LOCAL GOVERNMENT CLIMATE AND ENERGY STRATEGY SERIES

Energy Efficiency Programs in K-12 Schools

A Guide to Developing and Implementing Greenhouse Gas Reduction Programs

Energy Efficiency

U.S. ENVIRONMENTAL PROTECTION AGENCY
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EPA's Local Government Climate and Energy Strategy Series

The *Local Government Climate and Energy Strategy Series* provides a comprehensive, straightforward overview of greenhouse gas (GHG) emissions reduction strategies for local governments. Topics include energy efficiency, transportation, community planning and design, solid waste and materials management, and renewable energy. City, county, territorial, tribal, and regional government staff, and elected officials can use these guides to plan, implement, and evaluate their climate change mitigation and energy projects.

Each guide provides an overview of project benefits, policy mechanisms, investments, key stakeholders, and other implementation considerations. Examples and case studies highlighting achievable results from programs implemented in communities across the United States are incorporated throughout the guides.

While each guide stands on its own, the entire series contains many interrelated strategies that can be combined to create comprehensive, cost-effective programs that generate multiple benefits. For example, efforts to improve energy efficiency can be combined with transportation and community planning programs to reduce GHG emissions, decrease energy and transportation costs, improve air quality and public health, and enhance quality of life.

LOCAL GOVERNMENT CLIMATE AND ENERGY STRATEGY SERIES

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ENERGY EFFICIENCY

- Energy Efficiency in Local Government Operations
- Energy Efficiency in K–12 Schools
- Energy Efficiency in Affordable Housing
- Energy-Efficient Product Procurement
- Combined Heat and Power
- Energy Efficiency in Water and Wastewater Facilities

TRANSPORTATION

- Transportation Control Measures

COMMUNITY PLANNING AND DESIGN

- Smart Growth

SOLID WASTE AND MATERIALS MANAGEMENT

- Resource Conservation and Recovery

RENEWABLE ENERGY

- Green Power Procurement
- On-Site Renewable Energy Generation
- Landfill Gas Energy

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CONTENTS

Energy Efficiency in K-12 Schools

EXECUTIVE SUMMARY

Developing and Implementing Energy Efficiency Programs

Saving energy through energy efficiency improvements can cost less than generating, transmitting, and distributing energy from power plants, and provides multiple economic and environmental benefits. As President Obama said in June 2009, "By bringing more energy efficient technologies to American homes and businesses, we won't just significantly reduce our energy demand—we'll put more money back in the pockets of hardworking Americans." Energy efficiency also helps reduce air pollution and greenhouse gas emissions, improves energy security and independence, and creates jobs.

Local governments can promote energy efficiency in their jurisdictions by developing and implementing strategies that improve the efficiency of municipal facilities and operations and/or encourage energy efficiency improvements in residential, commercial, and industrial sectors. The energy efficiency guides in this series describe the process of developing and implementing strategies, using real-world examples, for improving energy efficiency in local government operations (see the guides on local government operations, energy-efficient product procurement, combined heat and power, and water and wastewater facilities), as well as in the community (see the guide on affordable housing).

Energy Efficiency in K-12 Schools

This guide describes how local governments can work with school districts to improve energy efficiency in existing, renovated, and new K-12 schools; reduce energy costs; and create a range of environmental, economic, and educational benefits. It is designed to be used by school district energy program managers, school districts and school boards, local government agencies, and mayors and city councils.

RELATED GUIDES IN THIS SERIES

- **Urban Planning and Design: *Smart Growth***

  Smart growth involves encouraging development that serves the economy, the community, and the environment. Smart growth principles favor a number of transportation and planning strategies—such as developing neighborhood schools and promoting bicycling and walking—that can reduce the costs and environmental impacts of getting children to and from school.

- **Transportation: *Transportation Control Measures***

  Transportation control measures are strategies that reduce vehicle miles traveled and improve roadway operations to reduce air pollution, GHG emissions, and fuel use from transportation. Because many of these measures encourage public transportation, carpooling, bicycling, and walking, they can also be used to help decrease the impacts of getting to and from school.

- **Energy Efficiency: *Energy-Efficient Product Procurement***

  Many local governments are saving energy by requiring that the energy-using products they purchase meet energy efficiency criteria. Schools can follow this same strategy to complement other efforts to improve energy efficiency in their buildings and other facilities.

- **Solid Waste and Materials Management: *Resource Conservation and Recovery***

  Like any other institution, school consume large quantities of materials and generate significant waste (including food waste) every day. Through activities such as source reduction, green purchasing, recycling, and composting, schools can further reduce their costs and environmental impacts, complementing efforts to improve energy efficiency.

Readers of the guide should come away with an understanding of options to improve energy efficiency in schools, a clear idea of the steps and considerations involved in developing and implementing them, and an awareness of expected investment and funding opportunities.

The guide describes the benefits of energy efficiency in K-12 schools (section 2); a step-by-step approach to improving energy efficiency in new and existing schools (section 3); key participants and their roles (section 4); the policy mechanisms that local governments have used to support energy efficiency programs in schools (section 5); implementation strategies for effective programs (section 6); investment and financing opportunities (section 7); federal, state, and other programs that may be able to help local governments with information or financial and technical assistance (section 8), and finally two case studies of local governments that have successfully improved energy efficiency in K-12 schools (section 9). Additional examples of successful implementation are provided throughout the guide.

Relationships to Other Guides in the Series

Local governments can use other guides in this series to develop robust climate and energy programs that incorporate complementary strategies. For example, local governments can combine efforts to improve energy efficiency in K-12 schools with **smart growth initiatives**, **transportation control measures**, efficient fleets programs for school buses, **energy-efficient product procurement**, and **resource conservation and recovery** programs to help schools achieve additional economic, environmental, and social benefits associated with reduced transportation emissions, increased recycling and composting of waste, and source reduction.

See the box on page v for more information about these complementary strategies. Additional connections to related strategies are highlighted in the guide.

1. OVERVIEW

Energy costs are second only to personnel costs as the leading draw on K-12 school district operating budgets, totaling approximately $8 billion annually nationwide (U.S. EPA, 2008; U.S. DOE, Undated). An estimated $2 billion of that total can be saved by improving energy efficiency in K-12 schools, an amount equivalent to the cost of nearly 40 million new textbooks (U.S. EPA, 2004b; U.S. DOE, 2006). As a result, many school districts are taking steps to improve the energy efficiency of their school buildings. Along with achieving significant energy cost savings, investing in energy efficiency can produce environmental, economic, and educational benefits.

K-12 SCHOOL ADMINISTRATION

A school is generally administered either locally (by a single municipal or county government with individual supervision) or regionally (by multiple municipalities that pool resources, often in the form of a school district or local education agency). This guide uses the term "school district" for school administrative units governed both locally and regionally.

Many local governments work closely with K-12 school district officials, who are often appointed by the local government executive or representative body. Because of this unique relationship, local governments are often well positioned to work through school districts to improve energy efficiency in K-12 school buildings. This guide provides information on how school districts, as extensions of local government, have planned and implemented programs to improve energy efficiency in existing school buildings and to incorporate energy efficiency in new school designs. It also includes information on the benefits of energy efficiency in K-12 school buildings, expected investment and funding opportunities, and case studies. Additional examples and information resources are provided in Section 10, *Additional Examples and Information Resources*.

2. BENEFITS OF ENERGY EFFICIENCY IN K-12 SCHOOLS

Improving energy efficiency in K-12 school buildings can produce substantial energy, environmental, and economic benefits, including:

- **Reduce greenhouse gas (GHG) emissions and other environmental impacts**. Improving energy efficiency in school buildings can help reduce GHG emissions and criteria air pollutants by decreasing consumption of fossil fuels. Fossil fuel combustion for electricity generation accounts for 40 percent of the nation's carbon dioxide (CO_2) emissions, a principle GHG, and 67 percent and 23 percent of sulfur dioxide (SO_2) and nitrogen oxide (NO_x) emissions, respectively, which can lead to smog, acid rain, and trace amounts of airborne particulate matter that can cause respiratory problems for many people (U.S. EPA, 2008l; U.S. EPA, 2008m).[1]

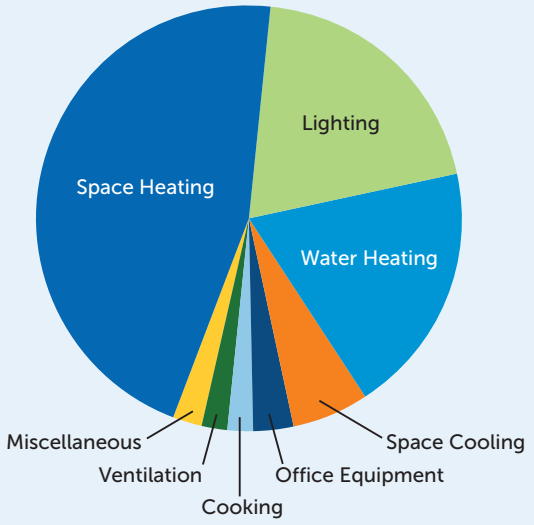
In 2005, the Council Rock School District in Newtown, Pennsylvania, established an energy management program and began recommissioning newer buildings and requiring ENERGY STAR labeled products, when possible, for new purchases. The district was recognized twice by EPA in 2007 as an ENERGY STAR Leader for improving its energy performance by 20 percent and then 30 percent, and was recognized again in 2009 for becoming the first ENERGY STAR school district partner to improve its performance by 40 percent across its entire portfolio. Council Rock also became a Top Performer in 2009 for achieving a portfolio-wide energy performance score of 84. It was named an ENERGY STAR Partner of the Year in 2008 and 2009. To date, the district's efforts have reduced CO_2 emissions by more than 7,000 metric tons, the equivalent of the annual emissions from more than 1,300 vehicles (U.S. EPA, 2009).

Reducing energy consumption can also contribute to other school district environmental objectives, such as resource conservation. For example, purchasing an ENERGY STAR labeled energy-efficient dishwasher

[1] *According to EPA, energy use in commercial and industrial facilities accounts for nearly 50% of all U.S. GHG emissions (U.S. EPA, 2008f).*

in an office kitchen to reduce energy costs can also help reduce water utility bills and decrease the amount of used water that enters the wastewater system (U.S. EPA, 2008v).

FIGURE 1 BREAKDOWN OF ENERGY USE IN K-12 SCHOOLS



Source: U.S. DOE, 2006b.

- **Reduce energy costs**. Schools spend approximately $75 per student on gas bills and $130 per student on electricity each year (U.S. EPA, 2008). Figure 1 provides a breakdown of energy consumption in K-12 schools by end use.[2] By implementing energy efficiency measures, many K-12 schools have been able to reduce energy costs by as much as 30 percent in existing facilities (U.S. EPA, 2004b). According to EPA, modification of a pre-existing building for energy efficiency (a process known as retrocommissioning; see page 13 for more information), can save a typical 100,000-square-foot school building between $10,000 and $16,000 annually, and simple behavioral and operational measures alone can reduce energy costs by up to 25 percent (U.S. EPA, 2008). Schools that have earned the ENERGY STAR label for superior energy performance cost $0.40 per square foot less to operate than conventional schools (U.S. EPA, 2008b).

Mahtomedi Public Schools ISD 832 educates 3,100 K-12 students in four schools in the northeastern Twin Cities metropolitan area. The district partnered with the Schools for Energy Efficiency[3] program and used ENERGY STAR support and resources to develop low- and no-cost strategies for improving energy performance. As a result, Mahtomedi ISD 832 has assessed the energy performance of all its schools and made improvements, such as lighting retrofits, that have helped realize avoided costs of more than $268,000. The school district became an ENERGY STAR Partner in 2005 and was recognized as an ENERGY STAR Leader the following year, with 10 percent improvement in energy use compared with its 2003–2004 baseline. The district built upon that success in 2007 with 20 percent improvement and was named a Top Performer in 2008 for achieving an average energy performance score of 82 for its schools (U.S. EPA, 2009h). (For more information on ENERGY STAR awards and recognition for energy performance improvements, see page 17.)

- **Increase economic benefits through job creation and market development**. Investing in energy efficiency can stimulate the local economy and encourage development of energy efficiency service markets. According to the Department of Energy (DOE), approximately 60 percent of energy efficiency investments goes to labor costs, and half of all energy-efficient equipment is purchased from local suppliers (U.S. DOE, 2004). Across the nation, energy efficiency technologies and services are estimated to have created more than 8 million jobs in 2006 (ASES, 2008).

- **Demonstrate leadership**. Investing in energy efficiency helps foster market demand for energy-efficient technologies from local residents and businesses, and demonstrates responsible stewardship of public resources since reduced energy costs translate into saved tax dollars. In addition, improving energy efficiency can provide an opportunity to introduce children to important energy and environmental issues (U.S. DOE, 2007).

[2] *The average school has an energy intensity of approximately 68,700 Btu per square foot (U.S. EPA, 2008).*

[3] *Schools for Energy Efficiency (SEE) is an ENERGY STAR partner that serves as a comprehensive program for K-12 schools to save energy and money by changing behavior throughout school districts. SEE provides a systemized plan, educational awareness materials, training, and utility tracking for immediate and sustainable savings.*

BETTER SCHOOL SITING CAN REDUCE ENERGY USE AND ENVIRONMENTAL IMPACTS

Both the location and design of a school play a major role in determining what benefits it provides to the community and what impact it has on the environment. If a community is interested in creating energy-efficient school facilities, it is important to consider both how the location will affect the way students, faculty, and staff get to and from the building and the building techniques used in construction and renovation. A school that is safe and easy for people to reach on foot or by bicycle helps reduce the energy used in automobiles and buses, and also lowers air pollution and greenhouse gas emissions and protects children's health. Locating schools in the neighborhoods they serve and reusing infrastructure and renovating buildings to create schools conserves energy and resources, preserves the natural environment, and avoids increases in contaminated water runoff from new impervious paved surfaces.

Local government practices and state policies affect school siting decisions. Minimum acreage requirements, facility reimbursement policies that favor new schools over renovated schools, and the trend toward larger schools (facilities and sites), all lead to schools being built on the fringe of the communities they serve and can increase transportation-related energy consumption. Local education agencies can access resources from organizations such as the Collaborative for High Performance Schools and the US Green Building Council for information on how to integrate location considerations into school facility planning and construction to counter this trend and how other green building techniques can complement location considerations and further lessen the environmental impact of schools. In addition, EPA is in the process of developing voluntary school siting guidelines for use by states and localities. These guidelines include both location and green building considerations and should be available in 2010. For more information on the voluntary school siting guidelines, see ***http://www.epa.gov/schools/siting.html***.

Sources: Kats, 2006; U.S. EPA, 2003d; U.S. EPA, 2009k.

In Montgomery County, Maryland, 10 high schools and middle schools participated in a pilot for the school district's School Eco-Response Team program, which helped the schools implement energy efficiency measures. In return for being allowed to retain a portion of the energy cost savings, the schools agreed to serve as mentors to students in district elementary schools to encourage broader understanding of energy and environmental issues (U.S. DOE, 2004).

- **Improve student performance**. Energy-efficient school building designs often use natural daylight to reduce the energy needed to light a building. Natural light has also been proven to have a positive effect on student performance. According to a study for the California Board for Energy Efficiency, students exposed to natural daylight in classrooms progress as much as 20 percent faster on math tests and as much as 26 percent faster on reading tests than students with no daylight exposure (HMG, 1999). Another study concluded that students in schools that offer systematic environmental education programs have higher test scores than students in schools with no such programs (U.S. EPA, 2008). Improving energy efficiency in K-12 school buildings can also have the indirect benefit of improving acoustic comfort (i.e., enabling effective communication by minimizing audible disturbance from outside and inside), which can also lead to improved student performance (U.S. EPA, 2008).

- **Improve indoor air quality**. Some energy efficiency upgrades can improve occupant health by enhancing indoor air quality. Installing energy recovery ventilation equipment, for example, can reduce infiltration of air contaminants from outdoors while significantly reducing heating, ventilation, and air conditioning (HVAC) energy loads (U.S. EPA, 2003). One study on building performance found the average reduction in illness as a result of improved air quality in buildings is about 40 percent (Carnegie Mellon, 2005).

In Colorado Springs, Colorado, the local school district has developed an integrated energy efficiency and indoor air quality management program that produces more than $900,000 in annual energy cost savings while significantly improving the air quality in school buildings for students, faculty, and staff. (While the average K-12 school uses approximately 70,000 Btu per square foot per year, this district's goal is to consume just 25,000 Btu per square foot per year, a reduction of more than 64 percent). The program uses energy cost savings from efficiency upgrades to offset the costs of achieving superior indoor air quality without transferring the costs to taxpayers. The energy efficiency and indoor air quality improvements have been implemented through an energy performance contract that has enabled the school district to use energy cost savings to pay for the upgrades. As a result of the upgrades, the district has been able to meet its indoor air quality goal of 700 parts per million (ppm) CO_2 or less during occupied hours (U.S. EPA, 2008h).

INDOOR AIR QUALITY IMPLICATIONS FOR ABSENTEEISM

According to the American Lung Association, asthma is the number one cause of school absences attributable to chronic illness in the United States. Improving energy efficiency in K-12 schools can reduce the risk of asthma attacks in students and staff by reducing the potential for infiltration of untreated air or accumulation of air quality-impairing contaminants (e.g., mold, dust mites, cockroaches, and certain chemicals). Increasing building envelope insulation, for example, can reduce energy waste while preventing infiltration of untreated outdoor air. Maintaining HVAC system components (e.g., cleaning refrigerator coils) can improve indoor air quality by removing unwanted contaminants. In addition, testing and calibrating HVAC system components can improve overall ventilation effectiveness.

- **Increase attendance**. An indirect benefit of energy efficiency measures in school buildings is an increase in school attendance rates. According to an analysis for the State of Washington, incorporating green building measures in school designs improves indoor air quality and can reduce absenteeism rates by as much as 15 percent (Washington, 2005). Also, since many school operating budgets are determined by average daily attendance, even a small reduction in absenteeism can save money (CHPS, 2006).

- **Enhance educational opportunities**. Energy-efficient school buildings can give students hands-on opportunities to learn about the benefits of smart energy management. (U.S. DOE, 2006). Several K-12 schools have used energy efficiency improvements as opportunities to adapt academic curricula to promote awareness of energy and environmental issues. Some school districts have installed energy data kiosks in K-12 school buildings so students can monitor their school's energy consumption.

