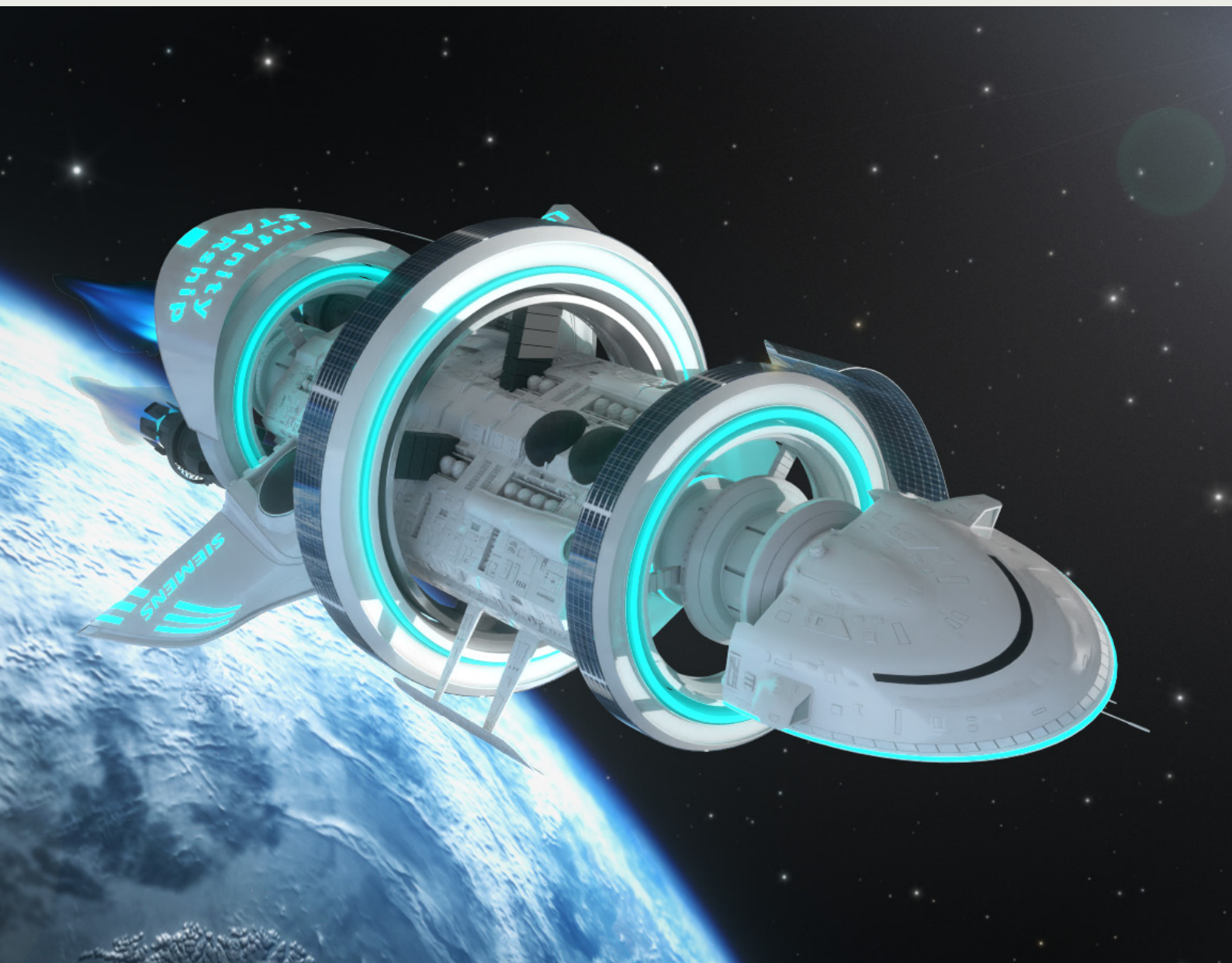


Siemens  
**Decarbonisation &  
Climate Change**



DECARBONISATION & CLIMATE CHANGE

# Guide to teaching & learning resources

The Siemens Decarbonisation & Climate Change resources are intended to be challenging and flexible and used in a variety of ways to support learning in a number of curriculum areas including; Science, Geography and PSHE curriculum topics.

