SACRAMENTO CITY UNIFIED SCHOOL DISTRICT
BOARD OF EDUCATION

Agenda Item#__7.1__

Meeting Date: October 3, 2013

Subject: SMUD High School Energy Audit Training Project – Energy Efficiency Recommendations for Isador Cohen Elementary

- ☒ Information Item Only
- ☐ Approval on Consent Agenda
- ☐ Conference (for discussion only)
- ☐ Conference/First Reading (Action Anticipated: _____)
- ☐ Conference/Action
- ☐ Action
- ☐ Public Hearing

Division: Facilities Support Services

Recommendation: N/A

Background/Rationale:

Nine students from four SCUSD schools participated in SMUD's student energy auditor and training project. Students were trained in energy efficiency auditing, the impact of energy use on the global environment, and green career pathways. In the process, students developed workforce skills and experience. Students used new skills to audit Isador Cohen Elementary School, and are presenting findings.

Financial Considerations:

No Cost. Incentive of $14,000 to support student recommendations added to general fund.

Documents Attached:

1. Executive Summary
2. Student Audit Report

Estimated Time of Presentation: 10 minutes

Submitted by: Teresa Cummings, Ph.D., Chief Accountability Officer

Farah Wissinger, Environmental Sustainability Manager II

Approved by: Jonathan P. Raymond, Superintendent

Board of Education Executive Summary

Facilitates Support Services

SMUD High School Energy Audit Training Project – Energy Efficiency Recommendations for Isador Cohen Elementary
October 3, 2013

I. Overview/History of Department or Program

The Sacramento Municipal Utility District (SMUD) is training the next generation of the energy industry's workforce. SMUD's new High School Energy Efficiency and Auditing Training (HS EE) project trains junior and senior high school students with the skills and experience to begin energy efficiency-related and energy-auditing careers. The program also provides opportunities for participating students to help their own school districts save money through energy efficiency.

Thirty Eight students from seven different school districts were trained together in one class about the green energy industry, energy efficiency, electrical load auditing, and were coached in developing workforce skills during a weeklong course. The course, provided by SMUD's partner Strategic Energy Innovations (SEI), included theoretical classroom lessons and practical field work. Nine students from four SCUSD high schools used their new skills to audit Isador Cohen Elementary School, and have prepared a report and presentation of their findings. Students are earning a stipend for their participation.

SMUD provides funding to develop and carry out the curriculum and roughly $14,000 in grant funds to support SCUSD in completing some of the student recommended energy efficiency measures. SEI developed the curriculum, trained the students, and has guided the group in building their audit and recommendations.

This initiative was funded by carbon sales under the AB32 cap and trade bill. Participating school districts are Center Unified, Natomas Unified, Elk Grove Unified, Sacramento City Unified, Twin Rivers Unified, Folsom Cordova Unified, and San Juan Unified. Participating SCUSD schools are American Legion, the School of Engineering and Sciences, Luther Burbank, and West Campus.

II. Driving Governance:

Board Policy 3511 Grimes-Kennedy Green and Grid Neutral Model Schools Policy

III. Budget:

No cost to SCUSD. $14,000, provided by SMUD, added to the general fund.

IV. Goals, Objectives and Measures:

- Provide workforce skills and experience to SCUSD high school students in energy efficiency and energy auditing, and introduce them to energy efficiency career paths.

- Establish students as a resource for educating peers, teachers and administrators regarding cost effective energy efficiency measures and options for reducing energy demand and associated carbon emissions.
- Reduce electrical costs associated with heating, lighting, and cooling at Isador Cohen Elementary School.
- Raise community awareness about the importance of energy conservation in helping to reduce greenhouse gas emissions and mitigate global climate change.

V. Major Initiatives:
N/A

VI. Results:
Nine Students from four SCUSD high schools (American Legion, the School of Engineering and Sciences, Luther Burbank, and West Campus), completed one week of intensive education in energy auditing, the impact of energy use on the global environment, and green career options. Students completed an audit of Isador Cohen Elementary School and have made recommendations for cost-effective energy reductions.

VII. Lessons Learned/Next Steps:
Facilities Support Services to evaluate student recommendations for potential efficiency projects. Possible program participation in 2013/14.

