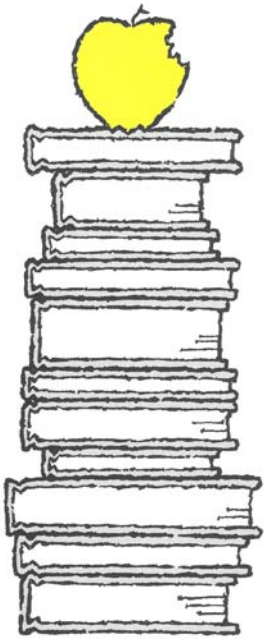
SCHOOL ENERGY COSTS

A MATTER OF LEADERSHIP

(2003 Edition)



ACKNOWLEDGMENTS

Our acknowledgment and thanks to administrators and staff in the 40 school districts in Utah who have taken the time to listen to suggestions on saving energy and who are committed to energy cost savings.

I would also like to thank the following authors and contributors to this guide: Sunny Dent (National Energy Foundation), Duane Devey (Jordan School District), Michael Glenn (Utah Energy Office), Bernell Loveridge (Utah Energy Office), Linda Nielson, Dari Scott (National Energy Foundation), Cara Weir, Darwin Woodbury, and Jerry Zenger.

This guide references the "School Building Construction and Inspection Resource Manual"—published by the Utah State Office of Education:—which can be valuable for planning and constructing new school facilities. The School Construction and Inspection Reference Manual is available as the "School Building E-Book 2003" at:

http://www.usoe.k12.ut.us/data/buildings/mainbody/index.htm

As we contemplate future updates to this booklet, please forward your district's energy successes to me.

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WHY IS ENERGY SUCH A BIG DEAL?

Introduction

Our Utah school buildings consume significant amounts of energy. The state-wide total for gas and electricity approaches $43 million per year – an unwanted bite out of precious education dollars.

The U.S. Department of Energy estimates that school districts can cut those energy expenses by at least 25 percent.[1] And, some Utah school districts are doing just that and saving thousands of dollars annually. One example is Box Elder School District, a relatively small district with 23 school campuses and more than 10,500 students. Since 1993 when the district started a comprehensive energy efficiency program that included building equipment upgrades and occupant education, the district has saved over $2 million dollars. In 2002-03, the Jordan School District saved over $135,000 at 40 elementary schools using an in-house district-managed occupant education program. And the Murray School District has constructed a new high school that will only use $.76 per square foot to heat, light, and cool through use of new energy technologies.

Architects, engineers, facility managers, and school administrators owe state taxpayers the most efficient and cost-effective structures possible. Through your leadership, energy costs in our new and existing school buildings can be reduced while still enhancing occupancy comfort, raising indoor air quality, improving the learning environment, extending life expectancy of each building, and doing something to help our environment. As conscientious care takers of school facilities, we must frequently reexamine the current energy conditions of our buildings, our operating procedures, our operating budgets, and our maintenance procedures.

[1] "In Focus: Clear Air, Efficient Energy Use", American Association of School Administrators, Arlington, Virginia, Spring 2000, page 10.

This publication offers an overview of energy saving concepts for school administrators, facility managers, teachers and maintenance staff . However, nothing will produce energy savings without the commitment of each district's superintendent and school board.

Ideas presented in this booklet are not without precedent; they have been used by a number of Utah school districts with great success. These ideas can help your district develop its own, customized program to control energy costs[2]. Under your leadership, your district can be an Energy Champion!

How Does Your District Score on the Two-Minute Energy Quiz?

The following 2-minute test assesses your district's energy condition:

- *Do you submit your new construction and remodel plans to the State Office of Education for energy review?*
- *Have you completed a comprehensive energy audit of your existing buildings?*
- *Have all your building operators received energy management training?*
- *Does maintenance staff perform regular preventative maintenance to keep equipment running at optimum efficiency?*
- *Have you installed state-of-the-art energy controls in all buildings to set-back buildings after school, weekends, and holidays by 10-15 degrees?*
- *Are each building's utility bills tracked through usage reports that are passed to principals and/or facility administrators?*
- *Does your district have an incentive plan for individual schools to share in their energy savings?*
- *Have excessive peak load demand and power factor charges been mitigated?*
- *Have you talked to staff about the people factor? (i.e. Asking faculty, students, principals, and maintenance staff to do all possible to avoid energy waste, such as turning off lights and not using space heaters?)*
- *With budgets tight, have you really considered the funding options for equipment upgrades: Utah Power's rebates, performance contracts*

[2] NOTE: Many aspects of an energy conservation program can also be used to include water conservation.

with ESCOs (Energy Service Companies) and energy equipment leasing?

- *Have you increased rather than decreased your maintenance and operations budget this year?*
- *Have you challenged your architects and engineers to design new schools that exceed current energy code by 25 percent?*
- *If your district is larger than 15 to 20 buildings, have you hired a full-time energy manager?*
- *Has your district standardized on the purchase of Energy Star rated products as products-of-choice (computers, lamps, printers, etc)?*
- *Have you rated any of your buildings for Energy Star recognition through the EPA website?*
- *Do you have Energy Patrols organized for any of your elementary students?*
- *Have you worked with the non-profit National Energy Foundation to incorporate energy in school curriculum?*
- *Does your district order and operate alternative fueled school buses and vehicles (natural gas, biodiesel, etc.)?*

If you can answer "yes" to at least twelve of the quiz questions, your district is doing a great job with energy efficiency. If you scored less than twelve "yes" answers, consider implementing some of the ideas from this booklet to cut your district energy costs!

ORGANIZE A DISTRICT ENERGY MANAGEMENT TEAM

As a first step toward successfully tackling district energy problems, superintendents should appoint a district energy management team and team leader. In appointing membership to that team, the superintendent should consider representatives from district administration, the district energy manager, PTA, school board, district facility management, principals, teachers, custodians, and other local volunteer professionals such as utility representatives, consulting engineers, and architects. District energy management teams are more effective when the membership is comprised of individuals who possess special interest in energy and environmental issues, who are proactive, and who possess the ability to work effectively in a team format.

The Energy Management Team develops an Energy Action Plan

The district can also invite a representative of the National Energy Foundation (NEF) with headquarters in Salt Lake City for an initial team meeting. NEF's involvement with Utah school districts is funded through a federal grant from the U.S. Department of Energy's Rebuild America program[3] and the Utah Energy Office. NEF can provide background case study information, guidance on development of your district's Energy Action Plan and access to local community partners for technical and financial assistance. Also, consider inviting a representative from districts like Jordan School District where a successful energy program is underway. It is not necessary to hire expensive out-of-state energy consultants.

The district energy management team should be chaired by a true energy champion team leader – someone with the ability to facilitate the team meetings where district energy goals are set and

[3] The U.S. Department of Energy (DOE) launched the EnergySmart Schools in 1998 in an effort to assist the nation's K-12 schools in meeting energy challenges. EnergySmart Schools helps K-12 schools develop energy education programs and save energy and dollars through energy efficiency. It is part of Rebuild America, a DOE program that focuses on improving communities nationwide through energy efficiency. DOE offers schools districts, resources and technical assistance, free of charge, to help save energy in schools. EnergySmart Schools partners include nonprofit organizations, government agencies, trade associations, businesses and community groups. Education materials and training are provided by Strategic Partners, such as the National Energy Education Development Project and the National Energy Foundation. For more information about EnergySmart Schools, Rebuild America, and other programs call the Rebuild America Clearinghouse at 252-459-4664.

carried out.

CONDUCT A DISTRICT-WIDE ENERGY NEEDS ASESSMENT AND DRAFT AN ENERGY ACTION PLAN

One of the first goals of the district energy management team is to complete a district-wide energy needs assessment. The team should request a summary of monthly utility expenses for the district from the business office. It would be helpful if the expenses could be broken out by school building and include several years of utility data. Include KW, KWH and natural gas decatherm information also. More and more school districts are focusing their energy management team on water as well as energy conservation. So, include water data in your request.

Thereafter, the team should conduct a district needs assessment. A sample needs assessment is included with this booklet as Appendix C. Using the assessment tool, districts can narrow their energy priorities. The priorities are then used by the team to develop the specific goals and objectives that become the district Energy Action Plan.

The district energy management team should meet regularly to chart achievements under the Energy Action Plan, monitor energy savings, develop incentives for schools, and update the plan from time to time (See Appendix A for a sample school district Energy Action Plan).

