

RENEWABLE & NONRENEWABLE ENERGY SOURCES & THEIR IMPACTS

FOURTH GRADE SUSTAINABILITY THEMED UNIT PLAN



Content Creator: Sydney Lund
Master of Sustainability Leadership
LinkedIn: [linkedin.com/in/sydney-dv-lund](https://www.linkedin.com/in/sydney-dv-lund)
Website: sydney-lund.jimdosite.com
sydneylund21@gmail.com



SUSTAINABILITY FOR
YOUNG LEARNERS
COURSES

TABLE OF CONTENTS

Introduction

Standards	1
Desired Results	2
Materials Needed	3

Lesson Plans and Teacher Resources

Lesson #1: Vocabulary Words and The Story of a Spoon Video	4
Lesson #2: Coal and Oil	6
Lesson #3: Gas and the Environmental Cost of Using Nonrenewable Resources	8
Lesson #4: Climate Effects of Burning Fossil Fuels – Introduction to Solar, Wind, and Hydropower	10
Lesson #5: Reducing Our Use of Nonrenewable Resources	11
Teacher Resources	13

Student Worksheets

Renewable and Nonrenewable Energy Sources	15
Renewable and Nonrenewable Energy Sources: What it is and how we use it	17
Renewable and Nonrenewable Energy Sources: Climate solution	18
Class pledge	20

Appendixes

Appendix #1: “The Story of a Spoon” Visual Representation	21
Appendix #2: The Story of Fossil Fuels, Part 1-4, NASA Climate Kids	22

STANDARDS

MAIN STANDARDS

4-ESS3-1: Earth and Human Activity - Obtain and combine information to describe that energy and fuels are derived from natural resources and that their uses affect the environment.

[Clarification Statement: Examples of renewable energy resources could include wind energy, water behind dams, and sunlight; non-renewable energy resources are fossil fuels and fissile materials. Examples of environmental effects could include loss of habitat due to dams, loss of habitat due to surface mining, and air pollution from burning of fossil fuels.]

SS3.A (4-ESS3-1): Disciplinary Core Ideas: Natural Resources - Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not.

STANDARD CONNECTIONS

4-ESS3-2: Constructing Explanations and Designing Solutions - Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution.

Literacy Common Core Standards Connections: RI.4.1 Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text. (4-ESS3-2)

DESIRED RESULTS

OBJECTIVE

Students will learn that energy can either come from a renewable or nonrenewable source and learn about the effects that burning fossil fuels has on our planet. Students will learn about potential solutions to not burning/using as many fossil fuels in their own lives.

ESSENTIAL QUESTIONS

1. What is a renewable source?
2. What is a nonrenewable source?
3. How does burning nonrenewable energy sources affect our environment?
4. What are some solutions to not using fossil fuels?

FACTUAL KNOWLEDGE

Students will learn:

1. That nonrenewable resources are limited and finite.
2. That renewable energy sources are sustainable and infinite.

PROCEDURAL KNOWLEDGE

Students will be able to:

1. Identify different ways that they can reduce their use of new renewable energy sources.

CONCEPTUAL KNOWLEDGE

Students will understand:

1. That burning/using fossil fuels is one of the many causes of climate change.

PERFORMANCE TASK

Students will complete a final project worksheet. The worksheet will include:

1. Different types of renewable and nonrenewable energy sources.
2. An explanation of renewable and non-renewable energy sources.
3. A paragraph explaining how the student can reduce their usage of fossil fuels and/or energy consumption.

MATERIALS NEEDED

Material	Lesson and Activity
Renewable and Nonrenewable Energy Sources – Student Worksheet <ul style="list-style-type: none"> One copy (front and back) per student 	Lesson #2, Activity 1.2 and 2.2 Lesson #3, Activity 1.2 Lesson #4, Activity 3
Renewable and Nonrenewable Energy Sources: What it is and how we use it – Student Worksheet <ul style="list-style-type: none"> One copy per student 	Lesson #4, Activity #1
Renewable and Nonrenewable Energy Sources: Climate Solution – Student Worksheet <ul style="list-style-type: none"> One copy (front and back) per student 	Lesson #5, Activity 2.1
“We Pledge to” – Printout <ul style="list-style-type: none"> One copy for the whole class 	Lesson #5, Activity #3
PowerPoint - Fully created PowerPoint outlining all of the information within the lesson, including the vocabulary words, links to all videos, photos, and screenshots of the in-class worksheets.	Lessons #1-5

LESSON #1: SOLID AND LIQUID BODIES OF WATER

LESSON TIME: 45 MINUTES

ACTIVITY #1 (30 MINUTES): VOCABULARY PRIMER

Students learn the vocabulary words for this lesson. The teacher teaches the vocabulary word, uses it in a sentence, and then asks a question about the word.

