

The Advantages of Renewable Energy



RENEWABLE ENERGY
THE INFINITE POWER
OF TEXAS

For Grades 4 and 5

OVERVIEW

This lesson continues the study of renewable energy as a means of becoming energy independent and healing the planet’s atmosphere, damaged by the use of fossil fuels. The lesson specifically focuses on sunshine and wind as major non-polluting sources of renewable energy in Texas. Students will familiarize themselves with renewable energy by engaging in an introductory class discussion, reading and discussing recommended text and the Reading Passage, giving presentations of

assigned topics and conducting a wind observation Lab Activity. Each student should have a science notebook (a spiral notebook is suggested) to write their vocabulary words, information-organizing webs and a Lab Report Form used in this unit of study.

OBJECTIVES

See Elementary School Teacher Resource Guide for TEKS objectives and additional information regarding this and other elementary school units.

SUGGESTED TIMEFRAME

Teacher will determine how many class periods to devote to each activity based on the suggested timeframe and length of classes.

Day	Time	Activity Title	Content Area	Activity Task
1	<i>50 minutes total</i> 10 minutes 20 minutes 20 minutes	Activity 1 – Teacher Introduction Activity 2 – Assessment of Student Knowledge Activity 3 – Vocabulary	Science Assessment Vocabulary & Language Arts	Information synthesis Identify & describe learned knowledge Vocabulary development & application
2	<i>85 minutes total</i> 60 minutes 15 minutes 10 minutes	Activity 1 – Lab Activity – Wind Observations Activity 2 – Lab Activity – Afternoon Wind Observations Activity 3 – Homework assignment (repeat on Day 3 & Day 4)	Science Science Science	Observing, describe & record weather patterns Observing, describe & record weather patterns Observing, describe & record weather patterns
3	<i>90 minutes total</i> 15 minutes 20 minutes 40 minutes 15 minutes	Activity 1 – Lab Activity – Morning Wind Observations Activity 2 – Literature Link Activity 3 – Reading & Cooperative Group Work Activity 4 – Lab Activity – Afternoon Wind Observations	Science Language Arts Reading & Language Arts Science	Observe, describe & record weather patterns Reading for meaning Reading for meaning Looking for vocabulary in context Use of graphic organizer Observe, describe & record weather patterns
4	<i>70 minutes total</i> 15 minutes 40 minutes 15 minutes	Activity 1 – Lab Activity – Morning Wind Observations Activity 2 – Group Presentation Activity 3 – Lab Activity – Wind Observations	Science Language Arts Science	Observe, describe & record weather patterns Application of learned knowledge in verbal & graphical format Observe, describe & record weather patterns
5	<i>75 minutes total</i> 30 minutes 45 minutes	Activity 1 – Post-Lab – Wind Observations Activity 2 – Assessment Questions	Science Science	Information synthesis in tabular format Analyze data & summarize results Review of learned material

REQUIRED MATERIALS

- copy of the Reading Passage for each student
- list of vocabulary words displayed so the entire class can view it (i.e. overhead transparency, chalkboard, poster, etc.)
- copy of the Lab Report Form displayed so students can copy the form in their science notebooks
- compass
- copy of the Assessment Questions for each student
- four large sheets of paper
- *The Wump World*, by Bill Peet, World-Houghton Mifflin, 1970

IMPORTANT NOTE: Send home a note to parents explaining the homework assignment **Wind Observation** so that the students can continue their observations at home. Note the importance of bringing the information to class the next day.

DAILY ACTIVITIES

Day 1 – 50 minutes

Activity 1 – Teacher introduction

(10 minutes)

Begin the unit with an anticipatory set that sparks the class attention and makes the subject relevant to the students' lives. If video footage of extreme weather events involving high wind is available, it can be shown as a dramatic demonstration of the power of the wind that can be harnessed for our energy needs. (See Teacher Resource Guide for other suggestions.) Continue the introduction by telling students that the next unit of study they will be learning about renewable energy and its advantages. Students will engage in a wind observation activity in which they will observe the wind both at school and at home.

