



Accredited

SCIENCE LEVEL 1/2

UNIT R071 - HOW SCIENTIFIC IDEAS HAVE AN
IMPACT ON OUR LIVES

MODULE 1 - USING ENERGY

DELIVERY GUIDE

VERSION 2 DECEMBER 2012



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INTRODUCTION

This Delivery Guide has been developed to provide practitioners with a variety of creative and practical ideas to support the delivery of this qualification. The Guide is a collection of lesson ideas with associated activities, which you may find helpful as you plan your lessons.

OCR has collaborated with current practitioners to ensure that the ideas put forward in this Delivery Guide are practical, realistic and dynamic.

We appreciate that practitioners are knowledgeable in relation to what works for them and their learners. Therefore, the resources we have produced should not restrict or impact on practitioners' creativity to deliver excellent learning opportunities.

Whether you are an experienced practitioner or new to the sector, we hope you find something in this guide which will help you to deliver excellent learning opportunities.

If you have any feedback on this Delivery Guide or suggestions for other resources you would like OCR to develop, please email resourcesfeedback@ocr.org.uk.

PLEASE NOTE

The activities suggested in this Delivery Guide **MUST NOT** be used for assessment purposes. (This includes the Consolidation suggested activities).

The timings for the suggested activities in this Delivery Guide **DO NOT** relate to the Guided Learning Hours (GLHs) for each unit.

Assessment guidance can be found within the Unit document available from www.ocr.org.uk.

OPPORTUNITIES FOR ENGLISH AND MATHS SKILLS DEVELOPMENT

We believe that being able to make good progress in English and maths is essential to learners in both of these contexts and on a range of learning programmes. To help you enable your learners to progress in these subjects, we have signposted opportunities for English and maths skills practice within this resource. These suggestions are for guidance only. They are not designed to replace your own subject knowledge and expertise in deciding what is most appropriate for your learners.

KEY



English



Maths

UNIT R071 - HOW SCIENTIFIC IDEAS HAVE AN IMPACT ON OUR LIVES

Guided learning hours : 60

AIM OF THE UNIT

In this unit, learners explore the way in which applications of science have an impact on our lives. The unit has been divided into three teaching modules:

MODULE 1: USING ENERGY
MODULE 2: KEEPING HEALTHY
MODULE 3: MATERIALS FOR A PURPOSE.

In each module there are opportunities to undertake practical work and develop skills in analysing, interpreting and evaluating evidence which will build towards the assessment of an investigation in Unit 3. Working with evidence is also assessed in Unit 2.

Learners produce a portfolio of work incorporating nine assessment tasks which are internally assessed and moderated by OCR. The tasks for each module are marked out of 40, giving an overall total for the unit of 120 marks.

The unit is weighted at 50% of the qualification and requires 60 GLH.

MODULE 1 - USING ENERGY

LO1	CONTENT
<p>Be able to analyse personal and social choices related to energy supply</p>	<p>Learners should be taught the following content:</p> <p>that energy transfers can be measured and their efficiency calculated, which is important in considering the economic costs and environmental effects of energy use, ie:</p> <ul style="list-style-type: none"> • different sources of energy: primary and secondary • renewable and non renewable fuels • energy density, ease of transportation and cost • environmental effects of energy use <p>that electrical power is readily transferred and controlled, and can be used in a range of different situations, ie:</p> <ul style="list-style-type: none"> • production of electricity using different energy sources, to include fossil fuels, nuclear fuels and renewables • distribution of electricity by the National Grid • the economic costs and environmental effects of electricity use <p>how and why decisions about science and technology are made, including those that raise ethical issues, and about the social, economic and environmental effects of such decisions, ie:</p> <ul style="list-style-type: none"> • limited to the context of energy supply • potential impacts on different groups and individuals within society • decision making processes and structures within the UK • the ideal that the best decision will have the best outcome for the majority of the people involved.

LO2	CONTENT
<p>Understand the risks and benefits related to the applications of nuclear radiation</p>	<p>Learners should be taught the following content:</p> <p>that radiations, including ionising radiations, can transfer energy, ie:</p> <ul style="list-style-type: none"> • electromagnetic and nuclear radiations • different types and characteristics of nuclear radiation • detection of nuclear radiation and the energy transferred • radiation energy can be beneficial or harmful • natural emission of nuclear ionising radiations by some materials <p>the use of contemporary scientific and technological developments and their benefits, drawbacks and risks, ie:</p> <ul style="list-style-type: none"> • limited to the contexts of electricity generation and the industrial and health care applications of nuclear radiation • quantitative and qualitative analysis of risk factors including the calculation of probabilities.

