**Carbon Neutral Teacher Guide**

**It’s part of CO****NNECT**

In the race towards exam it can be easy to forget the other goals of science education - scientific literacy and STEM careers. You can work towards these missing goals using - CONNECT an EC-funded project which offers a new kind of resource. Called **a Science Action**, it’s aset of activities to integrate a real-life challenge into an existing topic. It ticks lots of boxes:

√ Applies a science concept

√ Teaches an enquiry skill

√ Provides an authentic end of unit assessment

√ Shows students how science affects their world

√ Gets students interacting with a scientist or engineer (supplied by the project)

√ talking about science with their family

**Overview of Carbon neutral**

The world is running out of time to protect the planet from the worst effects of climate change. The UK has committed to being carbon neutral by 2050. Everyone must play their part: individuals, households and businesses. The Carbon neutral science-action prepares students to plan a presentation to win the job of being a café’s carbon consultants. Students use their knowledge of the Earth’s atmosphere, and the enquiry skill of consider different perspectives.

Carbon neutral integrates with the Year 10 unit: atmosphere. In the Blueprint 5-year plan there are 2 Key Concepts (Earth’s atmosphere and Global warming). Here’s how it fits into the unit:



Yellow boxes = existing lessons. Green boxes = Carbon neutral activities.

Here is a description of the activities in Carbon neutral:

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| **Activity** | **Learning objective** | **What students do** | **Who can be involved** |
| **1. Challenge** | Care about the issueUnderstand the scientific context | Explore what carbon neutral and carbon footprint mean.Calculate their household’s carbon footprint and decide ways to reduce it.Introduced to the challenge of helping a café become carbon neutral. | Teacher, STEM professionalFamily |
| **2. Carbon** | Apply Earth’s atmosphere to a new context | Find out the different ways that businesses create CO2 emissions, with a worked example: ‘fast fashion’.Apply this to help the café how their actions produce CO2 emissions. | Teacher |
| **3. Game** | Learn the skill ‘consider different perspectives’.  | Practise the skill of considering the economic, social and environmental consequences of an action, through a game.Apply this to evaluate the actions the café can take to reduce their footprint. | TeacherSTEM professional |
| **4. Recommendations** | Coordinate scientific knowledge and skill in a performance assessment. | Use carbon offsetting with their family.Write a plan for the café on recommendations for being carbon neutral. Compete against other teams to win the job. | TeacherSTEM professionalFamily  |

**Involve a STEM professional**

Carbon neutral provides an easy-to-use and effective approach for involving a scientist or engineer. This will give students insight into STEM careers and make the issue more real.

If you are working with a STEM professional, give them the ‘Information for STEM professional’. It has full details of the activities they can support:

**3. Game:** to help students learn the new enquiry skill, by explaining it, demonstrating it, or guiding students as they practise it.

**4. Recommendations:** to act as an audience, review the quality of presentations, give feedback and be a judge.

The detailed running notes below describe these roles.

Some scientists can also support the first Rewilding activity:

**1. Care** A scientist or engineer could introduce what a carbon footprint it and why we need to reduce carbon emissions.

**Involve families**

Carbon neutral allows you to engage parents or other family members in talking about science. This could especially benefit those students whose families have little experience of science. There are two Carbon neutral activities designed to involve families:

**1. Care** In the ‘home’ task households use a website to calculate their carbon footprint. They then discuss together which actions they will take to reduce it.

**4. Recommendations** Households find out about carbon offsetting and choose actions to reduce their carbon footprint to become carbon neutral.

**1. Challenge**

If you are using a STEM professional, the running notes show how they can help, **in bold**.

Advance preparation: Either print out the document **Carbon neutral 1 Home** (one for each student) or upload them so students can access at home. They will need to print off the second sheet.

You can get more background information about the topic from this video: [Can YOU fix climate change?](https://www.youtube.com/watch?v=yiw6_JakZFc)

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| **STAGE/PURPOSE RUNNING NOTES** |
| **AT SCHOOL**Introduce the terms carbon neutral and carbon footprint | Show the presentation **Carbon neutral 1 Challenge.** Tell the students their challenge is to help a café make the business carbon neutral. They will use the knowledge and skill gained during the activities to write a report.**If you are using a STEM professional, they could talk about what is meant by carbon neutral and carbon footprint.**Prepare students for the home task. Display the first slide of the document **Carbon neutral 1 Home** (or give each student their copy) and talk through so they understand what their home task is. Remind students they need to ask members of their family or others at home to take part in the task. |
| **AT HOME**Families calculate their carbon footprint and make a pledge | Families follow the instructions on the document **Carbon neutral 1 Home**. They use an online carbon footprint calculator to calculate their carbon footprint. They then fill in a pledge, which says what actions they are going to take to reduce it. Students will need to bring this sheet into school. |
| **AT SCHOOL**Actions are discussed | Discuss with the class what actions they decided as a family to take to reduce their carbon footprint, and how they work. Tell them that these changes will only make a small impact on the country’s carbon footprint, so companies also have to take action as well.Students then take their pledges back home where they can be displayed as a reminder to the family. |

**2. Carbon**

In this activity, students will apply the scientific idea of **Earth’s atmosphere** to a new context. They alsolearn a step-by-step strategy for solving problems.

Use the presentation: **Carbon neutral 2 Carbon**.

Print off copies of the student sheets (**SS1-4**) (slides 13-16) for each group of 8 students.