1. **Energy** – The power or ability to make something work, move, or be active.
2. **Fossil fuels** – Any carbon-containing fuel formed from the remains of prehistoric plants and animals. Ex: coal, petroleum, and natural gas
3. **Non-renewable resources** – Resources that have a limited supply and cannot be replaced by natural means at a pace that meets its consumption.
4. **Renewable resources** – Any source that can or will be replenished naturally over a short amount of time to meet consumption needs. Ex: wood or solar (sun)
5. **Climate change** – A change in global and regional climate patterns attributed to an increase in atmospheric carbon dioxide from the burning of fossil fuels.
6. **Pollution** – Pollution happens when the environment is contaminated, or dirtied, by waste, chemicals, and other harmful substances. There are three main forms of pollution: air, water, and land.
7. **Sustainable** – Ability to be maintained at a certain rate or level.
8. **Coal** – A hard black or dark brown substance that is found in the earth and burned as fuel.
9. **Oil** – Liquid found beneath the earth’s surface used for fuel to power cars.
10. **Natural gas** – A mixture of gases found in the earth’s crust and extracted by fracking to be used for cooking and heating.
11. **Solar energy** – Radiant energy from the sun that is captured to create energy.
12. **Wind energy** – Wind is used to create energy via turbines. The wind turns the turbines, which creates energy and electricity.
13. **Hydropower** - Producing electricity by converting the power of waves and water into energy.

ACTIVITY #2 (15 MINUTES): THE STORY OF A SPOON VIDEO AND DISCUSSION

Activity 2.1: Watching The Story of a Spoon - Video and Discussion (3 minutes)

Students will watch the video titled “The Story of a Spoon” which shows the process that goes into making a plastic spoon that will be used only once.

Video: The Story of a Spoon (1 minute, 55 seconds)

- [Click here to watch the video](#)
- Link to the video: <https://www.youtube.com/watch?v=eg-E1FtjaxY>

Activity 2.2: The Story of a Spoon Discussion (12 minutes)

After watching the video, students will participate in a guided discussion. The goal of the discussion is to guide the students to the conclusion that not using single-use plastics (e.g. a plastic spoon) and opting for a reusable option is easier, smarter, and better for the environment.

The video also presents a whole cycle showing how the spoon is made to how it ends up in the consumer's hand. The teacher can ask the students to describe the process to make a spoon that ends up at their school, and then draw this process on the board. Refer to Appendix #1: The Story of a Spoon Visual Representation, to see an example of the process needed to get a plastic spoon to your school.

Here are some questions to guide the discussion:

1. What was the video about?
2. Do you think it is better to use a plastic spoon once or a metal spoon that you wash?
3. What resources go into making a plastic spoon?
4. What steps are needed to make a plastic spoon and have the plastic spoon end up in your hand?
 - a. This is where the teacher will draw the process to make a spoon based off the students' answers.

LESSON #2: COAL AND OIL

LESSON TIME: 45 MINUTES

ACTIVITY #1 (18 MINUTES): COAL READING AND HANDOUT

Activity 1.1: Coal Reading (10 minutes)

Students will be given 10 minutes to read the article by NASA Climate Kids titled *The Story of Fossil Fuels, Part 1: Coal*. This article is a four-part reading regarding the history and origins of fossil fuels. The series goes over coal, oil, gas, and the environmental impacts of burning these fossil fuels. This first article is about coal, which highlights the history, origin, and use of coal.

The four-part article is titled [*The Story of Fossil Fuels by NASA Climate Kids*](#).

- The article for this activity can be found at: <https://climatekids.nasa.gov/fossil-fuels-coal/>
- A PDF version of the entire four-part article can be found in this document under Appendix #2: The Story of Fossil Fuels, Part 1-4 - NASA Climate Kids.

Activity 1.2: Coal Activity (8 minutes)

After the reading, students will start working on the student handout titled “Renewable and Nonrenewable Energy Sources.” In this worksheet, students will work on the section titled “Coal.” In this box, the students will first choose if coal is a renewable or nonrenewable resource, will write where coal comes from, and then will draw a photo of coal. The students can use the article to help with this activity.

ACTIVITY #2 (18 MINUTES): OIL READING AND HANDOUT

Activity 2.1: Oil Reading (10 minutes)

Students will read the next article in the series titled [*The Story of Fossil Fuels, Part 2: Oil*](#). Students read an article about oil, which highlights the history, origin, and use of oil.

Activity 2.2: Oil Activity (8 minutes)

After the reading, students will start working on the handout titled “Renewable and Nonrenewable Energy Sources.” In this worksheet, the students will work on the section titled “Oil.” In this box, the students will first choose if oil is a renewable or nonrenewable resource, will write where oil comes from, and then will draw a photo of oil. The students can use the article to help with this activity.

ACTIVITY #3 (9 MINUTES): OIL AND COAL DISCUSSION

After the students have read both the articles and filled out their handouts on coal and oil, the students will have a class discussion to review the article and the worksheets that they have filled out.