SAN LEANDRO UNIFIED SCHOOL DISTRICT, CALIFORNIA—EDUCATIONAL OPPORTUNITIES

In 2006, McKinley Elementary School, located in the San Leandro Unified School District in California, performed a lighting system retrofit that reduced lighting energy consumption by 49%. Inspired by the energy savings, a group of teachers worked with the California Public Utilities Commission's School Energy Efficiency Program to plan an energy efficiency open house and integrate educational opportunities into the curriculum that would help students learn about energy through hands-on experience. Educational materials were provided by the National Energy Education Development Project, a nonprofit organization that has created programs in many States to integrate energy efficiency lessons into everyday learning.

Source: SEE, 2006.

- **Increase security and safety**. Improving energy efficiency in K-12 school buildings can have positive effects on school security and student safety. For example, energy-efficient exterior lighting can enhance security while reducing energy costs by providing effective and even light distribution (U.S. EPA, 2008).

- **Other benefits**. Other benefits from improving energy efficiency in K-12 school buildings include improvements in teacher retention rates, reductions in insurance costs, and reduced legal liability due to improved indoor environmental quality (Capital E, 2006; CHPS, 2006).

  In California, Stockton's guidelines for developing energy-efficient school buildings in its K-12 school district cite lower risks of legal action stemming from inadequate indoor environmental quality as a benefit of school commissioning (Stockton, 2007).

3. PLANNING AND DESIGN APPROACHES TO ENERGY EFFICIENCY IN K-12 SCHOOLS

When planning and designing programs to improve energy efficiency in existing K-12 school buildings and incorporate energy efficiency in new school building designs, it is important for school districts to remain continually aware of the following aspects of school building performance that are integrally conducive to healthy and effective learning:

- **Indoor air quality**. Measures that improve occupant health and indoor air quality, such as good ventilation, are especially important in school buildings. According to a 1999 U.S. Department of Education study, approximately 26 percent of the nation's school buildings have inadequate quantities of fresh air (NREL, 2002). Poor indoor air quality can lead to occupant illness and potential lawsuits against school districts. Some school districts rely on retrocommissioning records as proof they are meeting indoor air quality standards (U.S. EPA, 2008).

- **Thermal, visual, and acoustic comfort**. Energy efficiency measures that improve the thermal, visual, and acoustic comfort of a school building can significantly improve student performance. Several studies have shown that daylighting in schools, along with other design strategies, improves students' capacity to learn in shorter periods of time (CHPS, 2006a, 2006b).

ENERGY EFFICIENCY MEASURES TAILORED TO ACOUSTICAL NEEDS

When Red Wing High School in Red Wing, Minnesota, needed to upgrade its HVAC system to improve indoor air quality, it worked with an architectural firm to ensure that installing new energy-efficient ductwork and fans would not compromise its priority of ensuring acoustic quality in critical spaces, such as the media center; the band, choir, and orchestra hall; and the theatre. In addition to preserving acoustic quality, the new HVAC system saves the school $120,000 annually in energy costs.

Source: Trane, 2007.

- **Security and safety**. Energy-efficient design can improve security and safety in school buildings. For example, using glass partitions between classrooms and hallways can increase daylight penetration and surveillance capabilities (NREL, 2002b).

Ensuring that these particular aspects of school building performance are included in energy efficiency program plans is a priority for many school districts. In addition, many energy efficiency projects can have multiple benefits. For example, energy-efficient daylighting strategies that reduce energy consumption can also enhance visual comfort for students, faculty, and staff, and have positive effects on students' learning (U.S. EPA, 2008).

The following subsections describe approaches that school districts can follow when planning and designing projects and programs to improve energy efficiency in K-12 school buildings. These approaches can help schools achieve the range of benefits described in Section 2, *Benefits of Energy Efficiency in K-12 Schools*. Specifically, this section addresses:

- Improving energy efficiency in existing and new school buildings.
- Incorporating energy efficiency in new and renovated green school buildings.

Improving Energy Efficiency in Existing and New Schools

The most effective way to reduce school district energy consumption is to engage in a portfolio-wide, systematic approach for improving energy efficiency in existing school facilities and properly design new and renovated school buildings. A portfolio-wide approach not only results in larger total reductions in school district energy costs and GHG emissions, but enables school districts to offset the costs of more substantial energy efficiency projects in buildings that have higher upfront costs with the savings from projects in other buildings. In addition, adopting a portfolio-wide approach can help local governments and school districts generate greater momentum for energy efficiency activities, which can lead to sustained implementation and continued savings.

A good place for school districts to start is EPA's ENERGY STAR program, which has developed a systematic approach for achieving superior energy management in existing buildings. This approach, summarized in the *ENERGY STAR Guidelines for Energy Management* (U.S. EPA, 2008v) and in Figure 2, *Overview of ENERGY STAR Guidelines for Energy Management*, involves seven steps:

- Step 1. Make Commitment
- Step 2. Assess Performance
- Step 3. Set Goals
- Step 4. Create Action Plan
- Step 5. Implement Action Plan
- Step 6. Evaluate Progress
- Step 7. Recognize Achievements

This section provides information on key strategies for each of these steps. While the primary focus of this section is to describe an overall approach to improving energy efficiency in a portfolio of existing buildings, the basic concepts can be applied to planning and design of energy-efficient new and renovated buildings. Tools and resources for addressing energy efficiency in these projects are identified in this section. In addition, the planning and design approach for improving energy efficiency in school buildings (described in this section) is also one of the most important components of a successful green school building program

FIGURE 2 OVERVIEW OF ENERGY STAR GUIDELINES FOR ENERGY MANAGEMENT

The ENERGY STAR Guidelines for Energy Management presents a seven-step approach to achieving superior energy management and savings across a portfolio of buildings.

For detailed descriptions of the above steps, see *http://www.energystar.gov/index.cfm?c=guidelines.guidelines_index.*

The steps include:

1. Make Commitment
   - Establish an Energy Team
   - Institute an Energy Policy
2. Assess Performance
   - Collect and Manage Data
   - Establish Baselines and Benchmarks
   - Analyze Data and Conduct Technical Assessments and Audits
3. Set Goals
   - Estimate Potential for Improvement
   - Establish Goals
4. Create Action Plan
   - Define Technical Measures and Targets For Each Building
   - Determine Roles and Resources
5. Implement Action Plan
   - Create a Communication Plan, Raise Awareness, Build Capacity, and Motivate
   - Track and Monitor Progress
6. Evaluate Progress
   - Measure Results
   - Review Action Plan
7. Recognize Achievements
   - Internal Recognition
   - External Recognition

(described in the following section, Energy Efficiency in Green School Buildings).

While this section describes an approach for implementing a comprehensive portfolio-wide energy efficiency strategy, there are cases where sufficient resources (e.g., funding and personnel resources) are not available. In these instances, school districts can apply the concepts to one or a few schools. Experiences from such demonstration projects can then be used to make the case for further energy efficiency improvements, and subsequently can be applied to a broader portfolio when additional support and/or resources become available.

Table 1, *ENERGY STAR Program Resources*, summarizes the many ENERGY STAR tools and resources available for planning and implementing programs to improve energy efficiency in existing school buildings and for incorporating energy efficiency in new school designs.

TABLE 1 ENERGY STAR PROGRAM RESOURCES

Title/Description	Web Site
ENERGY STAR Tools and Guidance for Existing and New Buildings	
Guidelines for Energy Management. EPA provides the seven-step Guidelines for Energy Management to assist in developing and implementing energy efficiency action plans.	*http://www.energystar.gov/index.cfm?c = guidelines.guidelines_index*
Guidelines for Energy Management Assessment Matrices. EPA has developed a matrix to help energy managers determine whether their organizations' practices are consistent with Guidelines for Energy Management. A second matrix allows managers to compare current energy management practices to the guidelines at the facility level.	*http://www.energystar.gov/ia/business/guidelines/assessment_matrix.xls* *http://www.energystar.gov/ia/business/guidelines/Facility_Energy_Assessment_Matrix.xls*
Portfolio Manager. School districts can use EPA's Portfolio Manager tool to benchmark the energy performance of their schools, establish baselines, prioritize investments opportunities, set reduction goals, verify results, and earn national recognition for energy efficiency improvements and top performance. For certain building types, such as K-12 schools, Portfolio Manager can be used to rate building performance on a scale of 1 to 100 relative to similar buildings nationwide—normalized for weather, square footage, and other characteristics.	*http://www.energystar.gov/index.cfm?c = evaluate_performance.bus_portfoliomanager*
ENERGY STAR Label. Buildings that achieve a score of 75 or higher using Portfolio Manager, and are professionally verified to meet current indoor environment standards, are eligible to apply for the ENERGY STAR label. The label is available for office buildings, school buildings, hospitals, courthouses, and other facilities.	*http://www.energystar.gov/index.cfm?c = evaluate_performance.bus_portfoliomanager_intro*
Profiles of ENERGY STAR Labeled Buildings and Plants. EPA has compiled profiles of ENERGY STAR labeled government buildings, accessible at its Web page ENERGY STAR Labeled Buildings and Plants.	*http://www.energystar.gov/index.cfm?fuseaction = labeled_buildings.showBuildingSearch*
Building Upgrade Manual. The ENERGY STAR Building Upgrade Manual describes a five-step systematic approach to improving energy efficiency in existing buildings, including recommissioning/commissioning, lighting, supplemental load reductions, fan system upgrades, and heating and cooling system upgrades. The manual includes an additional chapter on unique challenges and opportunities in K-12 school buildings.	*http://www.energystar.gov/index.cfm?c = business.bus_upgrade_manual*
Target Finder. EPA's Target Finder lets a user establish an energy performance target for a design project or major building renovation based on similar building types and desired energy performance. Users can enter a project's estimated energy consumption and compare it to the target to see whether the project will achieve its goal.	*http://www.energystar.gov/index.cfm?c = new_bldg_design.bus_target_finder*
"Designed to Earn the Energy Star" Label. Building designs that achieve a score of 75 or higher using Target Finder are eligible to receive the "Designed to Earn the ENERGY STAR" designation. By benchmarking actual energy use in Portfolio Manager, these buildings can apply for the ENERGY STAR if they remain in the top quarter of the energy performance scale after 1 year of operation.	*http://www.energystar.gov/index.cfm?c = new_bldg_design.new_bldg_design_benefits*
Target Finder Opportunities Flowchart. A flow chart detailing opportunities to use Target Finder to assess projected design performance.	*http://www.energystar.gov/ia/business/tools_resources/new_bldg_design/Design_process_flow_diagram_101404.pdf*
Integrated Energy Design Guidance. EPA provides guidance on planning and designing buildings that integrate energy efficiency improvements. This guidance includes information on how to use tools such as Target Finder to design buildings that achieve energy performance goals.	*https://www.energystar.gov/index.cfm?c = new_bldg_design.new_bldg_design_guidance*
Integrated Energy Design Guidance Checklist. A checklist that highlights components in the design process that can lead to ENERGY STAR labeling.	*http://www.energystar.gov/ia/business/tools_resources/new_bldg_design/BuildingDesignGuidanceChecklist_101904.pdf*

TABLE 1 ENERGY STAR PROGRAM RESOURCES *(cont.)*

Title/Description	Web Site
ENERGY STAR Financial Calculators	
Cash Flow Opportunity Calculator. This tool can be used to determine how much new energy-efficient equipment can be purchased based on estimated cost savings; determine whether equipment should be purchased now using financing, or if it is better to wait and use cash from a future year's budget; and determine whether money is being lost by waiting for lower interest rates.	*http://www.energystar.gov/index.cfm?c = assess_value.financial_tools*
Financial Value Calculator. This tool presents energy efficiency investment opportunities in terms of key financial metrics. It can be used to determine how energy efficiency improvements can affect organizational profit margins and returns on investments.	*http://www.energystar.gov/index.cfm?c = assess_value.financial_tools*
Building Upgrade Value Calculator. This calculator can be used to estimate the financial benefits of improving energy efficiency in office buildings.	*http://www.energystar.gov/index.cfm?c = assess_value.financial_tools*
Savings Calculators. These calculators can be used to estimate the life-cycle and annual costs and savings of a variety of ENERGY STAR labeled products.	*http://www.energystar.gov/index.cfm?c=bulk_purchasing.bus_purchasing*
ENERGY STAR Resources for K-12 Schools	
ENERGY STAR for K-12 Schools. This Web site provides resources for school districts to use as they plan energy efficiency activities, including energy management guidelines, information on financing options, and tools and resources to measure and track energy use.	*http://www.energystar.gov/index.cfm?c = k12_schools.bus_schoolsk12*
ENERGY STAR Leaders. This Web site provides information on the criteria to become an ENERGY STAR Leader. Based on Portfolio Manager results, ENERGY STAR Leaders recognition is provided for the following achievements: portfolio-wide energy efficiency improvements of 10%, 20%, or 30% (or more) reductions in normalized energy use. Partners with an average score of 75 or better portfolio-wide are recognized as **Top Performers**.	*http://www.energystar.gov/index.cfm?c=leaders.bus_leaders*
ENERGY STAR for Kids. School districts can use energy efficiency projects in school buildings as learning opportunities for their students. This Web site provides information for kids about energy efficiency.	*http://www.energystar.gov/index.cfm?c = kids.kids_index*
ENERGY STAR Success Stories. This Web site offers a series of K-12 energy efficiency success stories from school districts around the country.	*http://www.energystar.gov/index.cfm?c = k12_schools.bus_schoolsk12*
Indoor Air Quality in Schools. This Web site offers resources on integrating energy efficiency and indoor air quality goals in school buildings.	*http://www.energystar.gov/index.cfm?c = k12_schools.bus_schoolsk12_indoor_airquality*
Additional ENERGY STAR Resources and Tools	
ENERGY STAR for Government. This Web site provides resources for state and local governments to use as they plan energy efficiency activities, including energy management guidelines, information on financing options, and tools and resources to measure and track energy use.	*http://www.energystar.gov/index.cfm?c = government.bus_government*
ENERGY STAR Challenge. Build a Better World 10% at a Time. The program calls on governments, school buildings, and businesses across the country to identify energy efficiency improvements in their facilities and improve energy efficiency by 10% or more. EPA estimates that if each building owner accepts this challenge, by 2015 Americans would save about $10 billion and reduce GHG emissions by more than 20 million metric tons of carbon equivalent, equal to the emissions from 15 million vehicles.	*http://www.energystar.gov/index.cfm?c = challenge.bus_challenge*
ENERGY STAR Free Online Training. ENERGY STAR offers free online training sessions on a variety of energy performance topics.	*http://www.energystar.gov/index.cfm?c = business.bus_internet_presentations*
Off the Charts. Off the Charts is EPA's ENERGY STAR e-newsletter on energy management developments and activities.	*http://www.energystar.gov/ia/business/guidelines/assess_value/Off_the_Charts_Summer_2007.pdf*

STEP 1: MAKE COMMITMENTS

Committing to a policy for improving energy efficiency in a specified portfolio of buildings is an important first step for ensuring success. This step involves: (1) identifying a team of qualified personnel to initiate and lead the energy policy development process, and (2) instituting and committing to an energy policy based on the team's guidance and recommendations.

- **Use a team approach**. Identifying a team of qualified and experienced personnel from across the school district to initiate and lead the policy development process helps ensure that energy efficiency programs are carefully crafted. Bringing together a team of interested individuals with diverse backgrounds in school operations also ensures that energy efficiency programs receive broad support.

  In addition to using a team approach for developing the overall school district energy efficiency policy, a team approach can be applied within individual buildings. At the building level, upgrading and designing energy-efficient buildings requires all project team members to be involved early in the pre-design stages, when the project's energy performance targets are set, to ensure that future decisions will be made with the project intentions intact. The team works together to identify information needs and share knowledge of each building system to achieve optimal integration.

  EPA has developed a factsheet providing information on building a team to develop and implement energy efficiency programs, available at *http://www.energystar.gov/ia/business/challenge/get_started/CreateATeam.pdf*. For more information on using a team approach to continually develop and improve an overall school district energy efficiency program, see Section 6, *Strategies for Effective Program Implementation*.

- **Establish and commit to an energy policy**. Based on input from the energy policy team, the next step is to formalize the school district's commitment to improving energy efficiency. Instituting an energy policy that clearly states a school district's objectives can help secure support from elected officials and buy-in from schools. In addition, committing to a formalized energy policy facilitates accurate and useful tracking of the impacts of energy efficiency programs.

  Many school districts have included in their energy policies a range of commitments to specific actions that can eventually lead to easier and more effective implementation of an overall energy efficiency program. These commitments include:

  - ***Improving energy efficiency across an entire portfolio.*** A number of school districts have adopted energy policies that include commitments to reducing energy consumption in their facilities by a specific percentage portfolio-wide. These commitments provide a clear objective toward which progress can be continually measured. As of November 2008, nearly 200 school districts have committed to improving energy performance by 10 percent across their entire school building portfolios through the ENERGY STAR Challenge.

    In November 2005, Council Rock School District in Newtown, Pennsylvania, an ENERGY STAR Partner of the Year with 17 facilities, adopted an energy policy that established a goal for the school district to improve energy efficiency across its portfolio of buildings by 10–15 percent. By 2007 the school district had improved its energy efficiency by 30 percent, earning recognition as an ENERGY STAR Leader for reaching this important energy-saving milestone (U.S. EPA, 2008j).

  - ***Using life-cycle cost analysis.*** Because school districts plan to use their school buildings for up to 50 years, they are well positioned to adopt life-cycle cost analyses when making decisions about purchasing energy-using products (U.S. EPA, 2008). Traditional methods for assessing project cost effectiveness typically focus on the initial design and construction costs. The life-cycle cost of a product or service is the sum of the present values of the costs of investment, capital, installation, energy, operation, maintenance, and disposal over the life of the product (U.S. DOE, 2003). Because life-cycle cost analysis reveals whether energy efficiency investments are cost-effective over the long run, it can be an important feature of an overall energy policy.

    Some school districts use life-cycle cost analyses to prioritize energy efficiency activities and energy-efficient products based on comparative simple payback periods. Common applications of life-cycle cost analysis that can be used by school

districts include analyses of efficiency targets for buildings, machinery, and electronic equipment for the office. Life-cycle cost analysis can be particularly useful when evaluating high-cost infrastructure and renewable energy opportunities (Union of British Columbia Municipalities, 2009).

