Energy Use Reduction at Sunny Brae Middle School

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1 Problem Statement

Sunny Brae Middle School is spending money on energy that could be diverted to other educational uses.

2 Background

California schools are spending nearly $750 million on energy, more than the combined cost of supplies and books. In a time of rising concern over energy supplies and tight school budgets, this figure shows cause for readjustment. Energy costs have risen over the last few years, and due to existing contracts Reduction in energy costs would mean better opportunities for students by freeing up funds for academic purposes that are currently being spent on energy. In addition to this, the school board has the chance to acquire funds that are being held back. A grant is available to Sunny Brae School for reducing energy usage by 20%. It has also been shown that school districts can save 20%-30% on annual utility costs by renovating schools and applying high performance design concepts.

Sunny Brae Middle School has already taken some measures to improve their energy efficiency. They have replaced all of the ductwork for the heating systems in the classrooms, they have replaced the T-12 fluorescent lighting in some of classrooms with T-8 fluorescents, and they installed insulation board over two-thirds of the windows on the north side of the classrooms. Sunny Brae Middle School is committed to reducing their energy use and their spending on energy.

3 Objectives

Three main objectives were identified for this problem, these objectives are:

Objective 1: Identify ways that Sunny Brae Middle School can reduce energy usage by 20% within two years.

Objective 2: Identify ways that Sunny Brae Middle School can reduce spending on energy by 20% in ten years.

Objective 3: Identify grants and programs to assist Sunny Brae Middle School in implementing energy use reductions.

4 Implementation strategies

1. Research technologies that are applicable to Sunny Brae Middle School. To be completed April 24th. Research will be broken up and done by group members as follows
    - Erin will research: Behavioral modifications, phantom loads, task lighting, power strips, LED exit signs, and light reduction.
    - Aron will research: Behavioral modifications, low flow faucets, boilers, and ground source heat pumps
    - Mike will research: Thermal curtains, dual pane windows, window coatings, and fluorescent lighting retrofit.
    - Other subjects being researched by all members include: Shading for outdoor freezer, desk lights, insulation board repair, and the effects of behavioral modifications.
2. Compile research and prepare document for class presentation. To be completed by May 1st.
3. Fine tune presentation and final editing of documents. To be completed by May 8th.
4. Prepare presentation and document for school board presentation. To be completed by May 13th.
5. Give oral and written presentation to school board on May 13th outlining energy saving actions and their potential cost savings. Presentation will include:
    - Presentation of variety of alternatives, including no-cost, behavioral, low cost, and high cost alternatives.
    - Pros and cons of alternative solutions.
    - Cost-benefit analysis of alternatives
    - Long-term predictions.
    - Poster size checklist of energy saving behaviors for teachers/students/staff to implement, to be posted in classrooms.
    - List of potential grants and other programs designed to help schools reduce energy usage, such as Green Schools, and Destination Conservation.

5 Alternatives

5.1 Alternative 1

Implement behavioral modifications that reduce energy usage. This would include such behaviors as turning off lights when not in use, not leaving doors and windows open when climate control systems are in use, and filling empty refrigerator space with water bottles. Teachers could also utilize the same room instead of using separate rooms when teachers are on campus and students are not. Behavioral modifications cost very little, and can be implemented very quickly. Unfortunately they are limited in the amount of energy usage that they can reduce, especially if equipment that is being used is inefficient. It can also be difficult to modify habitual behaviors.

5.2 Alternative 2

Purchase and install low cost equipment upgrades and renovations to reduce energy usage. Examples of low cost equipment that could be used are power strips for appliances to eliminate phantom loads, or installation of occupancy sensors for certain areas. Low cost options can also be easily and quickly implemented and do not require a large outlay of capital, but are often times limited by the larger, more expensive equipment.

5.3 Alternative 3

Purchase and install high cost equipment upgrades and renovation to reduce energy usage. Examples of high cost equipment are a new, high efficiency boiler for the heating system, and replacing T-12 fluorescent light fixtures with T-8 high efficiency fluorescents. These options usually offer the largest amount of savings, but also require a large outlay of capital.