SACRAMENTO CITY UNIFIED SCHOOL DISTRICT AUDITING TEAM

SMUD High School Energy Auditing Program

September 9, 2013

Sacramento City Unified School District
5735 47th Ave
Sacramento, CA 95824

Dear Sacramento City Unified School District Board Members,

Our team has completed an energy audit at Isador Cohen Elementary School. Prior to auditing Isador Cohen, the team participated in training provided by SMUD and Strategic Energy Innovations at Luther Burbank High School. With this training, we were able to conduct an energy audit of Isador Cohen based on findings in 5 sample rooms (bathrooms, small classroom, large classroom, multi-purpose room, and mechanical rooms).

Through a combination of classroom training and hands-on skills training, SMUD's High School Energy Efficiency and Audit Training project (HS EE) equips students to cut waste and find energy savings for their schools. In the process, school districts save money and we gained valuable training toward future careers.

This initiative is funded by carbon sales under cap and trade provisions of Assembly Bill 32 (AB 32). As student interns we are earning a stipend for our participation in training, auditing, reporting, and a school board presentation, and school districts enjoy real savings through energy efficiency upgrades funded in part by a combination of qualified rebates and direct funding from SMUD.

SMUD is a community-owned non-profit utility. SMUD provides dividends its customer-owners through lower rates, some of the lowest in California. The HS EE program helps reduce SMUD's peak demand, which is critical in reducing costs and emissions. That's why SMUD encourages customers to reduce energy use.

Based on our audit of the five sample room types, we recommend the following energy efficiency and conservation measures for Isador Cohen Elementary:

- Unplug appliances when not in use
- Replace older, inefficient appliances with Energy Star rated appliances
- Replace incandescent exit signs with more efficient LED models
- Upgrade the thermostats in the portables and connect to the energy management system (EMS)
- Replace windows with double or triple pane windows
- Increase daylighting by installing skylights or solar tubes
- Replace old hot water heaters and old HVAC systems

We have concluded that you can save $8,333 annually if you implement all of the recommendations provided.

On a side note, we also audited Luther Burbank as part of our training and discovered that the pool pump was running 24 hours a day, approximately 13 hours longer than needed to meet health and safety codes. We recommend reducing the pool pump run hours or installing a variable-frequency drive pump. Our calculations show that a reduction of the pool pump runtime can save approximately $11,000 in electricity costs per year.

Sincerely,

Emmanuela Cao (West Campus High School), Jesse Christian (School of Engineering and Sciences), Esther Romero (John F. Kennedy High School), Ethan Saveland (School of Engineering and Sciences), Jessica Vang (Luther Burbank High School), Jessica Vang (Luther Burbank High School), Trenceton Walker-Gurule (School of Engineering and Sciences), and Richard Wong (West Campus High School)

Strategic Energy Innovations
Helping Communities Embrace a Sustainable Future

Isador Cohen Elementary

School Energy Audit Report

SMUD™ Powering forward. Together.

September 16, 2013

We've conducted an energy audit survey of Isador Cohen Elementary School. We looked at our electrical devices, thermostat settings, drafts, lighting, and mechanical systems to determine how energy-efficient our school is. In the report below we share our audit results and recommendations for saving energy and money.

We divided the school into five different space types: type 1 classrooms, type 2 classrooms, administration rooms, multipurpose rooms, and bathrooms. Type 1 classrooms are bigger classrooms with more electrical devices. Type 2 classrooms are smaller classrooms with less electrical devices. Administration rooms are the school's office or other staff rooms. Multipurpose rooms are auditoriums, kitchens, etc. Bathrooms can include rooms that only have a lighting component like a locker room as well.

We conducted an energy survey for each of the five space types and used those results to estimate existing conditions and energy saving recommendations for the rest of the school.

In our school we have:

13	Type 1 classrooms
8	Type 2 classrooms
2	Multipurpose rooms
4	Staff rooms
8	Bathrooms

If the recommendations in this report are implemented, each year the school could save:

55,555	kWh of electricity
$ 8,333	of electricity cost
36,666	pounds of carbon dioxide (CO_2)

Computers

There are approximately 214 computers in the school. Altogether, they have a phantom load of 88 Watts. If we eliminate the phantom load, each year, we can save:

407	kWh of electricity
$ 61	of electricity cost
269	pounds of CO_2

Our records show that our computers have the following average sleep mode setting:

10 minutes

Below are our recommendations for reducing energy waste from computers:

• All computers should be set to go into sleep mode within 15 minutes of inactivity. Screen savers consume a lot of energy and are not needed for flat screen monitors, so all screen savers should be deactivated. Computers that are not in use should be unplugged to prevent them from using energy even when they are off (a Phantom Load).
• Plug computers into power strips and turn them off when the computers are not in use. This is especially true for after school hours, during the holidays, and on weekends.

