STUDENT GUIDE
EXPLAIN 1 LESSON 9

Food and Agriculture Center for Science Education

Part 1: Our Motivation

Record what we were trying to explain that led to this investigation.

At the end of Lesson 8, we understand that cows emit methane when they burp, but now we know that humans also contribute to high levels of greenhouse gases like CO_2 In the atmosphere.

Questions that led to this investigation are:

- How does methane from cow burps tied to changes in temperatures and climate change?
- What is climate change?
- Where does the methane in cow burps go in the atmosphere? What does it do?

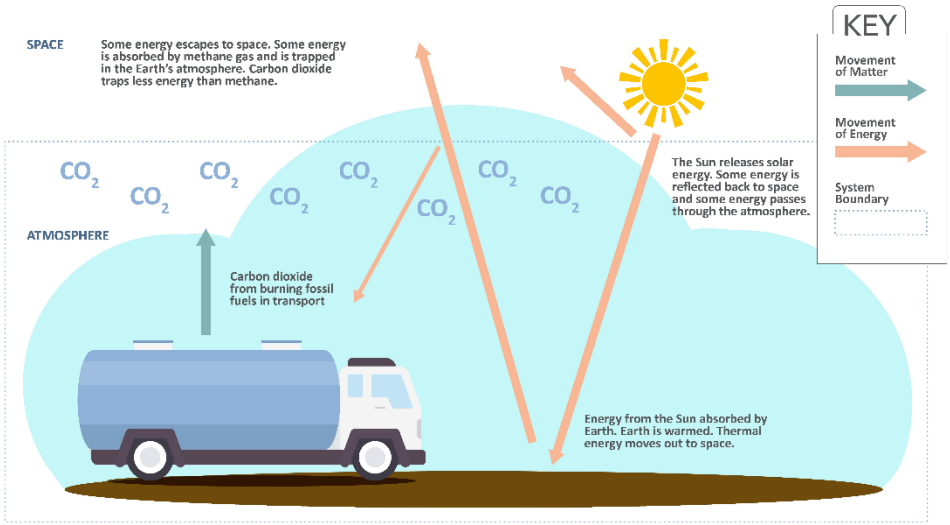
Part 2: Revisiting Initial Models

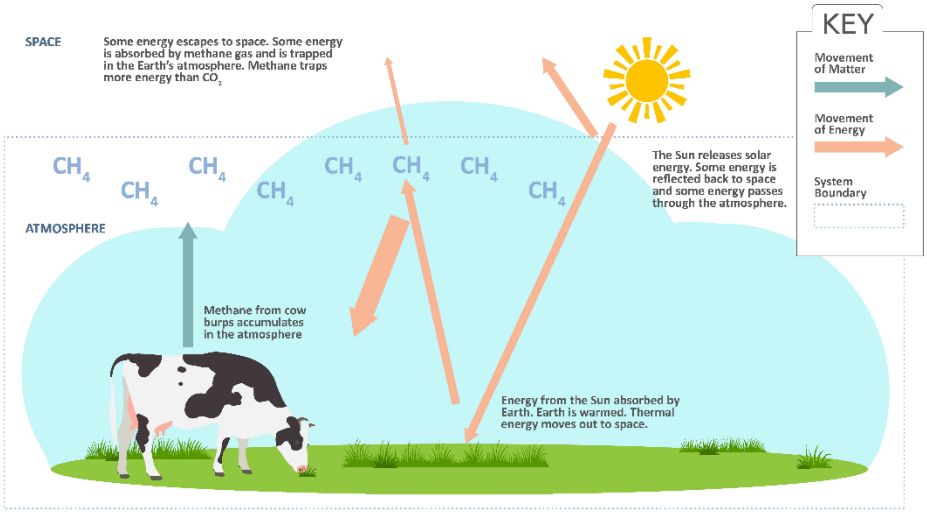
Revise your initial model that shows how you would currently answer our Module Question, "*How could cow burps be influencing climate change*?" In your model, be sure to utilize images, icons, and pictures to visually represent what is happening in the atmosphere.

Be sure to describe:

- How you are defining your system and its boundaries.
- How you think greenhouse gases influence climate via the greenhouse effect.
- How the movement of matter (carbon dioxide and methane) differs from the movement of energy.

