

Lesson 1: How can we decrease our impact on the Earth's climate at our school?

MS/HS Climate Unit

Previous Lesson....Where we've been: In our previous unit we learned that human activities are causing greenhouse gas emissions that are leading to climate change. We made a list of ways that we cause or save emissions in our day.

	This Lesson....What we are doing now: This lesson explores the district's solid waste plan and discusses how our school can save or decrease emissions by reducing solid waste at our school.		
Lesson Question	Phenomena	Lesson Performance Expectation(s)	What We Figure Out (CCCs & DCIs), <i>New Questions</i> and <i>Next Steps</i>
<p>Lesson 1: How can we decrease our impact on the Earth's climate at our school?</p> <p>(1 period)</p>  <p><i>Building toward</i> ↓ <u>NGSS</u> <u>PEs:</u> MS-ESS3-3 HS-ESS3-4 HS-ETS1-3</p>	<p>"Colorado is Using Piles of Rotting Food for Fuel" video</p> <p>Solid Waste Plan DPS</p>	<p>Define a design problem that involves the development of a process or system with interacting components and criteria and constraints that may include social, technical, and/or environmental considerations.</p>	<p>We watch a video about a solution that people in Colorado are already doing and we discuss points mentioned in the video and highlight the point at 1:50 that if global food waste was a country it would be the third largest GHG emitter behind the US #1 and China #3.</p> <p>We make a list of ways we cause or save Greenhouse Gas emissions in our day.</p> <p>We are wondering: <i>Where does all of this food waste come from?</i> <i>What happens to the food waste that isn't recycled into energy?</i> <i>Can we do something at our school to reduce the amount of food waste that we make?</i></p> <p>We recall that humans have influence on Greenhouse Gas emission and we wonder if our district is already taking action, and how we can help.</p> <p>We learn that DPS already has a plan for reducing food waste and we have been tasked with figuring out how to help!</p> <p>We read the solid food waste plan and wonder: <i>what does this have to do with CO₂, what does it have to do with food waste, how can we help? What are some things that we need to figure out to be able to contribute to these plans?</i></p> <p>We have a generating and prioritizing questions discussion to come up with an action plan. We discuss the criteria and constraints to solving the problem of food waste in our school and develop questions that reflect this discussion. We categorize our questions into these categories: <i>Which of these questions have to do with people, which have to do with the physical system or process? Are we lacking things or information that we would need to implement solutions?</i></p> <p>We are wondering: <i>Why do we need to reduce the amount of food waste that goes to landfills?</i> <i>What does this have to do with emissions?</i> <i>Do we have a recycling bin in the cafe?</i> <i>Can we waste less in the first place?</i> <i>How much do we waste?</i> <i>Can we measure our food waste?</i> <i>Is there a better use for food waste?</i> <i>Who makes decisions that lead to food waste?</i> <i>Which solutions might be most appropriate given realities (social, cultural, political, institutional, actual and potential resource access, environment etc...) of our context?</i> <i>Given the actions we might take, what logistical considerations should we pay attention to (social, cultural, available resources, potentially available resources, institutional, perceptions, priorities etc...)?</i></p>

			We decided that we need to look at our own school's food waste first
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Next Lesson....Where we're going: Next, we will explore our school food system and identify the ways in which Greenhouse Gases result from food waste in our school system. We then will develop an investigation about food waste at our school in order to know what should change.





Getting Ready: Materials Preparation

Materials For Each Group

Preparation of Materials (15 min.)

- Driving Questions Board (smartboard, chart paper)
- [Slides](#)

Materials For Each Student

- [Student Activity Sheet](#)

Safety





Getting Ready: Teacher Preparation

Background Knowledge

ESS3.C from the FRAMEWORK:

By the end of grade 8: Human activities have significantly altered the biosphere sometimes damaging or destroying natural habitats and causing the extinction of many other species. However, changes to Earth's environment can have different impacts (negative and positive) for different living things. Typically, as human populations and per capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.

ESS3.D from the FRAMEWORK:

By the end of grade 8: Activities such as the release of Greenhouse Gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior, applying that knowledge wisely, decisions, and activities.

ESS3 from the FRAMEWORK:

“Thus science and engineering will be essential both to understanding the possible impacts of global climate change and to informing decisions about how to slow its rate and consequences...”

Rate of and region of change matters for understanding climate change. Cities are changing faster because of their characteristics - localized amplification because of things black tops, resulting in heat islands in cities. However, this isn't the entire explanation for climate change. Overall, regionally and globally human activities are increasing CO₂ and Greenhouse Gases, which result in global warming.

Alternative Student Conceptions

Students may or may not know what happens to food that goes into the garbage and they may think it all goes to a landfill. Also, students might not know that food waste is a major contributor to greenhouse gases and may struggle to see the connection.