They are designed to support the increasing amount of interest in the climate crisis, as a broader appreciation that the changing situation is one that requires attention, understanding and action and as a result of the COP26 Conference hosted by the UK in Glasgow in November 2021. The resources are designed to inform students of secondary school age of various features of the climate crisis but also to present them with the challenge of drawing this together to form an overall view. Climate change is manifest in different ways and the evidence needs to be assembled with care and understanding.

**The resource has two components:**

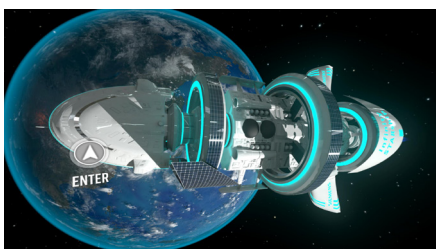
- Decarbonisation Interactive Game (Introduction to topic and stimulus to learning).
- Curriculum-linked extension resources.

**Interactive Game Play**

An opening sequence sets the context. Users are informed that the spaceship they are travelling on is approaching a planet which is not Earth but has many similarities in terms of size, surface temperature, day and year length. However, conditions on the surface are less hospitable than currently on the Earth. The challenge is to find out what has happened and why.

**The online simulation can be used in a variety of ways, for example:**

- As the basis for a structured, teacher-led session with the teacher asking questions and taking responses.
- By students during a lesson to support more independent study.
- By students in their own time.
- The teacher might want to use it as part of a flipped learning lesson plan, with students discussing what they have learned from accessing the resource at home and exploring findings in the next lesson.



Infinity starship flying through the galaxy on its mission.



The ship performs its initial scan of the planet - this is where the 5 regions are introduced.

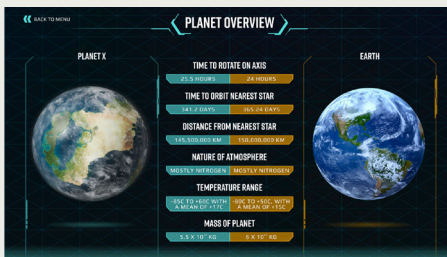


Initial scan reveals the Planet is similar to Earth but is in a state of disrepair due to climate change.

# From the Bridge of the Infinity STARship, users can access three key areas:

The planet overview compares this planet to Earth; users should realise from this that there are many similarities. The planet map indicates that there are several different regions that they can explore to gather evidence. This evidence can then be gathered to form the planet report.

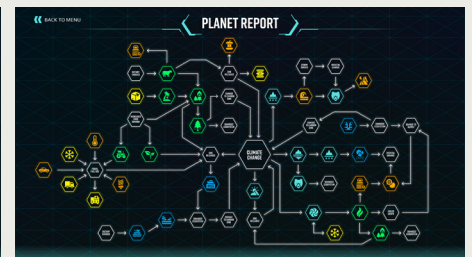
## Planet Overview:



## Planet Map:

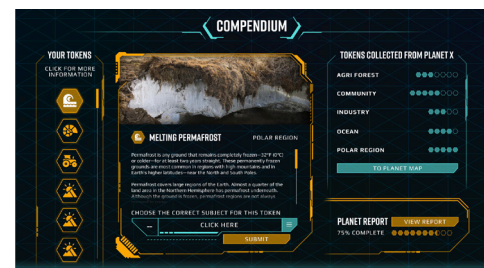


## Planet Report:



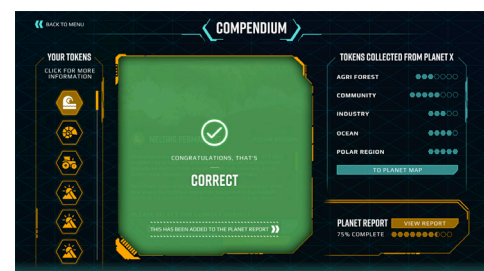
## Compendium:

Visiting a location allows the user to find out about changes that have taken place in that area. This is presented in three ways: an image to engage interest, text that is designed to form a summary accessible to students of the target age range and an item to summarise this. The accumulated items will appear on the planet report.



