Lesson 1: Buying Electric Appliances - Watt You Need to Know

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In this economics lesson, students learn about the importance of energy costs when considering household budgeting decisions. They also consider the role of US government agencies like the FTC and the EPA in providing information to consumers.

Description of the lesson

The cost of owning and operating an electric appliance is not just the price of the appliance. In a series of decision-making rounds, students use their preferences, a budget, and energy cost research to make household purchasing decisions.

Economics

Economics is the study of how people choose. Individuals make decisions by examining the costs and benefits of each alternative available to them and selecting the one that offers the greatest net benefit given the constraints they face. Conducting research before making a purchase benefits consumers by improving their understanding of each alternative's costs and benefits, but research itself imposes an opportunity cost. In this lesson students practice cost-benefit analysis and conduct consumer research to make appliance purchasing decisions.

Objectives:

Students will be able to:

- evaluate the benefits and costs of various products in order to make household purchasing decisions.
- compare the benefits and costs of conducting consumer research.
- identify U.S. government programs (the Federal Trade Commission and the Environmental Protection Agency) that aid consumers in researching appliance energy costs.

Materials:

- Slides 1.1-1.19
- Pencils, one per student
- Timer, for teacher use
- Calculators, one per student (as an alternative, students may use a calculator app on a phone or computer)
- Activity 1.1: Consumer Decision Making, one per student
- Activity 1.2: Energy Cost Research, one per student
- Activity 1.3: Assessment, one per student

Suggested Time Frame:

60 minutes

Concepts:

Decision-making, cost/benefit analysis, opportunity cost, budgeting

National Standards in Economics or Personal Finance:

Voluntary National Content Standards in Economics

- Standard II: Spending
  - 12-2 Consumer decisions are influenced by the price of products or services, the price of alternatives, the consumer's budget and preferences, and potential impact on the environment, society, and economy.
  - 12-5 Consumers incur costs and realize benefits when searching for information related to the purchase of goods and services.

Procedure

1. Display slide 1.2 and give students 1 minute to discuss the activator prompt on the slide with a classmate.
    - What electricity-powered household devices do you use on a daily basis? ***(Answers will vary but may include: TVs, lights, kitchen appliances, blow dryers, and heaters or air conditioners)***
    - Which household devices do you think use the most power? ***Move to slide 1.3 to show the top ten appliances that consume the most energy.***

2. Ask 2-3 students to share their responses to the prompts. Explain that when students become financially independent, they will need to make purchasing decisions about devices like the ones they discussed in the activator.

3. Advance through slides 1.4-1.5 to acquaint students with the hypothetical scenario that will guide their work today. Give students up to 1 minute to read the information on each slide. Provide clarification if needed.

- SCENARIO: You have just secured your first full-time job and are financially ready to move into your own place! A family friend who lives near your employer's headquarters has offered to rent their 500-square-foot guesthouse to you for the next year. In addition to rent, you will be responsible for paying utilities (the guesthouse has its own water and power meters). The only catch is that the guesthouse has been unused for several years and will need a few things before you can live there comfortably. In exchange for a below-market rental rate for the next 12 months, you will need to purchase the items listed below.
    - 8 light bulbs
    - Compact refrigerator
    - Window air conditioner
    - Electric water heater

4. Distribute a copy of *Activity 1.1: Consumer Decision Making* to each student.

5. Display slide 1.6. Explain that students will examine the features of each appliance before ranking Options A-D for each appliance purchase. Students will write the letters of each appliance option in descending order of preference in the first ranking round column on Activity 1.1. Direct student attention to the sample ranking on the slide. Give students 3 minutes to complete their rankings for all four items.

   Teacher Note: Students may ask you for price data or about the meaning of "ENERGY STAR Certified." Tell them that, for now, they should focus just on the information that they have on Activity 1.1 and to make their best guess about the meaning of each product feature.

