Year 4: Energy & Climate Change teaching pack

Where does our energy come from and how much do we use?

The Harmony Project

Contents

This page and front cover: Ladakh, India

Introduction

An ever-growing body of scientific evidence confirms that across our planet, the climate is changing — and we know that our reliance on fossil fuels is playing a huge part in this. In response to this truth, we've developed a teaching pack to help educators explore with students in Year 4 the link between climate change and our use of energy from carbon-emitting fossil fuels. Most importantly, the pack is also brimming with ideas about the role children can play and the difference they can make in halting climate change.

On p. 4 of this pack, you'll find a planning overview for a half-term's teaching and learning. This maps out National Curriculum-linked content across a range of subjects and can be used as a framework to explore the enquiry question: 'Where does our energy come from and how much do we use?'

Linked to the principle of Health, this enquiry of learning offers children and their teachers opportunities to find out how our reliance on fossil fuels impacts the future health of the planet and all life on it, to learn about the benefits of renewable energy and to understand how measuring the energy we use can help us identify the steps we must take to reduce our consumption.

In geography, children learn about the region of Ladakh in India, where many people live without access to electricity, and about the work of Global Himalayan Expedition (GHE) in bringing solar energy to remote villages here. Lesson plans for all six of the geography activities outlined in the planning overview, along with the resources needed to teach them, can be found in this pack from p. 70 onwards. The lesson plans and resources needed to teach the unit of English learning outlined in Week 3 of the planning overview is also included on p. 9. In this unit, the children take on the role of a GHE volunteer on an expedition to bring clean energy to Ladakh. They write a recount describing their experience.

The learning in PE focuses on the principle of Health, which sits at the heart of this enquiry of learning. The children practise yoga poses and breathing techniques and reflect on how these practices make them feel. These reflections can be further explored in PSHE through the exploration of mindfulness techniques, which can help us look after our mental health and build resilience when faced with challenges.

With a sustainability focus on climate change and energy use, the learning culminates in a Great Work that sees the children challenge their families and local community to reduce energy use through the '100 Club' Energy Challenge (p. 105).

The six maths investigations outlined in the planning overview give the children the opportunity to use real-life data to find out how much energy we use in our daily lives and how we can reduce this. The lesson plans and resources needed to teach them can be found in this pack from p. 36 onwards.

Half-term planning overview Year 4 - Spring Term 1

Enquiry question: Where does our energy come from and how much do we use?

Harmony principle: The principle of Health

Sustainability action: Energy saving challenge

Great Work: Presentation on energy saving challenges

Partners in learning: Energy companies; energy monitoring systems provider

	Weekly Questions					
	Week 1	**Week 2**	**Week 3**	**Week 4**	**Week 5**	**Week 6**
	Where does the energy for our homes come from?	**How much electricity do we use in our homes each week?**	**How much energy do we use at school?**	**What can we do to reduce our energy use at school?**	**What are the benefits of reducing our use of energy?**	**How can we challenge our community to save energy?**
	How will I create a five-pointed star?	How will I create a six pointed star?	How will I create an eight pointed star?	How will I represent the blades of a wind turbine using my geometry skills?	How will I represent a parabolic curve?	How will I recreate a spiral solar panel design?
SCIENCE	What different sources does our electricity come from?	What power do you need to make different toys work?	What is needed to create a simple electrical circuit to make a bulb light up?	What materials conduct electricity and what materials act as insulators of electricity?	How will I create a switch for an electrical circuit?	How will I present my findings of my own investigation on electricity?
ENGLISH	What will I include in my comic strip about the history of energy and why our energy sources are changing?	What will I include in my explanation text about different types of energy?	What will I include in my recount of 'From darkness to light in one night'?	What key questions do I want to ask in an interview with climate change activist?	What information will I include in my magazine article about an activist of climate change?	What persuasive language will I include in presentation on energy saving challenges?
GPS FOCUS	Which fronted adverbials will help me tell my story?	How will I organise my ideas into paragraphs?	Which fronted adverbials will help me order my ideas chronologically?	How will I use inverted commas in direct speech?	How will I use direct speech to quote my interviewee in my magazine article?	How will I use formal language to persuade my family to make changes at home?
MATHS	How do we measure our energy and how much do we use in our homes?	How much energy do different appliances use per hour? Which use the most energy?	How much electricity do we use in a day?	How much electricity do we use in a half term?	What is the link between reducing energy use and saving money?	What could change as the result of our community energy saving challenges?
DT	What is a wind turbine and how does one work?	What is the best structure for the base of a wind turbine?	What materials will I use to create the rotary blades of a wind turbine?	How will I use tools safely to construct a wind turbine?	How can I amend and improve the design of my wind turbine?	How will I evaluate the effectiveness of my wind turbine?
IT AND COMPUTING	What are the features of effective web pages?	What will I include in a wireframe for a webpage?	What text content will I include in my webpage?	What images will I include in my webpage?	How do I embed links within my webpage?	How effective is my webpage?
PE (YOGA)	How will I use different breathing techniques and sitting poses to help me create a healthy mind?	What are the different yoga poses and how do they help my mind and body?	How do I move from one pose to another in a mindful way?	What skills do I need to balance in poses either on my own or with a partner?	Which sitting poses and balances will I use to create a short yoga routine with a partner?	What skills do I need to perform a yoga routine for someone else to follow?
GEOGRAPHY	What human features of the landscape in the UK are linked to energy production?	How is daily life in Ladakh without electricity different to our daily lives?	Where is Ladakh and how will I use maps to identify its physical features?	What is the climate like in Ladakh and why is this perfect for generating solar energy?	Which countries produce the most solar energy?	Which countries produce other forms of renewable energy?
MUSIC	How do these songs inspired by the sun make you feel?	How could the volume of an instrument represent the sun at different points in the day?	Which instruments will best show the sun rising in the sky?	How will we use written notation to compose a piece of music as a group?	How will we use the peer evaluation of our composition to improve?	What do we need to perform our composition in a performance to an audience?
PSHE	How can we stay mentally healthy?	How can I manage positive and negative thoughts in a healthy way?	What can we do when we have to face a challenge in life?	What mindfulness techniques can we use to help us keep calm?	How can we manage feelings that make us feel anxious?	How will a positive mindset help me take on new challenges?
OUTDOOR LEARNING	Go on a local walk to identify energy at work in Nature	Investigate energy and water e.g. making a waterwheel	Monitor the amount of natural light each day for a week	Carry out a wind energy investigation e.g. racing sailboats or kites	Measure temperature (the Sun's energy) in sunny and shady places	Explore designs in Nature that use energy efficiently

Overview of weekly themes

Where does our energy come from and how much do we use?

This enquiry about our use of energy, and the sources that generate it, is guided by the principle of Health. The intention of the learning is to help children to understand how our use of energy derived from fossil fuels impacts the health of our planet and consequently the health of all living things. Children will begin to explore the benefits of alternative, 'clean' forms of energy from renewable sources. The learning builds very much on the knowledge and understanding the children developed in Year 2 through the learning enquiry 'Where are the polar regions and why are they melting?'

Week 1: Where does the energy for our homes come from?

In this week, the children learn about some of the different sources of energy that currently power our homes and schools. In geography, they begin to identify the locations in the UK where our energy is generated. In music, linked to their learning about solar energy, the children listen and respond to music inspired by the Sun and reflect on how it makes them feel. Meanwhile, the learning in PSHE and PE is very much linked to the principle of Health and invites the children to explore the ways in which they can keep their minds and bodies healthy. By the end of the first week, the children should be able to identify different types of energy and how much we rely on them in our daily lives. They begin to consider their own use of energy and identify any habits that might waste energy.

REFLECTION

Spend time at the end of the week reflecting on habits that might lead to 'healthy' and 'unhealthy' uses of energy (draw out the link to the principle of Health). You might ask the children: *Do you think you use more energy than you need? If you think you do, what changes could you make? How might this affect the health of the planet?*

Useful information for Week 1

Maths

Energy is measured in watts (W), but you will usually see it written as kilowatts (kW), which is 1000W. The rate at which we consume energy (or an appliance consumes energy) is measured in kilowatt hours (kWh). A kWh of electricity energy costs 34p.

Music

In Music, you may wish to explore some of the following songs inspired by the Sun:

- *Sunrise* by Norah Jones
- *Everybody Loves The Sunshine* by Takuya Kuroda
- *Grand Canyon Suite: I 'Sunrise'* by Ferde Grofé

Design and Technology

The following video content may be useful in supporting the learning about making wind turbines:

- Build a wind turbine
- How do wind turbines work?

PE

This YouTube clip can be used to explore yoga poses.

Computing

Google Sites is a webpage creator that is easy for children to use.

Week 2: How much electricity do we use in our homes each week?

Children are introduced to families who live without electricity in the Ladakh region of India in the Himalayas. They consider the similarities and differences between life in Ladakh and their own lives. They research different sources of energy – both renewable and non-renewable – and use this knowledge to create an information text in English.

In science, the children explore the energy required to power their favourite toys and other things they use, and sort them accordingly. To support this learning, the children will need access to a range of toys or gadgets. Once they know which appliances in their homes require electricity to run, they learn how this energy is measured, before moving on in maths to calculate the cost of running a variety of home appliances.

REFLECTION

Spend time at the end of the week reflecting on how the learning links to the principle of Health by asking: *Which activities in school are good for your health? What are the challenges in reducing energy use at home? How easy is it to reduce time spent on your game console or on screens?*

Useful information for Week 2

Maths

As of March 2023, 1kWh cost 34p (double the cost of energy a year previously).

Geography

Ladakh has a population of approx. 300,000 people. Known as India's high altitude cold desert (due to its very low rainfall), it has 320 sunny days a year and extremely cold, long winters. Winter lasts from October to May and can reach temperatures of –28°C. There are hardly any trees, so this region relies on timber from Kashmir, which is over 300 miles away. There is a strong Tibetan influence and 45% of the population are Buddhist.

Houses

Leh is the capital of Ladakh with a population of roughly 175,000. Many houses are made from mud and stone and sit haphazardly on hilly landscapes. There are narrow strips of land between homes; this means the inhabitants can look into each other's houses and communicate across balconies.

Locals have been encouraged to restore and rebuild traditional homes rather than replace them with modern constructions. Traditional buildings can withstand the cold weather conditions and maintain the beauty of the ancient housing system.

Way of life

Locals are encouraged to follow a life of 'atmanirbhar' which means being self-sufficient and independent. Many people have two or three jobs, such as tour guides, taxi drivers and farmers (either rearing sheep or growing their own food to sell in the markets).

Commonly grown crops include barley, wheat, radish, carrots, cabbages, cauliflowers, potatoes and tomatoes. Apricots, walnuts and grapes thrive in the sunny, cold conditions.

Locals prepare well in advance for winter when they will be cut off from the rest of the world as roads and mountain passes are impassable. They store grains, barley and food for their animals.

Many have their own animals, such as dzos, yaks and goats, which they use for meat, milk, butter and wool.

Living without electricity

Many villages in the Himalayan mountains rely on diesel generators, kerosene oil lamps and firewood to heat and light their homes, which is both a financial and environmental burden for these families. Breathing in the fumes from oil lamps and having to use minimal light to study and cook by also causes long term health problems.

The nights can be long and cold, and villagers talk about the challenges of this, including the boredom of having very little to do in the evenings, having to study by kerosene lamps (these give off very little light and strain their eyesight) and breathing in fumes from oil lamps or soot from burning firewood.

Geometry

Stargazing enthusiasts make special visits to the Indian Astronomical Observatory (IAO), located in Hanle, Ladakh. At 14,764 feet, it is one of the highest observatories in the world. In the first three weeks of this enquiry, children will learn how to draw different pointed stars.

Week 3: How much electricity do we use in our homes each week?

This week, the children build on their knowledge of life in the region of Ladakh in both English and geography. They are introduced to the Global Himalayan Expedition (GHE) organisation, which brings clean energy to villages that are currently without electricity. The children imagine they are part of a GHE team and write a recount of their experience. In maths, the children learn that monitoring the amount of electricity we use every day and at regular points throughout the day can really help us to understand our energy use. They use real life data to analyse and make comparisons with energy use in their own school. In science, they carry out practical investigations to explore what is required to make a bulb light up in a simple circuit.

REFLECTION

Bring the learning back to the principle of Health by asking the children: *How much energy are we consuming during the day in our school? When do we use most and why?*

Week 4: What can we do to reduce our energy use at school?

In the previous week, the children made the connection between energy use and climate change and studied a school's energy use over one school day.

In maths this week, the children investigate energy use over a period of five weeks. They draw conclusions about how energy usage changes at weekends and during school holidays and are encouraged to question why, on particular days, a school may use more or less energy.

In English, they research a climate change activist and widen their knowledge of different individuals or organisations involved in the development of cleaner energy or solutions to the negative effects of climate change. They also find out why solar energy is a successful source of energy for villages in Ladakh.

REFLECTION

Reflect on the learning and its link to the principle of Health by asking the children: How could we reduce the amount of electricity we use at school to address the issue of climate change?

Useful information for Week 3

Global Himalayan Expedition

Paras Loomba (founder) and Jaideep Bansal (CEO) of Global Himalayan Expedition have led many leadership expeditions to Himalayas to provide clean energy access to remote Himalayan communities. So far, they have brought solar energy to 131 villages which has impacted over 60,000 people.

Maths

The school data used in the graphs for the Maths activity was collected using the ecoDriver (ecodriver.co.uk) energy management system.

By the end of the week, the children are encouraged to consider achievable actions that could be taken within school to reduce energy use.

Useful information for Week 4

English

You will find information about young climate activists on the International Rescue Committee website.

PE

This YouTube video clip provides an overview of yoga partner poses the children can recreate.

Geography

Ladakh's climate provides the perfect conditions for generating solar energy. Solar panels work best in intense sunshine and at cold temperatures. Ladakh experiences 320 days of sunshine a year and the temperature does not rise above 15°C for eight months of the year.

Week 5: What are the benefits of reducing our use of energy?

This week, the children develop a stronger understanding of the benefits of reducing energy use at home and at school.

In geography, they use various sources to find out which countries are using solar energy.

By the end of the week, the children should be able to draw conclusions about the impact of saving energy on cost, health and the environment. They should also be aware of countries around the world which are expanding their use of clean energy such as solar energy to power their homes.

They continue to develop their knowledge of electrical circuits by exploring conductors and insulators and identifying the best material to use to create a switch.

In maths, they investigate how much money they could save by reducing their energy use by different fractions.

REFLECTION

Reflect on the learning and its link to the principle of Health by asking the children: *How could we reduce the amount of electricity we use at school to address the issue of climate change?*

Useful information for Week 5

Geography

You can find more information about countries' use of solar energy at Energyusage.com, Ourworldindata.org and Wikipedia.org

Week 6: How can we challenge our community to save energy?

The final week of the enquiry is one of celebration, culminating in a Great Work.

During this final week, the children evaluate the effectiveness of the wind turbine they created in DT and the webpage they developed in computing. They use the knowledge gained throughout the enquiry to create and present a climate change campaign to their peers, parents and the wider community. They are now aware of the benefits of reducing energy use but how will they communicate these benefits and how will they challenge their family and friends to take action?

In English, they produce a presentation on energy-saving challenges using persuasive language and facts to support their ideas.

In maths, they calculate how many kWh they are using if they reduce their use by different fractions.

Useful information for Week 6

Geography

To find out more about the impact of climate change on the polar regions, visit ipcc.com.

REFLECTION

As this week sees the end of the enquiry, this is a good time to reflect on the enquiry as a whole by referring back to the overarching enquiry question, 'Where does our energy come from and how much do we use?' To link the learning at this stage to the principle of Health, you might ask the children: *When is something healthy? When is it not healthy? What are our plans to reduce our energy use further and why is this so important for the future health of the planet?*

TEACHER TIP

As the enquiry draws to a close, there is a great opportunity to reflect on the learning and the principle of Health. There is a Harmony reflection form template that you could use for this here. This will be particularly valuable if you plan to apply for the Harmony School Curriculum Award.

English unit

Weekly question:
What will I include in my recount 'From darkness to light in one night'?

In the remote Indian Himalayan Mountain range, there are villages whose residents have lived without access to electricity all their lives. These villages cannot be found on Google Maps and it often takes 3-5 days to reach them on foot from the nearest road. More than 16 million people still rely heavily on kerosene lamps and diesel generators for their energy needs. These emit toxic fumes, creating health problems for all those living there.

An organisation called Global Himalayan Expedition (GHE) was created to conduct 'Impact Electrification Expeditions' that encourage visitors from diverse backgrounds and different countries to come together to bring solar energy to these remote, unelectrified villages in the Indian Himalayas. The cost for the solar grids is paid for by the tourists as part of their expedition fee.

GHE's Electrification Expeditions have created an everlasting impact on these communities and at the same time are a life-changing experience for the expedition team members. More than 150 villages in the remote Indian Himalayas now have access to clean and renewable energy, which has directly impacted the lives of 100,000 people. In the process, 1,300 visitors from 60 different countries have participated in the expeditions.

