Workshop 6
Energy and Systems

Students sometimes say that energy "disappears," "dies out," or "slips away," because they don't think carefully about the physical boundaries of the objects they are observing and the energy that passes through those boundaries. Scientists, on the other hand, think in terms of systems—collections of objects within a clearly defined boundary. By keeping track of how energy passes through the boundary, they are able to trace and quantify the flow of energy, and to identify places where energy is "leaking" in or out. In this session, viewers examine different systems, including bomb calorimeters, electric power plants, and insulated winter clothing. Finally, the program looks at cases in which a systems-oriented approach helps in analyzing real-world problems, such as predicting the destructive power of a hurricane or planning the water flow of a hydroelectric dam.

On-Site Activities

Getting Ready (30 minutes)

Home Energy Audit

1. Use your appliance list to determine how much energy was used during a 24-hour period in the room you selected. To do so, you will first need to convert watts to kilowatts (kW) (divide the number of watts for each appliance by 1,000) and then put your answer in the column labeled "Power (in kW)".

2. Calculate the energy used by each appliance in kilowatt hours (kWh). To do this, multiply the power (in kW) by the time (in h). Record your answer in the last column.

Appliance	Power (in W)	Power (in kW)	Total time (in h)	Energy (in kWh)

3. Which appliance used the most energy in the 24-hour period? Why do you think this was so? Share your results with the group.

4. If each appliance were on for only one hour a day, which one would use the most energy? Why do you think this is so? Discuss your ideas with the group.

Watch the Video (60 minutes)

As you watch the video, consider the following questions and answers:

1. How can we reconcile the principle of conservation of energy with everyday experience?

We can account for energy in terms of systems. Any "missing" energy can be accounted for by looking for energy conversions and transfers out of the system, even if they are not obvious at first.

2. What is a system?

A system is an object or objects around which we can draw an imaginary boundary to keep track of inputs, outputs, and internal changes.

3. How can systems be useful in thinking about energy?

Systems enable us to make predictions, take better measurements, and improve our energy efficiency.

4. What are some practical applications of energy systems?

Systems are critical in helping us understand energy flow in terms of inputs, outputs, and internal change—even with phenomena not usually thought of in terms of energy.

On-Site Activities, cont'd.

Going Further (30 minutes)

Paying the Price

1. Now that you have calculated the energy used in your room in a 24-hour period, it is time to find out how much it costs to run the appliances. Energy costs vary from region to region, depending on the availability of energy sources in your area. We will assume an average energy cost of $0.10 per kWh. Multiply your total energy (in kWh) by $0.10 to find out how much it would cost to run your room for one day.

   Your energy cost for one day _____

2. Multiply this number by 365 to find out the cost of running this room for one year.

   Your energy cost for one year _____

3. Estimate how much you spend to run your entire house for one day.

4. Estimate how much you spend to run your entire house for one year.

5. Compare your results with the group and discuss the ways you could reduce the amount of energy you use each day. How much energy could you save each year with this amount of conservation?

For Next Time

Homework Assignment

1. Find a copy of your energy bill from your electric company. What is your actual cost per kWh of energy used?

2. According to your bill, at what time of year is your energy use the highest? At what time is it the lowest?

3. What energy-users in your house do you think contribute the most to the high cost?

4. Go outside and find your electric meter. Read what it says one day and then read what it says at the same time the following day. How much energy does your meter indicate that you actually use in one day?

For further study: If you have oil or gas heat, take a look at your fuel bill and determine what you pay per day. Remember, oil and gas are also sources of energy for many homes.

Materials Needed for Next Time

Bring along the mileage sheet you have been keeping for your car.

Notes