6. Display slide 1.7 and tell students to discuss the questions on the slide with a nearby classmate. After 1-2 minutes, debrief as a class:
    - How did you decide on your rankings for each appliance? ***(Answers will vary but may include: descriptions of specific product features they liked or disliked—such as the light bulbs' brightness or the amount of freezer space. Students may also explain that they used the product feature data to make inferences about the relative prices of their appliance options and, in turn, used those inferences in their rankings.)***

    - What other information would help you make your appliance purchasing decisions? ***(Answers will vary but may include: price data, customer reviews, delivery costs, information about their budget in the scenario and/or the energy efficiency of their appliance options.)***

7. Advance to slide 1.8. Define **economic decision making** as the process of reaching a conclusion after considering alternatives. Define **cost/benefit analysis** as a process of examining what you gain (benefits) and what you give up (costs) of each available alternative and then using that information to arrive at a decision. Explain that the information available to students in their initial rankings was primarily helpful in thinking about the benefits of the appliance options available to them. Point out that rational decision making is built on cost/benefit analysis.

8. Explain that—as students likely pointed out in Step 6—information about costs is also essential in making good decisions. Tell students that they will see the monetary cost of each appliance option and consider a budget for their scenario.

9. Display slide 1.9 to share information about student finances in the lesson scenario. Give students 1 minute to read the slide. Provide clarification as necessary.
    - YOUR FINANCES: You have carefully reviewed your finances and have determined that you can spend up to $1,100 from your savings account to purchase appliances for the guesthouse. If you spend more than $1,100, you will need to borrow the additional money from your parents. Repaying the loan will mean that, for one or more months, you will have to reduce the amount of income you have allocated to entertainment spending in the budget you developed in line with your wages at your new job.

10. Distribute a calculator to each student or ask students to access a calculator app on their phone or on a computer.

11. Advance to slide 1.10 to provide prices for each appliance option (see the table below for reference).
    - Tell students to record the price for each appliance in the "Product Information" section of each table on Activity 1.1. Explain that students will take the information they have gained since their initial ranking into account as they re-rank their options for each appliance in Round Two Students should use their calculator to help them keep track of their total monetary costs so they know if they are over or under budget.
    - Direct students to re-rank their choices, writing the letter of each appliance in descending order of preference in the second ranking column *on Activity 1.1.* Allow 3-4 minutes for students to complete their rankings.

Option	8 Light Bulbs	Compact Refrigerator	Window Air Conditioner	Electric Water Heater
A	$20	$329	$179	$427
B	$20	$368	$229	$479
C	$23	$449	$254	$483
D	$25	$600	$270	$759

12. Advance to slide 1.11. Instruct students to discuss the questions on the slide with a nearby classmate. After 2 minutes, debrief as a class.
    - Were your rankings in Round 2 different from those in Round 1? Why or why not? ***(Answers will vary but may include: Yes, I changed my rankings to stick to my $1,100 budget. No, my ranking stayed the same because I was already under budget or because I have strong preferences for particular product features.)***
    - Did you always rank the option with the lowest price as your most preferred option? Why or why not? **(*Answers will vary but may include: Yes, I made my rankings strictly according to price so as to have more savings on hand. No, I used a combination of price and product features to make my rankings.)***
    - If you purchase each of your most preferred appliances, will you spend more or less than the $1,100 you have allocated for this purpose? **(*Answers will vary but may include: I will spend less/a little more/a lot more than $1,100.)***

13. Advance to slide 1.12 and define **opportunity cost** as the next-best alternative a person gives up when making a choice. Provide students with an example of opportunity cost by asking them:
    - Imagine you were to spend an hour watching videos on YouTube when you get home from school. What would be your next best use of that hour? ***(Answers will vary but may include: doing homework, spending time with friends, working at a job.)***
      Teacher Note: Point out that each person's opportunity cost may be different as it is based on individual preferences. Also make sure that students understand that opportunity cost in this scenario is *only* the next most highly valued use of the hour, *not all* possible uses of the hour.