In this unit of five English lessons, children immerse themselves in the experience of a volunteer travelling to Ladakh in the Himalayas as part of the Global Himalayan Expedition team. Drawing on modelled recounts from team members' experiences as well as photographic stimuli, the children plan, draft and edit their own recounts over the course of five lessons, relating what they imagine they would experience on an expedition with GHE and the positive impact they would have on the lives of the people they meet.

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English Lesson 1

Learning question:

How will I organise my ideas to plan paragraphs for a recount?

NC LINKS

- Plan writing by talking about the important parts to have in a story, poem, explanation or non-fiction piece
- Plan and improve writing by discussing examples from other writers that I like and looking at their use of sentence structure, words and grammar
- Make my writing interesting by using adjectives and other descriptive methods.

RESOURCES:

- Copies of Resource 1B (enough for one between two)
- Copies of Resource 1C (enough for one between two)
- Copies of Resource 1D (for children requiring support)
- Thesauruses

STARTER ACTIVITY

Explain to the children that there are people living around the world who do not have electricity in their homes. Their access to light is very limited. Show the image in Resource 1A. Give the children time to discuss with a partner what is happening in the photo and how the people in the photo may feel. Share ideas as a class and answer any questions the children have.

Some of these places are villages located in the Himalayas, which is the highest mountain range in the world. Use Google Maps in satellite view to locate the Ladakh region in the Himalayas, where their recount will be set.

Explain that people living in these villages use firewood for cooking or kerosene oil lanterns to give them some light in their homes at night. This source of light emits fumes, which are not only harmful to them but also to the planet.

An organisation called Global Himalayan Expedition (GHE) was created to bring clean, sustainable energy to villages without electricity in the Himalayas. Ask the children: *What is clean, sustainable energy? Why is it important?*

Explain that the journey that GHE expedition members take to remote Himalyan villages is not an easy one. Part of it involves travelling on foot for up to 10 hours along mountain paths, which can be dangerous. Ask the children: *Why do you think people would risk their lives to go on this journey?*

Provide the children with the image in Resource 1B showing the mountain setting they will imagine they are walking through. In pairs, the children discuss what they might see, hear and how they would describe the scenery. Share ideas as a class, and record key words and phrases around the image on the interactive whiteboard.

Save this annotated slide for use in Lesson 2.

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English Lesson 1

MAIN ACTIVITY: TEACHER INPUT

Explain to the children that you would like them to imagine themselves as a volunteer on a GHE expedition. Throughout the week, they will be writing a recount to describe their experience. Ask the children: *What is a recount? What are some of the features of a recount?* Draw out key features, such as: written in the past tense, first person, paragraphs in chronological order.

Provide the children with a copy of the recount in Resource 1C. In pairs, the children read the recount and highlight key phrases and events in the narrative that give detail. At this point, give the children time to ask questions about any unfamiliar language.

TEACHER TIP

Keep the copies of the recount the children have been working with to use again in Lesson 2.

Part-way through this activity, you could watch the video at vimeo.com/403961329 to further develop the children's ideas, from 11:55 to 14:09 (the arrival of the volunteers in Leh) and from 18:32 to 26:18 (the journey).

MAIN ACTIVITY: INDEPENDENT LEARNING

Using the modelled recount and the photographs, the children work in pairs to identify words and phrases that describe:

- feelings
- setting

They could highlight these in different colours.

DIFFERENTIATION

Support
Provide children with words and phrases from the modelled recount text (Resource 1D). These can be cut out by the children and arranged under the headings 'Feelings' and 'Setting'. The children could work with an adult to ensure they understand the meaning of any unfamiliar language.

Extension
Using the images provided, the children generate their own words and phrases to describe feelings and the setting, adding these to the words and phrases they have found in the text.

Encourage them to use thesauruses to improve their vocabulary choices.

PLENARY

Display the modelled recount the children have been working with on the interactive whiteboard. Give the children time to share the language that they have extracted from the text, highlighting some of them in the text. Ask any children who generated their own ideas to share some of these, too.

Remind the children of the key features of a recount (written in the past tense, first person, paragraphs in chronological order) and discuss with the children where these are found in the modelled recount they have been working with.

English Resource 1A

English Resource 1B

English Resource 1B

English Resource 1C

After weeks of waiting, I finally received the email I had been waiting for. I had been accepted to join Global Himalayan Expedition, which provides clean energy to villages in the Himalayas that don't have electricity. Our mission was the electrification of a Buddhist monastery. The ancient monastery was approximately 900 years old and overlooked the village of Lingshed. The village is home to around 700 people who had lived their whole lives without electric light.

When I arrived in Leh, the capital of Ladakh, I met the team of 40 volunteers who I would be travelling with. As we were 11,000 ft above sea level, we had to get used to the high altitude. There is much less oxygen in the air high in the mountains, so we struggled to breathe.

Our journey from Leh to the remote village of Lingshed was going to last two days, which would include an eight-hour trek over two mountain passes. Excited and a little apprehensive, we began our 75 mile journey from Leh to Photoskar.

At sunset, we arrived at Photoskar and set up base camp. Exhausted from our travels and the high altitude, we fell asleep in the darkness and the cold. The next day, we drove a few more hours to where the road ended. Carefully, we began to load the solar panel equipment onto donkeys. The donkeys carried the batteries and volunteers carried the panels since they were fragile and heavy.

Tentatively, we began the treacherous hike along the narrow, serpentine paths. One false step and we would end up tumbling down into the deep valley below. Even though the conditions were dangerous, we couldn't ignore the beautiful scenery that surrounded us. Ribbons of grey and white stone decorated the cliff faces and deep red and purple wildflowers were scattered across the grassy fields.

After a long day, our destination finally came into view. We were greeted by welcome cheers and locals presented us with kataks (ceremonial silk prayer scarves). As darkness descended on the village, we knew there was still more hard work to come.

English Resource 1D

deep red and purple wildflowers were scattered across the grassy fields

the steep climb up the mountain pass

we struggled to breathe

narrow, serpentine paths

ribbons of grey and white stone decorated the cliff faces

the deep valley below

exhausted from our travels and the high altitude

excited and a little apprehensive

I took a deep breath

the beautiful scenery

overlooked the village of Lingshed

the ancient monastery

the treacherous hike

as darkness descended on the village

English Lesson 2

Learning question:

What information and detail will I include in a plan for my recount?

NC LINKS

- Use an adverb phrase at the start of a sentence
- Make writing interesting by using adjectives and other descriptive methods
- Use paragraphs to organise ideas around a theme

RESOURCES:

- Copies of Resource 2A (enough for one each)
- Copies Resource 2B (enough for one between two)

STARTER ACTIVITY

Display the recount from the previous session (Resource 1C) on the interactive whiteboard. Discuss with the children what a fronted adverbial is, what job it does and how one can be spotted in a sentence. Using the copies of the recount they worked with in Lesson 1, the children work in pairs to identify the fronted adverbials used. Challenge them to find five or even 10. They could highlight these using a third colour or record them alongside the 'setting' and 'feelings' phrases they gathered in the previous lesson.

Take some feedback, highlighting on the interactive whiteboard some of the examples the children have found.

Discuss with the children the different types of adverbials they can spot that have been used to start sentences (for example, adverbs, conjunctions, -ed verbs, similes, -ing verbs, prepositions. You could ask them: *Who can find a fronted adverbial that's an adverb?*

English Lesson 2

MAIN ACTIVITY: TEACHER INPUT

Display the planning template (Resource 2A) on the interactive whiteboard and, using ideas from the children, model how to add bullet points for ideas to use in the first paragraph. Refer to the questions on the planning template to prompt discussion. Save this slide with the class plan on it for use later.

MAIN ACTIVITY: INDEPENDENT LEARNING

The children complete the plan for the first two paragraphs of their recount on their own planning template.

MINI-PLENARY

Show on the interactive whiteboard the annotated slide with class ideas about the photo in Resource 1B from Lesson 1. Ask the children: *Which ideas could we take to use in our plans?* Model how to add additional ideas in a different colour to the class plan. Remind the children about the phrases they collected in Lesson 1 about feelings and settings. Challenge them to add some of these ideas to the appropriate section of their plan, too.

DIFFERENTIATION:

Support
Provide children with a word bank of keywords (Resource 2B) to support their planning.

Extension
Add appropriate fronted adverbials to their plans, thinking carefully about where different adverbials would work best.

PLENARY

Working with a different partner, the children compare their plans and add any additional detail their partner included to their own plan. In pairs, the children use their planning notes to practise writing sentences using fronted adverbials and topic-related vocabulary.

Take ideas from the class and record good examples as a class reference resource for use in the next lesson.

English Resource 2A

Paragraph 1 How did you feel when you arrived in Leh? What did you need to do to prepare for the journey? Who else was part of the expedition team?	
Paragraph 2 What did you see on the journey? How did you feel about walking through the mountains?	
Paragraph 3 How did you feel when you arrived Lingshed? How did the villagers welcome you? What did the villagers say about life in the village without light?	
Paragraph 4 What did you have to do to install the solar panels? How did you feel when you were installing the panels? How did you feel when the solar panels were installed?	
Paragraph 5 What happened when the lights were turned on? How did the people celebrate? How will life be different for them? How do you feel now the project is complete?	

English Resource 2B

altitude	monastery	glistening
acclimatise	tentatively	Ladakh
kerosene lamps	mountain pass	electricity
scenery	Himalayas	apprehensive
electrification	deep valley	kataks (ceremonial silk prayer scarves)

English Lesson 3

Learning question:

How will I use inverted commas to show direct speech?

NC LINKS

- Use paragraphs to organise ideas around a theme
- Use an adverb phrase at the start of a sentence
- Make writing interesting by using adjectives and other descriptive methods
- Use inverted commas for direct speech

RESOURCES:

- Resource 3B (enough for one per child)

STARTER ACTIVITY

Remind the children that when they write their recount they will be using fronted adverbials to start some of their sentences.

Display the following sentence on the interactive whiteboard:

I jumped off the plane ready to meet the rest of the team.

Display the following examples of fronted adverbials on the same slide:

excitedly
my heart beating like a drum
after a long flight

Discuss with the children how to rewrite the sentence to include one of these fronted adverbials. Model rewriting the sentence with the fronted adverbial at the start followed be a comma.

Repeat with the following sentence:

We had to get used to the high altitude.

and examples of adverbials:

in Leh
as soon as we arrived
in the mountains

Display the following sentences and examples of fronted adverbials on the interactive whiteboard and ask the children to work with a partner to rewrite them with a fronted adverbial at the start. Challenge the children to explore more than one idea for each sentence or think of their own fronted adverbials.

Sentences:
We began our 75-mile journey from Leh to Photoskar.
We couldn't ignore the beautiful scenery that surrounded us.
Our destination finally came into view.
We knew there was still more hard work to come.

Adverbials:
in the mountains
the next day
as the sun rose
tired and hungry
finally
at the end of a long day
ahead of us

Take feedback and tackle any misconceptions.

Give children a minute or two to add a couple of ideas for fronted adverbials to the plan they started in Lesson 2.

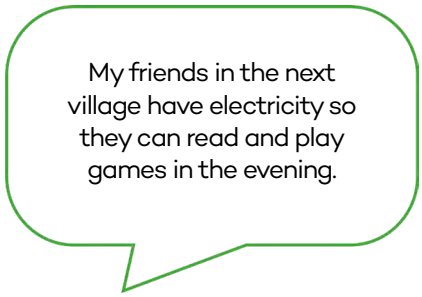
English Lesson 3

MAIN ACTIVITY: TEACHER INPUT

Explain to the children that they are going to think about what the villagers would have said to the expedition team about their life without light, the challenges that they face and the things they are unable to do. Display the images in Resource 3A on the interactive whiteboard to support the children's thinking. Give them time to discuss their ideas in small groups then share some of these with the class.

Model how to add their ideas to the start of the third paragraph on the class plan. Allow the children a few minutes to add ideas for this section to their own plan.

Display the speech bubble below on the interactive whiteboard. Ask children: *Who might have said this?*

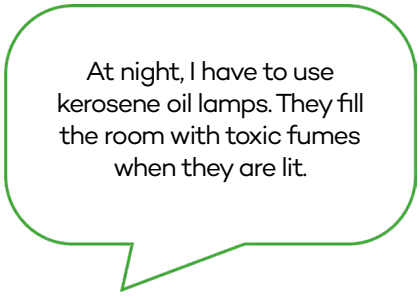


Model how to turn the speech bubble into direct speech, adding the speaker after the speech.

e.g. "My friends in the next village have electricity so they can read and play games in the evening," said a schoolboy, aged nine.

Explain that they will use direct speech in the recounts they write later in the week.

Repeat with other examples, displaying the speech bubbles below one at a time, then asking the children to turn the sentences into direct speech with a partner.



Ask the children to share their learning and use this opportunity to discuss other words that can be used instead of 'said' to improve the children's examples further.

e.g. "At night, I have to use kerosene oil lamps, which fill the room with toxic fumes when they are lit," explained a young student.

"In the summer we can become ill from the heat as there is no way of escaping the hot temperatures," an elderly woman shared.

Make a list of alternatives for 'said' on the interactive whiteboard.

English Lesson 3

MAIN ACTIVITY: INDEPENDENT LEARNING

Using the speech bubbles in Resource 3B, the children write direct speech to show what people in the village said.

DIFFERENTIATION

Support
Children work in pairs or as part of an adult-led group, starting with the shorter, simpler sentences at the top of Resource 2B.

Extension
Children use the own ideas to develop what each person said in more detail.

PLENARY

On the interactive whiteboard, show an example of direct speech with errors or areas for improvement.

e.g. "When the solar panels arrive, I am looking forward to reading my son a bedtime story each night. Said a mother in the village."

Allow the children to work with a partner to make corrections then ask the children for their ideas to correct this as a class.

Model how to add ideas for direct speech to use in the third paragraph of the recount to the class plan. Allow the children time to add some of the direct speech sentences they have generated this lesson to complete the third section of their own plan.

English Resource 3A

English Resource 3A

English Resource 3B

Speech bubbles

Turn the sentences in the speech bubbles below into direct speech.
Here's an example:

"We try not to use the kerosene oil lamps too much, so that the fuel in them lasts longer," a mother of three told us.

We have to carry kerosene oil for hundreds of miles to use in our lamps.

a teacher at the local school

Even when darkness falls on my village after sunset, food still has to be cooked and I have to finish my studies.

a boy, aged nine

Fumes from the diesel generators cover the wall of our buildings with black soot.

a farmer

Walking along the road can be dangerous because there are no streetlights.

a monk from Lingshed

Our village is perfect for solar energy. Solar grids work well in cold temperatures and we have 320 days of sun. With solar panels, we could have clean light all night. I am so excited!

a young student, aged 13

We grow our own food and prepare for winter by storing grains, barley and cattle fodder. Our cattle provide us with milk and butter.

an elderly woman

You could use some of these words instead of said:

explained	whispered
shared	commented
exclaimed	mentioned
stated	added

English Lesson 4

Learning question:

How can I use my plan to start writing my recount?

NC LINKS

- Use an adverb phrase at the start of a sentence
- Use commas after adverbials at the beginning of a sentence
- Make writing interesting by using adjectives and other descriptive methods
- Use paragraphs to organise writing so that blocks of text flow and ideas are grouped together

RESOURCES:

- Copies of Resource 4A (enough for one between two)

STARTER ACTIVITY

Explain to the children that to plan the fourth paragraph of their recount, they will need to find out how the lights and solar panels are installed in the village.

Watch the video clip at vimeo.com/403961329, which shows the installation of the solar panels and the celebration of light (38:25 to 47:00).

Provide children with the sentences on Resource 4A that describe the installation of the solar panels. In pairs, the children order them into the correct sequence.

Take feedback from the children, reveal the correct sequence, and model how to add ideas to the fourth paragraph of the class plan. Give the children time to add some ideas to their own plan.

English Lesson 4

MAIN ACTIVITY: TEACHER INPUT

Explain to the children that they will start writing their recounts in the rest of the lesson.

Display the self-assessment checklist in Resource 5A on the interactive whiteboard and briefly go through with the children the objectives for their writing.

Using shared writing, write the first paragraph of the recount with reference to the ideas on the class plan, using the children's suggestions about how to put these into sentences. Prompt them to use fronted adverbials to start some sentences. To support them, it may be useful to display a list of fronted adverbials on the interactive whiteboard for the children to refer to. For example:

As the plane landed in Leh,
While we got used to the high altitude,
When the road came to an end,
Carefully,
After a dangerous and exhausting journey,
In the mountains,
The next day,
As the sun rose,
Tired and hungry,
Finally,
At the end of a long day,
Ahead of us,

MAIN ACTIVITY: INDEPENDENT LEARNING

Children write the first four paragraphs of their recount using the plans that they have created throughout the week.

DIFFERENTIATION

Support
Children write simple sentences in chronological order, rehearsing their sentences with a partner before writing. Use the word bank of topic-related vocabulary (Resource 2B) for support.