5.4 Alternative 4

Implement a combination of behavioral modifications, low cost equipment upgrade, and high cost equipment upgrade as chosen by the school board. By using a combination of the three types of options, we can achieve the highest amount of savings for the amount of capital available.

6 Monitoring and evaluation

6.1 Prior to implementation

A written survey will be conducted asking students and teachers what energy saving behaviors are already in use. This will be useful for future comparisons.

6.2 6 month

A written survey will be conducted asking students and teachers what behavioral modifications have been implemented, and their impression of the measures' effectiveness. Answers to this survey will be compared to answers from the previous survey.

A third party could sit in on classrooms to observe what measures are actually being implemented thus far.

Listing of any new equipment purchases that have been made.

6.3 1 year

Compare energy bills from previous year to see how much decrease in energy usage and spending has occurred, paying special attention to decrease in actual usage (KWH and Therms) as well as any change in utility rate.

Another survey will be conducted asking students and teachers what behavioral modifications have been implemented, and their impression of the measures' effectiveness. Answers to this survey will be compared to answers from the previous surveys.

6.4 5 year

Analyze and compare energy bills over the previous 6 years to see what type of savings and usage reduction has occurred.

Analyze and compare money spent on upgrading equipment vs. any cost savings in energy spending to see if objective of reduced spending was met.

7 Findings

7.1 Behavioral modification

The least expensive way to reduce energy use is by changing wasteful behavior and habits at the school. While this option costs no money, it will be difficult to implement without effort and motivation on everyone's part (administration, staff, faculty, and students) to make the changes.

7.1.1 Awareness and Education

For effective change to take place, first everyone needs to be aware of what actions waste energy. Energy education can be added to the curriculum taught to students but administrators and staff also need to learn what behavior they can change to use energy more efficiently.

While awareness is a big step, by itself it is not always enough to cause a change in behavior. Positive motivation is also important. One way to motivate everyone to be more efficient in energy use is to show them what benefits can come from energy savings—such as guaranteeing a portion of the money saved for purchase of new equipment and classroom materials.

7.1.2 Make Energy Use Public

It may be very helpful to involve teachers and students and others who are currently uninformed of how much energy is used at the school by sharing this information with them and keeping them updated (perhaps monthly) of changes in the amount of energy used and rewarding them for decreases related to their conservation efforts. Seasonal fluctuations due to increased heating and lighting demand in the winter need to be kept in mind, but analyzing past energy bills can provide a baseline to compare energy use during a particular month in previous years to the present (temperature and weather variance over the years should also be kept in mind when making these comparisons).

7.1.3 Conceptualize Energy Use

It may be easier to encourage people to conserve energy if they have an idea of how much energy is used by certain actions. For example, knowing roughly how much electricity leaving the lights on uses per room over a certain amount of time or how much

energy is being used by the heating system to warm the room when it is on and the price of this energy may help convince everyone to not leave lights on unnecessarily and to not leave windows or doors open when the heater is on.

7.1.4 Effective Communication

Students and faculty may have ideas on ways energy can be saved and if the necessary measures are not in their control, there should be easy and effective ways to communicate their thoughts to those in charge of making the decisions or taking action. It is important that they feel that their opinions are valued and their ideas will be taken seriously or else they may feel powerless over the situation and become unmotivated to conserve energy. One idea to demonstrate the value the administration places on student, faculty, and staff input is to have a contest for who can come up with the best energy-saving ideas and then implement those winning ideas in the school.

7.1.5 Turning Off Unneeded Lights

Lighting can account for up to 60% of the energy use in schools. This amount can be reduced by turning off lights when leaving an empty room (even for a few minutes) or when there is sufficiently bright daylight available in the room. Studies have shown that using diffuse natural light when practical creates a more comfortable and productive environment for learning and working than using artificial light. There is no reason for lights to be on in an unoccupied room. Light switches must be located in convenient locations for turning them on and off when entering and exiting a room.

