



Caring for Cows & Nourishing Communities



CONVERTING POOP TO POWER

Overview: In this lesson, students will examine how dairy farmers and scientists are engaging in sustainable farming practices to create energy and other renewable products. They will work with a group to read an article and investigate the benefits of converting cow manure and other unexpected items into energy. They will then evaluate the different opportunities gained by recycling manure and characterize the renewable byproducts created through an annotated drawing. Finally, they will discuss their diagrams through a Socratic Seminar using higher order thinking questions, including a discussion regarding how these practices might work in and benefit their own community.

Suggested Time: Five 45-minute classroom sessions

Grade Levels: 5-8

Objectives

- Students will work collaboratively in groups to read, annotate, and summarize a non-fiction (informational) text.
- Students will examine how dairy farmers are engaging in sustainable farming practices to create energy and other renewable products.
- Students will create a drawing to characterize renewable products.
- Students will examine classmates' annotated drawings and provide feedback through a gallery walk.
- Students will discuss their work with peers and consider higher level questions regarding the environment and their communities.

Standards


Next Generation Science Standards

MS-LS2-3 Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

MS-ESS3-3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

Common Core ELA Standards

CCSS.ELA-LITERACY.RI.2 Determine a central idea of a text and how it is conveyed through particular details; provide a summary of the text distinct from personal opinions or judgments.



CCSS.ELA-LITERACY.RI.7 Integrate information presented in different media or formats (e.g., visually, quantitatively) as well as in words to develop a coherent understanding of a topic or issue.

CCSS.ELA-LITERACY.RI.10 By the end of the year, read and comprehend literary nonfiction in the grades 6–8 text complexity band proficiently, with scaffolding as needed at the high end of the range.

CCSS.ELA-LITERACY.SL.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly.

CCSS.ELA-LITERACY.SL.1.A Come to discussions prepared, having read or studied required material; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion.

CCSS.ELA-LITERACY.SL.1.B Follow rules for collegial discussions, set specific goals and deadlines, and define individual roles as needed.

CCSS.ELA-LITERACY.SL.1.C Pose and respond to specific questions with elaboration and detail by making comments that contribute to the topic, text, or issue under discussion.

CCSS.ELA-LITERACY.SL.1.D Review the key ideas expressed and demonstrate understanding of multiple perspectives through reflection and paraphrasing.

Materials

- Copies of the following articles for students to read and annotate:
 - [Digesting manure and recycling food waste to keep the family farm running](#)
 - [Turning cow poo into power is profitable for US farm](#)
 - [Dairy barn implements poop-to-power system](#)
 - [How These Farms Are Working to Fight Food Waste](#)
- Copies of Informational Text Handout, one per student

Procedure

Class 1

Before class begins, hang the Agree/Disagree signs on the walls of the opposite side of the room.

1. Introduce the topic by reading each of the Take a Stand statements and ask students to travel to the side of the room that best represents their thoughts/feelings on the statement. If a student is not sure or has a neutral stance, he/she should stand toward the middle of the room.



2. After students are settled in their places, call on 3–4 students to share their reasoning with the class before reading the next statement. Repeat this for all statements.
3. Ask students to take their seats and explain that today they will be reading an informational text that focuses on sustainable farming practices.
4. Arrange students into groups of four students and distribute one of the articles to each of the groups. (Since there are four articles, one fourth of the class will read each text).
5. Explain to students that they will be using the [“chunking”](#) method to read and annotate their article as a group.
6. Use an example article to model the chunking method for the class, creating smaller sections of the text where it seems logical.
7. Provide students a few minutes to “chunk” their articles in preparation for the next session.

Class 2

Before students arrive, project or write the following question on the board, “What is the relationship between *farming* and *science*?”

1. Ask students to take 3–5 minutes to answer the question in their notebooks or on a sheet of paper.
2. Select 3–4 students to share their responses with the class.
3. Tell students that today they will be spending some time examining this question further as they work with their groups to read and understand an article about sustainability in farming.
4. Review the concept of “chunking” an article to help with understanding.
5. Direct students to join their groups; distribute the Informational Text Handout, one per student.
6. Provide the remainder of the period for students to read and “chunk” the assigned article.