LO3	CONTENT
<p>Be able to measure energy transfers and calculate efficiencies</p>	<p>Learners should be taught the following content:</p> <p>how to collect data from primary or secondary sources, including ICT sources and tools, ie:</p> <ul style="list-style-type: none"> • set up scientific equipment to measure: voltage and current; mass and temperature change; time <p>how to work accurately and safely, individually and with others, when collecting first-hand data</p> <p>how to use the relationships between:</p> <ul style="list-style-type: none"> • voltage, current, power • voltage, current, resistance • power, energy, time • specific heat capacity, mass, temperature change, energy • energy input, useful and wasteful outputs and efficiency.




MODULE 1 – USING ENERGY

Suggested content	Suggested activities	Suggested timings	Possible relevance to
1 Introduction to talking about energy	<p>OCR's R071 Module 1 – Unit 1 Introductory PowerPoint (which can be found here (http://www.ocr.org.uk/Images/78309-unit-r071-module-1-introductory-presentation.ppt)) could be used in a number of ways eg:</p> <ul style="list-style-type: none"> • The presentation could be given to learners without any introduction from the teacher. Learners could watch the presentation and then discuss what they think will be covered in the first module. • Learners could use the presentation as a starting point to discuss the different ways that the term 'energy' is used in daily life. Learners could then, with teacher guidance, create definitions for: energy, energy sources, power, efficiency, primary/secondary energy sources, renewable/non-renewable energy sources. This would provide a good opportunity to identify any misconceptions held by learners and gauge prior knowledge. Useful teacher guidance about this can be found here (http://www.nuffieldfoundation.org/practical-physics/energy-common-knowledge-hard-concept) and here (http://www.nuffieldfoundation.org/practical-physics/helpful-language-energy-talk), and a more in-depth study, 'Teaching about energy' by Robin Millar, can be found here (http://www.york.ac.uk/media/educationalstudies/documents/research/Paper11Teachingaboutenergy.pdf). Learners could also carry out a practical called 'Jobs needing food or fuel' to introduce the idea of energy being required to do 'useful work' and explore the relationship between power, energy and time. Instructions can be found here (http://www.practicalphysics.com). 	20 minutes	R071: LO1, LO2, LO3
		30 minutes–1 hour	R071: LO1, LO3
	Learners could create a mind map of the different ways energy is used in daily life and the different types of energy sources involved.	30 minutes	R071: LO1
	Learners could create an 'energy use diary' for a day in their/somebody else's life (this could be facilitated through interviews with local businesses/individuals). This can be a basic activity focusing on direct usage of electricity or fuel, or be developed to look at the energy used to make and transport food and everyday items.	1 hour	R071: LO1





MODULE 1 – USING ENERGY

Suggested content	Suggested activities	Suggested timings	Possible relevance to
1 Introduction to talking about energy	<p>Learners could carry out a number of practical activities to explore the concept of current, voltage and resistance (eg the Practical Physics experiments ‘Investigating current around a circuit’, ‘Measuring resistance with a voltmeter and ammeter’ (http://www.nuffieldfoundation.org/practical-physics/investigating-current-around-circuit)). The Institute of Physics provide guidance on further ways to tackle some of the common misconceptions that learners may hold here (http://www.nuffieldfoundation.org/practical-physics/models-electric-circuits).</p>	30 minutes–1 hour	R071: LO3 R073: LO2, LO3
	<p>Learners could carry out the Practical Physics Experiment (http://www.nuffieldfoundation.org/practical-physics/measuring-power-lamp) to measure the power of a lamp.</p> <p>The extension activities give learners opportunities to practise energy calculations and discuss efficiency and how it can be calculated.</p>	30 minutes–1 hour	R071: LO3 R073: LO2, LO3
2 Different energy sources	<p>Learners could research the range of different energy sources used in electricity generation, for example working through the material and activities available on the Sources and Resources’ pages on the Physics Ethics Energy Education Project website here (http://www.peep.ac.uk/content/718.0.html). Learners could create a leaflet/blog for members of the public, develop a briefing for a politician, write a newspaper article or prepare a lesson for younger learners about the different energy sources.</p>	1–2 hours	R071: LO1, LO2
	<p>Learners could explore the concept of primary and secondary energy sources by developing case studies of the types of energy sources used by different communities around the world or around the UK (eg liquid fuels/solid fuels/gas/electricity for heating). Videos, (for example those available from Practical Action here (http://practicalaction.org/video/category/Energy)) could be used to identify some of the issues for different communities.</p>	30 minutes–1 hour	R071: LO1
	<p>Learners could use BP’s Energy Charting Tool (http://www.bp.com/sectionbodycopy.do?categoryId=9037132&contentId=7069049#/?chartView=chart&advancedOption=cumChange) to investigate trends in energy usage and energy sources used around the world, as well as the changing prices of fossil fuels. The tool allows learners to interact with data from the BP Statistical Review of World Energy 2012 and could be used in a number of ways eg:</p> <ul style="list-style-type: none"> using the graphs to answer a set of specific quantitative questions would familiarise learners with the tool so that they could then use it later to extract data or graphs for other tasks; 	35 minutes	R071: LO1



