



# Carbon Footprint



# CARBON FOOTPRINT

Students will learn to effectively present the findings of their research and analysis of the Carbon Footprint of their school. Students will collect their own data using several focused research questions, and present an action plan to their school based on what they have learned. The experience of developing local solutions to global problems is empowering for students and also provides a context for understanding how data can be used to share information with others, which is a valuable skill for a wide range of career and college pathways.

## Standards and Objectives

**Citizen Schools Unit Standard #1: Citizen Schools students will make an effective oral presentation**

Lesson Objectives

- Speak loudly enough for the audience to understand
- Speak slowly enough for the audience to understand
- Speak clearly enough for the audience to understand
- Present information using eye contact when speaking in public
- Present information using hand gestures when speaking in public
- Present information using good body posture when speaking in public

▪Effectively use visual aids in a presentation

- Can we use the results of measuring our contribution to carbon emissions to inspire our community to reduce global climate change?

**Citizen Schools Unit Standard #2: Citizen Schools students will evaluate the impact of the choices on a global world**

Lesson Objectives

- Describe the meaning of “a global world” in society
- Summarize the resources or groups of people that can be impacted across a global world
- Give examples of ways choices can impact other communities, countries, or resources
- Describe the ways people or resources are connected in a global world
- Estimate the impact of actions or choices on global resources or societies

▪Evaluate the impact of a decision on a global world or global resources

- Can we use the results of measuring our contribution to carbon emissions to inspire our community to reduce global climate change?

**Citizen Schools Unit Standard #3: Citizen Schools students will demonstrate and ability to collect and organize data**

Lesson Objectives

- Define data, survey/test, sample, and data collection
- Explain the role of objectivity, bias, and samples OR tests in collecting data
- Give examples of valid and invalid questions or tests for collecting data
- Develop and utilize survey questions OR tests to collect valid data
- Organize collected data into tables or charts that allow others to observe it effectively

### Guiding Question

## Assessment (WOW!)

*Presentation:* Apprentices share their work as environmental auditors and the methods they used to collect data and calculate the carbon footprint of their school and make recommendations on ways to reduce carbon usage. In a multimedia presentation to community members, school officials, and fellow students, apprentices share an oral presentation that outlines the steps they took to measure their school's carbon footprint. Following the presentation, and through a film written and directed by apprentices, students present an action plan that delineates ways in which the school can reduce or offset their carbon emissions in order to reduce global warming.

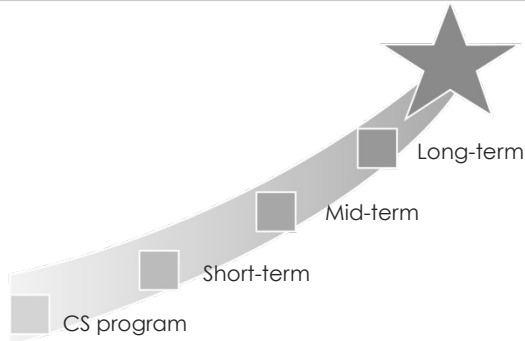
## Basic Unit Plan

Week	Connections to Standard/WOW!	Week	Connections to Standard/ WOW!
1	What is Global Climate Change? Resources in a connected world	6	Organizing Carbon Footprint data and Calculating Impact
2	Carbon Emissions Cause and Effect (greenhouse gasses, glacial melt and sea level rise). Collecting data on carbon emissions	7	Sharing Carbon Footprint data with others with tables and graphs
3	Building on sustainability and energy star ratings	8	Action Plan and Develop Presentation Script
4	Field Trip to Sustainability Business or Program; STEM Careers	9	Local to Global Carbon Impacts- Filming the presentation
5	What is a Carbon Footprint? Collecting valid data	10	Rehearse Presentation and Practice Fielding Questions



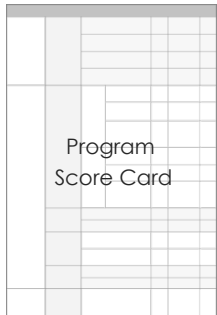
# CARBON FOOTPRINT

## UNIT CONTEXT / BIG IDEA



Students will understand how to collect data and present results of a question that has impact on decision making and actions of others. They will learn that there are a variety of jobs that include environmental sustainability as a goal, including technical careers and traditional trades with a focus on efficiencies (i.e green engineering). Students will be motivated to share the results of their study and think about next steps for being an advocate for reducing global climate change in their college and career pathways.

## SHARED GOALS



If you teach this unit successfully,

- Students will relate that the program is relevant to their lives and career interests
- Student achievement in STEM subjects will improve
- Teachers and families will observe that students make connections between their own actions and knowledge and local and global issues.

## TIMELINE OF SKILLS



- Students will have access to and belief that achievement in STEM subjects is important for addressing global challenges.
- Students will have access to a variety of STEM professionals and belief that they can pursue a college and career path with local and global sustainability focus.

## IMPLEMENTATION NOTES

- Plan early for a field trip to a sustainability focused small business, or a local business that has redesigned a product, facility or process to reduce carbon emissions. You might consider visiting a LEED certified building or academic program focused on “green jobs” or environmental workforce development. Schedule planning time to prepare staff at the site to organize the visit and work with your students.
- Carbon Footprint calculations can be done in several ways, if you have access to laptops or a computer lab, this is ideal for Lesson 6. If this is not feasible at your campus, you can use worksheets of each screen to calculate.
- Prepare to have extra help for filming the documentary during Lesson 7. You may also want some students to film outside of the building or collect footage during the sustainability field trip.



**LESSON PLANS AT A GLANCE**

Week	Lesson Objectives	Activities	WOW! Prep
1	<ul style="list-style-type: none"> <li>▪Describe the meaning of “a global world” in society</li> <li>▪Describe the ways people or resources are connected in a global world</li> <li>▪Define data, survey/test, sample, and data collection</li> </ul>	<p>Hook: Climate Conference Introduction of New Materials: What is Global Climate Change? Activity 1: Carbon Connection Activity 2: Resource Roundup Activity 3: What Have you Heard About Climate Change? Assessment: Action Steps</p>	<p>Students define global climate change and describe how carbon usage is connected to global climate change. Students survey the class to find out how they got to school today. Students describe what “global world” means.</p>
2	<ul style="list-style-type: none"> <li>▪Speak loudly enough for the audience to understand</li> <li>▪Speak slowly enough for the audience to understand</li> <li>▪Organize collected data into tables or charts that allow others to observe it directly</li> </ul>	<p>Hook: Climate Conference Introduction to New Materials: Global Climate Data Activity 1: Collecting Data Activity 2: Climate Cause and Effect Activity 3: Waste Assessment:</p>	<p>Students collect data on waste and waste water at their school. Apprentices describe the effects of carbon emissions using effective communication skills including speaking loudly and slowly.</p>
3	<ul style="list-style-type: none"> <li>▪Give examples of ways choices can impact other communities, countries, or resources</li> <li>▪Evaluate the impact of a decision on a global world or global resources</li> <li>▪Develop and utilize survey questions to collect valid data</li> </ul>	<p>Action Steps Hook: Climate Conference Introduction to New Materials : Emissions Activity 1: Local Choices, Global Impact Activity 2: Energy Stars Activity 3: Carbon Choices &amp; Field Trip Prep Assessment: Action Steps</p>	<p>Students collect data on appliances and land management at their school. Apprentices give examples of ways that choices impact global resources as they brainstorm action steps for the WOW! webinar.</p>
4	<ul style="list-style-type: none"> <li>▪Speak clearly enough for the audience to understand</li> <li>▪Present information using eye contact when speaking in public</li> <li>▪Estimate the impact of actions or choices on global resources or societies</li> </ul>	<p>Hook: Climate Conference Introduction to New Materials: Estimating Impact Activity 1: Carbon Quest Activity 2: Carbon Footprint of Site Activity 3: Share Action Steps for Feedback Assessment: Action Steps</p>	<p>Apprentices visit a business that has reduced carbon emissions to practice asking questions and sharing action plan ideas using eye contact and a clear, loud voice, just like they will in the WOW!</p>



**LESSON PLANS AT A GLANCE**

Week	Lesson Objectives	Activities	WOW! Prep
5	<ul style="list-style-type: none"> <li>▪Describe the ways people or resources are connected in a global world</li> <li>▪Explain the role of objectivity, bias, and samples OR tests in collecting data</li> <li>▪Give examples of valid and invalid questions or tests for collecting data</li> </ul>	Hook: Climate Conference Introduction of New Materials: Carbon Footprint Activity 1: Valid Carbon Data Activity 2: Valid Questions Activity 3: Carbon Connects Assessment: Action Steps	Students describe how several global resources are connected to each other. Describe why objectivity is important when researching carbon emissions. Students identify valid and invalid questions to collect data on carbon usage at their school.
6	<ul style="list-style-type: none"> <li>▪Give examples of ways choices can impact other communities, countries, or resources</li> <li>▪Develop and utilize survey questions OR tests to collect valid data</li> </ul>	Hook: Climate Conference Introduction of New Materials: Choices Activity 1: Action Planning Activity 2: Calculating Carbon Footprint Activity 3: Global Impact Assessment: Action Steps	Students give examples of choices at a local level that can impact global resources to begin an Action Plan. Students write and use survey questions to collect valid data about carbon usage at their school.
7	<ul style="list-style-type: none"> <li>▪Effectively use slides in a presentation</li> <li>▪Organize collected data into tables or charts that allow others to observe it effectively</li> </ul>	Hook: Climate Conference Introduction to New Materials: Carbon Visuals Activity 1: What did we find out? Activity 2: What does it mean? Activity 3: Presenting your Data	Apprentices create tables and charts that effectively organize the data they collected so that others can interpret it. Students practice sharing the data with others using the tables and charts as visual aids.
8	<ul style="list-style-type: none"> <li>▪Present information using hand gestures when speaking in public</li> <li>▪Present information using good body posture when speaking in public</li> <li>▪Summarize the resources or groups of people that can be impacted across a global world</li> </ul>	Assessment: Action Steps Hook: Climate Conference Introduction to New Materials: Describing What We Did Activity 1: Storyboard the Film Activity 2: Scripts for the Film Activity 3: Presenting the Plan Assessment: Action Steps	Apprentices master effective body posture and hand gestures as they practice reading the scripts for the video and WOW! presentation. Students summarize the resources that can be impacted globally by reducing carbon emissions



**LESSON PLANS AT A GLANCE**

Week	Lesson Objectives	Activities	WOW! Prep
9	<ul style="list-style-type: none"> <li>▪Speak slowly enough for the audience to understand</li> <li>▪Estimate the impact of actions or choices on global resources or societies</li> </ul>	Hook: Climate Conference Introduction of New Materials: Filming Basics Activity 1: Slow Script Read Activity 2: How We Estimated Activity 3: Film & Intro Assessment: Action Steps	Students practice elements of the webinar using scripts and speaking slowly enough for the audience to understand. In the webinar, apprentices describe how they estimated the impact of actions and choices on global resources.
10	<ul style="list-style-type: none"> <li>▪Effectively use visual aids in a presentation</li> <li>▪Summarize the resources or groups of people that can be impacted across a global world</li> </ul>	Hook: Climate Conference Introduction of New Materials: Sharing Our Film Activity 1: Rehearse Activity 2: Practicing Questions Activity 3: Rehearse Assessment: Action Steps	As students rehearse the full presentation and screening of the short film, they describe the data they collected and the action plan so that the audience can observe it effectively. Apprentices practice fielding questions about their process and how taking action steps locally would impact the global world.

**Lesson Elements**

Ritual- Each lesson begins with a **Climate Conference** Warm Up that introduces the global world. the day or previews the skill they will practice.

Assessment- The closing ritual every week, called **Action Steps**, will measure student mastery of objective in that lesson and connect the learning to actions that reduce carbon emissions locally and how that connects to reducing global climate change.

Structures- The concept of action steps (or setting priorities) as a closing ritual captures student mastery of the objectives and encourage s students to monitor their own progress toward shared goals. Capturing students practice oral presentation on video will help review areas for improving oral presentation skills. As students master each new objective, the lessons will focus on how people depend on natural systems, people can influence natural systems, and that decisions about natural systems and resources involve economic, legal, and political choices.

Procedures - The procedures for asking collecting carbon footprint data focuses on developing questions and asking the questions carefully using a clear, strong voice to ask the interviewee the question and recording responses carefully in order to ensure that all answers collected are valid.



Stationary Sources



Mobile Sources



Waste Sent to Landfill



Refrigerants and Air Conditioners



Purchased Electricity  
and Steam



Wastewater



Land Management





## What do Emissions Mean?

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It's not always easy to understand what emissions estimates mean in terms of the amount of carbon contained in everything from trees to plastics. The following provides just a few examples of what emission values mean when compared to the amount of carbon contained in materials we are accustomed to. These comparisons were obtained through the U.S. Climate Technology Cooperation Gateway's Greenhouse Gas Equivalencies Calculator.

Visit for more comparisons: <http://www.usctcgateway.net/tool/>

10 kgCO<sub>2</sub>E = just a little bit more CO<sub>2</sub> than what is released by burning a gallon of gasoline.

100 kgCO<sub>2</sub>E = about as much CO<sub>2</sub> as the amount released by burning all the propane in 4 bbq grill-size tanks.

1,000 kgCO<sub>2</sub>E = about as much carbon as the amount sequestered (stored) by planting 26 trees and allowing them to grow for 10 years.

10,000 kgCO<sub>2</sub>E = about as much CO<sub>2</sub> as the amount prevented by taking two passenger cars off the road for one year.

100,000 kgCO<sub>2</sub>E = about as much carbon as 83 acres of pine forest sequester in one year.

### Resources

1,000,000 kgCO<sub>2</sub>E = about as much CO<sub>2</sub> as the amount emitted by burning five rail-cars worth of coal

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This apprenticeship requires the Climate Check calculator. This is an excel sheet that is formatted and prepared to enable you and your students to gather and measure carbon footprints. This tool will gather and present data for your apprenticeship to use. You will need this tool in lessons 2-8, both in the classroom and between lessons to calculate carbon footprint

Please ask your support staff member to download and send you the tool from our internal website WOWspace. It can only be downloaded by Citizen Schools staff, so please ask for their help.

If you or your staff support have any trouble accessing this tool, please email Director of Curriculum, Emily Stainer at [EmilyStainer@citizenschools.org](mailto:EmilyStainer@citizenschools.org)

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# Carbon On the Move

Students describe what global climate change is and how data analysis skills will help us measure and describe the carbon footprint of the school. Students will list global resources that are impacted by climate change and describe how these resources are connected.

## Lesson Objective

- Describe the meaning of “a global world” in society
- Describe the ways people or resources are connected in a global world
- Define data, survey/test, sample, and data collection

## Lesson Agenda

10 MIN	<b>Hook:</b> Climate Conference
10 MIN	<b>Introduction of New Material:</b> What is Global Climate Change?
20 MIN	<b>Activity 1 (we do):</b> Carbon Connection
10 MIN	<b>Activity 2 (we do/you do):</b> : Resource Roundup
30 MIN	<b>Activity 3 (you do):</b> Climate Change on the Move
10 MIN	<b>Assessment:</b> Action Steps

## Lesson Preparation

- **Space:** Rehearse in the space where the WOW! Will take place of at least one of the run through, if possible. Offer quiet spaces for small groups to work together for practicing the question and answer session.
- **Group:** students will work in 2 groups for the Hook, (randomly select). Students work in groups of 3-4 for activity 1, whole class for activities 2 and 3. Students work independently for Check for Understanding.
- **Resources:** print and cut out resource cards and environment cards. Make copies of Mobile Handout. Prepare for administrator to visit- give this person a copy of the questions ahead of time so that they can prepare.

## Standards for Unit

### Global Awareness:

*Citizen Schools students will evaluate the impact of the choices on a global world*

**Data Analysis:** *Citizen Schools students will demonstrate and ability to collect and organize data*

**Connections**  
*Understanding basic terms about data collection and analysis is important for any career in business, STEM, and many other fields.*

*All careers and college pathways in our 21<sup>st</sup> century economy require a solid understanding of how the global world is connected and how resources and people are connected in the global*

## Materials

1. Visual of Objective/Agenda
2. Chart for vocabulary
3. Sticky Notes (5 colors)
4. Resource cards ( 1 per student)
5. Environment cards ( per group of 3-4)
6. Mobile Handout ( 1 per student)



▪Objective: Describe the meaning of “a global world” in society. Describe the ways people or resources are connected in a global world. Define data, survey/test, sample, and data collection.

### Hook Climate Conference

10 Minutes

▪Warm Up:

▪“Climate conference” is a time each week when we begin with a new topic for the day. Just like professional scientists come together to share their knowledge about climate change, we will share what we learn with each other.

▪Play a game of Telephone with the following prompt for the message:

▪ASK: What have you heard about climate change?

▪Students create two lines. On one end, the first people are the “operators”. They each whisper a separate to the person to their left. The message gets passed (by whispering) along the lines separately until the person at the end of the line shares it out.

▪Messages usually get silly by the time they reach the end of the line.

▪Each “operator” what the original message was at first and shares their name. Repeat several times.

▪Transition: You have already heard many things about global climate change. During this apprenticeship you’ll learn skills for measuring the impact of our own school on climate change and how we can reduce this impact.

### Introduction of New Materials:

### What is Global Climate Change

10 Minutes

▪Objectives / Agenda: Ask for a volunteer to read the objective. Ask for a volunteer to read the agenda. Any questions about the objectives or agenda for today?

▪Preview assessment: We will know we have mastered this objective if you can describe how we will use data, surveys, samples and data collection to learn about our school’s carbon footprint. I will also ask you to provide one example of how global resources are connected in global society.

▪Direct Teach:

- Global: the entire world
- Climate: the patterns of weather in a region over time
- Change: difference between two time periods.

▪CSAY: “Carbon Footprint measures the impact of human activities on the environment in terms of the amount of greenhouse gas (GHG)is produced. This is measured in units of carbon dioxide. We will learn about our carbon footprint using data collection.”

▪Define and write on chart:

- Data: observations you collect
- Survey
- Sample:
- Data collection: the process of collecting and recording observations.