14. Explain that all students faced opportunity costs when ranking their appliance options. Discuss the following questions with students:
    - What is the opportunity cost of purchasing your most preferred refrigerator?
      (Answer: The refrigerator they ranked as second most preferred.)

    - What is the opportunity cost of spending more than $1,100 on appliances for the guesthouse?
      (Answers will vary but may include: Giving up some entertainment spending in the future in order to repay a loan.)

15. Remind students that, so far, they have considered the appliances' features (which relate to the benefits they offer) as well as their prices and related opportunity costs. Ask students:
    - Are there any other factors you might want to consider before finalizing your purchasing decisions? **(*Answers will vary but may include: Yes, I might consider customer satisfaction and the cost to operate and maintain the appliances, such as electricity costs and the cost of parts and maintenance.*)**
      Teacher Note: If students do not mention the costs of operating and maintaining the appliances, bring these issues to their attention.

    - What are the benefits of conducting consumer research? ***(Answers will vary but may include: Research helps a consumer make a more informed decision—they will know more about a product's benefits and costs.)***
    - What is the opportunity cost of conducting consumer research? ***(Answer: Time that could be spent in the consumer's next best alternative activity, i.e. working, spending time with friends, etc.)***

16. Tell students that they will have a chance to conduct consumer research on the cost of electricity needed to operate the appliances they are preparing to purchase.

17. Distribute a copy of *Activity 1.2: Energy Cost Research* to each student. Review the three-step process for calculating an appliance's energy costs using Slide 1.13 as students follow along on the handout. Answer questions and provide clarification as necessary.

18. Tell students that because consumer research is not free—remember it requires giving up valuable time—they will have a limited amount of time to calculate the energy costs of operating the appliances under consideration. They will need to think about the appliances for which research (energy cost calculations) is worthwhile.

19. Provide students with the price per kilowatt hour (kWh) you want them to use for calculations—either the national average price or the state average price. Both prices can be found in Table 5.6.A. Average Price of Electricity to Ultimate Customers by End-Use Sector published by the U.S. Energy Information Administration. Tell students to check the relevant box and record the relevant price under "Your Task" on Activity 1.2.
    Teacher Note: While Activity 1.2 describes a three-step process for calculating appliance energy costs, students **will only complete the last calculation step** today.

20. Display slide 1.14 and announce that students have 2 minutes to conduct their research. Start a timer for 2 minutes. DO NOT give them more time.
    Teacher Note: Slide 1.19 shows all calculations completed using a price of $0.16/kWh.

21. After 2 minutes have elapsed, tell students to put down their calculators and to mark their final rankings for each appliance in the third ranking column on Activity 1.1.

22. Display slide 1.15. Tell students to discuss the questions on the slide with a nearby classmate. After 2 minutes, debrief as a class.
    - For which appliances did you conduct energy cost research? Why? ***(Answers will vary but may include:***
        i. ***I did research on the electric water heaters because they are expensive appliances and they require a relatively large amount of electricity to operate year-round.***
        ii. ***Knowing about the energy costs of operating these appliances offered the most benefit.***
        iii. ***Given my limited time, I chose not to research the light bulbs because they are relatively inexpensive to buy and use relatively little energy.***
        iv. ***Knowing about the energy costs of operating the light bulbs offered significantly less benefit to me as compared to having that information about the other appliances.***
        v. ***I did research only on my top two choices in each category because those were the appliances for which the energy cost information was most valuable.)***
    - Were your rankings in Round 3 different from those in Round 2? Why or why not? **(*Answers will vary but may include: Yes, I made changes after seeing how expensive it would be to operate at least one of the appliances under consideration. No, the energy costs simply confirmed my choices or did not make a big enough cost difference to change my rankings.)***
      Teacher Note: Students are most likely to make changes in their rankings for the electric water heater. Option A is the lowest priced alternative, but it has the highest energy costs. Students will likely have a decreased preference for Option A after conducting consumer research. This adjustment may lead to changed rankings for the other appliances in order to stay under budget.
    - Was it worth it to conduct energy cost research? ***(Answer: Students who changed their rankings will likely say yes. Students who did not change their rankings and those who were not strategic in choosing which appliances to research may say no.)***