7.1.6 Turn Off Unused Equipment and Appliances and Unplug Phantom Loads

Equipment that is not being used should not be left on. Computers and printers that are used infrequently should be turned off after use. Monitors account for 80% of computer electricity requirements, so monitors should be turned off or the computer put in sleep mode for periods when the computer is not being used but when waiting for it to boot up is not practical. A coffeemaker can use up to 1,000 watts of power, almost as much as having all the lights on in the classroom (which uses 1,224 W), so it should not be left on after it is done brewing just to keep it warm. Using a microwave to reheat is much more efficient or using a thermos to keep coffee warm. A phantom load is power used by an

appliance that is already turned off. These wattages are usually very low (< 10W per appliance) but draw electricity 24 hours a day, which adds up over time. Appliances such as TVs, VCRs, and anything with a clock all have phantom loads and should be unplugged when not in use or be plugged into a power strip that is turned off when not being used.

7.1.7 Keep Doors and Windows Closed When Heaters Are On

Raising and maintaining the temperature in rooms uses a significant amount of energy, and if windows or doors are left open when a heater is on, this heat quickly escapes to the outside; this is essentially the same as heating the outside and a clear waste of energy. This also causes the heating system to work harder to try to bring the area to the desired temperature. This may be caused by a lack of control over the thermostat by people using the room. If a thermostat is not working properly or if teachers are not able to turn it off when they feel the room is warm enough, they may feel it is easier to leave windows and doors open to keep the room comfortable than it is to contact maintenance personnel to turn it off or reset it. There should be an easy way to contact maintenance staff to fix the problem, or a way for the teachers to turn off the heater when it is not needed. If it is desired to open the windows, then the heater should be turned off.

7.1.8 Close Curtains When Leaving for the Day

Heat is lost very rapidly through windows, especially the single-pane aluminum frame type at Sunny Brae. Curtains somewhat insulate the room and decrease the rate of this heat loss and should be closed when the classroom is not in use, especially overnight. This will decrease the amount of energy used by heating systems to warm the room. Thermal curtains, discussed later, offer greater insulation than other curtains.

7.1.9 Open curtains to allow light and heat in

On days when the sun is shining brightly and it is warm outside, the curtains can be opened to allow both heat and light to enter from outside. This will reduce energy loads for the heating system as well as for the lights. During the walkthrough it was observed that on a bright day, with the curtains on the north side of the room open, as much as two-thirds of the lights in the room can be turned off while still maintaining adequate light levels in the room.

7.1.10 Share Workspace When Possible

It is not an efficient use of energy to heat and light an entire room when only one or two people are using it. If practical, have a common room where people can gather to work on tasks when class is not in session. If noise is the primary detraction people have for this idea, perhaps two rooms could be used, one designated a quiet area. As discussed later under Low Cost Options, desk lamps can be used when working alone in a classroom.

7.1.11 Consolidate Refrigerator Use

Refrigerators use a lot of energy to keep food and drinks cold, especially older models. A new very small unit (about 2 cubic feet of storage space) may use 100W of electricity nearly continuously. Every time the door is opened, warm air enters the compartment and the unit must use energy to chill this air. The more things are stored in the compartment, the less cold air will be displaced when the door is opened and the less energy will be required to lower the temperature. Opening the door less often and keeping it open for shorter amounts of time will also help reduce energy use. It would be even more efficient to share a larger refrigerator rather than using several small and mostly empty refrigerators.

7.1.12 Thermal mass in refrigerators

Many teachers have small refrigerators in their rooms, and the home economics room has two large refrigerators. These refrigerators can use quite a bit of electricity, especially if they are opened and closed often. Every time they are opened and the cool air from inside escapes, the refrigerator must work to cool down the new air that is inside. Thermal mass, such as bottles of water, can be put inside the refrigerator to prevent loss of 'cold'. The mass will take up space inside the refrigerator, reducing the amount of energy needed to cool the space, and will prevent cold from being lost when the refrigerator is opened. Placing full water bottles in a refrigerator that is not completely full can, in effect, store some of the refrigerated energy that is lost every time the door is opened. At times when the refrigerator is completely utilized the water bottles can be set aside until room is available. This is a low cost way to improve the efficiency of refrigerators. Here are some more helpful tips to keep a refrigerator operating optimally:

- Set temperatures at 38 to 45 °F for refrigerator compartment and 0 to 5 °F for freezer compartment. If your refrigerator is equipped with an energy saver-switch, use it whenever possible.
- For the most efficient operation, keep refrigerator and freezer full and minimize the number of times you open the door.
- Allow sufficient air space around food containers in the refrigerator for good air circulation and make sure the inside vents are not blocked.
- Make sure the door gasket seals well. Clean external coils behind and beneath the refrigerator regularly. Keep kick plates free of dust for proper circulation.