Other Electrical Devices

There are approximately 81 other electrical devices aside from computers in the school such as printers, coffee makers, electronic pencil sharpeners, projectors, fans, stereos, toasters, and microwaves. Altogether, they have a phantom load of about 77,590 Watts.

If we eliminate the phantom load, each year, we can save:

2,793	kWh of electricity
$ 419	of electricity cost
1,844	pounds of CO_2

Below are our recommendations to help reduce the phantom load from the electrical devices in Isador Cohen:

When appropriate (especially with computers), use power strips and turn them off when the electrical devices are not in use. This is especially true for after school hours during the weekdays and weekends.)
Unplug laptops and phone chargers when charging is complete.

Draft Analysis

Warm air leaking into the room during the summer and out of the room during the winter can waste a lot of energy and dollars. In fact, a weak draft can waste about 5% of our school's energy use, a moderate draft about 18%, and a strong draft up to 30% of the energy use.

The draft was measured at doors and windows within the rooms that were audited.

Draft Ratings	Doors	Windows
None	0%	23%
Low	70%	66%
Moderate	11%	11%
High	19%	0%

Depending on the weather, it may be appropriate to leave the doors and windows open at times. However, forgetting to close the windows and/or doors will create drafts throughout the classrooms and the rest of the school.

Below are our recommendations for reducing energy waste from drafts:

• Consider air sealing with weatherstriping and caulking to seal air leaks around movable joints, such as windows and doors. Choose a type of weatherstrip that will withstand friction, weather, temperatures changes, and wear and tear associated with its location.
• When appropriate (when heating or air conditioning is in operation), close doors and windows to prevent wasted energy.

Thermostat Analysis

A thermostat is crucial in supplying the proper amount of heat. If it is out of adjustment, it may provide too much or too little heat/cool air. This affects the amount of energy used as well as the comfort level of the rooms. As such, it is important to make sure that the thermostat in your room is maintained and calibrated regularly so that you do not waste unnecessary energy.

In warm weather, the thermostat should be set at 78 degrees. When no one is in the room for an extended period of time, set the thermostat at 85 degrees. In cold weather, wear warm clothing and have your thermostat set to 68 degrees or lower during the day and evening, health permitting. At the end of the school day, set the thermostat back to either 55 degrees, or turn it off. By turning your thermostat back 10–15 degrees for 8 hours (afterhours), you can save about 5–15% a year on your school's heating and cooling bill – a savings of as much as 1% for each degree.

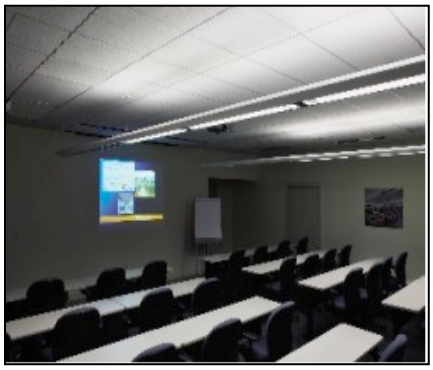
When conducting the energy audit in our school, the average thermostat in rooms was set to 75 deg F.
The average temperature of all the rooms measured was 78 deg F.

If the room's actual temperature is different than the thermostat setting, it's important to look for drafts by the windows and doors as air may be leaking into the room.

Below are our recommendations for making sure that the temperature in our school is set properly and that the relative humidity is at a healthy level:

• Replace old thermostats with new models. Considering replacing the old thermostats with "Smart Thermostats". For example, the Ecobee Smart Thermostat (about $350/unit) allows us to program our thermostat from anywhere with internet access. It also sends email reminders when the system needs service or when it's time to change the filter, and sends special alerts if there is an issue with the heating/cooling system. For additional information, go to http://www.ecobee.com/.
• Maintain thermostats on a regular basis to make sure that they are working properly.
• Set temperature to ≤68 in the winter and ≥78 in the summer.
• Make sure windows and doors are closed when heating and cooling systems are on.