Remaining sections of this guide explain goals of greatest opportunity for reducing school energy use – goals that are commonly addressed within district Energy Action Plans. These topic areas include:

1. Use energy efficient design for new buildings and additions to generate long-term energy cost savings.
2. Set up a program for energy accounting and tracking.
3. Carefully evaluate and complete the most cost-effective building upgrades for energy efficiency and explore creative funding options.
4. Regularly schedule and complete operational and maintenance procedures to reduce energy consumption.
5. Designate or hire a district energy manager.
6. Involve school staff, teachers, and students in occupant education

Goal No. 1 Use Energy Efficient Design for New Construction to Generate Long-term Energy Cost Savings

Utah Energy Code and Super Energy Efficient Design

Over the lifetime of a school building, the cost of construction is only 1-2 percent of the cost for operating the school. Much of that total lifetime cost is from utilities. To reduce long-term energy costs, all public buildings in Utah must be constructed to meet the provisions of the Energy Code for Commercial and High-Rise Buildings based on ASHRAE 90.1 - 1999[4]. The Code gives owners of new buildings a minimum benchmark for energy efficiency. Upon request, many architects and engineers will design new energy high performance buildings that exceed the minimum requirements of the energy code. The design for each new building or remodel must be reviewed by the Utah State Office of Education and its partners for Energy Code compliance.

Beginning in 2002, the State of Utah Building Board set a higher standard for new building designs for state buildings. The goal is for new state buildings to surpass the current energy code by twenty-five percent.

With the additional energy use forethought

[4] See Appendix N of "School Building Construction and Inspection Resource Manual" published by the Utah State Office of Education for code compliance forms. Contact the nonprofit Utah Energy Conservation Coalition *(telephone 1-800-550-8322)* for more information about Utah's energy codes.

during planning and an integrated design process, this higher standard can be achieved with little or no additional project cost. Utah school districts are encouraged to specify this higher standard for energy performance.[5]

School districts interested in building more environmentally sustainable school buildings can specify that architectural/engineering design teams meet the qualifications of the EPA and DOE's Energy Star program or the more rigorous Leadership and Energy and Environmental Design (LEED) rating system of the nonprofit U.S. Green Building Council. Energy Star qualified buildings must achieve an energy performance score of at least 75 on a scale of 1 to 100 and meet minimum in-door air quality standards. The LEED rating considers other factors besides energy efficiency and indoor air quality: site sustainability planning, safeguarding water, recycling of construction waste, water efficiency, use of renewable energy sources, and conservation of other natural resources.

Code Compliant Buildings Save Energy and Money

A classic case of schools being built to a higher energy efficiency standard is the Oquirrh Hills Elementary School in Jordan School District. The school was destroyed by fire in 1995. When a new school was built on the same site, the architect, engineers and district officials agreed to incorporate cost-effective, energy saving features to meet and in some cases exceed the Utah Energy Code.

Oquirrh Hills Elementary School

With the same square footage and occupancy accommodations as the old school, this compact, rectangular, energy-efficient school includes Low-E glass; compact lights in recessed fixtures; T-8 fluorescent lamps with electronic ballasts; building controls connected to the district's central energy management system for scheduling and set backs; vestibules; a light-colored roof to reduce cooling loads; high-pressure sodium exterior lamps; energy efficient skylights in the corridors, gym, and library; and a boiler system instead of rooftop units. Duane Devey, energy manager for that district says, "The list of energy efficiency measures installed in the Oquirrh Hills Elementary School should be on every district's checklist for new construction. Think of the long-term savings! Compared to the old school after 11 months of occupancy, we verified and attributed $22,521 in annual electrical and natural gas savings to the new school's energy saving features."

Going Beyond the Energy Code for School Design

Some Utah schools exceed the Utah Energy Code and are considered super energy efficient and called high performance buildings. Such buildings take advantage of special design elements — building orientation for solar heat gain or shading, outside air for natural cooling, enhanced daylighting features, other renewable energy sources such as ground-coupled heating and cooling, highly efficient building equipment and lighting, and integrated building controls -- to the extent that little energy is needed to ensure a comfortable environment. Energy high performance also includes careful selection of

[5] [5]See Appendix M of "School Building Construction and Inspection Resource Manual".

building materials and landscaping in order to enhance environmental-benefits, thermal characteristics, water conservation, reflectivity, and durability.

Energy high performing buildings cost less to light, heat, and cool than other buildings. By using less energy, these buildings justify the possible initial extra cost of incorporating specially designed features. Over an average 30 year operations life-cycle for Utah's schools, energy cost savings created by super energy efficient buildings become available for other educational programs. Year after year, this becomes a very compelling, long-term reason for using energy efficient concepts in new schools.

In 2003 the U.S. Department of Energy (DOE) developed a seven-volume publication entitled "Energy Design Guidelines for High Performance Schools" with each volume covering one of seven climate areas of the United States. The volume for Utah includes a subheading for "Cool and Dry Climates". The guidelines can be ordered through the DOE's Energy Smart Schools initiative of the Rebuild America Program by visiting www.energysmartschool.gov and can be viewed electronically at www.rebuild.org/sectors/k12_resources.asp.

When hiring an architect/engineer team for new construction, select one that will creatively incorporate high performance school building guidelines in the new school's design and a team that will apply sensitivity to long-term energy and maintenance costs. Although many Utah architects and engineers have developed expertise in High Performance Buildings, each district must be prepared to budget sufficient fees for designing new schools to the highest levels of energy efficiency. Michael Glenn, program specialist with the Utah Energy Office notes, "On average, fees for super energy efficient design are approximately one percent higher than fees for standard design. However, these additional fees are easily recovered through reduced long-term costs in the building operations."

Districts frequently ask whether a high performance building cost more to construct. Although there may be an increase in design costs, the cost for constructing a high performance school need not be higher than the costs for constructing a traditional, less energy efficient school.

Value Engineering Sessions are Important for New Construction

The planning and design process of every new school building must be critiqued through a value engineering process. Utah code 53A-20-102(2)(e) requires value engineering reviews of the plans and specifications for all building projects estimated to be more than $300,000. Value engineering takes into account the cost of long-term building operations, and it ensures long-term building durability. The value engineering team consists of architects, civil and structural engineers, mechanical engineers, construction contractors, facility operations and maintenance staff, and other representatives from your district. Districts lacking time and in-house technical resources often hire independent energy engineers and architects to conduct the value engineering sessions. During these sessions, participants consider the optimum design features that will provide the most long-term benefits to the district. Districts that use a traditional budget-design-bid-construct process should incorporate desirable energy features as alternates in the bid. If the new building, remodel, or addition bid is under budget, the alternate features can be accepted into the final construction contract.

Decisions about energy efficiency features during the value engineering process should not be driven by the construction budget. Larry Newton of the State Office of Education cautions, "Budget-driven construction, where the budget is firmly set prior to design and construction bidding, typically results in inferior grade materials, inefficient equipment and long-

term maintenance problems. To avoid budget driven decisions, we strongly recommend a non-traditional, two-step process that will enable district administrators and school boards to await completion of the design and value engineering process before setting construction budgets and prior to selling bonds for new facilities."

The design team was expected to met higher energy performance standards for the new Murray High School

In the case of the new Murray High School completed in 2003, the Murray School District challenged the architectural and engineering design team to meet higher energy performance standards. The new school includes substantial daylighting, energy efficient lighting, and an innovative geo-based heating and cooling system – all constructed at less cost than a traditionally-designed school.

Geo-based heating and cooling at the new Murray High School

Value-based Selection of Architectural and Engineering Teams and Contractors

For state-owned new construction, the State of Utah Building Board and the Division of Facilities Construction and Management (DFCM) have implemented value-based selection criteria – criteria that Utah school districts can replicate. This assures that state buildings are designed and built by firms committed to creating the greatest value per taxpayer dollar. Value-based selection criteria for project architects, engineers, and contractors weigh the past performance, references, the proposed management plan, interviews with the proposed project lead and team, and the sealed bid criteria. For state-owned buildings, proposals from AE firms are ranked by a state selection committee that includes a representative of DFCM, a member practitioner (general contractor, subcontractor, architect, or engineer), a public representative, and a representative of the Building Board. For more information on value-based selection criteria, contact the DFCM contract coordinator at 801-538-3018.

Commissioning New Buildings

To insure that new building energy systems and controls operate at optimum settings for optimum energy savings, budgets for new schools should include costs for independent commissioning by a commissioning agent. Generally, the cost for commissioning is 1-3 percent of the construction budget. However, the savings achieved through commissioning can make a building's initial operation 20-30% more efficient.

Because problems uncovered after construction are more difficult to adjust, it is advisable for districts to hire their commissioning agent early in the process – simultaneous to hiring the design architect and engineer. That way, the commissioning agent can be included as construction progresses. On a regular basis (every 3-4 years minimum), new buildings should be recommissioned in the process of continuous commissioning.

