



## Lesson Plan

Grade/Subject

8 Integrated Science

Title

*Electric/Solar Cars, an option?*

Core:

8.4.3 & 8.4.2

**Standard/Objective**

**8.4.2 Engage in argument** supported by evidence about the effect of per-capita consumption of natural resources on Earth's systems. Emphasize that these resources are limited and may be non-renewable. Examples of evidence include rates of consumption of food and natural resources such as freshwater, minerals, and energy sources. (ESS3.A, ESS3.C)

**8.4.3 Design a solution** to monitor or mitigate the potential effects of the use of natural resources. Evaluate competing design solutions *using a systematic process to determine how well each solution meets the criteria and constraints of the problem*. Examples of uses of the natural environment could include agriculture, conservation reports, recreation, solar energy, and water management. (ESS3.A, ESS3.C, ETS1.A, ETS1.B, ETS1.C)

**Lesson Performance Expectations (description):**

Students will identify some of the differences between the energy sources of electric vs fossil fuel cars. Students will test car design and solar panels to find the best angle to attach the solar panel to the car.

**Materials:** Pictures of the back of an electric car and a regular car, Solar car kit or panels, voltmeter, small light bulbs

**Time:** 40 minutes

**Teacher Background Information:**

Interactions of matter and energy through geologic processes have led to the uneven distribution of natural resources. Many of these resources are nonrenewable, and per-capita use can cause positive or negative consequences. Global temperatures change due to various factors, and can cause a change in regional climates. As energy flows through the physical world, natural disasters can occur that affect human life. Humans can study patterns in natural systems to anticipate and forecast some future disasters and work to mitigate the outcomes.

**Student Background:** Energy is transferred, circuits

**Student Performance**

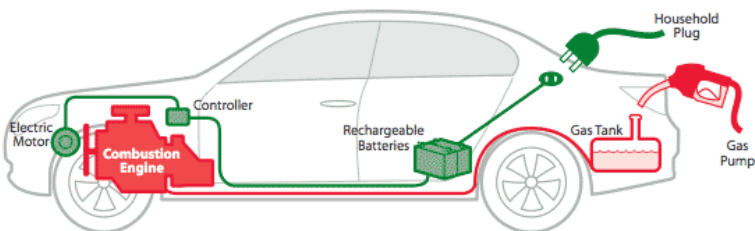
**Phenomenon:** *Observation of event, data or other evidence of activity.*



<https://www.engineersgarage.com/electric-cars/>

### Electric vs. Gasoline

No Tailpipe Emissions		Greenhouse Gases/Pollution	
Utility Company		OPEC	
100+/- Mile Range		300+ Mile Range	
Hours to Recharge		Minutes to Refuel	
2 cents per mile		12 cents+ per mile	



- A. Show the students pictures of two cars from the back. One car is electric and the other is a fossil fuel powered car. Also show the internal comparison. Ask the students to make observations and ask 3 questions about what they see.
- B. Show the chart comparing the lifetime emissions of a fossil fueled car and a battery electric vehicle.
- C. Electric cars must get their power from somewhere. List 3 sources.
- D. Why is it important to know the source of the power?
- E. Is solar power an option for cars or power?
- F. **First option:** Give each group of students a solar car kit, have them build their cars and test, using the voltmeter, the best angle to set their solar panel at.
- G. Make adjustments to the design.
- H. Race the cars.
- I. **Second option:** Give each student team a couple of solar panels, small LED light bulb and a voltmeter. The students will investigate how to get the most voltage out of the panels and then light the bulbs. Groups can combine to increase voltage.
- J. Lead the students in a discussion of alternative energy sources.
- K. Students will complete the worksheet.

**Teacher Resources:**

1. [Website](#) comparing BEV and fossil fuel cars.
2. [Website](#) on electric vs hybrid cars

### Assessment of Student Learning.

1. Electric cars are growing in popularity for a variety of reasons. What are three?
  - a. They are less expensive.
  - b. They produce little or no pollution.\*
  - c. They are larger and heavier than gas powered cars.
  - d. They have few moving parts than gas powered cars.\*
  - e. A variety of renewable sources may create the electricity.\*
  - f. They come in more styles and types than are currently available.
  
2. What are limitations of currently available electric cars compared to gasoline powered cars? Choose two.
  - a. Longer braking time to stop.
  - b. Larger, roomier interior space.
  - c. Longer time needed to recharge.\*
  - d. Slower acceleration as they start.
  - e. Reduced range without a recharge.\*
  
3. Electric cars are not currently all running on solar energy. Much of the electricity produced in the US is in coal or natural gas-fueled power plants. When will electric cars be truly environmentally friendly?
  - a. When enough people have purchased them.
  - b. When they are driven to national parks and used for camping.
  - c. When alternative energy sources are used to produce electricity.\*
  - d. When electric cars can run on any fuel without creating pollution.
  
