What are Greenhouse Gases and what can we do about them?



# Summary

1. Subjects: Greenhouse gases, carbon cycle, human solutions
2. Topic or Unit of Study: Climate Change/Global Warming
3. Grade/Level: Middle School (written for 7th Grade)
4. Objective:

**I can identify the main sources of greenhouse gases that are added to the atmosphere through human use and argue for alternative activities that will reduce greenhouse gases.**

Time Allotment: 55 minutes

# Implementation

## Learning Context

This lesson comes second in a unit on climate change, following a unit opener where students are introduced to anthropogenic global warming with anecdotal and graphical evidence and they learn about how climate change is affecting the balance of ecosystems. They have seen the graph comparing the rise of average global temperatures and added greenhouse gases, but have not gone into depth about how greenhouse gases get into the atmosphere or why we use them.

Following this lesson students will learn about renewable energy technologies and continue to a schoolwide awareness campaign.

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## Procedure

1. Anticipatory Set (5 min.)
	1. Show “The Carbon Cycle” video set to “The Circle of Life” from *The Lion King.*
	2. Hand out Greenhouse Gases Note Sheets (1 per student) and have them draw a sketch showing the natural carbon cycle
2. Direct Instruction - students take notes on slideshow with discussions and activities as noted (20 min.)
	1. Discuss diagram showing current carbon cycle
		1. Why are there bi-directional arrows on land and sea?
		2. What two processes add carbon to the atmosphere without taking any away
	2. Revisit global temperatures vs. extra greenhouse gases graph - think pair share
		1. What conclusions can we make? (lead discussion to connection between added greenhouse gases and global temperature rise)
	3. Follow rest of slide show (including embedded Fossil Fuels video) with students taking notes so students understand
		1. Where carbon dioxide and methane come from
		2. The human activities that contribute the largest percentage of gases into the atmosphere
		3. Connections between their daily lives and greenhouse gas use
3. Guided Practice
	1. Activities embedded in the slide show:
		1. Identifying places in the classroom where electricity is used with post-it notes
		2. Identifying kinds of transportation that use fossil fuels
		3. Connecting a meat-heavy diet with increased methane use
4. Check for Understanding - Think-Pair-Share embedded in the activity
5. Independent Practice (20 min.)
	1. Professional Scientist Role Play (1 sheet per group of 4 students) - students work in groups of 4 to identify the most problematic human activites for greenhouse gas emissions, no-tech, low-tech and high-tech ways to adress those needs, and make an argument for an area that needs more research in order to find a low-emissions solution to a human need.
6. Closing (10 min.)
	1. Groups share out their argument for more research, other groups have the opportunity to give feedback

# Materials & Resources

1. Instructional Materials:
	1. Computer with Projector and internet access
	2. Greenhouse Gases Slideshow <https://docs.google.com/presentation/d/1J1saz2OGhDaPnjmOWffpZk4bI6n1zfq2-n1tg16Sbsw/edit?usp=sharing>
	3. Greenhouse Gases Notes Sheet (1 per student) <https://docs.google.com/document/d/1m6k2YhCrq3FRzTKlGGk-tn1ZU6EjWIuKmYFCrSrszIw/edit?usp=sharing>
	4. Climate Scientists Role Play Sheet (1 per group of 4 students) <https://docs.google.com/document/d/1MgcSeXTd5IVv7Z57u7PCb_KdMETuaP-4fPY1dGsAnZo/edit?usp=sharing>
2. Resources:
	1. “The Carbon Cycle or The Circle of Life” video, by Melissa Landeen <https://www.youtube.com/watch?v=4vJ_1ojjlxw&list=PLYEYPYfZ-buebjcoAYqSWoLXgma3p3UAG&index=1>
	2. “Fossil Fuels 101” video, by Student Energy <https://www.youtube.com/watch?v=zaXBVYr9Ij0>

# Assessment

Think-Pair-Share responses as well as group work will serve as informal assessments for student understanding.