▪To know that something is changing over time, you must be able to measure it. Climatologists collect data about what climate was like in recent and distant history.

▪Climate vs. Weather:

▪Weather tells you what to wear for the day, climate tells you what clothing

### Student Says...



*Students may have heard that climate change isn't real or important, or many discouraging facts and stories. Students may have misunderstood facts about greenhouse gasses and garbage. Note students' initial ideas and curiosities and take time to respond to them during the apprenticeship when they connect to the skills students are learning.*

*Also help students stay optimistic about positive change and the impact they can make on their community and the world.*

### Closer Look!



**Everyday activities you do in your school impact the climate:** Heating your school, lighting your classroom, and disposing of your school's waste can cause greenhouse gas (GHG) emissions. These emissions can contribute to global warming, a phenomenon in which human activities can influence the temperature of the earth's atmosphere. This influence on the earth's atmospheric temperature alters of earth's climate, which is called climate change.



## Apprenticeship

### CARBON FOOTPRINT LESSON #1 – page #3

# CITIZEN SCHOOLS

Objective: Describe the meaning of "a global world" in society. Describe the ways people or resources are connected in a global world. Define data, survey/test, sample, and data collection.

## Activity 1 What is Carbon?

20 Minutes

- Students each have one of the following signs at their desk: Air
- Water, Soil, Plants, Animals to share with their table mates (3-4)
- EXPLAIN:** When I read a sentence and it mentions your part of the environment, one person from your table stands up and says the name of your environmental component.
- Model:** If I read: carbon is part of the soil (which it is), someone from the soil group would stand up. You can't repeat the same person twice, so groups should collaborate to decide the order.
- Carbon is everywhere and is a component of every living being.
- Carbon can be found in every part of our world, and is always cycling through the environment around us.
- There is carbon in the **air and water:** carbon atoms (in the form of the molecule CO<sub>2</sub>) dissolve from the atmosphere into the ocean.
- Some of this dissolved CO<sub>2</sub> is re-released into the atmosphere, some is also collected by organisms and sediments in the ocean. There is carbon in **animals plants and soils** as well: Other molecules of CO<sub>2</sub> are taken up by plants and becomes part of the plant's tissue. When plants die and decay, some of the carbon is released back to the atmosphere while some of the plant material becomes part of the soil.
- As more carbon-based material gets packed together it hardens into eventually become coal.
- One last time around, read out each place and students with that sign stand up.

## Activity 2 Resource Roundup 10 Minutes

- What do all the signs mean about carbon in our world? (it is everywhere and important)
- The whole class works together and students find random groups of 3 during the activity.
- Transition:** All the groups stood up at some point. This means that carbon is found in all of these places!
- Pass out one resource card on page 5 to each student.
- P SAY:** "Global world means all people and animals all over the world, not just in our city, state or country."
- EXPLAIN:** Students walk slowly, mixing around the room.
- When the Citizen Teacher or Team Leader says "Resource Round up," students find two other partners, share the resource card each person has, and then collaborate to say a sentence that tells how all three are connected to each other in the global world. If students can't create a sentence that relates the 3 resources they have, they can jump to another group as a 4<sup>th</sup> member.
- Model one round, including the sentence that relates all 3 resources.
- Play for several rounds and then ask a few students to share out:
- ASK:** How are these resources connected to each other?
- Transition:** Now we have listed places where carbon exists and learned

## Missing Parts...



*Students may struggle to understand how their own daily activities and choices could possibly contribute to climate change? Climate change is a change in long-term weather patterns (such as temperature and annual rainfall). Some changes in climate occur naturally. Human activities that result in GHG emissions can also cause changes in climate. When GHGs are emitted, they trap energy in the atmosphere, which can alter the world's climate.*

## Additional Notes



*You and your Team Leader should set a tone of optimism and action rather than doom and gloom about climate change. Inspire students to change their own behaviors and educate others while providing accurate information about the causes and consequences of climate change.*

*Emphasize how you can interpret evidence of global climate change along with media they have seen about climate. Help students comprehend but not fixate on the global*



Objective: Describe the meaning of "a global world" in society. Describe the ways people or resources are connected in a global world. Define data, survey/test, sample, and data collection.

### Activity 3: Climate Change on the Move

30 Minutes

Write "walk," "public," "school bus," "bike," and "car" on x-axis of 2 charts you draw on the board see sample on page 5. Label one "today" and one "usual." Write "number of students on y-axis.

**aSAY:** "To collect data on how students arrived at school this week, we are going to make a chart."

Students place a color coded sticky note for the way they arrived at school that day. Then, on a second chart, they place another for the way they get to school most often. The result is 2 separate bar graphs.

For example: blue= walked, red = public transportation, orange=school bus yellow=bike. Green=car.

**bSAY:** "When we asked how you came to school, that was an example of a **survey** question (just a little different because it wasn't in a longer document. The **data** was your answer about which method you used. The **data collection** was when you put the sticky note on the board. The **sample** is this class, because that is who we asked."

Several students teach back each of the terms.

Interview principal about the number of cars the school owns and commuting distance, and fuel consumed by each vehicle type

all students take notes on Mobile Handout.

**EXPLAIN** to students that this data will be entered into the Carbon CHECK spreadsheet to calculate the footprint (or impact) it has.

**Transition:** we have taken the first steps to calculate our school's carbon footprint. Share some details (below) about what to expect for the week and how data collection will continue.

**Exit Ticket**

#### Key Questions

3. Explain why each of these will be important in our apprenticeship

(use the definitions from the chart to help you):

- Data
- Survey
- sample
- Data collection

2. provide one example of how global resources are connected in global society.

**Demonstration of Mastery:** Review student's exit tickets for clear explanation of how the concepts will be used in the apprenticeship and for an example of global resources that are linked and a clear description of how they are connected

**Transition:** We have so much to look forward to . Next week we will learn more about resources and collect data on waste and waste water at our school

### Field Tips



Remind students for each of the emissions categories (Stationary, Mobile, Waste, Waste Water, and Land Management) they will have an opportunity to collect data (either observe or interview someone who knows).



Walk Bike Pub Bus Car  
**Today**

### Future Plans



At the end of the apprenticeship, our WOW! Will be a webinar to share our action steps with the school.

Give your apprentices an idea of the WOW! And outline the skills they will build each week.

Answer any questions students may have about the WOW! in general.



**Soil:** can be washed away from farmland and result in fewer crops, can erode because of drought

**Coastal property:** can be eroded from flooding – destroying habitats, human homes and businesses.

**Glaciers and ice pack:** are not freezing as much in the winter less snow melt during the spring and summer.

**Corals:** oceans become more acidic, resulting in corals dying. Corals are habitat for many species, including fish.

**Honeybees:** warming temperatures may be causing problems with their immune systems, so they cannot fight off viruses, making it difficult for them to survive.

**Water:** less drinking water is in aquifers because of less glacial melt in the spring and summer.

**Forests:** trees provide oxygen and they absorb



**Water**



**Air**

**(Atmosphere)**



**Animals**



**Soil**





# Plants



1. Explain why each of these will be important in our apprenticeship  
**Use the definitions from the chart to help you:**

▪Data: \_\_\_\_\_

\_\_\_\_\_

—

\_\_\_\_\_

—

▪Survey : \_\_\_\_\_

\_\_\_\_\_

—

\_\_\_\_\_

—

▪Sample: \_\_\_\_\_

\_\_\_\_\_

—

\_\_\_\_\_

—

▪Data collection: \_\_\_\_\_

\_\_\_\_\_

—



# Waste Footprint

Students collect data on waste and waste water for the carbon footprint calculation at their school. Students teach back some of the ways that carbon footprint is calculated, practicing effective oral presentation skills.

## Lesson Objectives

- Speak loudly enough for the audience to understand
- Speak slowly enough for the audience to understand
- Organize collected data into tables or charts that allow others to observe it directly

## Lesson Agenda

10 MIN	Hook: Climate Conference
10 MIN	Introduction of New Material: Climate Data
20 MIN	Activity 1 (we do): Collecting Data
20 MIN	Activity 2 (we do/you do): Climate Cause & Effect
20 MIN	Activity 3 (you do): Waste Data and Visuals
10 MIN	Check for Understanding: Action Steps

## Lesson Preparation

- **Space:** Offer quiet spaces for small groups to work together for practicing the question and answer session.
- **Group:** Students will work in pairs of their choice for the Hook, Activity 3, and Check for Understanding. In Activities 1 and 2 students work with groups of 3-4 that you choose (split class into 4 groups).
- **Resources:** For the Hook, list countries at risk names on the board (pg. 5). Make 3 sets of category cards (pg. 6). Arrange ahead of time for a school administrator to visit for questions for about 15 minutes.

## Standards for Unit

### Communication:

*Citizen Schools students will make an effective oral presentation*

**Data Analysis:** *Citizen Schools students will demonstrate and ability to collect and organize data*

## Connections

Describing data using graphs and tables to that other can understand is a skill that is important for college and careers beyond finance. While programs make it easy to create a graph, using visuals in a presentation takes practice.

Students will also learn about unexpected careers that focus on reducing waste in creative ways

### Materials

1. Visual of Objectives/Agenda
3. Chart Paper and Markers
4. Waste Handout
5. Waste Water Handout
6. 3 sets of category cards
7. Graph paper
8. Waste and waste water comparison data sheet



## Apprenticeship

### CARBON FOOTPRINT LESSON #2– page #2

# CITIZEN SCHOOLS

▪Objective: Speak loudly and slowly enough for the audience to understand. Organize collected data into tables or charts that allow others to observe it directly.

## Hook: Climate Conference

10 Minutes

### ▪Warm Up

▪**WSAY:** "Say your name and choose one country you hope to visit someday from this list on the board (list just the countries from page 5 not the key.)"

▪For extra challenge, ask if someone can say 5 peoples names and the country they picked. Can anyone name everyone's name? The country each person picked? Practice a few times.

▪**ASK:** These countries all have something in common. They were named the most at risk for climate change for several reasons. Some places are more vulnerable to climate change because of their current climate, sea level, soils, farming systems, and natural resources.

▪It is important to focus on what can be done to reduce waste to limit climate change.

▪**Transition:** Now we are ready to talk about collecting data on carbon emissions and how we can use that data to make recommendations about action steps.

## Introduction of New Materials: Climate Data our World 10 Minutes

▪**Objectives / Agenda:** Ask for a volunteer to read the objective. Ask for a volunteer to read the agenda. Any questions about the objectives or agenda for today?

▪**Preview assessment:** We will know we have mastered today's objectives if you can teach back how you used data to create a graph of the waste we measured using a slow, loud voice.

▪**Direct Teach: Our Carbon Footprint measures the impact of our emissions.** Today's measurements will be: Waste and Waste Water

▪. **SAY:** "We will interview (name guest) who has information about the trash and water use at our school. Then we will use this information to add to our carbon footprint calculator to find out the impact of this waste. Practice asking our guest questions from your handout with a loud, slow voice."

▪**Model** appropriate voice volume and speed for clear communication.

▪Waste, or trash, contributes to greenhouse gasses in several ways:

▪Some trash is incinerated (burned) which releases gasses.

▪Energy and materials are involved in manufacturing. If we throw things away, new things will be produced, which creates GHS. For example, if we are wasteful with food packaging, we are filling landfills or the package could be burned. If we buy reusable or recyclable things, items will not take as much energy and materials (petroleum) to produce.

▪Waste water is water that cannot be used for drinking because it has chemicals in it.

▪**Connections:** These are two of several categories we will measure in the apprenticeship. Now that we know what a carbon footprint is, we are going to learn about why carbon emissions and global climate change matter.

## Student Says...



*Students may know that scientists collect data on global climate change, but they may not realize that they, too, will collect real data and use it to make recommendations about action steps. Work to show students that although the data they are collecting is different from what climatologists collect, many of the skills for showing data to other people are similar.*

## Closer Look!



Later in the apprenticeship, we will recommend steps to reduce this waste water along with all the other emissions we are measuring.

*Students probably have heard many reasons why they should recycle. The focus of this lesson is to help students understand how many kinds of waste contribute.*

*Further, the amount and types of waste that a school creates can be measured and shown visually using a chart*



▪Objective: Speak loudly and slowly enough for the audience to understand. Organize collected data into tables or charts that allow others to observe it directly.

### Activity 1: Collecting Data

20 Minutes

**EXPLAIN:** We will collect carbon data from school officials who know the details of the schools' emissions.

- Choose 3 students randomly, give them a set of cards (pg.6).
- Students mix around the room until one of the 3 students says "Pick a Card, any card."
- Then, the first person who finds a cardholder chooses a card. The second person who finds the group reads the category.
- Person 1 lists a measurement the class could take that would relate to this category.
- The third person summarizes what person 1 said, and praises them.
- Person 3 becomes the card holder. Repeat for several rounds.
- P SAY:** "For each of the categories, we will describe the data we used for our carbon footprint calculation , how we measured it, and what it means."
- 3 students to share out the ideas of what can be measured. Kinds of data include what you would measure, for example, miles traveled by school busses, kg of trash thrown away.
- Our WOW! Will be a webinar, which is an online slideshow with sound, in which we show how we calculated the footprint and share action steps for reducing our schools emissions.

▪**Share Out:** For the category card you pick, name one kind of data might be

### Activity 2: Climate Cause and Effect

20 Minutes

▪**Transition:** We will collect data on many of these and other measurements for our WOW!  
o**SAY:** "Climate is the general pattern of weather for an area or region."

- EXPLAIN:** the relationship of climate is complicated, but there are a few important things to know.
- At each table, there is a climate cause and effect card. With your table partners, read the card and summarize the cause and effect relationship.
- Cause and effect means that when one thing happens, it makes another thing happen because of the change.
- If you don't understand a word or idea on your card, ask me or the Team Leader what it means.
- This is very new information, and we want you to be able to teach it back cause and effect means for waste and waste water.
- Write a 1 sentence summary of the cause and effect relationship on the chart paper at your table.
- Use this format..
- When \_\_\_\_\_ it causes \_\_\_\_\_ to \_\_\_\_\_.
- For example, when Greenhouse gas gets trapped it causes global temperatures to rise.
- ASK 2 students to share out the cause and effect relationship they learned about from not their own card, but a summary they read from their classmate..
- Share Out:** Ask several groups to share out they questions they developed. As a whole class, discuss possible responses to the questions, or possible confusions– think together: can we make the wording clearer?
- Arrange for a school administrator or other expert to visit in order for students ask several follow up questions.
- Transition:** We have created what we have learned in our WOW!

### Missing Parts...



*Students may not have concrete ideas of action steps to recommend. Provide a few examples from "Action Planning Suggestions" (pg..), but don't give them the whole document.*

*Encourage students to think about what data collected about each area, and ways that those items could be reduced.*

### Additional Notes



*Students may struggle to understand how to know if a question is valid or not. In this case, we know that if different people have different answers some questions because they have different experiences and different points of view. We hope to ask questions that are testable or and objective we want to make sure it isn't because the question is unclear.*



Objective: Speak loudly and slowly enough for the audience to understand. Organize collected data into tables or charts that allow others to observe it directly.

### Activity 3: Waste Data Collection and Sharing 20 Minutes

- Students work in the same groups of 3-4 that you selected for Activity 2.
  - Students conduct 10 minute interview with administrator who has been prepped for questions about wastewater on campus.
  - Ask for a volunteer to teach back what they asked the administrator about for waste and waste water.
- EXPLAIN** and write on the board:
- You can show data you collected using graphs and tables. Which visual do you think would be clearest for each measurement that you too.
  - For each measure, students list possible visuals that could show this impact
  - You can also use visuals to summarize information. If we wanted to show the proportion of different types of waste to what the school recycles, what kind of visual would be good (pie chart)
  - If we wanted to compare the amount of waste water created at our school to another school, what visual would be good? (Provide waste water comparison data, a bar graph would be good).
  - Graphs and tables help someone else quickly understand the data collected and what it means.
  - Using the visual you created, show a partner what you graphed and tell them why it is important. When you explain, be sure to you a loud, slow voice and clearly explain
  - What you measured, What you graphed
  - What your graph shows and what it means for our carbon footprint
  - Students create one of these visuals by hand.**
  - Share Out:** gather the whole group and several students share.
  - Talk to a partner:** What would you say to the audience so they know that your data on this question is **objective**?

Visit with groups to be sure they understand what objective data is.

**Transition:** We will share this information as the introduction and closing for our WOW! and it will help you choose the most important action steps to include in your recommendations.

- Exit Ticket:**
- Key Questions:**
- Give 1 example a measurement that is used to calculate carbon footprint.
  - Describe the graph you created and what it showed.
    - If students finish early they can list other measurements they think should be included in our carbon footprint calculation.
- Demonstration of Mastery:** Visit pair and listen for student's description of one reasonable measure of carbon footprint and an accurate description of the graph they created and a loud, slow voice for presenting.

**Transition:** The data you collected today and the type of graphs you created will be used in our WOW! presentation show how we calculated

### Field Tips



*Support students in making graphs that are accurate by helping them plan and draw the graphs with appropriate scales and guiding to create an effective image.*

*Develop a system with your Team Leader to incorporate some or all of the data collection follow up questions that students develop into the WOW! webinar.*

### Future Plans



*Continue to help students understand the logistics of the presentation, webinar recording of slides and audio and how students will interact with the audience at the WOW!*

*You could include as slides as part of the PowerPoint. Or create a visual as an introduction slide with some of students questions included as text.*



# Apprenticeship

## CARBON FOOTPRINT LESSON #2 Warm Up

Six Climate Threats, and the 12 Countries Most at Risk

Low Income		Middle Income		
Drought	Flood	Storm	Coastal 1m	Agriculture
Malawi	Bangladesh	Philippines	All low-lying Island states	Sudan
Ethiopia	China	Bangladesh	Vietnam	Senegal
Zimbabwe	India	Madagascar	Egypt	Zimbabwe
India	Cambodia	Vietnam	Tunisia	Mali
Mozambique	Mozambique	Moldova	Indonesia	Zambia
Niger	Laos	Mongolia	Mauritania	Morocco
Mauritania	Pakistan	Haiti	China	Niger
Eritrea	Sri Lanka	Samoa	Mexico	India
Sudan	Thailand	Tonga	Myanmar	Malawi
Chad	Vietnam	China	Bangladesh	Algeria
Kenya	Benin	Honduras	Senegal	Ethiopia
Iran	Rwanda	Fiji	Libya	Pakistan

Source: World Bank



# Apprenticeship

## CARBON FOOTPRINT LESSON #2

### Waste and Waste Water Comparison Data



▪NEED TO FINISH THIS HANDOUT

▪verdale Middle School students collected the following data on the waste that their school created in one year:

<b>Volume</b>	<b>Number of Times Dumpster is Emptied Each Year</b>
cubic meters	times
cubic meters	times
	Total:





When global temperatures rise, wealthy nations far from the equator (like the US) experience fewer effects AND also have more money to survive problems. They can buy more food, fix shelters after big storms, etc. Poorer nations are in more danger of the effects of climate change.

