DISCOVERY AWARD

CREST AWARDS

Sustainable Solutions

Teacher 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

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Background

Sustainability can be defined as meeting *"the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland Commission, 1987).* Sustainable development requires a fine balance of meeting economic and social needs, primarily through economic development and growth, while protecting the environment and its natural resources.

Industrialisation as a means of achieving economic development and growth is a key strategy across the globe, leading to the creation of industries, manufacturing output, job creation and government revenue. However, industrialisation often has negative impacts on the environment, particularly if unregulated.

Industry and the environment

Industrialisation is important for the economic growth and development of a society, but it can also be harmful to the environment. Amongst other things the industrial process can cause climate change, pollution to air, water and soil, health issues, extinction of species and more.

This resource uses a case study, '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.

Sustainable industrial development

More and more businesses are now prioritising sustainability. Typically, sustainable businesses supply environmentally friendly products or services, but they may also be companies that have made an enduring commitment to environmental principles in their business operations.

There are many aspects to sustainable industrial development. The United Nations for Industrial Development Organisation (UNIDO) defines sustainable industrial development as development that is:

- Economic: encourages a competitive economy, for exportation as well as domestic use
- Social: creates long-term employment and increased prosperity
- Environmental: creates energy efficiency, resource conservation, low waste production and the use of safe and environmentally-compatible materials.

Challenges

Non-polluting, environmentally sustainable industries tend to be intrinsically more labour intensive and less resource intensive than traditional processes.

In order to encourage sustainable industrial development, industries must be helped to modernise. The development of new markets for climate neutral and circular products must be stimulated. The decarbonisation and modernisation of energy-intensive industries such as steel and cement should be prioritised.

Overview

Sustainable Solutions has been specifically developed to meet the CREST Discovery Award requirements. By undertaking the activity and completing the reflective CREST Discovery passports, all your students should be able to achieve a CREST Award. This resource can be delivered in school during lessons, as an extracurricular activity or as an enterprise activity. The project can be completed over five lessons or as a single event.

The challenge

Sustainable Solutions is a team-based activity day with the aim of encouraging each team to design and create a sustainable start-up business concept linked to their community.

Their business idea should be focused on providing a product or service that is environmentally friendly, taking into consideration energy efficiency, resource conservation, low waste production and the use of safe and environmentally-compatible materials.

Students will:

- Explore the relationship between industrialisation and sustainability
- Research sustainable businesses
- Develop a concept for their own sustainable product or service.

Learning objectives

- Reflect on the balance of meeting the economic and social needs through economic development and growth, while protecting the environment and its natural resources.
- Explore how industrialisation is used as a means of achieving economic development and growth, leading to the creation of industries, manufacturing output, job creation and government revenue.
- Understand the negative impacts of industrialisation on the environment, particularly with regards to climate change, pollution to air, water and soil, and the extinction of species.
- Explore how more businesses are prioritising sustainability in terms of energy efficiency, resource conservation, low waste production, and the use of safe and environmentally-compatible materials.
- Understand the RAPID Design Thinking process and apply this in relation to a sustainable business idea.
- Employ design tools such as life cycle analysis and ‘personas’ to think critically about ideas.

Materials

Activity	Materials
Introduction	❑ Discovery passports (1 per student) ❑ Student pack (1 per student)
Starter activity	❑ Extra printouts of the Industry in Wales timeline cards (in Student Guide) ❑ Scissors
Brainstorming	❑ Access to computers for internet research ❑ Writing materials
Design challenge	❑ Access to computers for internet research ❑ A range of materials for design and prototyping e.g. ○ Scissors ○ Pens and pencils ○ Rulers ○ Glue sticks, Sellotape and string ○ Large paper and Post-it notes ○ Card ○ Polystyrene foam / Foam board ○ Wire and straws

Timings

Activity	Description	Timing
Introduction	Using the Sustainable Solutions presentation, students explore the relationship between industry and sustainability. The session leader introduces the day and divides students into teams.	30 mins
Starter activity	Starter activity – Industry in Wales timeline challenge: students explore a case study and complete a timeline of industrial and innovation development in Wales.	30 mins
Brainstorming	Students brainstorm ideas and agree on one to take forward in the next session.	30 mins
Research and design	The teams work together to research and develop their chosen idea in response to the challenge.	30 mins
Break		
Prototype, test, improve	Teams test out their idea by creating a prototype or conducting a survey, using the results to improve their concept. Teams prepare their presentations.	2h
Lunch		
Presentations	Teams finalise and deliver their five-minute presentations. Teachers and students provide constructive feedback and have a chance to ask questions.	1h
Reflections	Students reflect on their learning and complete their CREST Discovery passport.	10m

Top tips

- To inspire your students, why not invite a STEM ambassador or 'Inspiring the Future' volunteer to introduce the project or give feedback on students' presentations?
- When considering timings, start with the end of your school day and work backwards.
- Account for timings that cannot be changed, such as lunch breaks, and schedule around them.
- Try and plan the day to give your students as much time as possible for the design challenge.
- Before presentations, allow five minutes for students to clear their tables and tidy away any equipment.

