



6TH GRADE
STEAM & SOCIAL STUDIES





POTENTIALLY PERPETUAL

Driving Question:

How can knowledge of potential and kinetic energy help a community transit system go green?

Materials Needed:

Science notebook or sketchpad, writing utensil, magnets, small turbines, model vehicles, small gears, other prototyping materials such as glue, small balsa rods, etc., computer design program (in place of physical prototypes)

In this lesson, students will:

- use knowledge of kinetic and potential energy to brainstorm ideas to make a community transit system more sustainable.

National Learning Standards:

Science: MS-PS2-3; MS-PS3-1; MS-PS3-2; MS-PS3-5
Social Studies: VIII,a
Art: Cr1.1.6a; Cr2.1.6a; Cr2.3.6a; Pr5.1.6a



SPINNING THE COCOON

Begin by watching a quick [video](#) on potential versus kinetic energy with your students. After the video, tell students that everything has energy – either kinetic energy or stored as potential energy. Also, energy changes based on how it is acted upon by forces such as gravity. Ask students to brainstorm the ways forces change energy and write their ideas on the board. Some ideas that should be included are gravitational, frictional, magnetic and muscular force.

Explain that most energy we use to power homes or vehicles comes from the movement of gasses being captured by turbines or pistons. In gasoline powered engines, the combustion of gasoline produces a gas that is under pressure and moves pistons in the engine. As far back as steam locomotives, the steam energy produced from burning coal was able to move an entire train. To give an example of how a moving turbine converts energy from wind, water or gas, watch a short [video](#). Discuss how turbines can be used for more than just energy production in homes. Ask students to brainstorm ideas for how air movement and turbines can be used to help capture energy to power vehicles such as trains and busses.

KERNEL OF KNOWLEDGE

Turn your engine off at red lights!
Idling for 10 seconds consumes more
fuel than re-starting your engine.



METAMORPHOSIS

Student groups will get together to brainstorm ideas for how to create a city bus or train that runs, at least partially, on green energy. Students should create a concept that uses turbines and gears to either completely power a vehicle, or to power a vehicle after it has been started by a battery or other power source.

Before starting a prototype, students can draw a plan illustrating how to start the vehicle and also how turbines or pistons might be placed to capture energy. An example of student ideas might be placing turbines on top of a bus where the wind from the bus's movement would cause it to spin, allowing the turbine to capture more energy for use by the bus's engine. Students can build models of their energy producing system and attach them to model cars or put them on model wheels and chassis to test them on a downhill ramp. Students can make modifications to their prototypes to increase their concept's potential for perpetual motion.

THROUGH THE LENS



Have students work in small groups to create three-minute videos on Flipgrid that tell a story about green transit systems and why they are needed. The films can be narrative or documentary. Stage a screening of the films in the classroom with popcorn or another treat, and ask students to lead short Q&A sessions after their respective films to share what they learned from making their film and to promote class dialogue about ways to increase green transit systems.

UPCYCLE

With students still in groups, ask them to identify the reasons why mass transit, like subways and buses, have become available in urban areas. They can write their reasons on sticky notes and place their group's ideas on the board or share with the class as they are called on. Students should understand that there is a correlation between the population and how many public transit options are available. Next, ask students to brainstorm with their group ways to reduce carbon emissions by utilizing the ideas generated from the previous science lesson. Have them consider why it would be important to improve air quality in high-population areas and why society and government should care. Their group's responses can be recorded on sticky notes or shared verbally.



eARTh

Reducing our carbon footprint is important for many reasons, and the choices that we make regarding transportation have a huge impact on this. After discussing the importance of mass transit and carbon footprint reduction, have the students brainstorm other transportation methods that are greener. Some examples might include bicycle, scooter, skateboard, car pool or walking. Allow the students to call out their examples and write them down on the board.

Now, either in pairs or individually, tell the students that they are going to create an advertisement for a green form of transportation. They can either use one of the examples that were previously discussed, or they may invent their own. The sky's the limit - there are no wrong answers. Allow them to be as creative as possible with this! To begin, they should create sketches of their ideas for green transportation. When they decide on their final product, they should create a drawing, or if possible, a prototype of their form of green transportation. When finished, have them record a commercial promoting their design. Have them pretend they are selling their product to a green transportation company, so they should address how their transportation is good for the environment as well as aesthetically pleasing. If you are not able to create a commercial, have the students make an advertising poster for their design highlighting the same points.

Community Garden

- As a class, create posters focusing on the importance of mass transit to reducing our carbon footprint. Contact the nearest mass transit authority and ask if you can hang the posters inside the cars or display them on the walls of the waiting areas.



CAREER CONNECTION

Transit or Light Rail Operator - These operators drive public transit vehicles that operate on rail systems, including subway trains, trams and elevated trains. Operators are responsible for making sure that passengers get on and off vehicles safely. The education needed for this job includes a high school diploma or GED.

Engineer in Renewable Energy - This position is part of the growing sector of green jobs that involve environmentally conscious energy production. These individuals maximize the energy potential of clean energy sources including wind, solar, geothermal and hydropower. Renewable energy engineers monitor and develop alternative energy outputs. For this, you need a bachelor's degree and various licenses.



CAREER HIGHLIGHT

Alfred Ely Beach was an American inventor who designed New York City's earliest predecessor to the subway system that we know today. Created in the 1860's, it was called the Beach Pneumatic Transit. Beach proposed the underground transportation system to help relieve traffic congestion in New York.