Class 3

1. As students are entering the room, project or write the following question on the board: “Consider the following statement: ‘A picture is worth a thousand words.’ What does this phrase mean to you?”
2. Ask students to take 3–5 minutes to answer the question in their notebooks or on a sheet of paper.
3. Select 3–4 students to share their responses with the class.
4. Explain that today, students will spend the session creating an annotated drawing to communicate how manure or farm waste is being converted into energy. An annotated drawing is an illustration that is labeled with text to explain key points in the picture.



5. Ask students to take out a sheet of paper and provide students five minutes of individual brainstorming time before allowing them to meet with their groups to brainstorm their final drawings.
6. Instruct students to break into their groups and set a time for each group member to share his/her drawing and begin a rough draft of a group drawing.
7. After teacher approval, groups may begin a final draft of their drawing on a piece of chart paper. Remind students to copy their group's source and their names on the poster.

Class 4

1. As students are entering the room, instruct them to hang the final draft of their posters on the wall, then have a seat with their group members.
2. Distribute the Annotated Drawing Feedback Form, one per student (these will be cut in half).
3. Separate students into their reading groups, then allow students time to evaluate and provide feedback for three of their peers' posters.
4. When the gallery walk is complete, instruct students to begin the homework in preparation for tomorrow's activity: a Socratic Seminar. For homework, students should respond to the following questions in their notebooks:
 - a. What did you learn by examining the ways that farmers recycle and create energy?
 - b. How can energy created by recycled waste and manure help the environment?
 - c. Was there anything that surprised you about what you read?
 - d. Who should be responsible for maintaining a healthy environment?
 - e. How can we use what we learned this week to benefit our own community?

Class 5

Before students enter the room, arrange the chairs into two circles, one inner and one outer, with an equal number of chairs in each circle.

1. Arrange students into two groups—one inner circle and one outer circle.
2. Review the Expectations for a Socratic Seminar with the class.
3. Encourage student discourse during the discussion by asking follow-up questions.
4. After 15 minutes, ask the inner and outer circles to switch places, then continue the discussion.
5. After the discussion is complete, ask students to complete the Socratic Seminar Reflection form and submit before dismissal.



Take a Stand Statements

1. A healthy environment is vital to human life.
2. It is everyone's responsibility to maintain a healthy environment.
3. Humans are still finding new ways to create electricity.
4. I feel worried about the future of our planet.
5. One person can make a difference in maintaining a healthy environment.



Agree



Disagree



Informational Text Handout

Directions: Work with your group to read and analyze the article provided by your teacher. Use the “chunks” you created yesterday to make meaning from the text by paraphrasing each section in your own words. Depending on how many chunks you created, you may not need to use every box in the organizer.

Source/Name of Article:

Chunk/Section	Paraphrased text (in my own words)
1	
2	
3	
4	
5	
6	
7	



Annotated Drawing Feedback Form

Group Members	Title of Article	Positive Feedback	Areas for improvement

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Socratic Seminar Review¹

A Socratic Seminar is...

- Collective inquiry
- Collaborative
- An exchange of ideas
- An enlarged, shared understanding of ideas, issues, or values through dialogue

A Socratic Seminar is **NOT**...

- A debate
 - A competition
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Guidelines for a successful Socratic Seminar:

1. Refer to the text during the conversation.
2. Ask for clarification.
3. Listen carefully.
4. Take turns speaking.
5. Talk to each other, not the facilitator (teacher).
6. Discuss ideas rather than opinions.
7. Only the inner circle talks—outer circle takes notes.
8. Speak loudly and clearly.
9. Be responsible for the conversation!

¹Socratic Seminars International



Socratic Seminar Follow-up Questions²

Why do you say that?

What do you mean by that?

How does the text support your answer?

Can you tell us more?

What do you think about ____?

How do you think _____ would be viewed by _____?

How does this idea connect to ____?

Does the text agree or disagree with this statement?

What is puzzling you?

What did your classmate just say? Can you paraphrase his/her idea?

How does this idea connect to ____?

What if ____ happened?

²Socratic Seminars International



Socratic Seminar Reflection Form

Answer the following questions regarding today's discussion:

Did you participate in today's seminar? Why or why not?

How did your thinking change as the seminar progressed? What new ideas have you gained as a result of the discussion?

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