MODULE 1 – USING ENERGY

Suggested content	Suggested activities	Suggested timings	Possible relevance to
2 Different energy sources 	<ul style="list-style-type: none"> different learners could focus on different regions around the world and use the various data sets within the tool to create an energy profile for that region; 	30 minutes	R071: LO1
	<ul style="list-style-type: none"> the tool also allows learners to plot data in various graphical forms (using the 'select view' drop down menu) so could be used as the basis of an activity investigating the best way to visually represent different types of data. 	30 minutes	R073: LO2, LO3, LO5
3 Understanding the decisions involved in selecting an energy source 	<p>In pairs/small groups learners could discuss what they already know about the greenhouse effect and global warming. Learners could then:</p> <ul style="list-style-type: none"> watch the animation about 'global warming and the greenhouse effect' and use the interactive webpage (link to these websites can be found via the Resources Link, (http://www.ocr.org.uk/Images/82424-unit-r071-resources-link.pdf)) return to pairs/groups to discuss what they now know about the greenhouse effect and global warming; complete the 'global warming quiz' from the Resources Link (http://www.ocr.org.uk/Images/82424-unit-r071-resources-link.pdf). 	30 minutes–1 hour	R071: LO1
	<p>Learners could develop their ideas about global warming by carrying out the Royal Society of Chemistry's 'Assessment for Learning – What causes the greenhouse effect?' activity (http://www.rsc.org/education/teachers/resources/afchem/resources/49/index.htm) which involves demonstrating practical 68 from the Royal Society of Chemistry's Classic Chemistry Demonstrations which can be found here (http://www.rsc.org/learn-chemistry/content/filerepository/CMP/00/001/001/Classicdemos_full.pdf).</p>	1 hour	R071: LO1
	<p>Learners could work through OCR's Lesson Element 'How to choose – different views on what makes a good energy source' (http://www.ocr.org.uk/qualifications/cambridge-nationals-science-level-1-2-j815/) to assess different energy sources from different perspectives within the community and discuss any differences that emerge. Visits to local power generators, councils or businesses could be used to explore particular perspectives.</p> 	30 minutes–1.5 hours	R071: LO1, LO2




MODULE 1 – USING ENERGY

Suggested content	Suggested activities	Suggested timings	Possible relevance to
3 Understanding the decisions involved in selecting an energy source 	Learners could also investigate choices made in relation to energy sources and the importance of energy efficiency within their school or college (or a local business/industry). Learners could interview staff to understand how decisions are made in relation to energy usage. Alternatively learners could use the energy case studies from http://www.keepbritaintidy.org/ecoschools/ to investigate why the schools involved chose to change their approach to energy issues.	45 minutes	R071: LO1
4 How electricity is generated – combustionT  	Learners could carry out/observe a range of practicals/demonstrations relating to combustion of fuels found here on (http://www.practicalchemistry.com).	15 minutes– 1 hour	R071: LO1, LO3
	Learners could work through the information on heat transfer and efficiency (http://www.bbc.co.uk/schools/gcsebitesize/science/aqa_pre_2011/energy/heatrev5.shtml) from GCSE Bitesize before completing the Practical Chemistry experiment (http://www.nuffieldfoundation.org/practical-chemistry/measuring-heat-energy-fuels) about measuring the heat energy of fuels. This activity gives learners the opportunity to calculate the amount of energy transferred, compare fuels and investigate ways to increase the efficiency of the energy transfer.	1–1.5 hours	R071: LO3 R073: LO2, LO3
	Learners could explore how movement can generate electricity by carrying out the OCR Practical 'Generating an electric current'.	45 minutes	R071: LO1, LO3 R073: LO1, LO2, LO3
	Learners could watch the animation that shows how a coal power station works (link to these websites can be found via the Resources Link , (http://www.ocr.org.uk/Images/82424-unit-r071-resources-link.pdf)) and research the efficiency of coal power stations in comparison to nuclear and renewable energy sources. 	30 minutes	R071: LO1, LO3
5 How electricity is generated – nuclear power	Learners could discuss and write down what the term 'radiation' means to them before watching the NASA video (http://www.teachersdomain.org/asset/phy03_vid_nasaspectrum/) on the electromagnetic spectrum. After watching the video learners could discuss how their understanding of the term radiation has changed before watching the video again to complete OCR's 'Electromagnetic spectrum fact sheet'. The Practical Physics demonstration (http://www.nuffieldfoundation.org/practical-physics/beyond-visible-spectrum) 'Beyond the Visible Spectrum' could also be used to show the existence of a spectrum beyond the visible.	30 minutes	R071: LO2




