Carbon Footprint
Sustainability

Introduction

Carbon footprint is created when carbon dioxide (CO_2) and additional gases (methane, nitrous oxide, and fluorinated gas emissions), known as equivalents and collectively noted as CO_2e, are released into the atmosphere. These emissions are a byproduct of agriculture, transportation, heating, cooling, electricity production, and other goods and services that people want and need. These *greenhouse gases* trap heat in a layer around Earth similar to the way a glass roof traps the sun's heat in a greenhouse and causes global warming. Melting ice caps, retreating glaciers, rising oceans, and an increase in extreme weather events are all signs of climate change.

LEARNING OBJECTIVES
Students will:
- research what it means to leave a carbon footprint
- identify what is being done globally and locally to slow down or counter the effects greenhouse gases have on climate change
- explore examples of infographics and create visuals that communicate scientific data
- share their infographics and carbon footprint insights with others

SUPPLIES
- white sketch paper and thick construction paper or poster board
- crayons, markers, and colored pencils
- rulers, scissors, glue, and tape

PREPARE
Carbon footprint describes the impact humans have on the release of carbon dioxide and its equivalents (CO_2e) into the atmosphere. Infographics visually represent data using images or symbols to describe a situation. The carbon footprint is measured in metric tonnes with each tonne equal to 1,000 kilograms. Visuals help make complex information, large numbers, and comparisons easier to understand. It helps students feel engaged and empowered when they see the collective impact of individuals and communities working to solve a global issue and leave a smaller carbon footprint on Earth.

Vocabulary

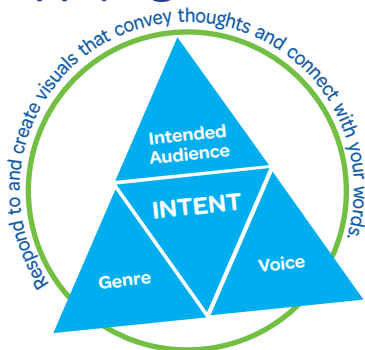|				
infographics	emissions	warming and cooling	comparisons	
scientific data	greenhouse gases	science-based targets	equivalencies	
visual symbols	global warming	agricultural use	atmosphere	
CO_2e	transportation	industry	carbon dioxide	
carbon footprint	energy	absorption	electricity	

Essential Questions

- How are CO_2 and CO_2e formed? What are their similarities and differences?
- Why are CO_2e emissions a concern and how can they be reduced?
- Why are infographics helpful in communicating data?
- How can images and design elements capture viewers' attention, help tell a story, and increase understanding?

Guiding Questions

- How are greenhouse gases calculated as a carbon footprint?
- Why does the carbon footprint need to be reduced to stabilize or reduce global warming?
- Where are some examples of global warming observed locally and around the world?
- What information about carbon footprint and greenhouse gases can be shown through infographics?

Applying the Intentional Writing framework to this project:

Respond to and create visuals that convey thoughts and connect with your words.

Intended Audience — **INTENT** — **Genre** — **Voice**

INTENT – What is the intended message you want to convey?

INTENDED AUDIENCE – Who will see this infographic? How might the message inform them or motivate them to take action?

VOICE – How will the visuals and words work together to convey data in an emotional, logical, or credible point of view?

GENRE – Why is an infographic an effective genre for this message?

Crayola Commitment to Reducing Carbon Footprint

Environmental experts agree that reducing our carbon footprint is one of the most important ways to slow global warming and positively impact the environment. The Science Based Target initiative (SBTi)*, a collaboration of global nonprofit organizations, businesses, and world governments, set goals to limit global warming to not exceed 1.5°C. To achieve these goals, participating organizations, including Crayola and its parent company, Hallmark, which joined SBTi, will reduce carbon emissions significantly by 2030.

Crayola sources raw materials locally and manufactures many crayons and markers close to where they are used, which helps reduce the carbon footprint. Crayola has reduced CO_2e emissions from the company-owned facilities' direct and indirect energy sources* by 82% since 2019, with investments in renewable energy as well as efficiencies in U.S. manufacturing processes. (*Direct energy is the use of gasoline, natural gas, oil, etc. Indirect energy emissions are created when the energy is produced, but not when it is used.)

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Carbon Footprint

Sustainability

Infographics

An infographic presents data visually using design elements, visual symbols, and facts to tell a true story about a situation. Some infographics, like the ones students will create in this project, provide scientific information, while others share demographic data to provide social insights. This special communication tool combines facts with math, art, and visual storytelling. The examples show the gases that make up CO2e and the sources for these greenhouse gases.
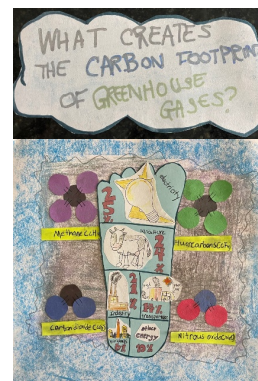
Using a footprint framework, infographics could show 1. what makes up CO2e—Carbon Dioxide (CO2), Methane (CH4), Nitrous Oxide (N2O), Ozone, and Fluorocarbons or 2. what is causing the greenhouse gases—agriculture, electricity production, heating, cooling, transportation, etc.