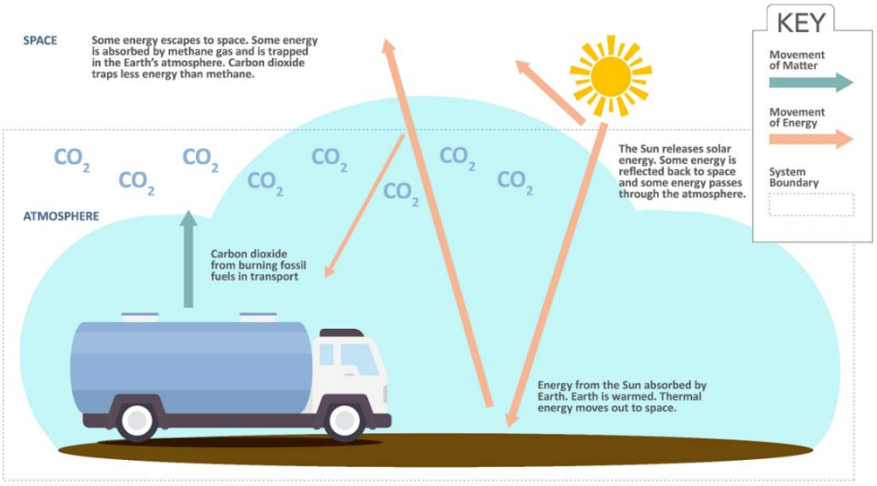
Draw a copy of your model in the space below.

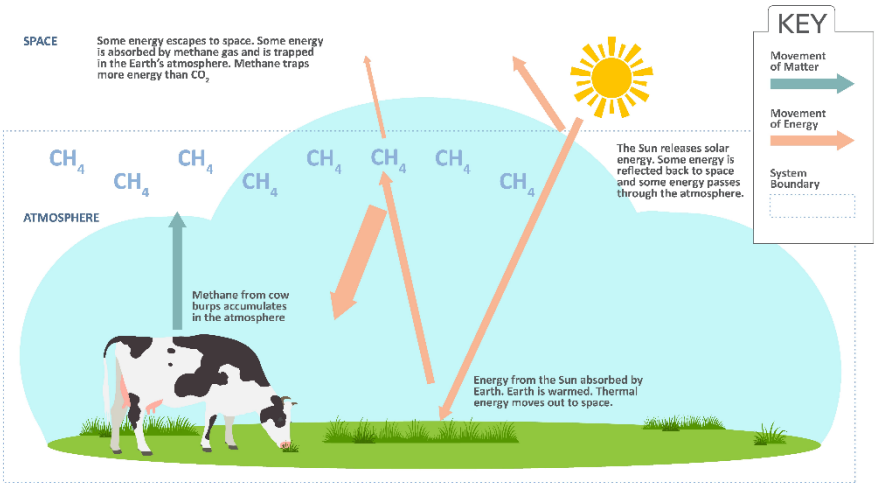




Part 3: Class Consensus Model

Use this space to record new ideas you gained from the class discussion.





The dairy system and its emissions can contribute to climate change, namely the increase in average temperatures. Earth is warmed by solar radiation. This solar radiation warms the planet, which then gives off thermal energy. The thermal energy is trapped in the atmosphere, which is the atmospheric temperature we feel. Greenhouse gasses like carbon dioxide and methane play a role in trapping heat in the atmosphere. Global GHG concentrations have increased over time, particularly since the Industrial Revolution, due to human activity emitting fossil fuels into the atmosphere. An increase in GHG concentrations in the atmosphere causes the average surface temperature of Earth to rise. If the input of electromagnetic energy is not balanced with the output of thermal energy in Earth's system, then the temperature will rise. Carbon dioxide from transportation in the dairy system and methane from cow burps move into the atmosphere. These greenhouse gasses prevent thermal energy from the Earth from exiting the Earth system, which will raise the temperature.

?? Part 4: Asking New Questions

Record new questions you have that might help you:

- Find additional information about how the dairy system impacts the environment.
- "Fill in a gap" in your model or our class model.
- Settle an area of disagreement that we've identified in our models.

- Do human activities or cow burps contribute more to greenhouse gases in the atmosphere?
- Throughout history, what has caused more greenhouse gases in the atmosphere: humans or cow burps?
- What are the other parts of the dairy system that lead to climate change?
- Is there more carbon dioxide or methane in the atmosphere?
- Which is worse for the atmosphere, carbon dioxide or methane?
- Is there any way to get rid of greenhouse gases in the atmosphere?