Extension
Include a range of fronted adverbials and topic-related vocabulary in their writing.

PLENARY

Children identify a section of their draft that they would like help improving. They work in pairs to assess the section they and their partner have identified and suggest improvements. To guide their assessment, display the self-assessment checklist (Resource 5A) on the interactive whiteboard for them to refer to.

Allow some time for a few pairs to share one of the improvements their partner helped them to make.

English Resource 4A

Finally, we attached a bulb to each wire that had been hammered into the wooden beams in the ceilings.

Carefully, we fed the wires along the ceilings into each room that needed a light bulb. Each bulb has two wires (one for the battery and one for the light switch).

As we tapped nails into the old wooden beams, clouds of dust billowed across the room.

Three days after we arrived, the electrification of the monastery and village of Lingshed was finally completed.

First, we hoisted solar panels onto the roof tops.

Glistening like diamonds in the sunlight, the panels were then connected to large batteries.

Exhausted but exhilarated, we waited for sunset.

At sunrise, we gathered together to listen to the instructions.

English Lesson 5

Learning question:

How will I edit and improve my recount to engage a reader?

NC LINKS

- I can edit my work by changing the grammar to improve the way my work reads
- I can use an adverb phrase at the start of a sentence
- I can use commas after adverbials at the beginning of a sentence
- I can make my writing interesting by using adjectives and other descriptive methods

RESOURCES:

- Thesauruses
- Copies of Resource 5A (enough for one per child)

STARTER ACTIVITY

Display on the interactive whiteboard the images in Resource 5B, showing the villagers enjoying electric light for the first time. Ask the children: *How do you think they felt? How might they have shown their emotions? What might they be able to do for the first time?*

In small groups, give the children some time to act out a scene in which the villagers turn on the lights in their homes for the first time to explore both the reaction of the villagers and the volunteers.

As a class, populate the final section of the class plan on the interactive whiteboard with ideas based on the drama activity. Ask one or two children to be 'thesaurus helpers' to look up and suggest more adventurous alternatives to words such as 'happy' and add these to the plan.

MAIN ACTIVITY: TEACHER INPUT

Using shared writing, write the final section of the recount, using ideas from the children to generate sentences and referring to the class plan.

English Lesson 5

MAIN ACTIVITY: INDEPENDENT LEARNING

The children finish writing their recounts, with reference to their plans.

MINI PLENARY

Display on the interactive whiteboard the self-assessment checklist (Resource 5A). With a partner, the children identify any elements they haven't yet included in their writing and where they could edit their writing to include them.

DIFFERENTIATION

Support
Direct adults in the class to work with this group of children. They support them in reading through their work so far and identifying what to focus on from the self-assessment checklist to finish writing their recount.

Extension
Use a thesaurus to improve their vocabulary choices. Aim to include all the elements from the self-assessment checklist.

PLENARY

The children read through their writing with a partner, helping each other to identify improvements before assessing their own writing against the self-assessment checklist.

If time allows, invite some children to share short sections of their recount that they're particularly proud of.

SUSTAINABILITY QUESTIONS

Why was cleaner energy better for the villagers? Why is it better for the environment? How could we use more clean energy in our homes?

English Resource 5A

RECOUNT: Self-assessment checklist	
	I have used a range of fronted adverbials.
	I have organised related ideas into paragraphs.
	I have written about events in chronological order.
	I have written in the past tense.
	I have chosen adventurous vocabulary related to the topic.
	I have used direct speech.

RECOUNT: Self-assessment checklist	
	I have used a range of fronted adverbials.
	I have organised related ideas into paragraphs.
	I have written about events in chronological order.
	I have written in the past tense.
	I have chosen adventurous vocabulary related to the topic.
	I have used direct speech.

English Resource 5B

English Resource 5B

English Resource 5B

Maths Investigations

The six maths investigations presented here explore how we measure energy at home and at school.

Energy is measured in watts (W), but you'll usually see it written as kilowatts (kW). There are 1,000 W in 1 kW.

However, the measurement you will see on an energy bill is kilowatt-hour (kWh). A kWh is a measure of the amount of energy used in an hour. In the second investigation in this set, the children learn that some of the electrical appliances in our homes and schools use more energy than others, and they explore the comparative costs of running them.

Alongside the learning in these investigations, the children could be shown how to take meter readings and how to record the amount of electricity their family uses at home each week. They and their families could then be challenged to reduce their energy use over the half term in which these investigations are taught, and to share their top tips for saving energy with the rest of the school community.

It is worth noting that meter readings are usually five-digit numbers and that this goes beyond the scope of Year 4 National Curriculum objectives for maths. However, children could be introduced to place value to 10,000 with support, either from adults, carers or older siblings at home, or using place value charts.

The Harmony Project

Maths Investigation 1

Learning question:

How much energy do we use in our homes and how do we measure it?

Maths skill: Using multiplication facts to calculate different amounts of money using both mental and written methods

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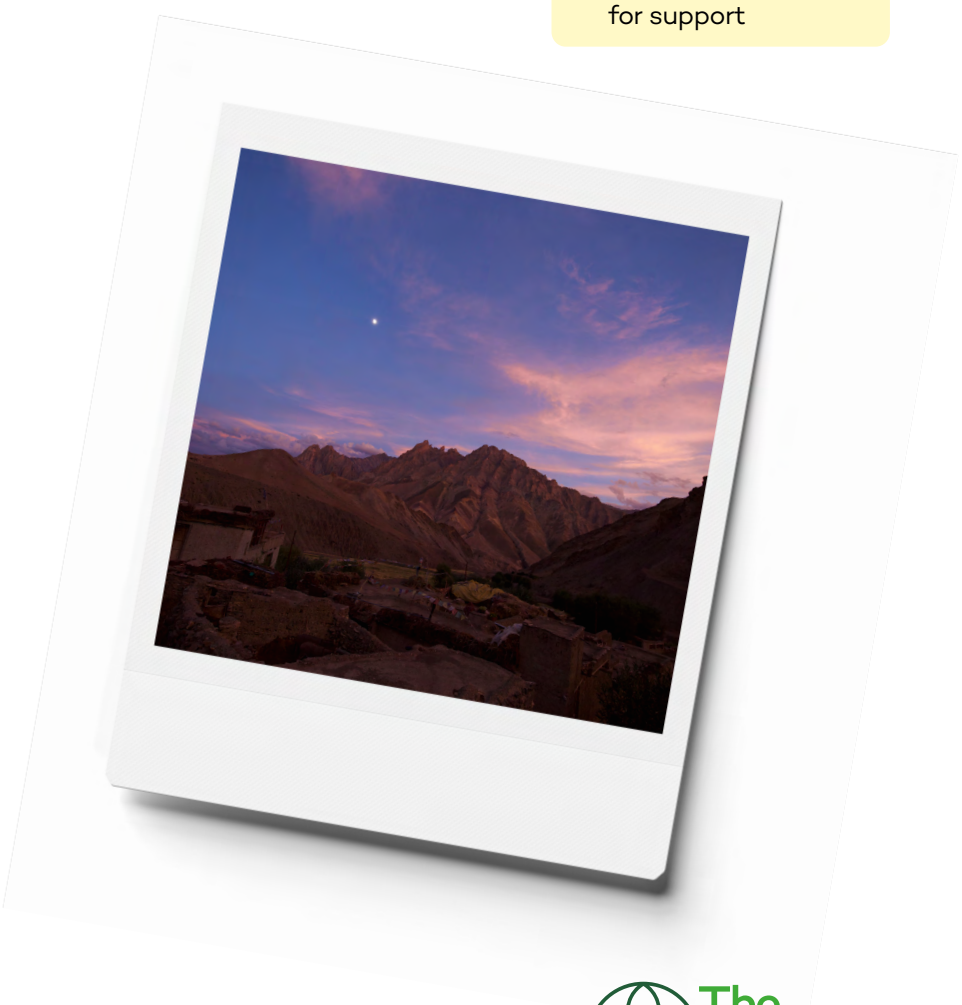
NC LINKS

- Recognise the place value of each digit in a four-digit number (1,000s, 100s, 10s, and 1s)
- Order and compare numbers beyond 1,000
- Find the effect of dividing a one- or two-digit number by 10 and 100, identifying the value of the digits in the answer as ones, tenths and hundredths
- Solve simple measure and money problems involving fractions and decimals to 2 decimal places

RESOURCES:

- Copies of cards in Resource 1A, cut out (enough for one set per group)
- Copies of Resource 1B (enough for one per child)
- Place value charts for support



Maths Investigation 1

STARTER ACTIVITY

Find out if students know where the electricity meters are in their homes. Show children images of electricity bills, electricity meters and smart meters and discuss how they help us to measure our energy use.

As a class, explore and compare the numbers in these images that show energy use in kWh by identifying the value of the different digits. These are usually five-digit numbers, which is beyond the scope of National Curriculum objectives for Year 4, so the children may need support to do this.

On the interactive whiteboard, display the table below showing the amount of electricity used by the average person each year in different countries around the world.

In small groups, the children order the cards in Resource 1A from smallest to largest. Alternatively, the children could work in groups of 10, each taking a card and moving around to order themselves.

TEACHER'S NOTES

A huge 99% of Norway's electricity comes from hydroelectric generation, so although the figure for kWh per person is high, Norway's electricity consumption produces very low levels of equivalent CO2 emissions. Electricity in Norway is very cheap for consumers, so Norwegians do not need to worry about their energy use financially or environmentally.

Although India uses the least amount of electricity of all the countries shown in this table, 75% of India's electricity generation comes from coal. Consumers in India pay around three or four times more than the electricity costs to produce, making it one of the highest tariffs.

Country	kWh
Norway	24,182
United States	12,154
India	1,255
Russia	6,685
Canada	14,612
France	6,702
Brazil	2,830
United Kingdom	4,496
Italy	4,928
Australia	9,502

Ask the children:

In which countries is the average amount of energy used per person less than 5,000 kWh?

What is the difference between the kWh used by the average person in France and the kWh used by the average person in Brazil? What about Australia and Norway?

Why might people in Norway use so much energy and why might people in India use so little? Is it OK that people in Norway consume so much more? Why or why not?

Maths Investigation 1

MAIN ACTIVITY: TEACHER INPUT

On the interactive whiteboard, show the statement:

An average household in the UK uses 10kWh of electricity each day.

In pairs, children calculate answers to the following questions:
How many kWh will an average household use in:
a) a week?
b) a month?
c) a year?

Answers:
a) 7 x 10 = 70 kWh
b) 30 x 10 = 300 kWh (or 31 x 10 = 310 kWh)
c) 365 x 10 = 3650 kWh

Now show this statement on the interactive whiteboard:

1kWh of electricity costs 34p.

In pairs, children calculate answers to the following questions using either repeated addition or a written multiplication method:
d) How much will 2 kWh cost?
e) How much will 3 kWh cost?
f) How much will 5 kWh cost?

Answers:
d) 2 x 34p (or 34p + 34p) = 68p
e) 3 x 34p (or 34p + 34p + 34p) = 102p
f) 5 x 34p (or 34p + 34p + 34p + 34p + 34p) = 170p

Go through the answers and ask the children: *How do we convert p into £?*

Use a place value chart to model or recap for the children how the digits in a number move two places to the right when dividing a number by 100. Repeat, if required, until children are secure in dividing a three-digit number by 100.

SUSTAINABILITY QUESTION

Why do some countries use so much more energy than others? Where do you think their energy comes from?

MAIN ACTIVITY: INDEPENDENT LEARNING

Activity 1
Children use multiplication (or repeated addition for some of the smaller numbers) to work out the different costs for the values in kWh shown in the table in Resource 1B. They go on to divide by 100 to turn the cost in p into £.

Activity 2
An average household in the UK uses 10 kWh of electricity a day. The children use this statement to answer the following questions:

a) How much will a household pay for the electricity it uses in one day if 1 kWh costs 34p?

b) Work out how much will it pay for the electricity it uses in:

5 days	10 weeks
A week	10 months
4 weeks (a month)	12 months

PLENARY

Discuss as a class the comparative costs of using different appliances at home. Ask the children: *If a games console uses 1 kWh of electricity every five hours, how much would it cost to play on it for five hours? How much if you played on it for five hours a day for a week? What would happen if you reduced the time by half? How much would you save over a month?*

DIFFERENTIATION

Support
Provide the first 10 multiples of 34 as a reference point for the children:
34, 68, 102, 136, 170, 204, 238, 272, 306, 340

Extension
1. If a household spends 68p, how many kWh of energy has it used?

2. Calculate how many kWh it has used if it spends:
a) £3.40 b) £1.02 c) £1.70 d) £2.38

3. If a games console uses 2 kWh in 10 hours, how many kWh in 1 hour?

4. If a dishwasher uses 91 kWh in 100 hours, how many kWh in 1 hour?

Maths Resource 1A

France 6,702	Norway 24,182
Brazil 2,830	United States 12,154
United Kingdom 4,496	India 1,255
Italy 4,928	Russia 6,685
Australia 9,502	Canada 14,612

France 6,702	Norway 24,182
Brazil 2,830	United States 12,154
United Kingdom 4,496	India 1,255
Italy 4,928	Russia 6,685
Australia 9,502	Canada 14,612

Maths Resource 1B

kWh	Cost in p	Cost in £
1 kWh		
2 kWh		
3 kWh		
4 kWh		
5 kWh		
10 kWh		
20 kWh		
25 kWh		
30 kWh		
50 kWh		
75 kWh		
100 kWh		
150 kWh		
200 kWh		

Maths Investigation 2

Learning questions:

How much energy do different appliances use per hour? Which appliances use the most energy?

Maths skill: Using multiplication facts to calculate different amounts of money using both mental and written methods

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NC LINKS

- Count in multiples of 6, 7, 9 and 25
- Multiply two-digit and three-digit numbers by a one-digit number using formal written layout
- Estimate, compare and calculate different measures, including money in pounds and pence
- Find simple fractions of two-digit whole numbers

RESOURCES:

- Copies of Resource 2A (enough for one table between two)
- Copies of Resource 2B (enough for one each)
- *Optional: Copies of Resource 2C (enough for one each) for those children*

STARTER ACTIVITY

As a class, count forwards and backwards in multiples of seven to support the learning in the main lesson. Children create their own games in circles to help each other remember the multiples.

Maths Investigation 2

MAIN ACTIVITY: TEACHER INPUT

Begin by asking the children: *What things use electricity at home?*

Explain to the children that different electrical appliances and devices use different amounts of energy. This could be demonstrated further by showing children different light bulbs or light bulb boxes and discussing how the wattage differs. The higher the wattage, the brighter the bulb, and the more energy the bulb uses.

On the interactive whiteboard, display the table in Resource 2A that shows the cost of the electricity that different appliances and devices use*.

In pairs, the children calculate answers to the following questions:

How much does it cost to watch TV for:
a) 2 hours
b) 5 hours
c) 10 hours
d) ½ hour

Answers:
a) 2 x 6p = 12p
b) 5 x 6p = 30p
c) 10 x 6p = 60p
d) 6p ÷ 2 = 3p

Ask the children: *How many hours of television do you watch each weekday? During the weekend?*

In pairs, children use the answers to the previous activity to calculate the answer to the question:

e) How much will it cost to watch television over a week?
Answers:
a) 2 hours per day (12p x 7 = 84p)
b) 5 hours per day (30p x 7 = 210p or £2.10)
c) 10 hours per day (60p x 7 = 420p or £4.20)
d) ½ hour per day (3p x 7 = 21p)

Give children time to explain how they calculated the answer to the class.

MAIN ACTIVITY: INDEPENDENT LEARNING

Using the information in the first table on Resource 2A, which shows the cost of the electricity that different appliances and devices use, the children calculate the cost of running these appliances each day for a week. They fill in the second table in Resource 2A with their answers.

PLENARY

As a class, work through some of the children's calculations and answers from the independent learning activity.

Ask the children: *What would be the costs over a month or year?*

As an extra challenge, the children could calculate these further costs:

1 day	2 days	7 days (a week)	A month (30 days)	A year (365 days)
e.g. £2	£4	£14	£60	£730
£3				
£2.50				
£5				

DIFFERENTIATION

Support
Children work through the simpler calculations on Resource 2B.

Extension
The children solve the following problem as an additional challenge:

If you have £2 to spend in one day, what range of appliances could you use and for how long? How many different combinations can you find?

SUSTAINABILITY QUESTIONS

How could you reduce the amount of electricity you use each day? What impact will that have on the cost of electricity used? What might be the other benefits of reducing the amount of electricity you use?

* The costs given here are approximate and rounded for the purpose of this investigation.

Maths Resource 2A

ACTIVITY 1

This is how much the electricity needed to run different appliances and devices in our homes costs:

APPLIANCE	COST PER HOUR
Television	6p
Vacuum cleaner	24p
Mobile phone (when it's charging)	15p
Games console	7p

APPLIANCE	COST PER HOUR
Hair dryer	56p
Toaster	26p
Microwave	28p
Oven	68p

ACTIVITY 1

This is how much the electricity needed to run different appliances and devices in our homes costs:

APPLIANCE	COST PER HOUR
Television	6p
Vacuum cleaner	24p
Mobile phone (when it's charging)	15p
Games console	7p

APPLIANCE	COST PER HOUR
Hair dryer	56p
Toaster	26p
Microwave	28p
Oven	68p

Maths Resource 2B

ACTIVITY 1

Use the information in the table that shows how much it costs to run different appliances and devices to calculate how much it costs to run these appliances and devices each day for a week. Add your answers to the table below.

