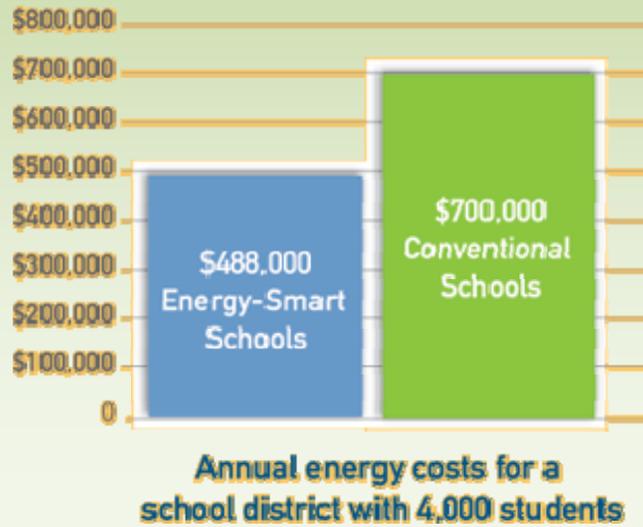


TRW ENERGY AUDIT CHALLENGE

Energy Efficiency's Bottom Line



The chart above is based on current data observed and collected nationally by Energy Efficient Solutions, www1.eere.energy.gov/buildings/energysmartschools/plan.html.

This leads us to the question, if schools can save money by being Energy Efficient, why not Companies?

TRW Energy Audit Challenge

INTRODUCTION

In this challenge, you will work as a member of a student team conducting an energy audit on the TRW Safety Systems building located on 26 Mile Road in Washington, MI. You will take scientific measurements, question employees, and obtain various kinds of information related to how the building uses energy. As you finish each investigation, you will write a report with graphs and recommendations and present it to TRW personnel. Your team's recommendations may cost the company little or no money and, if acted upon could save 2, 5, or 10 percent of the previous year's energy bill. Is this a lot of money? In this study you will find out. Dollars saved may be available for other things the company needs. Just as important, energy savings help the earth by improved energy efficiency, reduced consumption, and increased recycling and positive changes in transportation behaviors.



You will find that the facility uses lots of energy, and that energy costs both money and the environment. Most likely, dollars are leaking out of the building every day, and it is up to you to find out the location and size of the leaks. Much like detectives investigating a crime scene, it is up to you to find the right people and get the information you need. As in any investigation, you will collect a lot of information, develop a list of suspects, organize your information, and present your findings along with recommendations.

For example, let's look at energy uses for an example school. The electricity, fuel oil, and natural gas bills for one school year came to \$109,943. Of that, \$73,199 was for electricity; \$23,177 for #5 fuel oil; and \$13,567 for natural gas. The electricity bill for the November, just one month, was \$6,544 but then in December it was \$3,252. Why such a change between the two months? What was the electricity used for? You probably will think of lights. But, what other parts of the school may use electricity? Was there a large event in November in the school in order to use a greater amount of electricity? These are the types of things you will want to think.

A crime investigation is usually initiated with the discovery of a loss or injury. We are going to look into the possibility that an "energy crime" has been committed and energy is being wasted. We will look into this using two main methods; **Energy Accounting Audit** and a **Building Energy Audit**.

An **Energy Accounting Audit** is tracking your energy bills. Tracking expenditures helps prioritize where you should look first for savings, it enables you to measure whether steps you implement make a difference, and it permits you to spot unexpected anomalies that can lead to significant savings. We are going to look at gas, electric, water, waste and transportation. Savings are often available by simply reducing usage by the building occupants.

Payment Coupon

Please indicate amount paying \$ **3**

2 Account Number 1000 000 1000 1
Due Date: January 26, 2010
Total Due: \$269.65

101202061**AUTO3-DIGIT 12345
CHRIS CUSTOMER
1111 MAIN ST
ANYTOWN MI 12345 - 0111

Mail Payments To:
DTE Energy
P.O. Box 740795
Cleveland, OH 45274-0795

For address corrections, please visit www.dteenergy.com
or call 800-477-4747.

Printed upon customer self-pay request 2/10/09

Keep here portion for your records.

Contact Information

Gas Leak or Gas Emergency 800.947.5000
Customer Service or Power Outage 800.477.4747
Hearing-impaired TDD line 800.888.6806 (Voice & Non-Voice)
Web Site: dteenergy.com

4 Programs you are enrolled in **5**

Senior Program

6

Summary of Charges

Account Number 1000 000 1000 1

Account Balance as of Nov 30, 2009	86.11	Average temperatures for this billing period were 28 degrees colder than last billing period. As a result your appliances may be working harder to make you feel more comfortable.
Balance Prior to Current Charges	86.11	
Total Current Charges	173.54	
Account Balance as of January 4, 2010	\$258.62	

