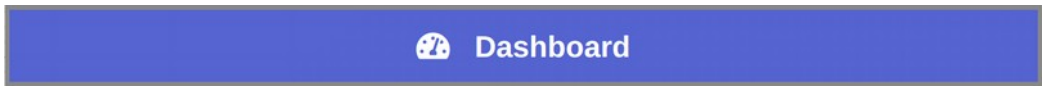
The Internet-based smart home is available at https://smarthome.cemastprojects.org/ **or** https://cemastprojects.org/IBSH/.



Take a moment to explore the functions on this page. You can tap many elements on this screen to control your home, but some elements provide status information only. When you are finished exploring, answer the questions below.

The dashboard shows an interface you might see on a tablet if you lived in a smart home. Based on what you see, what does it mean for a home to be 'smart?'

'Smart' devices have built-in microcomputers / microprocessors which enable them to be automated, and especially to be automated based on sensors or other sources of data.

Which of the functions on this page do you think could offer the greatest convenience? Defend your reasoning.

Which of the functions on this page do you think could help best conserve energy? Defend your reasoning.

Go to the Challenges page.

Complete the activities on screen. Before marking the challenge complete, answer the questions below.

All of the light bulbs produce the same amount of light. Why then does the energy cost of the different light bulbs vary so dramatically?

Each light bulb technology aims to reduce the amount of heat produced by the light bulb so more energy is used for light rather than heat.

In percent of energy use, what is the energy cost of an LED when compared to an incandescent?

15% (9/60)

If you use 4 bulbs in a room, how much energy do you save in a year by converting incandescent bulbs into LEDs?

(Answers will vary.) The energy cost of an LED is 15% of an incandescent. At 2.5 bulb hours per day, the yearly cost savings is $5.13.

HVAC Challenge

Complete the activities on screen. Before marking the challenge complete, answer the questions below.

Why is the recommended indoor temperature lower when it is cold outside and higher when it is hot outside?

The closer your indoor temperature can be to the outside temperature, the less your HVAC system will need to work.

Trend 1:

Explanation:

Trend 2:

Explanation:

The 20° and 100° lines are often mirror images of one another. Why is the shape of the 60°F line so different?

The 60°F line usually zeroes out at the 2 points in the day where the exterior temperature matches the interior temperature.

In what geographic region(s) of the U.S. would you expect to see the lowest energy usage? What region(s) might you expect to have the highest energy usage?

Smart Shopping Challenge

Complete the activities on screen. Before marking the challenge complete, answer the questions below.

Which of the reasons for choosing an appliance seems most reasonable to you? Why do you think that is most important?

Why does the U.S. Government mandate that EnergyGuide tags be made available for most appliances?

Without energy guide tags, it would be difficult for consumers to compare energy costs. Energy costs are often higher than the cost of the appliance itself over time, so energy costs are important!

Energy use is recorded in kilowatt hours (kWh). A clothes dryer typically uses about 4000 watts, so using the dryer for 15 minutes (one quarter of an hour) would be 1 kWh.

If the refrigerator uses an average of 160 watts each hour, how many kilowatts of energy does it use each day?

3.84 kWh per day (160W * 24h/day * 1kW/1000W)

Industrial Energy Challenge

Complete the activities on screen. Before you click the check mark, answer the questions below.

Why do you think the energy profiles of the office building are almost inverted between January and July?

Energy use seems to be fluctuating with outdoor temperature. The warmest part of the day is late morning to mid-afternoon, which reduces energy costs during the winter and increases energy costs during the summer.

In which month is the energy use greatest at each business? Why do you think the energy is highest during those months?

Energy use is greatest during January at the office building and during July at both the grocery store and factory. The grocery store and factory use energy to cool [refrigerators and equipment] during all seasons, but they have to use much more energy to cool during the summer.

How do you think a home's average daily energy usage would compare to that of the office (2,000 kWh), grocery store (400 kWh), and factory (10,000 kWh)?

The average home uses far less (24 kWh per day)

Proceed to the Experiments page.

Home Automation Experiment

Complete the activities on screen. Before you click the check mark, answer the questions below.

What was the plan you developed for your car's arrival?Why was your plan a good one? How would your plan reduce energy use? How would your plan improve convenience?

What are some additional ways automation might be used in your home? Describe why these additions would be energy-efficient and/or convenient.

Water Heater Experiment

Complete the activities on screen. Before you click the check mark, answer the questions below.

Why are heat pumps the most efficient electric water heater?

Heat pumps work like refrigerators, except instead of moving heat from inside the fridge into the room, heat pumps move heat from the room into the water. Moving heat requires 1/3 to 1/2 as much

energy as warming the water directly.

If you watch closely, you can figure out how much water showers, baths, and sinks commonly use. Which flow rates were you able to identify?

While flow rates in your home may vary some from these averages, the shower in this simulation uses 2.1 gallons per minute (gpm) and the bath uses 6.3 gpm. Kitchen sinks commonly have a higher flow rate than bathroom sinks, so the kitchen sink has a flow rate of has a flow rate of 2.2 gpm while the bathroom sink flows at 1.5gpm.

If kWh of electricity cost $0.12 and therms of natural gas cost $0.45, why are natural gas water heaters cheaper to power than electric?

kWh are not equivalent to therms—it takes many more kWh to heat the same amount of water.

Why is heat uptime a valuable number?

Heat uptime describes how much of the day the desired hot water was available. Some smaller, tankless, on-demand water heaters are unable to heat more than a few gallons a minute, so at times when showers and dishwashers are all running, the water heater may be unable to keep up.

Wind Power Experiment

What happens when there is not enough wind? Too much wind?

When there is too much or too little wind, the turbine does not spin.

Where do you get your electricity if there is no power coming from the turbine?

Most homes do not rely exclusively on wind power. Instead, they are connected to the country's electrical grid. This allows them to use other sources of energy when they need them and gives them a place to send any extra power.

What happens when the turbine generates more power than you need? Where does the extra power go?

Most homes do not rely exclusively on wind power. Instead, they are connected to the country's electrical grid. This allows them to use other sources of energy when they need them and gives them a place to send any extra power.

In Part 2, you can see a comparison of how different devices (eg. mobile phone, refrigerator, electric vehicle) use the power generated by your wind turbine. Do these energy use comparisons make sense to you? Why or why not?

This simulation assumes that the home we are looking at has power storage capabilities. In the real world this is rarely true, but is only sometimes a problem. Why would a lack of power storage be a problem? Why is it only a problem sometimes?

Most homes do not rely exclusively on wind power. Instead, they are connected to the country's electrical grid. This allows them to use other sources of energy when they need them and gives them a place to send any extra power.
While this doesn't create a huge problem for consumers, it does create something of a problem for producers. Utility companies must produce the amount of power consumed at any given moment (no more, no less). Unpredictable energy sources like wind make this a more difficult job.

Final Reflections

What kinds of household tasks use the greatest amount of energy?

Based on what you've learned today, what could you do in the next week to reduce your energy usage?