Goal No. 2 Set up a Program for Energy Accounting/Tracking

For long term energy cost savings, a district

cannot manage what it does not know. Compiling, recording, and analyzing energy data are important for several reasons:

- Energy accounting helps identify energy waste and possible equipment problems.
- Energy accounting provides year-to-year comparisons for targeting limited energy retrofit funds to the district's biggest energy problems.
- Energy accounting helps prevent overcharges and errors on energy bills.
- Energy accounting may be used to quantify the size of financial incentives each school might receive for the staff's energy-saving efforts.

Many Utah school districts have assigned a staff member to track energy consumption and provide monthly or quarterly performance reports to maintenance officials, district administrators, custodians and principals. Building-by-building reports help to create responsibility and accountability at the building and even the classroom levels. Some Utah superintendents have used building consumption reports and trends in energy savings as part of each principal's annual evaluation.

Energy consumption reports also help to detect utility billing errors. Through careful tracking, districts like Alpine, Murray, and Jordan have uncovered thousands of dollars in utility overcharges-- more than enough to pay the salary of a district energy manager. Over the past 10 years, the Jordan School District averaged over $50,000 per year in credits from water, electrical, and gas billing errors. You can contact these districts for information on their utility tracking software and procedures.

Once school personnel know their building's energy use, district's can reward those that reduce it. Philadelphia's district-wide annual energy budget of $32 million cut utility costs by nearly $7 million each year over eleven years. Attributed to careful monitoring of each school's energy use, the savings is shared with each school for use in educational or recreational programs.

Goal No. 3 Carefully Evaluate the Most Cost-Building Upgrades for Energy Efficiency and Explore Creative Funding Options.

After tracking energy consumption, districts should identify buildings with the highest consumption rate (energy use per sq. ft, or energy use per student) and prioritize the buildings for energy audits (see sample "Walk-through Energy Audit form attached as Appendix B). Using a dollar-per-square-foot scale and as "rule of thumb", school buildings using more than 80-85 cents per square foot need your first attention.[6]

Ideally, energy audits are conducted by professional engineers or architects who are unbiased and not aligned with any particular vendor or supplier. However, energy audits can also be completed by district staff who have been certified through a course in energy auditing. The energy audit includes: an inventory of energy equipment, a calculation of a building's variance from optimum efficiency, observations for improved maintenance and operations, and a proposed list building equipment retrofits. The energy audit also includes examination of the structure (building envelope) and the HVAC and electrical lighting systems. The auditor includes estimated costs and payback periods for retrofit options.

Larry Newton notes, "Whether completed by engineering professionals, utility company representatives, vendors, energy service companies or in-house staff, energy audit information is a crucial management tool used for allocating scarce capital." Generally, the most cost-effective energy upgrades listed in the energy audits conducted for Utah schools

[6] This average is based upon a school on regular schedule (not year-round) with air-conditioning. For non-air conditioned schools, use a threshold of 70-75 cents per square foot.

include: new electronic ballasts with T-8 lamps, centralized and upgraded building controls for night and weekend set back, steam trap replacement, pipe insulation, lighting motion sensors rather than traditional switch lighting controls, exterior high pressure sodium lamps with photo cell control, variable frequency drives on motors and pumps, summer hot water boilers, compact fluorescent light bulbs, fan/light timer switches, and chiller upgrades.[7] Completing retrofit measures on older school buildings with aging lights, boilers, and controls not only saves energy and money, it also reduces equipment downtime and improves building comfort.

Changing light fixtures to electronic ballasts with T-8 lamps is a cost-effective upgrade

No Money? No Problem!

Capital needed to fund energy efficiency measures in school buildings is increasingly scarce. However, Utah's school administrators can select from a wide variety of innovative financing mechanisms including: internal revolving improvement funds, master leases with capital financing companies, general obligation bonding, guaranteed performance contracts with energy service companies and utility financing programs such as the rebates available under Utah Power's FinAnswer program. Although internal funding and bonding[8] may cost less, some districts prefer using other financing mechanisms such as performance contracts with energy service companies (ESCOs) in order to avoid increasing indebtedness.

Private-sector ESCO partners successfully provide the expertise and arrange financing that will ensure installation of energy efficient measures while guaranteeing that energy savings will exceed annual finance payments. Repayment terms commonly range between eight and twelve years. Often these partnerships can bring a project to completion much faster than a process of internal budgeting and bonding. This faster track allows a district to avoid lost opportunity or inflation costs.

Box Elder School District has received rebates for all schools within the Utah Power service territory

Private-sector financial partnerships such as the performance contracts with the ESCOs for funding energy improvements are not new to Utah school districts and public buildings. Beginning in 2001, the Millard School District

[7] Buyer Beware Notice: Utah School districts are frequently contacted by sales representatives with products that feature tempting energy savings claims. In the past, some of these energy product claims have been proven true and the products useful and reliable. On other occasions, products have proven to be no less than "snake oil". Too often, purveyors of "snake oil" products rely on one or two case studies from XYZ school districts to justify energy saving claims. Before even considering a new energy product, The Utah Energy Office advises districts to request copies of independent laboratory results from sales representatives. Legitimate energy savings products will have independent laboratory performance data to validate a sales representative's claims.

[8] The Utah Guarantee Act of 1996 provides AAA ratings for all school district General Obligation Bonds. This has decreased the costs of bond interest statewide.

completed $4,227,307 in energy upgrades on eight schools using a private ESCO and received a $107,541 rebate from Utah Power to buy-down the project costs. Millard School District business manager, Keith Griffiths, note, "When properly procured, there is little risk associated with using private-sector partners – we are pleased with the work completed and the project economics for our project".

In 2001, the University of Utah completed upgrades for the entire 88 campus buildings using an ESCO. The project has a $44 million retrofit cost with $7,339,541 in achieved savings already being applied towards the retrofit costs. In 2003 with funding scarcities, the State of Utah Division of Facilities Construction and Management (DFCM) adopted performance contracting with ESCOs as the preferred approach to energy upgrades. Currently, the State of Utah has over $12 million in ESCO-partnered projects underway at Utah Valley Community College, the Utah State Prison, and the Ogden Regional Center. DFCM has chosen to move forward with the ESCO-based partners incur the lost opportunity costs that come from waiting.

For a successful energy service company partnership, experienced school districts, DFCM, and the Utah Energy Office advise administrators and facility managers:

1. Procure competitively - For districts interested in using of energy service companies, a generic Request for Proposals (RFPs) are available from DFCM and the non-profit Energy Services Coalition website (http://www.escperform.org/documents/. The ESC website also includes a guide to successful performance contracting.

2. Retain independent technical engineering expertise -- Independent consulting engineers assist districts in achieving successful private-sector ESCO partnerships by inspecting the quality of workmanship and the equipment installed. They can negotiate contract changes to achieve highest energy savings, check compatibility of ESCO-proposed work against existing building systems, oversee project commissioning, independently verify the level of energy savings guaranteed by the ESCO and calculate the amount of utility rebates due to the district. For a list of independent Utah-based consultants, contact the Utah Energy Office.

Some institutions have established internal revolving energy improvement funds - a block of funds budgeted and allocated for building improvements. As energy cost reductions are achieved, the revolving fund is repaid with the savings. The funds are then reallocated for other projects from year-to-year until all buildings are completely upgraded.

Goal No. 4 Regularly Schedule and Complete Operation and Maintenance Procedures to Reduce Energy Consumption.

Regularly maintained buildings operating at optimum efficiency not only save energy but are more comfortable, and their systems are more durable. Progressive Utah school districts maximize the operating efficiency of each building's energy systems by adhering to monthly schedules for checking and servicing building equipment. To properly maintain and operate energy equipment, head custodians may need special training in energy efficient operations. The Utah Energy Office, the Utah Association of Professional Energy Managers, and Utah ASHAE offer low cost local workshops and conferences (call 801-538-5428 or 1-800-662-3633 for a list of upcoming workshops).

Maintenance schedules are key to energy efficient operations. To keep maintenance schedules, it is important for district administrators to keep maintenance budgets at adequate funding levels. One Utah school district reports the equivalent loss of one school building per year due to deferred upkeep resulting from maintenance and budget cuts.

Districts that cut operations and maintenance are using a crisis management approach, leaving crews in the position of "putting out fires". This approach consumes 10 to 15 percent more energy per building than does one having a well-funded, scheduled maintenance program coupled with well-trained crews.

Goal No. 5 Designate or Hire a District Energy Manager

The Utah Energy Office recommends that districts with at least 15-20 school buildings consider hiring a full-time energy manager and that smaller districts hire a part-time energy manager to help achieve the goals and objectives of the district's Energy Action Plan. The energy manager should participate as an active member of the district's energy management team and work with district administration to consider, budget for, and implement team recommendations.