23. Display slide 1.16. Introduce students to two U.S. government programs that provide resources to consumers related to energy usage and costs. Tell students that the **Energy Labeling Rule** includes labeling requirements for refrigerators, freezers, dishwashers, water heaters, clothes washers, furnaces, air conditioners, heat pumps, plumbing products, lighting products, ceiling fans, and televisions. Per this rule, labels related to energy usage and costs are attached to appliances in stores and are also available when shopping online. In addition to the products covered by the Energy Labeling Rule, office equipment, electronics, and building materials can be **ENERGY STAR** Certified.

24. Advance to slide 1.17 to show students sample labels created under the Energy Labeling Rule. Point out that these labels contain cost estimates based on national energy prices that are sometimes inconsistent. For example, in 2023, the price per kWh on EnergyGuides and Lighting Facts boxes varied from $0.11/kWh to $0.14/kWh.

25. Ask students:
    - Do the Energy Labeling Rule and the ENERGY STAR program eliminate the cost of consumer research? ***(Answer: Most students will say no. Students will likely note that these programs lower the cost of consumer research but do not eliminate it as consumers still need to study the information and use it to compare their options before making a purchasing decision.)***

26. Display slide 1.18. Tell students to discuss the questions on the slide with a nearby classmate. After 2 minutes, debrief as a class.
    - Were the annual energy costs for the ENERGY STAR certified refrigerator and window air conditioners lower than those of the other options you considered? *(Answer: Yes.)*
      Teacher Note: When discussing this question, you may wish to display slide 1.19.
    - In your final rankings, did you rank any of the ENERGY STAR certified appliances as your most preferred option? Why or why not? ***(Answers will vary but may include: No, other factors such as price and product features were more important to me. Yes, I prioritized energy savings.)***

    - How might your final rankings have been different if you knew you were going to pay to operate these appliances for 5 years instead of 1 year? ***(Answers will vary but may include: I would have given more weight to energy costs in my decision making and ranked the most energy-efficient options more favorably.)***

Closure

27. Review the key concepts in the lesson by discussing the following:
    - Did you use cost/benefit analysis in deciding how to rank your options for each appliance purchase? Explain. *(Answer: Yes, we examined the benefits of each option—product features and possibly energy efficiency—as well as the costs —appliance prices, energy costs, opportunity costs.)*

    - What is opportunity cost? *(Answer: The next-best alternative a person gives up in making a choice.)*

    - When do the benefits of consumer research outweigh the costs of doing the research*? (Answers will vary but may include: Consumers perceive costs and benefits differently, so it will vary. But the benefits of research will likely outweigh the costs when the research uncovers information that significantly changes the consumer's understanding of the given products' features. In the case of energy research on electric appliances, that will most likely be the case for appliances that are used a lot. For example, energy cost research on the electric water heaters in this lesson revealed that the least expensive water heater—Option A—was actually the most expensive one to operate. Even though Option B and Option C had higher prices than Option A, that initial difference in purchase price would be more than made up for with energy savings in the first year of operation. The value of this information would outweigh the opportunity cost of the research for many budget-conscious consumers.)*

    - What resources can you use to factor energy usage and costs into your appliance purchasing decisions? *(Answer: I can look for EnergyGuides and other similar labels required by the Energy Labeling Rule. I can also look for appliances that are ENERGY STAR certified.)*

Assessment

28. Distribute copies of *Activity 1.3: Assessment* to each student. Allow students time to respond to the prompts during class or ask students to complete the assessment as homework. Review their work using the key below.