EPA has developed savings calculators that school districts can use to assess the life-cycle and annual costs and savings of a variety of ENERGY STAR labeled products, available at ***http://www.energystar.gov/index.cfm?c=bulk_purchasing.bus_purchasing***. For a list of ENERGY STAR labeled products that are relevant for schools, refer to Table 3, *ENERGY STAR Specification Overviews: Energy Savings and Payback Periods*.

- ***Purchasing energy-efficient products.*** Some school districts are making procurement policies for efficient products explicit parts of their energy policies. (See EPA's *Energy-Efficient Product Procurement guide in the Local Government Climate and Energy Strategy Series* for more information and local government examples.) Purchasing energy-efficient products can make comprehensive energy efficiency upgrades more cost-effective by reducing building energy loads (and the size of the systems needed to meet those loads), typically by as much as 10 percent (LBNL, 2002). Table 2 summarizes the potential energy and CO_2 savings associated with purchasing energy-efficient products for five product categories.

- ***Ensuring energy efficiency is a key component of green school programs.*** Energy efficiency can be integrated with other green building measures to achieve additional energy, environmental, indoor air quality, and water savings benefits. Designing for superior energy performance is often the first step in building green school buildings, and can improve environmental performance and overall cost effectiveness of a green building strategy (U.S. EPA, 2003; U.S. EPA, 2006). See the following subsection, *Energy Efficiency in Green Schools*, for additional information.

STEPS 2 AND 3: ASSESS BASELINE ENERGY PERFORMANCE AND SET GOALS

After making a commitment, the next two steps to improve energy efficiency across a portfolio of school buildings are to assess baseline energy performance and set goals. Assessing energy performance involves looking at how energy is used in existing school buildings and identifying priority opportunities to improve energy efficiency. Setting goals, on the other hand, involves looking at potential savings in new and renovated school buildings as well as existing ones.

Assess Baseline Energy Performance in Existing Schools

Understanding the impacts of improvements in energy efficiency in existing school buildings requires periodically reviewing a school's energy performance by comparing current energy consumption to its baseline consumption (established at a specified time in the past). Key approaches for assessing baseline building energy performance include:

- **Use available, standardized tools for baseline energy consumption assessments**. Standardized tools can help assess baseline energy performance and track building energy data. For example, EPA's Portfolio Manager is an online tool that can assess baseline energy performance in existing buildings, including school buildings, and compile data across a portfolio of buildings (U.S. EPA, 2008n).

  In 2003 the Whitefish Bay School District in Wisconsin, working with Energy Education, Inc.[4] and using Portfolio Manager, began an energy improvement program to help control rising energy costs. Since its baseline year of 2003, the district has succeeded in reducing energy use and cost by more than 20 percent, resulting in cost savings of more than $927,000, or the cost of 13 full-time staff. The school district has been recognized by EPA as an ENERGY STAR Top Performer for having an energy performance score of 75 or better across its portfolio of buildings (U.S. EPA, 2009b).

- **Benchmark buildings**. Benchmarking involves comparing a building's energy performance to the performance of similar buildings across the country. For certain building types, including school buildings, EPA provides an energy performance score in Portfolio Manager to compare buildings nationwide on a scale of 1–100. For example, a score of 75 means the evaluated building performs better than 75 percent of similar buildings nationwide. This information can help school

[4] *Energy Education Inc. is an ENERGY STAR partner that creates and implements energy conservation programs for schools and other organizations by focusing on organizational and behavioral change.*

TABLE 2 ESTIMATED ENERGY COST AND CO_2 SAVINGS FROM A SAMPLE OF ENERGY STAR PRODUCTS[a]

Action	Annual Energy Cost Savings	Annual CO_2 Savings (Tons)	Lifetime (Years)	Life-Cycle Energy Cost Savings	Life-Cycle CO_2 Savings (Tons)
Replace 5,000 computers and monitors with ENERGY STAR labeled products and activate power management	*$290,210*	*2,177*	*4*	*$663,428*	*8,708*
Replace 10 conventional commercial dishwashers with ENERGY STAR labeled products	*$8,690[b]*	*57*	*10*	*$60,483[b]*	*567*
Replace 50 conventional vending machines with ENERGY STAR labeled products[c]	*$8,544*	*64*	*14*	*$90,250*	*894*
Replace 100 conventional water coolers with ENERGY STAR labeled coolers	*$3,722*	*28*	*10*	*$30,188*	*278*
Replace 500 incandescent exit signs with ENERGY STAR labeled LED exit signs	*$16,737 in energy costs plus $33,696 in maintenance costs*	*125*	*10*	*$484,800 in energy and maintenance savings net price differential*	*1,251*

[a] Figures obtained from calculators on the ENERGY STAR Purchasing & Procurement Web site *http://www.energystar.gov/purchasing* using default settings and an electricity rate of 10.3¢ per kWh (EIA, 2009). Annual costs exclude the initial purchase price and installation cost. All costs are discounted over the product's lifetime using a real discount rate of 4%.

[b] Value includes water savings.

[c] Vending machines assumed to have capacities of less than 500 cans.

districts prioritize buildings for energy efficiency investments and/or a comprehensive energy audit (see the next bullet, below).

The Davenport Community School District in Davenport, Iowa, is using an automated benchmarking system to rate and track the performance of 29 of its school facilities. Formerly the school district manually entered energy consumption data for each facility into Portfolio Manager, but has recently installed software that automatically communicates with EPA's system so that energy consumption data is directly translated at regular intervals into performance scores. This automated tracking system enables the school district to periodically identify low-performing energy-using systems and prioritize energy efficiency investments. Using this information and following the *ENERGY STAR Guidelines for Energy Management*, the district has reduced energy costs by $1.2 million since the 2003–2004 schoolyear (U.S. EPA, 2008l).

- **Conduct technical assessments and audits**. In addition to establishing baseline energy performance and determining a school's relative performance compared to its peers, a thorough energy performance assessment includes comparing the actual performance of a school's systems and equipment with its designed performance level or the performance level of top-performing technologies. These technical assessments can be conducted as part of a whole-building energy audit by an energy professional and used to identify priority energy efficiency investments.

  Many school districts have incorporated these energy audits into energy performance contracts, which offer a one-stop process for purchasing, installing, maintaining, and often financing energy efficiency upgrades at no upfront cost. EPA has developed a directory of energy professionals, energy service companies

(ESCOs), and other companies that can provide school districts with expert advice and technical assistance on conducting energy audits and entering energy performance contracts. [5] For more information on energy performance contracting, see Section 7, Investment and Financing Opportunities.

Set Goals For Existing and New School Building Portfolios

School districts can establish portfolio-wide energy efficiency goals for their building portfolios (including existing and new school buildings) to help maintain momentum for energy management activities, guide daily decisionmaking, and track and measure progress. For existing school buildings, portfolio-wide goals can be based on the results of the baseline energy performance assessment and the priority investments identified through that process. For new buildings, goals can be based on output from energy performance projection tools and best practices.

Key considerations for setting portfolio-wide goals include:

- **Consider potential savings**. Assessing potential energy savings helps determine appropriate portfolio-wide energy efficiency goals that are clear and measurable. School districts can use information collected during energy performance assessments and technical audits to determine potential energy savings from priority investments. School districts can also evaluate a school's benchmarking results to estimate potential savings based on the energy performance of similar school buildings.

GREENSBORO, NORTH CAROLINA – GUILFORD NORTHERN MIDDLE SCHOOL

Guilford Northern Middle School earned EPA's "Designed to Earn the ENERGY STAR" designation, indicating the building was designed to achieve a top 25% score on the ENERGY STAR scale. The building's features include an innovative strategy that is intended to provide full lighting levels via daylighting for two-thirds of the building's operational hours. This strategy will incorporate south-facing clerestory windows designed to minimize heat-inducing glare, as well as occupancy and photocell sensors to control fluorescent fixtures.

Source: U.S. EPA, 2007d.

[5] *See http://www.energystar.gov/index.cfm?c = spp_res.pt_spps for a directory of energy service and product providers.*

For new and renovated buildings, school districts can consider the potential savings of each building by using tools such as EPA's Target Finder to set energy performance targets and assess building designs. In addition, school districts can consider the savings achieved by similar organizations by reviewing others' experiences. School buildings that earn the EPA ENERGY STAR label for superior energy performance, for example, generally use about 40 percent less energy compared to conventional school buildings (U.S. EPA, 2008o).

- **Determine appropriate scope**. Goals for improving energy efficiency across a portfolio of buildings can be established at different levels, ranging from a single school building to a set of school buildings to the entire portfolio. These goals can also be established over varying periods. Many school districts have established both short-term and long-term goals that can lead to quick cost savings that continue to accrue far into the future.

Goals for improving energy efficiency across a portfolio of K-12 school buildings can be part of a larger community or local government goal that incorporates multiple clean energy activities. For example, energy efficiency goals for K-12 school buildings can be part of a broader goal for reducing state and local energy use and GHG emissions. For information on how local governments can improve energy efficiency in other municipal buildings, see *EPA's Energy Efficiency in Local Government Operations* guide in the *Local Government Climate and Energy Strategy Series*.

In 2008, Wisconsin's lieutenant governor issued a statewide ENERGY STAR Challenge to school districts to become 10 percent more energy-efficient within 1 year, with a goal of 100 districts participating. Districts that choose to participate are provided with tools and support to guide their efforts. As of December 2008, 96 districts had risen to the challenge (Wisconsin, 2009).

STEP 4: CREATE AN ACTION PLAN

A regularly updated action plan can serve as a roadmap toward meeting portfolio-wide energy efficiency goals by systematically improving efficiency in existing school buildings and designing efficient new and renovated buildings. Step 4 of the *ENERGY STAR*

Guidelines for Energy Management, Create an Action Plan, involves establishing energy performance targets for each school building, identifying the technical measures that can help meet that performance target, identifying resources necessary to implement the action plan, and determining the responsibilities of internal and external parties.

Key strategies for creating an action plan include:

- **Develop whole building energy performance targets**. Once a school district has evaluated its portfolio's performance and set portfolio-wide goals, it can establish energy performance targets for each existing and new building. Establishing energy performance targets for each building allows school districts to clearly articulate to building occupants and other key personnel the expected results of energy efficiency investments in each facility, and enables them to track progress and measure results. Whole building energy performance measurements can be developed for existing buildings using Portfolio Manager, which enables users to identify baseline energy performance and set targets based on EPA's national energy performance scale (U.S. EPA, 2008n). For new school buildings, Target Finder can be used to set whole building performance targets (U.S. EPA, 2008p).

The Poudre School District in Fort Collins, Colorado, used Target Finder when designing its new Operations Building. By adjusting the design throughout the process, the design team was able to produce a final design that repeatedly achieved projected scores in the 80s and earned the designation "Designed to Earn the ENERGY STAR." Completed in 2002, the building earned the ENERGY STAR label after 1 year, and in 2005 achieved a perfect score (U.S. EPA, 2008p; U.S. EPA, 2008q).

- **Use a staged approach to identify technical measures for improving energy efficiency**. A staged approach to improve energy efficiency in existing school buildings and incorporating energy efficiency in new and renovated buildings can lead to greater overall energy cost savings. The sections below provide information on using a staged approach in existing and new school buildings, including a number of resources that offer guidance on selecting technical measures to incorporate into energy efficiency action plans.

In addition, school districts can obtain information on best practices from other school districts that have improved energy efficiency in their facilities. ENERGY STAR Labeled Buildings and Plants is an EPA-maintained list of the more than 4,000 buildings that have earned the ENERGY STAR label for energy performance (U.S. EPA, 2008r). In addition, many ESCOs have experience with proven technical energy efficiency measures, and can incorporate these measures into an action plan through the energy performance contracting process. EPA has developed a directory of providers that can help school districts with expert advice and technical assistance on entering energy performance contracts.[6]

Using a Staged Approach in Existing School Buildings

For *existing* school buildings, a staged approach that sequences building upgrades in a logical, systems-oriented way can lead to the greatest energy savings for the available budget. When following this approach, school districts can identify appropriate technical measures for each step in the process.

EPA recommends using a five-stage approach to upgrading facilities (see the text box on page 14 for a more detailed description). The approach includes the following stages:

1. Conduct retrocommissioning.
2. Install energy-efficient lighting.
3. Reduce supplemental loads (e.g., by purchasing ENERGY STAR labeled equipment).
4. Install fan system upgrades.
5. Install heating and cooling system upgrades.

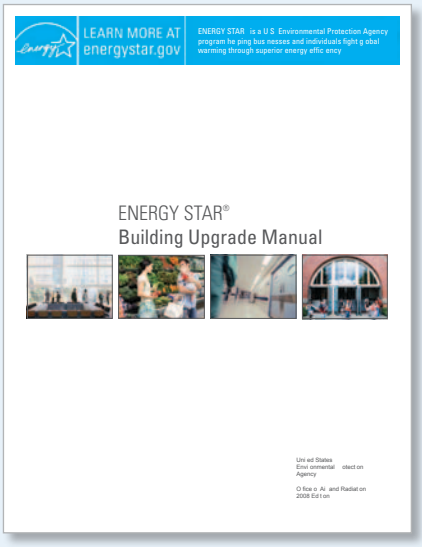
[6] *See http://www.energystar.gov/index.cfm?c = spp_res.pt_spps for a directory of energy service providers. For more information on performance contracting, see Section 7, Investment and Financing Opportunities.*

OVERVIEW OF EPA BUILDING UPGRADE MANUAL STAGED APPROACH FOR IMPROVING ENERGY PERFORMANCE

The staged approach outlined in the 2008 ENERGY STAR Building Upgrade Manual provides a systematic method for planning energy efficiency upgrades in buildings that accounts for interactions between building energy systems, enabling organizations to achieve significant energy savings. This approach involves the following stages:

1. **Retrocommissioning**: Commissioning is the process of ensuring that a new building is designed, installed, tested, and capable of being operated and maintained according to the owner's needs. Commissioning a new building can produce energy cost savings of $0.02 to $0.19 per square foot (Mills et al., 2004). Commissioning can also produce nonenergy benefits, such as improved occupant comfort and indoor air quality. One study estimates that the average value of nonenergy benefits for every $1 spent on commissioning ranges from $1 to as high as $2.30, when accounting for energy efficiency rebates. Nonenergy benefits resulting from commissioning are estimated to be $0.50 per square foot (Mills et al., 2004; Jennings and Skumatz, 2006).

Retrocommissioning buildings that were never commissioned is a key step in identifying technical measures for a staged approach to improving energy efficiency. This process can identify no- and low-cost technical measures for improving energy efficiency and can result in energy cost savings between $0.11 and $0.72 per square foot (Mills et al., 2004). Recommissioning is the process of commissioning a building that has already been commissioned.



2. **Lighting Upgrade**: Improving the energy efficiency of the building lighting system can reduce lighting energy costs. Lighting systems can account for up to 40% of a building's total energy use. Improving energy efficiency can halve lighting energy consumption while improving lighting quality and reducing unwanted heat gain. Improving lighting system energy efficiency involves the following steps:

- Design light quantity and quality to meet task and occupant needs
- Maximize lamp and ballast efficiency
- Install automatic controls to turn off or dim lighting
- Establish schedules for group re-lamping and fixture cleaning
- Purchase ENERGY STAR labeled lighting products
- Use responsible disposal practices

3. **Supplemental Load Reductions**: Purchasing ENERGY STAR labeled office equipment and improving the energy efficiency of building envelope components (e.g., installing window films and adding insulation or reflective roof coating) reduces supplemental load energy consumption. Reducing supplemental loads enables organizations to install smaller fan, heating, and cooling systems that cost less and use less energy.

4. **Air Distribution System Upgrades**: Air distribution systems account for approximately 7% of an office building's total energy use. Technical measures, such as right-sizing fan system equipment and converting to a variable-air-volume system, can significantly reduce air distribution system energy costs. For example, reducing a fan's speed by 20% (e.g., by using a variable-speed drive) can reduce its energy consumption by 50%.

5. **Heating and Cooling System Upgrades**: Heating and cooling systems typically account for one-fourth of a building's energy use. Improving energy efficiency in these systems can produce significant savings. A strategy for improving heating and cooling system efficiency involves:

- Measure heating and cooling loads
- Right-size heating and cooling systems
- Install energy-efficient chillers
- Upgrade other heating and cooling system components
- Install variable-speed drives on pumps and cooling tower fans
- Optimize operations.

Source: U.S. EPA, 2008.

Implementing upgrades in appropriate stages reduces the overall heating and cooling capacity needed,[7] which can enable school districts to purchase right-sized equipment. Right-sized equipment meets the necessary load after efficiency measures are implemented, as opposed to oversized equipment that serves the load but at a higher upfront cost.

Energy efficiency upgrade and design guidance materials are helpful for identifying and prioritizing technical measures to incorporate into a school district's energy efficiency action plan. For example, the *ENERGY STAR Building Upgrade Manual* provides guidance on using the staged approach for upgrading existing buildings, including a chapter on schools specifically (see the text box on page 14).

Using a Staged Approach in New and Renovated School Buildings

While the preceding staged approach makes sense for *existing* school buildings, many school districts follow a different approach for new school buildings. School districts can use EPA's ENERGY STAR *Integrated Energy Design Guidance* to design new school building systems and materials as an integral network that will improve energy performance (U.S. EPA, 2008c). This guidance document can help school districts identify cost-effective energy efficiency investments that consider the environment, climate, building orientation, and other features that affect performance in new school buildings.

For new and renovated school buildings, school districts can also use the *Whole Building Design Guide*, a resource developed with EPA and DOE support by the National Institute of Building Sciences, which provides information on energy-efficient building design and offers numerous case studies, tools, and guidance documents. Other design guidelines include the DOE EnergySmart Schools *Advanced Energy Design Guide for K-12 School Buildings*, which includes individual guidelines for a range of climate types, and the Collaborative for High Performance Schools (CHPS) *Best Practices Manual* (see the text box on page 15 for more information on CHPS).