Your Monthly Energy Usage

For ways to save energy and save money, go to YourEnergySavings.com

ELECTRIC **8** GAS

Detail of Charges

For Service at 1111
Detroit Edison Residential
Current Charges
Power Supply Charge
Power Supply Charge
Power Supply Charge
Renewable Energy P
Other Power Supply
Deliver Charge
Service Charge
Service Charge
Distribution
Distribution
Energy Optimization
Other Delivery Service
Detroit Utility Tax
Residential Mortgage
Total Detroit Edison
Michigan Residents
Current Charges
Customer Charge
Senior Winter Credit
Gas Distribution Charge
Energy Optimization
2006 LI-15093 UETL
Gas Cost Recovery
1/1/09 \$18.58

The **Building Energy Audit** is the second major tool you will use. This involves going through the building to identify what is present. Where is energy being used, what type of energy, and how much is being used? How much solid waste is being collected from the building? Where it generated and what are its characteristics? You then compare what you have with the cost and savings possible with other options to recommend specific actions.



IN THIS BUILDING AUDIT YOU WILL NEED TO:

- (1) Collect data through interviews and do an **Energy Accounting Audit** and **Building Energy Audit**.
- (2) Analyze the data from the audits (this will include graphing, correcting for climate and building usage, and calculating the economic cost-benefit of different alternatives).
- (3) Make recommendations based on your findings.
- (4) Create a visual report of your findings.
- (5) Present your findings to TRW Building personnel.
- (6) Educate TRW Building personnel on energy usage, and lastly,
- (6) Evaluate what recommendations are adopted and how much energy and money is saved.

Think about it



In addition to saving money, reductions in energy use has significant benefits for the environment. Energy use is damaging our environment. What can we do? Surprisingly, some of the solutions are quite simple. We can improve efficiency to get the same benefit while using less energy. The total number of CFLs in use globally nearly doubled between 2001 and 2003 alone, growing from an estimated 1.8 billion to 3.5 billion units. Substituting these bulbs for standard, incandescent lights will save up billions in dollars in energy, which is good news for not only the environment, but us the consumers. CFLs are far more efficient than traditional incandescent light bulbs because they produce less heat to create light, using about 75 percent less energy to produce the same amount of light and lasting up to 10 times longer. These energy savings translate into monetary savings. For example, a single CFL bulb can save up to \$30 in energy costs in the United States over its lifetime; savings can be even greater where electricity costs are higher. Incandescent bulbs burn out after around 1,000 hours of use while CFLs can last for up to 10,000 hours, lowering their cost even without taking energy savings into account.

(www.worldwatch.org)



BUILDING AUDIT CHALLENGE – GENERAL QUESTIONER AUDIT (STEP 1)

The first step in the audit will be for you to give the key personal a general audit. This will help you to understand the building you are working with quickly.

Following are questions you would want to ask to begin your building energy audit. What other questions can you think of that you may want to add?

General Questioner

1. When was the building built?
2. What additions have been made? When were they made?
3. What renovations have been made? When were they made?
4. What other facilities use energy on the grounds? Lighted parking lots? Storage sheds? Outdoor lighting?
5. What kinds of fuels are used to provide energy to the building? For heating, cooling, water heating, lighting, other?
6. Are there other energy costs that the building pays for? Transportation?
7. How many hours is the building in use on weekdays? On weekends? In the summer? On holidays?
8. Do other organizations that use the building reimburse the company for energy use?
9. Who is in charge of controlling energy usage in the building? Do others have access to any of the controls?
10. Is there a system in place for regulating and monitoring controls?
11. Who is in charge of maintaining energy-using equipment? Is there a maintenance schedule for all energy using systems?



BUILDING AUDIT CHALLENGE – BUILDING ENVELOPE (STEP 2)

Building Envelope

1. What is the building(s) made of? In what condition is it?
2. What is the roofing material? What is the condition of the roof? Are there any leaks in the building when it rains?
3. Is the building designed to make use of passive solar heat and light?
4. In which direction does the building face?
5. How many windows are on each side of the building? Are any windows cracked or broken?
6. What percentage of outside wall space do the windows encompass?
7. How many outside doors are there? Are the outside doors insulated? Are there windows in the doors? Are they double glazed? Are any cracked or broken?
8. Is the building(s) well insulated? Walls? Ceilings?
9. Are interior stairwells open or enclosed?
10. Do windows and doors seal tightly, or do they leak air?
11. Are windows single or double-glazed? Can they be opened? Do the windows have adjustable blinds or curtains?
12. Are there awnings or overhangs over windows to shade windows from the overhead direct sun in warm weather, yet allow the slanted rays in winter to enter?
13. Are trees placed around the building to provide shade in warm months?



BUILDING AUDIT CHALLENGE – HEATING/ COOLING/ BOILER (STEP 3)

Heating/Cooling Systems

1. What kind of heating system is used in the building? What fuel does it use?
2. When was the heating system installed?
3. Does the heating system have a programmable thermostat to control temperature? What are the settings?
4. What kind of cooling system is used in the building?
5. When was the cooling system installed?
6. Does the cooling system have a programmable thermostat to control temperature? What are the settings?
7. Are there controllable thermostats in different areas of the building? If so, what are the temperatures?
8. Is there an air exchange system when neither the heating nor the cooling system is operating?
9. Are the heating and cooling systems maintained on a regular basis?
10. Are boilers, ducts, and pipes insulated?
11. Does the building make use of passive solar heating?

