DISCOVERY AWARD

CREST AWARDS

Sustainable Solutions

Student Pack

TEAM PROJECT

Working in teams, students are challenged to use digital tools and new technologies to tackle climate change in their local area.

#Technology
#Environment
#Neighbourhood

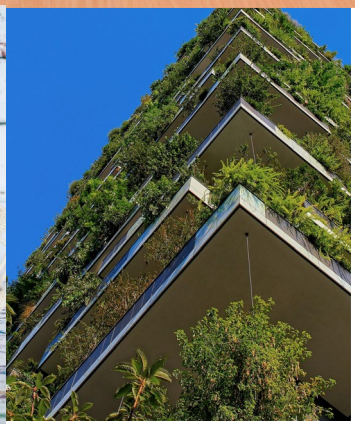
IN PARTNERSHIP WITH

UK Research and Innovation

Llywodraeth Cynulliad Cymru
Welsh Assembly Government

Inspiration

Here are some examples of sustainable solutions in use today.



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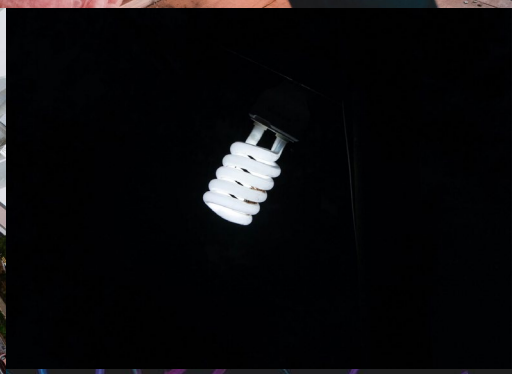


Team roles

REMEMBER: Your job title shows which part of the project you will lead. You are responsible for making sure that things get done in your role, but everyone in your team should contribute to all the tasks. If you have more than five members in your team, then there can be multiple designers and engineers.

Project Manager

Makes sure the whole team and the project is on track

Communication Manager

Responsible for ensuring that the team communicates its ideas effectively when presenting to the other teams, and responsible for coordinating the presentation.

Marketing

Responsible for developing a marketing plan and thinking about who this tool would benefit, and how and why it would be useful.

Research Manager

Helps other members of the team to gather examples and evidence using various resources, including the workshops, and reports back on this as part of the presentation.

Designer

Responsible for taking the knowledge and information gained from the workshops and developing them into ideas that will provide new solutions in the classroom.

Engineer

Ensures that the implications of the design ideas are thought through. Responsible for working with the designer to sketch ideas and question how they will work, and for researching the materials and technology required to make the design ideas work.

Starter activity: Industry in Wales timeline

Instructions

In this activity you will look at a case study of industry in Wales as a starting point for analysing industry and innovation in a specific local context.

Traditionally, mining in Wales produced carbon-heavy resources that fuelled the rapid industrialisation of the world, including the increase in worldwide transportation and global modernisation.

It is generally accepted by leading scientists that the Industrial Revolution and the burning of fossil fuels is to blame for the dramatic rise in greenhouse gases and the changes we are seeing to our global climate.

In your teams, cut out the cards on pages 8 and 9 and place them on the timeline in the order that you think they happened.