- **Secure necessary funding**. When designing an action plan for improving energy efficiency in school buildings, it is important to identify the costs of implementing the action plan, and to evaluate funding options. The following financial tools, as listed in Table 1, *ENERGY STAR Program Resources*, are available through EPA's ENERGY STAR program to evaluate the investment required for priority energy efficiency

[7] *In typical office buildings, local governments can achieve cooling capacity reductions of up to 5 percent if operations and maintenance practices, lighting systems, and HVAC systems are upgraded in subsequent order (National Action Plan for Energy Efficiency, 2008). For more information on improving energy performance in municipal buildings through the staged approach, see EPA's Energy Efficiency in Local Government Operations guide in the Local Government Climate and Energy Strategy Series.*

COLLABORATIVE FOR HIGH PERFORMANCE SCHOOLS

The Collaborative for High Performance Schools (CHPS) brings together stakeholders from utilities, state and local governments, and nonprofit organizations to facilitate design of high-performance school buildings. The goal of the program is to use energy-efficient design to provide an outstanding learning environment, a healthy and safe place to work, increased school durability, cost-effectiveness over the life of a building, maximum conservation of resources, and long-term benefits to taxpayers through energy cost savings.

The collaborative oversees a green building rating program designed exclusively for K-12 schools that is based on, and similar in structure and function to, the LEED green building rating system for new construction. It provides technical workshops for design professionals and has developed a six-volume best practices manual. The collaborative recognizes projects for meeting CHPS criteria through two programs: CHPS Verified and CHPS Designed. CHPS Designed is a free self-certification program, while CHPS Verified provides third-party verification.

The CHPS criteria address energy and water efficiency, site and materials selection, and indoor environmental quality, and provide sustainable policies and innovations that can be adopted by schools and districts. The criteria model originated in California and has been borrowed and adapted by a number of states, including Massachusetts, New York, and Washington, and the multistate, nongovernmental organization Northeast Energy Efficiency Partnerships. As a result, the criteria and the specific targets and goals within them vary across scorecards based on the different climate conditions, demographics, and needs of the states and organizations that have adopted the CHPS model.

Source: CHPS, Undated(a); MTC, 2007a; Washington, 2006; NYSERDA, 2007.

projects, and to help make the financial case for energy efficiency investments:

- ***Cash Flow Opportunity Calculator.*** This tool can determine how much new energy-efficient equipment can be purchased based on estimated cost savings, whether equipment should be purchased now using financing or if it is better to wait and use cash from a future year's budget, and whether money is being lost by waiting for lower interest rates.

- ***Financial Value Calculator.*** This tool presents energy efficiency investment opportunities in terms of key financial metrics. It can determine how energy efficiency improvements can affect organizational profit margins and returns on investments.

- ***Building Upgrade Value Calculator.*** This calculator can estimate the financial benefits of improving energy efficiency in office buildings.

CASH FLOW OPPORTUNITY CALCULATOR

The ENERGY STAR Cash Flow Opportunity Calculator is a decisionmaking tool that can be used to influence timing of energy-efficient product purchases. The tool can be used to determine:

- The quantity of energy-efficient equipment that can be purchased and financed using anticipated savings;
- Whether it is most cost-effective for the purchase to be financed now, or to be paid with future operating funds; and
- The cost of delay: whether money is being lost while waiting for a lower interest rate.

www.energystar.gov/ia/business/cfo_calculator.xls

Source: U.S. EPA, 2003b.

Once a school district has determined the size of the investment required to implement priority energy efficiency upgrades, it can consider a range of funding options. Financial assistance for improving energy efficiency in school buildings can be secured through a number of sources. Many states administer programs that provide incentives to schools for investments in energy efficiency, while a number of school districts have identified and secured funding resources from external sources. Energy performance contracts, for example, can be used to implement energy efficiency upgrades at no upfront cost, often through a financial arrangement with an ESCO. For more information on funding energy efficiency improvements, see Section 7, *Investment and Financing Opportunities*.

In cases where school districts do not have sufficient resources to improve energy efficiency across a broad portfolio of school buildings, they can concentrate resources to systematically improve energy efficiency in one or a few schools. Experiences from such pilot projects can be applied to a broader set of schools when additional resources become available. In addition, school districts can use pilot projects and studies to gather information on the benefits and costs of priority investments, and use them to increase public awareness of energy efficiency activities. Pilot projects can also help identify potential full-scale implementation challenges.

STEPS 5 AND 6: IMPLEMENT THE ACTION PLAN AND EVALUATE PROGRESS

Step 5 of the *ENERGY STAR Guidelines for Energy Management*, Implement the Action Plan, involves gaining the support and cooperation of individuals at different levels within the school district and individual schools. The guidelines identify five steps for ensuring effective implementation of the action plan:

- Create a communication plan
- Raise awareness
- Build capacity
- Motivate
- Track and monitor

Section 6, *Strategies for Effective Program Implementation*, provides information on strategies that school districts have used to address the first four steps, including strategies for gaining buy-in from key personnel.

Establish And Maintain A Tracking System

The fifth step in implementing an action plan is to develop a tracking system and use it to continuously track and monitor energy use data, which is critical for evaluating program progress. Maintaining an effective

centralized tracking system involves the following actions:

- **Perform regular updates**. Data can be collected and incorporated into the tracking system at regular intervals, typically weekly or monthly. Regular data updates ensure the system provides helpful output when it comes time to evaluate program progress.

- **Conduct periodic reviews**. Periodic reviews of progress made toward meeting interim goals and milestones can help ensure an energy program will meet its ultimate performance goals (as established in Steps 2 and 3, *Assess Baseline Energy Performance and Set Goals*) when the energy team conducts a complete program progress evaluation.

- **Identify necessary corrective actions**. Periodic reviews can also identify corrective actions the energy team can take before a formal program evaluation.

Evaluate Progress

Implementing an action plan for improving energy efficiency does not in itself guarantee a school building will achieve its intended energy performance target. Step 6 of the ENERGY STAR Guidelines for Energy Management, Evaluate Progress, describes a process for evaluating the progress of an energy program using information collected during the tracking and monitoring process described above. The guidelines identify two critical steps involved in evaluating an energy efficiency program:

- **Measure results**. Comparing the performance of a portfolio of buildings at the time of evaluation to the baseline performance enables school districts to determine whether they have met their portfolio-wide goals (see Steps 2 and 3, *Assess Baseline Energy Performance and Set Goals*). Measuring results involves gathering data on energy use and costs from the continuous tracking system (see Step 5, Implement the Action Plan) and analyzing these data to identify savings. A complementary step is to ensure third-party verification of savings data so that intended energy performance is actually achieved. School districts can obtain third-party verification from a number of sources, including ESCOs and energy service providers.[8]

  A final step in measuring results involves benchmarking energy performance. As described under Steps 2 and 3, Assess Baseline Energy Performance and Set Goals, benchmarking can occur earlier in the energy management process to estimate potential savings and help develop a baseline and set goals. Benchmarking can also be conducted during the evaluation process. Using EPA's national energy performance scale (e.g., using Portfolio Manager) allows school districts to:

  - Compare their new performance score to their baseline performance score
  - Compare their achieved performance against established goals for environmental performance or financial savings
  - Compare their achieved energy performance to peers to establish a relative understanding of where their performance ranks

- **Review the action plan**. Once a school district has determined the results of its energy efficiency investments, both in terms of energy savings and benchmarking, it can use this information to evaluate the effectiveness of its action plan. If the results indicate the school district did not reach its goals, the district can consider revising the action plan (e.g., to focus on implementing energy efficiency upgrades in additional priority buildings). If the results indicate the school district did reach its goals, the district can consider setting higher goals for achieving greater energy cost savings and revise the action plan accordingly.

STEP 7: RECOGNIZE SUCCESS

One way to sustain momentum and support for energy efficiency activities is to be recognized for achieving performance goals. As a complement to opportunities for recognizing success internally, third-party recognition options include:

- **ENERGY STAR labeled buildings**. School buildings achieving an energy performance score of 75 or greater are eligible to apply for the ENERGY STAR label. Buildings that have earned the ENERGY STAR label use, on average, 40 percent less energy compared to conventional buildings (U.S. EPA, 2008d).

- **ENERGY STAR awards**. EPA also provides recognition to organizations that meet important energy savings milestones, such as improvements of 10 percent, 20 percent, 30 percent, or more, relative to their initial baselines. As of August 2009, more than

[8] *See http://www.energystar.gov/index.cfm?c = spp_res.pt_spps for a directory of energy service providers.*

60 school districts have met these milestones, earning recognition as ENERGY STAR Leaders (U.S. EPA, 2009i).

ENERGY STAR LEADERS IN K-12 SCHOOLS

School districts that are ENERGY STAR partners and demonstrate continuous improvement in energy performance organization-wide, not just in individual buildings, qualify for recognition as ENERGY STAR Leaders. Based on results tracked in Portfolio Manager, ENERGY STAR Leader recognition is provided for achieving portfolio-wide energy efficiency improvements of 10%, 20%, and 30% (or more) in normalized energy use. ENERGY STAR Leaders who also achieve an average score in Portfolio Manager of 75 or better portfolio-wide are recognized as Top Performers (U.S. EPA, 2009i).

Nash-Rocky Mount School District in Nashville, North Carolina, initially committed to reducing energy costs across its portfolio of 29 facilities in 2004. By implementing portfolio-wide comprehensive energy upgrades—which involved partnering with the state energy office, ESCOs, and energy efficiency service providers—the school district was able to improve energy efficiency by 20 percent in 2006. In 2008 the school district was recognized as an ENERGY STAR Top Performer for achieving a portfolio-wide average score of 75 on EPA's national energy performance scale. Between September 2004 and August 2007, the school district saved a total of $3.1 million (Nash-Rocky Mount, 2008). Over 3.5 years, the district reduced overall energy use by 28 percent, decreasing CO_2 emissions by more than 18,600 tons, equivalent to the annual emissions of 3,000 cars (Southface, 2009). The district received an ENERGY STAR Partner of the Year award in March 2009.

Energy Efficiency in Green School Buildings

Many school districts have found that the processes of planning, designing, and constructing new and renovated energy-efficient school buildings—as described in the preceding section—offer opportunities to integrate energy efficiency with other green features (e.g., use of renewable energy supplies and sustainable site selection). These features can provide additional environmental, economic, and health benefits. In addition to enhancing a school building's environmental profile (e.g., through reduced GHG emissions), school districts have found that incorporating energy efficiency can improve the cost effectiveness of green school buildings. Because of this, energy efficiency is often considered first in green school building design, and has become the cornerstone of many school district green building programs.

GREEN BUILDINGS

Many terms are used to describe buildings that incorporate energy efficiency and other environmental features, including "green buildings," "high-performance buildings," and "sustainable buildings." Regardless of the definitions, there is often a public perception that energy efficiency and "green" are interchangeable, and that green buildings are energy efficient. However, this is not always the case. Some "green" buildings do not adequately incorporate energy efficiency.

This section uses the term "green building" as an all-encompassing description of buildings that incorporate energy efficiency *plus* other energy and environmental features where cost-effective and practical, including:

- Renewable energy supply
- Combined heat and power (CHP)
- Sustainable site design that minimizes stress on the local landscape
- Water efficiency and quality
- Green materials and resources that minimize consumption and waste
- Indoor environmental quality

BENEFITS OF GREEN BUILDINGS

By incorporating energy efficiency into green school buildings and green school building policies, school districts can achieve all the energy efficiency benefits described in Section 2, *Benefits of Energy Efficiency in K-12 Schools*. In particular, the reduced energy costs associated with incorporating energy efficiency in green school buildings can help districts achieve overall cost effectiveness in green building design (U.S. EPA, 2008o; U.S. EPA, 2006b).

Green buildings can provide several additional environmental benefits, including:

- Lower GHG emissions
- Reduced construction/demolition debris
- Ecosystem protection
- Natural resources conservation

Some green building environmental features can also have secondary energy-saving benefits. For example, many green school buildings incorporate water efficiency measures that reduce water heating energy consumption while conserving a natural resource (U.S. EPA, 2008s). The actual benefits of green buildings depend on the environmental features incorporated into the designs, which can depend on the green building rating system followed (e.g., CHPS, LEED, Green Globes) and whether the building operates as designed. The text box above provides information on the potential financial benefits of building green schools.

RECYCLING—ENERGY RELATIONSHIP

- Recycling 1 pound of steel saves 5,450 Btu of energy, enough to light a 60-watt bulb for more than 26 hours.
- Recycling 1 ton of glass saves the equivalent of nine gallons of fuel oil.
- Recycling aluminum cans requires only 5% of the energy needed to produce aluminum from bauxite. Recycling just one can saves enough electricity to light a 100-watt bulb for 3.5 hours.

Source: Pennsylvania, 2007.

EPA WATERSENSE LABEL

The EPA WaterSense Program label is for products that are independently tested to meet water efficiency and performance criteria. Labeling criteria have been established for plumbing fixtures (toilets, faucets, showerheads, and urinals), new homes, and training programs for irrigation professionals. In general, products that receive the WaterSense label are 20% more water-efficient than conventional products. In addition to conserving water, these products can reduce the amount of energy required to deliver and treat water.

Source: U.S. EPA, 2007c.

FINANCIAL BENEFITS OF GREEN SCHOOLS

Green school buildings generate substantial energy, environmental, and health-related benefits. A Capital E study estimated the savings resulting from green building design measures in 30 school buildings built in 10 states in 2001–2006. The table below shows the average financial benefits of these green school buildings by specific building attributes.

Table A: Financial Benefits of Green Schools ($/ft²)	
Energy	$ 9
Emissions	$ 1
Water and Wastewater	$ 1
Increased Earnings	$ 49
Asthma Reduction	$ 3
Cold and Flu Reduction	$ 5
Teacher Retention	$ 4
Employment Impact	$ 2
TOTAL	$ 74
COST OF GREENING	($ 3)
NET FINANCIAL BENEFITS	$ 71

"Increased Earnings" refers to the higher salaries that graduates of green schools are projected to earn due to the higher average learning rates and test scores associated with green school buildings

Source: Capital E, 2006.

PLANNING AND DESIGN APPROACH FOR INCORPORATING ENERGY EFFICIENCY IN GREEN BUILDINGS

When planning and designing green school buildings, school districts can follow the steps outlined in the preceding section on improving energy efficiency in school buildings. Incorporating energy efficiency into green school buildings can also involve the following actions:

- **Ensure that energy efficiency is specifically included in green building policies**. Energy efficiency is a critical element of green building and is a key feature of the design process. School districts have found that requiring a combination of energy performance tools and green building approaches from the onset can ensure that new and renovated school buildings meet both energy performance and environmental criteria. An increasingly common strategy is to use EPA's ENERGY STAR platform in conjunction with the U.S. Green Building Council's (U.S. GBC) Leadership in Energy and Environmental Design (LEED) rating system for green building design. For more information on incorporating energy efficiency in green building polices, see the text box on page 21.

The Fossil Ridge High School in Fort Collins, Colorado, was designed to meet the Silver standard on the LEED rating system in 2004. To ensure optimal energy performance, the school was designated "Designed to Earn the ENERGY STAR" using Target Finder.

- **Use energy efficiency investments to reduce the cost of using renewable energy sources**. Many school districts are improving the environmental profile of their green school buildings by incorporating on-site renewable energy generation systems into building designs. These systems, however, can have a high upfront cost. Many school districts have found that reducing energy consumption in green school buildings through energy efficiency allows them to meet their renewable energy goals with smaller and less expensive generation systems. In addition, the energy cost savings from energy efficiency investments can offset the cost premiums of using renewable energy sources. For more information on using renewable energy sources, see EPA's *On-site Renewable Energy Generation* guide in the *Local Government Climate and Energy Strategy Series*.

GREEN BUILDING AND ENERGY STAR

When upgrading existing buildings or designing new buildings, local governments are looking to green building certification programs such as the U.S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) rating system and the Green Globes rating system. These systems standardize the elements of green building by conferring design certification based on requirements for (1) energy and atmosphere, (2) site sustainability, (3) water efficiency, (4) materials and resources, (5) indoor air quality, and (6) innovative design process.

Depending on the rating system, it can be important to add requirements for energy performance, such as achieving EPA's ENERGY STAR program levels. It is also important to require third-party verification, which is required to earn the ENERGY STAR label on commercial buildings

Source: LEED, 2005; U.S. EPA, 2008o.

ENERGY-EFFICIENT DESIGN VERSUS PERFORMANCE

While using design standards can be helpful for implementing energy efficiency measures in new and renovated buildings, not all design standards guarantee energy-efficient performance. For instance, facilities designed to exceed building energy codes will not necessarily achieve superior energy efficiency because codes prescribe minimum design criteria for certain facility components, but do not predict whole building energy performance. Studies have shown that exceeding building codes is not a guarantee of future energy performance.

Source: U.S. EPA, 2006.

- **Include requirements for third-party verification of energy performance**. Third-party verification is an important step toward ensuring that green buildings are energy-efficient. While some green building certification only considers a building's design, third-party verification of energy performance can determine whether a building is performing as intended. School

INCORPORATING ENERGY EFFICIENCY INTO LEED GREEN SCHOOL BUILDING POLICIES

Energy efficiency can be incorporated into green school building policies in a variety of ways. Many school districts have adopted the LEED for Schools rating system. School districts can take the following steps to incorporate energy efficiency into their LEED green building policies:

- **Target Energy Performance**. Require design teams to meet aggressive energy performance targets based on the most energy-efficient existing buildings in the market. For building types covered by EPA's ENERGY STAR Target Finder, the target should be at least 75, the level at which a building is "Designed to Earn the ENERGY STAR." See Develop Whole Building Performance Targets under Step 4 in *Planning and Design Approaches for Energy Efficiency in K-12 Schools* for more detailed guidance and strategies for building types not covered by Target Finder. Design projects applying for LEED for Schools certification must establish an Energy Performance score goal using Target Finder as part of Energy & Atmosphere Prerequisite 2. The Statement of Energy Design Intent (SEDI), generated from Target Finder, documents the energy use goal.
- **Achieve Energy-Related Credits**. Strive to achieve the greatest possible quantity of credits in the LEED Energy and Atmosphere credit category.
- **Track Results and Strive to Earn the ENERGY STAR**. Compare the building's actual performance to the energy target used during the design phase and confirm that it is eligible for the ENERGY STAR once it has been operating for 1 year. EPA's Portfolio Manager enables users to track energy consumption, and certain building types are eligible to receive an ENERGY STAR score, similar to the score generated in Target Finder, for actual energy performance. Any building type, such as a school, that is eligible for a score must earn a minimum score of 69 in Portfolio Manager to apply for LEED for Existing Buildings: Operations & Maintenance (LEED-EB: O&M) certification. A summary of energy use, such as the Statement of Energy Performance (SEP) generated in Portfolio Manager and verified by a professional engineer, must be submitted along with other documentation to demonstrate compliance through at least 12 months of energy performance. Buildings that receive a 75 or better are eligible to receive the ENERGY STAR.

