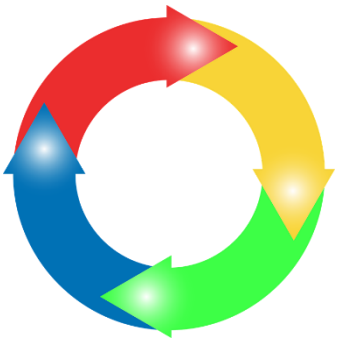
Make the World… more sustainable

Teacher guide

What is sustainability?

The World Commission on Environment and Development describes sustainable development as: *"…development that meets the needs of the present without compromising the ability of future generations to meet their own needs".*

What is behind this is the need to cease to exploit the earth's resources by continually taking, and consider alternative designs and production methods when coming up with new product ideas. It is a mind set that all designers need to adopt for commercial as well as environmental reasons.



Awareness of environmental issues is now widespread and the impact of not using sustainable design is clear. The massive quantities of waste plastics in the oceans is just one example of how products, packaging and non-degradable materials can affect our lives.

Sustainable design is fast becoming a matter of global corporate citizenship. More consumers are choosing products based on their environmental impact, forcing manufacturers to reconsider how they develop and market products.

Global Goals

The Sustainable Development Goals or **Global Goals** were developed by the United Nations in 2015 with the aim of ending world poverty by 2030. Certain goals are applicable to product designers, including developing affordable and clean energy, clean water and sanitation and encouraging responsible consumption and production. Designers should take account of the issues highlighted through the goals when designing and making new products.

The D&T Association's free resource **Sustainability in Product Design** offers students a wide-ranging look at sustainability in product design at an appropriate level for GCSE and A Level students. It looks at the role of the product designer and the many factors they should be aware of when designing.

Practical Action has a number of resources for teachers and students that aim to engage with and help understand the Global Goals.

Designing for sustainability at GCSE and A Level

GCSE students need to consider sustainability as part of the core examination and the contextual challenge, the non-examined assessment part of the Design and Technology GCSE. Sustainability is now an integral part of the exam and students need to show how they consider all the factors involved in developing and manufacturing a product before they finalise its design.

Incorporating sustainability into design means making bold decisions to ensure future environmental stability. Using a sustainable model in product design and designing for the environment can help establish a brand that stands apart from others.

The GCSE Contextual Challenge (Non-Examined Assessment) forms 50% of the overall marks in the D&T GCSE. The skills and learning developed here should also be carried forward to A Level where the same principles apply.

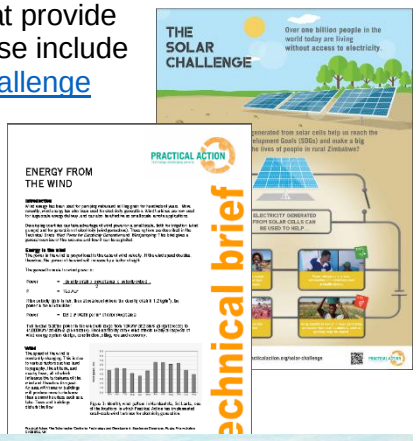
Marks are generally awarded where design concepts are developed from initial research and the generation of design ideas is developed and refined. Sustainability and the environment and an awareness of production methods and their impacts are significant considerations.

Activities

This resource contains a PowerPoint presentation linked to four short videos to introduce sustainable design and focus students on generating and storing electrical energy sustainably, and a fifth 'recap' video which can help reinforce the messages. Focused activities exploring the efficiency of different energy generation models should take place between showing videos 2 and 3.

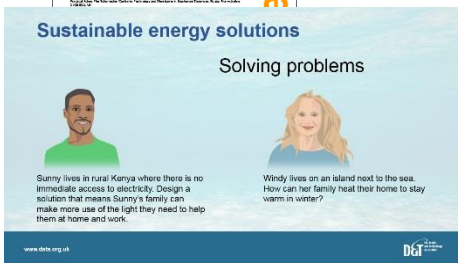
Wind and solar power
Students should plan, design, make and test model solutions to the need for energy using alternative energy. Prior learning to give a good understanding of circuits, structures and mechanisms will allow them to focus on sustainable approaches when solving problems.

Practical Action has a range of free resources for schools that provide guidance on learning about aspects of renewable energy. These include the Solar Challenge (including a competition), Wind Power Challenge and Power for the World. Each has extensive teacher notes, activities and presentations from which students will make and test wind turbines and model solar solutions for a village in Africa. Download the resources and using these students can make and test wind turbines and plan and model solar power solutions for a specific purpose.



Mindsets has a range of components and kits for making solar powered vehicles and other models.