Day	Appliance	Used for...	Cost
Monday	Television Games console Oven	3 hours 2 hours $\frac{1}{2}$ hour	
Tuesday	Charging mobile Games console Oven	1 hour 3 hours $\frac{1}{2}$ hour	
Wednesday	Oven Kettle Vacuum cleaner	$\frac{1}{2}$ hour $\frac{1}{2}$ hour $\frac{1}{2}$ hour	
Thursday	Toaster Oven Charging mobile	$\frac{1}{2}$ hour $\frac{1}{2}$ hour 1 hour	
Friday	Games console Microwave Television	3 hours $\frac{1}{4}$ hour $1\frac{1}{2}$ hours	
Saturday	Toaster Hairdryer Microwave	$\frac{1}{2}$ hour $\frac{1}{4}$ hour $\frac{1}{2}$ hour	
Sunday	Oven Charging mobile Television	$1\frac{1}{2}$ hours 1 hour 4 hours	
What is the total cost of the electricity used by these appliances and devices over the whole week?			Total:

Maths Resource 2C

ACTIVITY 2

Use the information in this table to calculate how much it costs to run these appliances and devices for a week. Add your answers to the table below.

Appliance	Cost to use for 1 hour	Amount of time	Total cost
Television	6p	5 hours	
Mobile phone (when charging)	15p	4 hours	
Games console	7p	6 hours	
Oven	68p	1 hour	
Kettle	80p	$\frac{1}{2}$ hour	
Hairdryer	56p	$\frac{1}{4}$ hour CLUE: halve the cost and halve it again	
Vacuum cleaner	24p	1 hour	
Toaster	26p	$\frac{1}{2}$ hour	
Microwave	28p	$\frac{1}{4}$ hour CLUE: halve the cost and halve it again	
			Total =

The Harmony Project

Answer sheet

ACTIVITY 1

Day	Appliance	Used for...	Cost
Monday	Television Games console Oven	3 hours 2 hours $\frac{1}{2}$ hour	6p x 3 = 18p 7p x 2 = 14p 68p ÷ 2 = 34p
Tuesday	Charging mobile Games console Oven	1 hour 3 hours $\frac{1}{2}$ hour	15p 7p x 3 = 21p 68p ÷ 2 = 34p
Wednesday	Oven Kettle Vacuum cleaner	$\frac{1}{2}$ hour $\frac{1}{2}$ hour $\frac{1}{2}$ hour	68p ÷ 2 = 34p 80p ÷ 2 = 40p 24p ÷ 2 = 12p
Thursday	Toaster Oven Charging mobile	$\frac{1}{2}$ hour $\frac{1}{2}$ hour 1 hour	26p ÷ 2 = 13p 68p ÷ 2 = 34p 15p
Friday	Games console Microwave Television	3 hours $\frac{1}{4}$ hour 1 $\frac{1}{2}$ hours	7p x 3 = 21p 30p ÷ 4 = 7p 6p + 3p = 9p
Saturday	Toaster Hair dryer Microwave	$\frac{1}{2}$ hour $\frac{1}{4}$ hour $\frac{1}{2}$ hour	26p ÷ 2 = 13p 56p ÷ 4 = 14p 10p ÷ 2 = 5p
Sunday	Oven Charging mobile Television	1 $\frac{1}{2}$ hours 1 hour 4 hours	68p + 34p = £1.02 15p 6p x 4 = 24p
What is the total cost of the electricity used by these appliances and devices over the whole week?			TOTAL: £5.04

Answer sheet

ACTIVITY 2

Appliance	Cost for 1 hour	Amount of time	Total cost
Television	6p	5 hours	30p
Mobile phone (to charge)	15p	4 hours	60p
Games console	7p	6 hours	42p
Oven	68p	1 hours	68p
Kettle	80p	$\frac{1}{2}$ hour	40p
Hairdryer	56p	$\frac{1}{4}$ hour	14p
Vacuum cleaner	24p	1 hours	24p
Toaster	26p	$\frac{1}{2}$ hour	13p
Microwave	30p	18 minutes	7p
			Total 298p

Maths Investigation 3

Learning question:
How much electricity do we use in a day?

Maths skill: Interpret data in a bar chart and solve comparison, sum and difference problems

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NC LINKS

- Compare numbers with the same number of decimal places
- Solve simple measure and money problems involving fractions and decimals
- Interpret and present discrete data using bar charts
- Solve comparison, sum and difference problems using information presented in bar charts

RESOURCES:

- Copies of Resource 3A (enough for one between two)
- Copies of Resource 3B (enough for one between two)

STARTER ACTIVITY

Compare and order numbers with up to two decimal places on a number line.

Begin by asking the children to write on whiteboards or sticky notes a number between 1 and 5 that has one decimal place — for example, 1.5 or 4.3. In groups of five, ask the children to order their numbers from smallest to largest. Ask the children to identify the value of the digits in the ones and tenths columns. Ask: *How did you work out how to order yourselves? Which digit helped you decide which number was smaller or larger?*

Repeat this activity but this time with numbers between 6 and 7.

Move on to work with decimal numbers with two decimal places. Ask the children to write a number between 4 and 5 with two decimal places — for example, 4.32 or 4.09. Ask the children to get into groups of five and order their numbers from smallest to largest. Ask: *How did you work out how to order yourselves this time? Which digit helped you decide which number was smaller or larger?*

Maths Investigation 3

MAIN ACTIVITY: TEACHER INPUT

Ask the children: *What things use electricity at school?*

On the interactive whiteboard, display the graph in Resource 3A, which shows the amount of electricity a school uses over an average school day. Ask the children: *What information is this graph showing us?*

Allow them to discuss this with a partner before sharing their ideas with the class. Take a moment to discuss what the bars and axes show and to tackle any misconceptions.

Ask the children questions to help them familiarise themselves with the data in the graph. For example: *What is the school's electricity use at 6am, 1pm and 7pm?*

How many more kWh did the school use at 10am than at 4pm?

At what times did the school use over 16 kWh? Why do you think this is?

Allow time for the children to discuss these questions in pairs before taking feedback as a class. Explain to the children that they will use this graph to answer questions independently.

MAIN ACTIVITY: INDEPENDENT LEARNING

Using the graph in Resource 3A, the children answer the questions on the sheet Resource 3B.

PLENARY

Go through the answers to some of the questions the children answered in the independent activity to spot-check their understanding and discuss the strategies they used to work out their answers.

DIFFERENTIATION

Support
Children pose questions orally for a partner to answer such as: *How much electricity did the school use at midday?*

Extension
The children go on to answer the following questions:

7) How many kWh did the school use from 7am to 12pm in total?
8) How many kWh did the school use from 12pm to 7pm in total?

Use a calculator to solve the following but remember to show your workings:

9) The school pays 34p for each kWh of electricity it uses*. How much money did the school pay for its energy use from 7am to 12pm?
10) The school pays 34p for each kWh of it uses. How much money did the school pay for its energy use from 12pm to 7pm?

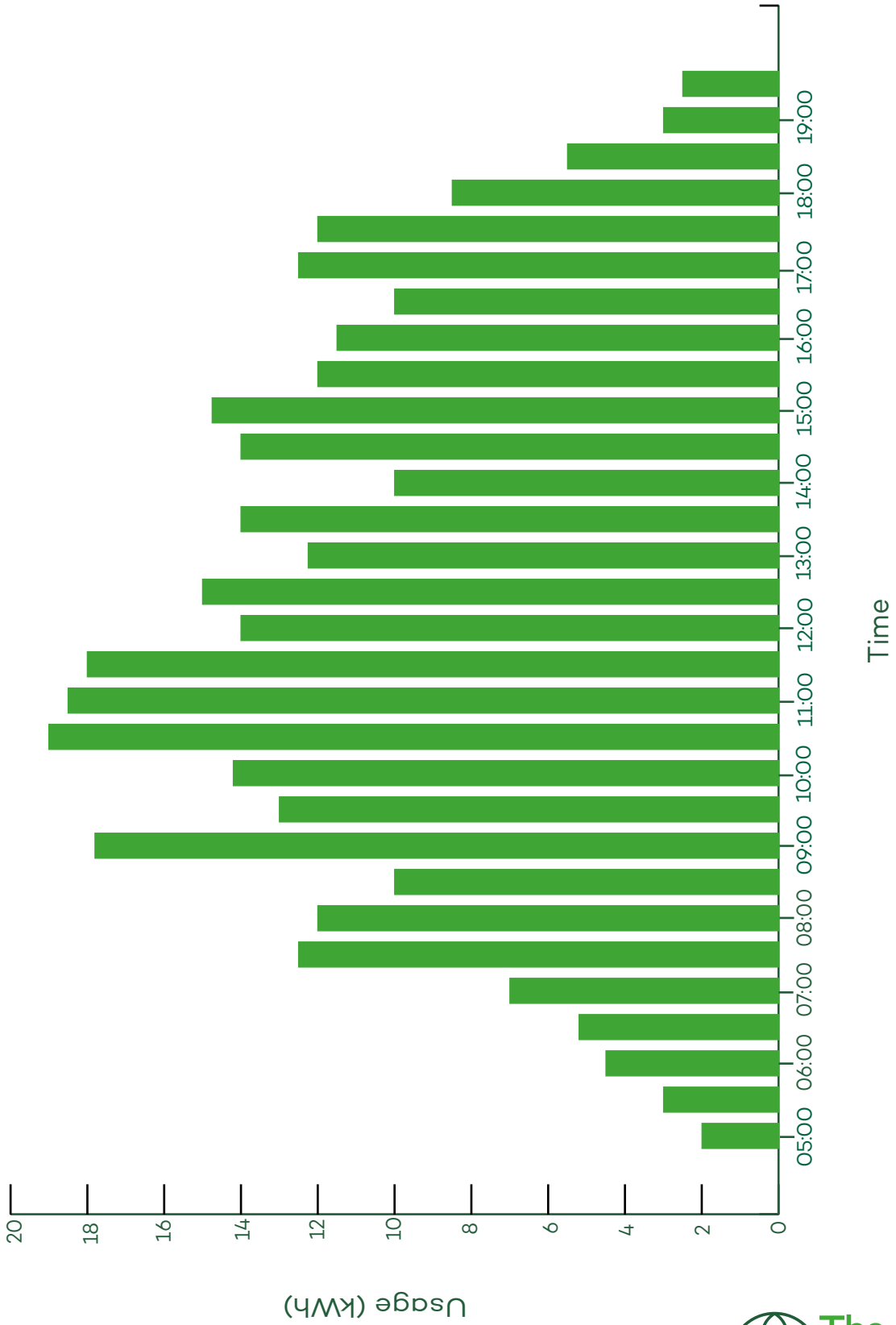
* price of electricity correct as of March 2023

SUSTAINABILITY QUESTION

In which half hour does the school use the most energy? Why do you think this is? What needs to happen to reduce this amount?

Maths Resource 3A

This graph shows the amount of electricity, measured in kWh, that a school uses in one school day.



Maths Resource 3B

Use the graph to answer the following questions.

1. How much electricity does the school use at:
   a) 7am
   b) 5pm
   c) 2pm
   d) 12pm
   e) 10.30am?

2. At what times does the school use approximately:
   a) 12 kWh
   b) 11.5 kWh
   c) 5.2 kWh
   d) 17.8 kWh
   e) 18.75 kWh?

3. How many more kWh does the school use at:
   a) 7.30am than 4.30pm
   b) 11am than 3pm
   c) 9am than 3.30pm?

4. How many kWh of electricity does the school use between:
   a) 8am and 9am
   b) 9am and 11am
   c) midday and 3pm?

5. Why do you think the electricity used rises so much at 7.30am?

6. Why do you think the electricity used rises at 5pm?

Maths Resource 3B

ANSWER SHEET

1. a) 7am **7 kWh**
   b) 5pm **12.5 kWh**
   c) 2pm **10 kWh**
   d) 12pm **14 kWh**
   e) 10.30am **19 kWh**

2. a) 12 kWh **8am, 3.30pm and 5.30pm**
   b) 11.5 kWh **4pm**
   c) 5.2 kWh **6.30am**
   d) 17.8 kWh **9am**
   e) 18.75 kWh **11am**

3. a) 7.30am than 4.30pm **12.5 – 10 = 2.5 kWh**
   b) 11am than 3pm **18.75 – 14.75 = 4 kWh**
   c) 9am than 3.30pm **17.8 – 12 = 5.8 kWh**

4. a) 8am and 9am **12 + 10 + 17.8 = 39.8 kWh**
   b) 9am and 11am **17.8 + 13 + 14.5 + 19 + 18.75 = 83.05 kWh**
   c) midday and 3pm **14 + 15 + 12.5 + 14 + 10 + 14 + 14.75 = 81.25 kWh**

5. Why do you think the electricity used rises so much at 7.30am?
   Possible answers: Most members of staff have arrived and turned lights on in classrooms. Breakfast clubs or sports clubs may also be starting at this point.

6. Why do you think the kWh usage rises at 5pm?
   It has got darker outside so adults working in classrooms/offices or running clubs in the school hall have turned the lights on.

ANSWERS (EXTENSION)

7) How many kWh did the school use from 7am to 12pm?
   125 + 200 + 220 + 210 + 230 + 225 + 215 + 235 + 220 + 215 + 210 = 2305 kWh

8) How many kWh did the school use from 12pm to 7pm?
   210 + 205 + 225 + 205 + 200 + 190 + 185 + 175 + 165 + 160 + 175 + 170 + 150 + 150+ 140 = 2705 kWh

9) The school pays 34p for each kWh of electricity it uses. How much money did the school pay for its energy use from 7am to 12pm?
   2305 x 0.34 = £783.70

10) The school pays 34p for each kWh of electricity it uses. How much money did the §school pay for its energy use from 12pm to 7pm?
   2705 x 0.34 = £919.70

Maths Investigation 4

Learning question:
How much electricity do we use in a half term?

Maths skill: Interpret data in a bar chart and solve comparison, sum and difference problems

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NC LINKS

- Add and subtract numbers with up to four digits using the formal written methods of columnar addition and subtraction, where appropriate
- Interpret and present discrete data using bar charts
- Solve comparison, sum and difference problems using information presented in bar charts

RESOURCES:

- Copies of Resource 4A (enough for one between two)
- Copies of Resource 4B (enough for one each)

STARTER ACTIVITY

Begin the lesson with counting games with a focus on multiples of 5, then multiples of 25. Then, with the children standing in a circle, count up from 0 in multiples of 5 going around the circle. The children clap every time they reach a multiple of 25. Move on to counting around in a circle in multiples of 25, starting from 0 and counting up, then switching to counting down or up each time you clap your hands.

Display a number line with intervals of 25 and an arrow pointing to a number that falls in between 25 and 50. Ask the children: *How will you estimate what the missing number is?*

Repeat this activity a few times and discuss strategies to practise the skill of estimating numbers that fall between multiples of 25. Explain to the children that they will be using this skill when reading information on a bar graph.

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Maths Investigation 4

MAIN ACTIVITY: TEACHER INPUT

On the interactive whiteboard, display the graph in Resource 4A, which shows the amount of electricity a school uses each day over a seven-week period. The turquoise bars represent weekend days, the blue bars represent weekdays and the green bars show days at the end of the Christmas break.

Ask the children: *What information is this graph showing us? What do the different coloured bars represent?* Take a moment to discuss what the bars and axes show and to tackle any misconceptions.

Ask the children questions to help them familiarise themselves with the data in the graph, such as:

1. How many kWh did the school use on 1st January?
2. Approximately how many kWh did the school use on 6th January?
3. In the week starting 15th January, which day has the lowest electricity use? How many kWh were used on that day?
4. What do you notice about the amount of electricity used on weekend days compared to weekdays? Why do you think this is?
5. What do you notice about the amount of electricity used during the Christmas break?

Allow time for the children to discuss these questions in pairs before taking feedback as a class.

ANSWERS

1. **75k Wh**
2. **60 kWh**
3. **Thursday 18th Jan, 390 kWh**
4. **Less electricity is used but the usage is still quite high. Possible reasons: appliances left on; appliances charging, such as laptop trolley; security lights; hall being used for clubs.**
5. **Much less, but, again, not as low as you would imagine. Possible reasons: some staff may be in school working, there may be tradespeople carrying out maintenance in the school, there may be clubs using the school premises.**

MAIN ACTIVITY: INDEPENDENT LEARNING

The children use the graph in Resource 4A to answer the questions on the sheet Resource 4B.

PLENARY

Go through the answers to some of the questions the children answered in the independent activity to spot-check their understanding and discuss the strategies they used to work out their answers.

