

Today I Learned About Nuclear Power

Description:

The use of nuclear power is controversial in some places, and commonplace in others. How do we estimate risk when making choices about how to generate energy? What are the effects of those choices? Through a series of activities, students learn about risk perception and investigate real data about the intersection of energy use, energy production, and carbon dioxide emissions around the world.

Skills & Objectives

SWBAT

- Explain what risk perception is.
- Explain which energy sources carry the highest risk for fatalities and emissions.
- Understand that different countries have made choices about the use of nuclear and other energy sources. Those choices have affected carbon dioxide emissions and other factors in each of those countries.

Skills

- Prediction
- Reading and interpreting graphs
- Communication

Students Should Already Know That

- Various energy sources come with different emissions and pollution profiles.

Standards Alignment:

HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions

HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs

RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media

RST.11-12.9 Synthesize information from a range of sources into a coherent understanding of a process, phenomenon, or concept

HSS-IC.B.6 Evaluate reports based on data.

Disciplinary Core Ideas:

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/Materials

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.

Social-Emotional Learning

Both risk-assessment activities have the potential to be challenging conversations, as they deal with accidental death. Consider how to frame either activity with your students to support social-emotional and trauma-informed learning. For more on discussing difficult issues in the classroom, consult the “How to use TILclimate Educator Guides” document that can be found on the same website where you found this Guide, or at <https://climate.mit.edu/sites/default/files/2021-08/How%20to%20Use%20TILclimate%20Educator%20Guides.pdf>

Podcasts in the Classroom: Throughout these Guides for Educators, we invite students to think about how they would share their learning with family and friends. One way to do this is to encourage your students to create their own podcasts - they're shareable, creative, and have multiple options for embedded assessment. 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.



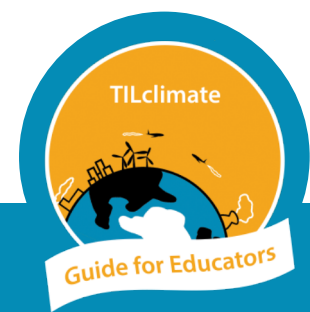
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Detailed Table of Contents

Page	Title	Description	Time (min)
	Podcast Episode	Students listen to TILclimate: TIL about nuclear power, either as pre-class work at home or in the classroom. https://climate.mit.edu/podcasts/e6-til-about-nuclear-power	10-15
1	Risk Perception: Cognitive Biases	Reading: Students are introduced to three common cognitive biases that may affect risk perception.	5-10
		Choose one or the other of the following risk perception activities. See note on previous page about Social-Emotional Learning.	
2-3	Risk Perception: Emissions & Safety	Worksheet: Students read about emissions and fatalities associated with various energy production methods. Based on data, they consider which forms of energy are the riskiest.	15-20
4-5	Risk Perception: Odds of Fatality	Worksheet: Students rank their perception of the risk of fatality associated with various non-medical activities, and then consider real data and how their perception of risk may have formed.	15-20
6-9	Nuclear Power: Global Choices (internet required)	Students investigate the energy use, energy mix, and CO ₂ emissions of one of five countries around the world. Then, in teams, they compare the five countries and discuss how these factors influence one another and how countries make energy choices. Alternatively, each student could investigate two countries and write an essay comparing and contrasting them.	30-45+



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Season 2 Collection

Season 2 of TILclimate from MIT covers a series of interrelated energy subjects. The associated teacher guides are structured for maximum flexibility. Each episode's activities could be done as a whole class or as small-group work while other teams work on other topics and share back in a jigsaw. Some activities also can be enrichment or homework, and many as asynchronous assignments for remote work. Activities of similar length could also be set up as rotating stations, with a group discussion at the end of class.

- Introductory activities are quick (15-25 minutes) and require no internet.
- Dive Deeper activities are longer (30-60 minutes) and require internet access.

The City of the Future overall project is flexible in terms of time, space, and materials. It will be engaging whether students have completed all activities in the collection, or just one. If teams of students have been working on one topic each, the City of the Future process will help them share their learning with the rest of the class.

Nuclear Power

This Educator Guide includes readings, worksheets, and data investigation. 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: Nuclear fusion, energy production and use.
- Life/environmental science: Climate change, international climate agreements.
- History/social science: History of nuclear use, international agreements.
- ELA/literature: Fictional texts related to nuclear use.
- ELA/nonfiction: Comparing and contrasting technical data.

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
 - Chapter 07 Understanding risk
 - Chapter 10 What can we do?
- MIT Climate Portal Explainers are one-page articles describing a variety of climate topics. <https://climate.mit.edu/explainers>
 - Nuclear Energy
 - Greenhouse Gases



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Wrap-Up Discussion Questions

- Which cognitive biases do you think affected your risk perception?
- When local, state, and federal leaders are making decisions about how to produce energy, what factors do you think they include?
- Why is it important to use 'per capita' data when comparing countries?
- What is the relationship between per capita energy use, energy mix, and carbon dioxide emissions?
- Based on what you have seen so far, what do you predict will happen with energy mix, energy use, and CO₂ emissions in each of these countries over the next 20 years?
- What other questions do you have about nuclear power? How would you investigate these questions?

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.