Activity 2 – Assessment of Current Student Knowledge (20 minutes)

To assess what students already know, prompt a class discussion based on the 4 questions listed

below. A graphic organizer (such as a web) is a good tool to use during this discussion because it allows visual learners to make connections to concepts they already know. Sample graphic organizers are included in the Teacher Resource Guide. The graphic organizer should be formatted so that information can be added to it throughout the Unit of Study.

Questions for class discussion:

1. How is renewable energy different from non-renewable sources of energy?
2. What are the major types of renewable energy in Texas?
3. How do these affect the environment?
4. What types of non-renewable forms of energy are used in Texas?

Activity 3 – Vocabulary Review

(20 minutes)

Have the students use dictionaries to find the definitions of the vocabulary words and record them in their science notebooks. See list of vocabulary words on page 6. They should create meaningful sentences with each word that reflect an understanding of the definition. If you began the alternative vocabulary activity suggested in the Teacher Resource Guide, ask students to pull the cards with words relevant to this unit. Students can first quiz each other using the flash cards they prepared, or students can play the board game they created, and then create sentences in their science notebooks using each word.

Day 2 – 85 minutes

Activity 1 – Lab Activity – Wind

Observations (60 minutes)

During the pre-lab activity, you will prepare the class for the wind observation lab. During the lab activity, students will make a total of 9 observations over 3 days. Each day, students should make 3 observations: in the morning at school, in the afternoon at school and in the evening at home. Students will record their findings in their science notebook based on the Lab Report Form provided in this unit. The main

TEACHER OVERVIEW

goal of this lab activity is to determine if capturing wind energy is a good idea for your town. Students will also become familiar with collecting and analyzing data.

1. PRE-LAB – Explain to the class that for the next activity, they will be conducting wind observations and recording their findings in their science notebook. Students will work in pairs during this lab. Display the Lab Report Form so it is visible to the entire class and tell each student to copy it into his or her science notebook. The Lab Report Form consists of the Data Table, questions and Beaufort Scale chart. Explain to students that they will make 3 wind observations a day for 3 days: morning (at school), afternoon (at school) and evening (at home). Instruct students that their observations should be made at the same location and close to the same time every day.
2. LAB – Morning wind observation: Instruct students to complete the first 3 items of the lab report (title, date and purpose). Take the students outdoors and have each pair find a location to conduct its wind observations. Instruct students to observe the wind and refer to the Beaufort Scale to determine how to classify their observation. Students should complete one entry in their observation table (date, time, description of observation, and Beaufort scale rating) for each observation. Ask students to decide collectively where the prevailing winds are coming from and use the compass to determine the direction. Tell students to record the direction in their notebooks.

Activity 2 – Lab Activity – Afternoon Wind Observations (15 minutes)

Repeat instructions provided during the morning wind observation lab. Students should complete another entry in their observation table.

Activity 3 – Homework assignment due next day (10 minutes)

Explain to the students that they should observe the wind speed at their home in the evening and

record their observations as they did at school. The observations need to be brought back to class the following day and copied into their student Lab Report Form in their science notebook (if students leave their notebooks in school). This homework assignment should also be given at the end of Day 3 and Day 4.

Day 3 – 90 minutes

Activity 1 – Lab Morning Wind

Observation (15 minutes)

Confirm that students completed their homework assignment of making a wind observation the previous evening. Allow students time to copy their results in their science notebook if needed. Take students outdoors for a wind observation following instructions provided in Day 2.

Activity 2 – Literature Link (20 minutes)

1. Read *The Wump World* by Bill Peet, either by reading it aloud to the class or by having various students take turns reading.
2. Have the students verbally summarize the story. Add any new concepts discussed to the graphic organizer developed in Day 1.