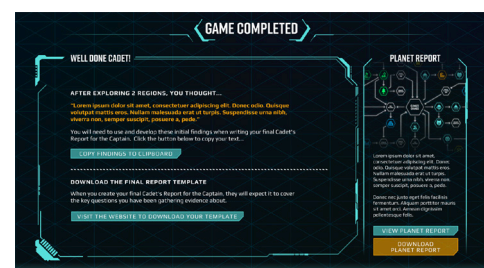
## Conclusions:

After users have visited two areas they will be asked for their tentative conclusions. This is to encourage students to start to form a view about the key features they have observed. This should then help them to learn more from visits to other areas of the planet subsequently, when it becomes clear whether that evidence fits the same pattern or suggests the need for a more nuanced explanation.



## Final Cadet's Report:

After visiting all five areas, users will then be asked to complete a final report. They will have access to their interim conclusions and also to the information they have gathered. Their challenge here is to come up with overall findings and recommendations. This provides a context for debate and reflection about climate change.



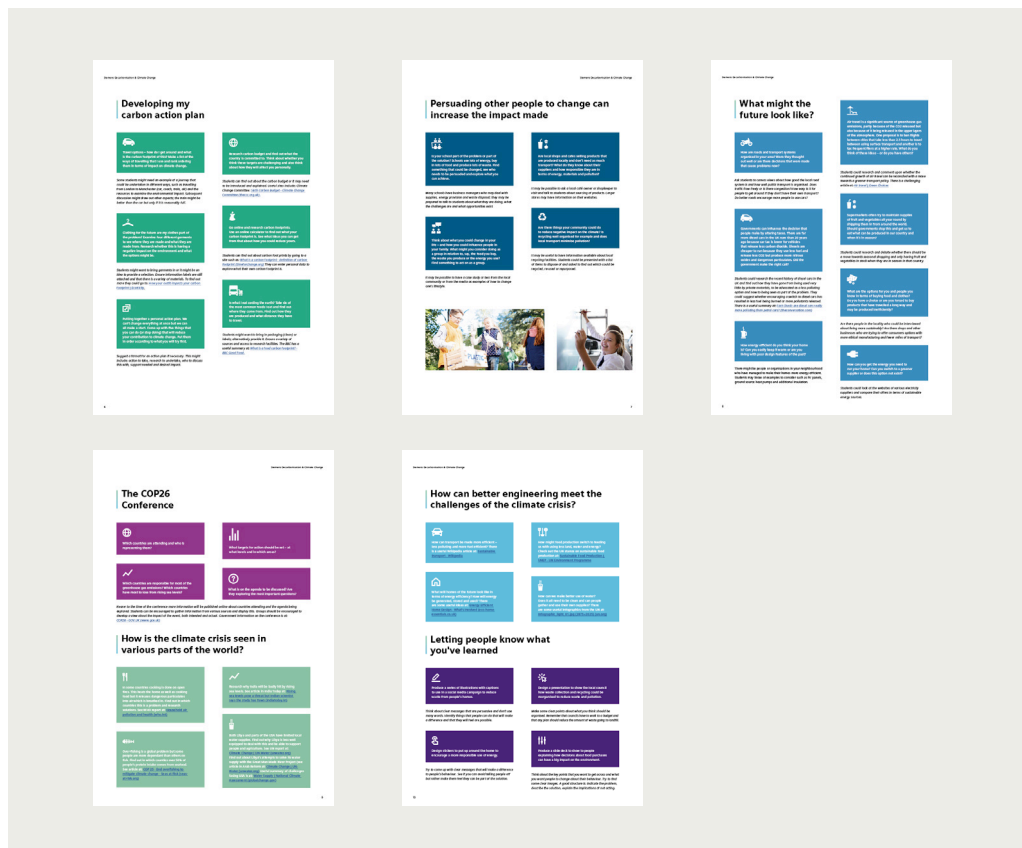
# Curriculum-linked extension resources

Additional resources and activity suggestions are provided, they offer a variety of ideas that can be drawn upon and used either in or outside the classroom. Some could be used as preparation for the online gameplay and others as follow up. Where appropriate, suggestions are made regarding structure and resources required but these should be used flexibly and in response to student interest, aptitude and background knowledge.

