

Methane and Climate Change

Description:

Methane is one of the most powerful greenhouse gases, but it is often overlooked next to carbon dioxide. Students explore some of the largest sources of human-caused methane emissions and consider how they are measured and how decision-makers can reduce emissions.

Skills & Objectives

SWBAT

- Know what some of the major sources of methane emissions are
- Understand some of the challenges associated with measuring methane emissions
- Explain why methane is an important gas associated with climate change

Skills

- Reading and discussing technical and non-fiction writing
- Critical thinking
- Graph and map reading

Students Should Already Know That

- Certain gases, such as carbon dioxide and methane, act as parts of a heat-trapping blanket in Earth's atmosphere, heating Earth and changing the climate.

Standards Alignment:

HS-ESS3-4 Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

RST.9-12.2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text.

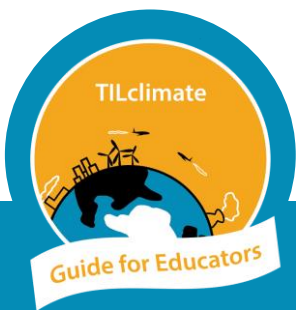
WHST.9-12.7 Conduct short as well as more sustained research projects to answer a question or solve a problem.

Disciplinary Core Ideas:

ESS3.A Natural Resources

ESS3.C Human Impacts on Earth Systems

ESS3.D Global Climate Change



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How To Use These Activities:



Pages with the circular “TILclimate Guide for Educators” logo and dark band across the top are intended for educators. Simpler pages without the dark band across the top are meant for students.

Each of the included activities is designed to be used as a standalone, in sequence, or integrated within other curriculum needs. A detailed table of contents, on the next page, explains what students will do in each activity.

A Note About Printing

All student pages are designed to be printable in grayscale.

The worksheets do not leave space for students to answer questions. Students may answer these questions in whatever form is the norm for your classroom – a notebook, online form, or something else. This allows you, the teacher, to define what you consider a complete answer.

Share with us! We would love to hear any podcasts or see any other projects you or your students create! Email us at tilclimate@mit.edu, tweet us @tilclimate, or tag us on Facebook @climateMIT.



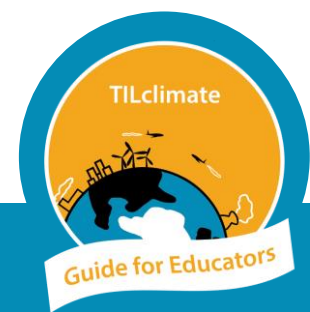
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Detailed Table of Contents

Page	Title	Description	Time (min)
	Podcast Episode	Students listen to TILclimate: How tackling methane cools the planet fast, either as pre-class work at home or in the classroom. https://climate.mit.edu/podcasts/how-tackling-methane-cools-planet-fast	10-15
1-3	Sources of Methane	Students read about the major sources of methane and some techniques used to measure it. Then, splitting into pairs or groups, they focus on one of the three largest anthropogenic sources of methane.	20-30
4-5	Sources and Solutions: Agriculture	A small group of students focuses on sources of methane from agriculture and discusses solutions.	30+
6-8	Sources and Solutions: Fossil Fuels	A small group of students focuses on sources of methane from fossil fuel exploitation and discusses solutions.	30+
9-10	Sources and Solutions: Waste and Landfills	A small group of students focuses on sources of methane from solid waste and wastewater and discusses solutions.	30+
11	Sources and Solutions: Bringing It Together	Small groups remix and teach one another about the three major methane sources.	20-30
12-14	Fugitive Emissions	Students read articles about two different efforts to map fugitive methane emissions. These articles could be assigned to different groups or used for a compare/contrast writing assignment.	20-30



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Methane Emissions

This Educator Guide includes a data investigation and readings. Educators may pick and choose among the pieces of the Guide, as suits their class needs.

Parts of this Guide may align with the following topics:

- Physical science: Methane vs other gases as heat-trapping agents in the atmosphere.
- Life/environmental science: Effects of methane, agricultural impacts.
- History/social science: Data needs for policy.
- ELA/nonfiction: Comparing and contrasting two pieces of nonfiction writing.

MIT Resources

We recommend the following as resources for your own better understanding of climate change or as depth for student investigations. Specific sections are listed below:

- Climate Science, Risk & Solutions, an interactive introduction to the basics of climate change. <https://climateprimer.mit.edu/>
Chapter 02 The greenhouse effect and us
- MIT Climate Portal Explainers are one-page articles describing a variety of climate topics. New Explainers are posted monthly. <https://climate.mit.edu/explainers>
Greenhouse Gases
Heating and Cooling
- MIT professors can answer your and your students' questions about climate change! Submit your questions or see other answers at <https://climate.mit.edu/ask-mit-climate>



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Wrap-Up Discussion Questions

- Why is methane such a challenge to measure?
- Why is it important that we measure methane?
- Do scientists have all the tools we need to answer the questions we have?
- What other tools, data, or information do decision-makers need to dramatically reduce methane in the next few decades?

Climate Solutions

Climate solutions can be thought of as falling into four categories outlined below. Across all categories, solutions at the community, state or federal level are generally more impactful than individual actions. For example, policies that increase the nuclear, solar and wind mix in the electric grid are generally more effective at reducing climate pollution than asking homeowners to install solar panels. For more on talking about climate change in the classroom, see “How to Use This Guide”.

•Energy Shift

How do decision-makers make the switch from carbon-producing energy to carbon-neutral and carbon-negative energy?

•Energy Efficiency

What products and technologies exist to increase energy efficiency, especially in heating and cooling buildings?

•Adaptation

How can cities and towns adapt to the impacts of climate change?

•Talk About It

Talking about climate change with friends and family can feel overwhelming. What is one thing you have learned that you could share to start a conversation?

What solutions are the most exciting in your classes? We would love to hear from you or your students! Images, video, or audio of student projects or questions are always welcome. Email us at tilclimate@mit.edu, Tweet us @tilclimate, or tag us on Facebook @climateMIT.