DIFFERENTIATION

Support
The children pose questions orally for a partner to answer, such as: *How much energy did the school use on the Thursday of the first week?*

Extension
How many kWh does the school use during each week? Order the answers from smallest to largest.

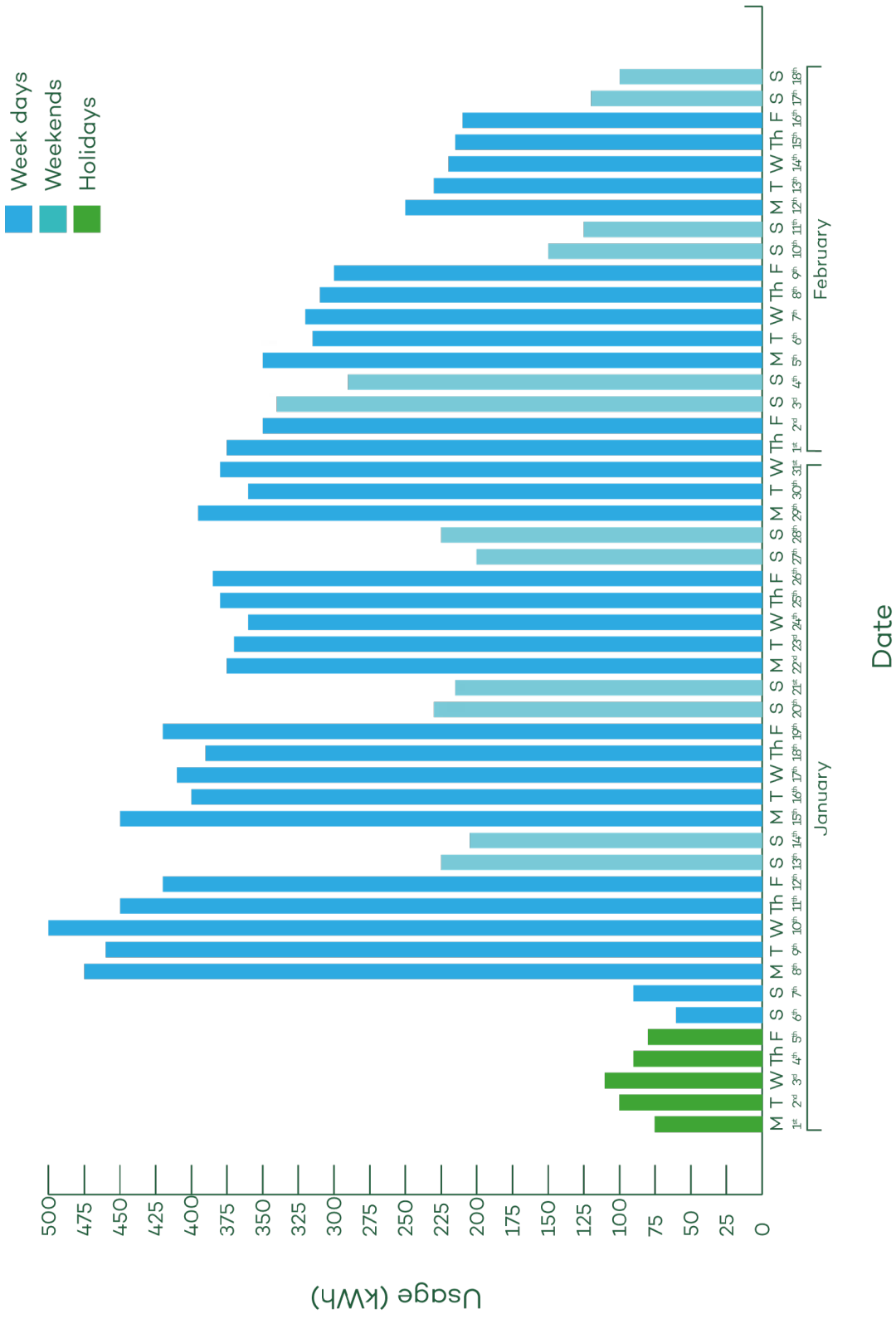
Think of three more questions about the data for your partner to answer. Remember to calculate the answers first.

SUSTAINABILITY QUESTION

Why do schools use so much energy at the weekends and in the holidays? Who can change this and what can they do differently? Could you record your electricity use daily?

Maths Resource 4A

This graph shows the amount of electricity, measured in kWh, that a school uses each day over seven weeks. The turquoise bars represent weekend days, the blue bars represent week days and the green bars show days during the Christmas holidays.



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Maths Resource 4B

Use the graph to answer the following questions.

1. How much electricity does the school use on:
   a) Tuesday 2nd January
   b) Wednesday 10th January
   c) Sunday 21st January
   d) Thursday 8th February
   e) Tuesday 13th February

2. How many kWh of electricity does the school use in total during each weekend? Order the amounts from smallest to largest.

3. 1kWh of electricity costs 34p.
   How much will the school pay for its electricity use in the week starting 8th January and the week starting 29th January? Use a calculator to help you.
   CLUE: Use 0.34 x number of kWh to find out how much each day costs in £ before finding the total amount for each week.

4. Why do you think the amount of electricity the school uses on Saturday 3rd February is higher than the other Saturdays?

Use the graph to answer the following questions.

1. How much electricity does the school use on:
   a) Tuesday 2nd January
   b) Wednesday 10th January
   c) Sunday 21st January
   d) Thursday 8th February
   e) Tuesday 13th February

2. How many kWh of electricity does the school use in total during each weekend? Order the amounts from smallest to largest.

3. 1kWh of electricity costs 34p.
   How much will the school pay for its electricity use in the week starting 8th January and the week starting 29th January? Use a calculator to help you.
   CLUE: Use 0.34 x number of kWh to find out how much each day costs in £ before finding the total amount for each week.

4. Why do you think the amount of electricity the school uses on Saturday 3rd February is higher than the other Saturdays?

Maths Resource 4B

ANSWER SHEET

1. a) Tuesday 2nd January **100 kWh**
   b) Wednesday 10th January **500 kWh**
   c) Sunday 21st January **215 kWh**
   d) Thursday 8th February **310 kWh**
   e) Tuesday 13th February **230 kWh**

2. Amounts ordered from smallest to largest:
   6th and 7th Jan = 150 kWh
   17th and 18th Feb = 220 kWh
   10th and 11th Feb = 275 kWh
   27th and 28th Jan = 425 kWh
   13th and 14th Jan = 430 kWh
   20th and 21st Jan = 445 kWh
   3rd and 4th Feb = 630 kWh

3. Week of 8th January **0.34 x 2305 = £783.70**
   Week of 29th January **0.34 x 1860 = £632.40**

4. Why do you think the amount of electricity the school uses on Saturday 3rd February is higher than the other Saturdays? **Possible answers: A special event such as a fair or a performance occurred on this day.**

EXTENSION ACTIVITY ANSWERS

In order from smallest to largest:

1. **Week 1 = 455 kWh**
2. **Week 7 = 1125 kWh**
3. **Week 6 = 1595 kWh**
4. **Week 5 = 1860 kWh**
5. **Week 4 = 1870 kWh**
6. **Week 3 = 2070 kWh**
7. **Week 2 = 2305 kWh**

Maths Investigation 5

Learning question:

What is the link between reducing energy use and saving money?

Maths skill: Finding fractions of amounts of money

NC LINKS

- Estimate, compare and calculate different measures, including money in pounds and pence
- Solve simple measure and money problems involving fractions and decimals to 2 decimal places

RESOURCES:

- Copies of Resource 5A (enough for one each)
- Place value charts
- Dice or number cards to generate decimal numbers

STARTER ACTIVITY

As a class, start by identifying the value of digits within a number with up to two decimal places. For example, 5.78, 2.03 or 34.9.

Explore with the children what happens when you add
a) 1 more tenth?
b) 1 more hundredth?
c) 10 more tenths?
d) 10 more hundredths?
e) 12 more hundredths

Ask the children: *When do we use decimals in real life?* Take ideas and explain they will be using decimals as money in the learning today.

Ask some questions to assess children's confidence with reading money and converting between pounds and pence. Then display some amounts of money on the interactive whiteboard for the children to order in pairs from smallest to largest e.g. £3.04, £2.89, £0.76, £3.40.

Ask the children:
What is 403p as £ and pence? What is the value of 9 in 36.9 and 36.09? If these were amounts of money, which would be the greatest amount?

Maths Investigation 5

MAIN ACTIVITY: TEACHER INPUT

Explain to the children that they will be exploring ways they can reduce the cost of energy for their families. The children may already have been thinking of ways to reduce their use of energy at home as part of their wider learning. Discuss the idea of reducing energy use by a tenth.

In pairs, the children discuss the following before feeding back to the class:

If a family pays £1 a day for its energy use, how much would they pay if they reduced their use by 1/10?

ANSWERS
£1 ÷ 10 = 10p
£1 - 10p = 90p

Repeat with other amounts such as £2, £6 or £10 to familiarise the children with the two-step calculation.

MAIN ACTIVITY: INDEPENDENT LEARNING

The children work out how much it would cost per month to use different appliances and devices at home if they cut their energy use by a tenth, using their answers to complete the table in Resource 5A.

DIFFERENTIATION

Support
The children find $\frac{1}{10}$ of different amounts of money. Children to choose different amounts of coins, add them up and then find $\frac{1}{10}$. Use place value chart for support.

Extension
How much would you save on each appliance over a) 2 months, b) 6 months, c) 12 months?

PLENARY

The children take on the role of teachers to share the written methods they have used to calculate the answers to complete the table in Resource 5A.

SUSTAINABILITY QUESTIONS

What changes could you make to reduce the amount of electricity you use at home and at school? How could you reduce your energy by $\frac{1}{10}$ (10%)? How could you persuade people at home to take part in a '10% Challenge'?

Maths Resource 5B

Appliance	Monthly cost	Find $\frac{1}{10}$ of the monthly cost	Subtract $\frac{1}{10}$ from the monthly cost
Toaster	60p		
Vacuum cleaner	£1.20		
Television	£4.20		
Games console	£6.60		
Microwave	90p		
Kettle	£4.50		
Hairdryer	£2.40		
Oven	£8.40		
Charging mobile phone	£18.60		
Total			

Maths Resource 5B

ANSWER SHEET

Appliance	Monthly cost	Find $\frac{1}{10}$ of the monthly cost	Subtract $\frac{1}{10}$ from the monthly cost
Toaster	60p	6p	54p
Vacuum cleaner	£1.20	12p	£1.08
Television	£4.20	42p	£3.78
Games console	£6.60	66p	£5.94
Microwave	90p	9p	81p
Kettle	£4.50	45p	£4.05
Hairdryer	£2.40	24p	£2.16
Oven	£8.40	84p	£7.56
Charging mobile phone	£18.60	£1.86	£16.74
Total	£47.40	£4.74	£42.66

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Maths Investigation 6

Learning question:

What could change as the result of our community energy saving challenges?

Maths skill: Finding fractions of amounts of energy measured in kWh

NC LINKS

- Round decimals with 1 decimal place to the nearest whole number
- Find the effect of dividing a one- or two-digit number by 10 and 100, identifying the value of the digits in the answer as ones, tenths and hundredths

RESOURCES:

- Copies of Resource 6A (enough for one each)
- Copies of Resource 6B (enough for those children likely to complete the extra challenge)
- Whiteboards, pens and erasers

STARTER ACTIVITY

Dividing by 10 and 100. Using chalk, the children work in groups of four to draw place value columns on the playground to show Thousands, Hundreds, Tens, Ones, Tenths and Hundredths.

Each child stands in one of the columns holding a whiteboard. When the teacher calls out a number (for example, 3042, 134.6, 23.09) the children have to write on their whiteboard the digit that corresponds to the column they're standing in. You might want to give the children the opportunity to switch columns. Check the children's understanding before moving on.

This time, call out a whole, four-digit number (not a decimal). Again, the children write on their whiteboard the digit that corresponds to the column they're standing in. Now, ask the children to move themselves to show what happens to the number when it is divided by 10. Ask: *What is the new number?*

Repeat this with various four-digit numbers alternating between dividing by 10 and 100 so both skills are practised.

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Maths Investigation 6

MAIN ACTIVITY: TEACHER INPUT

Remind the children that in the previous investigation they explored how much money families could save by reducing the amount of electricity they use.

Show the graph below on the interactive whiteboard. Discuss what it shows and what the different types of properties are.

Explore the information provided in the graph by asking the children questions. For example:
How many kWh does each type of house use on their electricity each year? How much will each type of house spend on their electricity each year? How much more does a detached house spend than a terraced house?

Then move on to ask: *How many kWh would the detached house use if the family reduced their electricity use by* $\frac{1}{10}$ *?*

Give children time to discuss the steps required and then share their ideas.

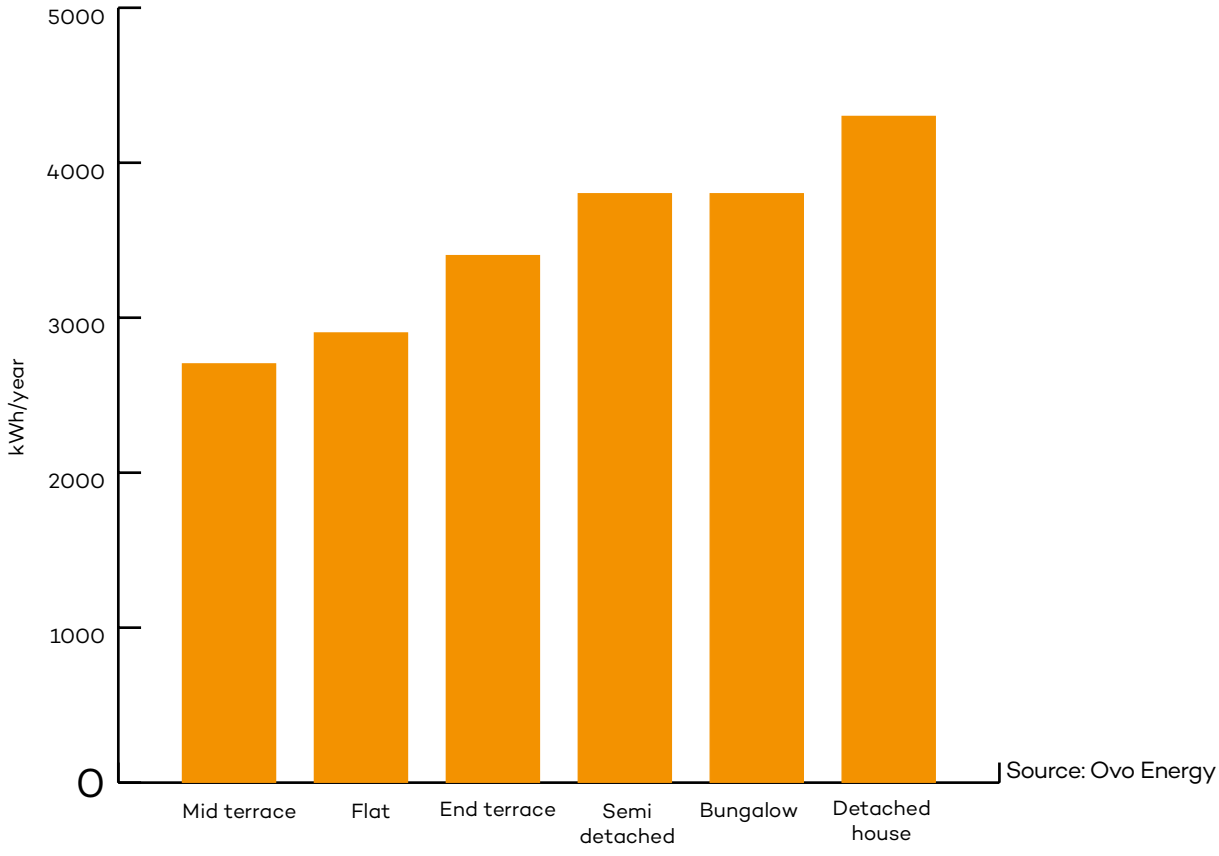
Model the three-step calculation needed to answer this and leave an example on the interactive whiteboard for the children to use as a reference point.

Now ask them: *What is* $\frac{1}{10}$ *of 4100? What is the answer rounded to the nearest whole number?*

Repeat with other kWh amounts, if necessary.

Average annual electricity use by house type (kWh/year)

Figures include all electricity use, except for space heating



Maths Investigation 6

MAIN ACTIVITY: INDEPENDENT LEARNING

The children calculate what the electricity use of 10 different families would be if they reduced their energy use by a tenth using the process outlined in the table in Resource 6A.

DIFFERENTIATION

Support
Focus on finding $\frac{1}{10}$ of different numbers using a place value chart and counters for support.

Extension
If 1kWh costs 34p, how much will each family save? Which family will save the most money? Use a calculator to help you.

PLENARY

Children to become teachers to share the written methods they have used to calculate the answers.

SUSTAINABILITY QUESTIONS

What have you done at home to reduce energy use? What have we done at school to reduce energy use? Who has taken part in the '100 Club Challenge'? Have they been successful and how did they do it?