The ideas are grouped around a number of leading questions which are intended to provide a range of ways forward to promote further learning. Some lead on directly from particular aspects of the simulation such as 'How can better engineering meet the challenges of the climate crisis?' whereas others have a broader view such as 'What might the future look like?' and some have a specific focus on the COP26 Conference and how students may respond either as individuals or groups.

## Topics and themes:

- Developing my carbon action plan.
- Persuading other people to change can increase the impact made.
- What might the future look like?
- The COP26 Conference.
- How is the climate crisis seen in various parts of the world?
- How can better engineering meet the challenges of the climate crisis?
- Letting people know what you've learned.



This resource supports learning in a number of curriculum areas, as shown in the table below.

Key stage	Curriculum area	Topics included
3	Science	<ul style="list-style-type: none"> <li>the interdependence of organisms in an ecosystem, including food webs and insect pollinated crops</li> <li>how organisms affect, and are affected by, their environment, including the accumulation of toxic materials</li> <li>Earth as a source of limited resources and the efficacy of recycling</li> <li>the carbon cycle</li> <li>the production of carbon dioxide by human activity and the impact on climate</li> </ul>
4	Science	<ul style="list-style-type: none"> <li>the carbon cycle</li> <li>the importance of water in biological systems</li> <li>positive and negative human interactions with ecosystems</li> <li>the biological challenges of increasing food yield using fewer resources</li> <li>carbon dioxide and methane as greenhouse gases</li> <li>carbon capture and storage</li> <li>common pollutants and their sources: carbon monoxide, sulphur dioxide, oxides of nitrogen, ozone and particulates</li> <li>the Earth's water resources and obtaining potable water</li> <li>national and global fuel resources, renewable energy sources</li> </ul>
3	Geography	<ul style="list-style-type: none"> <li>understand the key processes in human geography relating to: population and urbanisation; international development; economic activity in the primary, secondary, tertiary and quaternary sectors; and the use of natural resources</li> <li>understand how human and physical processes interact to influence, and change landscapes, environments and the climate; and how human activity relies on effective functioning of natural systems</li> </ul>
4	Geography	<ul style="list-style-type: none"> <li>Changing weather and climate – the causes, consequences of and responses to extreme weather conditions and natural weather hazards, recognising their changing distribution in time and space and drawing on an understanding of the global circulation of the atmosphere. The spatial and temporal characteristics, of climatic change and evidence for different causes, including human activity, from the beginning of the Quaternary period (2.6 million years ago) to the present day.</li> <li>Global ecosystems and biodiversity – an overview of the distribution and characteristics of large scale natural global ecosystems. For two selected ecosystems, draw out the interdependence of climate, soil, water, plants, animals and humans; the processes and interactions that operate within them at different scales; and issues related to biodiversity and to their sustainable use and management.</li> <li>Resources and their management – an overview of how humans use, modify and change ecosystems and environments in order to obtain food, energy and water resources. Detailed study of one of either food, energy or water, recognising the changing characteristics and distribution of demand and supply, past and present impacts of human intervention, and issues related to their sustainable use and management at a variety of scales.</li> </ul>
3	Citizenship	<ul style="list-style-type: none"> <li>Pupils should use and apply their knowledge and understanding whilst developing skills to research and interrogate evidence, debate and evaluate viewpoints, present reasoned arguments and take informed action.</li> <li>Pupils should be taught about the roles played by public institutions and voluntary groups in society, and the ways in which citizens work together to improve their communities, including opportunities to participate in school-based activities.</li> </ul>
4	Citizenship	<p>Pupils should develop their skills to be able to use a range of research strategies, weigh up evidence, make persuasive arguments and substantiate their conclusions. They should experience and evaluate different ways that citizens can act together to solve problems and contribute to society. Pupils should be taught about:</p> <ul style="list-style-type: none"> <li>local, regional and international governance and the United Kingdom's relations with the rest of Europe, the Commonwealth, the United Nations and the wider world</li> <li>the different ways in which a citizen can contribute to the improvement of their community, to include the opportunity to participate actively in community volunteering, as well as other forms of responsible activity</li> </ul>

# Developing my carbon action plan



Travel options – how do I get around and what is the carbon footprint of this? Make a list of the ways of travelling that I use and rank ordering them in terms of impact on climate change.