Step-by-step guide

Pre-project preparation

1. Read through the background information in the pack.
2. Print worksheets and gather the materials needed.
3. Think about which students will make strong leaders and assign them the role of Project Manager for their teams. (The groups can then decide the other roles.)
4. You might like to ask students to research an example of a local business that has a focus on environmental sustainability ahead of time.
5. You could also collect some physical examples to explore (e.g., reusable bag, reusable water bottle, eco-friendly cleaning products, reusable food wrap, pens made out of recycled plastic as additional stimuli.

Set-up

1. Every team should have a table and enough chairs for 5-7 team members.
2. Teams will need access to the internet for research.
3. Paper and pencils for drawing and sketching ideas should be available.

Introduction (30 mins)

1. **Slides 1-4**: Introduce the topic of sustainable industrial development:
    - **Industry and the environment:** explain how industrialisation is important for the economic growth and development of a society, but can also be harmful to the environment, contributing to climate change, polluting air, water and soil, and more.
    - **Sustainable Industrial Development:** more and more businesses are prioritising sustainability, incorporating energy efficiency, resource conservation, low waste production and the use of safe and environmentally-compatible materials. Typically, sustainable businesses supply environmentally friendly products or services, but it may also be a company that has made an enduring commitment to environmental principles in its business operations.
    - **Challenges:** starting a successful, environmentally-sustainable business is not easy, and it tends to be more expensive to run, so coming up with a good business plan is important.
2. Facilitate a class discussion about the impact of industry on the environment and how industry would need to change in order to become more sustainable.
3. **Slide 5**: Explain that today students are going to work in teams to design and create a sustainable start-up business concept linked to their community. Use this as an opportunity to discuss some different sustainable products and services that the students might have encountered.
4. **Slide 6**: Introduce the CREST Discovery Award and passport.

Step-by-step guide

5. **Slide 7:** Split into teams of 5–7. Each team member should have a specific role to play (as described in the student pack).
    - Project Manager x1
    - Communications Manager x1
    - Marketing Lead x1
    - Research Manager x1
    - Engineer (1 or 2 depending on team size)
    - Design Lead (1 or 2 depending on team size)

Starter activity: Industry in Wales – timeline challenge (30 mins)

1. **Slide 8: Get** students (in their teams) to complete the **Industry in Wales – timeline challenge** in the student pack, used here as a case study. In this activity, students place cards detailing key events on a timeline in order to discover how Welsh industry has changed over the last 200 years.
2. **Slides 9-10:** Reveal and discuss the answers. Facilitate a whole-group discussion on the timeline, noting one or two key points from each era, specifically focusing on the changes from heavy industry to IT and environmental research. What was surprising? Why? Encourage students to discuss the international agreements on climate change and where these sit within the timeline.

Brainstorming (30 mins)

1. **Slide 11:** Talk about the examples of sustainable products and businesses shown. Students can also refer to the **Inspiration** pages in the student guide.
2. **Slide 12:** Go through the RAPID Design Thinking process
3. Teams should follow the first two steps of the RAPID Design Thinking process to identify the problem(s) they hope to solve through their sustainable business, carry out research and start brainstorming ideas for their solution.
4. Towards the end of the allocated time for brainstorming, ask groups to choose one idea that they would like to focus on.

Step-by-step guide

Research and design (30 mins)

Now students need to turn those thoughts and ideas into a real product or service. Their idea might be a totally new invention, or they might choose to look at an existing device and improve it. Using the resources in the Student Guide, teams should start to develop their chosen idea further.

1. **Slide 13:** Explain how one of the first things to think about when designing a new product or service is who the target audience is. When designers think about their target audience, they develop what is called a 'persona'. This describes users in personal ways, so a product team can visualise the users as they create a digital product for them.
   - Who is the target audience?
   - Is it just one type of person that can use it?
2. **Slides 14-15:** Go through the **Life cycle analysis** and **Sustainability analysis** slides.
3. Students can use the **Idea development, Life cycle analysis** and **Sustainability analysis** pages in the Student Guide to help guide their research and develop their idea.

Prototype, test, improve (2 hours)

1. Teams should now start to think critically about their idea. Remind students about the 'prototype' and 'iterate' steps in the RAPID design thinking process. Your first idea is never the final design for a product or service. Remind students about the importance of testing and getting feedback from the target audience.
2. Students should also use this time to create a prototype and test it out. If the business idea is a service, students should still create something which they can get feedback on, such as drawings, an app mock-up, descriptions, a mood board, etc.
3. Teams should then create a survey and get feedback on their idea.
4. Students should use the results of their testing to improve their idea.
5. Students should prepare their presentation. They might like to make a poster or a PowerPoint and include images and diagrams. Encourage them to think about who will do the explaining during their presentation. Encourage each student to present and discuss what their role in the project was.