Climate change could make it too hot to grow certain crops, and droughts caused by climate change could reduce the amount of water available for irrigation. Climate change is also likely to cause stronger storms and more floods, which can damage crops. Higher temperatures and changing rainfall patterns could help some kinds of weeds and pests to spread to new areas. If the global temperature rises an additional 3.6°F, U.S. corn production is expected to decrease by 10 to 30 percent.

When the temperature of ocean water rises, some corals cannot survive because the ocean becomes too acidic. Corals are important habitat for many fish and other organisms. When the corals die these fish no longer have habitat, or homes.

Many parts of the world already have very little water, and climate change could make this problem worse. Rising temperatures, changing precipitation patterns, and increasing droughts will affect the amount of water in lakes, rivers, and streams, as well as the amount of water that seeps into the ground to replenish groundwater.

When trees grow, they absorb carbon from the environment to make their trunks, branches and roots. Millions of pounds of carbon is stored in forests around the world. When trees absorb carbon from the air, it does not contribute to global climate change.



As the Earth gets warmer and droughts increase, wildfires are expected to occur more often and be more destructive. Wildfires do occur naturally, but the extremely dry conditions resulting from droughts allow fires to start more easily, spread faster, and burn longer. In fact, if the Earth gets just 3.6°F warmer, we can expect wildfires in the western United States to burn four times more land than they do now. Fires don't just change the landscape;

they also threaten people's homes and lives. As the Earth gets warmer, plants and animals that need to live in

cold places, like on mountaintops or in the Arctic, might not have a suitable place to live. If the Earth keeps getting warmer, up to one-fourth of all the plants and animals on Earth could become extinct within 100 years. Every plant and animal plays a role in the ecosystem (for example, as a source of food, a predator, a pollinator, a source of shelter), so losing one species can affect many others.

As climate change causes precipitation (rain and snow) patterns to shift, some areas that currently have plenty of water to make hydropower might not have enough water in the future. Without enough water to produce electricity, these areas could experience power. They might have to use other energy sources to make more of the electricity they need, and if these sources are fossil fuels like coal, oil, or natural gas, more greenhouse gases will be added to the atmosphere.



Higher  
Temperatures

More  
Droughts

Wildier  
Weather

Changing  
Rain and  
Snow Patterns

Less  
Snowpack

Melting  
Glaciers

Shrinking  
Sea Ice

Thawing  
Permafrost

Increased Ocean  
Acidity

Warmer  
Oceans

Rising Sea  
Level



Stationary Sources



Purchased Electricity and Steam



Mobile Sources



Wastewater



Waste Sent to Landfill



Land Management



Refrigerants and Air Conditioners



# Climate Check Waste Water

Group Members: \_\_\_\_\_

The amount of wastewater treated from our school is: \_\_\_\_\_ gallons.

Does the wastewater treatment plant practice methane flaring ?

Yes

No

### Refrigeration and Air Conditioning (REF\_AC):

The type and amount of refrigeration and air conditioning units using HFC-134a and R-410 at our school is: (Please do not fill in shaded boxes).

Appliance	Number of Units using HFC-134a	Charge Size (kg)	Number of Units using R-410	Charge Size (kg)
Refrigerated Appliances				
Air Conditioning				
Window Units				
Small Commercial Unitary				
Large Commercial Unitary				
Packaged Terminal A/C				

Type of Vehicle	Number of Vehicles	Vehicle Use (%)
Cars		%
Trucks and SUVs		%
Buses in District		%

The type of vehicle and % use of the following vehicles per year at our school:





# Climate Check

## Waste

**Group Members:** \_\_\_\_\_

---

Does the landfill practice methane flaring?

Yes

No

**Fill out one of the three below**

1. The total amount of waste our school sent to landfill during the inventory year was: \_\_\_\_\_ Kilograms.

**Or...**

2. The volume of each dumpster and number of times our school sent waste to the landfill during the inventory year.

<b>Volume</b>	<b>Number of Times Dumpster is Emptied Each Year</b>
cubic meters	times
cubic meters	times

**Or...**

3. The average individual's annual waste disposal and the percent disposed at our school is:

\_\_\_\_\_ kg/year



# Energy Star!

Students collect data on appliances and land management for the carbon footprint and see the results of the carbon calculator when we add the new data to the spreadsheet. Students see a graph that shows the source of most of the carbon emissions for their school.

## Lesson Objective

- Give examples of ways choices can impact other communities, countries, or resources
- Evaluate the impact of a decision on a global world or global resources
- Develop and utilize survey questions to collect valid data

## Lesson Agenda

10 MIN	<b>Hook:</b> Climate Conference
10 MIN	<b>Introduction of New Material:</b> Emissions
5 MIN	<b>Activity 1 (we do):</b> Local Choices, Global Impact
35 MIN	<b>Activity 2 (we do/you do):</b> Energy Stars
20 MIN	<b>Activity 3 (you do):</b> Carbon Connects
10 MIN	<b>Assessment:</b> Action Steps

## Lesson Preparation

- **Space:** For activity 2, the whole group will go outside around the property with the Team Leader and Citizen Teacher to identify and count trees on campus
- **Group:** Students will work in partners of their choice for the Hook and Check for Understanding. Activities 1, 2 and 3 are with the same groups of 3-4 that you chose for Lesson 2.
- **Resources:** For the Hook, make several copies of each AC spec sheet. Ahead of time, count and ID trees on property- this will take serious planning with the team Leader to plan the trip and logistics. Prepare 2 school administrators to visit and answer questions. Students will not measure the appliances, only ask the administrator. Test out the projector and computer with the excel file of the Carbon Check to make sure students will be able to

## Standards for Unit

### Global Awareness:

*Citizen Schools students will evaluate the impact of the choices on a global world*

### Data Analysis:

*Citizen Schools students will demonstrate and ability to collect and organize data*  
Apprentices are practicing important skills for translating specific examples into generalizations. In many college and career pathways, students and professionals must use examples (or cases) as indicators to explore patterns and trends in larger data sets. Students measure the most important contributors to carbon emissions in order to make generalizations about the schools' carbon emissions.

### Materials

1. Visual of Objectives/Agenda
2. Handouts: Stationary and Land Management
3. Chart Paper
4. Handout: Menu of choices
5. Markers
6. Specs for A/Cs (1 sheet per pair)
7. School administrator guest.
8. Computer and projector to show the spreadsheet



## Apprenticeship

### CARBON FOOTPRINT LESSON #3– page #2

# CITIZEN SCHOOLS

▪Objective: Give examples of ways choices can impact other communities, countries, or resources. Evaluate the impact of a decision on a global world or global resources. Develop and utilize survey questions to collect valid data.

## Hook: Climate Conference

10 Minutes

▪**Warm Up: Did You Know?** If every room air conditioner sold had earned the ENERGY STAR (was an efficient air conditioner), it would prevent 900 million pounds of greenhouse gas emissions annually, equivalent to the emissions from 80,000 cars.

e**SAY:** "an energy star rating means that air conditioners must be least 10% more energy efficient than the minimum federal government standards."

-High-efficiency compressors

-High-efficiency fan motors

Hand out one air conditioner specs page per group of 3

Look for these things on the list of characteristics of air conditioners in front of you, and then with your partner, look at the details to decide if the air conditioner you have is energy star rated, meaning it is efficient.

### Read "How Air Conditioners Work"

▪Show which ones were energy star rated and why: the 3 window units are energy certified, but the portable ones are not.

▪**Transition** Air conditioning systems are one of the stationary items (or appliances) that we will collect carbon emission data on today.

## Introduction of New Materials: Emissions 10 Minutes

▪**Objectives / Agenda: Ask** for a volunteer to read the objective. Ask for a volunteer to read the agenda. Any questions about the objectives or agenda for today?

▪**Preview assessment:** We will know we have mastered today's objectives if you can teach back one choice that has an impact on communities or resources.

### ▪Direct Teach:

▪Today we will use survey questions to measure emissions from:

1. Stationary appliances and other items that stay still in the building.
2. Land management emissions on our campus.

Usually, with a survey, you would ask the questions to many people. We will interview just one administrator to collect our data.

▪List the appliances we will measure: Boiler, Heater, Generator, Coal, Natural Gas, Propane, Gasoline, Diesel, Fuel Oil, Kerosene, Fuel Units, Synthetic fertilizer, Organic fertilizer, Manure.

▪These are all parts of buildings that can be more or less efficient. Schools make decisions about which ones they buy and use. If they choose to use appliances with less emissions, they reduce emissions that impact global warming.

▪Energy Star products are energy efficient products which, that might cost more to purchase at first, will pay you back in lower energy bills within a reasonable amount of time.

▪They use energy more efficiently. You can find this label on computer products and home and kitchen appliances, even buildings!

▪**Connections:** We collect data to calculate the Carbon Footprint of our school. And then at the end of the day today, we will enter our data into the calculator and find the source of most of our emissions.

## Student Says...



*Students may have heard about efficiency of appliances and choices about what kind of appliances to use. However, most of these decisions are out of student's control, so they may not have experience.*

*It is likely that students have heard about unplugging things when they are not in use.*

## Closer Look!



*See the definitions on page 5 with details about the definitions of each.*

*As you walk students through each one, describe briefly why this would be important to count when calculating the carbon footprint of the school.*



## Apprenticeship

### CARBON FOOTPRINT LESSON #3 – page #3

# CITIZEN SCHOOLS

Objective: Give examples of ways choices can impact other communities, countries, or resources. Evaluate the impact of a decision on a global world or global resources. Develop and utilize survey questions to collect valid data.

#### Activity 1: Local Choices, Global Impact

5 Minutes

- Each student is assigned one local choice from the Menu of Choices handout.
- Local choices are decisions that individuals or groups (like schools) make about what and how much of something to buy and use or not to buy and use.
- Students tell a partner one global impact that this choice could influence and how.
- SAY:** The global resources you can choose from are: soil, water, disease, access to land, habitat for animals (write on the board)
- The responses can be specific or general, but students must describe how they are connected.
- Then, students switch choices with their partner and think of another global impact.
- Students Share Out:** For the local choice that you had, what evidence do you have that our data is valid?

#### Activity 2: Energy Stars

35 Minutes

- SAY:** The connections you made here are important for the action we have taken in the WOW!
- SAY:** We have collected data on several measures of carbon emissions. We will finish the last two now and then enter all the data in for Activity 3."
- Have** a student (or 2) to teach back the emissions we measured have measured so far to the whole group (Electricity, Mobile, Waste, Wastewater).
- Outline safety procedures including: staying with the group within defined boundaries, avoiding dangerous areas. Work with your Team leader to outline other behavioral expectations for students.
- ASK** what appliances do we have at school that use energy and produce carbon.
- What do students think falls into the category of Land Management (Grass, fertilizer, trees, others?)
- EXPLAIN** the data we will collect by previewing handouts for students.
- Describe how to count trees and the approximate ages of trees.
- Facility manager can supply information about fertilizer and its contents.**
- Students interview 1 administrator about the Appliances and 1 about the Land Management.
- First the whole class will collect data on the appliances at the school
- Then the whole class will collect the land management data (see handouts (25 minutes).
- Some of the places where we would directly measure appliances are dangerous, that is why we will ask the administrator using the questions on page 15 instead of measuring ourselves. These questions are a form of

#### Missing Parts...



Menu of choices:

- Amount of gas used in cars
- Space Heating – how warm to keep the school
- Water Heating – what temperature the water should be in the restrooms
- How often to cook
- Lighting – choice of light bulbs
- Space Cooling- how high to turn up the AC
- Ventilation – when to have fans on
- Refrigeration – how many our cafeteria needs
- Office Equipment – if we turn computers on sleep mode

#### Additional Notes



*Help students interpret the Stationary and Land Management data they measured. When it is entered in the spreadsheet, spend time discussing the comparison that the program makes to gallons of gasoline.*

*Based on the data collected, students may have some initial ideas about ways to reduce these emissions.*



Objective: Give examples of ways choices can impact other communities, countries, or resources. Evaluate the impact of a decision on a global world or global resources. Develop and utilize survey questions to collect valid data.

### Activity 3 Carbon Connects

20 Minutes

- Ahead of time, have the Carbon CHECK excel file open and ready to have new data entered.
- Team Leader or Citizen Teacher enters the data students collected. At various times, ask students to explain what they found out from the administrator they interviewed.
- Narrate the calculations the worksheets completes.
- **ASK** students to talk to a partner about one new vocabulary word and what it means.
- Have a student read out the comparisons at the end of the data sheet (compares the carbon used to gallons of gasoline etc)
- **ASK** for students reactions: Which of the comparisons or measurements are they most surprised about?
- Ask students to read and interpret the sidebars as you enter the data. Steam purchased by your school comes from a steam plant that produces the steam by burning fossil fuels. The steam plant providing your school with steam may choose to report the amount of steam you consume in several different ways, by weight (pounds), volume (cubic feet), or energy (Btu). To simplify the emission estimates, Climate CHECK requests the data in any one of these units and converts the consumption to energy.
- Out loud, students list several of the measurements students want to be sure to include in the webinar because they are interesting or surprising.

**Transition:** I am saving these results, because in Lesson 5 we will plan some ways to use them to convince people to take action at our WOW! And this thinking will help you choose the most important action steps to include in your recommendations.

- **Key Questions:**
  1. Give 1 example of choice that a school can make about appliances or land management
  2. Describe how that choice will impact:
    - Communities or
    - Resources
  3. List one survey question we asked an administrator today to gather data.

▪ **Demonstration of Mastery:** Look for a reasonable choice about an appliance or land management and an accurate description of how that choice would impact another community or resource.

▪ **Transition:** You collected hard work produced a large amount of helpful information today that will improve your action plan. We can include these questions in our WOW! presentation show how effective our action steps can be for reducing carbon emissions and impacting

### Field Tips



*Help students focus on the data collection sheets and the excel file as it updates by asking questions about their interviews to collect the data as you go along.*

### Future Plans



*Continue to help students understand the logistics of the presentation, webinar recording of slides and audio and how students will interact with the audience at the WOW!*

*ASK student which data from today they want to make sure is highlighted in the webinar.*

10 Minutes

### Action Steps Exit Ticket:



## Important Technical Terms for Carbon Emissions Data Collection

**Boiler:** heats water to be used for power

**Heater:** provides heat to warm the building

**Generator:** provides back up electricity to the building

**Coal:** Coal, a fossil fuel, is the largest source of energy for the generation of electricity worldwide, as well as one of the largest worldwide anthropogenic sources of carbon dioxide releases

**Natural Gas:** Natural gas is a major source of electricity generation through the use of gas turbines and steam turbines. Most grid peaking power plants and some off-grid engine-generators use natural gas.

**Propane:** A by-product of natural gas processing and petroleum refining, it is commonly used as a fuel for engines, oxy-gas torches, barbecues, portable stoves and residential central heating.

**Gasoline:** rived from petroleum that is primarily used as a fuel in cars, etc.

**Diesel:** any liquid fuel used in diesel engines, comes from petroleum or other sources,

**Fuel Oil :** fuel oil is any liquid petroleum product that is burned in a furnace or boiler for the generation of heat or used in an engine for the generation of power

**Kerosene:** common heating fuel.

**Fuel Mix :** describes sources from which the electricity was generated

**Nitrogen Content:** the proportion of fertilizer that provides nitrogen.

**Synthetic fertilizer:** man –made produce added to a soil to supply one or more plant nutrients essential to the growth of plants

**Organic fertilizer:** material that naturally occurs that is added to a soil to supply one or more plant nutrients essential to the growth of plants

**Manure:** animal waste used to provide nutrients for plant growth.



- Amount of gas used in cars- uses fossil fuels
- Space Heating – how warm to keep the school, uses electricity or coal
- Water Heating – what temperature the water should be in the restrooms, uses electricity
- How often to cook, uses electricity or fossil fuels
- Lighting – choice of light bulbs, uses electricity
- Space Cooling- how high to turn up the AC, creates wastewater, uses electricity
- Ventilation – when to have fans on, uses electricity
- Refrigeration – how many our cafeteria needs, uses electricity
- Office Equipment – if we turn computers on sleep mode, uses electricity



**Product Details:**

Delonghi PAC-A120E is one of the only portable air conditioners on the market that utilizes the more eco-friendly refrigerant gas, R410A. This portable AC model is ideal for anybody that is environmentally conscious.



**Features and Specifications:**

12,000 BTU

R410A eco-friendly refrigerant gas

Energy Efficient adjustable thermostat

24 hour timer

Electronic controls with LCD display

Remote Control

Easy-to-use control panel

Window bracket

4 fan speeds

Additional modes: Sleep-smart

Side-carry handles and castors

Dimensions (W x D x H): 18.23" x 15.08" x 30.43"

Weight: 73 lbs





## Sunpentown WA-1230E Portable Air Conditioner

\$399.00

### Product Details:

The Sunpentown WA-1230E portable air conditioner with electronic & remote control has 950W and 12,000 BTU's and is designed to fit in most average-size rooms up to 350 sq.ft. This model also functions as a 65 pint dehumidifier.

### Features and Specifications:

12,000 btu cooling power

Self evaporating system

Digital temperature display

2 fan speeds

LCDI (Leakage-Current Detection and Interruption) plug

Fire resistant PVC plastic housing

Removes moisture for personal comfort (dehumidifier functions automatically in AC mode)

Activated carbon filter helps remove odor

Extendable exhaust hose (up to 5ft.)

