Food Waste Analysis
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Lesson Overview

The purpose of this lesson is to develop student understanding of the global economic and environmental impact of food waste through an individual analysis of their own habits concerning food waste.

Materials Included in this Lesson

- Global food waste Ted talk
- Food waste tracking worksheet
- Food waste carbon footprint calculator website
- List of possible wastes for anaerobic digester
- Explanation of how anaerobic digesters work
- Grading Rubric

Other Materials for this Lesson

- Poster supplies

After completing this lesson, students will be able to:

- Understand the importance of reducing global food waste.
- Analyze data and compare their individual food waste carbon footprints.
- Calculate possible % reduction in carbon footprint if they reduced their overall food waste and if remaining food waste went to a biodigester, became compost, or became pig food.
- Create a poster with a summary of their data, graphs showing their mathematical analysis, and a written conclusion.

Student Deliverables

- Complete discussion about Ted talk.
- Complete food waste worksheet.
- Poster about their findings.

Length of Lesson: 3 Classroom Days
(7-10 total days beginning to end)

Activity Day One

Introduction (50 min.)

Show food waste video. (15 mins)

http://www.ted.com/talks/tristram_stuart_the_global_food_waste_scandal?language=en#t-833189

While students are watching the video, have them take note of the different stages of food waste. After watching the video, students write their reflections using the following prompt. Teacher can go back to the video and discuss the graph (how to understand it, what it's significance is). (20 mins)

> What are the different stages of food waste that Tristram Stuart mentions (the biscuit example)? What stage are you able to affect directly? Do you think that you waste a lot of food or not much at all? What do you think should be done about the food waste problem on a global scale? What about on a local scale?

Introduce Food Waste Worksheet and explain their tasks. Do some examples from your own grocery list. (15 mins)

Preparatory Activities & Prerequisite Knowledge:

Basic algebra skills are required to perform some calculations, though simple division and multiplication composes the majority of the exercises.

Vocabulary (to be taught in lesson):

Anaerobic	Carbon footprint
Percent change	Feedstocks

Activity Day Two

Explain what an anaerobic digester is and explain how the digesters at Clean World work. Go over the carbon footprint of the digester and review the feedstock list. (20 mins) Teacher resources for day 2: http://www.cleanworld.com/technologies/products/aps-anaerobic-phased-solids-digester-system/

Classroom discussion (15 mins): Lead a classroom discussion about possible solutions to the food waste problem on a local scale (what are things that we as individuals can do and what are things that cities can do?) This should include mention of cities using biodigesters for household food waste and

food waste from restaurants and stores.

Introduce Analysis assignment (15 mins): Go over their assignment (the analysis worksheet and the poster). They will have 2 days to complete it.

Enrichment Suggestions

Students can do further research about the food waste footprint of their city.
Teacher can offer extra credit to students who also collect data on the production and transportation emissions (from the website below) and include graphs representing this data on their poster.
Students should also include this extra information in their conclusion in order to receive extra credit.

Student Resources

Food emissions calculator: http://www.foodemissions.com/foodemissions/Calculator.aspx
Students will use this to calculate their food waste carbon footprint.

Common Core Academic Standards

- 11-12.9. Draw evidence from informational texts to support analysis, reflection, and research. (A8.0)
- **Numbers and Quantity A.1:** Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and origin in graphs and data displays.
- **Numbers and Quantity A.2:** Define appropriate quantities for the purpose of descriptive modeling.
- **Statistics and Probability**: 6) Evaluate reports based on data (A2.0, A8.0)

CTE Pathway Standards

E5.0 Students understand the design process and how to solve analysis and design problems:
- E5.1 Understand the steps in the design process.
- E5.2 Determine what information and principles are relevant to a problem and its analysis.
- E5.3 Choose between alternate solutions in solving a problem and be able to justify choices in determining a solution.
- E5.4 Translate word problems into mathematical statements when appropriate.
- E5.5 Understand the process of developing multiple details into a single solution.

Lesson Plan Relevance To Externship

Students will learn about how anaerobic digesters work and how they can help minimize the food waste footprint. At my externship, I learned about the carbon footprint and reusable output of anaerobic digesters. Students will learn about this in the classroom on day 2 and will understand the significance of using anaerobic digesters during their analysis.