Industry and innovation timeline 2000 –

2015
Paris Agreement international accord to address climate change signed by 195 countries

2007
Apple iPhone launch

2000
Human Genome deciphered

2000

Industry and innovation timeline 1900 – 2000

2000

1992
Kyoto Protocol – international treaty committing parties to reduce greenhouse gas emissions signed by 192 counties

1989
Internet invented by Tim Berners-Lee

1988
Intergovernmental Panel on Climate Change (IPCC) established

1975

1969
First moon landing

1950

1939-45
Second World War

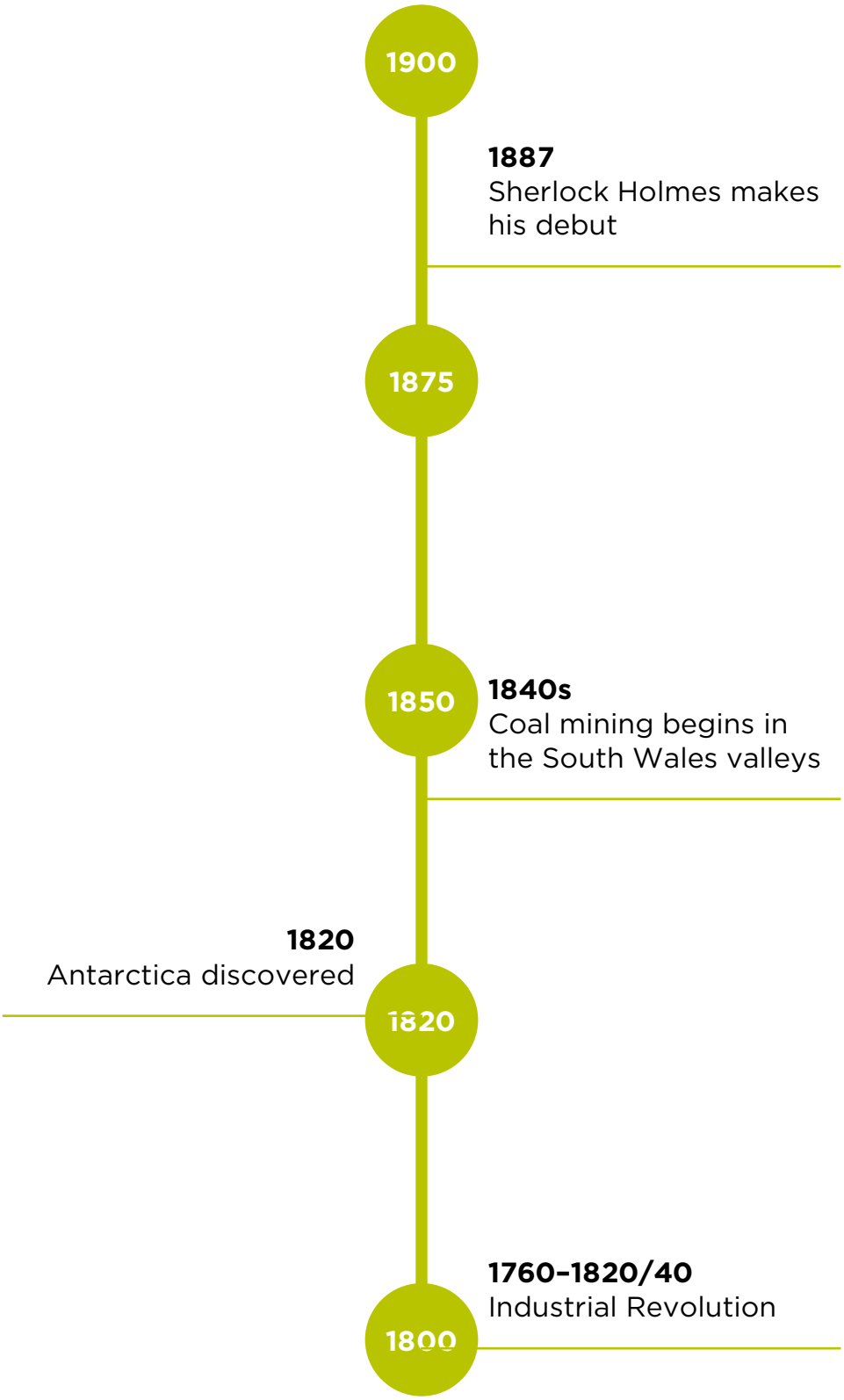
1926
First TV invented

1925

1914-1918
First World War

1900

Industry and innovation timeline 1800 – 1900



Richard Trevithick's steam locomotive carries ten tons of iron, five wagons and 70 people ten miles from Penydarren ironworks, Merthyr Tydfil to Abercynon in the world's first powered railway journey.	The Abbey Works steelworks at Port Talbot are opened, becoming the largest steelworks in Europe and employing 18,000 in the 1960s.	Based in Carmarthenshire, Biopharm becomes Europe's leading supplier of medical grade leeches.
Hoover opens its factory in Merthyr Tydfil to build washing machines. The factory closes in 2009.	Dr Lyn Evans, a Welsh scientist in charge of the Large Hadron Collider (LHC) which aims to recreate the conditions of the Big Bang, shows a great Welsh contribution to science and technology.	National Health Service (NHS) founded under Health Minister Aneurin Bevan.
Bloodhound SSC announced. Partnership with Swansea University and the FLITE aerodynamics design system.	Last deep mine in Wales closed. Tower Colliery in Hirwaun Rhondda Cynon Taff.	Dinorwig Hydroelectric Power Station commissioned in North Wales. Still operational today.
World's second largest offshore wind farm, Gwynt y Môr, opened in North Wales.	Sir Martin Evans wins the Nobel Prize for Physiology or Medicine for his research into stem cells.	Alzheimer's breakthrough, jointly led by Cardiff University. The largest study of its kind explores the relationship between genetics and lifestyle in the development of the disease.

William R. Grove invents the fuel cell, a device that produced an electric current from hydrogen and oxygen reacting on platinum electrodes	The first million-pound cheque was signed at the Coal Exchange in Mount Stuart Square in Cardiff Docks	Brecon Beacons National Park awarded International Dark Sky Reserve silver award. First area of its kind in Wales
Donald Davies devised the idea of information packet switching which lies behind the Internet	Great Western Railway joined with South Wales when Brunel's Chepstow Bridge opened	Sony begins production of the Raspberry Pi computer at its UK Technology Centre in Bridgend. Within a year it has made a million of them