Remote control

Built-in water tank or extended water tube for continuous drainage

Power Consumption: 950W/9A

Air Volume: 520m<sup>3</sup>/hr

Moisture Removal: 65 pints per day

Thermostat: 62F ~ 90F

Water Tank Capacity: 3.2 pints

Controls: Electronic with Remote

Power Supply: 120V / 60Hz / 1 Phase

Timer: 1 ~ 12 hours

Fan Speed: 2

Compressor: Rotary

Refrigerant: R22





## Sunpentown WA-1211S-12,000 BTU-Window AC

### Product Features

3 fan speeds.

Modes: Dry, Auto, Energy Saver, Sleep. Top air discharge

Fresh Air Vent for air circulation and odor removal. Thermostat controlled energy saver

Electronic controls with digital display.

Easy out and washable air filter

Auto Restart feature.

Up to 24 hours timer setting.

Flexible window mount

Window installation kit included.





### Continental 10,000 BTU Window Air Conditioner CE11105

Price: **\$239.99**



For use with rooms up to 400 square feet.  
Conditions vary according to direct sunlight  
10,000 BTU cooling capacity  
Energy-saver mode  
Built-in timer with sleep mode  
Removable filter



### **SG-WAC-12ESE-F - Soleus 12,000 BTU Cool Only Window AC**

#### **Specifications:**

Model: SG-WAC-12ESE-F

Brand: Soleus

Dehumidifies 81.6 pints/day

Remote control included

Digital thermostat

Uses R-410A refrigerant

Energy saving mode

24 hour timer

10.8 EER

Warranty: 1 year limited

Four (4) fan speed options

4-way directional louvers

Loss of power protection

Automatic restart

Washable, reusable air filter

Air flow: 290/270/250 CFM

Input voltage: 115 V/60 Hz

Power: 10.3 A/1,110 W

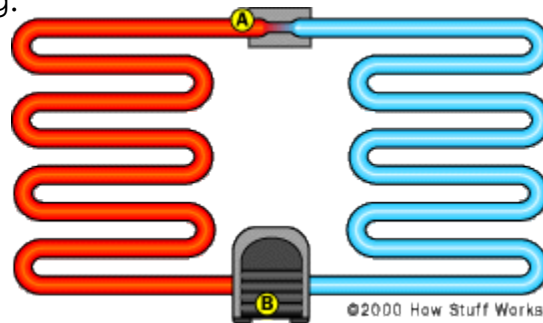
Weight: 68 lbs

Dimensions: 14.625" H x 19" W x 22.5" D



### How Air Conditioners Work

3. The compressor compresses cool Freon gas, causing it to become hot, high-pressure Freon gas (red in the diagram).
4. This hot gas runs through a set of coils so it can dissipate its heat, and it condenses into a liquid.
5. The Freon liquid runs through a valve, and in the process it evaporates to become cold, low-pressure Freon gas (light blue in the diagram above).
6. This cold gas runs through a set of coils that allow the gas to absorb heat and cool down the air inside the building.





# Climate Check

## Land Management

Group Members: \_\_\_\_\_

\_\_\_\_\_

### Fertilizer:

the type and amount of fertilizer applied in one year and the nitrogen content of these fertilizers is:

Kind of fertilizer	Amount applied	Synthetic nitrogen content
Synthetic	kg	%
Organic	kg	
Manure	kg	

### Non-road:

The type and amount of fuel consumed by non-road equipment (i.e., backhoes, lawnmowers, tractors, leaf blowers, and chain saws).

Gasoline \_\_\_\_\_ gallons

Diesel \_\_\_\_\_ gallons



# Climate Check

## Land Management (continued)

Group Members: \_\_\_\_\_

---

### Forestry

The type, age, and amount of trees located on school property.

Tree Type	Age of trees	Number of trees
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		



# Climate Check

**Stationary (Appliances)** *Pay close attention to units*

**Group Members:** \_\_\_\_\_

Device Name	Device Type	Type of fuel	Units	Quantity of Fuel

Possible
Boiler
Heater
Generator
Other

Fuel Types	Units
Coal	Metric Tons
Natural Gas	cubic feet
Propane	Liters
Gasoline	Liters
Diesel	Fuel Liters
Fuel Oil	Liters
Kerosene	Liters





# Climate Check

## Stationary (Appliances, continued)

Group Members: \_\_\_\_\_  
\_\_\_\_\_

The type and percent fuel mix used to produce this steam is:

### Fuel Mix (%)

- \_\_\_\_\_ Coal
- \_\_\_\_\_ Natural Gas
- \_\_\_\_\_ Propane
- \_\_\_\_\_ Gasoline
- \_\_\_\_\_ Diesel Fuel
- \_\_\_\_\_ Fuel Oil
- \_\_\_\_\_ Kerosene



# Visiting Carbon Heroes

Apprentices visit a sustainability business or program (restaurant, office space, builder, etc) that has reduced carbon emissions. Students ask questions and share their school action plan ideas with the staff member for feedback on site using eye contact and a clear, loud voice.

## Lesson Objective

- Speak clearly enough for the audience to understand
- Present information using eye contact when speaking in public
- Estimate the impact of actions or choices on global resources or societies

## Lesson Agenda

20 MIN	<b>Hook:</b> Climate Conference
5 MIN	<b>Introduction of New Material:</b> Estimating Impact
15 MIN	<b>Activity 1 (we do):</b> Carbon Quest
10 MIN	<b>Activity 2 (we do/you do):</b> Carbon Footprint of Site
10 MIN	<b>Activity 3 (you do):</b> Steps for Feedback
20 MIN	<b>Assessment:</b> Action Steps

## Lesson Preparation

- **Space:** To plan for this off-site trip, make sure to think about travel to and from the business, and what students are expected to do during the down time. When at the site, make sure everyone knows where rest rooms are etc. Make students and Team Leader aware of any places that are off limits in the space (set boundaries when you move from space to space). If possible, visit the space ahead of time to check.
- **Group:** Students will work in pairs of their choice for the Hook and independently for Check for Understanding. Activities 1, 2 are whole class and for Activity 3, split the class randomly by where they are standing or count off to mix up students.
- **Resources:** For the Hook, review and add to resources sheet. Make copies (1 resource for each student). Arrange ahead of time for a school

## Standards for Unit

### Global Awareness:

*Citizen Schools students will evaluate the impact of the choices on a global world*

### Communication:

*Citizen Schools students will make an effective oral*

### Connections

*Students test their questions and create new follow up questions, which is important for any task or project in college and careers that involves collecting data. The most interesting findings happen when you look closely at the initial information and build upon what it tells you using analysis and new, valid questions.*

## Materials

1. Visual of Objectives/Agenda (small for travel)
2. Note sheet for student questions and ideas
3. First aid and permissions for off site visit
4. Student copies of Handouts on page 5
5. Pencil for each student.



▪Objective: Speak clearly enough for the audience to understand. Present information using eye contact when speaking in public. Estimate the impact of actions or choices on global resources or societies.

### Hook: Climate Conference

20 Minutes

- Warm Up and Traveling Activity:** Carbon Footprint Commercials
- Make great use of your time driving or walking to prepare for the visit.
- MSAY:**
  - In pairs, one student names a product (doesn't need to be related to the topic of climate change or carbon footprint) and the other student describes a commercial for that product. The product can be real or pretend.
  - Use ideas related to today's field trip and carbon emissions.
  - Or, pretend you are doing a radio commercial for the business or product.
  - You can come up with a slogan, jingle, etc. You can even play the bloopers at the actual taping of the commercial.
  - Have a few fun ideas to inspire students who can't think of a product or idea. (emissions alarm, carbon sequestration gun, tree planting robot, etc)
  - If students finish early, they should brainstorm questions about reducing carbon emissions for the host in their notebook.

▪**Transition** We will arrive at the site soon. Preview who the students will meet with and what this person does professionally.

### Introduction of New Materials:

5 Minutes

### Estimating Impact

- Objectives / Agenda:** Ask for a volunteer to read the objective. Ask for a volunteer to read the agenda. Any questions about the objectives or agenda for today?
- Preview assessment:** I will know you have mastered today's objectives if you can teach back an estimate of how this business has reduced their emissions. I will ask you to provide feedback to the business owner in Activity3 using good eye contact and a loud voice.
- Direct Teach at the beginning of the site visit:**  
Estimated carbon emissions: a calculation of how much carbon dioxide you are releasing into the environment (based on measurements for several categories).  
Just like we measured categories like stationary, wastewater, and land management; businesses can calculate their footprint by estimating the carbon they release from travel, machines, etc (add details relevant to the type of business you are visiting).
- Describe** specific ways that this business has measured and reduced their carbon emissions (this will prepare students to ask great questions.
- Connections:** The categories we used to calculate the Carbon Footprint for our school are very similar to other businesses.
- Transition:** We will visit the site, hear about what action steps they have taken to reduce emissions, and think together about whether they might

### Student Says...



*Students may not realize why the site visit is important to the apprenticeship. This is not a wasted day- important thinking and practicing skills will happen today. Emphasize that this is a chance to see what happens when businesses take action steps based on their carbon footprint?*

### Closer Look!



*Be specific and encourage the host to be very specific about the changes in behaviors and systems that the business made to reduce carbon. It may be difficult to estimate the impact, but quantifying the change is important for showing growth.*

*Students might often hear of "green businesses," but the goal is to understand how carbon reduction happened.*



▪Objective: Speak clearly enough for the audience to understand. Present information using eye contact when speaking in public. Estimate the impact of actions or choices on global resources or societies.

### Activity 1: Carbon Quest

15 Minutes

- This is the main visit to the business, including touring any facilities relevant to carbon reduction.
  - For example, if the business initiated a program in their kitchen to reduce emissions, a visit to the kitchen might be included.
  - Help the host focus on specifically describing the changes made and how they impacted carbon emissions.
  - The host should tell the apprentices the important information about your business and how you have worked to reduce emissions (use items included in sample letter on page 6 for guidance.)
- This is also a great time for the host to mention his or her own college and career pathways and the skills and education required for careers related to this business.
- Transition:** Now that you have learned about the things that this business has done to reduce impact, I want to make sure we leave today understanding the results of these actions/choices on global resources.

### Missing Parts...



*Students may not have concrete ideas of action steps to recommend. Provide a few examples from "Action Planning Suggestions" (pg..\_), but don't give them the whole document.*

*Encourage students to think about what data collected about each area, and ways that those items could be reduced.*

### Activity 2: Carbon Footprint of Site

10 Minutes

- Students ask questions and take notes (they will get added to notebooks later) to make sure that they have each described 3 ways that the business has taken action to reduce carbon emissions.
- SAY:** "By the end of the day , you must be able to say not just the change the business made, but the estimated impact of that change. Ask questions now to make sure that you can do this effectively."
- Then, the host provides a problem or question (with your assistance) for the students to consider for their feedback.
- For example, if the host has noted that one area in which they have not reduced carbon emissions is in the waste category, he or she may request ideas for reducing waste in the offices. Providing this guidance will allow students to narrow in on their suggestions and make this task manageable for them.
- Students develop suggestions (on their worksheet) that address this specific concern.

**EXPLAIN:** the best action steps are ones that target areas that need improvement. Your ideas will be most helpful in this category, because the staff knows that this is an area that they want to improve upon.

**Transition:** Now that you have looked closely at the reasons why these changes have impacted carbon emissions, we will provide the hosts with our own ideas about how they could continue to take action on this

### Additional Notes



*Making behavioral expectations clear will help make this trip a success. Tell students that you expect respect and teamwork as you would on campus, even though you are off site.*

*Work with your Team Leader to find the best way to make these expectations and any safety concerns clear to students as you prepare for the visit.*



Objective: Speak clearly enough for the audience to understand. Present information using eye contact when speaking in public. Estimate the impact of actions or choices on global resources or societies.

**Activity 3: Share Action Steps for Feedback**

**10 Minutes**

**Field Tips**



- On their worksheet, students reflect on the question: What is one NEW idea you have to reduce emissions here?
- Students prepare to share their idea with the host or other staff member.
- S SAY:** "Share your idea with our host. Remember to speak clearly enough for everyone in the group to understand. When you share your idea, use great eye contact."
- Split the group in half, and each student shares out their suggestion to the host and/or a volunteer.
- The host provides feedback on the suggestions (instead of responding to every student, he or she should hear 2 students share and they respond with ideas about:
  - How specific the suggestion is
  - how much the action would inspire staff
  - The kind of impact they think this action step would have
  - To what extent this action step would be feasible at this business

**Transition:** You have provided great ideas about reducing carbon footprint and today you have seen how much change can happen when a business focuses on action steps to reduce their emissions.

*The most important idea to share in the WOW! Is that the steps we recommend will have a global impact.*

*Use concrete examples of this impact whenever possible and encourage students to be specific in the action steps they recommend to the business so they can get good feedback from the business host on what the global impact will be, and if this action step is feasible.*

**✓ Assessment and Return Travel**

**20 Minutes**

**Action Steps**

Students conversation is the assessment for today.

**Key Questions:**

- Give one estimate of the impact of one change that this business made to reduce carbon emissions.

**Demonstration of Mastery:** Look for student's own wording in the question, and a clear statement in a valid construction.

**Transition:** Your hard work produced a large amount of helpful information today that will improve your action plan. We can include these questions in our WOW! presentation show how effective our action steps can be for reducing carbon emissions and impacting global climate change

**Future Plans**



*Continue to help students understand the logistics of the presentation, webinar recording of slides and audio and how students will interact with the audience at the WOW!*

*Develop a system with your Team Leader to incorporate some or all of the data collection follow up questions that students develop into the WOW! webinar.*

*You could include as slides as part of the PowerPoint. Or create a visual as an introduction slide with some*



**Name of Business** \_\_\_\_\_

**Name of Host** \_\_\_\_\_

**List 3 things this business has done to improve its carbon emissions:**

**1.**

---

---

**2.**

---

---

**3.**

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**What is one NEW idea you have to reduce emissions here?**



## Apprenticeship

### CARBON FOOTPRINT LESSON #4 - Carbon Hero

#### Sample Letter to Volunteer Business



Dear \_\_\_\_\_,

Thank you for offering to host our apprentices!

Please be sure to tell the apprentices the important information about your business and how you have worked to reduce emissions, including:

- Your name
- The name of Business
- Size of your business (employees)
- Size of your buildings (square feet)
- How many cars in parking lot typically (or students can count them)
- How far people drive
- How many days of school are there
- % of cars vs. % of trucks/SUVs
- # of school owned Vehicles
- Special equipment
- Distance traveled
- Days per year which they travel
- How many dumpsters
- How many times per year the dumpster is emptied
- How you heat/cool your business
- Land management (forestry, etc)
- Describe in detail what you have done to reduce emissions and how you know you have an impact.
- One area in which you would still like to improve upon your emissions.

Students will ask you questions

Then, students will work together to offer you their ideas on an area in which you would like to like to improve based on what they have learned so far!

You can help apprentices learn by providing feedback on their ideas. Respond by telling them:

- How specific the suggestion is
- How much the action would inspire your staff
- The kind of impact you think this action step would have
- To what extent this action step would be feasible at this business.

Note: Include logistics about the visit (time, how long, how you will get there, how many students, how many volunteers, etc)

Sincerely,



# Valid Carbon Questions

Students collect information from school using valid, objective follow up questions that they develop collaboratively. These questions will help them plan the steps they will include in their recommended action plan for the webinar.

## Lesson Objective

- Describe the ways resources are connected in a global world
- Explain the role of objectivity, bias, and samples in collecting data
- Give examples of valid and invalid questions or tests for collecting data

## Lesson Agenda

10 MIN	Hook: Climate Conference
10 MIN	Introduction of New Material: Carbon Footprint
20 MIN	Activity 1 (we do): Valid Carbon Data
20 MIN	Activity 2 (we do/you do): Valid Questions
20 MIN	Activity 3 (you do): Carbon Connects
10 MIN	Check for Understanding: Action Steps

## Lesson Preparation

- **Space:** Offer quiet spaces for small groups to work together for practicing the question and answer session.
- **Group:** Students will work in partners of their choice for the Hook and Check for Understanding. Activities 1, 2 and 3 are with the same groups of 3 that you choose.
- **Resources:** For the Hook, review and add to resources sheet. Make copies (1 resource for each student). Arrange ahead of time for a school administrator to visit for questions for about 15 minutes.

## Standards for Unit

**Global Awareness:** Citizen Schools students will evaluate the impact of the choices on a global world

**Data Analysis:** Citizen Schools students will demonstrate and ability to collect and organize data  
Using one round of data collection to create new follow up questions is important for any task or project in college and careers that involves collecting data. The most interesting findings happen when you look closely at the initial information and build upon what it is tells you using analysis and new, valid questions.

## Materials

1. Visual of Objectives/Agenda
2. Questions from Climate CHECK handout (1 per student, collected from previous class)
3. Chart Paper
5. Markers
6. Global Climate Change Clippings/Articles/Images (for early finishers)
7. School administrator guest.





## Apprenticeship

### CARBON FOOTPRINT LESSON #5– page #2

# CITIZEN SCHOOLS

▪Objective: Describe the ways resources are connected in a global world. Explain the role of objectivity, bias, and samples in collecting data. Give examples of valid and invalid questions or tests for collecting data

## Hook: Climate Conference

10 Minutes

▪**Warm Up:** Ahead of time place 1 hand out of resources from page 6 on each desk.

6 **SAY:** "On your desk, there is an example of a resource affected by global climate change"

- Look closely at the resource described.
- Talk with a partner seated near you about:
  1. How is this resource affected by global climate change
  2. Name one other resource that this is connected to in a global world? (choose any, look at the list for hints)

**Ask** For a few students to share out how their resource is affected and one connection to another resource.

▪As students share their resources, write the names of the resources on the board and draw a line that shows relationships between the resources and how they depend on each other. Use specific connecting words to show the relationships. For example, freshwater is reduced when glacial ice melts.

▪**Transition** Now that we have reviewed the global resources involved in global climate change, we are ready to talk about collecting data on carbon emissions using questions will be specifically for our school and community audience.

