Environmental Science

PG & E Home Energy Audit

Subject Area: Energy Grade Levels: 10 – 12 Date: Fall 2013

Lesson Overview

Materials Included in this Lesson

- Computer access
- Notebook
- Post home Energy Calculator Analysis Worksheet

Other Materials for this Lesson

- Bring Energy Bill from home
- Completed Home Energy Assessment
- FRQ 2007 #2

Skills the Student will Learn

- How to access their PG & E Account on-line
- How to use the home energy calculator
- Cause & Effect of their energy usage
- Ways to decrease energy usage
- Communication/ Education about energy with family
- Explain how their Carbon Footprint is related to the environmental impact.

Student Deliverables

- Notes from Videos, home Energy Analysis, Role Playing, summary paragraphs.
- *Yolo Energy Watch* Measuring Electricity Worksheet (Classwork)
- Home Energy Audit Assessment *Yolo Energy Watch*
- Alternate Assignment for students who cannot access PG & E website. Summary to be typed (MLA format) and turn in a Trifold using Publisher.

Students, please talk to your family, and ask if it is OK for you to have access to your PG & E account. If so, this is the information you will need: Name on Account, Account Number, Username, Password. If your family has not set up an online account, please set one up together, remembering your username & password, and having your account number handy, with the person's name on the account for school when we do our energy audit.

PG & E Home Energy Audit

Length of Lesson: 2 Days

Activity Day One

Motivational Activity: Students will watch a construction video on home energy efficiency: http://bcove.me/5rhw93qz

- In addition, the second video: http://www.cemexusa.com/Sustainability/EnergyEfficiencyBuildings.aspx

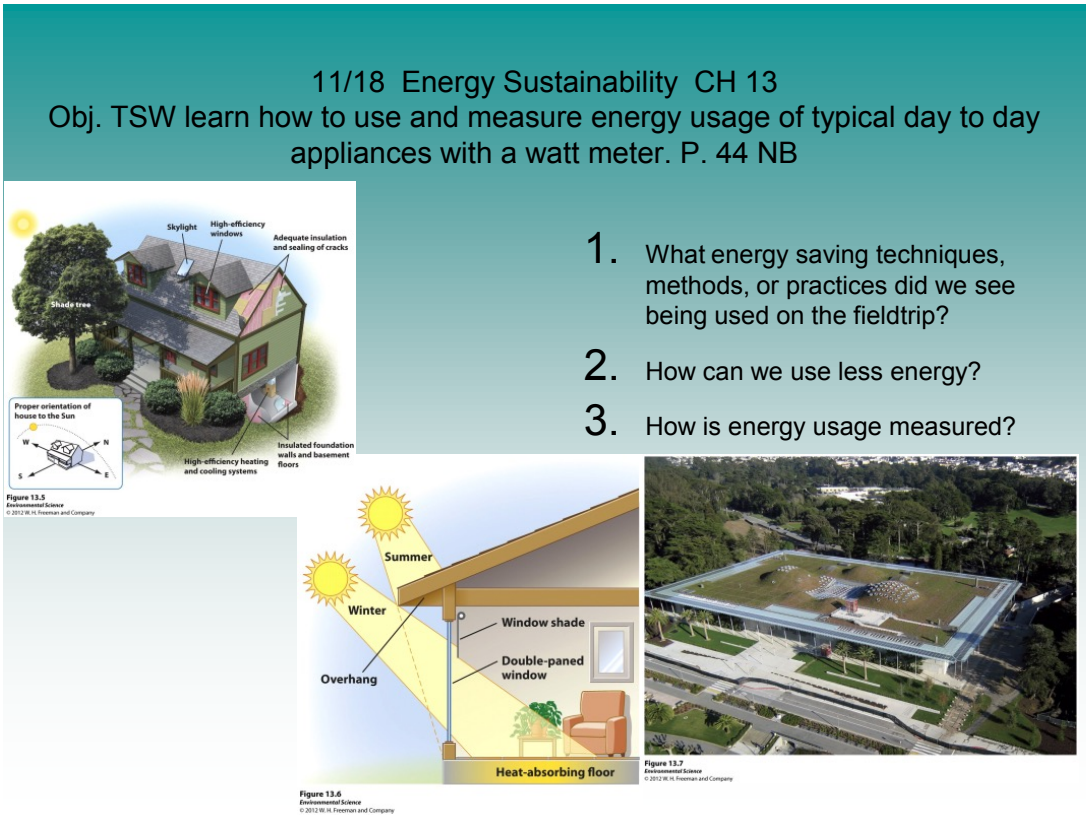
about energy efficiency in the construction industry.

