



## Components

	NAME	DESCRIPTION	AUDIENCE
	<i>Analysing energy</i> teacher guide	This guide explains how to use a learning object and associated fact sheet and worksheet to develop students' understanding of energy transformations in an electric vehicle.	teachers
	<i>Take it for a drive</i> learning object	This learning object contains an eight-minute video of a journey in an electric vehicle. An animated dashboard provides information and data to investigate relationships between road conditions, accessory use and energy consumption.	students
	<i>Tracking energy use</i> worksheet	This worksheet accompanies the learning object, <i>Take it for a drive</i> . Students use a graph of energy consumption versus time for the journey to explain energy transformations that occur in the vehicle.	students
	<i>Renewable energy vehicle</i> fact sheet	This fact sheet provides background information on the REV project at UWA and some characteristics of electric vehicles.	students
	<i>Lego car</i> video	This video demonstrates how the motor in a Lego car can be used to generate electricity, to model regenerative braking.	teachers

## Purpose

To build students' **Explanations** of energy transformations that occur in an electric vehicle.

## Outcomes

Students:

- understand energy can be transformed from one form to another in useful and non-useful ways;
- create energy flow diagrams to show how energy is transformed from one form to another, including where energy is 'wasted' as heat;
- understand heat energy is always produced during energy transformations;
- analyse and explain energy transformations in an electric vehicle and identify the main uses of this energy;
- explain the original energy source for an electric vehicle may be renewable or non-renewable;
- describe how efficient running of an electric vehicle depends on driving conditions;
- describe regenerative braking in an electric vehicle; and
- describe advantages and disadvantages of using an electric vehicle.

## Activity summary

ACTIVITY	POSSIBLE STRATEGY
Students read the fact sheet, <i>Renewable energy vehicle</i> , for background information on electric cars.	individually
Teacher may demonstrate how the motor in a Lego car may be used to generate electricity, to model regenerative braking. Alternatively students may perform this activity themselves.	teacher demonstration or student activity
Students use the learning object, <i>Take it for a drive</i> , to analyse an eight-minute journey in an electric vehicle. Students should pause the video to add notes and answer questions on the worksheet, <i>Tracking energy use</i> .	individually or in pairs

## Teacher notes

The learning object, *Take it for a drive*, contains an eight-minute interactive video and animation of an electric car driving from The University of Western Australia into Kings Park. An animation shows students a view of the road and a dashboard developed for this resource. The dashboard is 'live' and responds to driving conditions and accessory use.

Students should use the worksheet, *Tracking energy use*, while watching the animation. Take it for a drive. The worksheet contains a graph showing the relationship between battery charge (energy consumption) and time. In the worksheet students are asked to relate what they see in the animation to the graph and then answer questions about how energy is transformed in an electric vehicle.

This animation was based on data obtained from the REV project's electric Getz. Changes in energy consumption closely mirror those seen in reality.

The fact sheet, *Renewable energy vehicle*, contains information on the REV project and some important considerations when driving an electric vehicle.