## Introduction of New Materials: Carbon Footprint 10 Minutes

▪**Objectives / Agenda:** **Ask** for a volunteer to read the objectives and agenda. Any questions about the objectives or agenda for today?

▪**Preview assessment:** We will know we have mastered today's objectives if you can teach back a valid carbon footprint question to ask school administrators about how likely they are to take one of the steps in your action plan.

▪**Direct Teach: Remember that our Carbon Footprint measures the impact of our carbon emissions.**

Objective data: observations that do not involve personal feelings and are based on observable facts.

**ASK:** Why would your audience want information about carbon emissions that is objective? (accuracy, trust)

We are going to develop valid follow up questions to find out what can be done at our school to help reduce global warming.

**ASK:** What are some other objective questions?

**ASK:** a volunteer to teach back the categories we will measure in the apprenticeship.

▪**Connections:** The categories we will use to develop follow up questions are the same ones we have used to calculate the Carbon Footprint. Now that we know what the footprint is, we are going to research what solutions might help reduce it.

## Student Says...



*Students may know that resources are connected, but may find it difficult to describe these connections. This makes sense because the connections can be complex and students do not have direct experience observing some of the resources.*

## Closer Look!



Valid questions are ones that have answers that are objective. For example, the number of trees on campus has a single answer. Another word for this is "unbiased," which means that the answer will be the same for anyone you ask.



Objective: Describe the ways resources are connected in a global world. Explain the role of objectivity, bias, and samples in collecting data. Give examples of valid and invalid questions or tests for collecting data

### Activity 1: Valid Carbon Data

20 Minutes

**EXPLAIN:** We collected carbon data from school officials who knew the details of the schools' emissions.

- In order to make great recommendations we have to be able to say why these measurements are valid.
- The best way to do this is to show that we were precise, and that we were objective in our data collection.
- For each of the categories, one group will describe why the data we used for our carbon footprint calculation was unbiased and objective.
- Use the ClimateCHECK file and handout to remind yourself of how we calculated each
- Give an example of an invalid data collection technique: " I wanted to find the amount of solid waste our school disposed of for the year, but I only had the measurement for one month, so I assumed that every month would be about that and estimated that number. That seemed to small, so I added to it so it sounded better."

**Share Out:** For the category you had, what evidence do you have that our data is valid?

### Activity 2: Valid Questions

20 Minutes

**Transition:** We will share this evidence that we were objective in our WOW!, so our audience will know that we took this task seriously and that our recommendations can be trusted. Students will brainstorm questions they could ask school and community officials.

**qSAY:** "We have collected data on several measures of carbon emissions. We can find out which of these might be possible to reduce."

**Have** a student (or 2) to teach back the emissions we measured to the whole group (Stationary, Electricity, Mobile, Waste, Wastewater, Land Management).

- For our analysis to be valid, we need to make sure that it is possible to reduce these emissions, and that the administrator we asked knows if they can possibly be reduced.
- For each of the areas that we measured, what questions could we ask about this emission to find out more about how it could be reduced?
- For example, we might ask: are there any bus routes that could be combined to reduce fuel emissions?
- A valid question:
  - has relevance and connected to the topic
  - only has only one interpretation
  - can be expected to have an answer that is realistic (is known or can be known with further research)
  - may have multiple answers but these should be testable

**Share Out:** Ask several groups to share out they questions they developed. As a whole class, discuss possible responses to the questions, or possible confusions– think together: can we make the wording clearer?

### Missing Parts...



*Students may not have concrete ideas of action steps to recommend. Provide a few examples from "Action Planning Suggestions" (pg..), but don't give them the whole document.*

*Encourage students to think about what data collected about each area, and ways that those items could be reduced.*

### Additional Notes



*Students may struggle to understand how to know if a question is valid or not. In this case, we know that if different people have different answers some questions because they have different experiences and different points of view. We hope to ask questions that are testable or and objective we want to make sure it isn't because the question is unclear.*

Arrange for a school administrator or other expert to visit in order for students ask several follow



Objective: Describe the ways resources are connected in a global world. Explain the role of objectivity, bias, and samples in collecting data. Give examples of valid and invalid questions or tests for collecting data

Activity 3 Carbon Connects

20 Minutes

Field Tips



- Students work in the same groups of 2-3 that you selected for Activity 2.
- Ask for a volunteer to teach back global impacts of climate change: resources, sea level rise, extreme weather.
- EXPLAIN** and write on the board: There are 3 causes of climate change:
  - Greenhouse Gases: Gases, in excess, which trap heat in Earth's atmosphere. This occurs when an ecosystem produces more gas than it can naturally get rid of.
  - Carbon Emissions: Carbon Dioxide (CO2) is the greenhouse gas most responsible for climate change.
  - Anthropogenic Carbon Emission: Carbon Dioxide emissions caused by humans and the industries and machines they have created.
- Students back at the questions they developed for Activity 2.
- For each question, decide if it would impact 1,2,or 3, or more than one. Why would it impact 1, 2, or 3.
- Team Leader and CT support groups as they decide which it would impact.
- ASK** what data would have the most impact to make the community act?
- Share Out:** gather the whole group and several students share.
- Talk to a partner:** What would you say to the audience so they know that your data on this question is **objective**?
- Visit with groups to be sure they have mastered what objective data is.
- Transition:** Several students will present some of this information as the introduction and closing for our WOW! And this thinking will help you choose the most important action steps to include in your recommendation.

Assessment

10 Minutes

Action Steps Exit Ticket:

Think about how your community will take action on the steps you recommended. How will you know if they take action when they leave the WOW?

Key Questions:

- Give 1 example of a valid question to ask in order to create the Action Plan
- Add a scale like this one to your question: Circle one  
Not likely      Somewhat likely      Very likely      I don't know
- If students finish early they can begin looking at media and brainstorming good language and imagery for the action steps for next class.
- Demonstration of Mastery:** Look for student's own wording in the question, and a clear statement in a valid construction.

Transition: Your hard work produced a large amount of helpful information today that will improve your action plan. We can include these questions in our WOW! presentation show how effective our

The most important idea to share in the WOW! Is that the steps we recommend will have a global impact.

Help students keep this local to global focus in mind by referring to all the resources they listed in Lesson 3.

Use concrete examples of this impact whenever possible and encourage students to be specific in their action steps so they can remember what the global impact will be during the WOW!.

Future Plans



Continue to help students understand the logistics of the presentation, webinar recording of slides and audio and how students will interact with the audience at the WOW!

Develop a system with your Team Leader to incorporate some or all of the data collection follow up questions that students develop into the WOW! webinar.

You could include as slides as part of the PowerPoint. Or create a visual as an introduction slide with some



**Soil:** can be washed away from farmland and result in fewer crops, can erode because of drought

**Coastal property:** can be eroded from flooding – destroying habitats, human homes and businesses.

**Glaciers and ice pack:** are not freezing as much in the winter less snow melt during the spring and summer.

**Corals:** oceans become more acidic, resulting in corals dying. Corals are habitat for many species, including fish.

**Honeybees:** warming temperatures may be causing problems with their immune systems, so they cannot fight off viruses, making it difficult for them to survive.

**Water:** less drinking water is in aquifers because of less glacial melt in the spring and summer.

**Forests:** trees provide oxygen and they absorb



Check One:

Stationary	Electricity	Mobile	Waste	Waste Water	Land Management
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Question 1:

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1,2 or 3? Why?

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Question 2:

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1,2 or 3? Why?

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Question 3:

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1,2 or 3? Why?

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# ACTION PLAN

Students develop a draft action plan in small groups in order to give examples of how individual and group actions can impact global resources. Students ask survey questions to collect valid data about the action steps they have chosen.

## Lesson Objective

- Give examples of ways choices can impact other communities, countries, or resources
- Develop and utilize survey questions to collect valid data

## Lesson Agenda

10 MIN	<b>Hook:</b> Climate Conference
10 MIN	<b>Introduction of new material:</b> Choices
20 MIN	<b>Activity 1 (we do):</b> Action Planning
20 MIN	<b>Activity 2 (we do/you do):</b> Comparing Carbon Footprint
20 MIN	<b>Activity 3 (you do):</b> Global Impact
10 MIN	<b>Assessment:</b> Action Steps

## Lesson Preparation

▪**Space:** Rehearse in the space where the WOW! will take place of at least one of the run through, if possible. Offer quiet spaces for small groups to work together for practicing the question and answer session.

▪**Group:** Students will work in pairs of their choice for the Hook. Activities 1, 2 and 3 are with groups of 2-3 that you choose.

▪**Resources:** Ahead of time, make a handout with the graphs from the Carbon CHECK worksheet. For the Hook, collect resources (magazine clippings, articles) to show as example of recommendations or action steps others have shared. Set up your laptop and projector with the Climate Check Excel file opened and ready to

## Standards for Unit

**Global Awareness:** *Citizen Schools students will evaluate the impact of the choices on a global world*

**Data Analysis:** *Citizen Schools students will demonstrate and ability to collect and organize data*

**Connections**  
*An effective action plan shows that students have understood steps that will improve the global climate change problem.*

*Framing recommended steps in a format to motivate and inspire people to take action and care about an issue is a skill that can be used in any college or career pathway that involves education, management, advocacy or social change.*

- Materials**
1. Visual of Objectives/Agenda
  2. Student handouts with Graphs from Carbon Calculator
  3. Student handout Action Planning
  4. Chart Paper
  5. Markers
  6. Global Climate Change Clippings/Articles/Images.
  7. laptop/projector with excel open and ready to enter data.



## Apprenticeship

### CARBON FOOTPRINT LESSON #6– page #2

# CITIZEN SCHOOLS

Objective: Give examples of ways choices can impact other communities, countries, or resources. Develop and utilize survey questions to collect valid data.

## Hook: Climate Conference

10 Minutes

### Do Now

**DSAY:** “On your desk, or on the computer in front of you, there is an example (or two) of media related to global climate change”

- Look closely at the example
- Talk with a partner seated near you about these 3 things (write on the board)
- What action does this ad want you to take?
- Is that very clear in this example? Why or why not?
- What images and words are most convincing?

**Ask** For a few students to share out. Compare and contrast techniques that are clear and helpful, versus ones that are not specific or not related to actions that individuals or groups can take to help the problem.

Help students decide what kind of language and imagery are most motivating and help the audience decide exactly what they should do. For example, saying what to do instead of what not to do, or making the actions seem as easy as “1,2,3.”

Make a list of what students thought was the most convincing to refer to later.

**Transition** Now that we have closely examined what works for action steps will be based on the **Introduction of New Materials**

Carbon Footprint we calculated specifically for our school audience.

**Objectives / Agenda:** **Ask** for a volunteer to read the objective. Ask for a volunteer to read the agenda. Any questions about the objectives or agenda for today?

**Preview assessment:** We will know we have mastered today’s objectives if you can write a survey question to ask our audience about how likely they are to take one of the action steps in your recommended action plan.

**Direct Teach: What is an Action Plan?** It describes specific things that people can do to help solve a problem. In our case, it tells individual people and school decision makers what they can do to help reduce carbon emissions. There are 2 groups of action steps that can help reduce global warming: Personal choices (at home and at school) and school decisions. Today, we will focus on personal choices. These are things that anyone can do to reduce carbon emissions.

There are many actions that people can take to help the environment. Our action steps will ways to reduce carbon emissions the most. Because of that, our recommendations might be different than other lists, or even for other schools.

**Connections:** The categories we will use to plan action steps are the same ones we have used to calculate the Carbon Footprint. Now that we know what the footprint is, we are going to convince people to do things that will reduce it.

**Transition:** The first step is to list the possible things people can do. We’ll start

## Student Says...



*Students may have heard or seen ads and “green tips” outside of this apprenticeship. Not all of these recommendations are focused on reducing carbon, and many of them do not inspire action.*

*Point out some global warming media that is vague, not action-oriented, or even could be overwhelming. Use these models to guide students to making theirs clear and actionable.*

## Closer Look!



*Refer back to the examples from the Do Now: which ones were action steps for individuals? Which ones were for groups (like schools, or workplaces).*

*There are examples of action plans from a wide variety of professions and field including:  
Policy action plans  
Health and wellness  
Economic plans  
Marketing plans*



Objective: Give examples of ways choices can impact other communities, countries, or resources. Develop and utilize survey questions to collect valid data.

Activity 1 Action Planning

20 Minutes

EXPLAIN: Each group has a copy of the handout "Action Planning."

- Direct students to small groups you have selected- assign each group 3 Carbon Footprint categories.
Students think of one action step for each of the 3 of the categories from the Carbon Footprint Calculator (not all students will think of steps for every category).
Write the step in your own words (choose active words that will inspire your audience to change!- remember the clippings).
If students finish early, they can list additional action steps for their categories or others.

ASK students to share out which of the action steps they think are most exciting. Which steps might be most difficult for people to do? As a whole class, discuss connections between groups' recommendations. Can some be combined? Can we make the wording of any steps more specific or clear? The Citizen Teacher writes this list on the board to use for Activity 2 and further action planning.

Activity 2: Comparing Carbon We have started to develop the action steps we will share at our WOW! now we will make sure that we pick the most important ones to emphasize in our webinar. Hand out carbon footprint calculator and inventory pages from previous class.

20 Minutes

Students will work in groups of 2-3 that you select. Hand out carbon footprint calculator and inventory pages from previous class.

SAY: "You have listed a large number of action steps. While all of these would help reduce emissions, we want to focus our energy on the steps that are most important. The ones that are most important are the ones that can make the biggest carbon emissions at our school."

As a full group, ASK students to recall the areas that we measured (Electricity, Mobile, Waste, Wastewater, Land Management).

- EXPLAIN that groups will work at their own pace to complete the following steps:
6. Look at the graphs (by source) on the Carbon Footprint handout from the previous class.
7. Which area contributes most of the carbon emissions from our school?
8. Look at the Inventory list.
9. For the area that contributes most of the carbon emissions, what did we measure?
10. For the things that we measured, what actions from the list could reduce the carbon we create from this source?
11. For the two highest percentage sources, students find two steps from Activity 1 that would help reduce emissions of this source, for a total of 4 Action steps

Missing Parts...



Students may not have concrete ideas of action steps to recommend. Provide a few examples from "Action Planning Suggestions" (pg..), but don't give them the whole document.

Encourage students to think about what data we collected about each area, and ways that emission could be reduced from the out put of the excel calculator. Review the results from the calculator often.

Additional Notes







Objective: Give examples of ways choices can impact other communities, countries, or resources. Develop and utilize survey questions to collect valid data.

### Activity 3 Global Impact

20 Minutes

Students work in the same groups of 2-3 that you selected for Activity 1.

**S SAY:** "For each of the action steps , you recommended, I asked you to write the impact of that change."

**ASK** students to recall global impacts of climate change: resources, sea level rise, extreme weather.

These impacts can be very frightening, but they can also help make a case about why it is important to take these action steps.

▪On chart paper, Each group writes 1 sentence about why action steps are important based on what they have learned about carbon emissions at our school and the global impacts.

▪List or draw one action step (your favorite).

▪List why this action step will help reduce global climate change- be sure to include 1 resource global resource such as fossil fuels.

▪List or draw images that might inspire emotions and motivation for the action steps you selected.

▪Write one question to the audience to find out how if they will take this step. (yes, no maybe). Explain that these questions will be used during the presentation to find out what the audience plans to do to change.

**EXPLAIN:** This is a "gallery walk." Students visit each poster. They read the poster and look at any drawings– students may not visit all posters.

**Share Out:** Ask several groups to share out what question they would ask to find out if someone would take one of action steps they

recommended.

### Assessment

**Transition:** We have related what we have learned in our WOW! Several students will present some of this information as the introduction and closing for our WOW! How will you know?

10 Minutes

### Exit Ticket Questions

▪Write 2 action steps your group recommends.

▪Write a question to the audience about the action step that your group recommended. The question should let you know how likely they are be to do the step your suggest.

▪Add a scale like this one to your question: Circle one

Not likely          Somewhat likely          Very likely          I don't know

### Demonstration of Mastery

▪Look for student's own wording in the question, and a clear statement of the step

**Transition:** Your hard work produced a great action plan today. We can include these questions in our WOW! Presentation to see how effective our action steps were in convincing people to help reduce

### Field Tips



*The most important idea to share in the WOW! Is that the steps we recommend will have a global impact.*

*Help students keep this local to global focus in mind by referring to all the resources they listed in Lesson 3.*

*Use concrete examples of this impact whenever possible and encourage students to be specific in their action steps so they can remember what the global impact will be during the WOW!.*

### Future Plans



*Continue to help students understand the logistics of the presentation, webinar recording of slides and audio and how students will interact with the audience at the WOW!*

*Develop a system with your Team Leader to incorporate some or all of the survey questions that students develop during the WOW! into the webinar.*



**Group Members:** \_\_\_\_\_

**Action Step 1 Category:** \_\_\_\_\_

**We Recommend....** \_\_\_\_\_

Describe how can one person make a difference by taking this action step?

\_\_\_\_\_

What is the school-wide impact of this action step? \_\_\_\_\_

\_\_\_\_\_

How will this action step impact the world? \_\_\_\_\_

\_\_\_\_\_

**Action Step 2 Category:** \_\_\_\_\_

**We Recommend....** \_\_\_\_\_

Describe how can one person make a difference by taking this action step?

\_\_\_\_\_

What is the school-wide impact of this action step? \_\_\_\_\_

\_\_\_\_\_

How will this action step impact the world? \_\_\_\_\_

\_\_\_\_\_

**Action Step 3 Category:** \_\_\_\_\_

**We Recommend....** \_\_\_\_\_

Describe how can one person make a difference by taking this action step?