Wales' largest Energy Recovery Facility (ERF) opens in Cardiff. It diverts 95% of non-recyclable waste away from landfill and generates 30MW of electricity, enough to power 50'000 homes	The largest number of men ever to work in the Welsh coal mines was 271,000 in 620 mines and 122 shipping companies	

RAPID Design Thinking process

RAPID Design Thinking is a relatively fast and simple way to design something with (or without) technology.

Reveal

At its most basic, design is a solution to a problem. So, where do we find problems worth solving? We must reveal them!

Start by deciding on a problem you want to solve, Try to think of something specific (e.g., instead of thinking about pollution, focus on a particular kind of pollution, like air, water or plastic). Next learn as much as you can about the problem you have chosen by researching it.

Flip the problem into a question – this will help to guide your project.

Alternatives

Now that you have a question as your goal, you need to come up with a solution to answer it. In fact, you need to come up with many alternative solutions.

Start by brainstorming as many different ideas as possible – big, wild, far-out ideas! Once you have finished brainstorming, discuss the different ideas,. Are there any connections between them? Sometimes, two okay ideas can combine to make one great idea.

Decide which idea to take forward.

Prototype

Create a model of your device.

A model doesn't have to 'work', but it can be very helpful to show how something would work. Use whatever bits and pieces are available: pens, pencils, paper, cardboard, straws, tape, etc. Or, if your innovation is not a physical product (e.g., an app or service), draw sketches of how it will work.

Iterate

Continual feedback is very useful in improving a design.

Test the prototype with users while observing and asking questions.

Ask testers to give feedback by answering your prepared questions and giving general comments and opinions.

Look at your testing and the feedback. What went well? What didn't? What changes can you make to the prototype?

Develop

Create a plan to define each team member's role and work out the resources you will need to complete your project.

Planning

Your challenge: come up with an idea for a sustainable start-up business linked to your local community

You must work together as a team to:

- Produce a final concept for a start-up business. The business must be either a **PRODUCT** or a **SERVICE**.
- Write and deliver a five-minute presentation involving all team members.

