performance contracts and provide clear guidance to agencies to ensure compliance with procurement and legal requirements, as well as maintain high contractor performance standards.

c) Amend Colorado Revised Statute 24-82-801 and Long Bill Headnotes pertaining to "utilities" to permit lease/purchase or installment purchase agreements in excess of $50,000 for purchase of energy-efficient equipment through performance contracts. Purchases would

be paid through the existing utility line-item, which agencies are authorized to use for payments to ESCos. One problem with the line-item lease-purchase is that payments to an ESCo could potentially exceed the spending cap in the situation of higher-than-anticipated cost savings, even though excess funds are available in the utilities line item. Another problem is guaranteed savings contracts involve an unconditional municipal lease-purchase type of obligation to a finance company, which is backed by the ESCo's contractual guarantee to the State for a guaranteed energy savings amount. In the event of a dispute, the State is potentially double-obligated on utilities appropriations during the six-month arbitration period if the savings do not materialize. A back-up source of spending authority is necessary in the event of the need to pay both the utility supplier and the bank while resolving performance disputes with the ESCo (guarantor). The estimated cost of funds difference is three or more percentage points.

d) Ensure that an energy conservation capital fund or other encumbered funds are available for paying energy audit costs if a state agency decides not to enter into a performance contract based on the audit. The audit is the first step undertaken by the ESCo to identify and evaluate potential energy-saving retrofits. The audit agreement ensures that the ESCo will identify cost-effective retrofits within a specified payback period, to eliminate the State's risk of paying for an audit that has no value. In order to enter into this agreement, however, funds need to be encumbered. If a performance contract is signed after the audit is completed, the cost of the audit can be incorporated into the overall project cost to be paid through future savings. The fund is only needed to temporarily cover the initial encumbrance and to pay for audits that identify cost-effective retrofits within a specified payback period but which, for whatever reason, do not result in performance contracts.

Glossary

Energy audit – an intensive study of a facility used to identify potential energy conservation projects and analyze the costs and benefits of those projects.

Energy life-cycle costing – evaluating the costs related to energy efficiency of equipment or construction materials by considering all costs incurred over the product's lifetime, including initial cost, maintenance cost, salvage value and demolition cost. (See p. 8.)

Energy management plan – a comprehensive, long-term strategy to reduce energy use in a building. (See p. 12.)

Integrated design process – integrating the expertise of the entire design team, including architects, mechanical and illumination engineers, landscape architects and other professionals, into the initial planning stage of a building to design a more energy-efficient and cost effective building. (See p. 7.)

Metering – installing electricity, gas, and steam meters to measure energy consumption and track energy costs at buildings. (See p. 19.)

Payback period – the number of years necessary to recover the costs of newly-installed energy conservation measures through savings.

Performance contracting – using private firms or energy service companies to manage and finance projects through future energy savings which result from energy conservation measures. (See p. 22.)

Photovoltaics – solar cells made of semiconductor materials that produce electricity directly from sunlight.

Renewable energy – energy that is converted from resources that are not depleted when used, including sunlight, wind and, in some cases, water.

Retrofit – refitting an existing building with energy conserving technologies such as efficient lighting, heating and cooling equipment.

Solar hot water system – a system that uses solar panels to collect energy from the sun to heat water.