The following questions can be used to help guide the discussion:

1. Where does coal/oil come from?
2. What do people use coal/oil for?
3. Is coal/oil a renewable or nonrenewable resource?
4. What does it mean to be a nonrenewable resource?
5. Can we keep using nonrenewable resources forever?
6. Why is it harmful to use coal and oil?
 - a. Potential answers:
 - i. They are a non-renewable resource.
 - ii. They pollute our air.
 - iii. Coal mining destroys the ecosystem in which it is extracted from.

LESSON #3: GAS AND THE ENVIRONMENTAL COST OF USING NONRENEWABLE RESOURCES

LESSON TIME: 45 MINUTES

ACTIVITY #1 (18 MINUTES): GAS READING AND HANDOUT

Activity 1.1: Gas Reading (10 minutes)

Students will read the third article in the series titled, [*The Story of Fossil Fuels, Part 3: Gas*](#). This article discusses the history, origin, and use of gas. It also talks about how coal, oil, and gas are all nonrenewable resources and they will someday all run out.

Activity 1.2: Gas Activity (8 minutes)

After the reading, students will start working on the student handout titled “Renewable and Nonrenewable Energy Sources.” In this worksheet, students start working in the section titled “Gas.” In this box, the students will first choose if gas is a renewable or nonrenewable resource, will write where gas comes from, and then will draw a photo of gas. The students can use the article to help with this activity.

ACTIVITY #2 (15 MINUTES): “THE KING WHO BANNED COAL” READING AND DISCUSSION

Activity 2.1: Reading The Story of Fossil Fuels, Next (10 minutes)

Students read the last section of the article in the series titled, [*The Story of Fossil Fuels, Next*](#). This section of the article highlights the “The King Who Banned Coal” and also discusses the environmental impacts that burning fossil fuels has on people and our Earth.

Activity 2.2: Discussion on the reading (5 minutes)

After the reading, the students will participate in a short class discussion based off of the reading. The class discussion will focus on the students' understanding the environmental and human health issues of using fossil fuels. The discussion will also allow students to show their understanding of renewable and nonrenewable energy sources.

Use these questions to help guide the discussion:

1. Why did the King try to ban coal?
2. What happens when we burn coal?
 - a. Answer: Coal pollutes our environment, warms the earth, and causes health issues to humans.
3. What does it mean when a resource is a nonrenewable resource?
4. What does it mean when a resource is a renewable resource?

ACTIVITY #3 (12 MINUTES) RENEWABLE & NONRENEWABLE ENERGY VIDEO AND DISCUSSION

Activity 3.1: Videos on Renewable and Nonrenewable Energy (7 minutes)

The students will watch the video titled the "Difference Between Renewable and Nonrenewable Resources," which explains to kids what a natural resource is, and then explains what the difference is between a renewable and a nonrenewable resource. After this video the students will watch the video titled Safety Smart Science with Bill Nye the Science Guy, which explains why and how fossil fuels are heating up our Earth.

Video: Difference Between Renewable and Nonrenewable Resources (3 minutes, 25 seconds)

- [Click here to watch the video](#)
- Link to the video: <https://www.youtube.com/watch?v=PLBK1ux5b7U&t=2s>

Video: Safety Smart® Science with Bill Nye the Science Guy®: Renewable Energy – PREVIEW (3 minutes and 7 seconds)

- [Click here to watch the video](#)
- Link to the video: <https://www.youtube.com/watch?v=grI3BDSGEC4>

Activity 3.2: Conversation on renewable and nonrenewable energy (5 minutes)

After the students watch the two previous videos, the students will have a better understanding of renewable and nonrenewable energy resources. The class will have a discussion on these again to strengthen the students' understanding of these terms.

The following questions can be used to guide the in-class discussion:

1. What are some examples of nonrenewable energy sources?
2. What are some examples of renewable energy sources?
 - a. Answers to questions one and two can be written on the whiteboard for context
3. Bill Nye said that if it gets too hot in a car, we can roll down the windows. What happens if it gets too hot on Earth?
4. Is the world getting warmer?
 - a. Answer: Yes
5. What happens if the world is getting warmer?
 - a. It changes our weather patterns.

LESSON #4: CLIMATE EFFECTS OF BURNING FOSSIL FUELS – INTRODUCTION TO SOLAR, WIND, & HYDROPOWER

LESSON TIME: 45 MINUTES

ACTIVITY #1: (20 MINUTES): HOW WE USE ENERGY EVERY DAY

Building off of Activity #2 and #3 in Lesson #3, where the students learned about renewable and nonrenewable energy sources, students will complete the worksheet titled “Renewable and Nonrenewable Energy Sources: What it is and how we use it.” In this worksheet, students will draw four photos that show how we use energy within our daily lives, such as turning on the lights in a room, driving a car, or powering the TV. Then, students will describe what a renewable and nonrenewable energy source is. The teacher can display the slide explaining these two concepts via the PowerPoint for context.