Lighting Level Analysis



In general, many school classrooms are over-lit. This means that more lighting is produced from the lights than is needed and energy is being wasted to produce unnecessary light. This is especially true for areas by windows where natural light is sufficient in providing light. At these areas, lighting can be turned off. Moreover, studies suggest that natural light can help improve students' test scores by as much as **26%**! Delamping, or removal of lamps, can be another option to light energy use. For areas that may be under-lit, we should consider placing a task light within the area, such as a desk lamp.

The recommended light level for our school ranges from 10-75 foot-candles, depending on the type of activity. In bathrooms, 10-20 foot-candles is the recommended lighting level. In regular classrooms, 30-50 foot-candles is the recommended lighting level. The kitchen requires the highest lighting level of 50-75 Ft-C.

Based on the light level assessment, we may be able to:

	Remove this many linear florescent lamps from each room
Type 1 classrooms	0
Type 2 classrooms	0
Multipurpose rooms	0
Staff rooms	1
Bathrooms	3

If these recommendations are implemented, each year we will save:

1,688	kWh of electricity
$ 253	of electricity cost
1,114	pounds of CO_2

Based on the assessment, we found that in the following number of rooms, lights were left:

	On	On Sometimes	Off
During lunch	14	21	0
After school hours	14	21	0

To save energy, we recommend that lights are always turned off during lunch and after school hours, and when available use natural light. Below are our recommendations for cutting down electricity use by reducing unnecessary use of lighting in our school:

• Open shades whenever possible to offset the number of lights that need to be turned on. In addition to reducing electricity use, studies suggest that natural light can help improve student learning and performance.
• Turn off lights when they are not needed, especially near windows on sunny days.

Lighting Efficiency Analysis

Incandescent Light Bulbs

Incandescent light bulbs are inefficient in producing light. Compact fluorescent light bulbs are good replacements of incandescent light bulbs because they use 75% less energy to produce the same amount of light, and they last longer.

In the school, we found 4 incandescent light bulbs. If we replace them with CFLs, every year we will save:

144	kWh of electricity
$ 22	of electricity cost
95	pounds of CO_2

T8 versus T12

T12 and T8 are linear fluorescent lights that are common in lighting fixtures in school classrooms. T8 lamps are more energy efficient than T12 lamps. Additionally, T8 lamps use electronic, energy-efficient ballasts, while T12 uses magnetic, non-energy efficient ballasts. Ballasts help light bulbs start up and maintain the same amount of light coming from the lighting fixture. Ballasts use 6-20% of the energy of a fixture, and the lamps use the rest.

In the school, we found 0 T12 light bulbs.

Appliance Efficiency

Energy Star appliances help save money and protect the environment. Energy Star products range from light bulbs to refrigerators. Our school can save 30-75% of the energy use of our appliances if our school purchases Energy Star Appliances.

There are approximately | 25 | Energy Star energy efficient appliances, and
| 96 | old, inefficient appliances.

If we replace the old, inefficient appliances with Energy Star appliances, every year we will save:

	27,483	kWh of electricity
$	4,122	of electricity cost
	18,139	pounds of CO_2

Mechanical Systems Analysis

Heating, Ventilation, and Air Conditioning

Heating, Ventilation, and Air Conditioning (HVAC) systems are used in commercial buildings, such as schools, to improve indoor air comfort and safety by regulating air temperature and providing fresh air from outdoors. Using controls, such as a thermostat, HVAC systems receive information about the current conditions of the indoor air and will act accordingly, by either sending warm or cool air into the building.

Heating air requires a fuel, typically natural gas, to be burned near a heat exchanger which transfers the heat to filtered air, which is generally forced through ducts to the building by a blower.

Ventilation is creating air movement and replacing the indoor air with fresh, filtered outdoor air. The movement of air can remove heat, moisture, odors, and unwanted gasses from inside the building.