Maths Resource 6A

How much electricity would these families use if they reduced the amount they used by $\frac{1}{10}$? Use the clues along the top of the table to help you with your calculations.

Family name	KWh per year	Find $\frac{1}{10}$	Round it to the nearest whole number	Subtract this number from the 'kWh per year' number
Parker family	2000			
Campbell family	2200			
Knight family	3100			
Sanchez family	2420			
Williams family	5920			
Lee family	1895			
Stone family	2602			
Hudson family	3950			
Miller family	1718			
Hassan family	1467			

Maths Resource 6A

ANSWER SHEET

Family name	KWh per year	Find $\frac{1}{10}$	Round it to the nearest whole number	Subtract this number from the 'kWh per year' number
Parker family	2000	200	200	1800
Campbell family	2200	220	220	1980
Knight family	3100	310	310	2790
Sanchez family	2420	242.1	242	2179
Williams family	5920	592.3	592	5331
Lee family	1895	189.5	190	1705
Stone family	2602	260.2	260	2342
Hudson family	3950	395.6	396	3560
Miller family	1718	171.8	172	1546
Hassan family	1467	146.7	147	1320

Maths Resource 6B

Extra Challenge: Now complete this table to show how much money each family saves by reducing the amount of electricity they use by $\frac{1}{10}$.

Family name	KWh per year	Find $\frac{1}{10}$	Multiply by 34p	Total money saved
Parker family	2000			
Campbell family	2200			
Knight family	3100			
Sanchez family	2420			
Williams family	5920			
Lee family	1895			
Stone family	2602			
Hudson family	3950			
Miller family	1718			
Hassan family	1467			

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Maths Resource 6B

EXTENSION ANSWER SHEET

Family name	KWh per year	Find $\frac{1}{10}$	Difference in kWh	Cost of kWh saved
Parker family	2000	1800	200	£68
Campbell family	2200	1980	220	£74.80
Knight family	3100	2790	310	£10.20
Sanchez family	2420	2179	242	£82.28
Williams family	5920	5331	592	£201.28
Lee family	1895	1705	190	£64.60
Stone family	2602	2342	260	£88.40
Hudson family	3950	3560	396	£134.64
Miller family	1718	1546	172	£58.48
Hassan family	1467	1320	147	£49.98

Geography unit

The six Geography lesson plans in this section focus on energy generation in the UK and around world, and on the region of Ladakh in India, which links to the learning in English.

We now know that our reliance on fossil fuels (coal, oil and gas) is a major contributor to climate change, which is why it is so important that we move towards cleaner forms of energy generation.

Children begin this unit of six geography lessons by learning about different forms of renewable and non-renewable energy and the advantages and disadvantages associated with them.

In weeks 2 and 3, they move on to learn about the physical features of the Ladakh region of India in the Himalayas and are introduced to families who live there. They consider the similarities and differences between life in Ladakh and their own lives.

During the fourth week, children compare climate data in key cities throughout the UK and in Ladakh, drawing conclusions about why Ladakh is the best location for generating solar energy.

Then, in the final two weeks, the children identify what type of energy is most generated in the UK and why. They also use maps to identify the locations where it is generated. The unit draws to a close with children using atlases and online digital maps to locate countries which use the most solar energy.

NC LINKS

- Name and locate counties and cities of the United Kingdom, geographical regions and their identifying human and physical characteristics, key topographical features (including hills, mountains, coasts and rivers), and land-use patterns; and understand how some of these aspects have changed over time
- Physical geography, including: climate zones, biomes and vegetation belts, rivers, mountains, volcanoes and earthquakes, and the water cycle
- Human geography, including: types of settlement and land use, economic activity including trade links, and the distribution of natural resources including energy, food, minerals and water
- Locate the world's countries, using maps concentrating on their environmental regions, key physical and human characteristics, countries, and major cities
- Use maps, atlases, globes and digital/computer mapping to locate countries and describe features studied
- Understand geographical similarities and differences

Geography Lesson 1

Learning question:
How is electricity generated?

ENQUIRY QUESTION: Where does our energy come from and how much do we use?

RESOURCES:

- Atlases
- Copies of Resource 1A (enough for one between two)

TEACHER INPUT

Start by asking the children: *Where does the electricity we use come from? How is it made?* Assess what the children know already about different energy sources. As a class, watch the video clips 'What is renewable and non-renewable energy?' and 'How is electricity generated?' on the BBC Bitesize website.

Share the following statements with the children and discuss any unfamiliar words or concepts:

Electricity can be generated using coal, gas, nuclear fuels, the wind or sunlight. Electricity from fossil fuels or nuclear fuels is normally generated in big buildings called power stations.

Renewable energy sources won't ever run out. Most renewable energy such as wind energy and solar energy are related to the weather. You can also generate electricity from water, which is called tidal or hydroelectric energy.

We are trying to generate more of our electricity from renewable energy sources because this is better for the environment. Generating electricity from renewable sources can also be cheaper than generating energy from fossil fuels.

As a class, group the energy sources that have been discussed under two headings: 'fossil fuels' (this will include oil, coal and gas) and 'renewable sources' (this will include tidal or hydroelectric energy, wind, solar and biomass). You could discuss the fact that nuclear doesn't fit under either heading.

On the interactive whiteboard, show the pie chart in Resource 1B. Discuss with the children the different sources of energy we use in the UK. Ask the children: *What does the term 'clean energy' mean and why is it important?*

Draw out in discussion that most renewable energy resources are clean, because they do not produce pollution.

TEACHER TIP

The following video resources could be used to support the learning in this lesson:

Renewable energy sources (You Tube)

Non-renewable energy sources (You Tube)

Geography Lesson 1

MAIN ACTIVITY: INDEPENDENT LEARNING

In pairs, the children watch the video clips exploring fossil fuels, nuclear energy, hydroelectricity, wave energy, wind energy and solar energy on the BBC Bitesize website about

They then work with their partner to cut out and sort the statements on Resource 1A into 'advantages' and 'disadvantages'.

SUSTAINABILITY QUESTION:

Why should we move to using more renewable energy quickly? How can we do that?

DIFFERENTIATION

Support
Children work in mixed ability pairs.

Extension
Children provide a written response to the question: Which do you think is the best source of energy and why? Give reasons for your answer.

PLENARY

As a class, the children share which statements they have placed under which headings and any new knowledge they gained from watching the video clips.

TEACHER'S NOTES

Fossil fuels like coal, oil and gas contribute to climate change because they emit greenhouse gases when the burn. The build-up of greenhouse gases causes the temperature of the atmosphere around the Earth to rise. This, in turn, leads to extreme weather such as flooding and heatwaves, which can have devastating effects.

In the UK, our electricity comes from many different types of generation. The breakdown of the amount of electricity we get from each type of generation is called the 'fuel mix'. The fuel mix changes over time, depending on the amount of energy imported from other countries (and how it is generated) and on the conditions needed to produce energy from renewable sources. You can find live daily energy generation data here.

Over 50% of all renewable energy generated in the UK comes from wind farms. Most of this is from onshore turbines, but the number of offshore turbines is increasing. Today, there are more than 1,500 operational onshore wind farms across Great Britain, generating over 12 gigawatt hours (GWh) of electricity for the National Grid.

The Hornsea 2 offshore wind farm is the largest in the world. Its 165 wind turbines are capable of supplying 1.4 million UK homes with electricity.

In November 2022, more than 20 GW of electricity was produced by wind for the first time, representing over 70% of electricity generated in the UK on that day. Since then, this record has continued to be broken, with 30 December delivering the largest generation to date of just under 21 GW.

The three countries that generate the most wind energy are China, America, and the UK.

There are also currently just under 500 solar farms operating in the UK, which provide clean energy to the National Grid.

The vast majority of hydroelectric power stations are located in the wet and mountainous regions of Wales and northwest Scotland. The amount of the UK's electricity generated through hydroelectric power (HEP) has remained the same since 2012. This will not increase unless new dams are built.

Less than 0.01% of the UK's energy is generated from tidal power. The UK is an island nation and could potentially generate around a fifth of its electricity from waves and tides.

Another useful video clip explaining how electricity is made can he found here.

Geography Resource 1A

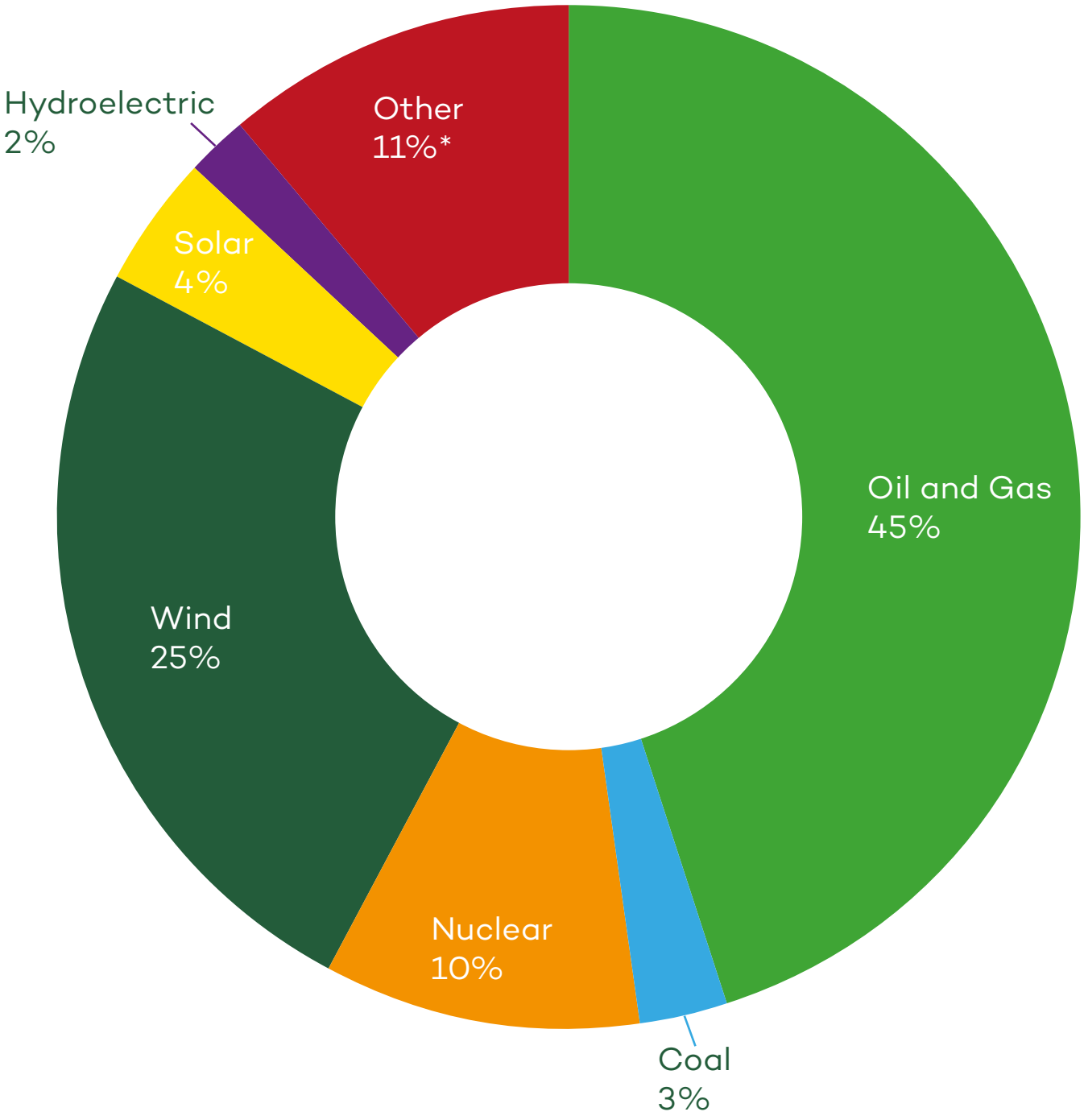
Solar energy is renewable. This means it will never run out.	Wind energy is renewable. This means it will never run out.
Fossil fuels will run out as they are not renewable.	Nuclear power will run out as it is not renewable.
Hydroelectric power stations can't generate energy when there is low rainfall or drought.	To generate a lot of solar energy, you need a lot of solar panels. They take up space on farm land that we could use to grow food.
Wind energy is clean energy. The wind turbines used to generate electricity don't produce greenhouse gases.	Hydroelectric power stations produce renewable energy, which will never run out.
Nuclear power is reliable. Nuclear power stations can still generate electricity when the sun isn't shining or the wind isn't blowing.	Wind turbines are large structures which change the look of the landscape.
Hydroelectric power stations can affect local ecosystems and the living things within them if a dam has to be built.	Wind turbines are expensive to build.
Nuclear power produces dangerous waste that is hard to dispose of.	Solar panels provide clean energy as they do not produce greenhouse gases.
Wind turbines are cheap to run.	Hydroelectric power stations are expensive to set up.
Hydroelectric power stations are cheap to run.	Fossil fuels (coal, gas and oil) are reliable. They can still generate electricity when the sun isn't shining or the wind isn't blowing.
Solar panels are cheap to run.	Fossil fuels create pollution and release greenhouse gases which cause climate change.
Wind turbines are not reliable as they can only generate electricity when the wind is blowing.	Solar panels do not always work well if there is not enough sun or if it is very hot.
Hydroelectric power stations generate clean energy as they do not produce greenhouse gases.	

Geography Resource 1A

ANSWER SHEET

Energy Resource	Advantages	Disadvantages
Fossil fuels (coal, gas and oil)	Fossil fuels (coal, gas and oil) are reliable. They can still generate electricity when the sun isn't shining or the wind isn't blowing.	Fossil fuels will run out as they are not renewable.
		Fossil fuels create pollution and release greenhouse gases which cause climate change.
Nuclear power	Nuclear power is reliable. Nuclear power stations can still generate electricity when the sun isn't shining or the wind isn't blowing.	Nuclear power will run out as it is not renewable.
		Nuclear power produces dangerous waste that is hard to dispose of.
Wind turbines	Wind energy is clean energy. The wind turbines used to generate electricity don't produce greenhouse gases.	Wind turbines are not reliable as they can only generate electricity when the wind is blowing.
	Wind energy is renewable. This means it will never run out.	Wind turbines are large structures which change the look of the landscape.
	Wind turbines are cheap to run.	Wind turbines are expensive to build.
Hydroelectric power stations	Hydroelectric power stations provide clean energy as they do not produce greenhouse gases.	Hydroelectric power stations can't generate energy when there is low rainfall or drought.
	Hydroelectric power stations produce renewable energy.	Hydroelectric power stations are expensive to set up.
	Hydroelectric power stations are cheap to run.	Hydroelectric power stations can affect local ecosystems and the living things within them if a dam has to be built.
Solar energy	Solar panels provide clean energy as they do not produce greenhouse gases.	Solar panels do not always work well if there is not enough sun or if it is very hot.
	Solar energy is renewable. This means it will never run out.	To generate a lot of solar energy you need a lot of solar panels. These panels take up space on farm land that we could use to grow food.
	Solar panels are cheap to run.	

Geography Resource 1B



*this includes tidal and biomass

Geography Lesson 2

Learning question:

Where is Ladakh and how will I use maps to identify its physical features?

ENQUIRY QUESTION: Where does our energy come from and how much do we use?

TEACHER INPUT

On the interactive whiteboard, display a blank map of Asia and find out what the children already know about the countries on this continent.

In mixed ability pairs, the children use atlases to find out which countries are located in Asia (there are 48 in total). Take feedback from the children and locate the countries they've found on the map on the interactive whiteboard. They could use compass directions to describe the location of each country.

Explain to children that they will be focusing on India and a region within India named Ladakh. Working with their partner, the children use an atlas to find:

- the Himalayan mountain range
- the region of Ladakh
- the city of Leh (this is the capital of Ladakh)

As a class, watch this YouTube footage of Leh and Ladakh and encourage the children to make notes of the different physical features they can spot.

RESOURCES:

- Atlases
- Copies of Resource 2A (enough for one between two)
- Copies of Resource 2B (enough for one between two)
- Copies of Resource 2C (enough for one set of questions between two)

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Geography Lesson 2

MAIN ACTIVITY: INDEPENDENT LEARNING

Provide the children with copies of the map of Ladakh on Resource 2A and the factsheet Resource 2B.

Using this information, the children work in pairs to answer the questions in Resource 2C.

DIFFERENTIATION

Support
Children write words and phrases about the physical features of Ladakh, using the images on the factsheet in Resource 2B to support them.

Extension
Children write a comparison of the physical features of Ladakh and a place (or places) they are familiar with in the UK.

PLENARY

As a class, go through the questions and answers the children were working on and tackle any misconceptions.

SUSTAINABILITY QUESTION:

What kind of renewable energy generation would be best suited to the conditions in Ladakh? Why?

TEACHER'S NOTES

Ladakh is situated in the Himalayan mountains. The region is encircled by high peaks, which stop the clouds from all directions, so there is hardly any rain in this area.