ACTIVITY #2: (10 MINUTES) EXPLAINING SOLAR, WIND, AND HYDROPOWER

Students will learn about solar, wind, and hydropower. First, the students will go over the definitions to each of these three vocabulary words. Once this is completed, the students will watch three videos describing each of the three types of renewable energy.

Video #1: Renewable Energy 101: How Does Hydroelectricity Work? (1 minute, 15 seconds)

- [Click here to watch the video](#)
- Link to the video: <https://www.youtube.com/watch?v=pEUzot8Zufo>

Video #2: Renewable Energy 101: How Does Wind Energy Work? (1 minutes, 5 seconds)

- [Click here to watch the video](#)
- Link to the video: <https://www.youtube.com/watch?v=vrN9QcJyCII>

Video #3: Renewable Energy 101: How Does Solar Energy Work? (1 minute, 54 seconds)

- [Click here to watch the video](#)
- Link to the video: <https://www.youtube.com/watch?v=eqDVW-vbFJY>

ACTIVITY #3: (15 MINUTES) RENEWABLE AND NONRENEWABLE ENERGY SOURCES HANDOUT

After watching the three videos describing hydropower, wind power and solar power, the students will fill out the solar, wind, and hydropower boxes on the handout titled “Renewable and Nonrenewable Energy Sources.” Once this activity is complete, the students have finished this worksheet.

LESSON #5: REDUCING OUR USE OF NONRENEWABLE RESOURCES

LESSON TIME: 45 MINUTES

ACTIVITY #1 (5 MINUTE): GROUP REVIEW & BRAINSTORM

The teacher will start by asking what a renewable and nonrenewable resource is. After that, the class will start the lesson by brainstorming different ways that they can reduce their use of fossil fuels and energy consumption. These ideas can be written on the white board to help guide the students through the next activity (Activity #2.1).

ACTIVITY #2 (30 MINUTES): WORKSHEET AND SHARING OF THE SOLUTIONS

Activity 2.1: Worksheet - Renewable and Nonrenewable Energy Sources (30 minutes)

For the final deliverable of this unit, students will complete the worksheet titled “Renewable and Nonrenewable Energy Sources: Climate Solution.” This worksheet will bring together the learnings from this week. The students will first write a short paragraph explaining why burning fossil fuels is harmful for our earth. Then, the students will propose three different solutions that they can implement into their lives to reduce the amount of fossil fuels they consume. They will do this by stating the solutions, drawing a photo of the solutions, and writing two to three sentences describing the solutions and how they can incorporate the solution into their lives.

Possible ideas for solutions include:

- Turning off the lights when I leave the room
- Unplugging computers, phones, and other devices when not in use
- Going outside to play instead of playing video games or watching TV
- Turning off the TV when nobody is watching it
- Washing dishes with cold water (warming up the water requires electricity)
- Powering down the classroom computers on the weekend and during breaks
- Using less resources (saves energy in the production stage of products)
- Turning up the air conditioner in the summer and turning down the heater in the winter by a few degrees to save electricity
- Opening the windows and using natural light instead of electricity during daylight hours
- Transportation:
 - Walking or biking to school
 - Carpooling with friends
 - Taking the bus, train, or public transit to run errands

Activity 2.2: Sharing the Solutions (Optional, if time permits)

For students who finish a few minutes early, these students can partner with another student and share the solutions that they came up with in pairs or small groups.

ACTIVITY #3 (10 MINUTES): CALL TO ACTION: PLEDGE

Now that the students have learned about fossil fuels, nonrenewable energy, renewable energy and their impacts, students will propose their solutions from Lesson #5, Activity #2 to create a class wide pledge. This class wide pledge will be something that the students can commit to doing at school or in the classroom to cut down on energy use. The teacher will ask students to come up with some solutions to reduce their energy use within the class and will write these solutions on the board.

Once the specific solution has been decided upon by the class, the teacher will write the class specific pledge at the top of the handout titled “We Pledge to.” Then, students will sign their name at the bottom of the paper. This paper could be hung up on the classroom door, in order for the students to see the pledge on a daily basis.

Examples of practical solutions that students can pledge to do at school to reduce energy consumption:

- Turn off the lights before leaving the classroom.
- Making sure computers are completely powered down on weekends and during breaks.
- Not keeping the door open when the air conditioner is running.

TEACHER RESOURCES

This section contains resources for teachers to learn more about the environmental and sustainability topics presented within this unit plan, including information about the negative effects of nonrenewable energy resources, information about renewable energy sources, and scientific articles about climate change. If you need more information regarding why climate change, sustainability, and environmental literacy should be taught within Elementary Schools, please email the content creator of this unit plan for more information.