Linking Our Understanding to Scientific Terminology

- Climate
- Emission
- Methane





Learning Plan: How can we lessen our impact on climate at our school? (45 min)

1. (10 min) Begin the lesson by showing this [video](#). Have students write down their observations and questions on a Notice and Wonderings Chart on their Student Activity Sheet. Have students discuss with a partner and then share out some of their ideas in a class discussion.

Suggested Prompts:

- What did you notice from that video?
- What are you wondering?
- What does this video have to do with what we've just learned about climate change and human causes?
- Do you think there's something we could do^A?

Listen for student responses that mimic the next step in the lesson, such as:

- *This video discussed how using food waste could be a solution to reducing the Greenhouse Gas: methane.*
- *We think we could look at the food waste at our school or across DPS and see what is being done or what we could do.*

2. (10 min) Next, show students the DPS key strategies slide. Shift to a Sharing Initial Ideas Discussion.

Suggested Prompts:

- What do these things have to do with carbon dioxide emissions?
- Are we doing any of these things at our school?
- What could we do in our school to help?

Listen for student responses that mimic the next step in the story line, such as

- *We think the things that involve vehicles have an impact on carbon dioxide emissions.*
- *We have seen recycling bins and other waste bins around school.*
- *Our heating system is unreliable.*
- *What does composting have to do with CO₂? We can easily turn off lights.*
- *We probably can't build solar panels.*



Teacher Supports & Notes



Staying on Task

A: Make sure throughout this discussion process to emphasize practicality. If someone says, 'I want to make sure everyone takes the bus to school', ask them how they would make sure the bus route goes to everyone's home, and how it would cost, emphasizing the difficulty and inefficiency of the process. The reason food waste was chosen is that it can change a lot through small tweaks of the current system.



3. (15 min) Introduce DPS solid waste plan and generate questions. We decided to focus on solid food waste aspect based on the video we started with. What can we do about solid food waste at our school? The solid waste plan talks a little bit about food scraps but we think there is more that can be done.

Suggested Prompts:

- Are we doing any of this stuff at our school (things described in the solid waste plan)?
- What are other ways we could reduce food waste at our school?
- If you want to solve a problem, what are some important things to know so that you can create an effective solution?
- What do we need to know in order to begin addressing food waste at school?
- What might we want to know in order to decide what solutions might be best?
- What do we know? What else might we need or want to know? Why?
- What questions do we have?
- Where might we obtain this information?

Listen for *student responses* such as, to build driving questions:

- *We are not composting. We are not recycling in the cafe or elsewhere. We need to take actions to reduce food waste at our school.*
- *In order to do that we need to do some background research to learn more about why food is wasted at our school and what might be done. We might also talk with people to figure out what is being done about food waste, what has been done, and gauge if people are interested in dealing with food waste in our school and why.*
- *We are wondering:*
 - ◆ *How does the food system create waste?*
 - ◆ *Why is food wasted?*
 - ◆ *Can we waste less in the first place?*
 - ◆ *Why do we need to reduce the amount of food waste that goes to landfills?*
 - ◆ *What does this have to do with emissions?*
 - ◆ *Do we have a recycling bin in the cafe?*
 - ◆ *How much do we waste?*
 - ◆ *Where is the waste generated?*
 - ◆ *Can we measure our food waste?*
 - ◆ *Is there a better use for food waste?*
 - ◆ *Who makes decisions that leads to food waste?*

Guide students to the design challenge of mitigating the impact of food waste on climate change while also considering how potential actions they could select might in turn affect aspects of the system and their own communities. Given this recognition, students might also consider how the effort of reducing food waste might also address social concerns at their school. Encourage questions that reference information, concerns, and insights that relate to what we have already learned. Encourage empowerment to change the system. Capture ideas on a Notice and Wondering Chart.



4. (10 min) Once students have had the opportunity to share their ideas on the Notice and Wondering Chart, categorize and prioritize the questions in order of importance.

Suggested Prompts:

- Can we group any of the questions together?
- Looking at our Driving Question Board, what do we need to answer first in order to make a feasible change? What do we need to know first? Why?
- What are the limits to this challenge?
- Are there limits to what we can do?
- Which solutions might be most appropriate given realities (social, cultural, political, institutional, actual and potential resource access, environment etc....) of our context?
- Given the actions we might take, what logistical considerations should we pay attention to (social, cultural, available resources, potentially available resources, institutional, perceptions, priorities etc...)?
- Where do we go next?

Listen for *student responses* that mimic the next row in the storyline, such as:

- *We are not composting. We are not recycling in the cafe or elsewhere. We need to take actions to reduce food waste at our school.*
- *We are wondering how the food system in our school works and think that would be a good place to start.*



Alignment With Standards

Building Toward Target NGSS PE

- **MS-ESS3-3:** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
- **HS-ESS3-4:** Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
- **HS-ETS-3:** Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

Building Toward Common Core Standard(s)

- **RST.11-12.7:** Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