Once these focused activities have been fully understood the learning can be applied to solve solutions in scenarios that demand a sustainable approach. Two scenarios are put forward in video 3, with opportunities to apply solar and wind powered solutions to local needs.



Presentation tips

Using video
General tips: Run through videos with a timer and note the points at which you might like to pause to make a point or ask questions. You may also want to add your own commentary. You may need to point out that some of the views expressed by interviewees or the originator will be their own opinions and may need to be considered.

Using PowerPoint presentations
The PowerPoint presentations contain instructions and activities for students and may contain links to videos. Ensure you have YouTube enabled in school to allow these to load correctly.

Activities
The materials with each of the activities are in pdf and PowerPoint formats the latter can be adapted to suit your teaching requirements.

Online links
To get the best from online resources ensure your web browser is updated and that you have access enabled to allow external videos to load correctly.

Videos

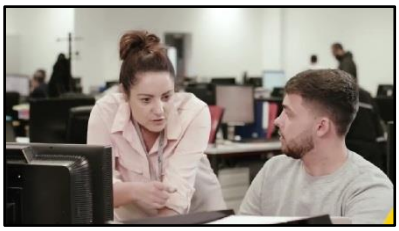
The videos have the following content

1 Introduction (2 minutes)
This introduces the Global Goals and illustrates how a growing population is putting demands upon limited available resources with consequent effects upon the environment and wildlife.

2 Sustainable energy (1 minute 15 seconds)
Considering demand upon energy sources for all the new products people buy and need. Nuclear energy, coal, oil and water turbines are highlighted and 'alternative energy' solutions are put forward as more environmentally friendly, sustainable options.

The focused activities should take place between showing videos 2 and 3

3 Scenarios (1 minute)
Introducing two examples of individuals with needs that might be solved by using wind or solar power.
Teachers can use the PowerPoint presentation to expand upon the two scenarios presented here or devise their own situations and users that are appropriate to students' understanding.



4 Engineering for change (1 minute 30 seconds)
What we have learned: that wind and solar energy are plentiful and sustainable and that other renewable sources of energy can be used.
The role of engineering – engineers and designers are working to develop and improve systems for the efficient generation and storage of energy. It includes examples of sustainable design engineers' solutions and reminds students that sustainability should be considered in all projects. Finally, it suggests finding out how to become a design engineer, with links included below and in the presentation.

5 Recap (2 minutes)
This briefly covers the key points from the earlier videos: Global Goals, pressures on energy needs and the need to find sustainable solutions.
This video can also be used as a brief introduction, summarising the whole resource.

Links

These links provide background information on sustainable engineering solutions and contains resources that can be used to complement the ones outlined above.

- The ERA Foundation has support for emerging engineers in all sectors.
- Engineers Without Borders has examples of their work with sustainable design around the world.
- Born to Engineer offers careers advice and resources to help you decide your future.
- Practical Action has resources that support sustainable solutions across the globe.
- Smallpeice Trust and Arkwright have courses, case studies and scholarships
- Engineering UK gives support across the industry including through Tomorrow's Engineers

Engineering solutions
Links to examples of sustainable engineering solutions, research and developments:

- Carnegie Wave Energy: https://www.carnegiece.com/wave/
- University of Binghamton, NY, Solar panels using bacteria: https://www.binghamton.edu/casp/research.html
- Alternative wind turbine designs: https://skippy.org.uk/alternative-wind-turbine-designs/
- Los Alamos National Laboratory, New Mexico, windows as solar panels: https://www.lanl.gov/discover/publications/connections/2018-02/science.php
- Solar roads: http://www.solarroadways.com/
- Lawrence Livermore National Laboratory – miniature nuclear fusion: https://lasers.llnl.gov/science/energy-for-the-future
- Airborne wind energy / Power generating drone: https://www.wartsila.com/twentyfour7/innovation/drones-and-power-generation-what-is-the-connection

Engineering in the UK
Some examples of engineering roles and activities in power industries and ow sustainability is being integrated into providing energy solutions.

- **Scotia Gas Network:** Using renewable, organic materials to replace finite supplies of natural gas.
  https://sgn.co.uk/Greening-the-gas/
  https://www.youtube.com/watch?v=oMbwlKIsa-k#action=share
- **Northern Gas:** locally sourced green gas supplies.
  https://biomethane.northerngasnetworks.co.uk/
- **Amey**: careers in civil engineering.
  https://www.amey.co.uk/your-career/
- **Scottish and Southern Electricity Networks**:
  https://sse.com/beingresponsible/ourresponsiblehouse/
- **Balfour Beatty**:
  https://www.balfourbeatty.com/how-we-work/sustainability/