- A third video will discuss the Youth Energy Summit: https://www.smud.org/en/video/cc-single-rebranded.html?bclid=769701255&bctid=10347018001

Using their Notebooks, the students will answer the following questions:

- What are some standard energy saving technique's performed in today's building technology?
- What did you find interesting about the second animated video?
- Not all of us have the luxury or possibly the desire to live in a brand new home, however there are some steps we all can do to decrease our carbon footprint.

Warm up: Energy Sustainability



- **Guest Speaker & Classroom Activity**: Yolo Energy Watch from Energy Program Youth Corp in Yolo County will have a presenter bring 25 Watt Meters to the classroom. The presenter has a brief power point with background information about watts, and power. The students take notes. Then the students will measure the watts (Power) used in 25 different sources: fans, hot plates, curling irons, etc. After they are back at their seats, they choose 5 devices and calculate the Watt/ hour equivalent and answer 5 questions. Worksheet will be attached.
- **Homework**: Students must check out a Watt meter and perform a Home Energy Audit Assessment to measure the energy usage at home of various appliances, at least 5. Worksheet will be attached.

Procedure:

Part I: Students will explore the PG & E website in partners using the computers in the classroom and answering the questions. Username & Password will be needed to log onto the account. Students will learn how their decisions & actions can be a part of the solution for energy conservation. Students will research/ explore: https://www.pge.com for about 20 – 30 minutes, making observations, gathering information, facts, making inferences about energy usage. Below is a paragraph I sent home with the students:

Dear Parents of my Environmental Science student:

We are learning about Energy in our latest unit and I would like to have the students use your PG & E account to do a **"Home Energy Audit."** We do not have to do this part at school, if you are more comfortable with your young adult accessing your **PG & E account** at home that is OK. If you are opposed to your young adult accessing your PG &E account, I will give him/ her an alternate assignment, no problem. If you are comfortable with your young adult knowing the username & password that you have for the PG & E account, then he/ she will need the Name of the person on the PG & E bill and the Account number to set up a username & password, if it is not already done. If you have any concerns, or questions. Please do not hesitate to contact me by email: jmcallister@wusd.k12.ca.us **The objective** is for the students to assess how energy efficient the home is, then learn about steps that can be taken to continue being more energy efficient. The students will work together in groups **to make Tri-folds (Alternate Assignment, see below)** to advertize ways to improve energy efficiency at home.
Thank you very much for your time and support of the AP Environmental Science class.
Mrs. McAllister

Home Energy Audit Worksheet:

Once the students have logged on to: https://www.pge.com **Overview**, should be the first screen to show up.

On the **Overview** page, look for **My Bill**, How much was last month's bill?_____

Find the **My Usage**, tab across the top of the page. Click on **My Usage**

My Usage Details tab will be selected orange.

- Look at the graph, How do you compare to similar homes, and energy efficient homes?

- Click on the **Usage tab**, What is your highest month usage in therms, what is your lowest month usage in therms?

- Click on the **Costs tab**, What are your three most expensive months, how much are each?

- Click on the **Weather tab**, What is the relationship between time of year (season) and usage of gas/ energy?

Click on the tab **My Dashboard,** what tips can you do now to save money?

Look to the right of the screen. How much will you save if you take those steps compared to what you typically spend?

Click on the tab **Compare My Bills**. How does this month bill compare to last months? Why? What are some contributing factors? How many therms did you use for each of the months?

Compare this month's bill (this year) to this month's bill (last year). **Select the down tab to the right**. What was the difference?

Click on the Blue tab **Ways to Save** at the top. What are some free tips to reduce your use?

Click on the tab **Home Energy Checkup**. Answer the questions to the best of your ability and draw the graph at the end that displays your energy usage below. Create a data table from the graph with the correct Percentages below.

In a summary paragraph, How does the energy use change over the course of a year?

- How does the energy use change from year to year, have people become more efficient over time?