Activity 3 – Reading and Cooperative Group Work (40 minutes)

1. On the large sheets of paper, write down a topic heading and its respective questions allowing space for answers to be added (see “Group Reading Section Topics and Questions” on page 4). Each topic with its respective questions should appear on a separate page.
2. Organize the students into 4 equal groups, attempting to cluster reading skills. Assign each group to one of the reading topics listed below based on sections from the Reading Passage. Assign the longer sections to the more advanced readers. Distribute to each group the large sheet of paper with its topic and questions written on it.
3. In the small groups, instruct the students to read aloud individual sentences or paragraphs from the assigned section of the Reading Passage.

- Once all of the paragraphs have been read, each group should create answers to the assigned questions for their section and record them on the large sheet of paper. Instruct each group to create a new graphic (chart, image, etc.) with a caption that illustrates the concepts described in their assigned section. Explain to the class that each group will make a presentation on the following day about their reading passage. The presentation should present the answers to the questions and use their new graphic to illustrate the concepts. Inform the class that assessment questions will include information from each group. (See Teacher Resource Guide for Reading Passage assignments and group presentation guidelines.)

Group Reading Section Topics and Questions

Group 1 – Sunshine and wind are renewable energy

- Why are sunshine and wind called renewable energy?
- Why are coal, oil and natural gas called non-renewable energy?
- How long does it take to make fossil fuels?

Group 2 – Renewable energy does not pollute

- How do fossil fuel plants pollute?
- Do renewable energy sources pollute?
- What is biomass?

Group 3 – Texas has plenty of renewable energy

- What are 3 types of renewable energy found in Texas?
- How could Texas meet half of its needs for electricity?

Group 4 – Renewable energy is free

- Why do non-renewable energy sources cost a lot of money to use?
- Why is renewable energy called “free”?
- Besides saving money, why is using renewable energy a smart choice?

Activity 4 – Lab Activity – Afternoon

Wind Observations (15 minutes)

Repeat instructions provided during the morning wind observation lab. Students should complete another entry in their observation table. Remind students of their homework assignment to complete an evening wind observation and to record their results.

Day 4 – 70 minutes

Activity 1 – Lab Activity – Morning Wind

Observation (15 minutes)

Confirm that students completed their homework assignment of making a wind observation the previous evening. Allow students time to copy their results in their science notebook if needed. Take students outdoors for a wind observation following instructions provided in Day 2.

Activity 2 – Group Presentations

(40 minutes)

- Allow students 5 -10 minutes to meet in their groups from Day 3 (Reading and Cooperative Group Work) and review the material they will include in their presentation (topics from the discussion questions, new graphic created, etc.).
- Bring students together as a class and have each group present their topic (allow 5 - 10 minutes for each group). Remind student that everyone will be assessed on the topics from the presentations, so they should all pay close attention.
- After all the groups have presented their information, refer to the graphic organizer created on Day 1. With the entire class, add to the graphic organizer any new concepts that the students learned. Be sure to include any information required for answering the Assessment Questions.

Activity 3 – Lab Activity – Afternoon

Wind Observations (15 minutes)

Repeat instructions provided during the morning wind observation lab. Students should complete another entry in their observation table. Remind

TEACHER OVERVIEW

students of their homework assignment to complete an evening wind observation and to record their results.

Day 5 – 75 minutes

Activity 1 – Post-Lab – Wind Observations

(30 minutes)

1. Instruct students to review the results of their wind observations recorded in their science notebooks and write a summary of what was learned and observed. Each student should also write his/her answers to the 3 questions at the end of the Lab Report Form. Allow students to work together with their lab partner. By allowing the students to share information and work together on this lab, the validity of data and the conclusions drawn by their answers can be improved.
2. Discuss the results of the lab from the student lab reports as a whole class. This task is practicing the TEKS skill of analyzing data information.

Activity 2 – Assessment Questions

(45 minutes)

Distribute the handout of Assessment Questions to each student. Working individually, students

should write down answers to the questions in the space provided. Once everyone has completed the questions, review the answers with the entire class.

ADDITIONAL ACTIVITIES

1. Internet Research

Using the Internet resources provided in the Teacher Resource Guide, have pairs of students research solar and wind projects in Texas. Each pair should create a poster of their findings by drawing pictures of the projects they found with descriptive captions.