Source: U.S. GBC, 2007.

districts can include provisions in their green building policies requiring third-party verification to confirm that, once operational, school buildings meet the energy performance targets established during the planning and design phases. School districts can obtain third-party verification from a number of sources, including ESCOs and energy service providers. [9] In addition, the ENERGY STAR Statement of Energy Performance that is generated from Portfolio Manager can verify energy efficiency results. School data can be verified by a professional engineer.

- **Consider conducting a demonstration project**. When resources and/or support for implementing a green building policy are limited, school districts can develop a single green school building to serve as a demonstration project. These projects can be used to showcase the energy efficiency and environmental benefits of green buildings, while helping to make the case for implementing a portfolio-wide green building approach as additional support and/or resources become available.

[9] *See http://www.energystar.gov/index.cfm?c = spp_res.pt_spps for a directory of energy service and product providers.*

4. KEY PARTICIPANTS

School districts often involve a number of participants when planning and implementing energy efficiency activities in K-12 school buildings, including:

- **Mayor or county executives**. Many local government executives have been influential in improving energy efficiency in K-12 school buildings in their communities. In a number of local governments, mayors have adopted energy efficiency policies encompassing all public facilities, including school buildings. A number of mayors have joined the Mayors' Alliance for Green Schools to increase awareness of opportunities for energy efficiency and other environmental features in school buildings (U.S. GBC, 2008).

- **City or county councils**. City and county councils often have a close working relationship with school districts, particularly the school superintendent. In many localities, the city or county council has worked with the superintendent to initiate energy efficiency programs across school districts.

- **Local government agencies**. School districts can obtain technical and informational assistance from

local government agencies, including local energy, environment, and planning departments. Staff from such agencies can often direct school districts to resources for improving energy efficiency in public facilities, and can sometimes offer technical assistance in implementing upgrades to school buildings.

- **Superintendents**. Many school districts have found it important to gain the support of school district superintendents because their visibility to both parents and local government officials can help highlight the effectiveness of energy efficiency improvements.

- **School boards**. School boards often play an important role in planning and implementing energy efficiency activities in K-12 school buildings. The school board is often responsible for determining how school district money is spent, which can have significant implications for energy efficiency investments. In a number of school districts, the board requires regular reports on energy efficiency upgrades in the district's school buildings.

DeKalb County Central United School District in Waterloo, Indiana, joined the ENERGY STAR Challenge in 2008 to improve energy performance by 10 percent. The school district has been working with an ENERGY STAR service provider for 4 years to improve energy efficiency in its school buildings. The school district's energy program managers report to the school board on energy efficiency activities every 6 months. These reports to the school board are covered by the local media (U.S. EPA, 2008i).

- **Energy program managers**. In school districts that have hired an energy manager to oversee their energy consumption, the manager often reports directly to the superintendent or school board, and generally works closely with the facility management team. Many schools participating in the Collaborative for High Performance Schools (CHPS) in California, for example, have appointed energy program managers to be responsible for implementing the collaborative's initiatives in each of the district's facilities (CHPS, 2006).

In Austin, Minnesota, the school district hired an energy coordinator to work with an outside firm in tracking energy consumption in the district's seven school buildings. Having an energy coordinator to oversee energy efficiency improvements has been an integral part of the school district's energy efficiency program, which has helped reduce annual energy costs by $140,000 (U.S. EPA, 2008e).

- **Principals, teachers, and other staff**. Many school districts have found that working with school districts to involve principals, teachers, and other staff in the energy efficiency activity planning process can help planners understand the specific needs that a school building's design must accommodate, and in turn helps educators teach students about these energy-efficient features. A number of school districts have provided training sessions for school staff on operating building controls and promoting energy-efficient practices to the student body (U.S. EPA, 2008).

- **Students and parents**. Many local governments have found that working with school districts to involve students in planning and implementing energy efficiency measures can be an effective way to ensure buy-in and gathering feedback. Some schools have asked students to identify strategies for reducing energy consumption in school facilities and operations.

Clarence Middle School in Clarence, New York, instituted an intentional, temporary blackout during which students were encouraged to brainstorm strategies for conserving energy, many of which—such as a school-wide light switch reminder sticker design contest—were subsequently implemented (ASE, 2002).

In Minnesota, the Schools for Energy Efficiency program works with school districts to improve energy efficiency in their facilities. Through the program, students are encouraged to develop their own energy efficiency initiatives, many of which have involved behavioral changes in school facilities (SEE, 2007).

Several school districts have reached out to parents in the energy efficiency program planning and development processes. Involving parents in these processes can increase local awareness of energy efficiency and build support for the activities a school is planning.

Involving parents can also offer opportunities for school districts to leverage additional community resources.

The Council Rock School District in Newtown, Pennsylvania, established a Go Green Team to lead its environmental initiative, which includes an energy management program. The team is comprised of faculty and staff from each of the district's schools and includes a representative from each school's parent-teacher organization (U.S. EPA, 2008j).

- **Utilities and other energy efficiency program administrators**. Utilities and other energy efficiency program administrators (e.g., state-administered public service energy efficiency agencies) can provide school districts with technical assistance in planning and implementing energy efficiency activities. In some states, investor-owned utilities are required by law to provide schools with technical assistance in implementing energy efficiency measures.

NEW YORK POWER AUTHORITY—POWER TO SCHOOLS

The New York Power Authority is a state-owned utility that administers energy efficiency programs. Its Power to Schools Program offers cost-effective energy efficiency opportunities to public and private schools throughout New York. The utility allows energy efficiency improvements to be paid from energy savings, which enables schools to finance projects they might otherwise not be able to afford.

The Williamsville Central School District has worked with the utility to implement $8.7 million in energy efficiency improvements to its 13 facilities. When completed, the improvements will include a range of energy efficiency measures, including lighting retrofits, boiler replacements, installation of energy management systems, and automated swimming pool covers. The cost of these improvements will be paid through energy cost savings over several years.

Source: U.S. EPA, 2007d.

The California Energy Commission's Bright Schools Program works with Pacific Gas Edison, an electric utility, and DOE's Rebuild America Program to administer the School Resource Program, which provides energy efficiency audits, technical assistance with retrofit plans, and staff training to schools (PGE, 2007).

Municipally owned utilities in other localities can be sources of information on energy efficiency for school districts, and can often be relied on for technical assistance on energy efficiency projects.

- **State and federal agencies**. Many state governments provide financial and technical assistance to school districts. In Pennsylvania, for example, the public school code directs the state to provide grants to school districts that achieve LEED Silver certification (GGGC, Undated). State energy offices can be another helpful source of information on energy-efficiency technical and financial assistance opportunities. Federal agencies such as DOE and EPA provide assistance and resources for energy efficiency activities in K-12 school buildings. A number of K-12 school districts have partnered with EPA and ENERGY STAR, which provides guidelines and tools for energy management district-wide and energy-efficient new school design, energy management training, and recognition opportunities for improvement and top performance.

- **Energy efficiency service and product providers**. Many school districts work with energy efficiency service and product providers to obtain technical assistance and guidance for energy efficiency projects. Many of these service and product providers offer continuous energy monitoring for school districts, which can help sustain the cost-savings benefits of energy efficiency improvements. Many providers have become ENERGY STAR Partners (for more information, see *http://www.energystar.gov/index.cfm?c = spp_res.pt_spps*).

The Blue Mountain School District in Orwigsburg, Pennsylvania, has implemented a range of energy efficiency projects through an ENERGY STAR service provider that have led to cumulative energy cost savings of $850,000 since 2005, preventing emission of 3,300 tons of CO_2, equivalent to the annual emissions of about 550 cars or the carbon storage capacity of more than 500,000 healthy adult trees. [10] The service

[10] *The average healthy tree in the United States stores 13 lbs of carbon. From Identified Benefits of Urban Trees and Forests, by R.D. Coder, University of Georgia. Available at http://www.marshalltrees.com/upload/articles_files/art_31attached_file.pdf.*

provider works directly with the energy managers and maintenance teams in each school district building (U.S. EPA, 2008f).

5. FOUNDATIONS FOR PROGRAM DEVELOPMENT

Local governments have employed a variety of mechanisms to initiate programs for improving energy efficiency in K-12 school buildings. This section provides information on a range of these mechanisms, including descriptions and examples of how key participants have used different types of mechanisms to motivate development of energy efficiency programs and policies.

- **Individual school initiatives**. Some schools adopt low-cost energy efficiency and conservation measures, such as campaigns to turn off lights and computers when not in use, which do not require additional funds from the school district. These simple efforts can produce significant benefits and may lead to broader, district-wide activities.

- **School district resolutions**. Entire school districts have implemented energy efficiency measures in response to resolutions that require new or existing facilities to adhere to specified design or performance standards, such as ENERGY STAR, LEED, and CHPS. Many school districts have developed their own guidelines for energy and environmental design in school buildings. In California, for example, 19 school districts have adopted resolutions committing to the new school design guidelines laid out by CHPS [CHPS, Undated(b)].

COLUMBIA HEIGHTS SCHOOL DISTRICT—ENERGY SAVINGS POLICY

In Minnesota, the Columbia Heights School District school board adopted an energy savings policy to guide energy-related decision-making in its five schools. The policy sets standards for lighting, temperature control, ventilation, scheduling, computer and office equipment use, kitchens, swimming pools, and water use. It has helped the district earn recognition as an ENERGY STAR Leader, an achievement that only four other school districts in the nation earned in 2006.

Source: Columbia Heights School District, 2006a

The school board in Council Rock School District in Newtown, Pennsylvania, which serves more than 12,000 students in 17 facilities, adopted an energy policy in November 2005 that initiated an energy efficiency program. The policy's initial goal was for the school district to improve energy efficiency across its portfolio of buildings by 10–15 percent. By implementing a comprehensive retrocommissioning and energy efficiency improvement program that included operational adjustments, staff training sessions, system upgrades, and purchasing energy-efficient equipment, the school district was able to achieve a 30 percent improvement in energy efficiency portfolio-wide by the end of 2007 (U.S. EPA, 2008j). As a result, the district has been recognized by EPA as an ENERGY STAR Leader.

- **School district planning process**. A number of school districts around the country have developed long-range plans for renovating existing school buildings and developing new ones. Some school districts have incorporated energy efficiency goals into their plans.

- **Mayor or county executive initiatives**. Local government executives have been the catalysts for improving energy efficiency in school buildings in their communities. Mayors and county executives have used the visibility of their offices to encourage school districts to improve energy efficiency, often through executive orders or other proclamations.

In October 2007, the county executive of Prince George's County, Maryland, issued an executive order that directed the Green Building Executive Steering Committee to develop guidelines for county government to reduce energy consumption in existing facilities by 20 percent by 2015, and to design and construct all new facilities and public schools to meet LEED Silver certification (Prince George's County, 2007).

- **Local government resolutions**. City and county councils have been influential in initiating energy efficiency programs in school buildings in many localities. In some localities, the city or county council has passed legislation requiring school buildings to be constructed to meet specific energy and environmental standards.

In 2006 the Washington, DC, city council passed legislation requiring all publicly owned and publicly financed buildings, including schools, to be designed to meet LEED Silver certification standards for environmental performance. To ensure these buildings achieve optimal energy performance, the legislation includes a requirement that buildings also be designated "Designed to Earn the ENERGY STAR" by Target Finder, and to be benchmarked annually using Portfolio Manager. To ensure compliance with these requirements, the legislation mandates reviews by a government agency or certified third party. The green building program is guided by a Green Building Advisory Committee (Washington, DC, 2006).

- **Local government programs**. Some school districts have implemented energy efficiency activities as part of broader community efforts coordinated by local governments.

In Louisville, Kentucky, the Jefferson County School District joined with the Louisville Metro Government and University of Louisville to form the Partnership for a Green City to encourage broader adoption of environmentally responsible practices throughout the community. The partnership's Energy Committee develops strategies for incorporating energy efficiency activities into partnership projects (Louisville, 2007). More than 150 schools in the district have also joined the Louisville Kilowatt Crackdown, a year-long competition sponsored by the Louisville Metro Government and local commercial real estate associations to promote and recognize building energy efficiency. Participants measured and tracked their buildings' energy performance using Portfolio Manager and worked to improve performance during the contest period of July 2008–July 2009 (U.S. EPA, 2009f).

- **State programs**. Some states, such as Connecticut and North Carolina, have established requirements for school districts to achieve certain energy efficiency performance goals or follow statewide design guidelines (Connecticut, 2006; North Carolina, 2004).

6. STRATEGIES FOR EFFECTIVE PROGRAM IMPLEMENTATION

There are numerous opportunities for school districts to promote energy efficiency in their buildings. However, there are many barriers that could hinder effective implementation of energy efficiency programs, such as a lack of expertise, funding, or local government support. These types of barriers and others can be overcome through various strategies.

- **Engage management**. Emphasizing the benefits of energy efficiency through life-cycle cost analysis, building an experienced team, and creating a well-defined energy policy or plan can help school districts secure support from elected officials and local government agency managers.

- **Obtain adequate information**. There are a number of federal, state, and nongovernmental resources available that can help school districts implement energy efficiency initiatives and inform the program development process. For a list of relevant resources and local government case studies, refer to Section 10, *Additional Examples and Information Resources*.

- **Utilize measurement tools and methodologies**. Setting up an energy efficiency program can be daunting, especially for school districts that may not possess extensive in-house expertise on energy management. Using effective measurement tools and methodologies can help facilitate the program development process. ENERGY STAR offers many resources that can help measure progress, including Portfolio Manager for buildings, which allows building managers to track upgrades and resulting energy savings.

- **Pursue creative financing options**. School districts often face tight budgetary constraints that can make it difficult to find funding for the upfront costs of energy efficiency projects. However, many creative financing options exist that can help school districts leverage their available funds, such as energy performance contracts and lease-purchase agreements (National Action Plan for Energy Efficiency, 2008). Strategies to help overcome financial obstacles are discussed in Section 7, *Investment and Financing Opportunities*.

- **Develop political consensus**. Local government decisions are often subject to consensus and therefore can

run into barriers brought on by differing opinions or political perspectives. For school districts, this process can prolong development or adoption of an energy efficiency program. By incorporating energy efficiency goals into preexisting related initiatives, school districts can avoid some of the difficulties associated with building political consensus.

Once a school district has initiated a program for improving energy efficiency in its school buildings (see Section 5, *Foundations for Program Development*), it can use various implementation strategies to strengthen the program and address the barriers identified above. These strategies can serve two purposes:

- Developing the energy efficiency program to enhance its effectiveness
- Engaging the community to leverage additional resources and increase program visibility

Strategies for Developing an Energy Efficiency Program

Strategies that school districts have used to develop their energy efficiency programs are similar to those involved in planning and designing the program (see Section 3, *Planning and Design Approaches to Energy Efficiency in K-12 Schools*). However, the implementation strategies described in this section can be used after the program has been initiated to continue to enhance its benefits. For example, when planning and designing energy efficiency improvements in school buildings, it is important to use a team approach to develop an energy policy and create an action plan. Similarly, when implementing the program for improving energy efficiency in school buildings, it is important to use a team approach to guide continual development, refinement, and successful execution of the program.

- **Continue to use a team approach to continually improve the energy efficiency program**. Just as building a team of individuals with diverse areas of expertise can be a key initial step in developing an energy efficiency program (see *Step 1: Make Commitments*, in Section 3), continuing to use a team approach is critical for implementing and continually developing a successful energy efficiency program. Many school districts have established scoping teams, or energy efficiency advisory committees, to guide decisionmaking related to existing energy efficiency programs. These committees can help to continuously identify new ways to improve the program's effectiveness.

When the Bainbridge Island School District in Washington began planning its new Sakai Intermediate 5th and 6th grade-level school in 1997, it appointed a program planning team composed of teachers and administrative staff to work with the project manager and architects. The team was responsible for ensuring the design team's plans were consistent with the school's curriculum and goals (PPRC, 2004).

Establishing a team of administrators, faculty, and students that can take on additional responsibility for ensuring energy efficient measures, especially O&M practices, are sustained, can be a good way to educate students while ensuring continued energy performance.

In Elma, New York, students from the Iroquois Green Schools team at Iroquois High School prepared class plans and developed educational materials to demonstrate energy conservation concepts and benefits to elementary school students throughout the school district (ASE, 2002).

- **Adapt activities to unique school priorities and curricula**. Tailoring energy efficiency measures to a school's particular needs and resources can help incorporate energy efficiency into a school's culture.

When the Poudre School District in Fort Collins, Colorado, decided to build a new Fossil Ridge High School, its primary goal was to build the healthiest and most comfortable school possible to provide its students with a superior learning environment. A secondary goal was to make the school a teaching tool for environmental stewardship at no added cost. The building, completed in 2005, received LEED Silver certification and has earned the ENERGY STAR label for top energy performance each year from 2005 to 2008 (U.S. GBC, 2006; U.S. EPA, 2009c).

- **Combine low-cost energy efficiency measures with higher cost measures**. Combining energy efficiency measures that have lower implementation costs with

measures that have higher costs can allow school districts to use savings from the lower cost measures to offset the costs of the more extensive measures, thus shortening the overall payback period. A shorter payback period can make energy efficiency improvements more palatable to school district officials and the public, whose tax dollars are at stake (U.S. EPA, 2008).

- **Train facilities maintenance staff**. Training for facilities maintenance staff is an important component of a comprehensive energy efficiency upgrade because it helps ensure that the benefits of the upgrades are sustained. Training can cover a range of topics, including equipment warranties and maintenance, operational schedules, emergency procedures, and air quality and comfort issues. Some school districts have incorporated training sessions for facility staff in performance contracts with ESCOs (U.S. EPA, 2008).

- **Use a district-wide shared savings approach**. Many school districts employ a shared-savings approach that allows schools to retain a certain percentage of their energy savings from behavioral and operational changes. This approach often leads to increased buy-in from individual schools and can result in greater overall savings.

Schools in Wake County, North Carolina, retain 10 percent of the annual energy savings they accrue. The increased buy-in produced by this shared-savings approach, combined with training sessions for faculty, staff, and students, has resulted in energy cost savings reaching nearly $600,000 per year (U.S. EPA, 2008).