Calculate your carbon footprint. EPA website or
http://www.footprintnetwork.org/en/index.php/gfn/page/personal_footprint/

Alternate Assignment: For those of you who do not have access to PG & E website:

Watch the following video: http://www.cemexusa.com/Sustainability/EnergyEfficiencyBuildings.aspx

- Find a company other than Cemex, that is working on a sustainable approach to our resource use and increasing our energy efficiency. Once someone has found a company, that company can no longer be used. Your company has to be original.
- Send me the link, or print a hard copy of the article.
- Write an AXES paragraph showing how this company is achieving a sustainable approach to the future. Include what you think they could be doing to improve what they have already done.
- Make sure you still calculator you carbon footprint from the EPA website or http://www.footprint.org/en/index.php/gfn/page/personal_footprint/
- From your research develop a Trifold in Publisher (Microsoft Office) that demonstrates new technologies to save energy, and advertizes the Sustainable approach.

Activity Day 2

Activity: Students will work in partners (5 – 10 minutes). **"Changing behaviors for an environmentally friendly world"**. One of the challenges with saving energy in a family home is hanging human behavior, old habits are hard to break. Sometimes individuals in the family are reluctant to turn off the water while doing the dishes, leaving water running while washing one's teeth, leaving the hose on to water plants and flood irrigating, r even taking long, hot showers every day. Suggest some ways to address these challenges in an environmentally friendly, non-confrontational way. Choose a partner and "Role Play your conversation using information and facts you have learned from the website and your research. One student needs to be the reluctant family member, the other being the one to initiate change.

- How can "how you approach" the change help the reluctant family member listen?
- What tips can you offer to help the change?
- Overall, how did the conversation go?
- Include these tips & conversation starts in your summary.

Summary: Students will type up and present an individual summary/ conclusion answering the following questions:

- Summarize your conversation with the reluctant family member.
- How can you and your family be more efficient within your home? Apply what you have learned/ experience from you on-line access to SMUD energy bills to demonstrate your environmental impact.
- How many pounds (lbs.) Carbon/year do you use?
- Why should you care?
- How did you Carbon footprint compare with other students environmental impact?
- What were some of the recommendations for energy efficiency?
- How can they be implemented, include ideas for challenging situations/ people? Make sure you cite all references in your summary (MLA format).

Foundation Academic Standards

CTE Pathway Standards

Energy & Utilities Industry Sector

- Foundation Standards
  - Technology
  - Problem Solving & Critical Thinking
  - Technical Knowledge & Skills
- Pathway
  - Energy & Environmental Technology Pathway
  - Public Services Pathway

Manufacturing & Product Development Industry Sector

- Foundation Standards
  - Technology
  - Problem Solving & Critical Thinking
  - Technical Knowledge & Skills
- Pathway
  - Graphic Arts Technology Pathway – Microsoft Publisher, Trifold

Common Core Standards Addressed

Investigation and Experimentation

1a. Select and use appropriate tools and technology to perform tests, collect data, analyze relationships, & display data.

1k. Recognize the cumulative nature of scientific evidence.

1l. Analyze situation and solve problems that require combining and applying concepts from more than one area of science.

1m. Investigate a science-based societal issue by research in the literature, analyzing data, and communication the findings. Examples include: Energy choices made land and water use decisions in California.

Lesson Plan Relevance To Externship

In my externship with SMUD I had the opportunity to work with Susan Wheeler and Jacob Caditz. I learned how to open my account with SMUD online and evaluate my energy usage. From there I could show my husband at home how we could save energy and money by incorporating simple steps toward energy conservation. Studying my carbon footprint was a huge eye opener concerning energy resources, and resources in general. Taking this to the classroom will be relevant to the students because they can learn ways to be conservative now to help tomorrow's energy challenges.

River City High School
Environmental Science
Problem Based Learning Rubric #5

Evaluated:
Evaluators:

Environmental Impact of Renewable Energy

Problem is Stated	What is your family's energy usage? How can you decrease your energy usage and your Carbon Footprint?
Product Description	Publisher Trifold on Energy Saving Techniques & Carbon Footprint
Presentation Description	Students will be divided into 4 groups of 9 individuals, each demonstrating/ explaining their Tri-folds in a Gallery walk around the room at 9 different lab stations to the rest of the class in a rotational pattern. Students may choose to demonstrate their role play to the class instead of the reluctant family member or friend and the other students being the energy conscientious one.

