



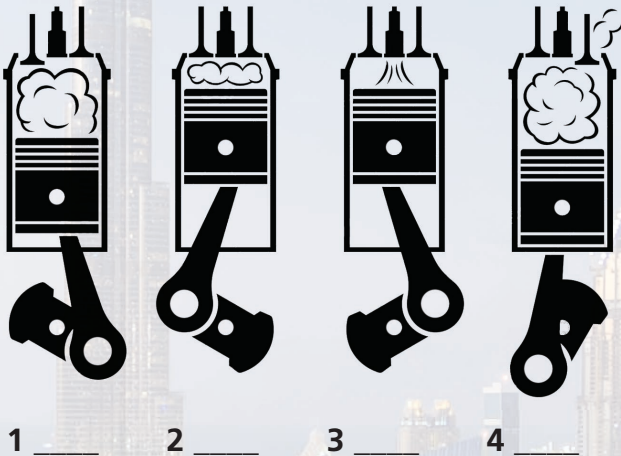
GRADES 6-8

ACTIVITY 3 ROOM FOR HOPE

Part 1. In *Planet Power*, we learn that a typical automobile engine is only about 30% efficient. That means only about 30% of the energy produced by the engine is transferred to kinetic energy that moves the automobile — the rest is wasted. When you realize that transportation accounts for about a third of our total fossil fuel consumption in the U.S., you can see that we have a lot of room for improvement! For example, a typical electric car is more than 70% efficient. And the motors on Solar Impulse 2 achieved a record 97% efficiency! To understand the difference, let's take a look at how these engines work.

The internal combustion engine used in most cars, and even in some planes, works in a four-step process shown in the illustrations below. Match each description below to the correct step in the process.

Four-stroke cycle



- The piston pushes up to compress the air-fuel mixture.
- A mixture of air and fuel is drawn into the combustion chamber. The piston is down.
- Burned gases are pushed out into the exhaust pipe. In a jet plane, this release of gases propels the plane forward.
- A spark causes the compressed mixture to explode, which forces the piston back down and turns the crankshaft.

In an internal combustion engine, which relies on both chemical reactions and mechanical movement, there are many places to lose energy – friction among the parts, temperature difference between the fuel and the air, energy needed to create pressure build-up, etc. Just imagine that a little bit of energy is lost during each step. Then multiply that lost energy by the 6 to 8 cylinders that power the engine of a large car. It all adds up!

Part 2. By comparison, a solar-powered motor is much simpler, with fewer moving parts, and no need for heat or pressure changes. Photovoltaic cells convert light to electricity spontaneously, and the electric energy flows along a circuit to the motor where it is converted to kinetic energy.

Check out the image of a simple solar engine at www.instructables.com/id/The-Easter-Solar-Engine. Your teacher may ask you to build a solar engine using these directions.

Even if you haven't built a solar engine, you can use these schematics to analyze how one works. This solar engine uses a rechargeable battery to store energy. Draw arrows on the schematic to illustrate the flow of electrical current in these different circuit configurations:

- When the motor is being run directly by energy from the solar cell.
- When the battery is being charged.
- When the motor is running on battery power.