Step-by-step guide

Presentations (60 mins)

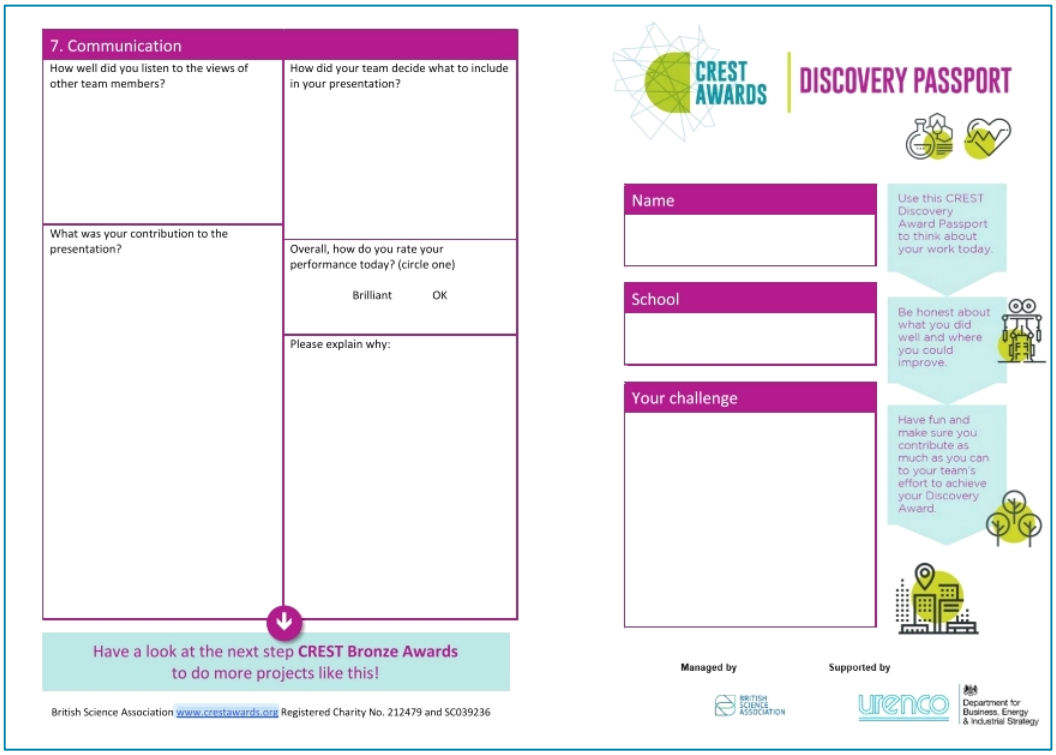
Each team should prepare a presentation that is no longer than five minutes, with each member contributing. The content of the presentation should include:

- An overview of the sustainable solution
- Information on how the team came up with the idea
- Sketches, drawings or images to illustrate how the solution works.

If time allows, other teams may be given the opportunity to ask questions.

Reflection (10 mins)

Time for students to reflect on their learning and complete their CREST Discovery passport.



7. Communication

How well did you listen to the views of other team members?

How did your team decide what to include in your presentation?

What was your contribution to the presentation?

Overall, how do you rate your performance today? (circle one)

Brilliant OK

Please explain why:

Have a look at the next step **CREST Bronze Awards** to do more projects like this!

British Science Association www.crestawards.org Registered Charity No. 212479 and SC039236

CREST AWARDS | DISCOVERY PASSPORT

Name

School

Your challenge

Use this CREST Discovery Award Passport to think about your work today.

Be honest about what you did well and where you could improve.

Have fun and make sure you contribute as much as you can to your team's effort to achieve your Discovery Award.

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CREST Discovery Award

Students should complete the CREST Discovery passport, available at www.my.crestawards.org. When you assess the passport to submit the Awards, you will be recognising the skills that students gain by participating in the day.

Preparation

Ready to get going with CREST? Sign up for a CREST account here: www.crestawards.org/sign-in.

Create a new Discovery Award project with the name(s) of the student(s) and the title of the project. If you don't have all the details, you can fill these in later!

Run the project

We've created some handy packs to help you deliver a successful Discovery Day. The activities in these packs can be done in one day or over a period of shorter sessions – whichever suits you. Students should spend five hours on the project.

You can download the Discovery passport when you create your CREST account by following the link above.

Make sure you complete a risk assessment before running the project.

Reflection

Once your students have completed their CREST project, ask them to complete their Discovery passport. This is a chance for them to reflect on all the interesting things that they've learnt and the invaluable skills they have used along the way.

Enter your project for a CREST Discovery Award

Hard work deserves a reward! Celebrate and certify each student's achievement by entering their project for a CREST Discovery Award. Simply:

1. Log in to your CREST account at www.crestawards.org/sign-in.
2. Select the project and upload a sample of the student's Discovery passport or other project evidence.
3. Check that the participating student has met each of the criteria on the teacher assessment page.
4. Finally, complete the delivery and payment details to order your snazzy certificates.
5. Congratulations on completing CREST Discovery Award!

What next?

The scientific discovery doesn't need to end here. Why not encourage your students to go to the next level and try the CREST Bronze Award?

Share the wonder of science and inspire others to take part in CREST projects, too. For free ideas on how to get started, visit www.crestawards.org.

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