Royal Academy of Engineering

THIS IS ENGINEERING

Teacher Guide

POWER UP!

This STEM resource looks at different types of energy, energy in engineering, the importance of electricity and how this is generated. It investigates different types of renewable energy through a number of hands-on and practical activities.

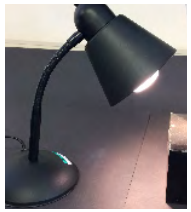
Curriculum links

Science: Energy stores and transfers, Generating electricity
Maths: Problem solving using percentages, Area and perimeter
Design technology: Identify, solve and reformulate given design problems

SOLUTIONS ENERGY CIRCUIT

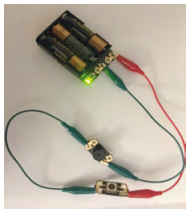
Solutions are guides. You may have different energy stores and transfers based on discussions with your pupils.

Lamp powered by mains supply and a black box with a thermometer inside



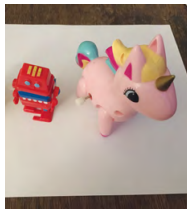
TRANSFER electrically (from the power socket) → TRANSFER radiation (through light and infrared waves) → ENERGY **Thermal store** (in the black box)

Buzzer connected to a battery pack and a switch



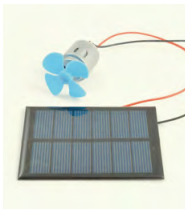
ENERGY **Chemical store** (in the battery) → TRANSFER electrically → TRANSFER radiation (sound) → ENERGY **Thermal store** (in the room)

Wind-up toys



ENERGY **Chemical store** (in your body) → TRANSFER mechanical → ENERGY **Elastic store** (in the wind up toy) → TRANSFER mechanical → ENERGY **Kinetic store** (in the moving toy)

Solar-powered fan



ENERGY **Nuclear store** (in the sun) → TRANSFER radiation → TRANSFER electrical (in the circuit) → ENERGY **Kinetic store** (in the motor and fan blades)

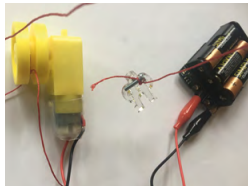
Yo-yo

ENERGY **Gravitational store** → TRANSFER mechanical → ENERGY **Kinetic store** → TRANSFER mechanical → ENERGY **Gravitational store**

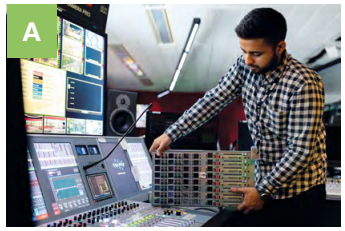
Hour glass

ENERGY **Gravitational store** (in the sand in the hourglass) → TRANSFER mechanical → ENERGY **Kinetic store** (in the moving sand)

An electric motor is used to raise a small mass attached to a piece of string



ENERGY **Chemical store** (in the battery) → TRANSFER electrically → ENERGY **Kinetic store** (motor) → TRANSFER mechanical → ENERGY **Gravitational store** (to lift the mass)



ENERGY IN ENGINEERING

A. BBC broadcast engineer manages sound
B. Flying drone
C. Energy engineers outside plant
D. Aerodynamics engineers testing race cars
E. Mechanical engineer with farming robot
F. Design engineer for sustainable farming
G. Sports engineer testing tennis technology
H. Civil engineer creating theme park rides
I. Mechanical engineers on a solar farm
J. Chemical engineer developing clean energy batteries
K. Orthotics engineer makes personalised leg splint

There are no set solutions here.

Decide on energy stores and transfers based on discussions about what is happening in the images with your students.

HOW MANY ROWERS DOES IT TAKE TO POWER...?

One rower will output 100.8 watts
20 rowers could generate enough electricity to charge your phone.
Approximately **40,000 rowers** to power the house.

RESOURCES THAT GENERATE ELECTRICITY

Solar: 105 kWh
Other: 175 kWh
Coal: 245 kWh
Bioenergy: 315 kWh
Gas: 1435 kWh
Wind: 455 kWh
Nuclear: 455 kWh

SOLAR POWER

190 watts of energy will be generated from a 1 square metre solar panel.
4,750 watts of energy will be generated from 5m x 5m of solar array.
2,280 watts of energy will be generated from 4m x 3m solar array.
2,600 watts of energy will be generated from 7m x 2m solar array.

Royal Academy of Engineering

The Royal Academy of Engineering is harnessing the power of engineering to build a sustainable society and an inclusive economy that works for everyone.

In collaboration with our Fellows and partners, we're growing talent and developing skills for the future, driving innovation and building global partnerships, and influencing policy and engaging the public.

Together we're working to tackle the greatest challenges of our age.

What we do

Talent & diversity

We're growing talent by training, supporting, mentoring and funding the most talented and creative researchers, innovators and leaders from across the engineering profession.

We're developing skills for the future by identifying the challenges of an ever-changing world and developing the skills and approaches we need to build a resilient and diverse engineering profession.

Innovation

We're driving innovation by investing in some of the country's most creative and exciting engineering ideas and businesses.

We're building global partnerships that bring the world's best engineers from industry, entrepreneurship and academia together to collaborate on creative innovations that address the greatest global challenges of our age.

Policy & engagement

We're influencing policy through the National Engineering Policy Centre – providing independent expert support to policymakers on issues of importance.

We're engaging the public by opening their eyes to the wonders of engineering and inspiring young people to become the next generation of engineers.

Royal Academy of Engineering
Prince Philip House
3 Carlton House Terrace
London SW1Y 5DG

Tel: +44 (0)20 7766 0600
www.raeng.org.uk
Registered charity number 293074