Boiler Room Questioner

1. What exactly are the boilers used for?
2. What kind of boiler or what is the exact name of the type of boiler used at the school?
3. What is the size of the boiler?
4. What type of fuel is used to run the boilers?
5. How old are the boilers?
6. How much does a boiler like the one used in this school cost?
7. What type of schedule are the boilers on? Do they run the same amount during different heating/ cooling seasons/ school vacations, etc?

We are not boiler experts, but in doing research, we found the following maintenance is supposed to be done on a boiler. Find out if these items are being done on this schedule, and what is the purpose of doing each check?

Daily Requirements:

- Check temperature of exhaust gasses
- Check the steam pressure
- Check for unstable water level
- Check the burner
- Check motors and auxiliary equipment
- Check blowdown
- Keep a daily log, pressure, temperature of room, stack, water

Weekly Requirements:

- Check exhaust gas composition and temperature
- Check relief valve
- Check water level control
- Check pilot and burner assemblies
- Check boiler operating characteristics

Monthly Requirements:

- Check blowdown and water treatment procedures
- Exhaust gases
- Combustion air supply - keep air supply openings free of obstructions
- Check fuel system
- Check belts and packing glands
- Check for air leaks
- Inspect boiler room for cleanliness
- Inspect linkages for tightness
- Observe the fire when unit shuts down
- Inspect all boiler insulation, refractory, brickwork, and boiler casing for hot spots and air leaks.

Source: Northwest Natural Gas Company Commercial Conservation Checklist.

*** When you are at the TRW Building record the temperatures of the rooms and record which room you are in.



BUILDING AUDIT CHALLENGE – LIGHTING (STEP 4)

Lighting

1. What kinds of lighting are used in the building? Outside the building?
2. Are lights and fixtures kept clean?
3. Can lights be controlled with dimmer switches? In which areas or rooms?
4. Does the building make use of skylights and natural lighting?
5. Are there automatic timers for any of the lights?

Appropriate Lighting Levels:

See attached handout for appropriate foot candle lighting levels.



BUILDING AUDIT CHALLENGE – ENERGY VAMPIRES (STEP 5)

In this part of the audit, take an inventory of the different electric devices at TRW which could be considered energy vampires. Before visiting the building write down all items that could be considered an energy vampire. Then when you are at the facility you can look for these items and ones you didn't think of and plug in a Kill-A-Watt meter the first day. On the second day you can then record the amount of electricity used with the 24 hour span,



Equipment and Information Needed:

1. Energy Vampire Survey Sheet- (*Use the same sample of rooms that you used in the Lighting Survey*)
2. Kill- A-Watt Meter to use for devices not listed in the sheet.
3. The “Cool School- Energy Vampire Spreadsheet” (to be filled out after the site-visit)



BUILDING AUDIT CHALLENGE – WATER USAGE HEATING (STEP 6)

Water Heating

1. What fuel is used to heat water in the building?
2. Is there more than one water heater? How many?
3. How old are the water heaters?
4. Do the water heaters have timers? What are the settings for each heater?
5. At what temperatures are the water heaters set?
6. Are the water heaters and water pipes insulated?
7. Are flow restrictors used?
8. Are there leaks in the hot water system?

Do all faucets have water-saving faucet attachments? What is the flow rate? Test as many different faucets as you can. *Use the Water Flow Bag to determine.*

Do you have any toilet tank leaks? *Use the detecting tablets for this.*



BUILDING AUDIT CHALLENGE – TRANSPORTATION (STEP 6)

TRANSPORTATION

Although not directly tied in with the building, it is interesting to record and make aware of the transportation habits of the building inhabitants. Some business and organizations actively promote their employees to walk or bicycle to work for transportation, recreation, exercise, and sport. Sometimes walking or biking isn't an option and so another idea is to promote carpooling. The idea behind this is enforces a social responsibility on employees giving them the opportunity to be active stewards of their personal and environmental health.



Review the Questions below ask as many TRW employees as you can these questions;

1. What is the roundtrip distance you travel to and from school each day in miles?
2. How many days per week do you use each mode of transportation to get to work?
 - a. Drive alone _____
 - b. Carpool _____
 - c. Walk, bike or bus _____
3. If you drive alone or carpools, what is the car's fuel efficiency in miles per gallon (mpg)?
 - a. Drive alone's mpg _____
 - b. Carpool's mpg _____
 - c. If unknown, what is the make and model of the car? (so it can be looked up on line)

4. If you carpool, how many people total are in the carpool? _____
5. How many days a week do you commute by walking, or riding the bus? _____
6. If you had the option, (and don't already) would you walk/ ride your bike to work? Why or why not?

Thank the person for their time to fill out the questioner. ☺