- **Recognize students**. School districts can encourage student buy-in for energy efficiency programs by recognizing students who contribute significantly to their school's activities. Increased recognition of student contributions can lead to more widespread awareness of a school's efforts, stronger appreciation for the benefits of energy efficiency, and more increased dedication to improving school energy performance.

The Council Rock School District in Newtown, Pennsylvania, which serves more than 12,000 students, has reduced its energy costs by a total of $2.5 million since becoming an ENERGY STAR Partner in 2006. The school district has also been engaging students to increase their awareness and encouraging them to partake in its efforts. The school district established a scholarship fund for middle and high school students to reward students who contribute to energy efficiency projects (U.S. EPA, 2008j).

- **Integrate energy efficiency and clean energy supply objectives**. Many school districts are relying on renewable energy sources, in particular solar and geothermal, to meet energy loads that have been reduced using a variety of energy efficiency measures. Geothermal heat pumps, which capture heat from beneath the earth's surface, can use 25–50 percent less energy than traditional heating and cooling systems. Reducing energy consumption prior to installing renewable energy generation systems can significantly reduce the size, and thus the cost, of the generation system. In addition, energy cost savings produced by the energy efficiency measures can offset a portion of the cost of the generation system, thus reducing its payback period (U.S. EPA, 2008).

When the Great Seneca Creek Elementary School in Germantown, Maryland, was built, designers incorporated energy efficiency measures, including a cool roof, to enable the school to use a smaller geothermal system to meet its reduced energy load (Montgomery County, 2007).

Fairview Elementary School in Normal, Illinois, an ENERGY STAR labeled building, serves students in preschool through fifth grade. In 2007 school officials decided to replace the aging boiler system with a ground-source (geothermal) system. The unique one-pipe geothermal design was promised to be as energy efficient as the former three-boiler system, while also providing air conditioning. The performance of the geothermal system has far exceeded expectations, and the school has realized considerably greater savings than originally promised. The increased comfort for students and staff has also resulted in a much better learning environment (U.S. EPA, 2009d).

School districts can also compliment their energy efficiency efforts by making green power purchases for their facilities. See EPA's *Green Power Procurement* guide in the *Local Government Climate and Energy Strategy Series* for more information.

Strategies for Engaging the Community

School districts have also used implementation strategies that engage the community and other potential partners to help improve energy efficiency in schools. These strategies can help school districts leverage additional resources and increase the visibility of their energy efficiency programs.

- **Work with the community**. Creating partnerships with other schools, local governments, and businesses and residents can enhance the benefits of energy efficiency improvements in K-12 school buildings by sharing information and experience, and by increasing public awareness.

To help facilitate these partnerships, EPA has developed a Web site that provides information on how school districts, local governments, and other organizations can leverage community resources to support energy efficiency programs and promote energy efficiency (see ***http://www.energystar.gov/index.cfm?fuseaction=challenge_community.showIntroduction***). The Web site outlines a five-step process for engaging the community. It also provides examples and information resources, including a factsheet on examples of community-wide ENERGY STAR events and key strategies for working with different types of groups within the community (U.S. EPA, 2008w).

Willmar School District in Willmar, Minnesota, is a participant in the Schools for Energy Efficiency program, a public-private initiative that works with school districts across the state to improve energy efficiency and educate students about the benefits of reducing energy consumption. In 2006 students from Willmar Junior High School, while raising funds to purchase solar panels for their school, canvassed the neighborhood to collect contributions and inform residents about the school's energy efficiency activities (SEE, 2006b).

In addition, many school districts are communicating the benefits of their energy efficiency programs to the community. These communications come in various forms, including updates on school district Web sites, newsletters, and community briefings.

- **Inspire buy-in through competition**. Some school districts have found that competitions with other school districts to achieve the greatest energy consumption reduction can be a low-cost strategy for encouraging energy-efficient behavior.

Nearly 80 schools entered the 2007 Minnesota Energy Challenge, which encourages students from schools throughout the state to conserve energy to reduce CO_2 emissions (Minnesota Energy Challenge, 2007). As of early 2009, 129 schools had enrolled in the challenge. The program estimates that conservation efforts associated with the challenge are responsible for almost 74,000 fewer tons of CO_2 emissions annually, equivalent to the annual emissions of more than 12,000 cars (Minnesota Energy Challenge, 2009).

Another method for inspiring buy-in is to challenge students and teachers to meet a specific energy consumption reduction goal.

Many schools and school districts, such as Kenton County School District in Kentucky, have joined the ENERGY STAR Challenge, which sets a goal for school districts to reduce energy consumption by 10 percent (Kenton County, 2007). Two schools in the district are now ENERGY STAR labeled buildings. One of the schools, Caywood Elementary, built in 2005, incorporates daylighting and geothermal heating/cooling into its design scheme and saves approximately $45,000 annually in energy costs (Kentucky Department of Energy Development and Independence, 2009).

- **Participate in national campaigns**. Many school districts have joined national campaigns to reduce energy consumption and improve environmental profiles in schools. Joining national campaigns can help school districts leverage information and financial resources. For example, the Alliance to Save Energy's

Green Schools program helps school districts access resources for improving energy efficiency in their facilities, and works with them to join the ENERGY STAR Challenge (ASE, 2008).

In 2005 the Maize Unified School District in Maize, Kansas, committed to improve energy efficiency across its portfolio of eight buildings by 10 percent through the ENERGY STAR Challenge. Since then the district has improved its energy efficiency by 16 percent, saving a cumulative $340,000 and reducing GHG emissions by 5,500 tons annually, equivalent to the carbon storage capacity of more than 840,000 healthy trees (U.S. EPA, 2008g).

7. INVESTMENT AND FINANCING OPPORTUNITIES

This section provides information on the size and payback periods associated with upfront investments in energy efficiency improvements in school buildings. It also identifies several financing opportunities that can help school districts manage the costs of these investments.

Investment

Improving energy efficiency in school buildings is an investment that earns a return over time. The size and payback period (length of time required to recoup upfront costs) of this investment varies depending on the extent of the upgrade and the resources required. Many significant improvements can be made with little or no upfront cost. While some energy efficiency improvements require substantial upfront investment, the costs can often be quickly recovered. Life-cycle cost analysis, which measures the lifetime costs of design and construction, maintenance and replacement, and other impacts, reveals the cost effectiveness of energy efficiency upgrades. For more information on life-cycle cost analysis, see Section 3, *Planning and Design Approaches to Energy Efficiency in K-12 Schools*.

The short payback periods associated with some components of a comprehensive energy efficiency upgrade can help reduce the overall payback period for the entire project. For example, the third stage of the approach for upgrading facilities, described in Section 3, involves reducing supplemental loads by purchasing energy-efficient products. Purchasing these products, which typically have short payback periods, can generate significant energy cost savings that can shorten the payback period for the building upgrade as a whole.

TABLE 3. ENERGY STAR SPECIFICATION OVERVIEWS: ENERGY SAVINGS AND PAYBACK PERIODS[a]

Product Category	Percent Energy Savings Compared to Conventional Product	Payback Period
Appliances		
Dehumidifiers	15%	0 years (typically no retail cost premium)
Commercial Food Service		
Commercial dishwashers	30%	2 years (for typical unit)
Commercial griddles	10%	<5 years
Commercial hot food holding cabinets	65%	<5 years
Commercial ovens	30% (gas) 15% (electric)	0 years (no premium for gas) <5 years (electric)
Commercial refrigerators & freezers–glass door	30%	2-5 years (preliminary assessment)
Commercial refrigerators & freezers–solid door	35%	<2 years (preliminary assessment)

TABLE 3. ENERGY STAR SPECIFICATION OVERVIEWS: ENERGY SAVINGS AND PAYBACK PERIODSA *(cont.)*

Product Category	Percent Energy Savings Compared to Conventional Product	Payback Period
Commercial steam cookers	50% (electric) 35% (gas)	<2 years
Electronics		
Televisions	15%	0 years (typically no retail cost premium)
Envelope		
Roof products	NA	0 years (typically no retail cost premium)
Heating and Cooling		
Air source heat pumps	10%	Varies Regionally
Boilers	5%	<5 years
Ceiling fans	45% (with light kit) 10% (fan only)	<4 years
Furnaces	15% (gas) 8% (oil)	<5 years
Geothermal heat pumps	30%	Varies Regionally
Light commercial HVAC	5%	Varies Regionally
Ventilating fans	70%	0 years (typically no retail cost premium)
Office Products		
Computers	30%	0 years (typically no retail cost premium)
Copiers	10%	0 years (typically no retail cost premium)
Monitors	20%	0 years (typically no retail cost premium)
Multifunction devices	15-30% (laser v. inkjet)	0 years (typically no retail cost premium)
Printers, fax machines, and mailing machines	10%	0 years (typically no retail cost premium)
Scanners	10%	0 years (typically no retail cost premium)
Servers	30%	0 years (typically no retail cost premium)
Other		
Vending machines	July 2007	0 years (typically no retail cost premium)

[a] ENERGY STAR develops performance-based specifications to determine the most energy-efficient products in a particular product category. These specifications, which are used as the basis for ENERGY STAR qualification, are developed using a systematic process that relies on market, engineering, and pollution savings research and input from industry stakeholders. Specifications are revised periodically to be more stringent, which has the effect of increasing overall market energy efficiency (U.S. EPA, 2007h). EPA and DOE screen all of the specifications annually to determine if any require reassessment. These assessments may lead to a specification revision, a specification being sunset, or no action being taken depending on market readiness for the next level. To view current ENERGY STAR criteria, please visit *http://www.energystar.gov/index.cfm?c=product_specs.pt_product_specs*. To view specifications that are under review or revision, please visit *http://www.energystar.gov/index.cfm?c=prod_development.prod_development_index*.

Source: U.S. DOE, 2009; U.S. EPA. 2009j.

Similarly, behavioral adjustments, such as setting thermostats at lower temperatures in the winter, can often be implemented at no cost, yet produce significant savings and reduce the payback period of a comprehensive upgrade. Table 3, *ENERGY STAR Specification Overviews: Energy Savings and Payback Periods*, illustrates the payback periods for a variety of energy-efficient products.

The cost premium of designing and constructing high-performance school buildings is often 1–2 percent of the total construction cost of a conventional school, though some high-performance school buildings have been designed and constructed at no additional cost. According to one study, the average additional cost of designing and constructing a high-performance school is only $3 per square foot, or 1.7 percent of the cost of construction for a conventional school building. Because the cost premium for high-performance buildings can be very low, the cost savings they produce can result in life cycle savings as much as eight times the original cost (Capital E, 2006). [11]

CHPS estimates that the initial cost of complying with its design criteria is approximately $2 per square foot, which in many cases can be offset by a 20 percent energy cost savings, as indicated in Figure 3, *Initial Costs and Payback Periods for Compliance with CHPS Criteria*.

[11] *The average school building construction cost is approximately $150 per square foot (Capital E, 2006).*

Financing

Upfront costs can present a barrier to improving energy efficiency in school buildings. However, delaying cost-effective energy efficiency improvements can also be costly; an activity not undertaken can result in increased operating costs (Zobler and Hatcher, 2008). [As described on page 22 in Section 3, *Planning and Design Approaches to Energy Efficiency in K-12 Schools*, school districts can use the ENERGY STAR Cash Flow Opportunity Calculator to help make decisions about the most effective timing of energy-efficient product purchases (U.S. EPA, 2003b)]. This section describes a variety of financing vehicles and funding sources that school districts can access to address financial barriers.

FINANCIAL VEHICLES

Financing refers to accessing new funds through loans, bonds, energy performance contracts, lease-purchase agreements, and grants to pay for energy efficiency upgrades. Financial vehicles can access the sources of funding described in the subsequent section to obtain the capital for energy efficiency

FIGURE 3. INITIAL COSTS AND PAYBACK PERIODS FOR COMPLIANCE WITH CHPS CRITERIA

This figure demonstrates how energy cost savings can offset the initial costs of compliance with CHPS high-performance school design criteria. For a 7th and 8th grade school, for example, an initial cost of $1.90 per square foot, which includes both hard costs (i.e., material and labor costs for design, construction, implementation, and O&M) and soft costs (e.g., fees for design, documentation, commissioning, and consulting), can be offset by annual energy cost savings of $0.32 over 5.9 years.

School Type	Hard Costs (per ft²)	Soft Costs (per ft²)	Total Initial Costs (per ft²)	Annual Energy Costs for Noncompliant Designs (per ft²)	Annual Energy Costs for Compliant Designs (per ft²)	20% Annual Energy Cost Savings (per ft²)	Simple Payback Period
K-6	$0.65	$1.10	$1.75	$1.31	$1.05	$0.26	6.7 years
7-8	$0.65	$1.25	$1.90	$1.61	$1.29	$0.32	5.9 years
9-12	$0.65	$1.40	$2.05	$1.75	$1.40	$0.35	5.9 years

Source: Hawaii DBEDT, 2005.

upgrades. Financial vehicles that school districts use to finance energy efficiency improvements include:

- **Energy performance contracts**. An energy performance contract is an arrangement with an ESCO or energy service provider (ESP) that allows a school district to finance energy-saving capital improvements—usually over a 7–15 year term—with no initial capital investment by using money saved through reduced utility expenditures. Contracts bundle energy-saving investments (e.g., energy audits, design and specification of new equipment, ongoing maintenance, measurement and verification of product performance, indoor air quality management, and personnel training) and typically offer financing (Zobler and Hatcher, 2008).

An ESCO often provides a guarantee that energy cost savings will meet or exceed annual payments covering all activity costs. Such guaranteed savings agreements are the most common type of performance contract in the public sector. [12] If the savings do not occur, the ESCO pays the difference. Some performance contracts include a reserve fund to cover potential shortfalls, while others provide security enhancements in the form of performance bonds or letters of credit. In some instances, performance insurance may be available (Zobler and Hatcher, 2008).

MONTICELLO HIGH SCHOOL

In Illinois, Monticello High School entered into a performance contract agreement in 1994 with Johnson Controls to install a number of energy efficiency upgrades, including lighting retrofits, boiler and window replacements, and a new roof. Through the agreement, the school district was able to use guaranteed energy and operational savings over 10 years to pay off the $3.86 million cost of the project. The energy efficiency investment has resulted in annual energy cost savings of 30–40%, and has earned the building the ENERGY STAR label.

Source: U.S. EPA, 2008t.

ESCOs often offer financing as part of performance contracts. However, because ESCOs are private sector firms that typically borrow at taxable, commercial rates, it is often possible for a public sector entity to secure better financing arrangements by taking advantage of lower, tax-exempt interest rates available to government entities (U.S. EPA, 2004).

- **Lease-purchase agreements**. A tax-exempt lease-purchase agreement (also known as a municipal lease) allows public entities to finance purchases and installation over long-term periods using operating budget dollars rather than capital budget dollars.

Agreements typically include "nonappropriation" language that limits obligations to the current operating budget period. If a local government decides not to appropriate funds for any year throughout the term, the equipment is returned to the lessor and the agreement is terminated. Because of this nonappropriation language, lease-purchase agreements typically do not constitute debt. Under this type of agreement, a local government makes monthly payments to a lessor (often a financial institution) and assumes ownership of the equipment at the end of the lease term, which commonly extends no further than the expected life of the equipment. These payments, which are often less than or equal to the anticipated savings produced by the energy efficiency improvements, include added interest. The interest rates that a local government pays under these agreements are typically lower than the rates under a common lease agreement because a public entity's payments on interest are exempt from federal income tax, meaning the lessor can offer reduced rates (U.S. EPA, 2004).

TAX-EXEMPT LEASE PURCHASE AGREEMENTS AND ENERGY PERFORMANCE CONTRACTING

Florida's Miami-Dade County Public Schools district financed energy-efficient equipment installations in its facilities at reduced cost by adding guaranteed energy savings performance contracts with three ESCOs to an existing tax-exempt master lease-purchase agreement rather than financing the projects directly through the ESCOs. Through the master agreement, the school district has invested $9.5 million in energy efficiency. The investment produced savings of $3.5 million in just 3 years.

Sources: U.S. EPA, 2003c; U.S. EPA, 2004.

Unlike bonds, initiating a tax-exempt lease-purchase agreement does not require a voter referendum to approve debt, a process that can delay energy efficiency

[12] *Another type of agreement is an own-operate agreement, in which the ESCO maintains ownership of the facility, and sells back its output to the state entity.*

improvements. Tax-exempt lease-purchase agreements typically require only internal approval and an attorney's letter, which often takes only 1 week (as opposed to months or years for bonds). Local governments can expedite the process by adding energy efficiency projects to existing tax-exempt lease-purchase agreements. Many local governments have master lease-purchase agreements in place to finance a range of capital investment projects. Energy-efficient product procurement can often be added to these agreements without difficulty (U.S. EPA, 2004b).

In addition, many local governments have found that interest rates available through tax-exempt lease-purchase agreements typically are lower than rates offered by an ESCO. The lease-purchase agreements can be especially effective when used to underwrite energy performance contracts that include guaranteed savings agreements, under which an ESCO agrees to reimburse any shortfalls in expected energy cost savings.

The Aiken County Public Schools in Aiken, South Carolina, for example, used a $3.5 million performance contract to make many energy efficiency upgrades, including improved temperature and humidity controls and light levels as well as new cooling equipment that meets EPA standards for chlorofluorocarbons (CFCs). These measures have reduced the Aiken County Schools' energy consumption by 12%, saving the district $320,000 per year. Because the investment was paid for with energy savings, the upgrades were made without additional tax dollars (Johnson Controls, Undated).

- **Loans, rebates, other assistance**. Some states have loan programs to help school districts finance energy efficiency activities. These programs often provide financial assistance via low-interest loans that can be paid off using energy cost savings. In addition, many school districts have used rebates or other financial assistance from utilities to offset the cost of improving energy efficiency in their facilities. The Database of State Incentives for Renewables and Efficiency provides information on state government and utility incentives available to school districts in each state (*http://www.dsireusa.org/*).

FUNDING SOURCES

Numerous funding sources can support school district energy efficiency programs, including public benefits funds (PBF), state governments, and utility assistance programs. These sources can be accessed through the financial vehicles described above to provide capital for energy efficiency upgrades (Zobler and Hatcher, 2008). For example, a revolving loan fund or state-run PBF can provide funding to a school district via a financial vehicle such as a loan or grant. This section describes how school districts have used different funding sources.