    1. Which of the following best describes the process that an economic thinker would use when choosing a smartphone to purchase?
        a. Buy the least expensive smartphone
        b. Buy the most energy efficient smartphone
        c. Buy the smartphone that offers the exact and specific features you value most even if it means spending a little more
        d. Buy the smartphone that you most prefer after carefully comparing the costs and benefits of your alternatives

    2. For which of the following appliance purchases would the benefits of researching energy costs most likely outweigh the opportunity cost of conducting that research?
        a. Blender
        b. Clothes dryer
        c. Vacuum cleaner
        d. Coffee maker

    3. Which of the following is a resource consumers can utilize to lower the opportunity cost of researching energy costs?
        a. EnergyGuide label
        b. Energy Costs box
        c. Eco-Appliance label
        d. Eco-Facts box

    4. Imagine you are a consumer advocate who wants to raise awareness about the importance of considering energy costs when purchasing electric appliances. Write a professional newsletter for your subscribers that explains how and why people should factor these costs into their decision making. Your message should correctly incorporate the terms **cost/benefit analysis** and **opportunity cost**, as well as references to U.S. government programs that can help consumers make informed choices.

Extension

Conduct research on new automobiles a consumer could purchase with a $35,000 budget. Identify three alternatives and create a short video or slide presentation that provides a first-time buyer with information about the:

- Benefits of each alternative; consider the best 5-10 features of each automobile
- Costs of each alternative, including purchase price and the expenses associated with owning and operating each automobile
- Economic process for analyzing each alternative to arrive at a final decision

References

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Federal Trade Commission. (2022, August). *How To Use the EnergyGuide Label To Shop for Home Appliances*. Consumer.FTC.gov. https://consumer.ftc.gov/articles/how-use-energyguide-label-shop-home-appliances

The Home Depot (n.d.). *Appliances.* HomeDepot.com. Retrieved September 11, 2023, from https://www.homedepot.com/b/Appliances/N-5yc1vZbv1w.

U.S. Energy Information Administration. (2023). *Electric Power Monthly.* EIA.gov. https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_6_a

8 LIGHT BULBS

Option	Product Information
A	15-watt CFL, 800 lumens, Life of 9.1 years
B	15-watt CFL, Spiral bulb, 900 lumens, Life of 7.3 years
C	9.5-watt LED, 840 lumens, Life of 10 years
D	8-watt LED, 800 lumens, Life of 13.7 years

	Ranking Rounds		
	1	2	3
Most Preferred			
↓			
Least Preferred			

CFL = Compact fluorescent lamp; LED = Light-emitting diode
Higher lumens indicate a brighter light; Life based on 3 hours of use per day

COMPACT REFRIGERATOR

Option	Product Information
A	7.1 cubic feet (ft^3) (1.4 for freezer), Stainless steel look, 1 freezer shelf, 2 fridge shelves, Crisper drawer, In-door 2-liter bottle storage
B	7.5 ft^3 (1.5 for freezer), White, 1 freezer shelf, 3 fridge shelves, Crisper drawer, In-door 2-liter bottle storage
C	10.1 ft^3 (2.7 for freezer), White or black, 1 freezer shelf, 2 fridge shelves, Crisper drawer, In-door can and gallon storage
D	10 ft^3 (2.4 for freezer), Milkshake white or bebop blue, Retro 50s style, 1 freezer shelf, 2 fridge shelves, Crisper drawer, In-door can and 2-liter bottle storage, ENERGY STAR Certified

	Ranking Rounds		
	1	2	3
Most Preferred			
↓			
Least Preferred			

WINDOW AIR CONDITIONER

Option	Product Information
A	Cools 150 square feet (ft^2), 50 dBA, 2-speed fan, 2-way air direction
B	Cools 250 ft^2, 54 dBA, 4-speed fan, 4-way air direction
C	Cools 250 ft^2, 56 dBA, 3-speed fan, 4-way air direction, ENERGY STAR Certified
D	Cools 250 ft^2, 55 dBA, 3-speed fan, 8-way air direction, ENERGY STAR Certified