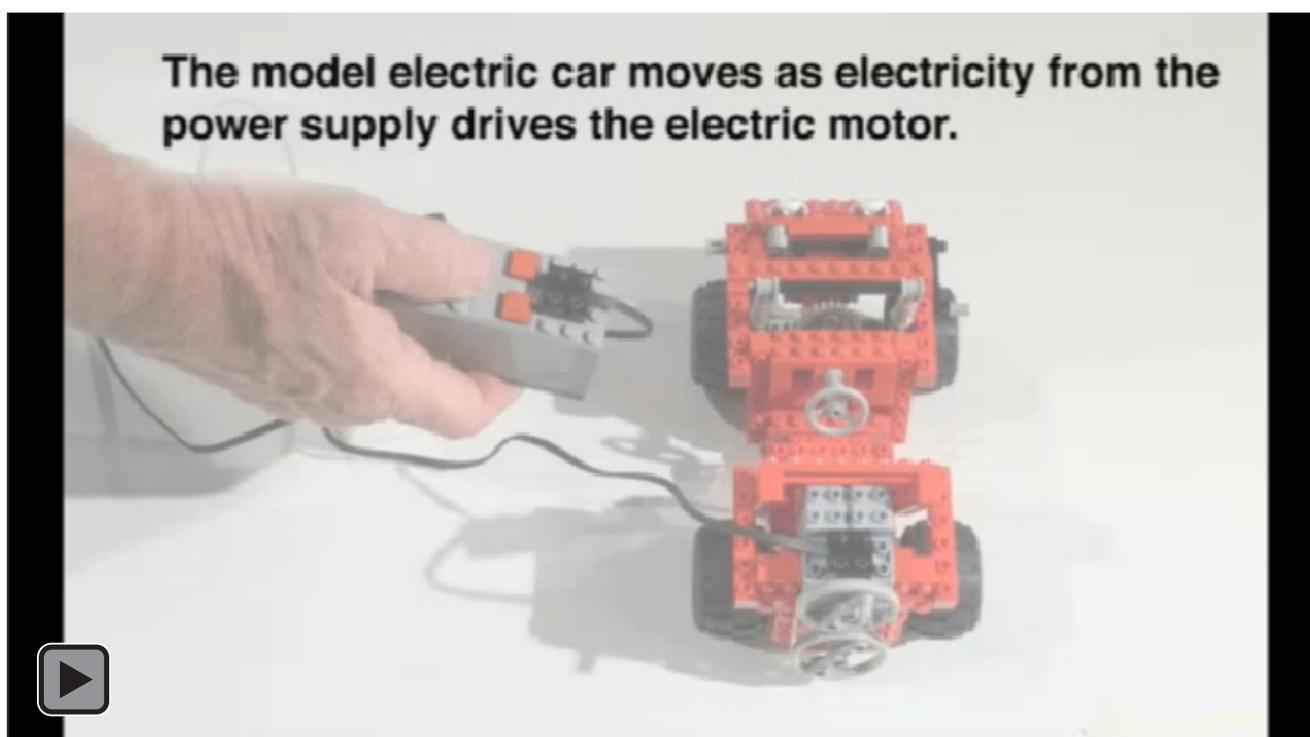
### Regenerative braking

Most simple electric motors use interaction between electric current supplied to the motor, and a magnetic field within the motor, to produce motion. If there's no supplied current, but the motor shaft is rotated, the motor can work as a generator.

This is used in electric vehicles. When current from batteries is cut to the motor, during braking, motion of the vehicle turns the motor shaft and produces electricity that can 'top up' batteries.

A short video shows how electricity is produced from a motor when a model electric car is pushed along.

This may be demonstrated to students, or they can be challenged to build Lego cars and perform the activity themselves.



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Web: [spice.wa.edu.au](http://spice.wa.edu.au)  
Email: [spice@uwa.edu.au](mailto:spice@uwa.edu.au)  
Phone: (08) 6488 3917

Centre for Learning Technology (M016)  
The University of Western Australia  
35 Stirling Highway  
Crawley WA 6009

## Technical requirements

The teacher guide, worksheet and fact sheet require Adobe Reader (version 5 or later), which is a free download from [www.adobe.com](http://www.adobe.com). The worksheet is also provided in Microsoft Word format.

A modern browser (e.g. Internet Explorer 9 or later, Google Chrome, Safari 5.0+, Opera or Firefox) is required to view the learning object.

## Acknowledgements

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For more information on the REV project, see <http://www.therevproject.com>

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## Associated SPICE resources

*Energy transformations 3: Analysing energy* may be used in conjunction with related SPICE resources to address the broader topic of energy transfer, transformation and conservation.

DESCRIPTION	LEARNING PURPOSE
<i>Energy transformations (overview)</i>	
<i>Energy transformations 1: Comparing cars</i> A video compares conventional internal combustion powered cars to REV vehicles and introduces some associated energy transformations.	<b>Engage</b>
<i>Energy transformations 2: Investigating energy</i> Students make model vehicles that use different energy sources to investigate energy transformations.	<b>Explore</b>
<i>Energy transformations 3: Analysing energy</i> Students develop explanations of energy transformations by analysing data from a simulated electric vehicle journey.	<b>Explain</b>
<i>Energy transformations 4: Car choices</i> Students use data about a range of conventional, electric and hybrid vehicles to decide and communicate which car is suited to specific purposes.	<b>Elaborate</b>