- **Energy cost savings**. Many school districts have used energy cost savings from low-cost energy efficiency measures to offset the costs of larger energy efficiency upgrades, such as HVAC system replacements. Schools that invest in energy efficiency or improve their energy management can develop agreements with their districts to have a percentage of cost savings from those improvements returned to a school for reinvestment in additional energy efficiency measures (Zobler and Hatcher, 2008).

- **State government programs**. Some states administer programs that fund school district energy efficiency upgrades. For example, Massachusetts reimburses up to 2 percent of the total project costs for school buildings that earn certification as Massachusetts High-Performance Green Schools (MTC, 2007a). [13] Similarly, New Hampshire provides a 3 percent incremental reimbursement for school buildings that meet high-performance guidelines (NEEP, 2007b).

In 2008 the Maryland legislature passed a bill mandating that beginning in July 2008, schools built using state funds must meet LEED Silver standards. To help school districts meet this new requirement, the state has agreed to pay for 50 percent of the premium associated with designing and constructing schools to meet the standards through FY 2014 (Maryland, 2008).

[13] Certification is contingent on evaluation and scoring by the Massachusetts CHPS Certification Review Committee. School buildings that earn high scores are certified as Massachusetts High-Performance Green Schools (MTC, 2007c).

MUNICIPAL ENERGY FUND

The Ann Arbor, Michigan, Municipal Energy Fund is an excellent example of how energy efficiency can pay for itself in the long term. The fund started with an initial payment of $100,000 per year over 5 years, capturing 80 percent of the resulting savings for reinvestment back into new energy saving projects. As these new projects grow, their energy and cost savings increase. By year 5, future investment is based solely on payment of past projects to finance new ones. Annual cost savings enabled by the fund total $142,000 across 60 facilities.

Sources: Ann Arbor, 2007; C40 Cities, 2008.

- **Increases in state funding**. School district funds are often allocated by state governments based on a specific formula. This formula is determined by multiple factors, including a school district's attendance rate. Energy efficiency upgrades that improve indoor air quality can help a school district improve attendance, thus earning it more state funds.

- **Capital budgets and operating budgets**. Using capital or operating budget funds has many advantages: Funding is already on hand, there is no need to negotiate financing arrangements, and there are no interest payments. Using life-cycle cost accounting to quantify the lower net capital and future operating costs can help school districts improve chances of incorporating energy efficiency into their limited capital budgets (Zobler and Hatcher, 2008).

  School districts can use a "paid from savings" approach to fund purchases of energy-efficient products that have cost premiums by reserving energy cost savings generated from their energy efficiency activities to pay for energy-efficient products.

- **Utility assistance**. Some utilities offer financial assistance to school districts for energy efficiency projects. Some states provide school districts with information on how to access utility assistance programs. For example, New Hampshire maintains information on energy efficiency programs run by state utilities (New Hampshire Public Utilities Commission, Undated).

  - ***Incentives.*** The Washoe County School District in Reno, Nevada, received a $103,119 incentive payment from the Sierra Pacific Power Company to perform energy efficiency upgrades in 10 school buildings, a project expected to reduce the school district's electricity use by nearly 2 million kWh annually, preventing emission of 1,520 tons of CO_2.[14] (Washoe County School District, 2007).

  - ***Public benefits funds.*** Some states, such as California and Oregon, require utilities to provide energy efficiency assistance through PBFs from state-mandated system benefits charges that they collect from customers (Oregon, Undated). For example, Southern California Edison, an electric utility, used PBFs when it partnered with the Newport-Mesa Unified School District to design a new energy-efficient elementary school. The resulting design integrated all building systems and optimized energy use while reducing the building's environmental impacts (PPRC, 2004).

8. FEDERAL, STATE, AND OTHER PROGRAM RESOURCES

Many school districts work with federal, state, and regional agencies and organizations when planning and developing programs for improving energy efficiency in their school buildings. These agencies and organizations can provide school districts with information resources and financial and technical assistance, as described below.

Federal Programs

Federal programs that provide information and assistance for improving energy efficiency targeted to school districts include:

- **ENERGY STAR for K-12 School Districts.** More than 400 school districts across the country have partnered with ENERGY STAR to improve energy efficiency in school buildings (see the Poudre School District example in the text box below) (U.S. EPA, 2008d). ENERGY STAR provides tools and information that help school districts improve energy performance. Resources include tools for measuring, tracking, and setting an energy savings goal; online energy management training; communications kits; financing information; and case studies of successful energy efficiency improvements. In addition, EPA has developed a chapter that

[14] *In Nevada, the average emissions produced by electricity generation are 1.52 lbs/kWh. From http://www.eia.doe.gov/oiaf/1605/ee-factors.html*

focuses exclusively on K-12 schools in its recent revision to the *ENERGY STAR Building Upgrade Manual*. The chapter provides strategies and best practices for improving energy efficiency in K-12 schools.

Web sites: *http://www.energystar.gov/index.cfm?c = k12_schools.bus_schoolsk12*

POUDRE SCHOOL DISTRICT

The Poudre School District in Fort Collins, Colorado, used ENERGY STAR's Target Finder to set energy targets for its Operations Building multiple times during the early stages of the building design process. These early evaluations allowed the design team to make adjustments to building orientation, envelope, materials, internal systems, and equipment. As the design process progressed, the team was able to achieve consistent Target Finder energy scores in the 80s.

The building was completed in May 2002, and after accruing 12 months of energy use data, it earned the ENERGY STAR label for achieving a score of 97, making it the 11th Poudre School District building to earn the label. In addition, the district was named the 2003 ENERGY STAR Partner of the Year for Leadership in Energy Management, and in 2005 the building achieved a perfect score.

Source: U.S. EPA, 2007e.

- **EnergySmart Schools**. Through its EnergySmart Schools program, DOE works with public and private entities to improve energy efficiency in the nation's new and existing K-12 school buildings. The program's goals are for new school buildings to be designed to be 50 percent more efficient than building energy codes require, and for existing school buildings to reduce energy consumption by 30 percent (U.S. DOE, 2007). The program has developed "how-to" guides for planning, designing, financing, and operating and maintaining energy-efficient school buildings. It has also produced *Energy Design Guidelines for High Performance Schools*, which provides technology ideas for different climate zones across the country.

  Web site: *http://www.eere.energy.gov/buildings/energysmartschools/index.html*

- **Healthy School Environments program**. This EPA program is a clearinghouse of resources on programs and information on ensuring healthy environments in school buildings. Through the program, school districts can access the HealthySEAT tool, which enables schools to manage self-assessment programs for ensuring the health of students, faculty, and other occupants. EPA's related Indoor Air Quality Tools for Schools Program provides detailed guidance to help schools adopt indoor air quality management practices that reduce student, teacher, and other occupant exposure to indoor environmental contaminants. The program's Action Kit has been used by hundreds of schools across the country. The program also recognizes schools that produce substantial improvements in indoor air quality.

  Web site: *http://www.epa.gov/schools/*

- **U.S. EPA State and Local Climate and Energy Program**. This program assists state, local, and tribal governments in meeting their climate change and clean energy efforts by providing technical assistance, analytical tools, and outreach support. It includes two programs:

  - The **Local Climate and Energy Program** helps local and tribal governments meet multiple sustainability goals with cost–effective climate change mitigation and clean energy strategies. EPA provides local and tribal governments with peer exchange training opportunities and financial assistance along with planning, policy, technical, and analytical information that support reduction of greenhouse gas emissions.

  - The **State Climate and Energy Program** helps states develop policies and programs that can reduce greenhouse gas emissions, lower energy costs, improve air quality and public health, and help achieve economic development goals. EPA provides states with and advises them on proven, cost–effective best practices, peer exchange opportunities, and analytical tools.

  Web site: *http://www.epa.gov/statelocalclimate/*

- **U.S. DOE Energy Information Administration**. The National Energy Information Center publishes Energy Education Resources: Kindergarten Through 12th Grade, which gives educators access to no- and low-cost energy-related educational materials.

  Web site: *http://www.eia.doe.gov/bookshelf/eer/kiddietoc.html*

- **U.S. Department of Education**. The Department of Education administers Qualified Zone Academy Bonds (QZAB) that can be used by school districts or low-income populations to finance renovation projects, equipment purchases, and training. The program is designed to provide bond holders with tax credits approximately equal to the interest that would normally be paid.

Web site: *http://www.ed.gov/programs/qualifiedzone/index.html*

State Programs

Many states have programs to assist school districts in planning and designing high performance school buildings. Some states, such as Massachusetts and New York, have adopted the CHPS model, which originated in California, and modified it to meet state their criteria. Other states, such as Maine and Kentucky, administer programs that provide financial and technical assistance to school districts.

The Maine Green Schools program, supported by the Maine Department of Environmental Protection's Bureau of Air Quality and the Maine Energy Education Program, provides technical assistance to school districts that want to reduce energy costs and GHG emissions through energy efficiency. The program helps districts inventory GHG emissions and identify areas with potential for energy savings. Different levels of assistance are available depending on a district's particular needs. The program Web site allows district employees to download tools to get started; it also provides assistance for those that need help to get going. With the help of the Green Schools program, the Lewiston School District has installed an advanced lighting system that saves up to 50 percent in energy costs while reducing maintenance costs and increasing student and teacher comfort. The system works by allowing individuals to manually control lighting based on preference, and can automatically adjust lighting levels based on the natural light available (Maine Green Schools, 2009).

COLORADO SCHOOL DISTRICT 16 USES QZABS TO FUND ENERGY EFFICIENCY IMPROVEMENTS

School District 16 in Garfield, Colorado, used a $2.5 million allocation of the state's QZAB funds to implement energy efficiency improvements to district buildings. Use of the funds was predicated on the district's compliance with a requirement that a partner be willing to pay an initial 10% of the borrowed amount. The district was able to work with oil and gas industry representatives to secure this guarantee. The QZAB funds enabled the district to implement $2.5 million in energy efficiency improvements at a cost of less than $900,000 to the district's general fund.

Source: Rebuild Colorado, 2007.

In New York, the state-owned New York Power Authority assists public and private schools in installing energy-efficient equipment and systems through its Power to Schools program (NYPA, 2007). The New York State Energy Research and Development Authority (NYSERDA) is also funding grants and workshops for energy efficiency education. Various school districts have submitted proposals to NYSERDA regarding their plans to reduce energy consumption by 15 percent. (NYSERDA, 2009).

Other Programs

Some school districts are working with private organizations to promote energy-efficient design and operation of K-12 school buildings. In response to district demands for a comprehensive plan to reduce energy costs, for example, a Minnesota mechanical and electrical engineering firm created Schools for Energy Efficiency (SEE), a program that partners with ENERGY STAR to provide schools with customized energy plans. The 14 school districts that have joined the program achieve annual energy savings of 10–20 percent. This group includes 15 of the 47 districts in the nation that have earned ENERGY STAR Leaders awards for continuous improvement in energy efficiency district-wide (SEE, 2007; U.S. EPA, 2009e).

Some national and state-specific nonprofit organizations are dedicated to integrating energy and environmental education into classroom lessons. These organizations, such as the National Energy Education Development project (NEED), Project Learning Tree,

National Energy Foundation, and the Alliance to Save Energy, are good sources of educational materials, and may help school districts finance energy efficiency improvements. NEED, for example, created a network of partners that provides teachers with resources to promote understanding of the implications of energy use and conservation (NEED, 2007; PLT, 2009; ASE, 2008).

9. CASE STUDIES

The following case studies describe two school districts' comprehensive programs for improving energy efficiency in K-12 school buildings.

Colorado Springs School District 11—Colorado Springs, Colorado

District 11's Resource Conservation Management program is a long-term energy management program intended to reduce energy costs and improve the flexibility of the district's operational budget. Since the program's inception, the district has saved $6.5 million on utility bills and decreased average energy consumption per square foot by nearly 20 percent.

PROFILE: COLORADO SPRINGS DISTRICT 11

Area: 186 square miles

Population: 31,000 students, 3,500 employees

Structure: The school district is governed by a school board and a board-appointed superintendent. The Resource Conservation Management Program is administered by the district energy manager.

Program Scope: The Resource Conservation Management Program covers the school district's 70 facilities, which encompass 4.2 million square feet.

Program Creation: The program was initiated in summer 1999 to reduce energy costs and increase operational budget flexibility.

Program Results: $6.5 million in energy cost savings for FY 1999–2006. Average energy consumption per square foot was reduced from 92 kBtu to 75 kBtu.

PROGRAM INITIATION

District 11 initiated the Resource Conservation Management program in summer 1999 to reduce energy costs and improve the flexibility of its operational budget. The program requires active participation from all district schools. In 2000 the district school board adopted an energy conservation policy stating the district's commitment to long-term sustainable energy management and encouraging all district facilities to participate in energy management programs. The policy requires the district energy manager to work with the Energy Advisory Committee to develop an annual energy report to be presented to the school board (Colorado Springs School District, 2000).

PROGRAM FEATURES

The District has achieved significant energy cost savings by implementing a range of energy efficiency measures, including:

- **Utility bill tracking database**. In 1998 the district created a utility accounting database using Microsoft Office Access software. The database calculates avoided costs and enables the district energy manager to compare current consumption with the 1998–1999 baseline. When first employed, this database helped the district immediately recognize nearly $100,000 in billing errors, resulting in a substantial refund.

- **Energy monitoring system**. The district uses direct digital building controls to monitor near real-time energy consumption in its facilities. The tool helps the energy manager to quickly spot and investigate any anomalies, as well as analyze consumption for any time period and project future consumption trends.

- **Energy performance contracting**. The district uses ESCOs to perform various energy efficiency retrofits. Through 2005, the district used energy performance contracting to perform $5 million in energy efficiency upgrades that have produced $500,000 in guaranteed annual savings. The contracts are self-funded through energy cost savings, so there is no added tax burden on the community.

- **Lighting retrofits**. Through 2005, the district invested approximately $2.7 million in lighting retrofits to 95 percent of its school buildings. These upgraded lighting systems save 40–60 percent on energy consumption and provide a superior quality of light.

- **Energy savings incentives**. The district's program includes an incentive for individual schools in which a percentage of energy cost savings are returned by the district to a school. Through February 2007, the district has returned nearly $500,000 directly to schools.

- **High-performance school design standards**. The district developed its own design standards that require higher environmental standards for indoor air quality, comfort, natural lighting, and acoustics than code currently requires. These standards also include an energy performance requirement that facilities achieve an annual energy consumption rating of 25 kBtu per square foot. The district projects that strict adherence to these guidelines will save it $12.7 million over the life-cycle of a typical elementary school (Buildings, 2007; Colorado Springs School District, 2005b).

PROGRAM RESULTS

In FY 1999–2006, the district saved $6.5 million on utility bills. According to the district's tracking database, average energy consumption per square foot was reduced from 91.9 kBtu in FY 1999 to 75 kBtu in FY 2006, with some school buildings as low as 45 kBtu. The district has established a goal for all new facilities to reduce energy consumption per square foot to 25 kBtu (Buildings, 2007).

Through 2005, seven of the district's buildings had earned the ENERGY STAR label. In 2003 and 2004, the district was named an ENERGY STAR Leader, and in 2005 it was named an ENERGY STAR for Excellence in Energy Management Partner of the Year (Colorado Springs School District, 2005a).

Web site: *http://www.d11.org/fotc/energy/*

Gresham-Barlow School District —Multnomah County, Oregon

The school district's Resource Conservation Management program is a comprehensive strategy for reducing district energy costs and to allocate savings to instruction and student programming. By gaining support from district staff and combining the common interests of multiple stakeholders, this program has achieved significant energy, economic, environmental, and educational benefits.

PROGRAM INITIATION

The district formed a waste reduction committee, made up of principals, teachers, custodians, parents, and students, to oversee resource conservation efforts in its 20 school buildings in 1995. The committee provided stakeholders with an opportunity to engage in dialogue about cost-reducing and environmentally conscious projects that could be implemented throughout the district. Increased awareness of the cost implications of wasted resources resulted in a district-wide focus on modifying student and staff behavior to reduce waste.

In 1998 these waste reduction efforts began to incorporate energy conservation, leading to the hiring of an energy manager. The energy manager used a utility tracking software program to analyze the previous 4 years' energy consumption data and monitor the district school buildings' energy usage. The district then turned to the state Department of Energy's Schools Team for guidance on establishing the Resource Conservation Management program. The district adopted a comprehensive energy policy to invest in building infrastructure, energy-efficient equipment, and energy management software (Oregon DOE, 2005).

PROFILE: GRESHAM-BARLOW SCHOOL DISTRICT

Area: 54 square miles

Population: 12,150 students, 1,200 staff

Structure: The school district is governed by a seven-member school board, which appoints the superintendent. The Resource Conservation Management Program is overseen by the assistant director for facilities.

Program Scope: The Resource Conservation Management Program is implemented across 20 school buildings.

Program Creation: The program was created in 1998 when the district established an energy policy and hired an assistant facilities manager to oversee the program.

Program Results: Despite increases in student enrollment and classroom space, the district has reduced energy consumption by 46% from 1998 levels, resulting in a total energy cost savings of $5.2 million through October 2006.

PROGRAM FEATURES

The Resource Conservation Management program includes a number of features, such as:

- **Energy performance tracking**. The district's ESCO, Save More Resources, uses the ENERGY STAR performance scores system to track the effectiveness of energy efficiency activities in school facilities.
- **Broad-based support**. The district's energy manager has worked with the school superintendent, school board members, teachers, and other staff to maintain ongoing support for energy efficiency activities. The energy manager meets monthly with the head custodians of each school to review problems and identify best practices. This information is then presented to the superintendent and school board.
- **Public-purpose charge funding**. Oregon law requires utilities to collect a public-purpose charge from consumers. Ten percent of these charges must be redistributed to consumers through energy efficiency improvements in public schools within the utilities' regions. The district receives approximately $180,000 annually through this fund.
- **Energy savings incentives**. Individual schools can earn incentives for energy efficiency behavior. The incentives range from $1,000 for elementary schools to $3,000 for high schools, and are awarded for exemplary energy performance and participation by staff and students.
- **Educational opportunities for students**. Individual schools are integrating energy efficiency into classroom lessons in a variety of ways. The district's Center for Advanced Learning initiated the Student-to-Energy Tech program that involves high-performing students in day-to-day management of the facility's energy and water consumption. In one school, students pledged to abide by energy-conserving principles of behavior and are allowed to ticket peers and staff members who are noncompliant with these principles (Helmke-Long, 2006). At a district elementary school, the head custodian presented students and teachers with an overview of how an energy audit is conducted and what data are collected. The school achieved a subsequent 30 percent reduction in energy consumption (Oregon DOE, 2005).