The efforts of the energy managers to focus district resources on energy goals and objectives usually create energy cost savings that more offset the salary and expense of hiring the energy manager. While employing a full-time energy manager, the Davis School District saved more than $3.0 million per year.

Sunny Dent, Energy Smart Schools coordinator for the Utah-based National Energy Foundation notes, "Employing an energy manager is certainly one of the most important aspects of controlling school energy costs. The manager keeps energy issues in district focus, unclouded by other district problems and programs. Hiring an energy manager is one personnel action where districts actually get a return on investment".

Goal No. 6 Involve school staff, teachers, and students in occupant education

Energy use is not all related to equipment efficiencies. Energy use is also related to the behavior of school occupants including the principals, custodians, teachers, and students. Coupled with the energy retrofits of school buildings, people-related or behaviorally-based programs can achieve significant levels of energy savings.

Realizing that everyone needs to do their part to save energy, the Jordan School District involves school staff, 350 teachers, and students in energy conservation at elementary schools in an "Energy Action in Schools" program. Last year, 40 Jordan School District elementary schools accepted the challenge to save as much energy as possible with a promise of incentives for schools with documented energy cost savings. At the 40 schools, students conducted energy patrols of the rooms to verify that unneeded lights are turned off, room temperatures are correct, unused computer equipment is turned off, incandescent lamps have been replaced with compact fluorescent lamps, and that hot water temperatures do not exceed 115 degrees. Principles and custodians insure that equipment is maintained on schedule and that control systems are properly calibrated by the district maintenance workers. Teachers provide energy conservation training to students using curriculum provide by the National Energy Foundation.

Involve school staff, teachers, and students to capture the people-related or behaviorally-based energy cost savings

At the end of each school year, the district monitors energy costs compared to previous years and provides incentive funds based upon

energy savings. Last year, the Jordan School District "Energy Action in the Schools" program saved $135,000 in energy costs and 4 million gallons of water. This resulted in $90,000 being provided back to the schools to purchase copy supplies, fund special field trips, buy textbooks, purchase whiteboards for classrooms, and upgrade playground equipment. One school used their incentive payment to replace 17- year old history textbooks.

Some out-of-state consulting companies have approached Utah school districts with offers to develop a people-oriented district energy management program for a hefty fee. In some larger Utah school districts that fee alone can approach $1 million over four years. As Bernell Loveridge with the Utah Energy Office notes, "Utah school districts can develop their own people-oriented programs and hire their own energy manager for a lot less cost. The U.S. Department of Energy has provided funding to our office and the non-profit National Energy Foundation to help Utah districts to set up their own programs".

For a great list of low-cost people-oriented tips for your district's energy management team to implement in your district, see Appendix D.

SUMMARY

As energy costs continue to raise, school district and public building administrators find it necessary to reduce energy-use wherever possible in order to protect funds for educational programs. This booklet provides valuable how-to guidance from the Utah Energy Office and the Utah State Office of Education.[9]

State Superintendent Steven O. Laing: "Energy use is a matter of leadership."

Steven O. Laing, State Superintendent of Public Instruction, strongly urges Utah schools to develop an effective management system that will include the following: careful consideration of higher energy performance standards for new school building design and construction, operational and maintenance practices for reducing energy use, and retrofitting of older buildings to eliminate major energy losses. "**We need to take charge of energy use in our school buildings. Some districts are doing it, and others are not. It is, however, a matter of leadership!"**

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[9] For more information about energy efficiency for your school district, please visit the following websites:

- For a listing of simple people oriented/behavioral energy actions for your school to implement see the Utah Energy Office website: www.energy.utah.gov/schools.htm
- Check out the U.S. Department of Energy's Rebuild America/Energy Smart Schools website: www.energysmartschools.gov/energysmartschool/index.html
- For assistance setting up your district energy program, contact the non-profit Utah-based National Energy Foundation: www.nef1.org/
- For information about performance contracting, see the Utah Energy Services Coalition: www.escperform.org/
- Also refer to "School Building Construction and Inspection Resource Manual" published by the Utah State Office of Education (contact 801-538-7500 for a copy)
- See the California Energy Commission's "High Performance Schools Construction Online Video Series" accessible at http://dsa.ishow.com/
- Two excellent forums for energy information are the Utah Facilities Operations and Maintenance Association www.ufoma.org/ and Utah Association of Professional Managers at www.apemutah.org/index.html.

List of Appendixes

Appendix A - Sample School District Energy Management Plan

Appendix B – Energy Walkthrough Audit Form

Appendix C – District Energy Assessment Form

Appendix D - Simple No-Cost People-Oriented Tips to Save $$ for Your School

Appendix A

Sample District Energy Action Plan

Mission Statement – The district will derive more funding for school programs and activities by making our schools at least 25% more efficient.

Goals and Objectives:

(1) Organize a district energy task force to oversee achievement of a district-wide ten percent reduction from base-year consumption in year one, and a 15 percent reduction in year two. (by July 1)

(2) Monitor overall consumption of energy units (therms, kWh, etc.)
- (a) Set up in-house spreadsheets for utility tracking using templates from other Utah school districts. (by July 1)
- (b) Work with the superintendent to appoint a staff person to track and analyze all utility bills and provide comparative reports to district administrators, facility managers and principals on a monthly basis. (beginning July 1)

(3) Reduce peak demand and power factor costs in electrical energy use.
- (a) Establish a policy for shop instructors, cafeteria personnel and art teachers to avoid use of electrical equipment (kilns, sawdust collectors) between 11:00 a.m. and 2:00 p.m. where possible. (by September 1)
- (b) Complete an assessment of each school's power factor charges and install correcting capacitors (by March 1 of next FY).
- (c) Have staff person assigned to track energy use meet monthly with utility company representatives to rectify billing problems (beginning September 1)

(4) Identify causes of excessive energy loss and prepare a list of cost estimates and pay-back periods for various corrective measures to include in the district's next budget. (by June 30 of next fiscal year)
- (a) Have three of the district facilities staff attend energy auditor training to become certified energy auditors (by January 31)
- (b) Complete energy audits of each building and prepare a list of priority funding measures for the school board's consideration (by May 31).

(5) Make all users of the buildings aware of energy cost saving opportunities and motivate them to conserve energy (by September 1).
- (a) Announce the program of shared energy savings with staff at each school (by September 1).
- (b) Use the district energy task force to establish and award incentives and monitor district progress (after July 1 of next year).
- (c) Work with NEF to implement Energy Patrols in elementary schools (by May 1).
- (d) Include monthly energy saving tips in the district/school newsletter (beginning October 1).
- (e) Work with NEF to provide training to custodians on energy efficient school building operations (beginning October 1).

(6) Cut energy waste through a regularly scheduled and adequately funded maintenance program.
- (a) Have maintenance officials establish a computer-based schedule for releasing work orders to check and maintain each school's energy using equipment. (by Jan. 15)
- (b) Budget 10 percent more for maintenance for the next year. (beginning next July 1)
- (c) Provide energy auditing and boiler maintenance training for all district maintenance staff. (beginning October 1)

(7). Hire an engineer to oversee the procurement of an energy service company to upgrade energy using systems at all district buildings that were not funded as capital improvements by the school board (by September 1 of next FY).

- (a) Prepare a RFQ to select an independent engineer (by July 1 of next FY).

(b) Complete commitment form to Utah Power for energy rebates (by July 1 of next FY).
(c) Issue a RFP to Utah-based energy service companies. (by September 1 of next FY)

(d) Select an ESCO for partner. (by November 30 of next FY)

(8). Work with the superintendent and school board to insure that each school building receives 20% of the overall energy savings achieved during the fiscal year for discretionary programs and activities approved by the local school energy team and the superintendent (after July 1 next FY).

(9) Prepare annual district energy progress report for the superintendent and school board (by next July 1).

Attachment B

WALK-THROUGH ENERGY AUDIT FORM

Utah Energy Office
Department of Natural Resources
(Developed for the U.S. Department of Energy's ICP Program – 2003 update)

Forward

The "ICP Walk-Through Energy Audit" has been prepared by the Utah Energy Office for use in the Utah Institutional Conservation Program (ICP), authorized by the National Energy Act of 1978. The form is designed for schools, hospitals, public care institutions and local governments. This form can also be used for commercial and other building audits.

Operations and maintenance (O&M's) of a facility can dramatically effect on energy efficiency. This audit identifies relevant low-cost O&M's that should be completed promptly and incorporated into a facility's ongoing maintenance schedule.

While this audit has been reviewed for technical accuracy, the Utah Energy Office Services (OES) and the U.S. Department of Energy are not liable if potential cost savings identified as a result of using this audit are not achieved. None of the above agencies endorse or recommend the use of any specific brand of equipment.

