

Sustainability Counts! Energy Challenge **K-12 Version**

We invite teachers and their students from across the nation to take part in the Sustainability Counts! Energy Challenge. Students will learn about energy use in their school and then develop a plan to reduce energy use which they will implement for a one or two day period (longer if you can arrange it). In partnership with the school or district facilities professional, they will estimate the energy savings that their actions produced. In the Energy Challenge you will be measuring electrical energy usage and savings.

Participants will submit their results to our [national database](#) where we will track how much energy the Sustainability Counts Energy Challenge saves nationwide. While each of us as individuals have a role to play in energy conservation, to make a significant impact we have to work together!

Step 0: Decide to take action!

This project will require cooperation with your school administration and will be more successful if you involve other teachers and, in particular, if you form a partnership with the facilities professional in your school or district. Those of us on the Advisory Committee for Math Awareness Month 2013 have found that having an official “title” has made it easier for us to take initiative and organize activities. So we hereby deputize you as a **Math Awareness Month Sustainability Counts! Coordinator** for your school. Congratulations!

You will need to decide on a date and how many days your Energy Challenge will last. Earth Day is Monday, April 22; this might be a good day to implement the Energy Challenge – unless your school already has other activities scheduled for that day. You can carry out the Energy Challenge anytime between April 1 and May 31st. We will post the national results in June.

Once you have gotten plans started to participate in the Energy Challenge, it will be fun to create buzz around the initiative. Invite a local politician or Congressman to attend the event. Let your local press know about the efforts your students are making to save energy and money in their schools and school districts. The Sustainability Counts! [publicity packet](#) includes a sample press release and invitation letter. Be sure to [register](#) as a Sustainability Counts! participant; the national organization can help you get publicity. And when you register, we will mail you up to five free copies of the [Mathematics of Sustainability poster](#).

Step 1: Learn about and then use the Plug Loads teaching unit from the National Energy Education Development Project ([NEED](#)). Students will learn how much power a variety of electronic devices use, will canvas the school to determine which and how many of these devices are present, and will then calculate the energy use of these devices per month and per year. For these calculations, they can use the NEED pre-made Plug Load and Phantom Load spreadsheets.

To find the power ratings (in watts) for the various devices, one can use the power values for appliances given in the Plug Loads unit, look at the device’s nameplate to find its wattage rating (as described in the NEED Electric Nameplates unit) or go online to find values. Another and perhaps more engaging

approach is to use a plug-in watt meter to measure the actual power being used by the device. Maybe your science department has one your students can use. If not, check with your local library or utility company as to whether they can provide you with one. A meter costs about \$25 to purchase.

Step 2: Students will develop an energy reduction plan for their school based on their findings in Step 1. Turning off lights is one way to save energy. Some schools have a “lights out” day or hour in which classrooms try to keep their lights turned out and just use natural light. Another idea is to turn off the non-emergency lights in the hallways between classes or wait until almost the start of school to turn those lights on. Some schools have a “cold lunch” day in which they do not use the kitchen ovens. See the Alliance to Save Energy’s *Energy Saving Tips for Schools* at the end of this document. As part of the plan, the students should predict how much energy they expect to save and justify their prediction using the mathematics of step 1.

Step 3: Implement the energy reduction plan at least for one day, longer if that is doable at your school. Be careful about which day you choose for Energy Reduction Day. You do not want to choose a day on which special events that use extra energy are scheduled. Have your local politician and press representative in attendance.

Step 4: Determine the energy savings. There are a variety of ways to do this.

a. On a day shortly before Energy Reduction Day, read the electric meter at the start and at the end of the day to determine a baseline for electric energy usage in the school. You can decide on what constitutes a “day”. Is it from 7 am to 6 pm or from 7 am till 7am the next day? You will probably need to work with your facility professional to find this data. For safety reasons, the facility professional may need to be the one to read the meter. If possible though, include the students in the process.

Then on Energy Reduction Day, again read the meter at the start and the end of the day. The difference in electric usage on the two days is an estimate of the saving produced by the energy reduction plan. Note that for a variety of reasons, this difference in electric usage might not be completely attributable to the energy reduction plan. This in itself is a math modeling issue worthy of discussion with the students.

If you are not able to access the data from an electric meter, there is still the possibility that your school’s power company can provide a daily reading of energy use. This might take a few days to arrive. Contact the power company to see if this is possible. Be sure to tell them it is part of the national Sustainability Counts! Energy Challenge. They might be willing to make an extra effort to get you the data. In many states, power companies are under state mandate to reduce energy consumption so would be very supportive of your energy conservation initiative.

b. Energy smart meter. If your school has an energy smart meter that allows you to see energy use in real time, then use the meter to see the actual drops in electricity consumption that are being caused by the various energy conservation actions. For example, if one turns the non-emergency lights off in the hallways between classes, then the smart meter should show a noticeable dip in electrical usage at that time.

c. If you are not able to get an actual measurement of energy savings, estimate the savings using the Plug Loads spreadsheets.

Step 5: Post Event Debrief. Examine with the students the energy savings that were achieved. Compare these numbers with the savings your mathematical model had predicted. Discuss reasons for any differences. Think about ways that one might revise the mathematical model to make more accurate predictions in the future.

Your students will have now engaged in a full cycle of mathematical modeling. Creating a model (i.e. gathering the data and performing calculations with the Plug Loads spreadsheet), testing the model (ie. implementing the energy reduction plan and comparing predicted outcomes with actual outcomes), and revising the model based on the findings.

Have the students discuss which components of their energy reduction plan it would be feasible to implement on a regular basis year round. Have them estimate how much energy and money could be saved over the course of a year.

