



WEATHERIZATION

TOPIC OF STUDY

Energy Efficiency



90 MINUTES

LESSON

Energy Efficiency Strategies for Appliances

BIG IDEA(S)

Energy efficiency refers to the renovations and retrofits we do to a building to reduce the energy usage and the cost to the home or property owner.

OBJECTIVES

Students will:

- Compare usage costs of three kinds of lighting
- Describe what automatic controls can lead to energy cost reduction
- Calculate and compare energy use of appliances through power use, amount of time used, and cost of electricity
- Describe how refrigerator use can save money and when refrigerator replacement is beneficial

TASK LIST SUBCATEGORY

- 102 Describe how energy is fundamental to our everyday lives
- 805 Perform energy audit procedures
- 809 Apply math concepts to energy efficiency
- 810 Use energy efficiency industry vocabulary

OVERVIEW

Once baseload consumption is analyzed, technicians look for ways that energy use can be lowered. A variety of strategies can be used including repairs to appliances, replacement, and client education. Improvements in technology usually make upgrades worth the investment so students calculate use and estimated savings with replacement technologies.

STANDARDS

PA/SDP

- 3.4.10.B1.** Compare and contrast how the use of technology involves weighing the trade-offs between the positive and negative effects.
- 3.4.10.E7.** Evaluate structure design as related to function, considering such factors as style, convenience, safety, and efficiency.

NGSS

- HS-ETS1-2.** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
- CL** Analyze data using tools, technologies, and/or models in order to make valid and reliable scientific claims or determine an optimal design solution.
- CN** Apply concepts of statistics and probability to scientific and engineering questions and problems, using digital tools when feasible.

KEY TERMS

Light emitting diode bulbs (LEDs)

Incandescent bulbs

Compact fluorescent lamps (CFLs)

Kill-a Watt™: audit device used to measure electric use of lighting and appliances

Efficiency: getting the same function with less energy

Conservation: using less energy by changing behavior





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INSTRUCTIONAL

TEXT/REFERENCES

Energy Conservation Handbook. pp. 117-123, 149-152

MATERIALS NEEDED

MATERIALS

- Kill-a-Watt to measure wattage use for LED, CFL and incandescent bulbs

Technology: Computers or phones to research rebates and reduced prices for appliances on line; calculators or phones with calculator apps

IMPLEMENTATION (LESSON PLAN)

1. Have students use their phones to check in their local area or state for (1) rebates for old refrigerators that are “energy hogs”; (2) cost reductions or rebates for energy efficient appliances and light bulbs.
 - Students will most likely discover that PECO in Philadelphia gives a \$75 bonus for letting them take away your energy guzzling refrigerator.
 - There are discounts for buying Energy Star appliances, and they have good prices on LED bulbs, but they are expensive.
 - Discuss findings with students and ask why they think PECO, a company that sells energy, is giving out rebates for using less of their product.
2. Lighting Efficiency: Review the technology for the 3 kinds of lighting (*Energy Conservation Handbook*, pp. 118-120) and review the cost chart on p. 120.
3. Determine the energy use of each kind of bulb using a Kill-a-Watt to demonstrate in the lab. Try to keep the associated lumens (lighting output) the same for each bulb.
4. List the main findings of the Refrigerator Study (text and chart both have information).
5. Calculate the baseload savings of several appliances using LAB 5 (*Energy Conservation Handbook*, pp. 149-152). Energy Use = Power x Time — start with the chart estimates on p. 150, then use the results from the Kill-a-Watt.

$(\text{Wattage} \times \text{Hours Used Per Day}) \div 1000 = \text{Daily Kilowatt-hour (kWh) consumption.}$

Window fan: $(200 \text{ Watts} \times 4 \text{ hours/day} \times 120 \text{ days/year}) \div 1000. = 96 \text{ kWh} \times 11 \text{ cents/kWh.}$

Personal Computer and Monitor: $[(120 \text{ Watts} + 150 \text{ Watts}) \times 4 \text{ hours/day} \times 365 \text{ days/year}] \div 1000.$

HOMEWORK

1. Find out what kind of bulbs are in use where you live. Choose 5 of them and estimate what switching to LED's would save in a year using the chart on p.120 of the *Energy Conservation Handbook*.
2. Based on the refrigerator study (Blasnik, pp. 122-123), be prepared to role play an energy technician telling a homeowner the pros and cons of at least 5 features of a new refrigerator (example: refrigerators with tight freezers on the top use less energy than freezers on the bottom). Pair with another student the following day to complete the role play.





RESOURCES/LINKS

Kill-a-Watt Use

<https://www.youtube.com/watch?v=7K2uBZKLOEg>

PECO Rebates

<https://www.easycoblog.com/606/peco-energy-energy-efficiency-rebates/>



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