Get started (REVEAL)

Start by thinking about some environmental issues. Research the effect of climate change and how this might affect your community in the future. How could you use science or technology to solve these problems?

Brainstorm ideas (ALTERNATIVES)

In the introduction you explored some ideas for sustainable products and services. These might provide inspiration for a new idea or product for you to develop.

- **Design a product:** Think about products that you use regularly. Are they environmentally friendly? Do they have a lot of packaging? Are they disposable? Are they made from local and sustainable materials? If not, can you think of an alternative? Will your product be made using sustainable materials? You could research how to use local, recycled or upcycled materials.
- **Services:** Think about what services you use on a regular basis. Could you think of a way to offer environmentally friendly transport? Or a sustainable restaurant that produces no waste or only uses local, in-season ingredients? Or an app that helps people to reuse things or buy things locally? Could you provide locally generated energy?

TIP!

You should think about sustainability in every aspect of your business.

Idea development

Research and develop your concept (ALTERNATIVES & PROTOTYPE)

Start by researching your chosen idea. Look into what similar products already exist and how they work for inspiration.

- How would your product or service work?
- Who is your target audience? Does your product or service meet its needs?
- Think about the whole process of your business. For example, if you are selling a product you could do a life cycle analysis to think about sustainability from creation to end of use.
- What will you do to ensure that your business will be sustainable?
- You will also need to make decisions about the physical designs of your product. How will you make your design both fit for purpose **and** attractive to consumers?

Design and test your product or service (PROTOTYPE & ITERATE)

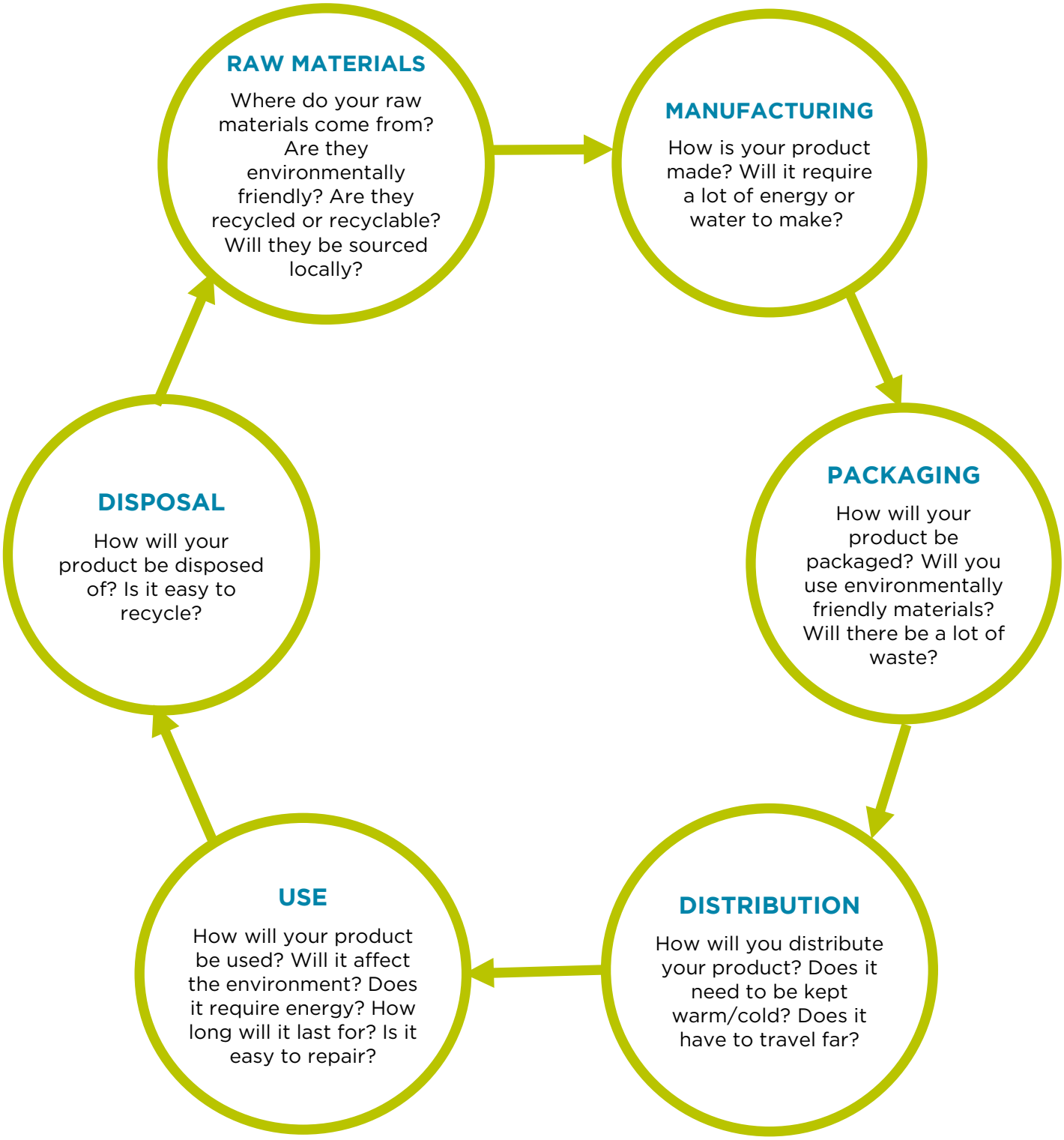
Your first idea is never the final design for a product or service. When developing your idea, it is important to:

- Create prototypes and conduct tests to find out if your idea works. If your business idea is a service, you should still create something to get feedback on. You could:
    - Create some diagrams or drawings
    - Make some wireframes or a storyboard to mock-up an app or website
    - Design a logo for your invention
    - Design packaging
    - Think of a snappy strapline/motto
    - Design an advert for your invention

  Because it can take more than five impressions for an individual to recognise a brand or specific marketing message, follow the 'Three Cs' for marketing messages:

    - Clear – What is the message and the offer of your invention? It must be clear and not filled with confusing words or phrases.
    - Compelling – Interesting, relevant, topical and important to your audience.
    - Consistent – Regardless of channel, the message must be the same.
- Get feedback from your target audience: you might like to create a survey or conduct interviews to find out what people think.
- **Use your testing and feedback to resolve any issues and improve your product or service.**

Life cycle analysis (for products)



Sustainability analysis (for services)

Think about how your business will approach these elements of environmental sustainability. You don't need a perfect idea, but it's important that the positive consequences outweigh any negative ones.

Procurement

What things will you need for your business? Make a list. Where will you buy these from? Can you source them sustainably by buying things that are made from recycled or environmentally friendly materials, by buying less, by buying things that come with minimal or no packaging, etc.?

Energy

How much energy will it take to provide your service and where will this energy come from?

Water

How much water will it take to provide your service? Will the water be polluted/contaminated? What will happen to this water after your business has used it?

Waste

How much waste will your business create? What steps will you take to minimise waste? Can your waste be recycled?

Transport

The transportation involved in your business may relate to the other elements on this sheet. What will you do to reduce the amount of transportation required?

Positive change

Will your business do anything to actively improve the environment by contributing to biodiversity, educating others about environmental issues, etc.?

Presentations

Prepare your presentation

In the final session your team will present its ideas. In your presentations you should include:

- An overview of your product or service.
- An explanation of how your business is sustainable.
- An explanation of who your target audience is and how your product or service meets its needs.
- Information on how you came up with and developed your initial ideas into the product or service you are presenting.
- Discussion of your idea in more detail, including sketches, drawings or images to illustrate how your solution works.

Every team member must contribute to the presentation. It should last no longer than five minutes. If there is time available, the other teams will be able to ask you questions.

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