The U.S. Department of Energy publication, *Making Sense of Your Energy Dollar*, is referenced throughout this workbook and can assist you in completing each section of the audit workbook. The OES will try to answer any questions about the workbook and program. If you need on-site assistance from OES in completing this audit, please assemble the following: (a) one year of energy consumption data by month and fuel type (three years is preferable), (b) building plans and blueprints including any additions, (c) a copy of the building operations manual and maintenance schedule and (d) a list of the large energy-using equipment in the building. For questions or assistance, please contact:

Utah Energy Office
1594 West North Temple
Salt Lake City, Utah 84114-6480
(801) 538-5428

Step 1

For each building under your jurisdiction, complete the Building and Energy Consumption Survey. This should include a basic run-down of energy systems existing in the building, how much fuel is used, what kind of fuel is used, and general building identification and characteristics. The OES can advise you on the relative efficiency of your building compared to other similar buildings.

Step 2

Step 2 must be completed by either: (a) an engineer or architect, (b) any institutional personnel who have attended a OES-sponsored energy auditor seminar or equivalent or (c) personnel of the OES or its contractors. Step 2 includes the Operations and Maintenance and Energy Conservation Measure Audit Checklists. The auditor should walk through the building and determine whether each of the checklist conditions exist. Obvious problems, findings and concerns from the checklists are summarized in Section VIII.

Step 3

Complete the Auditor Certification Form. The certification must be signed by the individual who completed Step 2 above. Please photocopy and send the energy audit to the OES. The OES will review each energy audit for completeness and will compare the audit information with statewide averages.

STEP 1: BUILDING AND ENERGY CONSUMPTION INVENTORY

Please answer all questions, and provide only answer(s) requested.

Section I: Building Identification (Handbook I, p. 95) *(please print clearly)*

1. Building Name	**2. Building Address** *(Street, City, County, State Zip Code)*
3. Contact Person	**Phone**
4. Name of Legal Owner	**5. Address of Legal Owner** *(Street, City, County, State Zip Code)*
6. Ownership *Category* *(Circle appropriate code of legal owner)* 1 Public 2 Private Non-Profit 3 Indian Tribe 4 Other:	
7. Building Type *(Circle one only)* 1 School 2 Hospital 3 Public Care Institution 4 Local Government 5 Other:	
8. Building Function *(Circle one only)* SCHOOL 1 Elementary 2 Secondary 3 College or University 4 Vocational 5 Local Educational 6 Other (Specify) HOSPITAL 7 General 8 Tuberculosis 9 Other (Specify)	PUBLIC CARE INSTITUTION 10 Nursing Home 11 Long Term Care - Other than Nursing Home 12 Rehabilitation Facility 13 Public Health Center 14 Residential Child Care Ctr 15 Other (Specify) STATE/LOCAL GOVT. 16 Office 17 Storage 18 Service 19 Library 20 Police Station 21 Fire Station 22 Other (Specify) 23 Pool OTHER 24 Small Commercial 25 Large Commercial 26 Ind. Processing 27 Other (Specify)

Section II: Annual Energy Consumption (Handbook I, P. 98-104)

Utility Report Period *(include 12 full months)*
From: _____ 20___ to _____ 20___

FUEL TYPE	ANNUAL USE	X	CONVERSION FACTOR	=	ANNUAL BTU	ANNUAL COST
Electricity*	KWH	X	11,600	=		$
Natural Gas	CCF	X	87,500	=		$
Natural Gas	Therm	X	100,000	=		$
Fuel Oil No. 2	Gal	X	138,690	=		$
Fuel Oil No. 6	Gal	X	149,690	=		$
Coal	Tons	X	24,500,000	=		$
LPG Propane	Gal	X	95,475	=		$
Purchased Stream	Lbs	X	1,390	=		$
Other (Specify		X		=		$
TOTALS						

9. *If your electric bill includes a demand charge, please enter the highest electrical demand and time of day and month for which it is recorded: *(if available)*
Highest Daily Demand _____kw Time of Day _____ Highest Monthly Demand _____ Month _____

10. BTU per GSE *(Divide total annual BTU by GSF from No. 12)*	**11. Cost per GSF** *(Divide total annual BTU by GSF from No. 12)*

Section III: Building Characteristics (Handbook, I, P.97)

12. Gross Square Feet *(Enter the square footage of all heated or cooled floor areas enclosed in the building. Calculate square footage from the outside building dimensions, or from the center line of common walls.)*		
13. Functional Use *Changes (Circle the number(s) that describes major changes planned in functional use or mode of operation in the next 15 years.)* 0 None 1 Demolition 2 Disposal 3 Rehabilitation 4 Conversion (e.g. from office to warehouse) 5 Other (Specify)		
14. Building *Conditions* *(Describe general building condition.)*		
15. Year *(Enter the year building was first placed into service.)*		
16. Building Modifications after May, 1989:	**17a. Design Occupancy**	**17b. Current Occupancy**
18. Location *(Circle the number which best describes the location of the building.)* 1 Urban 2 Suburban 3 Rural		
19. Complex *(Indicate whether this building is part of a complex in which hot water, steam, chilled water is supplied from a central power plant.)* 1 Yes 2 No		

Section IV: Major Energy Systems (Handbook 1.p. 100)

(Circle the number(s) that describes each of the following systems and fuels in the building.)

20. Primary Heating System(s) 1 Central Heating Plant – Hot water/steam 2 Boiler – hot water – steam 3 Furnace – hot air 4 Unit Heater(s) 5 Heat Pump 5 Solar 7 Other (Specify)
21. Heating Fuel(s) 1 Electricity 2 Natural as 3 Fuel oil No. 2 4 Fuel oil No. 6 5 Coal 6 LPG (propane) 7 Solar 8 Other (specify)
22. Domestic Hot Water System(s) *(Describe how domestic hot water is heated.)* 1 Hot Water or steam supplied from central plant 2 Electricity 3 Natural gas 4 Fuel oil No. 2 5 Fuel oil No. 6 6 Coal 7 LPG (propane) 8 Solar 9 Other (Specify)
23. Cooling System(s) 0 None 1 Chilled water supplied from central plant 2 Chilled – centrifugal 3 Chilled – absorption 4 Refrigeration – electric compressor – water cooled 5 Refrigeration – electric compressor – air cooled 6 Refrigeration – steam turbine compressor 7 Evaporative cooling unit 8 Other (Specify)
24. Cooling Fuels(s) 0 None 1 Electricity 2 Natural gas 3 Fuel oil No. 2 4 Fuel oil No. 6 5 Coal 6 LPG (propane) 7 Solar 8 Other (Specify)
25. Terminal System(s) 1 Unitary – single zone (rooftop package, unit heaters, and etc) 2 Perimeter – hot water/steam radiators (convectors) without fan 3 Perimeter – forced air 4 Multizone 5 Fan coils (100% return air) 6 Unit Ventilators (some outside air) 7 VAV (variable air volume) 8 Terminal Reheat 9 Dual Duct 10 Other (Specify)

26. Interior Lighting System(s) *(Percent of grass square feet)*

1 Fluorescent _____% 2 Incandescent _____% 3 Mercury vapor _____% 4 Metal halide _____%

5 High pressure sodium _____% 6 Low pressure sodium _____% 7 Other (Specify) _____%

26b. Exterior Lighting System(s) *(Specify type in space provided)*

27. Major Energy Using System(s) *(List energy using systems)*

Equipment Inventory:	Number of Units:	Size:	Rating:
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Section IV: Major Energy Systems (Handbook I, p. 100) (Continued)

(Circle the number(s) that describe each of the following systems and fuels in the building.)

28. Heating System Location (Describe the location of the primary heating system)

1 Outside the building 2 Within the building on the ground floor

3 Within the building in the basement 4 On the roof 5 Other (Specify)

(If the heating system is within the building or on the roof circle the number from the following list which best describes the type of heating system)

6 Centrally located 7 Multiple units 8 Central and multiple units

29. Domestic Hot Water heating System(s) Location *(Describe the location of the domestic hot water systems.)*

1 Outside the building 2 Within the building on the ground floor

3 Within the building in the basement 4 On the roof 5 Other (Specify)

(If the water heating system is within the building or on the roof, describe the type of domestic hot water system)

6 Centrally located 7 Multiple units 8 Central and multiple units

30a. Type of Control System

1 Central energy management system (remote)
2 Mechanical time clock
3 Electronic time clock
4 Other (Specify)

30b. Control Functions *(Describe the functions controlled.)*

a. Night Set-back
b. Holiday Set-back
c. Demand/Load Shedding
d. Optimum Start-Stop
e. Mixed Air
f. Lighting
g.