RESPOND

- Start by introducing a variety of sustainability infographics and using the vocabulary to describe what information is being shared visually.
- Discuss infographics students have seen and design characteristics that are most effective, for example: a crisp title, one main idea, images that connect with the data, use of color, line, and contrast for visual appeal.
- Have students use infographic examples, vocabulary, and essential/guiding questions as springboards to research carbon footprint. They could focus on its key causes, use comparisons to help explain metric tonnes, or the impact of global warming on Earth.

CREATE

- Have students work individually or in pairs as they choose which aspect of their carbon footprint research they will focus on in their infographic.
- As students create an infographic, ask them how the data can be presented using visual symbols and minimal explanatory text. What labels and title will help convey their message?
- Help students explore how design elements such as proportion, balance, color, contrast, and unity make visual communication effective.
- Urge students to seek feedback from classmates on their work in progress so they can adjust their wording and images for clarity. Provide students with time to refine their ideas into a well-designed infographic.
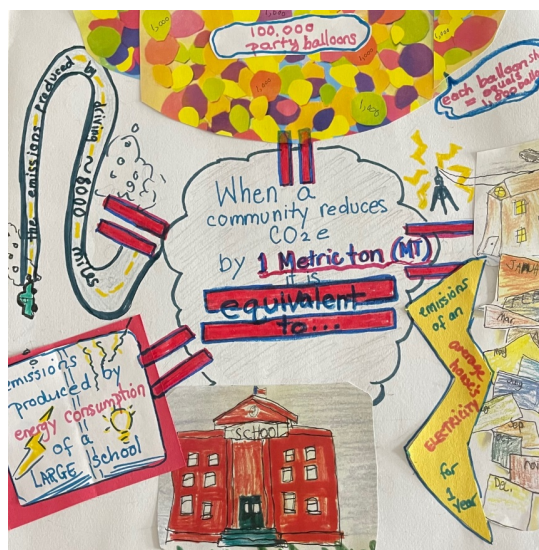
One metric tonne (MT) of CO2e is equivalent to 100,000 party balloons, the emissions of an average house's electricity for one year, the emissions produced by driving a car 8,000 miles, or producing one large school's annual energy consumption.

PRESENT

- Consider options for displaying the infographics. Perhaps they could be posted in the school building or digitally on the school's website, or they might be presented within the community in a public building, at an airport, bank, library, or mall.
- Consider whether the infographics stand alone or would benefit from an explanatory presentation, where students would share their insights during a community meeting and engage in a discussion about how the town might take action.

CONNECT

- Help students connect their carbon footprint infographics to other sustainability data. Discuss how visual representations of data make compelling statements with few words.
- Discover community organizations or university programs that are committed to reducing the carbon footprint. Partner with them to expand the use of use infographics and data sharing.

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Sustainability

▶ For Younger Students

Carbon footprint, climate change, and greenhouse gases are abstract ideas that can be confusing for young children. Focus on local issues that can readily be seen and understood. Discuss how children can help by turning off lights, walking to local places instead of going by car, and reducing the amount of waste they discard. Explain the topic using concrete examples that children can understand, like throwing out food that could have been eaten, leaving water running, driving cars, heating houses, etc. Help them use simple visual symbols and math on their infographics. What is equal? What gets added? What can be subtracted? Explore measurements such as temperature and weight.

▶ For Older Students

Carbon footprint is still an abstract concept, but infographics make the issues visually clearer. There is an immediacy to the problem that will appeal to students when they understand that the sooner everyone takes action, the better the combined results will be. Help them find compelling data and use visuals that motivate their viewers to take action.

Student Reflections

- How would you explain global warming to those who are unfamiliar with the problem?
- What evidence—local or global— would be most compelling to cite?
- How can individuals and communities help to reduce CO2e emissions?
- What main messages did others remember from your infographics?

Teacher Reflections

- What fascinated students about carbon footprint, greenhouse gases, and global warming?
- What misconceptions did students have at the beginning of this project that changed as they researched and represented data on the issue?
- What impact did this project have on students' desire to learn more about sustainability and protecting the environment?
- How did this infographic project help students find additional ways to visually communicate?

Standards and Skill Development

Standards provide a guide to what students should know and be able to do. They help connect everyday learning experiences to the curriculum. This **sustainability** project addresses the following educational standards:

SCIENCE (NGSS)
- Identify evidence to support a science-based claim.
- Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.
- Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.
- Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

LANGUAGE ARTS
- Draw evidence from literary or informational texts to support analysis, reflection, and research.
- Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations.

VISUAL ARTS
- Brainstorm multiple approaches to a creative art or design problem.
- Analyze components in visual imagery that convey messages.
- Individually or collaboratively construct representations, diagrams, or maps of places that are part of everyday life.
- Discuss and reflect with peers about choices made in creating artwork.
- Investigate and discuss possibilities and limitations of spaces, including electronic, for exhibiting artwork.

MATHEMATICS
- Understand concepts of volume and relate volume to multiplication and to addition.
- Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms.
- Write and interpret numerical expressions.
- Represent and Interpret data.

SOCIAL AND EMOTIONAL COMPETENCIES
Help children understand how emotions, behaviors, skills, and attitudes impact achievement in school, career, and life by building skills in:
- Self-awareness—developing interests and a sense of purpose.
- Relationships—communicating effectively and demonstrating positive interactions with others.
- Responsible Decision Making—identifying solutions for personal and social problems.
- Self-Management—showing the courage to take initiative.

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