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5 How electricity is generated – nuclear power 	Learners could carry out a survey to find out what the general public think the following terms mean: radiation, ionising radiation, radioactive, irradiation, and contamination. A guided class discussion could then be used to decide on definitions for the terms and explore some of the common misconceptions. Learners could then create an information leaflet/blog/article explaining the terms for the general public. This activity could be useful for addressing some of the common misconceptions learners can hold – for example there is often confusion about what it means when radiation is absorbed by something and learners can tend to describe something exposed to radiation as becoming radioactive or describe ionising radiation as having the properties of radioactive material. Some of these common misunderstandings are described by the Institute of Physics here (http://www.iop.org/education/teacher/resources/radioactivity/page_41562.html).	1–2 hours	R071: LO2 R073: LO2
	Learners could observe the demonstration ‘ Identifying three types of ionising radiation ’ (http://www.nuffieldfoundation.org/practical-physics/identifying-three-types-ionizing-radiation) from Practical Physics to identify the range and penetrating properties of alpha, beta and gamma radiation. (Three more detailed activities are also available on the website: Alpha radiation: range and stopping , Beta radiation: range, stopping and deflecting (http://www.nuffieldfoundation.org/node/2523) and Gamma radiation: range and stopping (http://www.nuffieldfoundation.org/node/2526)).	30 minutes–1 hour	R071: LO2
	Learners could complete the OCR Lesson Element ‘Designing a nuclear power station’ (coming soon) to develop understanding of how nuclear power stations function.	1–2 hours	R071: LO1
6 How electricity is generated – alternative ways 	Learners could use the Royal Society of Chemistry’s ‘Faces of chemistry’ videos (http://www.rsc.org/learn-chemistry/resource/res00000873/faces-of-chemistry-organic-solar-cells) about the development and use of organic solar cells or UVSAR’s ‘what’s inside a wind turbine’ video (http://www.youtube.com/watch?v=LNXTm7aHvWc) or the Science Museum’s animation of how energy is generated from moving water (links to these websites can be found via the Resources Link (http://www.ocr.org.uk/Images/82424-unit-r071-resources-link.pdf)) as background information for writing 50 word summaries (with diagrams) of how energy is generated by solar panels, wind turbines or water turbines.	30–45 minutes	R071: LO1


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Suggested content	Suggested activities	Suggested timings	Possible relevance to
6 How electricity is generated – alternative ways 	Learners could discuss their understanding of the term 'biofuel' before doing some research, eg using the National Geographic Biofuel Profile - (link to these websites can be found via the Resources Link , page 8 (http://www.ocr.org.uk/Images/82424-unit-r071-resources-link.pdf)) and completing the National Geographic interactive quiz on biofuels (Resource Links, page 9).	30–45 minutes	R071: LO1
	Learners could build a basic wind turbine, (for example in the activity available here (http://www.ourplanet.org.uk/climate-change-lesson-plan.asp?lessonID=26)). Learners could then design an experiment to measure the efficiency of their turbine.	1 hour	R071:LO1, LO3 R073: LO1, LO2, LO3
	Learners could, through discussion, map out visually the similarities (eg movement required to generate electricity) and differences (eg how movement is generated) between different methods of electricity generation (with particular focus on how solar electricity generation is different).	30 minutes–1 hour	R071:LO1
7 How electricity is distributed 	Learners could learn about the construction of a distribution grid by playing E.ON's interactive game titled 'Energy World: Distributing to You' (link to these websites can be found via the Resources Link , page 13 (http://www.ocr.org.uk/Images/82424-unit-r071-resources-link.pdf)).	30 minutes	R071: LO1
	Learners could use the ESKOM factsheet on energy which can be found here (http://www.eskom.co.za/content/TD_0003TxDxelecRev4~1.pdf) or a Catalyst article available on the National STEM Centre website here (http://www.nationalstemcentre.org.uk/elibrary/file/8760/catalyst_15_3_234.pdf) (log-in required but registration is free). They could run a customer information line responding to (pre-prepared) email inquiries about how energy is generated and distributed to the home. This activity could focus on using appropriate language for different audiences.	45 minutes	R071: LO1
8 Wider issues in selecting an energy source – national and international 	Learners could work through the interactive lessons within 'Explaining Climate Change' (http://www.explainingclimatechange.ca/Climate%20Change/Lessons/lessons.html) to develop their understanding of climate change or use the interactive climate data graph (http://www.explainingclimatechange.ca/Climate%20Change/swf/climatetrends/historyGraphs.swf) to explore the relationship between changes in gas concentrations in the atmosphere and global temperatures.	1–2 hours	R071: LO1