Step 6: Celebrate your students' success! Organize some type of post event celebration that highlights the students' achievement in using their mathematical skills to green the school and help save the school district money. Students could present their findings to the School Board. A reporter from a local paper or TV station could be invited to hear the students' presentation.

Step 7: Send in your energy savings results to the Sustainability Counts! Energy Challenge [national database](#) where we will track how much energy our students have saved nationwide. By filling in the requested information, you will also receive a Certificate of Participation for your class.

Step 8: Plan for the Future.

The [U.S. Department of Education's Green Ribbon Schools](#) award honors schools that are exemplary in reducing environmental impact and costs; improving the health and wellness of students and staff; and providing effective environmental and sustainability education, which incorporates STEM, civic skills and green career pathways. Congratulations! **You have just taken the first step to transforming your school into a Green Ribbon school.**

The [ENERGY STAR program for K-12 School District](#) provides information on how your school can save big money by energy reduction. A key component of the ENERGY Star program is the [EPA's Portfolio Manager system](#), an easy to use interactive energy management tool that allows one to track and assess energy consumption in schools and other buildings. Get your school and district to enroll in the Portfolio Manager system and then develop an ongoing plan to reduce energy use. Track your school's progress year after year and incorporate this data into your math lessons. Use the money saved by reduced energy costs to support academic programs at your school.

[The Alliance to Save Energy's PowerSave Schools Program](#) focuses on empowering students to make a difference in the way their schools use energy. North Penn School District, Hatfield, PA which has been designated by the EPA as the 2013 Energy Star Partner of the Year is a PowerSave School. [Read about their success](#) and check out the [website](#) the district's middle school students have created describing their energy efficiency efforts.



Energy Saving Tips for Schools

Lighting

1. Turn off lights when not in use—lighting accounts for nearly 50% of the electric bill in most schools. There's no reason to leave lights on if a room is empty for more than one minute. (And, yes, this applies to the new energy-efficient fluorescent lights.)
 - Form a student energy patrol to ensure lights are out when rooms are empty (check classrooms, the cafeteria, the auditorium, etc.).
 - Have students make signs and stickers to remind people to turn off the lights when they leave a room.
 - Put light switches where people can find and operate them.
2. Remove unneeded light fixtures near windows, especially in unused corners or along banks of windows.
 - Have students conduct an experiment in classrooms by turning off selected banks of lights and surveying occupancy comfort at different lighting levels (often, occupants prefer working under natural light).
3. Use energy efficient compact fluorescent light bulbs (CFLs) and light-emitting diode (LED) bulbs.
 - Have students calculate the energy savings achieved by:
 - Replacing incandescent light bulbs with CFLs
 - Changing incandescent lights in Exit Signs to light-emitting diode (LED) bulbs

Heating & Cooling

1. Save on energy costs without sacrificing comfort. It's expensive to heat and cool school buildings, but indoor temperatures must be comfortable so teachers can concentrate on teaching and kids can concentrate on learning. A rule of thumb: Consider setting thermostats at 68 degrees for heating and 78 degrees for cooling. Using fans can make people feel degrees cooler, at much less cost than air conditioning.
2. Where classrooms or other areas are uncomfortably cold or drafty, find out why and fix the problem. Custodians, teachers, and students should work together to increase building comfort.
 - Don't block the airflow around vents. Keep bookcases and other bulky items away from the heating and cooling units so they don't block and/or absorb the warm (or cool) air that should be coming into the room.
 - Install programmable thermostats in areas like the cafeteria to minimize operating hours of the heating and cooling systems during low occupancy periods.
 - Turn down heat in the hallways. And—keep classroom doors closed. Otherwise, the heat runs down the hall and outside—where it is wasted to the outdoors.
 - Clean furnace filters regularly.
3. Stop leaks!! Look for simple draft beating strategies.

- Have students determine areas of energy loss by using “draftmeters” made from plastic wrap and pencils to study where drafts are coming in.
- Avoid infiltration in conditioned spaces.
 - Have students help replace insulation and stuff energy loss “holes” through innovative measures, such as making translucent window quilts to hang in classrooms and “insulation snakes” to put at the bottom of doors and windows.
- Work with facility staff to install permanent weather stripping, caulking, and insulation.

Computers

1. If your school computers have power-management features, make sure controls are set so they will go into the “sleep” mode when not in active use. (Screen savers don’t save energy—only the sleep mode does.)
 2. Students should turn off monitors that will not be used for the next class period. All computer equipment should be turned off at the end of the day and on weekends, unless your network technicians specifically instruct otherwise.
- Form a student energy patrol to make sure monitors are off when computers are not in use and to turn computers off at the end of the day.
3. Is your school purchasing new equipment? Save 50% on energy costs by using Energy Star computers, monitors, printers, fax machines, copiers and other equipment. (Visit www.energystar.gov for more information.) Have students calculate potential savings from the use of Energy Star equipment and present the results to school administrators. If your school purchases the equipment, make sure the Energy Star features are enabled.

Appliances

1. Maintain appliances and replace old appliances.
 - Have students use a watt meter to study how much electricity a device uses. This is useful in determining which appliances are outdated and less efficient.
 - Have students conduct a survey of the number of appliances in each classroom and encourage teachers to take away unneeded appliances.
2. Clean refrigerator coils regularly.

Involve the Whole School

1. Get the entire school involved. Energy savings add up when the entire school joins together in conservation efforts. Schools with effective conservation programs have reported reductions of as much as 25% in utility bills.
2. Publicize energy costs and savings. When people know how much it costs to power their school, they can see why it’s worth some extra effort to avoid waste.

Involve the Whole District

See if your district administrators would be willing to return a percentage of the dollars saved from your school's no-cost energy efficiency changes

<http://www.ase.org/resources/energy-saving-tips-schools>