1. Electricity demands change throughout the day as people are awake and using electric appliances and gadgets or asleep and using a minimum number of electric devices. Electricity demands change across seasons. In the summer, many people use more electricity because they use air conditioners to cool their living spaces. In the winter, people use more electricity for light and heating as daylight hours are shorter in the winter than they are in the summer.

2. Considering the information in the electricity flow diagram, which change in electricity generation and delivery would most increase the efficiency (reduce the losses) of electricity delivery? Upgrading fossil fuel power plants to combined heat and power (CHP) plants.

3. Explain your answer.
Most of the energy losses of electricity generation come from conversion losses. The diagram shows that the generating sources have 40.11 quadrillion Btus of energy. Conversion losses total 26.03 quadrillion Btus. This is a huge loss compared to the 1.01 quadrillion Btus lost during transmission and delivery of electricity. Reducing the number of fossil fuel plants and increasing the number of nuclear power plants will not do much to increase efficiency, as there are large energy losses from both fossil fuel and nuclear power plants. The biggest efficiency gain (loss reducer) is to reduce the losses of the lossiest step of electricity generation.

4. How certain are you about your claim based on your explanation? Student answers will vary.

5. Explain what influenced your certainty rating.
Student answers will vary. Scientific evidence includes specific references to numbers in the diagram. Students may consider that they do not have the actual data of losses from each type of generating source; however, the lines are proportional in size. Students may also note that the data in the diagram is estimated from information in the Energy Information Administration publication.

6. By end use, what is the highest demand for electricity? lighting

7. Approximately what percentage of electricity used by schools (educational institutions) is used for lighting? 35%
Energy Efficiency Answer Key, continued

8. What could building managers do to decrease the amount of electricity used for lighting?
   Building managers could decrease the amount of electricity used for lighting by turning off
   unnecessary lighting or having lights that automatically turn themselves on and off when there
   are people around (motion controlled). They could install more windows and skylights to let in
   natural light, which would reduce the amount of electric light they need. They could also install
   more efficient lighting that uses less electricity.

9. What is the biggest expense for the average household?
   heating and cooling

10. What could you do to reduce that expense?
   You could reduce heating and cooling expenses by keeping the temperature lower in the winter
   and warmer in the summer so that the temperature difference between inside and outside is
   closer together. You could also insulate your house better so that it doesn’t lose heat to or gain
   heat from the outside as easily.

11. What improvements could be made to your school to make it more energy-efficient?
    Student answers will vary. Students may suggest more insulation, more efficient use of
    electricity, using less electricity, or changing the thermostat settings.

12. An electrical grid system connects electricity producers with electricity consumers. The
    network allows electricity to flow where it is needed, when it is needed. What effect does
    energy efficiency have on the electrical grid?
    Energy efficiency affects the electrical grid. When people use electricity more efficiently, electricity
    generators don’t need to produce as much electricity. The electrical grid doesn’t get overloaded.
    If the electrical grid is overloaded, it can overheat and go down, resulting in blackouts.

13. How might a business generate negawatts?
    A business could generate negawatts by turning off lights and equipment when it is not being
    used. They could keep lights off until it gets dark instead of automatically turning on lights,
    even when it’s bright outdoors. Alternatively, they could use dimmer lighting when there are
    natural sources of bright light.

14. Many power plants burn fuels to produce electricity. How can energy conservation in homes
    and businesses lead to a reduction in emissions from power plants?
    Conserving energy in your home means that less electricity has to be generated. Since most
    of our electricity in the United States comes from coal and natural gas, reducing the amount
    of electricity generation should reduce the amount of coal and natural gas being burned. If the
    fossil fuels are not burned, emissions will decrease.
15. What would electricity consumption be in 2015 and beyond? Electricity consumption would decrease.

16. What would happen to the fuel mix for electricity generation in 2015 and beyond? (Select as many choices as you need to for your prediction.)
   Fewer fossil fuels would be used.
   More renewable fuels would be used.

17. What would happen to the price of electricity in 2015 and beyond? The price of electricity would increase.

18. Explain your answers.
   I predicted that more renewable fuels and fewer fossil fuels would be used in the future. This seems to be the current path. The amount of coal used for electricity generation has decreased. I think it will continue to decrease. Natural gas will pick up some of the slack, but I think that renewable fuels will increase because of increasing efficiency and tax subsidies. If less electricity is used in the future because of conservation measures and if more of that electricity comes from renewable sources, electricity prices will rise. This is because renewable fuels are more expensive than fossil fuels.

19. How certain are you about your claim based on your explanation?
   Student answers will vary.

20. Explain what influenced your certainty rating.
   Student answers will vary. Scientific evidence includes specific reference to the graphs or information on this page. Students may express uncertainty about predicting the future of electricity generation if policies change (i.e. around greenhouse gas emissions) and availability of different types of resources.