INFORMATION ABOUT NONRENEWABLE ENERGY

Article by Solar Schools: [*Non-renewable energy*](#)

- This article gives a detailed explanation of how we find, mine, capture, or refine nonrenewable energy sources, such as coal, oil, and natural gas. The article also goes over why using fossil fuels is bad for people and the planet.
 - More information on how [coal](#) is made and obtained.
 - More information on how [oil](#) is made and obtained.
 - More information on how [natural gas](#) is made and obtained.

INFORMATION ON THE NEGATIVE IMPACTS OF NONRENEWABLE ENERGY SOURCES

Article by the Climate Reality Project: [*How do we know Humans are Causing Climate Change?*](#)

- This article goes over the greenhouse effect and how scientists know that humans are causing climate change. “When we burn these fossil fuels, the carbon combines with oxygen to make carbon dioxide. This extra carbon dioxide (and other GHGs like methane) traps more and more heat in our atmosphere.”

INFORMATION ON RENEWABLE ENERGY SOURCES

Article by the Union of Concerned Scientists: [*Benefits of Renewable Energy Use*](#)

- This article goes over the benefits of renewable energy use, such as reducing global warming, improving public health, that this resource is regenerative and unlimited, and that renewable resources provides economic benefits.
- The article also shows the difference of the release of carbon dioxide from both renewable and nonrenewable resources. “Burning natural gas for electricity releases between 0.6 and 2 pounds of carbon dioxide equivalent per kilowatt-hour (CO₂E/kWh); coal emits between 1.4 and 3.6 pounds of CO₂E/kWh. Wind, on the other hand, is responsible for only 0.02 to 0.04 pounds of CO₂E/kWh on a life-cycle basis; solar 0.07 to 0.2; geothermal 0.1 to 0.2; and hydroelectric between 0.1 and 0.5.”

INFORMATION ON GLOABL WARMING

Article by NASA: [*The Causes of Climate Change*](#)

- This article explains the root causes of climate change, explains the greenhouse effect, and discusses the various gasses which contribute most to climate change.
- “In its Fifth Assessment Report, the Intergovernmental Panel on Climate Change, a group of 1,300 independent scientific experts from countries all over the world under the auspices of the United Nations, concluded there's a more than 95 percent probability that human activities over the past 50 years have warmed our planet.”

Video and Article by [*The Royal Society: The Basis of Climate Change*](#)

- Article contains a one-minute video titled “Climate Change in 60 Seconds.” The article covers the scientific claims that the earth has been heating at a much faster pace since the start of the Industrial Revolution, where humans began to utilize and burn fossil fuels.
- “Many other impacts associated with the warming trend have become evident in recent years. Arctic summer sea ice cover has shrunk dramatically. The heat content of the ocean has increased. Global average sea level has risen by approximately 20 cm (8 inches) since 1901, due both to the expansion of warmer ocean water and to the addition of melt waters from glaciers and ice sheets on land.”

Article on Oxford Academic: [*World Scientist’s Warning of a Climate Emergency*](#)

- This article provided two figures, titled “Change in global human activities from 1979 to the present” and the “Climatic response time series from 1979 to the present.” The article provided six important actions that need to happen in order for our climate to stabilize. Those include energy, short-lived pollutants, nature, food, the economy, and population.

RENEWABLE AND NONRENEWABLE ENERGY SOURCES

Name: _____ Date: _____

Coal	
Coal is (Circle one): Renewable Nonrenewable	
Where does coal come from?	Draw a photo of coal:

Oil	
Oil is (Circle one): Renewable Nonrenewable	
Where does oil come from?	Draw a photo of oil:

Gas	
Gas is (Circle one): Renewable Nonrenewable	
Where does gas come from?	Draw a photo of gas:

Solar Power	
Solar power is (Circle one): Renewable Nonrenewable	
Where does solar power come from?	Draw a photo of solar power:

Wind	
Wind is (Circle one): Renewable Nonrenewable	
Where does wind come from?	Draw a photo of wind:

Hydropower	
Hydropower is (Circle one): Renewable Nonrenewable	
Where does hydropower come from?	Draw a photo of hydropower:

RENEWABLE & NONRENEWABLE ENERGY SOURCES: WHAT IT IS AND HOW WE USE IT

Name: _____ Date: _____

Draw and label: Different ways we use energy			

Describe what a non-renewable energy source is:

Describe what a renewable energy source is:

RENEWABLE & NONRENEWABLE ENERGY SOURCES: CLIMATE SOLUTION

Name: _____ Date: _____

The problem with burning fossil fuels is: _____

Directions:

- Step #1: In the box below, write the solution you have to minimize your use of fossil fuels in the top box.
- Step #2: In the bottom box, draw a photo to represent each solution.
- Step #3: On the lines provided on the next page, write 2-3 sentences describing your solution and how you will use the solution in your own life.