*Some students might need an example of a journey that could be undertaken in different ways, such as travelling from London to Manchester (car, coach, train, air) and the resources to examine the environmental impact. Subsequent discussion might draw out other aspects; the train might be better than the car but only if it is reasonably full.*



Clothing for the future - are my clothes part of the problem? Examine four different garments to see where they are made and what they are made from. Research whether this is having a negative impact on the environment and what the options might be.

*Students might want to bring garments in or it might be an idea to provide a selection. Ensure information labels are still attached and that there is a variety of materials. To find out more they could go to: [How your outfit impacts your carbon footprint | Ecotricity](#).*



Putting together a personal action plan. We can't change everything at once but we can all make a start. Come up with five things that you can do (or stop doing) that will reduce your contribution to climate change. Put them in order according to what you will try first.

*Suggest a format for an action plan if necessary. This might include: action to take, research to undertake, who to discuss this with, support needed and desired impact.*



Research carbon budget and find out what the country is committed to. Think about whether you think these targets are challenging and also think about how they will affect you personally.

*Students can find out about the carbon budget or it may need to be introduced and explained. Useful sites include: Climate Change Committee: [Sixth Carbon Budget - Climate Change Committee \(theccc.org.uk\)](#).*



Go online and research carbon footprints. Use an online calculator to find out what your carbon footprint is. See what ideas you can get from that about how you could reduce yours.

*Students can find out about carbon footprints by going to a site such as: [What is a carbon footprint - definition of carbon footprint \(timeforchange.org\)](#) They can enter personal data to explore what their own carbon footprint is.*



Is what I eat costing the Earth? Take six of the most common foods I eat and find out where they come from. Find out how they are produced and what distance they have to travel.

*Students might want to bring in packaging (clean) or labels; alternatively provide it. Ensure a variety of sources and access to research facilities. The BBC has a useful summary at: [What is a food carbon footprint? - BBC Good Food](#).*

# Persuading other people to change can increase the impact made



Is your school part of the problem or part of the solution? Schools use lots of energy, buy in lots of food and produce lots of waste. Find something that could be changed, see who needs to be persuaded and explore what you can achieve.

*Many schools have business managers who may deal with supplies, energy provision and waste disposal; they may be prepared to talk to students about what they are doing, what the challenges are and what opportunities exist.*



Are local shops and cafes selling products that are produced locally and don't need as much transport? What do they know about their suppliers and how responsible they are in terms of energy, materials and pollution?

*It may be possible to ask a local café owner or shopkeeper to visit and talk to students about sourcing of products. Larger stores may have information on their websites.*



Think about what you could change in your life – and how you could influence people in your family. What might you consider doing as a group in relation to, say, the food you buy, the waste you produce or the energy you use? Find something to act on as a group.

*It may be possible to have a case study or two from the local community or from the media as examples of how to change one's lifestyle.*



Are there things your community could do to reduce negative impact on the climate? Is recycling well organised for example and does local transport minimise pollution?

*It may be useful to have information available about local recycling facilities. Students could be presented with a list of items to dispose of and asked to find out which could be recycled, re-used or repurposed.*



# What might the future look like?



How are roads and transport systems organised in your area? Were they thought out well or are there decisions that were made that cause problems now?

Ask students to canvas views about how good the local road system is and how well public transport is organised. Does traffic flow freely or is there congestion? How easy is it for people to get around if they don't have their own transport? Do better roads encourage more people to use cars?



Governments can influence the decision that people make by altering taxes. There are far more diesel cars in the UK now than 20 years ago because car tax is lower for vehicles that release less carbon dioxide. Diesels are cheaper to run because they use less fuel and release less CO2 but produce more nitrous oxides and dangerous particulates. Did the government make the right call?