7.1.13 Check Thermostat Settings and Functioning

Recommended temperature settings for thermostats in rooms is 68 °F during the day when occupied and 55 °F or less at night or when unoccupied. This has already been done at Sunny Brae, with timers being used to turn off the heat before students leave. However, some teachers have commented that the heaters are not always responding properly. Since they are unable to control the settings, there should be a survey of the teachers asking them about the performance of the thermostats and heaters in their classroom and if they feel the temperature of the room is adequate. There should also be an easy way for teachers to communicate problems to maintenance staff so that energy is not wasted by opening doors and windows to counteract unnecessary heating.

7.1.14 Use Visual Reminders

After educating everyone about energy use and energy-efficient behaviors, visual aids such as a poster-sized checklist can be used to remind everyone about what they can be doing to save energy, such as turning off lights and appliances when they are not needed and keeping doors and windows closed when it is cold enough for the heater to turn on. It may be more effective if the people who will be seeing the poster are the same ones who created it, especially for students. Each classroom can come up with the ideas to put on the poster. Putting "Please turn off lights" stickers on or near each switch plate or at eye level on doors can remind people to turn them off when leaving an empty room. A

student activity could be designed where students paint messages directly on the wall switch plates about turning off lights and saving energy.

7.1.15 Vending Machine Efficiency

Vending machines use 7 to 14 KWH per day, whether or not anyone is using them, which adds up to 2,500-5,000 KWH over a year per machine. The lights used to backlight soda machines are an unnecessary use of electricity, even from an advertising point of view, because the light is not visible in the daytime and there is no one there to buy the product at night. Ask the vending machine operator to turn off these advertising lights. Unplugging the machines when they will not be used for extended periods such as weekends and holidays will save electricity used to run the compressor that refrigerates the product. A device called VendingMiser, can power down the machine when sensing no one in the vicinity.

7.2 Low cost equipment options

7.2.1 Use Task Lighting

If teachers or others are the alone in a room and primarily working in a small space such as at a desk, a bright but low wattage desk lamp that uses 20W can be used instead of turning on the overhead lights in the classroom, which requires 1,224W. This is an energy savings of 98%! None of the classrooms visited had a desk lamp. Buying inexpensive 20W halogen desk lamps for every classroom would cost $150-$250, about the same amount of money it costs to use all the overhead lights in all the classrooms for 50-90 hours.

7.2.2 Window insulation

Windows are the main source for heat loss that occurs in a room. This especially applies to Sunny Brae Middle School, where most classrooms have an entire wall of windows that faces the north. Insulating board has already been installed on part of the window surface, but much more can still be done. If the windows can be insulated, then heat loss and heating costs will be lowered. The efficiency of insulating materials is measured by their R-value or U-value. A higher R-value means the material resists heat flow more. The U-value is the inverse of the R-value, therefore a higher U-value means the material

allows more heat to pass through it. Standard single pane windows have an R-value of 1. There are a number of types of window insulation that increase the R-value of the windows.

7.2.2.1 Thermal curtains

Thermal curtains dramatically reduce the amount of heat that is lost through the windows, lowering heating costs by as much as 20%. Thermal curtains are similar to regular curtains, but are made much thicker and seal along the edges of the window to help create a "dead space" between the outside and the inside. Thermal curtains can be purchased from dealers, or can be inexpensively made from existing curtains. The Campus Center for Appropriate Technology on Humboldt State University campus offers classes on how to make thermal curtains. Existing curtains can have an additional layer of material sewn into them, and a Velcro strip could be sewn around the edges to help seal the curtain against the wall. Homemade thermal curtains such as these can increase the R-value up to three, while professionally made and installed thermal curtains and can raise it as high as five. Thermal curtains easily pay for themselves in just a few years.

