

Slides 4.4: Conserving Energy and Water: the Home Energy Audit

Slide outline for Lesson 4.4. Day 1 has twelve slides; Day 2 has nine. *[Sal: slide 5 is yours. Put one photo from your Penn State zero-energy home project on it and tell the story in two minutes.]*

Day 1

Slide 1: Where does it go?

- Lesson 4.4, Day 1
- Today: where a home's energy and water go, and the math that shows what a fix is worth
- Tomorrow: you audit this room Image: a house drawn in cross-section with arrows leaving through the roof, the windows, the faucet, and the outlets.

Slide 2: Do now

- Name three things in your home using electricity right now while nobody is using them
- Guess: what does one light bulb cost to run for a year?
- Two minutes Notes: Write the three-things list on the board and circle the phantom loads. Hold up the two bulbs for the hook.

Slide 3: Energy in a home

- Heating and cooling: about half
- Heating water: about a fifth
- Everything else: lights, fridge, laundry, electronics, cooking Image: a pie chart with a furnace icon on the biggest slice, a water heater on the next, and a bulb, a fridge, and a TV on the rest. Notes: Rounded from U.S. EIA residential data. Students fill Part 1.

Slide 4: Water in a home

- Toilets: about a quarter
- Showers: a fifth
- Faucets: a fifth
- Laundry: a sixth
- Leaks: about a tenth. A tenth of the water bill goes down a drip. Image: a pie chart with a toilet, a showerhead, a faucet, a washer, and a drip icon. Notes: Rounded from EPA WaterSense.

Slide 5: A zero-energy home

- *[Sal: your Penn State project. One photo, three lines: what it is, what it cost, what surprised you.]* Image: *[Sal: your photo or drawing.]* Notes: Two minutes. This is the story students will remember from this lesson.

Slide 6: Phantom load

- A device that draws power while “off”: chargers, TVs, cable boxes, game consoles, microwaves with clocks
- About 5 to 10 percent of a home’s electricity
- Watch the meter Image: a plug-in electricity meter with a game console plugged in, reading 14 W. Notes: If you have the meter, plug in the biggest phantom you tested. If not, the number on the slide stands.

Slide 7: Two words

- Conservation: using less of a resource on purpose so it lasts (the state’s definition in plain words)
- Efficiency: getting the same result with less
- Turning off the light is conservation. The LED is efficiency. You want both. Notes: CTE SUS 3. d) is “define conservation as it applies to energy.” Students write both definitions.

Slide 8: The math, one bulb

- $60 \text{ W} \times 5 \text{ hours} \times 365 \text{ days} = 109,500 \text{ Wh}$
- Divide by 1,000 = 109.5 kWh
- $\times \$0.25 = \27.38 a year
- The LED: 9 W . $16,425 \text{ Wh} = 16.4 \text{ kWh} = \4.11
- Savings: \$23.27 per bulb. Twenty bulbs: about \$465. Image: the two bulbs side by side with the wattage circled on each. Notes: Work it on the board with the template. “Watt-hours are pennies, kilowatt-hours are dollars.”

Slide 9: The math, a drip and a thermostat

- One drip per second is about 5 gallons a day
- $5 \times 365 = 1,825 \text{ gallons a year}$, about 30 bathtubs
- Thermostat: each degree set back for 8 hours saves about 1 percent of the heating bill
- 7 degrees at night saves about 7 percent. The fix is a sweater. Image: a faucet with one drop falling, and a thermostat dial turned to 65. Notes: Pairs do the three practice problems on the handout, Part 2. Check with the pair beside them.

Slide 10: The audit checklist

- Lights: on in empty rooms? LED?
- Phantom: chargers, screens, consoles
- Heat: thermostat, open windows, blocked vents, drafts
- Water: drips, a running toilet, shower length

- Appliances: fridge seal, full loads, cold laundry
- Score each line: OK, Fix (free), Fix (\$) Notes: Walk the twelve lines in Part 3.

Slide 11: Practice on a bedroom

- A lamp on with nobody in the room, old bulb
- A laptop charger plugged in, no laptop
- A space heater running with the window open two inches
- A radiator with a dresser in front of it Image: a bedroom photo with those four things visible. Notes: Score it as a class, one line at a time. Every line here is a free fix except the bulb.

Slide 12: Exit card

- 3 places a home's energy goes
- 2 phantom loads you will unplug tonight
- 1 number from today's math you will remember Notes: Assign five teams and five zones of the room for tomorrow before they leave.

Day 2

Slide 13: Audit day

- Lesson 4.4, Day 2
- This room is the client
- Five zones, one team each, ten minutes Image: the classroom with five zones outlined.

Slide 14: Do now

- One bulb: 60 watts, 5 hours a day, 365 days
- How many watt-hours?
- Divide by 1,000: how many kilowatt-hours?
- Two minutes Notes: 109,500 Wh; 109.5 kWh. Leave it on the board.

Slide 15: Audit the room

- Take the checklist and a clipboard to your zone
- Score all twelve lines
- Every fix: free or money
- I planted something in every zone. Find it. Notes: Circulate. Reveal the planted wastes at ten minutes.

Slide 16: Audit the apartment

- The Marchetti-Oyelaran apartment, Part 4
- Two adults, one child, a rental; the landlord pays for heat, the family pays for electricity and hot water
- Read it room by room; score the same twelve lines

- Ten minutes Notes: Watch for the heat lines. The family does not pay for heat, which changes who should fix what.

Slide 17: Twelve fixes

- Each has a cost and an estimated yearly saving
- Cross out the two that cost more than \$50
- Rank the other ten by savings, highest first
- Payback = cost / savings per year Image: the twelve-fix table from the handout. Notes: Common mistake is ranking by cost. Say it twice: cheapest first is the filter; savings is the rank.

Slide 18: Who pays?

- The landlord pays for heat. Who should buy the weatherstripping?
- The family pays for hot water. Who should buy the low-flow showerhead?
- The fridge seal is torn. Whose fridge is it? Notes: Take three answers. This comes back in the Design a Room budget.

Slide 19: Read the bill

- Electricity used: 650 kWh
- Supply \$0.12 per kWh; delivery \$0.13 per kWh; together \$0.25
- Basic service charge \$18: the same every month, even at zero
- Total \$180.50
- Ten LEDs save about \$230 a year: next month's bill drops about \$19 Image: the sample bill from the handout with the five numbers boxed.

Slide 20: Exit card

- Your top three fixes
- One sentence: why the first one is first Notes: The quiz in Lesson 4.5 has one energy math item and one water math item with the numbers given.

Slide 21: Reset the room

- Turn off what we turned on to find it
- Chargers unplugged, windows closed
- This room is now audited. Keep it that way.