Students could research the recent history of diesel cars in the UK and find out how they have gone from being used very little by private motorists, to be advocated as a less polluting option and now to being seen as part of the problem. They could suggest whether encouraging a switch to diesel cars has resulted in less fuel being burned or more pollutants released. There is a useful summary at: [Fact Check: are diesel cars really more polluting than petrol cars? \(theconversation.com\)](https://www.theconversation.com/fact-check-are-diesel-cars-really-more-polluting-than-petrol-cars/)



How energy efficient do you think your home is? Can you easily keep it warm or are you living with poor design features of the past?

There might be people or organisations in your neighbourhood who have managed to make their homes more energy efficient. Students may know of examples to consider such as PV panels, ground source heat pumps and additional insulation.



Air travel is a significant source of greenhouse gas emissions, partly because of the CO2 released but also because of it being released in the upper layers of the atmosphere. One proposal is to ban flights between cities that take less than 2.5 hours to travel between using surface transport and another is to tax frequent fliers at a higher rate. What do you think of these ideas – or do you have others?

Students could research and comment upon whether the continued growth of air travel can be reconciled with a move towards a greener transport policy. There is a challenging article at: [Air travel | Green Choices](#)



Supermarkets often try to maintain supplies of fruit and vegetables all year round by shipping them in from around the world. Should governments stop this and get us to eat what can be produced in our country and when it's in season?

Students could research and debate whether there should be a move towards seasonal shopping and only having fruit and vegetables in stock when they are in season in that country.



What are the options for you and people you know in terms of buying food and clothes? Do you have a choice or are you forced to buy products that have travelled a long way and may be produced inefficiently?

Are there people in the locality who could be interviewed about living more sustainably? Are there shops and other businesses who are trying to offer consumers options with more ethical manufacturing and fewer miles of transport?



How can you get the energy you need to run your home? Can you switch to a greener supplier or does this option not exist?

Students could look at the websites of various electricity suppliers and compare their offers in terms of sustainable energy sources.



# The COP26 Conference



Which countries are attending and who is representing them?



What targets for action should be set – at what levels and in which areas?



Which countries are responsible for most of the greenhouse gas emissions? Which countries have most to lose from rising sea levels?



What is on the agenda to be discussed? Are they exploring the most important questions?

Nearer to the time of the conference more information will be published online about countries attending and the agenda being explored. Students can be encouraged to gather information from various sources and display this. Groups should be encouraged to develop a view about the impact of the event, both intended and actual. Government information on the conference is at: [COP26 - GOV.UK \(www.gov.uk\)](http://COP26 - GOV.UK (www.gov.uk))

# How is the climate crisis seen in various parts of the world?



In some countries cooking is done on open fires. This heats the home as well as cooking food but it releases dangerous particulates into air which is breathed in. Find out in which countries this is a problem and research solutions. See WHO report at: [Household air pollution and health \(who.int\)](https://www.who.int/news-room/fact-sheets/detail/indoor-air-pollution)



Research why India will be badly hit by rising sea levels. See article in India Today at: [Rising sea levels pose a threat but Indian scientist says the study has flaws \(indiatoday.in\)](https://www.indiatoday.in/india/story/rising-sea-levels-pose-a-threat-but-indian-scientist-says-the-study-has-flaws-1284447)



Over-fishing is a global problem but some people are more dependant than others on fish. Find out in which countries over 50% of people's protein intake comes from seafood. See article at: [COP 25 - End overfishing to mitigate climate change - Seas at Risk \(seas-at-risk.org\)](https://seas-at-risk.org/news/cop25-end-overfishing-to-mitigate-climate-change)



Both Libya and parts of the USA have limited local water supplies. Find out why Libya is less well equipped to deal with this and be able to support people and agriculture. See UN report at: [Climate Change | UN-Water \(unwater.org\)](https://www.unwater.org/news/2021/04/2021-04-20-2021-04-20) Find out about Libya's attempts to solve its water supply with the Great Man Made River Project (see article in Arab Reform at: [Climate Change | UN-Water \(unwater.org\)](https://www.arabreform.com/en/2021/04/2021-04-20-2021-04-20)) Useful summary of challenges facing USA is at: [Water Supply | National Climate Assessment \(globalchange.gov\)](https://www.globalchange.gov/water-supply)