	Ranking Rounds		
	1	2	3
Most Preferred			
↓			
Least Preferred			

dBA = A-weighted decibels, a higher decibel rating indicates a louder machine

ELECTRIC WATER HEATER

Option	Product Information
A	40-gallon tank, 6-year warranty, Dual 3800-watt heating elements
B	30-gallon tank, 6-year warranty, Dual 4500-watt heating elements
C	30-gallon tank, 6-year warranty, Dual 3800-watt heating elements
D	40-gallon tank, 12-year warranty, Dual 5500-watt heating elements, leak detection system, manage from a mobile device with EcoNet Wi-Fi technology

	Ranking Rounds		
	1	2	3
Most Preferred			
↓			
Least Preferred			

How Much Will Using That Appliance Cost You Each Year?

Step 1: Calculate watt-hours (Wh) per year

device wattage x hours used per day x 365 days per year = Wh per year

Example: 150-watt television used for 4 hours per day
150 watts x 4 hours per day x 365 days per year = 219,000 Wh per year

Step 2: Convert Wh per year to kilowatt-hours (kWh) per year

Wh per year ÷ 1000 = kWh per year

Example: Television using 219,000 Wh per year
219,000 Wh per year ÷ 1000 = 219 kWh per year

Step 3: Calculate annual energy costs

kWh per year x price per kWh = energy cost per year

The average price for one residential kWh in the U.S. as of 2023 rounds to $0.16. The most current data (including state-level data) is available at https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_6_a

Example: Television using 219 kWh per year at the national average price
219 kWh per year x $0.16 per kWh = $35.04 per year

Your Task: Conduct consumer research by calculating how much it will cost you to operate these appliances for one year. Indicate below which price you will use for your calculations. **Note that Steps 1 and 2 of the calculation process have already been completed for you** based on the stated assumptions.

☐ I will use the national average price of $0.____ per kWh.

☐ I will use the average price for _____ of $0.____ per kWh.
(indicate the state)

8 LIGHT BULBS (Assumes all 8 bulbs are used 3 hours per day.)

Option A	Option B	Option C	Option D
131 kWh per year Energy cost per year $_____	114 kWh per year Energy cost per year $_____	83 kWh per year Energy cost per year $_____	70 kWh per year Energy cost per year $_____

COMPACT REFRIGERATOR

Assumes use necessary to maintain a typical temperature setting.

Option A	Option B	Option C	Option D
375 kWh per year Energy cost per year $_____	378 kWh per year Energy cost per year $_____	297 kWh per year Energy cost per year $_____	292 kWh per year Energy cost per year $_____

WINDOW AIR CONDITIONER

Assumes seasonal use of 8 hours per day for 3 months per year.

Option A	Option B	Option C	Option D
346 kWh per year Energy cost per year $_____	408 kWh per year Energy cost per year $_____	369 kWh per year Energy cost per year $_____	375 kWh per year Energy cost per year $_____

ELECTRIC WATER HEATER

Assumes use necessary to maintain a typical temperature setting.

Option A	Option B	Option C	Option D
3531 kWh per year Energy cost per year $_____	2494 kWh per year Energy cost per year $_____	2439 kWh per year Energy cost per year $_____	3493 kWh per year Energy cost per year $_____

NAME_____

1. Which of the following best describes the process that an economic thinker would use when choosing a smartphone to purchase?
    a. Buy the least expensive smartphone
    b. Buy the most energy efficient smartphone
    c. Buy the smartphone that offers the exact and specific features you value most even if it means spending a little more
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3. Which of the following is a resource consumers can utilize to lower the opportunity cost of researching energy costs?
    a. EnergyGuide label
    b. Energy Costs box
    c. Eco-Appliance label
    d. Eco-Facts box

4. Imagine you are a consumer advocate who wants to raise awareness about the importance of considering energy costs when purchasing electric appliances. Write a professional newsletter for your subscribers that explains why and how people should factor these costs into their decision making. Your message should include the terms **cost/benefit analysis** and **opportunity cost**, as well as references to U.S. government programs that can help consumers make informed choices.