30c. When were controls last calibrated:

31. Annual Operating Hours:

_____No. hrs/day x _____No. of days/week x _____No. weeks/yrs = _____ Total Operating Hours

32. Annual Heating Degree Days **33. Annual Cooling Degree Days**

_____ days _____days

34. Solar Characteristics/Potential (handbook I, p.105)

The Department of Energy has determined that the following characteristics are significant in determining the potential of a building for the utilization of solar energy heating systems. If at least three of the following characteristics exist for your facility, investigate a solar retrofit opportunity.

- ❑ The roof of the building is flat or pitched and generally south-facing; the roofing materials are durable and easily worked; the structural members have sufficient capacity to support weight; and the roof is relatively free of obstructions that would hinder the installation of a solar energy system or cause shading.
- ❑ The wall of the building that generally faces south is over 50% glass and the predominant type of solid wall construction material is masonry or metal.
- ❑ Less than 50% of the building's roof and south-facing wall(s) are shaded for more than 4 hours per day.
- ❑ The building utilizes electricity as the fuel for space heating and for domestic hot water or oil, natural gas, or LPG for space heating and electricity for domestic hot water.
- ❑ The shape of the building is square or rectangular and the distance between a potential solar installation and the primary heating, cooling, or domestic hot water system to which it would be connected is less than 50 feet.

35. Should deciduous trees be planted on the south and west side of the building to provide natural cooling?

1. Yes 2. No

6. Site Sketch:

↑
N

Section VI: Operations and Maintenance Procedures Checklist (to be used in completing Section VIII)

Building Controls and Management

- ❑ Reset thermostats to correct settings.
- ❑ Install or replace locking screws to prevent tampering.
- ❑ Adjust thermostats to 68ºF to 70º in heating season and to 75º to 78ºF during cooling season.
- ❑ Change the location of thermostats from areas subject to extreme temperature fluctuations.
- ❑ Reduce winter thermostat settings to 55ºF in unoccupied areas.
- ❑ Where possible, turn off heating systems if nothing in space can freeze.
- ❑ Use spot heaters/coolers in large spaces with low occupancy.
- ❑ Turn off cooling systems in unoccupied areas.
- ❑ Reschedule off-hour activities to accommodate partial shutdown of building systems.
- ❑ Reduce thermostat settings by a minimum of 10ºF at nights, for weekends and holidays during heating season.
- ❑ Shut down all air conditioning units at night, on weekends and holidays.
- ❑ Close supply ducts and radiators and/or lower heating set points in lobbies, corridors, vestibules.
- ❑ Properly adjust and balance air/water systems and control.
- ❑ Experiment with start-up times and reduce or turn off heating and cooling during the lat hour5 or occupancy, allowing the building to "coast".
- ❑ Schedule use of major electrical equipment to avoid peak electrical demand periods.
- ❑ Close interior shading devices, such as draperies and blinds, to reduce night heat loss in winter and to reduce solar heat gain during the summer.
- ❑ Using nameplate data, prepare an up-to-date list of all motors and pumps used in the facility and list routine maintenance to be performed on each.
- ❑ Routinely check all time clocks and other control equipment for proper operation; correct time and day; and proper programming of on-off set points. Protect from unauthorized adjustment.
- ❑ Blow out moisture, oil and direct from pneumatic liens on pneumatic control system.
- ❑ Educate building operators on proper operation of building control systems.
- ❑ Monitor bu8ilding utility usage on a monthly basis and compare it to historical consumption.
- ❑ Organize an energy committee for each building and provide incentives to building occupants to conserve.

Cooling Systems

- ❑ Verify that control valves and dampers modulate properly, especially the economizer section of the system.
- ❑ Raise chilled water temperature.
- ❑ Adjust electric controls to st5age air conditioner compressor operation properly.
- ❑ For a dual duct or multi-zone system: Lower hot deck temperature and raise cold deck temperature.
- ❑ Repair or replace damaged insulation on pipes.
- ❑ Inspect refrigeration condensers or coils and clean/maintain any that are dirty, clogged and/or not functioning efficiently.
- ❑ Repair leaking chilled water piping, valves and fittings.
- ❑ Service any refrigeration compressor that runs continually.

Building Envelope System

- ❑ Realign or re-hang windows or doors that do not close properly.
- ❑ Make sure automatic door closing mechanism work properly. Adjust for faster return.
- ❑ Replace or repair faulty gaskets in garage or on other overhead doors.
- ❑ Repair roof where required to prevent insulation damage.
- ❑ Use weather stripping and caulking to insure that all areas of infiltration are sealed.
- ❑ Replace broken or cracked windows.
- ❑ Keep all vents free of debris.

Heating Systems

- ❑ Stage and sequence operation of multiple boilers by adjusting controls.
- ❑ Insure proper amount of air for combustion, examine and clean air intake filters, and perform flue gas analysis on a regular basis (especially where stack temperatures are more than 105º over steam or water temperatures).
- ❑ Make sure reset controls work properly.
- ❑ Turn pilots off during unoccupied or summer periods.
- ❑ Repair or replace steam, condensate, and heating water pipe insulation.
- ❑ Check oil burners that produce excessive smoke and soot.

- ❑ If burners short-cycle, reset hot water temperature limit switch and replace any faulty thermostat.
- ❑ Lower steam pressure to the minimum pressure that will just satisfy needs.

- ❑ Regularly check all steam traps and repair/replace as warranted.
- ❑ Provide water treatment for boilers to reduce scale deposits on water side surfaces.

Lighting System

- ❑ Where possible, use a single incandescent lamp of higher wattage rather than two or smaller lamps of combined higher wattage.
- ❑ Purchase compact fluorescent lamps for replacement of screw-in incandescent bulbs, especially flood and spot lamps.
- ❑ Discontinue using extended service lamps.
- ❑ Discontinue using multi-level lamps.
- ❑ Disconnect ballasts when tubes have been removed.
- ❑ Remove two lamps and disconnect ballasts in four lamp fixtures.
- ❑ Purchase energy efficient electronic ballasts when ballasts are replaced.
- ❑ When re-lamping , replace fluorescent tubes with more efficient and lower wattage types.
- ❑ Establish a regular inspection and cleaning schedule for lamps, fixtures, and lenses.
- ❑ Replace lens shielding that has turned yellow or hazy.
- ❑ Install a control device (i.e., time clock, motion, or photocell) to automatically turn off lights in unattended areas where lights are usually left on.
- ❑ Mount stickers reminding occupants to turn off lights when leaving room.
- ❑ Provided task lighting rather than illuminate an entire area.
- ❑ Rewire switches so a single switch does not control all fixtures in multiple workspaces.
- ❑ Utilize natural lighting whenever possible.
- ❑ Clean walls or repaint with light reflective non-glossy colors.
- ❑ Replace dark carpet with light color.
- ❑ Complete a walk-thru of your building's lighting with a light meter, comparing lighting levels to industry standards.

Ventilation Systems

- ❑ Reduce outdoor air quantity to the minimum allowed by codes by adjusting outdoor air dampers during hours of occupancy.
- ❑ Close outdoor air dampers when building is unoccupied.
- ❑ Where codes permit, close outdoor air dampers during first and last hours of occupancy to permit fast warm-up and cool-down.
- ❑ Install controlled or gravity dampers on all exhaust ducts to close ducts when fan is not operating.
- ❑ Be sure damper motors are operating properly.
- ❑ Readjust position indicators to accurately indicate damper positions.
- ❑ Reset linkage or replace dampers if blades do not loose tightly.
- ❑ Utilize economizer cycle to optimize the use of outside air for cooling rather than using refrigeration.
- ❑ Discontinue use of unnecessary exhaust fans.
- ❑ Re-wire toilet exhaust fans to operate only when lights are on.
- ❑ Consider rebalancing system.
- ❑ If ductwork is leaky, seal all leaks with tape or caulk.
- ❑ Inspect filters carefully. Create a filter replacement schedule. Use high-efficiency, low cost filters.
- ❑ Do not turn on gym fan unit until the first class occupies the gym and turn it off immediately after the last class leaves in the afternoon

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System Systems

- ❑ Enclose tops of fryers to reduce the exhaust volume required.
- ❑ In the kitchen and cafeteria areas, cook with lids in place on pots and kettles, preheat ovens only for baked goods, use dishwasher with full loads only.
- ❑ Shut off walk-in coolers during summer months (or when not needed).
- ❑ For laundry equipment – wash and dry full loads only.
- ❑ For special diagnostic and treatment equipment, consider scheduling this equipment during electrical off-0eak periods.
- ❑ Turn off computer equipment at night and weekends.
- ❑ Check cooling air temperatures for computer areas and do not over cool.
- ❑ For swimming pools, reduce water temperatures to 80º-84ºF and turn off heater and circulating pumps until an hour before use.
- ❑ Try utilizing kilns, kitchen and laundry equipment during off-peak periods.
- ❑ Utilize pool covers and check humidistat operation in pool areas to reduce energy loss during unoccupied times.
- ❑ Disconnect all lamps and ballasts in vending machines, and connect all vending machines, and connect all vending machines to timers for summer, weekends, and evening shutdown.