Academic/ Content Literacy	Unsatisfactory	Proficient	Advanced
Descriptors	• Student ineffectively, inadequately demonstrated knowledge of content • Little or no correct examples of content • Little or no correct drawings to support content • Limited explanation • No analysis or creativity • Could be off topic	• Student demonstrated solid understanding of the content • Explained most of the content correctly in depth and in detail • Use of some drawing, pictures and examples • Content mostly accurate, complete and well presented • Thought out, & creative, attention to detail	• Student demonstrated thorough understanding of the content • Explanation of content was in-depth, detail oriented, and well supported • Use of drawings/ pictures/ examples were relevant and useful • Content was accurate, complete, well presented • Well thought out, very creative, analysis of content • Engaging
Standards	1a. Select and use appropriate tools and technology to perform tests, collect data, analyze relationships, & display data. 1k. Recognize the cumulative nature of scientific evidence. 1l. Analyze situation and solve problems that require combining and applying concepts from more than one area of science. 1m. Investigate a science-based societal issue by research in the literature, analyzing data, and communication the findings. Examples include: Energy choices made for land and water use decisions in California.		
Point Scale	0 - 14	15 - 21	22 - 25

Critical Thinking	Unsatisfactory	Proficient	Advanced
Descriptors	• Student did not address the driving question/ off topic. • Oversimplified answer as a solution to the driving question	• Student answered the question adequately. • Explained different points of view about the topic. • Explained why one point of view was preferred.	• Student thoroughly answered the question in detail. • The topic was explained in detail with several points of view. • Well thought out explanation as to why one view was preferred.
Driving Questions	How can we as individuals increase our energy efficiency to decrease our Carbon Footprint?		
Point Scale	0 – 14	15 – 21	22 - 25

Oral/Presentation Proficiency	Unsatisfactory	Proficient	Advanced
Descriptors	• Student could not be heard/ mumbled. • Student could not answer questions • Poorly organized • Awkward, pauses, fillers • Inappropriate tone/ words • No use of rhetorical strategies	• Student organized ideas logically • Presentation was adequately delivered • Appropriate tone used for setting and audience • Used rhetorical strategies • Answered fellow student's questions	• Student presentation flowed well, seamless • Fellow students were engaged • Rhetorical strategies were thorough and creative • All questions answered in detail
Rhetorical Strategies	Introduced self & topic Hook Repetition Preview & Summary Transitional Phrases Tone, Gestures, Call to Action Eye Contact Ability to answer questions		
Point Scale	0 - 14	15 - 21	22 - 25

Energy Audit Lesson

Student_____

Electronic Device	Watt	kWatt (divide by 1000)	Hours used/day (estimate)	kWatt·hr/day (multiply)	kWatt·hr/mo (multiply by 30)
Example: Hair Dryer, Setting: hot, high	1550	1.55	5 min • $\frac{1 \text{ hour}}{60 \text{ min}}$ = 0.083	(1.55)(0.083) = 0.13	(0.13)(30) = 3.9
Example: CFL bulb	13.6	0.0136	8	(0.0136)(8) = 0.1088	(0.1088)(30) = 3.3

Station #1 _____

Electronic Device	Watt	kWatt (divide by 1000)	Hours used/day (estimate)	kWatt·hr/day (multiply)	kWatt·hr/mo (multiply by 30)
Incandescent Bulb					
Compact Fluorescent Light (CFL) bulb					
Light Emitting Diode (LED) bulb					

Observations:

Station #2 _____

Electronic Device	Watt	kWatt (divide by 1000)	Hours used/day (estimate)	kWatt·hr/day (multiply)	kWatt·hr/mo (multiply by 30)
Hair Dryer Low, cool					
Hair Dryer High, hot					

Obversations:

Station #3 _____

Electronic Device	Watt	kWatt (divide by 1000)	Hours used/day (estimate)	kWatt·hr/day (multiply)	kWatt·hr/mo (multiply by 30)

Observations:

Station #4 _____

Electronic Device	Watt	kWatt (divide by 1000)	Hours used/day (estimate)	kWatt·hr/day (multiply)	kWatt·hr/mo (multiply by 30)

Observations:

Conclusion and Analysis

1) Explain the difference between "power" and "energy" in regards to measuring electricity consumption. What units of measurement do we use for each?

2) Why is "stand-by power" or "vampire power" important?

3) Name 2 ways that you could conserve energy in your daily life.

4) What are 2 benefits to conserving energy?