# How can better engineering meet the challenges of the climate crisis?



How can transport be made more efficient – less polluting and more fuel efficient? There is a useful Wikipedia article at: [Sustainable transport - Wikipedia](#)



How might food production switch to feeding us with using less land, water and energy? Check out the UN stance on sustainable food production at: [Sustainable Food Production | UNEP - UN Environment Programme](#)



What will homes of the future look like in terms of energy efficiency? How will energy be generated, stored and used? There are some useful ideas at: [Energy Efficient Home Design - What's Involved \(eco-home-essentials.co.uk\)](#)



How can we make better use of water? Does it all need to be clean and can people gather and use their own supplies? There are some useful infographics from the UN at: [Infographic light 01.jpg \(2875x2025\) \(un.org\)](#)

# Letting people know what you've learned



Produce a series of illustrations with captions to use in a social media campaign to reduce waste from people's homes.

*Think about clear messages that are persuasive and don't use many words. Identify things that people can do that will make a difference and that they will feel are possible.*



Design a presentation to show the local council how waste collection and recycling could be reorganised to reduce waste and pollution.

*Make some clear points about what you think should be organised. Remember that councils have to work to a budget and that any plan should reduce the amount of waste going to landfill.*



Design stickers to put up around the home to encourage a more responsible use of energy.

*Try to come up with clear messages that will make a difference to people's behaviour. See if you can avoid telling people off but rather make them feel they can be part of the solution.*



Produce a slide deck to show to people explaining how decisions about food purchases can have a big impact on the environment.

*Think about the key points that you want to get across and what you want people to change about their behaviour. Try to find some clear images. A good structure is: indicate the problem, describe the solution, explain the implications of not acting.*

# Since 2015 Siemens has had a global target to halve its emissions by 2020 and become Net Zero in operations.

Siemens has committed to a science-based reduction pathway along our entire value chain. In this way, we are ensuring that our climate-protection efforts are in harmony with the Paris Climate Agreement's, highest level of ambition. For more information visit

<https://new.siemens.com/global/en/company/sustainability/carbonneutral.html>

This resource is one of many from Siemens Education supporting understanding and awareness of global climate change issues and decarbonisation including:

## Schemes of Work

<b>The Inspired Bus Company (11-14)</b>	Identify the best fuel source for a bus, exploring the pros cons of battery powered vehicles, fuels cells and diesel engines.
<b>Here Comes the Sun (11-14)</b>	Compare the pros/cons of petrol generators and photovoltaic cells in the context of a case study.
<b>Blowing in the Wind (11-14)</b>	Plan a proposal for the development of a new windfarm.
<b>Energy Island (11-14)</b>	Identify characteristics to allow for effective energy provision and evaluate different methods of supplying energy for domestic consumption.
<b>The Monte Rosa Mountain Hut (11-14)</b>	Apply concepts of energy transfer/conservation by designing a mountain hut. Energy is lost, students propose ways of reducing this heat loss.
<b>Underwater Energy (14-16)</b>	This resource looks at the key features, advantages and disadvantages of tidal power as an energy source.
<b>Build a wind turbine (7+)</b>	This activity can be included in a lesson focusing on how wind turbines are one of many methods used to produce a sustainable energy source.

## Interactive learning tools and games

<b>Energy Farm</b>	Discover how different energy technologies can be used to power a farm. Design a system that meets demand whilst minimising cost and environmental impact.
<b>Energy Island</b>	Find the balance between cost, pollution and efficiency to keep Energy Island from grinding to a halt!
<b>Green City</b>	Manage air quality levels over a seven day period using a range of air quality sensors and measures.
<b>Smart Infrastructures</b>	Looks at decarbonisation, the future and sustainable cities.
<b>The digital twin challenge</b>	Modelling a car to best balance Power/Range/Emissions. Interactive game also comes with teachers notes and a worksheet.

Visit [www.siemens.com/education](http://www.siemens.com/education)