Solutions to reducing your usage of fossil fuels		
Solution #1:	Solution #2:	Solution #3:

Here are some ways that I can reduce my usage of fossil fuels:

Solution #1: _____

Solution #2: _____

Solution #3: _____

WE PLEDGE TO



Pledge - Sign your name here:

APPENDIX #1: “THE STORY OF A SPOON” VISUAL REPRESENTATION

The teacher can use this list as a resource to help guide the students in understanding the process needed to make a plastic spoon. Here are all of the steps in the process. The whole list is not necessary to write down during the discussion with the students but is provided here for context.

1. The Earth is born.
2. First life appears.
3. Reptiles, birds, and mammals live and die.
4. Each year the dead bodies are covered by hundreds of years of sediment (dirt).
5. Heat and pressure rise.
6. Dead animals turn into oil.
7. Humans study to find the oil.
8. Rigs are built.
9. Giant pumps extract the oil.
10. Refineries refine the oil.
11. Turns the oil into plastic pellets.
12. The plastic pellets are shipped again to a factory.
13. The plastic pellets are molded into the shape of a spoon.
14. The spoon is wrapped in plastic.
15. The spoon is put into a box.
16. The box is put into a truck.
17. The box is shipped around the world.
18. A truck takes the box to a store.
19. You buy the spoon from the store.
20. You drive the spoon home.
21. You use the spoon once.
22. You throw the spoon away.

Copyrights to NASA Climate Kids.



SEARCH CLIMATE KIDS

Big Questions

Weather & Climate

Atmosphere

Water

Energy

Plants & Animals

The Story of Fossil Fuels, Part 1: Coal

An Ancient Find

Around 4,000 years ago, someone in northern China came across an odd black rock. It was one of many. Then this person discovered something. Somehow this person discovered that the rock could burn.



Life was harder back then. Keeping warm and getting food were big worries. With no electricity or gas for heating or cooking, everyone burned wood. The strange rock that burned like a log must have been very exciting back then.

This rock was coal. Archeologists think this was the first time a human used a fossil fuel.

Slow to Pick up Steam

For many years, only a few places with easy access to coal used it. Outside China, one such place was Britain. It was hard to miss there. People could go to the beach and pick up lumps of coal. They called it "sea coal."

During the years of Roman rule in the British isles, they used coal to heat water for the public baths. The Romans liked coal so much that they brought it back to Rome with them. Traces of British coal can be found all around the Roman ruins in Italy.

But when the western part of the Roman Empire disintegrated around the year 410 CE and the Dark Ages overtook Europe, coal was nearly forgotten.

What does CE mean?

CE stands for "Common Era." It's the time that we're counting in years. When we say it's 2015, we're saying

The Industrial Revolution



Before the late 1600s, coal was used mainly for things like smelting and blacksmithing. (Smelting is a process of heating the ore dug out of the earth to get out the metals.)

There were no real factories. Things were made by hand without the help of machines. That all changed with the invention of the steam engine.

The first common steam engine was called the Newcomen engine. It was first built 1712. It changed the world forever. It was first used to drain mines, but over time it was used for many other things too.



The steam engine made big factories possible. Then it

APPENDIX #2: THE STORY OF FOSSIL FUELS, PART 1: COAL

Copyrights to NASA Climate Kids.

Coal became popular again in the 1200s, especially in London. The growing population made it harder to find firewood. The stage was set for one of the most important events in human history.

It's the 2,015th year in the Common Era. We put "CE" after a year that was so long ago you might not even realize it's a year.



was put into trains and ships, so it could help transport things. It even powered some early cars. The demand for coal skyrocketed.

This big change was called the Industrial Revolution. It began in Britain. It gradually spread over much of the rest of the world. It's not by chance that Britain led the Industrial Revolution. It had so much coal! It was this very coal that drove Britain, and eventually the world, into the modern society we know today.

Next →



Games



Activities



People



Videos



Mystery

Big Questions

What does global climate change mean?
What is the big deal with carbon?
What is the greenhouse effect?
How do we know the climate is changing?
What is happening to the oceans?
What else do we need to find out?

Weather & Climate

Weather
Climate

Atmosphere

Air
Carbon
Greenhouse gases

Water

Oceans
Rivers
Lakes

Energy

Renewable energy
Fossil fuels

Plants & Animals

Plants
Animals

Climate Kids is produced by the Earth Science Communications Team at NASA's Jet Propulsion Laboratory / California Institute of Technology

[About Us](#) | [Privacy](#) | [Image Use](#)

Program Manager: Heather Doyle
Contact NASA Climate Kids

Site last updated: November 16th, 2019



GLOBAL CLIMATE CHANGE

Copyrights to NASA Climate Kids.



SEARCH CLIMATE KIDS

Big Questions

Weather & Climate

Atmosphere

Water

Energy

Plants & Animals

The Story of Fossil Fuels, Part 2: Oil

A Nice Ride through the Countryside

Early one August morning in 1888, Bertha Benz left home with her two sons on a 66-mile trip to visit her mother. She took a brand new car. She didn't tell anyone. That car just happened to be her husband's Benz Patent-Motorwagen—the first true automobile.