Water Heating System

- ❑ Replace damaged or missing insulation on hot water tanks and piping.
- ❑ If possible, reduce hot water temperature to 105º-115ºF.

- ❑ Install a small domestic hot water heater to eliminate the need for operating one of the large space heating boilers during summer months.
- ❑ Shut off "summer boilers" during the heating season.
- ❑ Repair all leaks including those of the faucets and pumps.
- ❑ Use flow reducers and timers in faucets and showers.
- ❑ Remove or turn off domestic hot water to toilet rooms and other spaces that could function without hot water.

Section VII: Energy Conservation Measures Checklist (to be used in completing Section VIII)

(Note: Where a building is occupied an average of 40 hours per week, paybacks average less than two years for terms in italics, these should not require an engineering analysis.)

Building Envelope

- ❑ Install storm windows or double glazing.
- ❑ Reduce glass area (add insulated panels).
- ❑ Install solar exterior shading, screening, blinds, and awnings.
- ❑ Replace glass with high performance glazing.
- ❑ Install insulated doors.
- ❑ Install airlocks, vestibules, revolving doors.
- ❑ Wall up/close off unneeded openings.
- ❑ Install insulation (roof, ceiling, wall, and floor).
- ❑ Add reflective film to windows.
- ❑ ***Install weatherstripping – caulk joints and windows***
- ❑ ***Install covers on air-conditioners/coolers during off-season.***

Heating

- ❑ Replace inefficient burners.
- ❑ Replace inefficient boilers.
- ❑ Downsize system to match actual loads.
- ❑ Install automatic flue dampers.
- ❑ Replace pilot lights with electronic ignition.
- ❑ Preheat combustion air/make up water with waste heat.
- ❑ Recover waste heat from exhaust air, flue gas, laundry, kitchen, condenser, cooling tower.
- ❑ Install more efficient rooftop units.

Cooling

- ❑ Replace inefficient chillers.
- ❑ Install window air conditioners to match load requirements at a SEER well over 10.0.
- ❑ Provide for economizer cycles.
- ❑ Utilize evaporative cooling.
- ❑ Manifold chillers in parallel and sequence.
- ❑ Insulate off-line chillers and cooling towers.
- ❑ Replace air cooled condensers with cooling towers.
- ❑ Insulate unused air conditioner sleeves.

Ventilation/Distribution

- ❑ Install/upgrade outside air controls
- ❑ Reduce air volume/CFM
- ❑ Reduce air stratification
- ❑ Convert to variable air volume system
- ❑ Insulate pipes
- ❑ Install automatic dampers
- ❑ Lower resistance in duct system.
- ❑ For pool areas, control fans from humidistats
- ❑ Eliminate ventilation to unoccupied areas
- ❑ Upgrade valves on unit ventilators.
- ❑ ***Install timers on restroom exhaust fan***
- ❑ ***Retrofit/upgrade inoperable dampers***
- ❑ Control fan speed with variable frequency Drives
- ❑ Duty cycle exhaust fans
- ❑ Control building mixed air per CO_2 sensors
- ❑ Insulate ducts running in unconditional space
- ❑ Control parking area fans per CO_2 sensors
- ❑ Do not exceed outside air requirements
- ❑ Shut off/reduce heat to lobbies, stairwells, hallways
- ❑ Reduce/eliminate air to unoccupied areas
- ❑ Utilize outside air for free cooling.
- ❑ Eliminate simultaneous heating and cooling.

Lighting

- ❑ ***Convert incandescent exit light to LED technology***
- ❑ ***Convert incandescent to fluorescent***
- ❑ Convert mercury vapor to metal halide or high-pressure sodium
- ❑ Convert fluorescent fixtures to electronic Ballasts and T-8 lamps
- ❑ Modify fixtures (add reflectors, lower height, Etc.).
- ❑ Reducing the number of fixtures and reduce Lighting levels where over lit.
- ❑ Install task lighting.
- ❑ Install occupancy sensors (infrared, daylight, Motion)
- ❑ Install local/zone switches
- ❑ Utilize skylights or other day lighting techniques.
- ❑ Add photo control for exterior lighting
- ❑ Connect exterior and interior lights to central EMS for control
- ❑ ***Convert incandescent to MH, HPS, or LPS***

Domestic Hot Water

- ❑ Install flow restrictors.
- ❑ Add self-shutoff for faucets and showers
- ❑ Install piping and tank insulation.
- ❑ Install separate hot water boiler for summer.
- ❑ Install booster heaters for hot water in lieu of high temperature central system.
- ❑ Add preheat from waste heat source.
- ❑ Downsize DHW tank.
- ❑ Control DHW pumps for off hours
- ❑ Use on-demand DHW units.
- ❑ ***Install pilotless ignition on DHW units.***
- ❑ ***Convert electrically-based DHW and booster Heaters to natural gas (where feasible***).

Section VII: Energy Conservation Measures Checklist (continued)

Laundry and Kitchen

- ❑ Install heat reclamation system on laundry wash discharge.
- ❑ Install heat reclamation system on dryers.
- ❑ Preheat makeup air supply from exhaust.
- ❑ Install local booster heater. (Gas fired)
- ❑ Install high-efficiency steam control valves.
- ❑ Install nighttime automatic steam cut off.
- ❑ Utilize chemical dishwashing systems and lower DHW temperature

Utility Plant Systems

- ❑ Install multi-fuel boilers to optimize savings from competitive fuel markets.
- ❑ Increase boiler efficiency.
- ❑ *Insulate boiler and boiler piping including condensate lines.*
- ❑ Install economizers.
- ❑ Install air pre-heaters.
- ❑ Install blow-down controls.
- ❑ Modernize boiler and chiller controls.
- ❑ Inspect, replace or upgrade steam traps.
- ❑ Install modular boilers.
- ❑ Downsize boilers.
- ❑ Provide for condensate return.
- ❑ Lower boiler plant operating steam pressure if feasible.
- ❑ Upgrade insulation on tunnel piping system.
- ❑ *Install boiler water treatment equipment.*

Electrical Equipment

- ❑ De-energize equipment when not in use.
- ❑ Reduce loads when not required.
- ❑ *Install capacitors or synchronous motors to increase power factor.*
- ❑ Reduce transformer losses by proper loading and balancing.
- ❑ Convert to energy efficient motors.
- ❑ Install variable speed motors.
- ❑ Replace oversized motors and pumps.

Controls

- ❑ Relocate improperly placed thermostats.
- ❑ Upgrade from timeclocks to computer-based energy management system.
- ❑ Install temperature/pressure reset devices.
- ❑ Install night setback devices.
- ❑ Install load shedding & load scheduling devices
- ❑ Install enthalpy controls.
- ❑ Replace hand valves with automatic.
- ❑ Provide separate thermostats for infrequently Used areas/zones.
- ❑ *Install timer or circulation pumps.*

Renewables

- ❑ Install active or passive solar hot water system.
- ❑ Install active or passive solar space conditioning
- ❑ Utilize photovoltaics.
- ❑ Convert to wood or biomass.
- ❑ Utilize renewable energy sources such as solar, geothermal, and wind.
- ❑ Utilize hydro power, geothermal or wind.
- ❑ Install ground-coupled heat pump system.
- ❑ Provide for natural daylighting.

Miscellaneous

- ❑ Install cogeneration system.
- ❑ Install thermal storage system.
- ❑ Convert to less expensive fuels.
- ❑ Install pool covers and consider heat recovery where pools exist.
- ❑ Install air curtain or wind screen at loading docks.
- ❑ Shift to a less costly utility rate.

Section VIII: Summary Findings (from O&M and ECM Checklists):

Describe the history of energy conservation activities for this building (include prior audits, a description of energy management, monitoring of utility data, operations and maintenance, and energy conservation measures): _____

_____

_____

What percentage reduction has been achieved through the activities described above _____%.

Estimated energy and cost savings likely to result from implementing O&Ms noted the above checklist.

Detailed description of what will be done: include number of items, proposed operation, type, location, and size.	Est. Cost	Est. Energy Cost Savings or Payback
O&M No. 1		
O&M No. 2		
O&M No. 3		
O&M No. 4		
O&M No. 5		
O&M No. 6		
O&M No. 7		
O&M No. 8		
O&M No. 9		
O&M No. 10		

Estimated costs, and energy and cost savings likely to result from implementing ECM's noted in above checklist (Handbook II).