Air Conditioning cools the building by collecting indoor heat and releasing it outside. A fluid refrigerant flows through a series of pipes from the evaporator (which collects heat) to a condenser (which releases heat), while a fan moves air across the system and produces cool air.
In the school, we found | 8 | inefficient HVAC systems. If we replace them with efficient models, each year we will save approximately:

	23,040	kWh of electricity
$	3,456	of electricity cost
	15,206	pounds of CO_2

Water Heaters

Heating the water we use allows us to take comfortable showers, effectively wash dishes and clothes, prepare food, and other daily tasks. Heating water requires a fuel, typically natural gas, to be burned beneath a water storage tank. The water will be heated up to the desired temperature, and will be pumped out of the tank when it is demanded. After hot water is used and the tank is drained, fresh, cold water will replenish the tank and more fuel will be burned to heat up the new water.

There are 3 main ways to increase water-heating efficiency: reduce the use or waste of hot water, reduce standby losses by insulating storage tanks, and reduce distribution losses by insulating pipes.

In the school, we found 5 inefficient water heaters. If we replace them with efficient models, each year we will save:

353	therms of gas
$ 353	of gas cost
4,129	pounds of CO_2

When conducting our energy auditl, we found 0 hot water heaters with temperature settings above 120 °F. Reducing the temperature setting of hot water heaters to 120 °F will provide hot water and energy savings.

Motors

A motor is an electric machine that converts electricity into movement. For example, there is often an electrical motor in fans or water pumps on a pool.

The efficiency of motor depends on a few factors: operation, sizing, and timing. Motors should run smoothly, with the least amount of friction from debris or build-up. Motors should be sized appropriately for the job required; motors that are too large often waste electricity. Finally, motors should only be run when needed. Fans don't cool the air; they only cool our skin by evaporation, so leaving fans on in an unattended room is wasteful and inefficient.

In the school, we found 0 inefficient motors.

Observations & Recommendations

Below are some additional observations we made and suggestions we have for our school:

Install motion sensors for lighting in all rooms.

Replace TVs with flat screen monitors.

Replace all computer monitors with flat screen monitors.

Control HVAC units with the Energy Management System (EMS) in the portables.

Insulate the pipes on the electric water heater in the kitchen.

Change incandescent bulbs to CFL or LEDs in kitchen and janitor rooms.

Replace the wall-mounted Bard HVAC system in Room 17, manufactured in 1987, with a new heat pump and programmable thermostat. Consider replacing the additional 7 Bard units from 2004 on the portables.

Replace the 60 gallon water heater in the kitchen with an Energy Star electric heat pump water heater.

Unplug the fish tank in Room 2 when not occupied with fish.

Upgrade 11 electric exit signs to LEDs. When operating (a code requirement) they are drawing 50 watts, 24 hours per day, 365 days per year.

Unplug appliances, including Smart Boards and computers, when not in use.

Replace windows with double or triple pane windows and add air sealing around windows and doors.

Install skylights and/or solar tubes to provide daylighting to replace electric lighting and improve student learning.

Unplug mini-fridges when not in use or eliminate mini-fridges and use the main staff fridge.

We observed that refrigerators in the cafeteria were operating during the summer but were unoccupied. We recommend that the appliances in the cafeteria be powered down and unplugged for vacation periods.

Incentives

Below are SMUD rebates and incentives that may be applicable to our recommendations. Contact your Key Account Manager for additional informaton:

Lighting:

1) 5 cents/kWh or up to $150,000 to update control systems, update day-lighting systems and de-lamping measures
2) $20 - $40/sensor for occupancy sensors

Heating and Cooling

1) 8 cents/kWh or up to $150,000 to increase efficiency of AC unit that cause reduction of demand during peak hours

Refrigerator

1) $55/door for LED lighting in vertical food case

Office Equipment

1) $16.50 for plug load occupancy sensors
2) $10/software license for software that manages power settings

Savings by Design

1) Up to $150,000 for building-level systems such as daylighting, interior lighting, HVAC and service hot water

Next Steps

This audit is for educational purposes. The results reported here are estimates based on sample rooms. If the school wishes to proceed with energy efficiency measures, the next step is to conduct a professional audit.

For additional tips on how to reduce energy use in our school, please visit the following resources:

• U.S. Environmental Protection Agency. Climate Change – What you Can Do At School
http://www.epa.gov/climatechange/wycd/school.html

• Up2meforkids. Reduce Energy in your classroom and at home
http://www.up2meforkids.com.au/popup2.php?Do=ContentView&pageno=151

If you have any questions about energy efficiency in your classroom, please contact us.

Please join us in helping our District save energy, money, and our environment!

Thank you,
SMUD Student Auditing Team - Sacramento City Unified School District