Rubric for the Final Poster

Student Deliverables	A. Data collection (worksheets)	B. Graphical representation of data	C. Written conclusion and reflection
Not Proficient	Student is missing most data and calculations.	Graphs are missing, are not nicely presented, or are very inaccurate.	Conclusion is minimal in depth and breadth. Student does not demonstrate understanding of the food waste issue.
Basic	Student collected minimal data and did not accurately calculate percent change or food waste emisions.	Graphs are missing a key, don't have appropriate labeling, or don't accurately represent data in a relevant way.	Conclusion is not very thorough and demonstrates some student understanding of the food waste issue, their role in it, and possible solutions.
Proficient	Student accurately collected data on their worksheets and correctly calculated the percent change at each stage of their data collection	Graphs are nicely presented with a clear key and appropriate labeling. Graphs accurately represent data in a way that is relevant to the food waste issue.	Conclusion is thorough and demonstrates student understanding of the food waste issue, their role in it, and possible solutions.
Advanced	Student accurately collected data on their worksheets and correctly calculated the percent change at each stage of their data collection. Student goes beyond the scope of the project by including data about production and transportation emissions.	Graphs are nicely presented with a clear key and appropriate labeling. Graphs accurately represent data in a way that is relevant to the food waste issue. Student goes beyond the scope of the project to include graphical representation of data from other aspects of the food process (transportation, production, etc).	Conclusion is thorough and demonstrates student understanding of the food waste issue, their role in it, and possible solutions. Goes beyond the scope of the project to include a discussion about different aspects of the food waste issue (such as production emissions, transportation emissions, etc).

Food Waste Worksheet

Complete this worksheet for your entire household. You will probably have to ask your parents/guardians for help.
What is your typical weekly grocery list?

Food item (ex: milk, cheese, cereal, bread, etc)	Amount purchased (ex: gallon, 2 bags, 3 lbs)	Store purchased from	Amount thrown out (ex: all, half, etc)

List any other food not purchased from a grocery store (ex: fast food, restaurants)

Food item (ex: burger, salad, chips)	Amount purchased	Place (ex: McDonald's, Restaurant name)	Do you finish all of it? If no, how much do you leave?

Food Waste Footprint Analysis Worksheet

Use the Food Waste Worksheet that you filled out already and this website: http://www.foodemissions.com/foodemissions/Calculator.aspx to calculate your food carbon emissions.

Food item (ex: milk, cheese, cereal, bread, etc)	Amount purchased (ex: gallon, 2 bags, 3 lbs)	Store purchased from/Place	Amount thrown out (ex: all, half, etc)	Emissions (Food Waste)

Total emissions: _____ Kg of CO2e

There are lots of ways to cut down the amount of food wasted. Individuals can compost organic food waste and also use food before it goes bad. Cities can implement a food waste program to process all food waste through biodigesters. With these possible solutions in mind, make adjustments to your own waste and compare emissions.

Food item (ex: milk, cheese, cereal, bread, etc)	Amount purchased (ex: gallon, 2 bags, 3 lbs)	Amount thrown out (ex: all, half, etc)	Emissions (Food Waste)	Adjusted amount purchased	New level of food waste	New Emissions (Food Waste)

Total of new emissions: _____ Kg CO2e

What was the percentage decrease in emissions?

Which of the food items can be processed by a biodigester?

Subtract the emissions for each of those foods from the new emissions total. What is the adjusted emissions? _____ Kg CO2e

What is the new percentage degrease in emissions?

Poster:

Create a poster that is at least 3' by 2'. The poster must include:

-All of your data (the worksheets), written nicely and legibly.
-Graphical representation of your data (specifically, the graphs should compare the total emissions for each stage of your analysis and the percentage decreases).
-A written conclusion and reflection. This must be at least 500 words.

CleanWorld

Alive with possibilities

Acceptable Feedstock

Consumer Food Waste	• Fruits and vegetables* • Meat, poultry, and seafood* • Coffee grinds/filters and teabags • Grains (rice, pasta, and bread)* • Bakery items* • Dairy

Agricultural	• Perennials
	  ○ Grass
	  ○ Herbs
	• Floral waste
	• Yard/Garden waste**
	• Livestock waste
	  ○ Feed
	  ○ Bedding
	  ○ Manure
	• Straw
	• Rodents
	• Spent chicken products
	• Wastewater

Liquids	• Fats, oils, and greases • Dairy products and waste • Fructose syrup
Food Processing	• Sugar • Starch • Protein • Brewery grain • Draff • Citrus feed • Packaged ingredients • Concentrates

Dining Waste	• Food soiled paper
	• Soiled cardboard (pizza boxes, paper cups, etc.)
	• Biodegradable plastic (PHA and PHB)***
	  ○ Bioware
	  ○ Dinnerware
	  ○ Packaging

*Raw, frozen, dehydrated, cooked, rotten, and leftover

**No woody materials (stumps, sticks, or branches)

***Excludes Polylactic Acid (PLA) based materal