

First Lego League Curriculum - Ontario

Activity Sheet	
Gr 5 - Lesson #1	Building and Setup – Energy Loss
Date:	Name(s):

Check That I'm Done <input checked="" type="checkbox"/>		
<input type="checkbox"/> Commented on my code	<input type="checkbox"/> Modify it task	<input type="checkbox"/> Coding Challenge

Learn

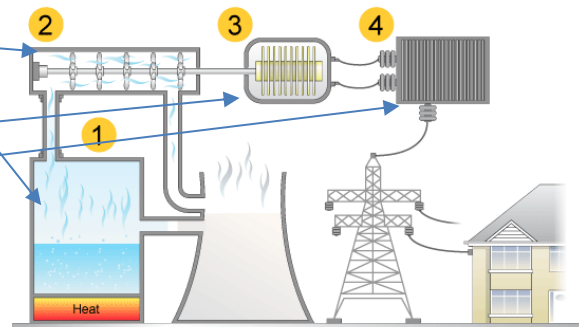
Energy can be described as the potential to do things. For example, moving something or heating it up. But because energy is never destroyed, these things you're doing can also be used again to do *other* things, and are thus forms of energy themselves. Heat can spin a wheel, and motion can cause heat (friction).



The main types of energy are, heat, light, mechanical (movement), sound, chemical and electrical.

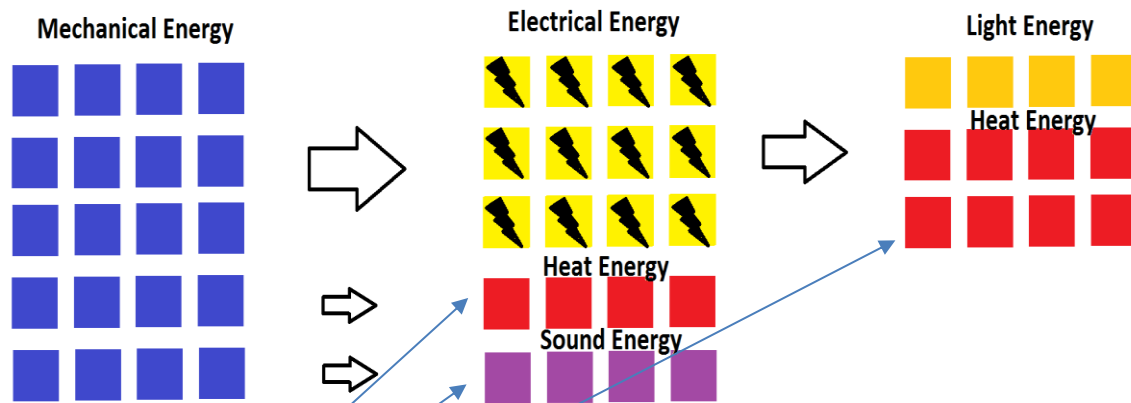
Let's follow some energy though a typical scenario.

Energy stored inside the chemicals in coal can be burned to create large amounts of heat. This heat energy is used to pressurize steam which is then used to spin a turbine (mechanical energy). This mechanical energy is then used to create electric energy using a generator. This electrical energy is sent down wires to your home where it is turned into light, sound, and whatever other forms of energy you need.



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There's also a hidden thing happening in this story we need to mention. EVERY time energy changes forms, from one type to another, its never a pure conversion. For example, when mechanical energy is used to spin a generator only some of that mechanical energy goes into electricity. The generator also makes sound and heat (as a side effect). Efforts are made to reduce this heat and sound but some of it will ALWAYS be there.



When that energy is transformed again, it *also* MUST split up into at least two forms of energy (usually more). For example, using electricity to turn on the lights also heats the light up. This wasted energy is called **energy loss**.

Of course, some devices are better at transforming energy than others. For example, incandescent light bulbs turn 97% of the electricity they receive into wasted heat, where LED's only waste 75%.