This trip wasn't really about visiting Bertha's mother. Bertha was frustrated with her husband, Karl Benz. Karl had an incredible invention, but he hadn't been doing a great job of letting people know about it. Before Bertha set out on this trip, Karl had only given short demonstration rides, and there was always a team of mechanics standing by.

Bertha's trip was the first long-distance car ride ever attempted. It was a great success. Bertha acted as her own mechanic. She came up with makeshift brake pads. She cleaned all the fuel pipes. And, like anyone else on a long road trip, she had to fill up with gas. She did so by purchasing a fluid called benzene from a local pharmacy. This pharmacy became the world's first gas station.

The Rise of Oil

Petroleum is a liquid that comes from oil. We put it into our cars to make them run. Petroleum means "rock oil." It comes from the remains of once-living organisms, just like coal.

People have used petroleum for different purposes throughout history. But petroleum wasn't used very much until another invention came along—the internal combustion engine.

Petroleum, Oil, Gas: What's in a Name?

A lot of different names are tossed around for liquid fossil fuels. Do they all mean something different? Here's a brief explanation:

Petroleum is a collection of liquids formed from once-living things. It is a mixture of chemicals that contains carbon and hydrogen. People can also refer to petroleum as crude oil and sometimes just oil.



But you can't pour that black sludge of oil into a car. You need to get specific chemicals out of the oil. **Gasoline** is what we usually put into our cars. It is one set of chemicals (with a couple of other added ingredients).



Kerosene is another set of chemicals used to heat homes and to cook. It is also the main ingredient in jet fuel!

APPENDIX #2: THE STORY OF FOSSIL FUELS, PART 2: OIL

Copyrights to NASA Climate Kids.



The process of removing these chemicals from the oil, called "cracking," occurs at an oil refinery.

In 1863, a man named Nikolaus Otto created the first successful engine of this kind. Unlike a steam engine, in Otto's engine, the heat comes from igniting fumes from a petroleum liquid. The pressure from the heat moves pistons. This is pretty much how all gas-powered cars still work to this day.



Big Questions

What does global climate change mean?
 What is the big deal with carbon?
 What is the greenhouse effect?
 How do we know the climate is changing?
 What is happening to the oceans?
 What else do we need to find out?

Weather & Climate

Weather
 Climate

Atmosphere

Air
 Carbon
 Greenhouse gases

Water

Oceans
 Rivers
 Lakes

Energy

Renewable energy
 Fossil fuels

Plants & Animals

Plants
 Animals

Climate Kids is produced by the Earth Science Communications Team at NASA's Jet Propulsion Laboratory / California Institute of Technology

[About Us](#) | [Privacy](#) | [Image Use](#)

Program Manager: Heather Doyle
 Contact NASA Climate Kids



Copyrights to NASA Climate Kids.



SEARCH CLIMATE KIDS

Big Questions

Weather & Climate

Atmosphere

Water

Energy

Plants & Animals

The Story of Fossil Fuels, Part 3: Gas

A Fuel of Many Uses

You can find natural gas near oil, coal, and other rocks. It comes from the same natural processes that make coal and oil. It, too, comes from once-living things.

Humans have known about natural gas for a long time. Around 500 BCE, people in China used bamboo shoots to transport natural gas. They used it to boil water.



A famous historian wrote about natural gas between 100 and 124 CE. That's 1,900 years ago. This person wrote about flames burning from the ground of present-day Iraq. But even though people knew about it, it didn't catch on as a major fuel source for some time.

Today, natural gas is often used for cooking and heating homes. It is one of the most important sources of energy in the world.

A Complicated Future

People once considered natural gas a problem. It was explosive and dangerous. Most oil and coal operations just burned it.

Now it is valuable. Natural gas is cleaner burning than either coal or oil. That means it causes less pollution. Many places have switched from burning coal to burning natural gas. That means many places want more of it.

Nonrenewable Resource?

Fossil fuels form all the time, but that doesn't mean that we won't run out someday. It takes millions of years for coal, oil, and natural gas to form, and we are removing them much faster than that.

Think about it this way: The fossil fuels we have used over the past **200 years** formed over the past **500 million years**. It's like we're emptying a bathtub with a huge drain while refilling it with a tiny, slow drip. Even with the drip, the tub will still empty completely.



Some scientists think we are getting close to being halfway through all that fuel. It's hard to know exactly how much remains because the technology we use to get these fuels from the ground is always changing.

Still, no new inventions will get around the fact that, at some point, there will be no more fossil fuels left.