Ladakh is known as India's high-altitude cold desert. It has 320 sunny days a year and extremely cold, long winters with incredibly low levels of precipitation.

There are few trees, so the people who live here rely on timber from Kashmir, which is over 300 miles away. Some vegetation can be found in the Ladakh region, but only along riverbanks.

The Indus River is 3,180 km long and 1,165,000 km² of land drains into it. From Tibet, the river flows through Ladakh, where it meets the Zanskar river. The villages here are entirely dependent on the river for their water supply.

Geography Resource 2A

Geography Resource 2B

The Himalaya are a long range of mountains stretching for about 2,500 km. They are the highest mountains on Earth.

The highest peaks in the Himalaya include Mount Everest (8849 m), K2 (8611 m) and Kanchenjunga (8586 m). The word 'Himalaya' means 'house of snow' in Sanskrit (an old Indian language).

Ladakh is a beautiful desert region in northern India, between the Himalayan and Karakoram mountain ranges. Ladakh is the highest plateau (an area of flat land) in India; it is over 3000 m above sea level. It is known as India's high-altitude cold desert because it has 320 sunny days a year and experiences extremely cold, long winters. There is very little rainfall in Ladakh because the high mountains hold back the clouds in all directions.

Leh is the capital city of Ladakh. The city is located on the banks of the Indus River. The mountains dominate the landscape around Leh.

Geography resource 2B

The main source of water comes from the winter snowfall on the mountains.

The Drang-Drung Glacier is a long river of ice and snow. When this ice and snow melts, the water flows downhill and becomes the Stod River, the Zanskar River and the Indus River.

In the winter, the Zanskar River freezes and people can walk along it. This is called the Chadar Trek.

The rivers are important because they allow the people who live in Ladakh to grow crops. Plants only really grow in Ladakh near the rivers or in the wetlands, because the rest of the region is so dry.

The Pangong Lake is almost 4350 m up in the mountains. It is the world's highest saltwater lake and is 160 km long. One third of the Pangong Lake lies in India and the other two thirds are in China.

The lake is holy to local people. The water is extremely cold so people do not swim in it.

Geography resource 2C

Use the information on the factsheet to answer the following questions.

1. In what part of India is Ladakh located?
2. What is the capital of Ladakh?
3. How high is Ladakh?
4. Name two of the mountain ranges in Ladakh.
5. Write two facts about the Himalaya mountain range.
6. What is special about Pangong Lake?
7. Name two rivers in Ladakh. Why are they important?
8. Why is Ladakh known as a desert?

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4. Name two of the mountain ranges in Ladakh.
5. Write two facts about the Himalaya mountain range.
6. What is special about Pangong Lake?
7. Name two rivers in Ladakh. Why are they important?
8. Why is Ladakh known as a desert?

Geography resource 2C

ANSWER SHEET

1. In what part of India is Ladakh located?

   North India

2. What is the capital of Ladakh?

   Leh

3. How high is Ladakh?

   Ladakh is at an altitude of 3500 m

4. Name two of the mountain ranges in Ladakh.

   The Karakoram mountain range and Himalya mountain range

5. Write two facts about the Himalaya mountain range.

   Home to 9 of the 10 highest mountains in the world; known as 'house of snow' in Sanskrit (old Indian language)

6. What is special about Pangong Lake?

   Holy place and very cold so no swimming allowed; highest saltwater lake in the world

7. Name two rivers in Ladakh. Why are they important?

   Indus River and Zanskar River. The rivers are important because they allow the villagers to grow crops. They are the main source of water in the region as there is so little rain.

8. Why is Ladakh known as a desert?

   It is known as India's high-altitude cold desert because it has 320 sunny days a year and experiences extremely cold, long winters with incredibly low precipitation. This is because the area is encircled by high mountains which block the clouds from all directions, so there is hardly any rain in this area.

Geography Lesson 3

Learning question:

How is daily life in Ladakh without electricity different to our daily lives?

ENQUIRY QUESTION: Where does our energy come from and how much do we use?

RESOURCES:

- Copies of Resource 3A (enough for one set of images per small group or table)
- Copies of Resource 3B (enough for one between two)
- *Optional: Copies of Resource 3C for those children requiring support*

TEACHER INPUT

In science and maths, the children will have begun to explore their own use of electricity at home in their daily lives. If this hasn't already been covered, you could begin this lesson with a discussion by asking the children: *Can we live without electricity? How would life be different?*

Provide the children with the photographs of Ladakh in Resource 2A. Ask them to discuss with a partner or as part of a small group what daily life in Ladakh is like using the clues in the images. For example, what energy sources can they see that people in Ladakh might use to heat and light their homes? Give children time to discuss what they can see in the photos with a partner and then discuss their ideas as a class.

Give the children time to read through the facts about Ladakh in Resource 2B, then answer any questions they have about unfamiliar language or ideas.

DIFFERENTIATION

Support
The children write a fact about Ladakh and a fact about their own life. Use the writing frames in Resource 2C, if needed.

Extension
The children provide a written response to the question: What aspects of life in Ladakh do you think are the hardest and why?

MAIN ACTIVITY: INDEPENDENT LEARNING

Show the children how to fold a page in their books in half to create two columns. Under the heading 'Life in Ladakh' in one column and 'Life here' in the other, the children record their ideas about how life there compares to life here. Encourage them to think about energy sources, jobs, houses, food, school and landscape.

PLENARY

Children share the similarities and differences that they have recorded between life in Ladakh and their lives here.

SUSTAINABILITY QUESTION:

What would it be like to have no electricity? What are the benefits of introducing solar energy into the homes of villagers in Ladakh?

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Geography Lesson 3

TEACHER'S NOTES

Ladakh is 3500ft above sea level, so the air is thin. The region has a population of roughly 300,000 people.Leh is the largest city with a population of roughly 175,000.

Beliefs
Local people are encouraged to follow a life of self-sufficiency. They produce what they need, sell the rest at the local market and try to recycle everything.

Jobs
Local people can have several such as tour guides, taxi drivers and farmers, either rearing sheep or growing their own food to sell.

Local people prepare well in advance for winter when they will be cut off from the rest of the world as roads and mountain passes are impassable. They store grains, barley and cattle fodder.

Many have their own cattle, such as dzos, yaks and goats which they use for meat, milk, butter and wool.

Crops grown locally
Barley, wheat, radish, carrots, cabbages, cauliflowers, potatoes and tomatoes are all grown in the region. Apricots, walnuts and grapes thrive in the sunny, cold conditions.

Living without electricity
Many villages in the Himalayan mountains rely on diesel generators, kerosene oil lamps and firewood to heat and light their homes, which is both a financial and environmental burden for these families. Breathing in the fumes from oil lamps and having to use minimal light to study and cook by can also cause long-term health problems.

The nights can be long and cold, and villagers talk about the challenges of this, such as: the boredom of having very little to do in the evenings; having to study by kerosene lamps, which give off very little light and strain their eyesight; and breathing in fumes from oil lamps or soot from burning firewood, which causes health problems.

Culture and traditions
Children in Ladakh aren't named until their first birthday. Then, the child gets a name during a feast called Ming Ton. The lama (a teacher of the Dharma in Tibetan Buddhism) comes to the house and gives the most appropriate name to the child.

Most of the population are followers of Tibetan Buddhism and the monasteries are still at the centre of Ladakhi life.

Houses
Many houses are made from mud and stone and sit haphazardly on hilly landscapes. Homes are built close together, so it's possible for many Ladakhis to look into each other's houses and communicate across balconies.

Local people are encouraged to restore and rebuild traditional homes rather than replace them with modern constructions. Traditional buildings can withstand the cold weather conditions and are sustainable, and they will maintain the beauty of the ancient housing system.

Typical foods eaten in Ladakh
Chang: Homemade barley wine, a typical drink in Ladakh.

Apricot jam: The valleys in Ladakh are abundant in apricot trees, and the apricot jams and juices are incredibly delicious.

Momos: These are fried or boiled dumplings filled with minced meat, spinach, potato, cabbage, carrots, or onions.

Skyu: A soup-based stew made with potato.

Chutagi: A famous pasta-like dish with a rich vegetable-based sauce. It is one of the most famous dishes that you can find in every local restaurant in Leh. Each one has its secret Chutagi recipe. 'Chu' means 'water' in Ladakhi, and 'tagi' means 'bread'. So, the literal translation of 'chutagi' is 'water-bread'.

Chhurpi (yak's milk cheese): This hard yak cheese in another stable food in the Himalayas.

Khambir: the most popular local bread.

Geography Resource 3A

Geography Resource 3A

Geography Resource 3A

Geography Resource 3B

In Ladakh, the rivers are very wide and deep. Children cross the river using a trolley on a pulley to go to school.	Apricots, walnuts and grapes thrive in the sunny, cold conditions.	Many villages in the Himalayan mountains rely on diesel generators, kerosene oil lamps and firewood to heat and light their homes.
People in Ladakh say the evenings can get very boring as there is little to do without light.	Many families have their own cattle, such as dzos, yaks and goats, which they use for meat, milk, butter and wool.	A child gets their name on their first birthday during a feast called Ming Ton.
Many houses are made from mud and stone and sit haphazardly on hilly landscapes.	Chutagi is the most famous dish that you can find in every local restaurant in Leh. It is made from pasta and vegetables. 'Chu' means 'water' in Ladakhi, and 'tagi' means 'bread'.	Most of the people in Ladakh are Buddhist.
Many homes do not have electricity. However, they are beginning to get access to solar energy, which is better for their health and the health of the planet.	Children go to primary school and study subjects such as Tibetan, Urdu, English, geography, sciences, maths, geometry and Bible study.	Children study at night using a kerosene oil lamp to see.

Geography Resource 3C

Fill in the gaps to complete the sentences below.

In Ladakh, some children travel by _____ . I travel to school by _____ .

In Ladakh, the people use _____ to light their homes but at home we use _____ .

In the evenings in Ladakh, people _____ but in the evenings at home I _____ .

In Ladakh, the houses are made of _____ but our houses are made of _____ .

In Ladakh, they grow _____ and in the UK we grow _____ .

At school in Ladakh, children study _____ and in the UK we study _____ .

Geography Lesson 4

Learning question:

What is the climate like in Ladakh and why is this perfect for generating solar energy?

ENQUIRY QUESTION: Where does our energy come from and how much do we use?

TEACHER INPUT

Ensure that the children are confident using the tables of data for Activities 1, 2 and 3. Ideas about how to do this are included below.

Activity 1
Display on the interactive whiteboard the tables for Activity 1 in Resource 4A showing the average temperature each month in Leh (the capital of Ladakh) and cities in the UK.

Ask questions to familiarise the children with the data provided, such as:

Which is the hottest month in Leh?

Which is the coldest month in Leh?

Which is the warmest city in June?

Which is the coldest city in March?

Activity 2
Now display the table for Activity 2 in Resource 4A, showing the number of days with clear skies in Leh and cities in the UK.

Ask questions to familiarise the children with the data provided such as:

How many more clear days did Leh experience compared to Edinburgh in May?

Looking at the table overall, is there anything that surprises you?

Activity 3
Finally, present children with the table for Activity 3 in Resource 4A, showing how many days in each month it rains in Leh compared to cities in the UK.

Ask questions to familiarise the children with the data provided such as:

Which month had the fewest days of rain in Leh?

How many days or rain did the UK cities have in this month?

Which month had the most days of rain in Leh? How does this compare to the UK cities?

RESOURCES:

- Copies of Resource 4A (enough for one between two)
- Copies of Resource 4B (enough for one between two)

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Geography Lesson 4

MAIN ACTIVITY – INDEPENDENT LEARNING

Working in pairs, the children use the data tables to work through the activities in Resource 4A.

DIFFERENTIATION

Support
The children pose simple questions orally to answer with a partner. Adult-led group discussion about what we can learn about the climate in Leh compared to the UK.

Extension
Work through as many of the activities as possible in Resource 4A and answer the extension questions.

PLENARY

Go through the answers to the questions with the children so they can assess their understanding.

SUSTAINABILITY QUESTION

Why is Ladakh perfect for generating solar energy? What are the challenges in installing these solar panels?

TEACHERS' NOTES

The data used in this lesson is from the Weather Spark website.

Winter lasts from October to May in Ladakh and can reach temperatures of –28°C.

Ladakh's climate provides the perfect conditions for tapping into the energy potential of the sun. Solar panels work best with intense sunshine and at cold temperatures. Even though it hardly rains in Ladakh, storm and localised heavy downpours can cause flash floods and mudslides.

Global Himalayan Expedition (GHE) is an organisation which brings clean energy in the form of solar panels to villages which only have access to kerosene lamps or diesel generators to provide heat and light.

Paras Loomba (GHE founder) and Jaideep Bansal (GHE CEO) have led several leadership expeditions to the Himalayas to provide clean energy to remote Himalayan communities. So far, they have brought solar energy to 131 villages and to over 60,000 people.

GHE offers homestays for visitors so they can experience star gazing as the high altitude and low light pollution in the Ladakh region creates excellent conditions in which to observe stars.

Geography Resource 4A

ACTIVITY 1: Average temperatures

HIGH

City	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
London	9°C	9°C	11°C	14°C	17°C	20°C	23°C	22°C	19°C	15°C	11°C	9°C
Leh	-3°C	-2°C	2°C	8°C	14°C	19°C	23°C	23°C	18°C	10°C	4°C	-1°C
Belfast	7°C	8°C	9°C	11°C	14°C	17°C	18°C	18°C	16°C	13°C	10°C	8°C
Edinburgh	6°C	7°C	9°C	11°C	14°C	16°C	18°C	18°C	16°C	13°C	9°C	7°C

LOW

City	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
London	4°C	4°C	5°C	7°C	10°C	13°C	15°C	15°C	13°C	10°C	7°C	5°C
Leh	-15°C	-15°C	-10°C	-3°C	2°C	5°C	8°C	8°C	3°C	-2°C	-7°C	-12°C
Belfast	3°C	3°C	4°C	5°C	7°C	10°C	12°C	12°C	10°C	8°C	5°C	3°C
Edinburgh	1°C	1°C	2°C	4°C	6°C	9°C	11°C	11°C	9°C	6°C	3°C	2°C

QUESTIONS

a) What is the lowest temperature in February in all four cities? Order them from coldest to warmest.

b) What is the difference between the lowest temperature in April in London and Leh?

c) What is the difference between the lowest and highest temperature in July in all four cities? Which city has the greatest difference?

Geography Resource 4A

ACTIVITY 2: Numbers of days with clear skies

City	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
London	9 days	10 days	11 days	13 days	14 days	15 days	18 days	17 days	16 days	13 days	10 days	9 days
Leh	14 days	11 days	13 days	16 days	21 days	26 days	27 days	27 days	29 days	26 days	21 days	17 days
Belfast	10 days	9 days	11 days	13 days	15 days	14 days	15 days	15 days	12 days	12 days	11 days	10 days
Edinburgh	10 days	10 days	11 days	12 days	14 days	14 days	15 days	15 days	12 days	12 days	11 days	10 days

QUESTIONS

a) For how many days does Leh experience clear skies in one year?

b) For how many days does Belfast experience clear skies in one year?

c) Which city would be the best for generating solar power? Why?

EXTENSION

d) For how many more days each year does Leh experience clear skies compared to London?

Geography Resource 4A

ACTIVITY 3: Days of rainfall

City	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
London	9 days	7 days	7 days	7 days	7 days	8 days	7 days	7 days	7 days	9 days	9 days	9 days
Leh	1 day	2 days	2 days	2 days	2 days	2 days	3 days	3 days	2 days	1 day	1 day	1 day
Belfast	13 days	10 days	10 days	9 days	9 days	9 days	10 days	11 days	10 days	12 days	12 days	13 days
Edinburgh	11 days	8 days	9 days	8 days	8 days	9 days	10 days	10 days	9 days	11 days	11 days	11 days

QUESTIONS

a) How many more days of rain did Edinburgh have in August compared to Leh in August? What about in September and October?

b) Which is the wettest month in each city?

EXTENSION

c) Which city has the most rainy days in one year?

Geography Resource 4A

ACTIVITY 4: Average rainfall measured in mm

City	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
London	45.8	35.5	31.3	31.7	37.5	40.6	35.7	38.6	40.6	54.9	52.1	51.4
Leh	0.1	0.4	3.3	6.1	6.1	6.7	12.9	14.1	7.2	3.2	1.1	0.1
Belfast	72.6	58.5	53.1	47.2	47.8	52.7	53.2	63.5	65.8	81.5	79.8	75.4
Edinburgh	51.1	41.1	40.2	39.4	39.6	46.4	54.9	58.5	52.9	64.7	57.8	54.6

QUESTIONS

a) How many mm of rain fell from January to May in London?

b) How many mm of rain fell from January to May in Leh?

EXTENSION

c) What evidence is there to explain why Ladakh is known as a desert?