	Est. Cost	Est. Energy Cost Savings or Payback
ECM No. 1		
ECM No. 2		
ECM No. 3		
ECM No. 4		
ECM No. 5		
ECM No. 6		
ECM No. 7		

STEP 3: AUDITOR CERTIFICATION FORM

(Please check one):

_____ I am qualified to perform energy audits through successful completion of a state auditor training course conducted on _____, _____.

_____ I am qualified to perform energy audits as a professional engineer or architect who has registered with the Utah Energy Office.

_____ I am qualified to perform energy audits as a member of the UEO staff or as a contractor of UEO.

_____ I am qualified to perform energy audits through demonstration of equivalent skills gained through other training and experience approved by UEO.

My financial interests in connection with this energy audit are:

_____ No outside interests.

_____ Own or am employed by (specify): _____

I have completed this energy audit workbook accurately and thoroughly to the best of my knowledge and abilities.

I have no responsibility for the day-to-day operation of the building.

Signature _____

Date _____

Appendix C

District Energy Needs Assessment Form

In support of the U.S. Department of Energy Rebuild America/Energy Smart Schools Program, the Utah Energy Office and the National Energy Foundation assist Utah school districts in developing and implementing an Energy Action Plan. Districts energy management teams can consider these possible needs as they develop the District Energy Management Action Plan:

For our buildings we need:

- ❑ Help identifying cost effective energy retrofit opportunities.
- ❑ Assistance in the process of acquiring funding to pay for building upgrades.
- ❑ Assistance on working through procurement of an energy service company
- ❑ Design assistance to an architect or engineer for designing high performance buildings (that exceed the energy codes in ASHRAE 90.1 by 30% or more).
- ❑ To develop high performance building guidelines.
- ❑ Help gathering and correlate information on which existing schools are energy inefficient.
- ❑ Help improving our central energy management/control system.
- ❑ Help identifying operations and maintenance procedures and schedules that save energy.
- ❑ To identify ways to implement electrical load/demand reduction strategies for energy cost savings and utility incentives.
- ❑ Help qualifying buildings under Energy Star or the LEED rating programs.
- ❑ Help with energy efficiency for relocatable/mobile classrooms
- ❑ To access utility company rebates for energy efficiency
- ❑ Support for organizing student Energy Patrols for our elementary schools
- ❑ _____
- ❑ _____

For training and workshops, our district needs:

- ❑ Help in hiring and training an energy manager for our district
- ❑ Training for our facility managers in energy auditing.
- ❑ To provide a boiler workshop for managers.
- ❑ Help implementing a system for tracking energy use and for monitoring utility bills.
- ❑ To provide our staff with information about local workshops and special events and presentations on energy efficiency.
- ❑ To develop a program for retrocommissioning existing buildings and commissioning new buildings
- ❑ Employee brochures/booklets to improve energy consciousness.
- ❑ Training about energy efficient lighting products.
- ❑ _____
- ❑ _____

We also need (other):

- ❑ To provide curriculum, educational, or instructional resources for students and teachers about energy efficiency
- ❑ To provide staff with information about Energy Star appliances and equipment.
- ❑ To identify opportunities for using renewable energy sources.
- ❑ Help identifying community resources to support our energy Action Plan.
- ❑ To identify ways to ensure energy supply reliability for our schools.
- ❑ Help instituting a low water schedule for facility landscaping.
- ❑ Assistance in acquiring fleet vehicles that use alternative fuels or high MPG vehicles.
- ❑ To identify ways to participate in reducing urban heat islands around our buildings.
- ❑ Help instituting an “employee trips” reduction program.

- ❑ Help with district purchasing procedures to assure that purchases consider life cycle based rather than first cost.
- ❑ Strategies for acquiring lowest cost gas, fuel, and electricity.
- ❑ Assistance in developing an incentive program that encourages district staff, students, and teachers to conserve energy.
- ❑ _____
- ❑ _____

Appendix D

PUT YOUR HEADS TOGETHER

Simple No-Cost People-Oriented Tips to Save $$ for Your School

School energy costs have continued to rise in recent years. Some of the reasons for increased energy costs include the supply verses demand for electricity and gas in the region, unseasonably warm or cold weather, and regional pressure on energy supplies.

What can Utah schools do? When there are increases to electrical and gas rates, Utah students, teachers, staff, and administrators can be proactive and take action to stave off high bills. This not only helps your district to save funds for education needs, but also helps improve the situation for all of Utah. When Utah's total demand for energy are under control, you are not likely to see prices escalate so sharply.

Everyone can help at school and at home by following these tips from the Utah Energy Office. Please discuss these items in your next assembly, and challenge teachers and students to find other energy saving actions for your school. It is always a challenge for students to brainstorm about activities that they can do at school and at home to do more with less energy.

Cut Lighting Costs

- "Would the last one out please turn off the lights?" Over 20% of your school's energy is used for lighting. When occupants leave a room for more than two minutes turn the lights off -- more energy is used keeping lights on than turning them off and back on again. Order *Lights Off* stickers as reminders from the Utah Energy Office (see HOTLINE telephone number below).
- Many schools leave their lights on for an extra hour or two every afternoon after school. This can raise electrical costs for lighting 12 to 15 percent. Turn all the lights off in the school as soon as school is out.
- Ask the custodians to turn on and off lights as they move through the school from area to area during cleaning time.
- Ask district electricians to disconnect lamps and ballasts in all vending machines.

- Let mother nature give a hand by using natural daylighting and shutting off electric lights. Open the blinds to let in sunlight and warmth. Studies show that students score better with daylighting rather than electric lighting. Close blinds on cold winter nights to keep heat in the rooms.

- Make sure that parking lot and outside security lights are off during the day.

It pays to turn off equipment.

- Turn off televisions, VCRs, computers and printers when you are finished with them and remember to turn them off immediately after school.

- Save energy by activating the sleep mode for computer monitors rather than using screen savers.

- Schedule use of kilns, electric ovens, sawdust collectors, stage and sports lighting, and other heavy electrical-use equipment before 10:00 a.m. and after 2:00 p.m. to avoid peak electrical power demand charges.

- Order *Vending Miser*s to shut off pop machines when no one is in the school (free from Utah Power)

Turn it down

- Restroom hot water should not exceed 110° to 115°. This saves energy and avoids scalds.

- Ask custodians to maintain school thermostats at no more than 68° to 72°F during the winter months and no less than 78°F when air-conditioning the school during the summer

- Have custodians or district energy managers use building control systems to set building temperatures back 15° to 20° during nights, weekends, and holidays. Setback can occur as early as half an hour before school is out! Most school heating systems can be timed to restart from 5:30 to 7 a.m. to bring a school building back to a comfortable temperature by the time teachers and students arrive. It is more efficient to reheat a building each morning than leaving the heating or cooling system on all night.

- If a room is too hot or cold, report problems promptly to the district.

- Shut off heat to vestibule heaters. Avoid drafts by not propping vestibule doors open.

Save Gas

- Carpool, bike, walk or ride the bus to school.

Green Up the Schoolyard

- Plant deciduous trees on the south and west sides of the building to keep rooms cooler on warm spring and fall days. Plant conifers on the north and northwest sides for windbreaks. Call *TreeUtah* to find out which trees are best for your school. Phone: (801) 364-2122.

Tune Up Building Equipment

- Custodians and district staff should follow a regular schedule for maintaining building equipment.

- Check steam traps, reset timers on fans and pumps, clean filters, check control set points, check damper operation and recalibrate thermostats regularly.

Set up an Energy Patrol

- Students, ask your teachers and principal to sponsor a Student Energy Patrol. You can call the non-profit *National Energy Foundation at (801) 539-1406* for more information on how to set up a patrol. To check your patrol's progress, ask the district office for a monthly report of electricity and gas use. Share this information with other students, teachers and custodians each month. Ask district administrators to share the patrol's energy cost savings with your school.

Try New Technology

- Request district funds for installing compact fluorescent lamps and electronic ballasts with T-8 fluorescent tubes. These provide 20 percent more light and use two-thirds less energy than standard technologies.

- Use energy efficient compact fluorescent lamps to replace incandescent and halogen lamps in your school. These lamps including dimmable varieties are available under state contract at: http://www.purchasing.utah.gov/bidprocessing/Contracts.asp

Dress for the Weather

- Wear long fleecy pants, long stockings, sweaters or sweatshirts on cold winter days. Wear short-sleeve shirts and shorts on summery days.

- Dressing appropriately can eliminate the need for space heaters and fans which are both expensive and dangerous to operate.

Save Water

- Report leaky facets, toilets, urinals, and showers as well as broken sprinkler heads to the custodian.

- Shut off sprinklers on rainy days and reduce run time in late fall and early spring.

For more information or help setting up your school and district's energy program, contact: the Utah Energy Office's Energy Hotline: 1-800-662-3633