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8 Wider issues in selecting an energy source – national and international	Learners could play Operation Climate Change which can be found here (http://www.operationclimatecontrol.co.uk/content/) – this focuses on energy sources for transport but does highlight some of the complexities in designing energy policy. The game is free to use and allows teachers to choose the scenario that they wish their learners to attempt. It gives learners the opportunity to explore how an environmental policy for Europe for the 21st century could be created.	2 hours	R071: LO1
9 Wider issues in selecting an energy source – individuals	 Learners could analyse the information given on the websites of different companies offering energy packages for the home to identify the types of information that are important to customers eg costs, usage patterns (night/day), % green energy sources.	45 minutes	R071: LO1
	 Learners could design a format for an energy bill for customers that provides more information eg about how energy is generated, ways to reduce energy use in homes/businesses, or the wider implications of energy generation/use.	45 minutes	R071: LO1
	Learners could design a programme to engage the local community and address their concerns about a potential wind farm development using the research carried out by E.ON (link to these websites can be found via the Resources Link , (http://www.ocr.org.uk/Images/82424-unit-r071-resources-link.pdf)).	30 minutes–1 hour	R071: LO1
	 Learners could explore why energy is an ethical issue by carrying out the activities available on the 'Energy in Trouble' pages on the Physics Ethics Education Project website here (http://www.peep.ac.uk/content/717.0.html). For example learners could use the 'Talking Heads' (http://www.peep.ac.uk/content/fileadmin/user_upload/documents_peep/worksheets/01_PEEPDISC_Nuclear_Power.pdf) worksheet from the Physics Ethics Education Project to record their own feelings about the range of different opinions about the use of nuclear power.	45 minutes	R071: LO1, LO2
	Learners could complete the OCR Lesson Element 'Benefits and risks of using nuclear radiation' – learners could be given the websites included in the resource link document as a starting point for their research (link to these websites can be found via the Resources Link , (http://www.ocr.org.uk/Images/82424-unit-r071-resources-link.pdf)). Learners could also research different aspects of Activity 1 for a class debate arguing for and against the use of ionising radiation in medicine (a number of sites listed in the resources link document could be used for research). Learners could also work in groups/pairs in Activity 2 to research the different ways ionising radiation is used in industry and prepare a presentation for the class.	1–2 hours	R071: LO2

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Suggested content	Suggested activities	Suggested timings	Possible relevance to
9 Wider issues in selecting an energy source – individuals 	Learners could watch a segment (eg 14 min 35 s - 19 min 29 s) of 'The Science of seeing inside your body' (http://www.iop.org/resources/videos/education/schools-and-colleges-lecture/page_52977.html) from the 2011 Institute of Physics Schools Lecture before a class discussion on how radioactivity can be both beneficial or harmful to human health. This would provide a good opportunity to review learners' understanding of the different properties of alpha, beta and gamma radiation and the importance of correct dosage.	20 minutes	R071: LO2
	Learners could complete the Institute of Physics worksheet to calculate their annual exposure to background radiation or use the Radiation Dose Chart (link to these websites can be found via the Resources Link , page12 (http://www.ocr.org.uk/Images/82424-unit-r071-resources-link.pdf)) to identify natural and man-made sources of ionising radiation. Alternatively learners could be given the role of a medical technician calculating the exposure of patients receiving different treatments.	30 minutes	R071: LO2

Contact us

Staff at the OCR Customer Contact Centre are available to take your call between 8am and 5.30pm, Monday to Friday.

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