7.2.2.2 Window coating

Windows coatings can be applied to existing windows, reducing heat lost through the windows for a very low cost. A company called Vista sells a product called Llumar window coatings, which can be applied professionally or even sold as a do-it-yourself kit. Window coating can be purchased in sheets for as little as $1.50 per square foot, and can increase the R-value by 30%.

7.2.2.3 Repair worn insulation board over northern windows

In many of the classrooms, insulation board has been installed on the windows on the north side to prevent unwanted heat loss. Over the years, the insulation board has deteriorated dramatically, reducing the effectiveness of the insulation. On some of the insulation board, the bottom sealing strip is no longer there, eliminating the "dead air" effect that the insulation board is supposed to provide. Worn or damaged insulation board should be repaired or replaced to restore the insulating value.

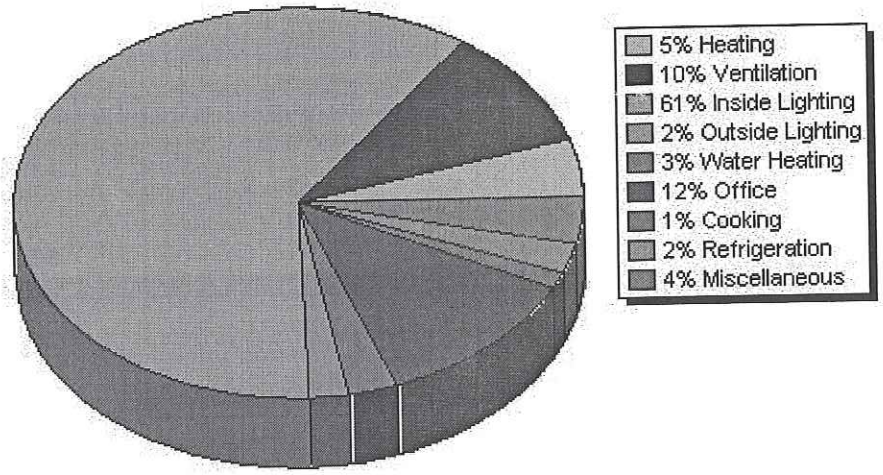
7.2.3 Faucet aerators

It is estimated that the average household can save on average 4,000 gallons of water a year by attaching low-flow aerators to kitchen and bathroom faucets. Aerators can dramatically reduce water demand and also reduce hot water demand, which leads to reduced energy costs. If aerators were installed in every bathroom sink, the cafeteria facility, and in the Home Economics class room, hot water demand could be reduced by as much as 10% on the campus for a small investment. The average new faucet uses about two gallons per minute (gpm) of use, aerators can be purchased for a little more than a dollar each to reduce this flow to about 1.5 gpm (suggested) or for a little over three dollars to reduce the flow to about 0.5 gpm (recommended).

7.3 High cost equipment options

7.3.1 Lighting retrofit

According to the online energy estimator at energyguide.com, a school the same size, type, and with equipment similar to Sunny Brae Middle School, uses 61% of its energy for indoor lighting. The graph below shows the estimated energy use for various activities. Retrofitting existing lighting equipment can reduce energy use by a very large amount.



7.3.1.1 Fluorescent retrofit

Lighting is by far the largest use of energy at Sunny Brae Middle School. T-12 fluorescent lighting provides lighting in a large portion of the school. T-12 fluorescents use less efficient ballasts, and give less lumens per watt than T-8 fluorescents (lumens are

a measure of light levels). T-8 lights also save electricity because they use electronic ballasts instead of magnetic ballasts. A magnetic T-12 ballast consumes 13 watts per fixture, while an electronic T-8 ballast uses only 3 watts. The lights in the classrooms in the main building have already been replaced. Assuming that the rooms have the same light levels before and after the retrofit, the retrofit saved 3,225 KWH per month, for a cost savings of between $329 and $497 per month, depending on the utility rate. The following areas are still equipped with inefficient T-12 fixtures and ballasts: front office, hallway, girls and boys locker rooms, girls and boys restrooms, classrooms in the complex, library, home economics room, and the nurse's office. In total there are 1,018 four foot, 34 watt, T-12 fixtures installed in these areas, providing a total light output of 1,608,000 lumens of light. The same amount of light can be provided with 594 four foot, 32 watt, T-8 fixtures. This change would reduce electricity usage for lighting these areas from 7,177 KWH to 3,118 KWH per month, for a cost savings of between $414 and $625 per month. A retrofit of this size and type would likely cost between $15,000 and $20,000, so payback period would be between three and five years.