\_\_\_\_\_

What is the school-wide impact of this action step? \_\_\_\_\_



## ACTION PLAN SUGGESTIONS

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1. Shopping: making strategic consumer choices. Purchasing energy efficient products helps reduce the release of greenhouse gases into the atmosphere. For example, aluminum packaging has a much more energy intensive production process than plastic packaging, and therefore higher greenhouse emission
2. Recycling: Buying products that are reusable or recyclable, or contain reduced packaging, can save a significant part of the energy and resources required for manufacturing new goods. You can recycle paper, cardboard, glass and metal.
4. Public transport: More frequent use of public transportation helps the environment by reducing the use of cars. Boats and ferries are the most efficient method of fossil fuel transport, followed by trains, then buses. Airplanes can be more than ten times less energy-efficient than cars
5. Walking is the least harmful mode of transportation, followed by the bicycle, whose usage produces no carbon emissions. However, the manufacturing of bicycles does emit carbon dioxide and other pollutants.
6. Trees: Protecting forests and planting new trees contributes to the absorption of carbon dioxide from the air. There are many opportunities to plant trees in the yard, along roads, in parks, and in public gardens.
7. Labels: The Energy Star label can be seen on many appliances, electronics, office equipment, heating and cooling equipment, windows, residential light fixtures, and other products. Energy Star products use less energy.
8. Cars: Purchasing a vehicle which gets high gas mileage helps to reduce emissions of carbon dioxide.
9. Renewable energy: The use of alternative energy sources, such as solar, wind, geothermal, and hydro energy, is gaining increased support worldwide. These methods of energy production emit few greenhouse gases once they are up and running.
10. Carbon offsets: The principle of carbon offset is thus: one decides that they don't want to be responsible for accelerating climate change, and they've already made efforts to reduce their carbon dioxide emissions, so they decide to pay someone else to further reduce their net emissions by planting trees or by taking up low carbon technologies. Every unit of carbon that is absorbed by trees -- or not emitted due to your funding of renewable energy deployment --offsets the emissions from their fossil fuel use. In many cases, funding of renewable energy, energy efficiency, or tree planting -- particularly in developing nations -- can be a relatively cheap way of making an individual "carbon neutral"-- some as inexpensive as US\$0.11 per metric ton (US\$0.10 per US ton) of carbon dioxide.
11. Using less animal products: The United Nations' Food and Agriculture Organization reports that rearing livestock contributes more greenhouse gases than all fossil fuel burning combined. A 2006 study from the Department of Geophysical Sciences at the University of Chicago found the difference between a vegan diet and red meat diet is equivalent to driving a sedan compared to a sport utility vehicle.



# Showing Our Footprint

Apprentices analyze the data they collected at school using several kinds of visuals. Apprentices create tables and charts that effectively organize the data they collected so that others can interpret it and take action to reduce carbon emissions at school. Students practice sharing the data with others using the tables and charts as visual aids.

## Lesson Objective

- Effectively use slides in a presentation
- Organize collected data into tables or charts that allow others to observe it effectively

## Lesson Agenda

10 MIN	<b>Hook:</b> Climate Conference
10 MIN	<b>Introduction of New Material:</b> Carbon Visuals
20 MIN	<b>Activity 1 (we do):</b> What Did We Find Out?
20 MIN	<b>Activity 2 (we do/you do):</b> What Does it Mean?
20 MIN	<b>Activity 3 (you do):</b> Presenting Your Data
10 MIN	<b>Assessment:</b> Action Steps

## Lesson Preparation

- **Space:** Space for groups to work in groups of 3-5, preferably in the computer lab.
- **Group:** students will work in groups of 3 that you select for the Hook and in groups of 3 that you select for Activity 1,2 and in about 7 groups of 2-3 (depending on number of laptops that you select for Activity 3).
- **Resources:** Arrange for at least 3 laptops, or one for each pair if possible. If only 1 is available, plan rotations so each group has 15 minutes to work during Activities 1, and 2. If no computers are available, students can draw their visuals and you can scan them in. Review Climate CHECK ahead of time using student data. Create PowerPoint slides for students to use as sample and template for developing visuals. Record as a webinar to use as a sample for Activity 1. Arrive early to test all technology and files ahead of time.

## Standards for Unit

**Data Analysis:** Citizen Schools students will demonstrate an ability to collect and organize data

**Communication:** Citizen Schools students will make an effective oral presentation

Students will use several visuals to inspire the audience to care about the impact of carbon emissions. Professionals use visuals to clearly communicate a message in formal presentations and meetings. In this case, students are using visuals to compel the audience to act! Advocates, entrepreneurs, salespeople and many other professionals use visuals to inspire action and present.

- Materials**
1. Visual of Objective/Agenda
  2. Chart paper
  3. Markers
  4. Projector with sample webinar
  5. Handouts with Carbon Footprint Steps.
  6. Data Sets with graphs (EPA handouts)
  7. Several laptops with PowerPoint (students create charts and tables)



Objective: Effectively use slides in a presentation. Organize collected data into tables or charts that allow others to observe it effectively.

Hook: Climate Conference

10 Minutes

- Warm Up: Give each group of 3 students a handout with one of the categories on it.
SAY: 'With your group, list ways that any choice in each category can impact people around the globe. Think about as many ways as possible in 5 minutes. Be ready to share what you think is the most important one, and why.'
Write on the board: 'list the ways that reducing carbon in this category would impact the world.'
1. Transportation: more public transportation instead of family cars would put less carbon in the air, meaning that global temperature wouldn't rise as much.
2. Food: eating less animal products means that less methane which reduces greenhouse gasses.
3. Heating and A/C: changing the thermostat helps conserve heat.
4. Lighting: motion sensor lights means less electricity, power plants create carbon to produce energy
5. Water: conserving water in the bathrooms means that global communities have more access to fresh water.

Transition: T SAY: 'We'll continue to work with these category groups all day to organize our webinar'
Introduction of New Materials: Carbon Visuals 10 Minutes

- Objectives / Agenda: Ask for a volunteer to read the objectives and agenda. Any questions about the objectives or agenda for today?
Preview assessment: We will know we have mastered today's objectives if you can effectively describe the visuals on the slide that your group created to a classmate who worked on a different topic.
To use visuals well:
4. show the audience the visual
5. Describe what you are showing
6. tell them what it means in the context of the topic and question.
ASK for a student to teach back ways to effectively use a visual in a presentation.
Direct Teach: In our Carbon Footprint calculations, we made a comparison for each category of carbon emissions. For example, the landfill waste was compared to burning gallons of gasoline. In our presentation, we can use visuals like bar charts and pictograms to show the before and after of our action steps. In small groups, you will work to
Model adding photos and simple graphs (from Climate CHECK) to a PowerPoint slide.
Review PowerPoint slide tips (pg 7).
Transition: The expectation for all of our visuals in the presentation is that they make ideas clear to our audience, they don't distract from what we

Student Says...



During rehearsals, students might want to make major changes to the script or plan.

Try to avoid major changes unless necessary, so that students have plenty of time to prepare and to prevent confusion on the day of the WOW!

Closer Look!



Help students plan effectively to discuss each of the action steps and why they were including in the Action Plan.

Give students several opportunities to practice telling each other about the steps in the process to calculate Carbon Footprint.



Objective: Effectively use slides in a presentation. Organize collected data into tables or charts that allow others to observe it effectively.

### Activity 1: What did we find out?

20 Minutes

- The webinar is a recording of our presentation that has our voices recorded and also shows the slides we will have projected during our presentation.
- Later today we will plan out what we will say. But first, here is a short sample of a webinar.
- Just pay attention to the format, not the content.
- The first slides will make will show visuals of the different kinds of data we collected and what we found out.
- Then we will make slides that describe the action steps we developed.
- T SAY:** “For example, for the transportation images, you might have an image of a school bus and bicycle to represent taking public transportation and riding bikes to reduce carbon footprint
- Visit groups to ask questions for deeper thinking such as: What questions might the audience have about this, why did you decide to put this idea first, last, etc?
- Collect:** Ask students to save the PowerPoint file (using a convention like their name\_carbon) on the desktop or in a shared folder. You or the Team Leader will collect these at the end of the day.

Transition: Now that we have created slides to show what we learned in each category, we can interpret what it means for our audience at the

### Activity 2: What Does it Mean?

20 Minutes

- EXPLAIN:** You will talk with your group for 1 minute and then choose one scribe to write one line that you think is important for us to tell the audience about this topic. You can add to the thoughts of the group before you, or put a new thought. PowerPoint slides should include powerful images.
- ASK:** What visual would help you understand what this means if you did not already know about global climate change? What pictures or graphs would show this information?
- Students discuss with a table partner, then each find a member of their category group and discuss as a group of 4.
- Connections:** This activity connects back to all the different types of data we used to do research on many sources of carbon emissions. We will use this information to build our presentation.
- T SAY:** “One of the objectives for the apprenticeship is that you are able use slides effectively. The visuals you create today in PowerPoint will demonstrate that skill.” This is important because it is a skill that professionals in many careers must use effectively.
- ASK** for several volunteers to describe the visual they plan to make with their group (in words). The category group gathers back together and lists all of their ideas. Choose 1 idea to sketch. Once the TL or CT approves the sketch, the team can begin creating it in PowerPoint.
- Transition:** Now that we have started developing the ideas, we can create

### Missing Parts...



*Students might think that the webinar is going to be dull or that they don't need to plan for what they will say. Help motivate students to use the webinar as a way to share the information they found not only with the school community at the WOW!, but also with a wider audience since the webinar will be recorded and can be easily shared digitally.*

*Ask students to think about who else might benefit from seeing the webinar– other schools, school leadership who won't be at the WOW! parents, and teachers at other grade levels.*

### Additional Notes



*Help students use specific examples of visuals that will be meaningful in the presentation.*

*Students may want to create a very detailed visual with too much or too little detail for PowerPoint slides. Help them think about the most important information and giving the audience a clear sense of what we did, what we found out, and the action steps we recommend. All the slides should support these main topics.*

*Help groups decide together about the best way to show the information we learned about carbon.*



Objective: Effectively use slides in a presentation. Organize collected data into tables or charts that allow others to observe it effectively.

### Activity 3: Presenting Your Data

20 Minutes

- Some students may have started building in PowerPoint. If you do not have enough computers or computers at all, or students are unable to use PowerPoint, they should draw the layout of their slides with text and the Team Leader will make the slides.
- Students have 15 minutes to create 2 PowerPoint slides using the skills you demonstrated in the Direct Teach session.
- Students work in groups of 2-3 that you select.
- S SAY:** "Remember that the webinar we are creating is designed to show what we did, what we found out, and recommendations for action steps we want to make based on what we learned about the carbon footprint for our school. One great way to do that is to include graphs and tables."
- Using the details on your handout (from template on pg7).
- Debrief** with students: **ASK** several students to provide feedback to their classmates on how easy to read and understand the slide text is.
- ASK:** What improvements did we make today? Record student ideas for practice later.
- Share Out:** Ask several groups to share out what they have created. They can show the group their screen or the sketch the group did. As students share, continue to remind them about audience and defining terms that their audience may not know.
- Provide feedback to groups about the clarity of the visuals they are creating, especially the graphs and their labels. (size, color, clarity of images, clutter on slides).
- Discuss** connections between slides and ask volunteers to suggest ways that the categories are related. This will begin the thinking for the order of slides and flow of the presentation.

### Assessment: Action Steps 10 Minutes

**SAY:** "Find someone who was not in your group today. Using hand up transition. I think we are ready to learn our lines next time and very soon we will be ready to show what we have learned in our WOW!"

**Stand Up:** When I say go, put your hand up when you find someone to pair with, put your hands down and sit together."

1. Explain to them the way we estimated carbon emissions for the category that you focused on.
2. Describe the visuals on the slide that your group created. What does it look like? What does it show the audience?
3. If you want to, you can use a piece of scrap paper to sketch the visual for your partner.

**Demonstration of Mastery:** as you walk around the room, listen for students describing and interpreting the visuals from the presentation slide precisely.

**Transition:** I heard great descriptions of the visuals you created. Next time, we'll polish our presentation and discuss roles, which will include many of the ideas you wrote and shared out today. Thank you for your

### Field Tips



*Remind students to think about who the audience for the presentation is and what they may or may not already know about carbon emissions and reducing global climate change.*

*What terms will students need to define in their presentation. What calculations will they need to describe in detail so that the audience understands that they did and how they know it is a good estimate of impact.*

### Future Plans



*The WOW is approaching quickly!*

*Give your apprentices a reminder about what the WOW! timeline will be like. This is a great time to remind apprentices about expectations for what to bring, do and what to be prepared for in general.*

*Be ready, with your TL to answer any questions students may have about the WOW! in general or their responsibilities for the WOW! – providing lots of information to prepare student will help ensure that*



Test your graph in PowerPoint to make sure it looks accurate.

### Group 1

#### First Sheet: Stationary Combustion

Important words: Carbon Content

Oxidation Factor

Incomplete combustion

Global Warming Potential

Carbon Dioxide Equivalent

Boiler

GHG emissions coming from Stationary Sources at our school are about equal to driving \_\_\_X passenger cars for one year\*.

\*Based on average annual distance traveled

### Group 2

#### Purchased Electricity and Steam

Important Words:

Fossil Fuel

Electricity Supplier

Turbine Kilowatt hours (kWh)

Generator

Renewable Resource

GHG emissions coming from Purchased Electricity and Steam at our school are about equal to providing electricity for \_\_\_\_X households\* for one year.

What action step relates to this topic?

\*Based on national average

### Group 3 Mobile Sources

Methanol

Liquefied Petroleum Gas (LPG)

Ethanol

Compressed Natural Gas (CNG)

Biodiesel





#### Group 4 Landfilled Solid Waste

- Aerobic
- Fermentation
- Anaerobic
- Anthropogenic
- Cellulose
- Amino Acids

**GHG emissions coming from waste that our school sends to landfill are about equal to consuming \_\_\_\_\_ gallons of gasoline.**

**What action step relates to this topic?**

#### Group 5 Wastewater Treatment

- Anaerobic
- Nitrification
- Denitrification
- Biochemical Oxygen Demand (BOD<sub>5</sub>)

**GHG emissions coming from wastewater that your school sends to a wastewater treatment plant are about equal to sending \_\_\_\_\_ tons of waste to a landfill each year.**

**What action step relates to this topic?**

#### Group 6 Refrigeration and Air Conditioning

- Refrigerant
- Hydroflourocarbons
- Coolant
- Ozone Depleting
- Potential Leak Rate
- Chlorofluorocarbons

**GHG emissions coming from Refrigeration and Air Conditioning sources at your school are about equal to \_X\_ gallons of gasoline.**

**What action step relates to this topic?**

#### Group 7 Land Management

- Carbon Sequestration
- Nitrogen
- Organic Leaching/Runoff Non-road
- Synthetic



**PowerPoint is a visual medium, so focus on images and graphics.**

- Often an image and a title are all you need for a great slide to support your own words.
- Choose powerful images and label them thoughtfully.
- Make sure the details of your graphs are visible.
- Label your graphs and make titles.

**Use text as prompts for your presentation.**

- The text on your slide should be words that will help the audience follow your presentation including:
  - topic headings
  - key points or essential questions.
  - Keep the number of words on each slide to a minimum.

**Use simple designs.**

- When choosing a design template, avoid designs that take up too much space.
- Stick with basic designs that will keep your audience focused on you and the content, not the decorations.

**Avoid flashy animations and transitions.**

- Much of what you can do with PowerPoint is a waste of time.
- Focus on creating great content with effective illustrations.
- Don't spend your time making words shoot in on rocket ships.

Some Places to find public domain images for presentations:

▪ **Environmental Education System**

[http://web.centre.edu/enviro/Photos\\_files/Photos.htm](http://web.centre.edu/enviro/Photos_files/Photos.htm)

▪ **Flickr**

<http://flickr.com>

▪ **FreePhoto.com**

<http://www.freefoto.com/index.jsp>

▪ **Freelimages.com**

<http://www.freeimages.com/photos/>

▪ **Free Stock Photos**

<http://www.freeimages.co.uk/>

▪ **Usa.gov**

<http://www.usa.gov/>



**Our PowerPoint slides will be shown using a webinar**

**Instructions**

- Before you start, create an outline to organize your thoughts and determine what information to include.
- If you are using Microsoft PowerPoint, decide how many slides you will include. Allow for approximately 2 minutes per slide.
- Use bullet points and keep the text to a minimum. Too much text is overwhelming and looks confusing. Include graphics like images, charts, graphs, and screen shots.
- Avoid having several text slides in a row. Alternate text slides with images, charts, and graphs. This keeps the audience from getting bored during the presentation.
- Avoid distractions like sound and flashy animation. You don't want your presentation to look and sound like a carnival.
- Proofread several times, and ask others to proofread the presentation. Nothing says unprofessional more than misspelled words.
- Save time at the end for questions.
- Tell your audience at the beginning of your presentation that you will have a question and answer period at the end of the presentation.
- Avoid answering questions during the presentation as this will cause you to lose your focus and the presentation won't flow as well if you are interrupted.



# Impact of Action Steps

Students use effective body posture and hand gestures as they practice the presentation that will be recorded at the WOW! Students work in groups to summarize the resources and groups of people that will be impacted globally by reducing carbon emissions by their action plan.

## Lesson Objective

- Present webinar using professional pace and tone
- Summarize the resources or groups of people that can be impacted across a global world

## Lesson Agenda

10 MIN	<b>Hook:</b> Climate Conference
10 MIN	<b>Introduction of new material:</b> What We Did
20 MIN	<b>Activity 1 (we do):</b> Storyboard the Webinar
20 MIN	<b>Activity 2 (we do/you do):</b> Scripts Carousel
20 MIN	<b>Activity 3 (you do):</b> Presenting the Plan
10 MIN	<b>Assessment:</b> Action Steps

## Lesson Preparation

- **Space:** Space for groups to work in groups of 3-5.
- **Group:** students will work in groups of 3 that you select for the Hook and in groups of 3 that you select for Activity 1,2 and in groups of 5 that you select for Activity 3 (one person from each of the category groups).
- **Resources:** Set up webinar technology ahead of time and show students a sample (short webinar). Based on students ideas, write student scripts for each category of carbon emissions. Plan time to work on polishing student created PowerPoint slides for webinar. See lesson 7 about modifications with limited or no laptops (sharing, drawing slides)

## Standards for Unit

### Global Awareness:

*Citizen Schools students will evaluate the impact of the choices on a global world*

### Communication:

*Citizen Schools Connections Students will make and effective oral presentation. Students will think about how best to present the carbon footprint and action steps to an audience at their school. To do this, they must effectively summarize the impact of the change on people locally and globally.*

*In order to plan for the scripts for the webinar, students think about what information should be included in the scripts and how best to present their finalized action steps. These planning skills are useful for middle and college pathways.*

### Materials

1. Visual of Objective/Agenda
2. Chart paper
3. Markers
4. Projector with webinar saved
5. Handouts with Carbon Footprint Steps.
6. Handouts of Action Plan steps for each student.
7. Storyboard worksheet
8. Laptops with PowerPoint



## Apprenticeship

### CARBON FOOTPRINT LESSON #8 – page #2

# CITIZEN SCHOOLS

▪Objective: Present webinar using professional pace and tone. Summarize the resources or groups of people that can be impacted across a global world.