2. Energy Debate

Direct the students to research information for a debate about the pros and cons of alternative energies. Divide the class into two sides. Assign students to one side of the debate or the other (renewable energy vs. fossil fuel energy) and have them write note cards and outlines about what they learn or would use in a debate. Let them debate the advantages and disadvantages of energy production by use of nuclear and fossil fuel and production using renewable sources.

Assessment Questions

(descriptive answers may vary)

- A.1. Renewable energy is different from non-renewable energy in that renewable sources are derived and replenish quickly from nature and usually do not pollute our environment when used to generate electricity.
- A.2. Wind and sun are renewable because they are derived and replenish quickly. A fresh supply is created in a very short time.
- A.3. Some of the non-renewable fossil fuels used in Texas are oil, coal and natural gas.
- A.4. The effects of using non-renewable sources for electricity production include: smog formation, radioactive waste accumulation, smoke production, consumption of millions of gallons of water, and chemical emissions that pollute the air and water.
- A.5. Sun and wind are Texas' major sources of renewable energy. Other renewable resources include biomass, geothermal and hydropower.
- A.6. The environment is kept clean of pollutants when sun and wind are used as sources of electricity generation. Other natural resources, such as water, are conserved.
- A.7. Texas has plenty of bright sunshine and steady winds to fill all our energy needs.

Group Reading Section Questions

Group 1 – Sunshine and wind are renewable energy

1. Sunshine and wind are renewable energy because they are always around and will not run out.
2. Coal, oil and natural gas are non-renewable energy because once they are gone, they are gone forever.
3. It takes millions of years to make fossil fuels.

Group 2 – Renewable energy does not pollute

1. Coal emits smoke and chemicals; nuclear power plants create radioactive waste; gasoline burned in our cars causes smog.

2. Wind and sunshine do not pollute at all; other renewable energy sources cause less pollution than fossil fuels, such as biomass.
3. Biomass is a fuel that comes from things that were once living, like wood from trees or garbage.

Group 3 – Texas has plenty of renewable energy

1. Renewable energy found in Texas includes solar, wind and biomass.
2. Texas could meet half of its needs for electricity by not wasting any and with renewable energy.

Group 4 – Renewable energy is free

1. Non-renewable energy sources cost money to find and move; oil must be refined; we also have to pay to clean up the pollution they cause.
2. Renewable energy is called free because the sun shines every day for all of us, free of charge, and the wind blows for free.
3. Renewable energy is a smart choice because it does not pollute our planet.

Vocabulary Words

efficient – acting or producing effectively with a minimum of waste, expense, or unnecessary effort

emit – to give or send out matter or energy

radioactive – capable of emitting high-energy rays or particles

refined – free of impurities; purified

smog – generic term used to describe mixtures of pollutants in the atmosphere usually at ground-level; combination of smoke and other particulates, ozone, hydrocarbons, nitrogen oxides, and other chemically reactive compounds that under certain conditions of weather and sunlight may result in a brown haze that causes adverse health effects

vertical – going straight up or down from a level surface

wind turbine – a machine that has propeller-like blades that can be moved by wind to make electricity

The Rewards of Renewable Energy



RENEWABLE ENERGY
THE INFINITE POWER
OF TEXAS

HIGHLIGHTS

- The sun always rises; the wind always blows
- Sunshine and wind do not pollute
- Texas has lots of renewable energy