Geography Resource 4A

ACTIVITY 5: Average snowfall measured in mm

City	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
London	3.8	1.4	0.1	0	0	0	0	0	0	0	0	1.1
Leh	45.3	58.2	56.1	13.5	2.2	0.2	0	0	0.2	8.1	22.1	44.5
Belfast	1.6	0.8	0.9	0.1	0	0	0	0	0	0	0.1	1.1
Edinburgh	10.6	6.3	5.7	1.1	0.1	0	0	0	0	0	1.4	3.3

QUESTIONS

1. How many mm of snow falls on average from October to April in Leh?

2. Which city gets more snow: London or Belfast?

EXTENSION

3. Which months do you think would be the hardest for people to get around in Ladakh? Why?

Geography Resource 4A

ANSWER SHEET

ACTIVITY 1

a) -15°C (Leh), 1°C (Edinburgh), 3°C (Belfast), 4°C (London)
b) 10°C (London = 7°C, Leh = -3°C)
c) London 23-15°C = 8°C
Leh 23-8°C = 15°C
Belfast 18-12°C = 6°C
Edinburgh 18-11°C = 7°C

ACTIVITY 2

a) Leh: 248 days
b) Belfast: 147 days
c) Leh, because it has the most days with clear skies each year
d) 248 days (Leh) - 155 days (London) = 93 days

ACTIVITY 3

a) August: 10 days (Edinburgh) - 3 days (Leh) = 7 days
September: 9 days (Edinburgh) - 2 days (Leh) = 7 days
October: 11 days (Edinburgh) - 1 day (Leh) = 10 days
b) London: January, October, November, December
Leh: July, August
Belfast: January, December
Edinburgh: January, October, November, December
c) Belfast (128 days)

ACTIVITY 4

a) 181.8 mm
b) 16 mm
c) The total amount of rainfall in Leh, the capital of Ladakh, is considerably lower than that of the UK cities here.

ACTIVITY 5

a) 247.8 mm
b) London (6.4 mm compared to 4.6 mm in Belfast)
c) From November to March. This is when the heaviest snow falls, so roads might be closed.

Geography Lesson 5

Learning question:

What human features of the landscape in the UK are linked to energy production?

ENQUIRY QUESTION: Where does our energy come from and how much do we use?

TEACHER INPUT

In this lesson, the children learn about energy production in the UK. At the start of the lesson, the children could work with a partner to identify the UK and the countries within it using an atlas. They could then be encouraged to identify key cities, where they live or places they may have visited.

Ask the children: *What do we use electricity for in our daily lives?* Explain that they will be learning where in the UK some of that electricity is generated.

Display the map on Resource 5A on the interactive whiteboard and explain that each of the numbers shows where some of our electricity is generated. Go on to explain that when the numbers are the same colour, the electricity produced in these locations is generated in the same way (e.g. from burning coal, from nuclear energy, from solar energy etc). The map also includes clues that describe the conditions required for some of different types of renewable energy generation.

MAIN ACTIVITY – INDEPENDENT LEARNING

The children work in pairs to read the clues on Resource 5A and work out where different types of energy might be produced, explaining their reasoning.

DIFFERENTIATION

Support
The children work in mixed ability pairs for support reading the clues.

Extension
The children write statements to explain their thinking about what type of energy generation takes place where.

RESOURCES:

- Copies of Resource 5A (enough for one between two)
- Copies of Resource 5B (enough for one between two – to be given out in the plenary)
- Laptops or tablets

EXTENDED PLENARY

Take feedback from the children about the type of energy they think is generated at each of the numbered locations. Display the colour coded table in Resource 5B on the interactive whiteboard and distribute copies for the children to share with their partner. Give them time to discuss which of their predictions were correct.

Model how to create a colour-coded key for the map and allow time for the children to work in pairs to create their own. Show the children how to locate the power generation plants on Resource 5B using the online UK Renewables Map or Google Maps to see what each one looks like and to find out more about the location. For example, are the solar panels in fields and are the hydroelectric power plants near water?

SUSTAINABILITY QUESTIONS:

What can we learn from Ladakh about switching our energy to renewable sources? How could this be done in your school?

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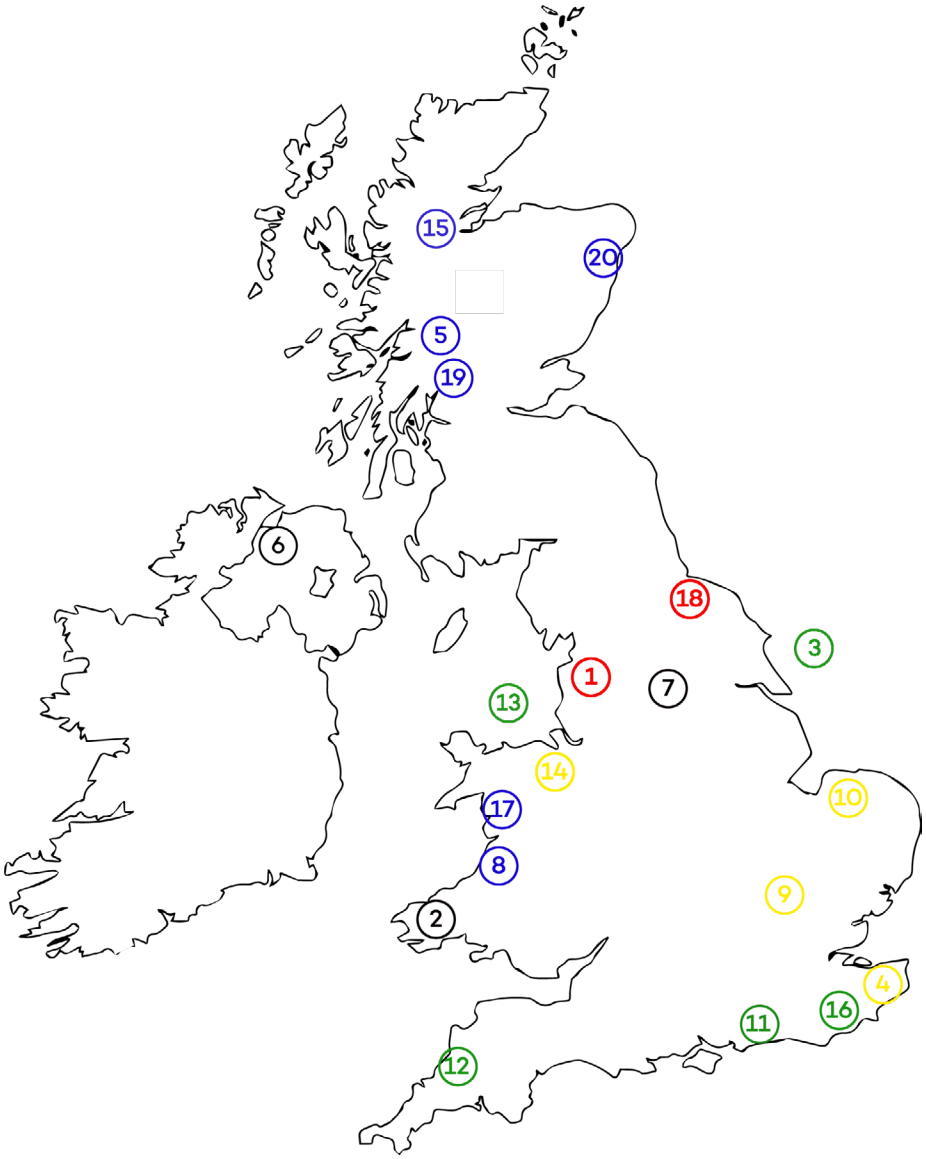
Geography Resource 5A

Each number on the map shows where energy is generated in the UK, but what type of energy do you think is generated where?



Use these clues to help you work out where in the UK these different types of energy are generated:

Wind energy
Wind turbines need to be located in places where it's often windy. It's frequently windy on the coast so wind turbines are often found here. They can be placed on land (onshore) or in the sea (offshore).

Solar energy
Solar panels generate power from the sun. The south of the UK experiences more sunlight hours than the north of the UK.

Hydroelectric energy
Hydroelectric turbines generate power from the movement of water. They are normally built in mountainous areas next to rivers.

Geography Resource 5B

Number	Name	How it produces energy
3	Hornsea Wind Farm, Hornsea	Wind energy (the largest wind farm in the world; 175 turbines at Hornsea 1 and 165 turbines at Hornsea 2)
13	Gwynt y Môr Wind Farm, Holywell	Wind energy (160 turbines)
16	Little Cheyne Court Wind Farm, Dungeness	Wind energy (26 turbines)
11	Rampion Wind Farm, Littlehampton	Wind energy (26 turbines)
12	Cold Northcott Windfarm, Launceston	Wind energy (22 turbines)
14	Shotwick Solar Park, Deeside	Solar energy (the largest solar farm in the UK)
4	Solar Power Station, Herne Bay	Solar energy
10	West Raynham Solar Park, Norfolk	Solar energy
9	Solar Site Vine Farm, Royston	Solar energy
17	Dinorwig Power Station, Caernarfon	Hydroelectric energy
19	Cruachan Power Station, Loch Awe	Hydroelectric energy
15	Glendoe Hydro Scheme, Fort Augustus	Hydroelectric energy
8	Rheidol Hydropower Plant, Aberystwyth	Hydroelectric energy
20	Donside Hydro, Aberdeen	Hydroelectric energy
5	Sron Mor Power Station, Inveraray	Hydroelectric energy
1	Heysham Nuclear Power Station, Heysham	Nuclear energy
18	Hartlepool Power Station, Hartlepool	Nuclear energy
7	West Burton Power Station, Retford	Energy from burning coal
2	Pembroke Power Station, West Pennar	Energy from burning coal
6	Coolkeeragh ESB Power Plant, Londonderry	Energy from burning gas

Geography Lesson 6

Learning question:
Which countries produce the most solar energy?

ENQUIRY QUESTION: Where does our energy come from and how much do we use?

TEACHER INPUT

Take a moment to discuss the learning question with the children and see what they remember about solar energy from previous lessons.

As a class, rewatch the video on solar energy on the BBC Bitesize website to consolidate the children's learning about solar energy so far.

Either as a class, or independently in pairs on laptops or tablets, give the children time to read through the rest of the information about solar energy on the BBC Bitesize Scotland website. If the children do this independently, ask them to note three facts they've learnt to share with a small group. Allow them to share their ideas in groups then take feedback as a class.

Display on the whiteboard the table of data in Resource 6B (this shows the top 10 countries that produce the most solar energy) and the blank world map on resource 6A. Explain the independent activity to the children.

RESOURCES:

- Copies of Resource 6A (enough for one each)
- Copies of Resource 6B (enough for one set of data between two)

Geography Lesson 6

MAIN ACTIVITY – INDEPENDENT LEARNING

Using an atlas or Google Maps, the children locate the 10 countries that produce the most solar energy. They colour these on their blank world map and either label them or create a key.

DIFFERENTIATION

Support
Children work in mixed ability pairs.

Extension
Create a quiz on solar energy for a partner to answer, using the information on the BBC Bitesize website.

PLENARY

The children who created a quiz as part of the independent activity pose their questions to the class to test the children's knowledge of solar energy.

SUSTAINABILITY QUESTION:

How would you persuade other countries to generate and use more solar energy?

TEACHER'S NOTES

The primary source of all energy on Earth is the Sun. Solar power works by converting energy from the sun into electricity or heat. Both are generated through the use of solar panels.

The solar panels that are used to generate electricity are made up of photovoltaic cells. The word 'photovoltaic' comes from the word 'photons' (the particles that make up sunlight) and the word 'volts' (the measurement of electricity).

You may be surprised to learn that, although solar panels convert energy from the Sun, they actually perform less efficiently at hotter temperatures.

The rate at which solar energy is intercepted by the Earth is about 10,000 times greater than the rate at which we consume energy.

The largest solar energy plant in the entire world is located in Rajasthan, India. It is called Bhadla Solar Park.

Solar energy was used by humans as early as the 7th century BC, when humans used sunlight to light fires by reflecting the Sun's rays onto shiny objects. Later, in 3rd century BC, the Greeks and Romans harnessed solar energy with mirrors to light torches for religious ceremonies.

In 1839, the French physicist Edmond Becquerel discovered the photovoltaic (PV) effect while experimenting with a cell made of metal electrodes in a conducting solution. He noted that the cell produced more electricity when it was exposed to light – it was a photovoltaic cell.

In 1954, PV technology was born when Daryl Chapin, Calvin Fuller and Gerald Pearson developed the silicon PV cell at Bell Labs. This was the first solar cell capable of absorbing and converting enough of the Sun's energy into electricity to run everyday electrical equipment.

Today, satellites and spacecraft orbiting Earth are powered by solar energy.

The current peak solar electricity generation record seen in the UK is 9680 MW on 20th April 2020 – enough to boil five million kettles!

Geography Resource 6A

Geography Resource 6B

The data in this table shows the 10 countries that produce the most solar energy. They are listed in order, so China (number 1) produces the most.

1	China
2	United States
3	Japan
4	Germany
5	India
6	Italy
7	Australia
8	South Korea
9	Vietnam
10	Spain

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1	China
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Great Work

'100 Club' Energy Challenge

The '100 Club' Energy Challenge provides the perfect opportunity for children to take their school energy monitoring home and see if they and their families can keep their electricity consumption below 100 kWh (kilowatt hours) each week.

How does the '100 Club' work?

Each week at the same time, the children check their electricity meter reading with their parents or another adult at home to work out how much they have used over the week. If the amount used is above 100 kWh, they need to work out as a household what they can do to get the amount below 100 kWh. The template on p. 106 provides an easy-to-use form for children to record their weekly readings. The difference between the two will, of course, give the amount of electricity used that week in kWh.

Climate action at home

The '100 Club' allows maths learning to be applied in the real world. It helps children to become energy conscious, to think about where and when they are using electricity, and what they can do to reduce it to save money and cut emissions. Climate change can cause real anxiety in young people and this challenge gives them an opportunity to do something about it. It's a great way to save money, too.

Incentivising success

There are opportunities to incentivise success once families get their electricity usage to under 100 kWh per week. For example, working out the amount of energy in kWh saved compared to the previous week and putting the amount of money that has also been saved into a kitty to help pay for an agreed family or household reward. At the time this pack was created, one kWh of electricity cost 34p, so 100 kWh of energy saved would equate to £34, while a saving of 10 kWh would provide £3.40 for the kitty.

Seasonal variation

Seasonal variation will have a significant impact on how much energy is used. In the darker winter months, it will be harder to keep consumption down. When run in a school or linked to a year group project of learning, it works particularly well to start the challenge at the beginning of the summer term when the days are getting longer and lighter. This will make the challenge easier to achieve.

'100 Club' certificates

Once families get below 100 kWh a week, and the children can show the figures on their form, they can be rewarded with a '100 Club' certificate (you'll find this on p. 107). A certificate for families who get their energy consumption below 50 kWh is also included (see p. 108). These can be given out in assemblies each week and it is noticeable how excited parents get when their children bring one home. It's very much a challenge for all the family!

Taking the '100 Club' further

Some families will want to go further. It is possible to go below 50 kWh a week and for those energy-conscious families who want to push themselves to get their consumption below the 50 kWh mark, there is a 50 kWh certificate, too (see p. 108).

Promoting conservation consciousness

Underpinning the '100 Club' is a message that it is good to be conservation conscious. In a world with so many people and a finite amount of resources, we all need to be consuming less and saving more.

Key to success

The key to making the '100 Club' Energy Challenge a success is to keep it high profile so that parents and children alike are encouraged to take part each week and keep counting. It's a lovely way to build community around a project that benefits children's learning, saves money and takes action to address the climate crisis.

The Harmony Project

‘100 Club’ Energy Challenge

Use the table below to complete your ‘100 Club’ Energy Challenge. Decide on a time in the week when you will read your meter – it could be 6pm on a Sunday, for example. You should always read your meter at the same time. Take your first meter reading at this time and write it in the ‘Meter reading’ column next to ‘Start of challenge’. At the same time the following week, read your meter again and write this figure in the ‘Meter reading’ column next to ‘Week 1’. Subtract the ‘Start of challenge’ reading from the ‘Week 1’ reading to find how much electricity your household used in Week 1. Write this in the ‘Amount of energy used’ column in the ‘Week 1’ row. The following week, subtract the meter reading for ‘Week 1’ from the reading for ‘Week 2’ to find the amount of electricity used in Week 2 and so on. Can you find ways to reduce your energy use each week until it is less than 100 kWh? Can you get it below 50 kWh?

	Date of meter reading	Meter reading	Amount of electricity used (kWh)
Start of challenge			
Week 1			
Week 2			
Week 3			
Week 4			
Week 5			

The ‘100 Club’ Energy Challenge

Congratulations go to

.....

for reducing their weekly electricity consumption at home to less than 100 kWh.

Signed by: .....

KEEP SAVING ENERGY!

The Harmony Project

The ‘100 Club’ Energy Challenge

Congratulations go to

.....

for reducing their weekly electricity consumption at home to less than 50 kWh.

Signed by: .....

KEEP SAVING ENERGY!

The Harmony Project