4. Creating a model car using a solar panel relies on a motor and connection of the motor to the wheels. What must be reduced to get the greatest distance and speed?
  - a. Friction\*
  - b. Motor size
  - c. Size of solar panel
  - d. Wheel size

Students will Investigate the sources of electric/solar power within Utah. Students will investigate the materials that it takes to make the batteries and solar panels. Go on a field trip to the Rio Tinto facility. Contact Landon Freter at [lfreter@rsl.com](mailto:lfreter@rsl.com)

## Title: Solar Cars, are they an Option?

Name \_\_\_\_\_

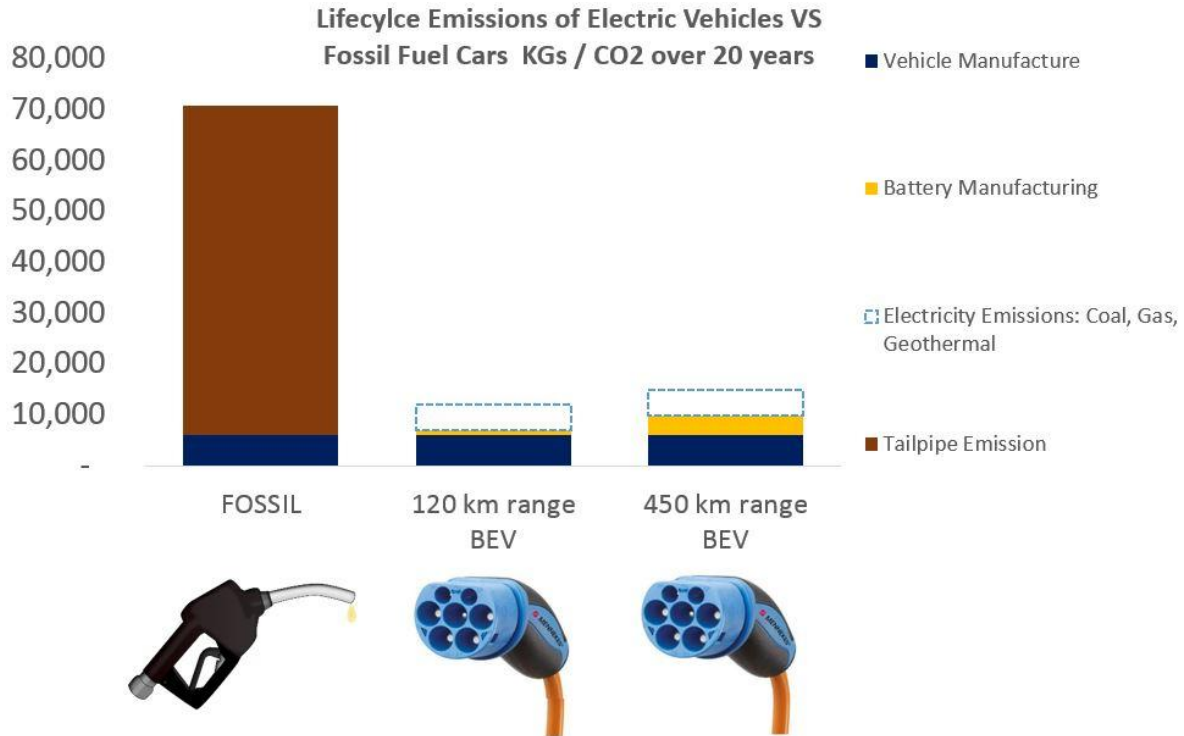
Phenomenon: Look at the two pictures and make observations. Ask three questions about what you see.



1.

2.

3.



<https://ecotricity.co.nz/cradle-to-grave-emissions/>

Analyse the chart. (BEV stands for Battery Electric Vehicle)

What are two ideas that stand out to you? After you write them down, discuss with your group your ideas.

- 1.
  
- 2.

Where does the power come from for the Fossil fueled cars?

Where does the electricity come from for the BEVs? List 3 possible sources

- 1.
- 2.
- 3.

Why is it important to look at the source of the electricity for the BEVs?

How can the use of Solar Energy minimize the potential effects of the use of natural resources like fossil fuels on air?

Sketch your circuit that successfully lights the LED bulb or turns the motor. Use the voltmeter to see how much power is being generated.

Sketch the circuit that produced the most voltage.