7.3.2 Dual pane windows

Dual pane windows, like thermal curtains, retain the heat that is normally lost through regular windows. Dual pane windows generally increase the R-value to 2, but gas fillings, and low-e coatings can increase it to as much as 3. Unfortunately installing dual pane windows can be very costly because all windows must be replaced, but can pay for themselves in 10-15 years.

7.3.3 Boiler

Heating is the largest energy expense in most homes, accounting for almost two-thirds of annual energy bills in colder areas of the country. Conservation efforts and a new high-efficiency heating system can cut your fuel bills significantly. If the furnace or boiler is old, worn out, inefficient, or significantly oversized, the simplest solution is to replace it with a modern high-efficiency model. Old coal burners that were switched over to oil or gas are prime candidates for replacement, as well as gas furnaces without electronic (pilotless) ignition. Based on the following table:

DOLLAR SAVINGS PER $100 OF ANNUAL FUEL COST

AFUE of New System

		55%	60%	65%	70%	75%	80%	85%	90%	95%
	50%	$9	$16	$23	$38	$33	$37	$41	$44	$47
AFUE	55%	-	8	15	21	26	31	35	38	42
of	60%	-	-	7	14	20	25	29	33	37
existing	65%	-	-	-	7	13	18	23	27	32
system	70%	-	-	-	-	6	12	14	22	26
	75%	-	-	-	-	-	6	11	16	21
	80%	-	-	-	-	-	-	5	11	16
	85%	-	-	-	-	-	-	-	5	11

AFUE stands for Annual Fuel Use Efficiency. This figure represents the percentage of energy that a heater outputs compared to the total contained in the fuel. An estimation of energy cost savings can be calculated by comparing the current boiler efficiency to an upgraded efficiency factor. For example, say the current boiler in the gymnasium is 70% efficient, by replacing it with a 90% efficient model; it will save $22 for every $100 spent on the old boiler running costs. If the gymnasium costs $850 to heat for the year with the old model a 90% efficient model will reduce the cost by approximately $187 = $[22*(^{850}/_{100})]$.

7.3.4 Heat pump

A heat pump is a device that extracts available heat from one area (the heat source) and transfers it to another (the heat sink) to either heat or cool an interior space. For instance, in heating climates, during the winter the heat pump extracts heat from the air outside and transfers it to the inside of the house to heat the house. In cooling climates, during the summer the heat pump extracts heat from the air inside the house, cooling it, and transfers it outside. Heat pumps work very much like your refrigerator: heat is released from the back of your refrigerator as it grows cooler inside. This is exactly like cooling your house during the summer.

Heat pumps can be very energy efficient, because instead of actually generating heat like a furnace, they just draw heat from the outside. But because the efficiency drops as the air outside gets very cold, many builders are turning instead to ground-loop or geothermal heat pumps. These heat pumps operate more efficiently than the standard air-source heat pumps, because the ground doesn't get as cold as the outside air (and during the summer, it doesn't heat up as much).

A heat pump can trim the amount of electricity you use for heating as much as 30% to 40%. Geothermal heat pumps can trim the amount of electricity you use for heating as much as 70% to 75%.

Heating/cooling systems like this can pay itself off within three to five years due to energy savings, after that time period the cost savings on energy, compared to the previous unit, will be money in the bank.

8 Programs and rebates

8.1 Programs

There are several programs available to help schools become more energy efficient. They offer a combination of energy education resources and curriculums, as well as technical assistance, energy audits, retrofit recommendations, and assistance with finding funding for the projects.