PROGRAM RESULTS

Despite increases in student enrollment and classroom space, the district has reduced its energy consumption by 46 percent from 1998 levels, resulting in total energy cost savings of $5.2 million through October 2006.

The district's school buildings currently use about 40 percent less energy annually than the national average for K-12 school buildings, which translates into GHG emission reductions of 40 percent. The energy cost savings achieved during the 2004–2005 school year alone were equivalent to 22 teaching position salaries (U.S. EPA, 2008u; Oregon DOE, 2005; Helmke-Long, 2006).

The district was recognized as an ENERGY STAR Leader in 2005, and in 2006 and 2008 earned the ENERGY STAR Partner of the Year award. Through 2008, 18 of the district's schools have received the ENERGY STAR Label (U.S. EPA, 2008u).

Web site:
http://www.peterli.com/archive/spm/1235.shtm and *http://www.energystar.gov/index.cfm?fuseaction=pt_awards.showAwardDetails&esa_id=635*

10. ADDITIONAL EXAMPLES AND INFORMATION RESOURCES

Title/Description	Web Site
Examples of Energy Efficiency in K-12 Schools	
Albert Lea, MN—Albert Lea Area Schools. The school district has been recognized as an ENERGY STAR Leader, having improved energy efficiency by more than 20%. The improvement has saved the district nearly $1 million.	*http://www.energystar.gov/index.cfm?fuseaction = PARTNER_LIST.showLeadersStory&lds_id = 622&o_ id = 1043576*
Augusta, MN—Cony High School. Financed through the Efficiency Maine High Performance Schools Program, the school's $100,000 energy efficiency improvements will produce annual savings of $28,000.	*http://apps1.eere.energy.gov/state_energy_ program/update/project_detail.cfm/pb_id=1111*
Averill Park, NY—Averill Park Central School District. The school district reduced energy costs by $500,000 over 2 years, earning it recognition as an ENERGY STAR Leader.	*http://www.energystar.gov/index.cfm?fuseaction = PARTNER_LIST.showLeadersStory&lds_id = 161&o_ id = 1035742*
Berwick, ME—Noble High School. The shool, completed in 2001, incorporates energy-efficient HVAC components that save money and enhance occupant comfort.	*http://www.energyvortex.com/pages/ headlinedetails.cfm?id = 655*
Colorado Springs, CO—School District 11. The district has saved $6.5 million on utility expenses since the beginning of its energy program in 1999.	*http://www.d11.org/fotc/energy/*
Enosburg Falls, VT—Middle and High School. Renovation of the Enosburg Falls Middle and High School increased square footage of the complex by 118%, but energy efficiency measures ensured consumption increased by only 54%.	*http://www.efficiencyvermont.com/pages/ BBBD2006/docs/Hemmelgarn-VT%20 Examples%20of%20High%20Performance-%20 Enosburg%20Falls%20M.pdf*
Fort Collins, CO—Poudre School. The school was planned using Target Finder. The building earned a perfect ENERGY STAR performance score.	*http://www.energystar.gov/index.cfm?c = new_ bldg_design.poudreschool_cs*
Greensboro, NC—Guilford Northern Middle School. The school, has received the designation "Designed to Earn the ENERGY STAR."	*http://www.energystar.gov/index.cfm?c = new_ bldg_design.project_guilford*
Gresham, OR—Gresham-Barlow School District 10. The district, which joined ENERGY STAR in 2005, has achieved the ENERGY STAR for 12 of its schools—more than half—and is the first school district in the Nation to achieve a 30-point improvement in energy performance.	*http://www.energystar.gov/index. cfm?fuseaction=PARTNER_LIST. showLeadersStory&lds_id=167&o_id=1029380*
Lakeland, WA—Clover Park School District. The district has implemented energy efficiency measures at two of its school buildings, producing combined energy cost savings of nearly $14,000 annually.	*http://www.ga.wa.gov/EAS/bcx/CloverPark-SD-retro-cx.pdf*
Mapleton, CO—Mapleton School District. The district utilized an energy performance contract to implement $4.7 million in energy efficiency improvements at its schools.	*http://apps1.eere.energy.gov/state_energy_ program/update/project_detail.cfm/pb_id=622*
Montgomery County, MD. The county has developed a green building program for its K-12 schools.	*http://montgomeryschoolsmd.org/departments/ facilities/greenschoolsfocus/sert.shtm*
Murrieta Valley, CA—Murrieta Valley Unified School District. The district used a $1.9 million loan from the California Energy Commission to iadopt energy efficiency improvements that have produced annual cost savings of $420,000.	*http://www.energy.ca.gov/efficiency/ brightschools/CASE_STUDY_MURRIETA.PDF*
New Haven, CT—New Haven School District. The school district has earned the "Designed to Earn the ENERGY STAR" label for four of its new schools.	*http://www.energystar.gov/index.cfm?c=new_ bldg_design.project_sheridan*
Red Wing, MN. Red Wing High School received an HVAC upgrade that was tailored to preserve acoustic quality in critical spaces, including the school media center and theatre.	*http://trane.com/Commercial/CaseStudies/Tier3/ RedWingMN.aspx?CaseId = 0*

10 ADDITIONAL EXAMPLES AND INFORMATION RESOURCES *(cont.)*

Title/Description	Web Site
San Leandro, CA—McKinley Elementary School. Through the California School Energy Efficiency program, the school implemented energy efficiency measures that reduced energy consumption by 49%.	*http://www.schoolsenergyefficiency.com/Documents/McKinley%20Case%20Study.pdf*
Somerville, MA—Capuano Early Childhood Center. This school, completed in 2003, was designed to achieve overall energy savings of 38% compared to a conventional design.	*http://www.masstech.org/renewableenergy/green_schools/Capuanobrochure.pdf*
Statesville, NC—Third Creek Elementary School. The school was designed to achieve a 25% energy savings compared with a conventional school building. It was the first school to receive LEED-Gold certification.	*http://leedcasestudies.usgbc.org/energy.cfm?ProjectID = 119*
Walled Lake, MI—Walled Lake Consolidated Schools. The school district, which encompasses 22 school buildings, has improved its energy performance portfolio-wide by 30% relative to 2003. The reduction has decreased the school district's CO_2 annual emissions by more than 21,000 tons.	*http://www.energystar.gov/index.cfm?fuseaction=PARTNER_LIST.showLeadersStory&lds_id=681&o_id=1026497*
Whitefish Bay, WI—Whitefish Bay School District. Since its baseline year of 2003, the district has succeeded in reducing energy use and cost by more than 20%, resulting in cost savings of more than $927,000, or the cost of 13 full-time staff. The district's emission reduction is equivalent to the emissions from more than 500 cars per year, or planting more than 700 acres of trees annually.	*http://www.energystar.gov/index.cfm?fuseaction=PARTNER_LIST.showLeadersStory&lds_id=601&o_id=1058543*
Information Resources for K-12 Schools	
American School and University Energy Resources. The American School and University Web site provides numerous energy-related resources for school administrators and facility operators.	*http://asumag.com/energy/*
Daylighting in Schools: An Investigation into the Relationship Between Daylighting and Human Performance. This report was produced for the California Board on Energy Efficiency to assess the benefits of daylighting on student performance in schools in California, Colorado, and Washington.	*http://www.coe.uga.edu/sdpl/research/daylightingstudy.pdf*
DOE Operations and Maintenance Best Practices. DOE developed this best practices handbook for K-12 schools.	*http://www.ase.org/uploaded_files/greenschools/School%20Energy%20Guidebook_9-04.pdf*
Dwindling Support: Annual School O&M Cost Study. This American School and University report addresses the trend of decreasing school O&M budgets across the country.	*http://asumag.com/images/archive/04as21.pdf*
Energy Design Guidelines for High Performance Schools. DOE has published eight reports that provide guidance for designing high-performance school buildings in eight unique climate regions.	*http://www1.eere.energy.gov/buildings/energysmartschools/design_guides.html*
Energy Efficiency and Indoor Air Quality in Schools. This ENERGY STAR report describes the relationship between energy efficiency upgrades, such as HVAC retrofits, and indoor air quality in school buildings.	*http://www.energystar.gov/ia/business/k12_schools/Ee&iaq.pdf*
Energy Resources for Schools. This EnergyIdeas Clearinghouse factsheet provides information on energy efficiency in K-12 school buildings.	*http://www.energyideas.org/documents/factsheets/EIC_schools.pdf*
EnergySmart Schools "How-to" Guides. DOE's EnergySmart Schools program has developed "how-to" guides for planning, designing, financing, and operating and maintaining energy-efficient school buildings.	*http://www1.eere.energy.gov/buildings/energysmartschools/publications.html*

10 ADDITIONAL EXAMPLES AND INFORMATION RESOURCES *(cont.)*

Title/Description	Web Site
Energy Solutions for School Buildings. This DOE Office of Energy Efficiency and Renewable Energy Web site provides a wealth of information and examples showing opportunities for energy efficiency in school building design, construction, and operation.	*http://www1.eere.energy.gov/buildings/energysmartschools/*
ENERGY STAR Building Upgrade Manual. The manual provides information on implementing a staged upgrade approach to improving energy efficiency in buildings. The revised manual includes a chapter on unique opportunities and challenges in K-12 schools.	*http://www.energystar.gov/index.cfm?c = business.bus_upgrade_manual*
ENERGY STAR Operations and Maintenance Reports. ENERGY STAR has collected a number of resources on energy-efficient operations and maintenance practices.	*http://www.energystar.gov/index.cfm?c = business.bus_om_reports*
Energy-Efficient Education—Cutting Utility Costs in Schools. This Texas State Energy Conservation Office guidance document provides 10 strategies for reducing energy costs in public schools.	*http://www.window.state.tx.us/tspr/energy/*
ENERGY STAR Performance scores Technical Methodology for K-12 Schools. This document presents specific details on EPA's analytical results and score methodology for K-12 schools.	*http://www.energystar.gov/ia/business/evaluate_performance/k12school_tech_desc.pdf*
Green Schools: Attributes for Health and Learning. This report by the National Research Council of the National Academy of Sciences offers recommendations for green school guidelines based on health and productivity benefits associated with green schools.	*http://www.masstech.org/renewableenergy/green_schools/NRCreport10_2_06.pdf*
Green Schools Program. The Alliance to Save Energy has used this program to reduce energy use in schools by 5–15%.	*http://www.ase.org/section/program/greenschl*
Green Schools Toolkit. Southface, a nonprofit green building advocacy group, developed a toolkit for school districts to help them incorporate energy efficiency and green building design measures in their schools. The toolkit includes separate sets of resources for the various participants that might be involved in upgrading and designing school buildings, including facility and energy managers, superintendents, administrators, teachers, and students.	*http://www.southface.org/web/resources&services/schools/energystar-schools.htm*
Greenhouse Gas Reductions Manual for Schools. The New Jersey Sustainable Schools Network developed this guidebook for schools to help them reduce their GHG emissions.	*http://www.globallearningnj.org/GHGmanual.doc*
Greening America's Schools: Costs and Benefits. This Capital E report discusses the cost effectiveness of designing new school buildings with energy-efficient and sustainable features.	*http://www.cap-e.com/ewebeditpro/items/O59F11233.pdf*
Greening Schools. This Illinois state initiative seeks to inform school administrators and teachers of ways to incorporate green practices and lessons into school design and operations.	*http://www.greeningschools.org/*
Hawaii High Performance Schools Guidelines. These technical guidelines were developed by the State Department of Business, Economic Development, and Tourism.	*http://www.archenergy.com/services/sda//hi%20high%20performance%20school%20guidelines.pdf*
High Performance School Characteristics. This American Society of Heating, Refrigeration, and Air Conditioning Engineers report addresses the features, benefits, and costs associated with designing high-performance school buildings.	*http://www.ashrae.org/publications/detail/16439*
Indoor Air Quality Tools for Schools Program. This EPA program provides information to school officials, teachers, and parents on ways to monitor and maintain good indoor air quality in school buildings.	*http://www.epa.gov/iaq/schools/index.html*

10 ADDITIONAL EXAMPLES AND INFORMATION RESOURCES *(cont.)*

Title/Description	Web Site
Maine High Performance Schools. The State of Maine has developed a program to provide energy-efficient design and implementation assistance to public schools. The program offers various workshops and seminars, as well as project financing opportunities.	*http://www.efficiencymaine.com/other_programs_hps.htm*
Managing the Costs of Green Buildings. This report for the California Sustainable Buildings Task Force describes the costs of incorporating energy and environmental features in several types of buildings, including K-12 schools, and addresses opportunities and strategies for managing costs.	*http://www.ciwmb.ca.gov/greenbuilding/Design/ManagingCost.pdf*
Massachusetts Green Schools Initiative. Administered by the Massachusetts Technology Collaborative and Massachusetts School Building Authority, this program provides school districts with information and resources to help them build high-performance school buildings.	*http://www.masstech.org/renewableenergy/green_schools.htm*
Menu of ENERGY STAR Offerings for the Public Sector. This table provides school officials with guidance on how ENERGY STAR can assist with energy efficiency upgrades.	*http://www.energystar.gov/ia/business/government/Menu_of_Offerings.pdf*
National Best Practices Manual for Building High Performance Schools. This report presents design strategies covering 10 different disciplines, such as building envelope, lighting and electrical systems, ventilation, maintenance, and water conservation.	*http://www.nrel.gov/docs/fy08osti/31545.pdf*
National Clearinghouse for Educational Facilities. The clearinghouse maintains a collection of resources relevant to improving energy performance in school buildings.	*http://www.edfacilities.org/rl/high_performance.cfm*
National Energy Foundation. This nonprofit organization promotes development, dissemination, and implementation of energy-related educational materials.	*http://www.nef1.org/*
National Review of Green Schools: Costs, Benefits, and Implications for Massachusetts. This report was produced by Capital E for the Massachusetts Technology Collaborative. It describes the financial costs and benefits of green schools compared to conventional schools, and presents the cost effectiveness of greening schools in Massachusetts.	*http://www.cap-e.com/ewebeditpro/items/O59F7707.pdf*
National Science Teachers Association. This organization offers guidance to educators and administrators on how to incorporate energy-related learning into classroom studies.	*http://www.nsta.org/*
School Energy Efficiency Program. This Resource Solutions Group program—funded by the California Public Utilities Commission—offers no-cost technical and financial assistance to California school districts for energy efficiency upgrades.	*http://www.schoolsenergyefficiency.com/*
Schools for Successful Communities: An Element of Smart Growth. This This publication by the Council of Educational Facility Planners International and U.S. EPA explains why and how communities can employ smart growth planning principles to build schools that better serve and support students, staff, parents, and the entire community.	*http://www.epa.gov/smartgrowth/pdf/SmartGrowth_schools_Pub.pdf*
School Operations and Maintenance: Best Practices for Controlling Energy Costs. Prepared for DOE, this guidebook is designed to provide school district staff with technical information and information on barriers to implementing energy- efficient O&M practices.	*http://www.ase.org/uploaded_files/greenschools/School%20Energy%20Guidebook_9-04.pdf*

10 ADDITIONAL EXAMPLES AND INFORMATION RESOURCES *(cont.)*

Title/Description	Web Site
Smart Growth and Schools. This EPA Web page provides information to help communities integrate the principles of smart growth into decisions about where and how schools are built or renovated.	*http://www.epa.gov/smartgrowth/schools.htm*
Tips for Implementing a School-Wide Energy Efficiency Program. The Alliance to Save Energy has developed a list of 10 action items for implementing energy efficiency measures in K-12 school buildings.	*http://www.ase.org/content/article/detail/637*
Travel and Environmental Implications of School Siting. This EPA publication is the first study to empirically examine the relationship between school locations, the built environment around schools, how kids get to school, and the impact on air emissions of those travel choices.	*http://www.epa.gov/smartgrowth/school_travel.htm*
Vermont High Performance Schools. This partnership coordinates stakeholders from state agencies, industry groups, and trade organizations.	*http://neep.org/public-policy/hpse/hpse-vermont*
Washington Sustainable School Protocol Pilot Program. This protocol is a variant of the California CHPS standard that requires high performance in public schools throughout the state.	*http://www.k12.wa.us/SchFacilities/Programs/HighPerformanceSchools/WSSPFinalDraft2006.pdf*
Information Resources on Commissioning K-12 Schools	
Commissioning for Schools. This Hawaii Department of Business, Economic Development, and Tourism factsheet provides information on the estimated costs of commissioning a broad range of school building components.	*http://www.hawaii.gov/dbedt/info/energy/publications/schools/commissioning.pdf*
The Cost-Effectiveness of Commercial Buildings Commissioning. This Lawrence Berkeley National Laboratory report assesses the cost and benefits of commissioning several types of buildings, including schools.	*http://eetd.lbl.gov/emills/PUBS/PDF/Cx-Costs-Benefits.pdf*
Lessons Learned from Commissioning 15 Schools. This report identifies a number of commissioning issues and challenges encountered by California schools undergoing building commissioning processes.	*http://resources.cacx.org/library/holdings/202.pdf*
Information Resources on CHPS Initiatives	
Best Practices Manual. The Collaborative for High Performance Schools has developed guidance for planning, designing, constructing, and operating high-performance schools.	*http://www.chps.net/dev/Drupal/node/288*
Collaborative for High Performance Schools Web Site. The Collaborative for High Performance Schools is a program that has been used in several states that oversees a green building rating program designed exclusively for K-12 schools.	*http://www.chps.net/dev/Drupal/node*
Massachusetts Collaborative for High Performance Schools. The Massachusetts Technology Collaborative adapted the California CHPS model, building on the model's strongest features and adding more stringent requirements.	*http://www.masstech.org/renewableenergy/green_schools/gs_publications.html*
New York Collaborative for High Performance Schools. The New York CHPS is based on the Massachusetts CHPS, but is tailored to meet New York State building energy codes.	*http://www.emsc.nysed.gov/facplan/documents/NY-CHPS_Sep2007finalNYSERDA.doc*
Northeast Energy Efficiency Partnerships. The partnerships have developed a protocol for designing high-performance schools in the Northeast.	*http://neep.org/public-policy/hpse/hpse-nechps*

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1200 PENNSYLVANIA AVENUE, NW
WASHINGTON, DC 20460

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