The EV3 robot has a battery, LED light, speaker, and electric motors. All of these devices can be thought of as energy transforming machines, taking one form of energy and changing it into another.

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Predict and Plan

Using the forms of energy, heat, light, mechanical, sound, chemical and electrical, write the type of energy each device receives and then produces.

Chemical Energy



Electrical Energy

Energy In

Energy Out

Electrical Energy



Light Energy

Energy In

Energy Out

Electrical Energy



Sound Energy

Energy In

Energy Out

Electrical Energy



Mechanical Energy

Energy In

Energy Out

Which one of these devices do you predict wastes the most energy? Explain your thinking. _____

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Demonstrate/Design/Discover

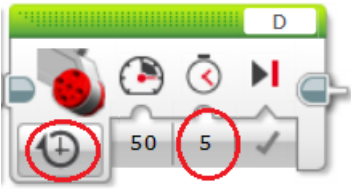
TRY THIS: Plug one EV3 motor directly into another EV3 motor. Spin one motor EXACTLY one rotation and carefully observe the result. What happened? Record your results in the record section.

- ✓ You will be creating several programs that demonstrate your understanding of energy transformation.
- ✓ Below is the information you will need to know in order to create each program correctly and answer the discussion questions.
- The EV3 battery contains 66.4 KJ (66,400J) of energy when fully charged.
- The LED uses ~10J of energy every 5 seconds
- The speaker ~20J of energy every sound
- The motor (at 50% power) ~100J of energy every 5 seconds

#	Program Description
1	Program your robot to use the following energy in order: Mechanical energy (200J) then Sound Energy (20J) then Light Energy (20J).
2	Create a program that uses increasingly more energy starting with 10J every 5 seconds and ending with 130J every 5 seconds.
3	Create program that uses the most amount of energy possible in a 5 second period. Hint: Try using the steering block, and changing the power.

Tips: You will need to use the “large motor” block and set it to run for 5 seconds (see below).

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To turn your light off, use a wait 5 second wait block, and another Brick Status Light Block.

The Joule is a unit of energy just like grams are a unit of mass. 100J is about as much energy as it takes to lift an apple onto a desk.

Record

Describe what happened when you connected the motors directly to each other. _____

Questions

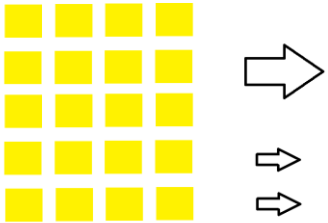
Question 1 Science	Fun fact, motors and generators are the same thing, just backwards. Using the “Energy In, Energy Out” activity as a guide, explain the energy transformations that took place when you connected two motors directly to each other.
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The mechanical energy from one motor, was transformed into electrical energy in the wire, and then the other motor transformed it back into mechanical energy.

Question 2 Science	When you spun the motor exactly around once, how far did the other motor spin? Explain why they weren’t identical. Use energy loss in your answer.
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Not all of the mechanical energy from the one motor was converted into electrical energy in the wire. Both the generator and the motor created heat and sound which caused energy loss.

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Question 3 Science	Which would have more energy loss, a hybrid car that uses a gas motor to charge a battery, or a pure electric car? The hybrid car would have more energy loss because each time energy is transformed, you lose some of it.
Question 3 Science	Calculate total energy lost in program number one if all the devices wasted half the energy they used. $(100J+20J+20J)/2 = 120J$
Question 5 Science	Why do you think that the motors use the most amount of energy? Draw a chart of where you think the 100J of energy went to. <div style="display: flex; align-items: center;"> <div style="margin-right: 20px;"> <p>Electrical Energy (to motors)</p>  </div> </div> <p>Motors use the most amount of energy because 1) its harder to make things move then light up or create sound 2) motors waste more energy by creating heat <i>and</i> sound.</p>
Extension Coding and Science	How long could program number 3 last before a full battery would die? $(66,400/130J/5sec) \times 5sec = 2,554 \text{ sec}$ or 42min Create a program that uses exactly 370J of energy.