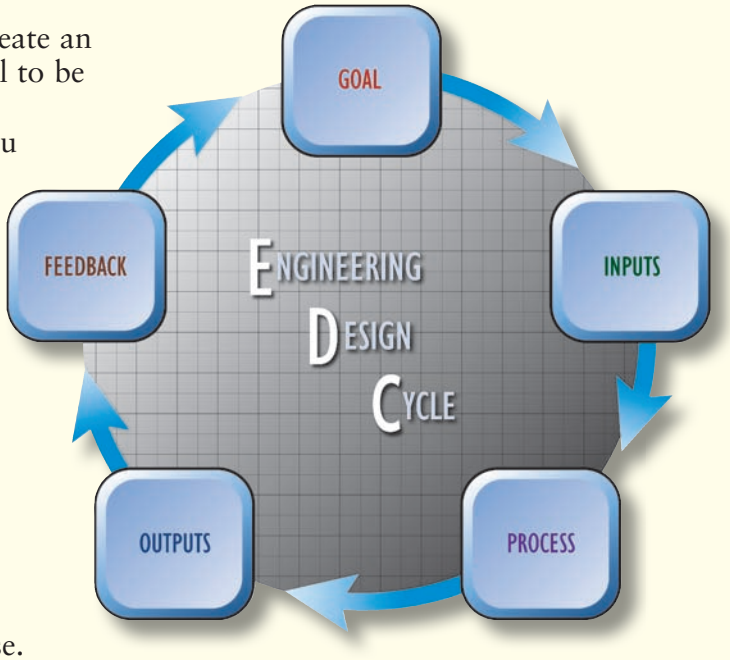
Chapter Mini-Challenge

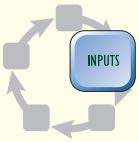
Your challenge for this chapter is to create an appliance package and training manual to be used with the HFE wind generator to supply electricity to a family home. You will have to give some careful consideration to each appliance you select and explain how each one can be used within the system. You will need the physics you have learned so far to help you make your selections and to illustrate how much energy and power each appliance will require. For the *Mini-Challenge* you will complete two very important steps.



1. Develop a preliminary list of appliances that your home might need. You can revise this list later once you have more information about how much power different appliances require. Provide a rationale for the appliances you chose.

2. Create a circuit diagram for your house, including switches, one or more fuses (for safety), and symbols (like the light bulb) to represent the appliances in your list. Assume a single voltage source, which is the windmill generator and batteries. Provide an explanation for how you have designed your circuit based on the electrical requirements of the house.

Go back and quickly read the description of the *Goal* you established at the start of the chapter. Review the *Goal* as a class to make sure you have all of the criteria and necessary restraints. You are now more than halfway through the chapter and you have learned a lot about electricity that will help you design the electrical system for the HFE dwelling.



In addition to the physics you have learned so far, you will be adding most of the *Inputs* for this phase of the *Engineering Design Cycle*. You will be selecting appliances for the appliance list based on your own experience with using electricity. The constraints for this design are the wind generator that will be supplying the electricity and the design goal of creating a universal list of appliances.

Your team should review the physics content from the first six sections to help you compose your appliance package and training manual.

Section 1: You generated electricity and created a circuit that allowed you to light up a light bulb. The transformations of the energy from your body, to the wires, and then to the bulb are very important parts of understanding electricity.

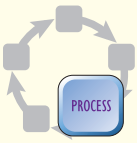
Section 2: You used a physical model for the flow of electricity in a circuit. By acting out the parts of the battery, the electric charge, and the bulb, you now have a very strong understanding of where energy goes when you are working with electricity.

Section 3: In this section, you explored two different types of electrical circuits and compared their similarities and differences. You also learned how to draw a simple circuit diagram for each type of circuit.

Section 4: You explored an electrical "black box" using tools to measure the voltage and current in a circuit. Using this information you learned about resistance in electrical circuits and how it affects the movement of electric charge, or electric current. The relationship among resistance, voltage, and current in an electrical circuit is known as Ohm's law.

Section 5: You learned about load limits and electric power. Part of your challenge requires you to stay within a 2400-W power limit at all times. The physics you learned in this section will help you do that.

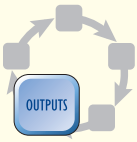
Section 6: You explored the role of simple electrical switches. You also considered the wiring diagram that would provide for the best distribution of electricity in your electrical system design.



The *Process* phase is when you decide what information you have to help you meet the criteria of the *Goal*. Brainstorm with your group to come up with a list of potential appliances. After you have a list of ten or more appliances, have each member of your group put them in order from most important to least important by assigning a number to each one. Add the numbers from each group member to get a total rank value for each appliance. This would be an objective way to select the most important appliances using the input of every group member. Remember to include the reasons why each appliance is necessary.

Your first circuit diagram will become a prototype for your final circuit design. Have each student in the group make a sketch of a circuit diagram including switches, fuses, appliances, and the single voltage source. Review each diagram and discuss the advantages and disadvantages of each one. You could make a pros and cons table to help you keep track of your information. Select the circuit diagram that best meets the requirements of the electrical system design. You might find that you want to combine elements from several circuit diagram sketches.

Finally, remember to include an explanation for the design of your circuit diagram. Describe why you placed switches where you did, how your fuses will protect the system, and why you have the wiring layout that you do. You could also discuss how the design of your circuit will affect the electrical current at different points of the circuit using Ohm's law.



Presenting your information to the class is your *Output* for your *Engineering Design Cycle*. You should have a list of appliances, including the reason why each one is important. You should present your circuit diagram. Finally, you should describe the features of your circuit diagram that will enable it to function properly and meet the design goals.

Your classmates will give you *Feedback* on the accuracy and the overall appeal of your presentation based on the criteria of the *Mini-Challenge*. This *Feedback* will become an *Input* for your final design in the *Chapter Challenge*. You will have enough time to make corrections and improvements, so you will want to pay attention to the valuable information your classmates provide.

At this point, remember to correct any parts of your design that did not meet the design goals of the *Mini-Challenge*.

Finally, identify those goals that have not been addressed through research (*Investigates* and reading) and were therefore not addressed in your *Mini-Challenge*. Look for additional information in the remaining sections that will help you calculate power and kilowatt-hours of electricity consumption. Also, find out how to stay within the power and energy limits set in the original design challenge.