8.1.1 Bright Schools

The California Energy Commission offers the Bright Schools Program to provide technical assistance to public schools to implement energy efficiency retrofits as well as assist in designing energy efficient new schools. The program is free or very low cost, and offers energy audits of the school, reviews of proposals and designs, assistance in selecting contractors and assistance with installation. They can also help secure low-interest loans to help fund the projects.

Their ten page brochure which includes the application can be downloaded from:

http://www.energy.ca.gov/efficiency/brightschools/2002_04_BROCHURE.PDF

For additional information, contact:

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151 Ninth Street, MS-26

Sacramento, CA 95814

Phone: (916) 654-4053

Email: Jbrewste@energy.state.ca.us

8.1.2 Destination Conservation

Destination Conservation is a program that combines student learning and involvement with technical retrofits. It is a comprehensive waste reduction program that includes reducing energy use, saving water, and reducing solid waste. As described by Mark Hertsgaard, in the first year of the program students and teachers are taught how to measure energy and water use at the school and how to change behavior to reduce this. Students monitor the results, which are often a reduction of around 6%. In the second year, Destination Conservation brings in an energy services provider, such as PG&E, to install energy efficient equipment. The service provider guarantees a minimum energy savings, such as 20-30% and will pay the difference if this goal is not met. Destination Conservation is a partner of the US Department of Energy's Rebuild America and EnergySmart Schools programs.

For more information about this program please visit their website: www.dcplanet.org

Or contact:

Randall Hayes, Program Coordinator

The Thoreau Center for Sustainability

The Presidio Building #1014

San Francisco, CA 94129

Phone: (415) 305-7300

Fax: (415) 398-2732

Email: rhayes@ran.org

8.1.3 Green Schools

The Alliance to Save Energy offers the Green Schools program to assist schools in reducing energy use. This program focuses on building partnerships with the community to help achieve goals. The program offers curriculum materials and provides

instructional resources for teaching about energy and the environment. They offer workshops and assist with finding partners and ideas for funding retrofits.

For more information about Green Schools, visit their website at:

http://www.ase.org/greenschools/

Or Contact:

Green Schools

A Project of the Alliance to Save Energy

1200 18th Street, NW, Suite 900

Washington, DC 20036

Phone: 202/857-0666 Fax: 202/331-9588

Email: info@ase.org

8.2 Rebates

A number of rebates are available to schools and businesses for purposes of reducing energy use. Some are offered before energy saving actions are implemented, while others are given after energy use reduction has taken place.

8.2.1 Express Efficiency

PG&E offers the Express Efficiency rebate program to qualifying small-to-medium size customers. Monthly electric aggregated demand must be less than 500 kW and monthly gas use must be less than 20,800. Rebates are up to $25,000 per fuel per account per year. Because of the program's limited budget, funds must be reserved before purchasing equipment. For 2002, applications must be submitted (after purchasing and installing equipment) by December 13. The Express Efficiency Program cannot be used with other offers or incentives.

Some of the rebates that could be applied include:

Screw-in Compact Fluorescent Bulbs (per bulb): 5-13W, $3.50; 14-26W, $5.50; 27W+, $6.50

LED Exit Signs: Retrofit Kit: $4.50/fixture; New Exit Sign: $13.50/fixture

Electronic Ballast (replacing magnetic ballast): non-dimming: $2/lamp controlled; dimming with daylighting: $10/lamp controlled

More information on the Express Efficiency Program can be found at PG&E's website:

www.pge.com

(and specifically at page:

http://pge.com/003_save_energy/003b_bus/003b1a_equip_rebate.shtml)

9 Conclusion

The average American school spends $110 per student per year on energy costs. Sunny Brae Middle School spends over $500 per student per year on energy costs. Part of this increase can be attributed to the small size of the school, the small class sizes, the energy inefficient building design, and high California energy prices. These factors cannot be easily adjusted. But a large portion of this increase is because of inefficiencies in the equipment, and in the operation of equipment at the school. We believe that implementation of our suggestions can meet our stated objectives, reducing spending and energy use by 20%. This would bring Sunny Brae School closer to the national average for energy spending.

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