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| **STAGE/PURPOSE RUNNING NOTES** |
| **EXAMPLE**Give the problem | Introduce the task – to work out what the CO2 emissions of the café are (2).Show the objectives for the activity (3).Read through the worked example question. Click on the link for an optional video showing a news story about fast fashion (4). |
| **DETECT**Work out how to answer the question | Use the slide to model the thinking used in the detect stage (5). |
| **RECALL**Think about what you already know | Go through the three main sources of CO2: Vehicles (6), electricity (7) and waste (8). Use the questions at the bottom of each slide to check understanding. |
| **SOLVE**Use what you know to answer the question | Use the slide to go through the thinking behind the solve stage (9).Show the model answer (10). Explain to the students that they will be writing a similar answer later in the lesson. |
| **YOUR TURN**Students complete a similar problem independently | Now students work in groups of at least 8. Give each pair of students a copy of **SS1, SS2, SS3** or **SS4.** (11)They use the information on the sheet to discuss how the café creates CO2 emissions in one of four areas: Staff transport, goods transport, electricity and waste. These correspond to the areas identified in the worked example.Pairs also decide which person or item on their sheet they think releases the most CO2, with reasons.The groups reform and pairs share what they found out.Students work individually to explain the differwnt ways the café emits CO2. This could be done for homework.You can assess their answers with the **assessment rubric** (17) and provide feedback. |

**3. Game**

In this activity students will practice the skill: **Consider different perspectives.**

We have adopted the ‘EDGE’ approach for teaching a skill systematically:

* **E**xplain to students the need for the skill
* **D**emonstrate how to use the skill using modelling
* **G**uide students so they can use the skill with support
* **E**mpower students to use the skill independently

In this activity we have not included the Demonstrate stage, as students are practicing a skill taught in KS3.

If you are using a STEM professional, the running notes show how they can help, **in bold**.

Use the presentation: **Carbon neutral 3 Game**. Print copies of the student sheets **SS1-6** (slides 10-15) for each group of 3 students.

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| **STAGE/PURPOSE RUNNING NOTES** |
| **ENGAGE**Introduce the task  | Check student’s understanding about the links between deforestation, CO2 and climate change (2).Introduce the challenge – to help the café to reduce its CO2 emissions. The question is set: ‘How can we decide which actions are best?’(3).Show the objectives for the lesson (4). |
| **EXPLAIN**  Clarify the need for the new skill and where it fits | Explain that every action has different consequences (social, economic and environmental) (5) and you can weigh up them up to make a decision (6). This justifies the need to learn a new skill (5).**The STEM professional can talk about how this skill is relevant to their work.** |
| **GUIDE**Coaching/support for students | Set the task: to play a game to practice making decisions (7).The action the class will be using needs to be added to the box. You can decide in the lesson as a class or add it before the lesson. Some examples are: should... schools ban all junk food, homework be banned, mobile phones be banned in school, all 12-16 year olds have to do an hour a week litter picking on the streets, children go to school on Saturdays? Students are introduced to 'a game of consequences' which will help them to decide if an action is a good idea. They work in a group of 3 and follow the instructions on the slide and **SS2**. To make the game more competitive an extra option is to allow students only 20 seconds to come up with a consequence when filling the 2 and 3 boxes. If they fail to do this, they miss their turn. The player with the most cards on the board at the end is then the winner.Spend some time going round each group asking them if they found that the action had more negative or positive consequences, examples of some of the consequences they came up with and if they are social, economic or environmental consequences. |
| **EMPOWER**Students make their decision  | Still in their group, give each student a copy of **SS4**, **5** or **6**. They mimic what they did in the game and list possible consequences of each action, if they are positive or negative and if they are social, economic or environmental. They decide which action they think is best before feeding back to the group. **The STEM professional can help students to think about the consequences.**Note: There is a homework activity that can be completed following this lesson – see below. |

**4. Recommendations**

In this activity, students work in groups to prepare and present their plan to the café owner outlining the recommendations for achieving carbon neutral.

If you are using a STEM professional, the running notes show how they can help, **in bold**.

Print the student sheets from the document: **Carbon neutral 4 Recommendations.**

**SS1**: Offset your household’s footprint, one per student

**SS2**: Help Coffee Club become carbon neutral, one per group

**SS3**: Action costs and savings, one per group

**SS5**: Assessment checklist, for the STEM professional

Groups will also need copies of SS5-6 from **Carbon neutral 3 Game.**

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| **STAGE/PURPOSE RUNNING NOTES** |
| **CARBON OFFSETTING**Students recommend carbon offsetting actions for their household | Students complete the task on **SS1** for homework.This is a follow-on task from the CARE activity. It also helps students prepare to write the final presentation to the café owner.Students learn about carbon offsetting and choose actions to help their household become carbon neutral. They persuade their family why these actions are the best choice. |
| **PLAN** Groups decide how to reduce the café’s footprint | Arrange the class into groups of 3-5 (6 groups is ideal). Make sure students do not work in the same groups as in KNOW 2 to allow for new discussions. Give each group a copy of **SS2**, which outlines the task, and **SS3**.Students plan their recommendations to the café owner.   |
| **PRESENT**Groups present or write their recommendations | Groups take it in turn to present. Each should last no more than 5 minutes. Alternatively, groups can write their plans, sharing out the workload. It can be written collaboratively using Google documents.**The STEM professional can act as the café owner. They watch/read the presentations and assess them using SS4. They give feedback to each group and say which group has won the job at the café.** |

You may like to extend this science-action and get students to:

* Research what real companies are doing to reduce their carbon footprint. E.g.:

Beauty company: <https://tropicskincare.com/pages/environmental-report>

Food company: <https://www.healthynibbles.co.uk/pages/our-achievements>

Clothing company: <https://staywildswim.com/pages/sustainability>

Hotel: <https://www.thegreenhousehotel.co.uk/environment>

* Write recommendations for local businesses on how they could reduce their footprint.
* Visit local businesses and conduct interviews to see what they are doing to reduce their footprint.