## Hook: Climate Conference

10 Minutes

### ▪Warm Up

1. Give each pair of students a paper with one of the category on it. This should be different from the one they had last time, in Lesson 7's hook. This is another chance to think about choices.

i **SAY:** "With your group, list ways that any choices in each category can impact people around the globe. Think about as many ways as possible in 5 minutes. Be ready to share what you think is the most important one, and why."

▪Write on the board: "list the ways that reducing carbon in this category would impact the world."

1. Transportation: more public transportation instead of family cars would put less carbon in the air, meaning that global temperature wouldn't rise as much.

2. Food: eating less animal products means that less methane which reduces greenhouse gasses.

3. Heating and A/C: changing the thermostat helps conserve heat.

4. Lighting: motion sensor lights means less electricity, power plants create carbon to produce energy

5. Water: conserving water in the bathrooms means that global communities have more access to fresh water.

## Introduction of New Materials: What We Did 10 Minutes

**Transition:** We will work in category groups to organize our webinar.

▪**Objectives / Agenda: Ask** for a volunteer to read the objective and agenda. Any questions about the objectives or agenda for today?

▪**Preview assessment:** We will know we have mastered today's objectives when I observe you using strong body language and hand gestures. You will also be asked to summarize the people and resources that can be impacted by reducing global climate change.

▪**Model** characteristics of pace and professionalism. By walking through a few of the student-generated slides and describing what they show (should be natural but confident, appropriate speed and pauses for breath and reflection.

▪**Ask** for a student to teach back several of the characteristics of good pace and professionalism.

▪**Direct Teach:** We have discussed that societies with the least resources are likely to be most affected by lack of water, places to live, increasing extreme weather and famine.

▪For each category, ask a student volunteer to describe what we did to estimate the carbon footprint.

Break down the steps of each category to the procedure that we completed.

**ASK** for students to **teach back** what we found out.

**ASK** for students to **teach back** the action steps from Lesson 6.

## Student Says...



*During rehearsals, students might want to make major changes to the script or plan.*

*Try to avoid major changes unless necessary, so that students have plenty of time to prepare and to prevent confusion on the day of the WOW!*

## Closer Look!



*Help students plan effectively to discuss each of the action steps and why they were including in the Action Plan.*

*Give students several opportunities to practice telling each other about the steps in the process to calculate Carbon Footprint.*



▪Objective: Present webinar using professional pace and tone. Summarize the resources or groups of people that can be impacted across a global world.

### Activity 1: Storyboard the Webinar

20 Minutes

- Remember from Lesson 7 that a webinar is a recording of our presentation that has the voices and shows the slides we will have projected during our presentation. Later today we will plan out what we will say.
- Students will be in the same category groups for Lesson 9.
- S SAY:** “You have a storyboard worksheet (page 5) and category on a card at your table. Your job is to put the cards in the order that you think makes the most sense for your webinar. With your group, be ready to explain why you put the events in the order that you did. Once your group has decided on an order, use the storyboard handout to draw images that represent each
- For example, for the transportation images, you might have an image of a school bus and bicycle to represent taking public transportation and riding bikes to reduce carbon footprint.
- The TL and I will look at the order that we agree to as a class (when we collect your story board worksheet) and this will be the order that we describe our Carbon Footprint research in the WOW! we will use your images to finish making slides for the PowerPoint presentation.
- Visit groups as they work to encourage collaboration and ask questions for deeper thinking such as:
  - What questions might the audience have about this, why did you decide to put this topic first, last, etc?
- Collect** storyboard worksheets. When students have handed in their worksheets they may continue to work on laptops on PPT slides from Lesson 7.

### Activity 2: Scripts Carousel

20 Minutes

- Transition:** Now that we have practiced our pace for the webinar, we can rehearse again to prepare for our WOW!
- S SAY:** “Look around the room. There are posters that say Transportation, Water, Heating and A/C , etc You will visit several of the posters with your small group.”
- EXPLAIN:** You will talk with your group for 1 minute and then choose one scribe to write one line that you think is important for us to tell the audience about this topic. You can add to the thoughts of the group before you, or put a new thought.
- pSAY:** “Your Team Leader and I will use these lines to create the script for the Webinar. You can answer the following questions, or be other thoughts you think are most important: (list on board):”
  - Why this category is important to global climate change
  - What we did to measure our impact in this category, or
  - What actions steps relate to this category?
- Model an example of one thing the audience needs to know about Transportation.
- You will have about 4 minutes at each station and we will rotate through the stations using this signal (decide on a method to indicate that it is time to switch: lights out, clap, saying, etc.)
- Connections:** This activity connects back to all the different types of data we used to do research on many sources of carbon emissions
- wSAY:** “One of the objectives for the apprenticeship is that you are able to

### Missing Parts...



*Students might think that the webinar is going to be dull or that they don't need to plan for what they will say. Help motivate students to use the webinar as a way to share the information they found not only with the school community at the WOW!, but also with a wider audience since the webinar will be recorded and can be easily shared digitally.*

*Ask students to think about who else might benefit from seeing the webinar– other schools, school leadership who won't be at the WOW! parents, and teachers at other grade levels.*

### Additional Notes



*Help students use specific examples of how the action plan will help to address what we found when we calculated the carbon footprint of our school.*

*Students may want to create a very detailed script or far too many PowerPoint slides. Help them think about the most important information and giving the audience a clear sense of what we did, what we found out, and the action steps we recommend. All the slides should support these main topics.*



Objective: Present webinar using professional pace and tone. Summarize the resources or groups of people that can be impacted across a global world.

### Activity 3: Presenting the Plan

20 Minutes

- **SAY:** The webinar is designed to show what we did, what we found out, and recommendations for action steps we want to make based on what we learned about the carbon footprint for our school. We are developing ideas for our script, and then by next class, you will have a script that is finalized.
- Remember all of your presentation skills. (Ask volunteers to teach back skills). Today I am looking for your appropriate hand gestures and body posture. Can someone **teach back** what this looks like? These will be helpful for the webinar.
- Regroup so that there is one member of each category group to Share Out: each person in the group answers the following questions using the carousel chart paper about the category:
  1. How we measured the category
  2. What we found out
  3. Which action steps relate to this category
  4. How action in this category will help the global world.
  5. Use notes from your notebooks and handouts to help
- After practicing, if any of the information was missing from the chart paper, they can write it in.
- **Connection:** We will do a very similar practice again next time, but with the script!
- **ASK** several students to provide clear feedback to their classmates.
- What improvements did we make today? Run through parts of the WOW! that need practice a second time.
- Groups practice at the same time. The Citizen Teacher and Team Leader move around the room, assess pace of presentations and slide quality. Offer feedback to small groups for improving presentations.
- **Transition:** We are ready to learn our lines next time and very soon we will be ready to show what we have learned in our WOW!

### Assessment Action Steps

10 Minutes

- **Key Question:** Summarize the resources that can be impacted by global climate change across a global world.
- Find someone who was not in your group of 3 today put your hand up, when you find someone to pair with, high five them and sit together.
  1. Explain the way we estimated carbon emissions for the category you focused on: Transportation, Food, Heating and A/C, Lighting or Water.
  2. List 2 groups of people and 2 resources that would be affected by global warming.
  3. Describe how the line for the script you wrote relates to the impact on the global world.
- **Demonstration of Mastery:** as you walk around the room, listen for students identifying a range of resources and people impacted globally. If none of the suggestions relate to global impacts, give students one more rotation. For this last rotation, they should think about and write about the global impact of the category. Watch for great pacing and professionalism.
- **Transition:** I heard several ways that global climate change will impact

### Field Tips



*Remind students to think about who the audience for the presentation is and what they may or may not already know about carbon emissions and reducing global climate change.*

*What terms will students need to define in their presentation. What calculations will they need to describe in detail so that the audience understands that they did and how they know it is a good estimate of impact.*

### Future Plans



*The WOW! is coming right up!*

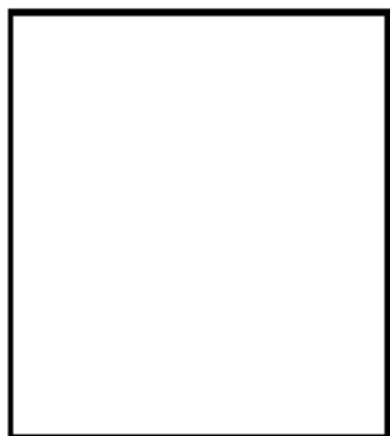
*Give your apprentices a reminder about what the WOW! timeline will be like. This is a great time to remind apprentices about expectations.*

*Remind students of any materials they should bring and of the logistics : where, when, who can come, etc.*

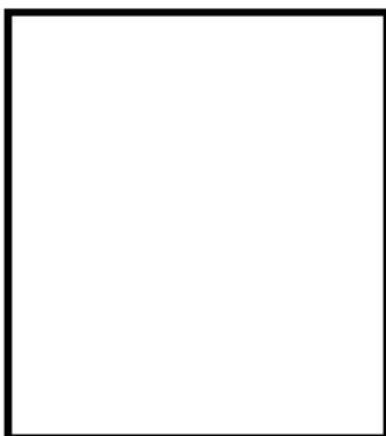
*Answer any questions students may have about the WOW! in general or their responsibilities for the WOW!*

# Carbon Footprint StoryBoard

Group Members: \_\_\_\_\_



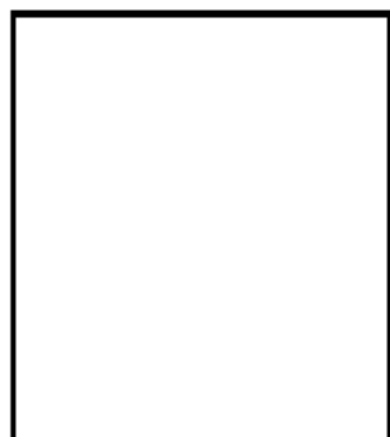
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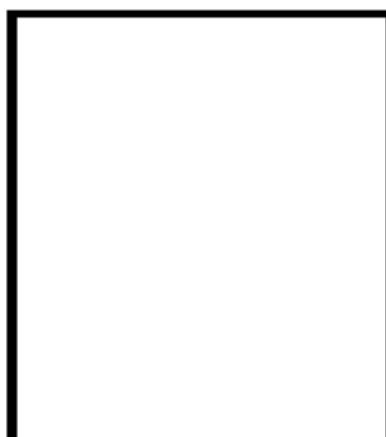
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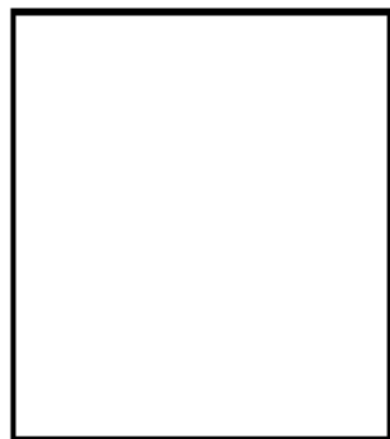
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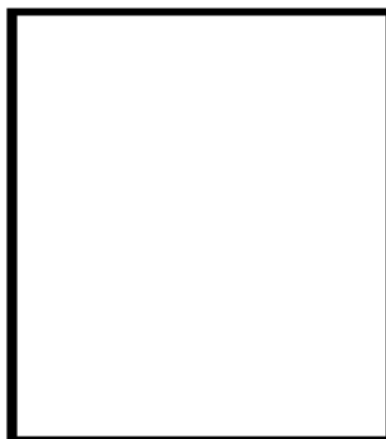
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# Action!

Students practice the presentation that will be recorded at the WOW! using scripts and speaking slowly enough for the audience to understand. In the webinar, apprentices describe how they estimated the impact of actions and choices on global resources.

## Lesson Objective

- Speak slowly enough for the audience to understand
- Estimate the impact of actions or choices on global resources or societies

Lesson Agenda	
10 MIN	<b>Hook:</b> Climate Conference
10 MIN	<b>Introduction of new material:</b> Presentation Basics
20 MIN	<b>Activity 1 (we do):</b> Script Read Red, Yellow, Green Light
10 MIN	<b>Activity 2 (we do/you do):</b> How We Estimated Heads Together
30 MIN	<b>Activity 3 (you do):</b> Film and Introduction/Closing
10 MIN	<b>Assessment:</b> Action Steps

## Lesson Preparation

- **Space:** Groups will need to travel to various locations for footage that shows the sources of carbon emissions at schools. Students will also need a quiet space to record footage (a set in a quiet corner of a classroom or in the library).
- **Group:** students will work in groups of 3 that you select for the Hook and in groups of 3 that you select for Activity 1,2 and 3.
- **Resources:** Write student scripts for each category of carbon emissions ahead of time based on their work in Lesson 8. Set up technology for filming ahead of time create a list based on the story board. Extra adult volunteers to assist will make the webinar recording go most smoothly.

## Standards for Unit

**Global Awareness:** Citizen Schools students will evaluate the impact of the choices on a global world

**Communication:** Citizen Schools students will make and effective oral presentation.

## Connections

Students will provide feedback to the group about how to improve the WOW! presentation and practice questions that they can expect the audience to ask at the WOW!

This lesson also provides an additional opportunity to reflect on how their own action plan will improvement in global impact on climate change. The skill of understanding how solutions can impact global groups and resources is important for many careers that aim to improve social and scientific problems directly or indirectly.

1. Visual of Objectives/Agenda
2. Chart paper
3. Markers
4. Scripts that you have written ahead of time
5. Computer
6. Phone



## Apprenticeship

### CARBON FOOTPRINT LESSON #9– page #2



Objective: Speak slowly enough for the audience to understand. Estimate the impact of actions or choices on global resources or societies.

### Hook: Climate Conference

10 Minutes

- Warm Up:** Each pair gets a paper with one of the categories on it.
- E **SAY:** “With your group, list ways that making choices in each category can impact people around the globe. Think about as many ways as possible in 5 minutes. Be ready to share what you think is the most important one, and why.”
- Lets think together to link each of our categories to global impact.
- Write on the board: “list the ways that reducing carbon in this category would impact the world.”

  1. Transportation: more public transportation instead of family cars would put less carbon in the air, meaning that global temperature wouldn't rise as much.
  2. Food: eating less animal products means that less methane which reduces greenhouse gasses.
  3. Heating and A/C: changing the thermostat helps conserve heat.
  4. Lighting: motion sensor lights means less electricity, power plants create carbon to produce energy
  5. Water: conserving water in the bathrooms means that global communities have more access to fresh water.

**Transition: T SAY:** “We'll continue to work with these category groups all day and our film will have separate scenes based on the categories.”

### Introduction of New Materials: Presentation Basics 10 Minutes

- Objectives / Agenda: Ask** for a volunteer to read the objective and agenda. Any questions about the objectives or agenda for today?
- Preview assessment:** We will know we have mastered today's objectives when I observe you speaking slowly in your script rehearsal and if you can describe how we estimated the carbon emission of our school in one category. I will also ask you to list 2 choices that students and schools can make to reduce carbon emissions in this category.
- Connections:** In lesson 8 we identified several groups and resources that are impacted by global climate change. Today we will In tomorrow's lesson we will summarize the different groups and resources that are impacted by global climate change.
- Direct Teach:** We have discussed that societies with the least resources are likely to be most affected by lack of water, places to live, increasing extreme weather and famine. Can someone teach back one reason why global climate change will affect different groups more than others?
- Today we want to capture all the different categories that we estimated in our webinar. For each category, ask a student to teach back how we estimated carbon emissions.
- ASK:** a volunteer to give an example of one of the choices that we are recommending in our action steps. Which category does this choice belong in?
- For each category we will have part of the script for your group.
- In your group's script, you will see there is a role for each team member
- To practice your lines:
  - 1. Read quietly to yourself and make sure you understand the lines.
  - 2. Read at a normal pace, read slowly for practice.
- Model for students: slow, clear reading of a sample from script. We will practice with the slide presentation, too.
- Transition:** Lets remember this global perspective when we rehearse today. During

### Student Says...



*During rehearsals, students might want to make major changes to the script or plan.*

*Try to avoid major changes unless necessary, so that students have plenty of time to prepare and to prevent confusion on the day of the WOW!*

### Closer Look!



*Help students see that if many people take small steps, there is an opportunity for impact on a global level. The impacts can be estimated in the same way that the emissions were calculated. This is what we began to do in Lessons 4 and 5 and what we shared visually in Lesson 7.*

*Calculating the difference between current emissions and emissions after action steps are taken, you can measure the impact of making a better choice.*

*If you do this locally, you can estimate what impact his would have globally.*



Objective: Speak slowly enough for the audience to understand. Estimate the impact of actions or choices on global resources or societies.

### Activity 1: Script Read Red, Yellow, Green Light 20 Minutes

- There are a few things to think about when you plan for the speed you read your lines for the webinar. We're going to play around with the speed, so you can get a sense of the "just right" speed. Remember that speaking slowly will help your audience understand and think about what you are saying. Your audience hasn't calculated a carbon footprint before, so this is new!
- c SAY:** "When I say "Red light Read through like you're in SLOW motion to your partner. (model reading 1 sentence very slowly). When I say Yellow Light, read through at a "just right" pace. When I say Green light, zoom right through as fast as possible, you might even skip over some words. Call "red," "yellow," and "green" 2 times each. Switch partners. Call "red," "yellow" and "green" 2 times again.
- The pace that we want is somewhat slower than the pace you use to talk. The best way to practice is to really pay attention to your pace.
  1. Read through lines at the pace that you think is great
  2. Speak loudly and clearly at the same time
  3. Ask your group members if you should speed up or slow down.
- Remind** students that if they are not speaking at any point in time, their job is to be listening and watching the script rehearsal to offer suggestions for improvement.
- Teach back:** what are some reasons for speaking slowly during our presentation?
- Transition:** Now that we have practiced our pace for the webinar, lets rehearse the whole presentation one more time before our WOW!