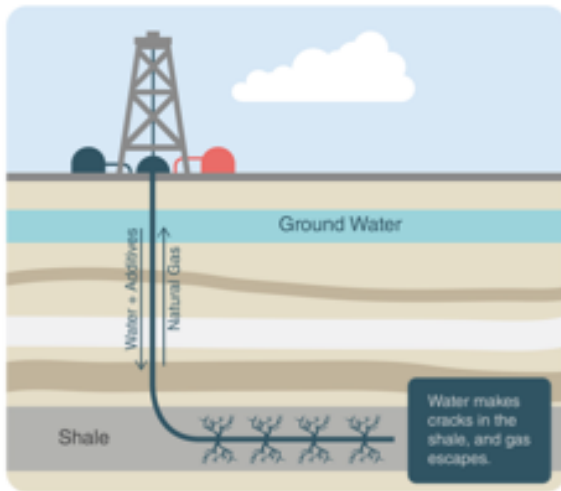
APPENDIX #2: THE STORY OF FOSSIL FUELS, PART 3: GAS

Copyrights to NASA Climate Kids.



Since more people want natural gas, people will get it however they can. One way to get natural gas is with something called hydraulic fracturing, or "fracking." Fracking is expensive, but people want natural gas so much, they'll use this method.

Fracking involves injecting water, sand, and chemicals into rocks to break them apart. This releases natural gas. Fracking helps people increase the amount of natural gas we can get.



Sadly, there are environmental concerns over fracking. People worry that these chemicals can get into drinking water.

What does CE mean?

CE stands for "Common Era." It's the time that we're counting in years. When we say it's 2015, we're saying it's the 2,015th year in the Common Era. We put "CE" after a year that was so long ago you might not even realize it's a year.

What does BCE mean?

BCE stands for "Before Common Era." It's counting backwards from the year 0. That means that 500 BCE was 2,015 + 500 years ago, or 2,515 years ago.



Big Questions

- What does global climate change mean?
- What is the big deal with carbon?
- What is the greenhouse effect?
- How do we know the climate is changing?
- What is happening to the oceans?
- What else do we need to find out?

Weather & Climate

- Weather
- Climate

Atmosphere

- Air
- Carbon
- Greenhouse gases

Water

- Oceans
- Rivers
- Lakes

Energy

- Renewable energy
- Fossil fuels

Plants & Animals

- Plants
- Animals

Copyrights to NASA Climate Kids.



SEARCH CLIMATE KIDS

Big Questions

Weather & Climate

Atmosphere

Water

Energy

Plants & Animals

The Story of Fossil Fuels, Part 4: Next

The King Who Banned Coal

King Edward I of England tried to ban coal in 1306. The air was dark and polluted. The smoke from coal was too much. It was poisoning the city. The king banned coal. It may have been the first environmental law ever.



Coal was more popular than wood at the time. There wasn't enough wood to go around. Many metal smiths, brewers, and other craftsmen used coal, even though it was against the law.

Things got worse after the steam engine was invented. The Industrial Revolution was happening. There was now lots of pollution. It caused acid rain, sickness, and even death.



Air quality was one of the first environmental issues addressed in the USA and Britain. They passed laws to limit pollution, but not until 1955.

A Quieter Threat

The Price of Success



Fossil fuels have changed the course of human history. Cars, airplanes, and other fossil-fueled inventions changed everyone's life. Without fossil fuels, life would be very different.

All these good things come at a cost. The cost is pollution, the destruction of landscapes and natural habitats, oil spills in the ocean, and nasty fracking chemicals in the ground. Global warming will be the biggest problem of all. Global warming will affect everyone on Earth.



There is still time for another chapter in this

APPENDIX #2: THE STORY OF FOSSIL FUELS, PART 4: NEXT

Copyrights to NASA Climate Kids.

Besides the dark smoke, there's another problem with burning fossil fuels. It's the carbon dioxide, CO₂, that gets released. We have known that gases in the air can trap heat since 1824.



John Tyndall showed that CO₂ warmed the Earth in 1860. Many people have tested it since then. Many of them worried about all the CO₂ from burning fuel. Humans were burning so many fossils fuels. It could be a problem.



Many people didn't believe there was a problem. People didn't think the climate could ever change. They didn't think people could do anything to change the world's climate.

People changed their minds. In 1957, scientists began to take measurements of CO₂ in the atmosphere. They saw that CO₂ was rising. Scientists could prove that most of that rise was from humans. That's because fossil fuels make CO₂ with slight chemical differences compared to other CO₂.

Global temperatures are rising, too. Almost all climate scientists agree that a big cause of that is the burning of fossil fuels. The warming could lead to rising sea levels, droughts, flooding, and more severe weather. It is a challenge that we will have to deal with in the coming years.

story. This chapter will be a turn away from fossil fuels. We will move toward sustainable, green energy. We need a new way to power the many improvements that fossil fuels have given us.



Big Questions

What does global climate change mean?
What is the big deal with carbon?
What is the greenhouse effect?
How do we know the climate is changing?
What is happening to the oceans?
What else do we need to find out?

Weather & Climate

Weather
Climate

Atmosphere

Air
Carbon
Greenhouse gases

Water

Oceans
Rivers
Lakes

Energy

Renewable energy
Fossil fuels

Plants & Animals

Plants
Animals