THE GREEN MICRO CYCLE

The Pedal as a Transfer of Energy

In this lesson, students learn about energy transference and examine a real-world example using the Green Microcycle. Furthermore, students then consider how energy transference differs for various sources of current, including motion/pedal power, coal generation and solar. Depending on student preparedness & understanding, relative efficiency can be additionally addressed.

Grade: 4th Grade	Lesson Length: 45 minutes
Standards	4-PS3-2: Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents. 4-ESS3-1: Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment. DSCI-ESS3.A:
Objectives	● Students will be able to identify and define both the atmosphere and hydrosphere with 80% accuracy. ● Students will be able to describe the way in which both the hydrosphere and atmosphere interact with one another, verbally and in written form with 80% accuracy.
Materials/Technology/Equipment	✓ One Green Microcycle ✓ Writing materials (Pencils/pens) ✓ Blank Paper (Enough for entire class) ✓ Cereal box or printouts from http://www.cheerios.com/en/Products/Cheerios.aspx

Activity Structure

Opening Discussion/Introduction **5 minutes**

Students begin the lesson by engaging in a class discussion:

- Students will begin brainstorming the means by which energy transference occurs.
- Will also look at the question: How does energy transfer from object to object?

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***The discussion should consolidate around heat, light, sound, motion and current. It may be useful to probe for example, e.g. "listening to music" or "turning on a light bulb"**

Lesson minutes **30**

Explore energy transference:

- Ask if energy always has the same state, e.g., does light energy always remain as light energy?
    - Seek a student to identify an instance of when energy is transferred through various forms.
- Get concrete. Ask: what happens when one eats breakfast? Where do the cheerios go? What happens with them? What are they converted into? Touch upon the calorie as a unit of energy.

Pedal Power

- **Ask for a volunteer. The volunteer will pedal the bike (as a demonstration for the class) for 60 seconds.**
- **While the volunteer pedals, track energy output on the watt meter.**
- **Write this output on the board.**
- **When finished, thank the volunteer and ask the volunteer to try to describe what happened to the cheerios they ate. What was their cheerio-energy used to do, what did it convert into, and where did it go? If hooked to the grid (through the bike), the energy is now electrical current.**

All Part of the picture

- **Ask students, as their desks, to draw draw a diagram of the bike, and the energy it produces.**
- **Now, challenge the class to figure out where the energy came from to produce the cheerios. They should add that into their picture. Start by asking students about what's in cheerios. The nutrition label may be helpful at this stage (e.g., "ingredients"). Wheat (should be a primary answer). And how is wheat grown? Light energy!**
- **Thus, the light energy stored by wheat is later converted by the human body into expendable motion, as calories, that the exercise bike then converts, through motion, into current - which is transferred elsewhere.**

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- **Who can find the calorie information on the box label? What does that tell us about the food(s) one eats? Engage students in describing how this relates to energy transference.**

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Wrap-up **5 - 10 minutes**

- **Ask students to name the ways in which energy can be transferred; write these on the board; ask for follow-on examples of objects that they believe transfer energy from one location to another.**
- **Ask about efficiency. For example, is the transference of energy from breakfast cereal, through an exercise bike, to the grid, efficient? How might they know and/or test if it is more efficient than, say, the transference of sunlight energy into current in the grid?**

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<tr><td>After the Lesson</td><td></td></tr>
<tr><td>Homework</td><td>Options:
➢ Draw a picture of four instances in which energy is converted from one form into another. Include heat, light, motion, sound and current in your diagram.
➢ Draw and/or create an illustration for the each of the following means for transferring energy from its source to its destination:
● Mining coal to produce current by way of steam
● Eating cereal to produce current by way of pedal power
● Capturing sunlight to produce current by way of solar cells</td></tr>
<tr><td>Extension Activities</td><td>● Provide students with various objects (bike, flashlight, iPhone) and ask for them to identify the chain of energy transference.
● Engage students in determining how they might measure the efficiency of energy transference. Of the following, how would they know which is most efficient?
○ Mining coal to produce current by way of steam</td></tr>
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	○ Eating cereal to produce current by way of pedal power ○ Capturing sunlight to produce current by way of solar cells