### Activity 2: How We Estimated Heads Together 10 Minutes

- We will make sure that everyone in your group knows about how we estimated one of the categories and how this category relates to global climate change and its impact on resources. The goal is to ensure that each member of the group knows how we calculated the emissions for a category.
- The same teams of 3 will work together and make sure all members understand
- One teammate will be called on randomly to give your group's response.
  1. Students count off numbers in their groups from the Warm Up.
  2. **SAY:** Everyone think about how we measured the carbon emissions category you selected).
  3. Students can stand up, group together, discuss and teach each other the way that we measured emissions (refer to poster).
  4. Students sit down when everyone knows the answer (2 minutes)
  5. Teacher calls a number. The student with that number from each team answers question individually.
- ASK:** "How does reducing carbon emissions in your category relate to the global world?"
- Connections:** This activity connects back to the research we did to collect data on different sources of carbon emissions What if every school reduced their carbon emissions by as much as we did in each of the categories?
- e SAY:** "one of the objectives for the apprenticeship is that you use visuals effectively. We have visuals that show the carbon we use, and now I am adding a visual to our presentation that shows worldwide ." We will use these visuals in the presentation to connect our local action plan to global impacts.

### Missing Parts...



*Students might feel like they don't need to practice any more because they know the part. Help students remember that extra practice will make transitions smoother and that there is always room for improvement.*

*If they feel well prepared for the WOW! presentation they can continue to prepare for audience questions even more. You can provide additional roles and responsibilities to students who are not feeling challenged by rehearsal. Talk with your TL about organizing these additional roles.*

### Additional Notes



*Give specific examples of what could be improved and give students a chance to practice at a more appropriate pace or volume.*



Objective: Speak slowly enough for the audience to understand. Estimate the impact of actions or choices on global resources or societies.

### Activity 3: Practice Webinar with Intro & Closing 30 Minutes

- **SAY:** The recorded webinar is designed to show what we did, what we found out, and recommendations for action steps we want to make based on what we learned about the carbon footprint for our school. Each group will present one category of research and action steps. The scenes match the areas of carbon emissions we estimated: Transportation, Food, Heating and A/C, Lighting, and Water
- Students use the script to run through as if this is the big day. Remember all of your great presentation skills. (Ask volunteers to teach back what they are).
- Roles during the webinar:
  - Speaker (one or more students)
  - Presentation manager: responsible for advancing the slides and coordinating the group to present (may also have a speaking part).
  - Introduction: Says 2 sentences about the category
    1. How we measured the category
    2. What we found out
  - Closing: Says 2 sentences
    1. Which action steps relate to this category
    2. How action in this category will help the global world.
- Write your note cards for intro and conclusion before you rehearse.
- With your group, practice what you will do during your segment. Practice a run through and show the visuals that you will show during the webinar.
- Each group member shares with the group:
  11. 1 thing about our rehearsal earlier today that was successful
  12. 1 thing about the rehearsal earlier today that could still use some work
- Student should **Rehearse** with a full run through. Students should make notes of any improvements when they are not presenting. This will take most of the 30 minutes.
- **Assessment Action Steps**
  - Ask several students to give their class feedback to their classmates.
  - What improvements did we make today? Run through parts of the WOW! That need practice.
  - **Key Question:** Summarize the resources that can be impacted by global climate change across a global world.
  - **Transition:** I think we are ready to show what we have learned in our WOW!
  - Find someone who was not in your group of 3 today When I say go,
    3. Put your hand up
    4. When you find someone to pair with
    5. Put your hands down and sit together.
    6. Explain to them the way we estimated carbon emissions for the category that you focused on: Transportation, Food, Heating and A/C, Lighting or Water.
    7. Did you measure the two categories in the same way? How were they different?
    8. List 2 choices that your school or students can make that reduce carbon emissions in this category.
- **Demonstration of Mastery:** as you walk around the room, listen for students connecting local action steps with impact on global communities. The resources are water, coastal land, migration and conflict, and famine (food).
- **Transition:** I heard several ways that global climate change will impact the global world. Some of these are... I noticed these in your rehearsal of questions as well.

### Field Tips



Recording a webinar is great way to demonstrate mastery and focus on the skills that students have achieved.

Remind students that this recording will be of great quality and the presentation will be interesting to the audience, but the real purpose is to demonstrate what we have learned about calculating a carbon footprint and developing action steps to reduce carbon emissions—not to have a 100% perfect webinar. If there are hiccups or technological problems, we will just keep moving forward.

### Future Plans



Next week is the WOW!

Give your apprentices a reminder about what the WOW! timeline will be like. This is a great time to remind apprentices about expectations.

Remind students of any materials they should bring and of the logistics: where, when, who can come, etc.

Answer any questions students may have about the WOW! in general or their responsibilities for the WOW!



# Record & Review

Students rehearse the full presentation and watch playback of their webinar. They describe the data they collected and the action plan they created so that the audience can observe it effectively. Apprentices practice fielding questions about their process and how taking action steps locally would impact the global world.

## Lesson Objective

- Effectively use visual aids in a presentation
- Summarize the resources or groups of people that can be impacted across a global world

## Lesson Agenda

10 MIN	<b>Hook:</b> Climate Conference
10 MIN	<b>Introduction of new material:</b> Sharing Our Film
25 MIN	<b>Activity 1 (we do):</b> Rehearse
10 MIN	<b>Activity 2 (we do/you do):</b> : Practicing Questions
25 MIN	<b>Activity 3 (you do):</b> Rehearse
10 MIN	<b>Assessment:</b> Action Steps

## Lesson Preparation

▪ **Space:** Rehearse in the space where the WOW! Will take place of at least one of the run through, if possible. Offer quiet spaces for small groups to work together for practicing the question and answer session.

▪ **Group:** students will work in groups of 5 that you select for the Hook and in groups of 3 that you select for practicing question and will work in the large group for WOW! rehearsal.

▪ **Resources:** Set up technology for projecting the film ahead of time and practice the cues for starting and stopping the film as if is the actual WOW! If there are volunteers available, they can play the role of audience and ask questions about the Action Steps just like the audience will on the day of the WOW! Cut Cool Cities

## Standards for Unit

**Global Awareness:** Citizen Schools students will evaluate the impact of the choices on a global world

**Data Analysis:** Citizen Schools students will demonstrate and ability to collect and organize data

## Connections

Students will provide feedback to the group about how to improve the WOW! and practice questions that they can expect the audience to ask at the WOW!

This lesson also provides an additional opportunity to reflect on how their own action plan will improvement in global impact on climate change. The skill of understanding how solutions can impact global groups and resources is important for many careers that aim to improve social and scientific problems directly or indirectly.

1. Projector and Screen to show video
2. All materials for student WOW! presentation
3. Handout: Practice Questions (1 for each student)
4. Cool Cities Cards for each student.



•Objective: Effectively use visual aids in a presentation. Summarize the resources or groups of people that can be impacted across a global world.

Hook: Climate Conference

Minutes

Do Now / Warm Up

1. Divide the class into 3 or 4 groups based on where they are sitting.
2. Students choose a card with details about a Mayors action plans and commitments to reducing carbon emissions in their cities.

c **SAY:** These are all actions that mayors other leaders have taken on behalf of cities and countries, which is a little different from the kind of action plan we have created.

Share with your group of 5:

- your own favorite new skill from this apprenticeship
- the city you drew
- Summarize what the city did to reduce their carbon emissions.

**Transition: T SAY:** “We’ve been talking about what can be done by and individual or a school to reduce carbon emissions, and this activity helps us think about what a state or city can do. Actions at a small, local scale help solve the global problem. We’ll talk more today about how our action plans relate to the global world.”

Introduction of New Materials  
Impact on a Global World

10 Minutes

•**Objectives / Agenda:** Ask for a volunteer to read the objective and agenda. Any questions about the objectives or agenda for today?

•**Preview assessment:** We will know we have mastered today’s objectives when I observe you effectively use visual aids in the WOW! rehearsal question session and if you can summarize the resources that can be impacted by global climate change across a global world. This will mean we are ready for the WOW!

•**Connections:** In lesson 8 we identified several groups and resources that are impacted by global climate change. We also have looked at how the impacts of global climate change will affect people in different countries and communities differently. For example, if people have money to buy water and move their buildings and home to new sites.

•**Direct Teach** Lets list together the groups and resources that we have included in our WOW! presentation. We’ve talked about both local and global impacts, so you can include both here. (Write student responses on the board).

•Throughout the apprenticeship we have discussed how many different groups of people and communities might be impacted by global climate change. We need to remember that the reason we want to take these steps is because they will benefit the global world, not just our school.

**ASK:** Which groups and resources are not included in our WOW! that are also impacted by global climate change?

•**Transition:** Lets remember this global perspective when we rehearse today. We will have some practice answering audience questions during

Student Says...



*During this lesson's rehearsals, students might want to make major changes to the script or plan. Try to avoid major changes, so that students have plenty of time to prepare and to prevent confusion on the day of the WOW!*

Closer Look!



*Details about city initiatives are available at Cool Cities: <http://coolcities.us/>.*

*This activity helps students reflect on the scale of the action steps they have created– most of the steps are small changes on a local level. Though apprenticeship have discussed how many different groups of people and communities might be impacted by global climate change, the solutions they offer are focused on actionable steps in their own communities*



Objective: Speak slowly enough for the audience to understand. Estimate the impact of actions or choices on global resources or societies.

### Activity 1 Rehearse

25 Minutes

Drum roll Please! It is our privilege to show the video of the webinar we recorded last time.

**SAY:** Based on what we just saw, we can work on more rehearsals for the next 10 minutes This includes introducing the recording with the scripts we wrote, running through a viewing of the film, and providing a closing in which we discuss the action steps with the audience and tell our audience that we can answer any questions they may have."

**Remind** students that if they are not speaking at any point in time, their job is to be listening and watching the rehearsal to offer suggestions for improvement. Give students key areas to focus on for rehearsals such as:

- speaking loudly and clearly; keeping pace when going through the slides, referring to visuals with specific comments.

- Share out: Ask** several students to share one of the ways they used the visual aids to help you answer the questions from your partner ( might include- I described what a graph was showing, I would look back at a slide, I showed them the list of the questions we asked, photos from our field trip, photos from our school, etc).

### Activity 2: Practicing Questions 10 Minutes

whole presentation we can practice answering questions before our **Connections:** This activity connects to our discussion about how to share information with your audience so that they clearly understand:

- 2.What you did
- 3.What you found out
- 4.What action you recommend based on what you found out

**WSAY:** "When we finish our explanation, the audience may want to clarify something they didn't understand in the presentation. This is a great chance to demonstrate what you have learned. Practicing these questions will help you be prepared for their questions."

**Explain** the questions on the handout. Model a complete answer to one of the questions.

With a partner, choose 4 of the questions on the list. Ask each other them and give a response just like you would if we were are the WOW! and an audience member asked you the question.

- Use specific examples
- Refer to the action steps and visual aids to help you
- Use great presentation skills including: speaking slowly, loudly and clearly; using eye contact,
- Share out: Ask** several students to share one of the ways they used the visual aids to help you answer the questions from your partner ( might include- I described what a graph was showing, I would look back at a slide, I showed them the list of the questions we asked, photos from our field trip, photos from our school, etc). We will have a great audience who

### Missing Parts...



*Students might feel like they don't need to practice any more because they know the part. Help students remember that extra practice will make transitions smoother and that there is always room for improvement.*

*If they feel well prepared for the WOW! presentation they can continue to prepare for audience questions even more. You can provide additional roles and responsibilities to students who are not feeling challenged by rehearsal. Talk with your TL about organizing these additional roles.*

### Additional Notes



*As you go around to groups to listen for mastery of the questions and answers, you can also provide pointers for their presentation skills.*

*Avoid making major changes, but you can give examples of strong presentation skills and offer direct feedback on how students are using these skills.*

*You might choose to talk with students individually about a suggestion instead of sharing the suggestion in front of the large group.*



Objective: Speak slowly enough for the audience to understand. Estimate the impact of actions or choices on global resources or societies.

### Activity 3 Rehearse

25 Minutes

**f SAY:** the goal for this rehearsal is for you to feel completely comfortable with the WOW! And the role and responsibilities you will have. We'll  
Let's start with any questions you have about what will happen at the WOW!

Turn to your partner and say:

5. 1 thing about our rehearsal earlier today that was successful
6. 1 thing about the rehearsal earlier today that could still use some work

**Ask** for a few volunteers to share.

Provide clear instructions for improving the performance if necessary.

**Rehearse** the WOW! With a full run through.

Students should make notes of any improvements when they are not presenting in the WOW! The expectation is that all students are attentive to the WOW! Because they will be asked to provide clear feedback to their classmates.

**Debrief** with students

Did we make some improvements from earlier today: What were they?

Run through any parts of the WOW! That need extra practice.

Provide encouragement that the WOW! will be a great success.

Transition: I think we are completely ready to show what we have learned in our WOW!

### ✓ Assessment

10 Minutes

**Key Question:** Summarize the resources that can be impacted by global climate change across a global world.

Talk to the person next to you for 5 minutes to summarize the global resources that will be impacted by global climate change.

**Demonstration of Mastery:** as you walk around the room, listen for students connecting local action steps with impact on global communities. The resources that they can mention are water, coastal land, migration and conflict, and famine are possible answers.

Transition: I heard several ways that global climate change will impact the global world. Some of these are... I noticed these in your rehearsal of questions as well. We're ready to show what we have learned to do in our WOW!

### Field Tips



*Having the expectation that students will provide feedback to the group about how to improve the WOW! Encourages them to be an attentive audience.*

*Your TL may have other suggestions about tasks that students can do who are not speaking in the WOW! At any given time. Structuring this time will help manage students behavior and limit distractions from the objectives of the day.*

### Future Plans



*Next week is the WOW!*

*Give your apprentices a reminder about what the WOW! timeline will be like. This is a great time to remind apprentices about expectations.*

*Remind students of any materials they should bring and of the logistics : where, when, who can come, etc.*

*Answer any questions students may have about the WOW! in general or their responsibilities for the WOW!*





## PRACTICE AUDIENCE QUESTIONS

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Choose 4 of the questions below to ask your partner to practice for the WOW!

### Questions about how you collected data:

How did you know how efficient the refrigerator/heater/

What transportation emissions did you include?

How do you know that the data you collected on mileage is valid?

How did you make sure the questions you asked the principal were valid?

### Questions about how you chose the action steps:

Why is transportation included?

Why did you recommend cutting down by \_\_\_\_\_ instead of \_\_\_\_\_?

How will \_\_\_\_\_ help global climate change?

Why does it matter if you do \_\_\_\_\_ when there are so many carbon emissions from factories?

How can \_\_\_\_\_ be effective if only your school does it?

Why did you choose this number of action steps?

Which of the action steps do you think will have the most impact on global resources?

### Questions about how you created visuals for the data:

What does \_\_\_\_\_ graph show?

What is the axis on \_\_\_\_\_ graph?

Why did you decide to show the graph about \_\_\_\_\_?

### Questions about the apprenticeship?

Do you want to have a STEM career? Why or why not?



## Cool Cities

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Mayor Martin Chavez  
Albuquerque, New Mexico

I co-sponsored the New Mexico Forest Re-Leaf Act. The right tree in the right places can have positive environmental, economic, and sociological impact.

As Mayor, I have launched a major Urban Forestry Improvement Initiative to take advantage of all the ways trees help Albuquerque.

Our goal is to have 75,000 trees planted within two years between the city and community group efforts.

- The city plants trees in parks, medians, and streetscapes. ..Trees provide shade, help to keep Albuquerque's air clean and provide visual diversity in the desert landscape.
- The Parks Department has worked with the U.S. Forest Service to create a Master Plan to guide and direct the city on how to reach the desired goal of 60% canopy cover.



Mayor William D. Euille  
Alexandria, Virginia

"In 2006, the City Council initiated a strategic and comprehensive environmental planning process called the Eco-City Alexandria initiative. Its objective was to develop an environmental vision for the city named the Eco-City Charter, which was adopted in 2008, and an Environmental Action Plan, which was adopted in 2009.

This action plan contains 48 goals, 50 preliminary targets, and 353 actions that would span the course of 21 years.

Several short-term actions have been completed such as the following:

- Adopted a progressive green building policy for commercial and residential buildings
- Adopted the Urban Forestry Master Plan
- Hired an energy manager and developed an energy strategy





## Cool Cities

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Mayor Shirley Franklin  
Atlanta, Georgia

Atlanta has developed an employee education and outreach program called the Power to Change campaign.

The purpose of this program is to engage all city employees in how they can help reduce their carbon footprint at work, home, church, etc.

It's great to see the innovation and excitement that comes from our employees.

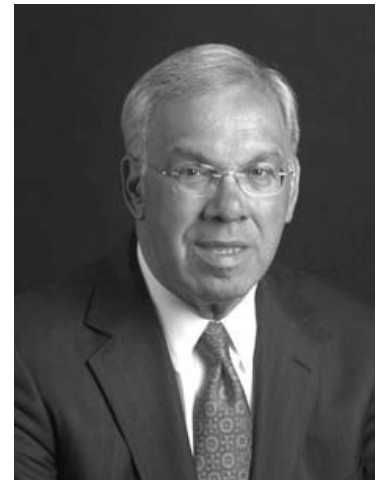


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Individual actions like these will get us out of this crisis.”

Mayor Thomas M. Menino  
Boston, Massachusetts

In 2007, I issued an executive order setting a goal of 80% reduction in municipal emissions by 2050. At the same time, our city issued its first comprehensive Climate Action Plan describing and formalizing our GHG reduction programs. As nearly 75% of our GHG emissions come from the energy demand of the building sector, we developed a comprehensive green building strategy, including:



- A first-in-the-nation adoption of LEED standards for new private development
- A LEED Silver standard for municipal projects
- A \$3 million green affordable housing program
- Purchase of electricity from renewable sources