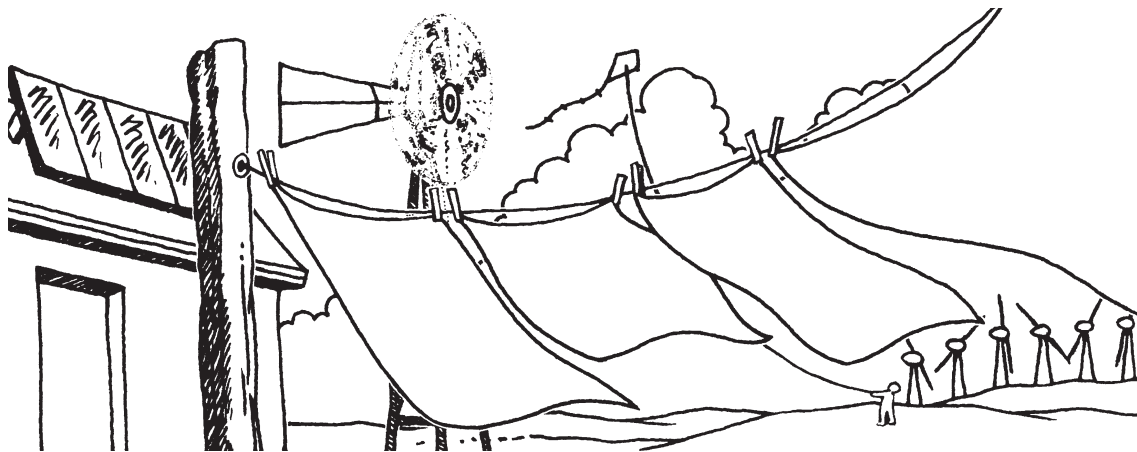
SUNSHINE AND WIND ARE RENEWABLE ENERGY

Every time you fly a kite or hang your swimsuit out to dry, you are using two renewable energy sources – the wind and the sun.

Why are these energy sources renewable? Because sunshine and wind are always around us. These energy sources will not run out. Every morning, the sun rises. And every day the wind blows. It may be a calm, cloudy day where you live, but the sun is shining and the wind is blowing other places in Texas and in the world. The sun and wind provide huge amounts of energy, more than enough to meet all of our needs.

On the other hand, fossil fuels, such as coal, oil and natural gas, need the right conditions in order to be made. It took millions of years for heat and pressure to turn layers of dead plants, animals, sand and mud into these fuels. This is why fossil fuels are called non-renewable energy sources. Once they are used, they are gone forever.

There are many good reasons to use renewable energy sources. If we are clever enough to use the energy in sunshine and



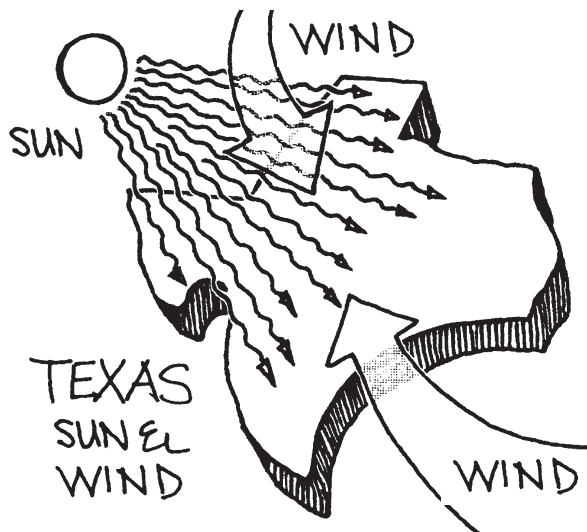
FREE FUEL: SUNLIGHT AND WIND If we are clever enough to capture the energy in sunshine and wind, we can use it in many ways.

wind, we can use it to heat our homes or run our cars, computers and TVs. When each day begins, it brings with it a new supply of renewable energy that cannot be used up!

RENEWABLE ENERGY DOES NOT POLLUTE

Fossil fuel power plants that make electricity can pollute the air and water. Coal emits smoke and chemicals when it is burned to make electricity. Nuclear power plants create radioactive waste that is dangerous for thousands of years. Gasoline burned in our cars causes smog. Even natural gas adds to our pollution problems.

Some renewable energy sources, such as wind and sunshine, do not emit smoke or create pollution when they are used. Other renewable energy sources almost always cause less pollution than fossil fuels or nuclear power plants. Biomass, for example, is a fuel that comes from



TEXAS TOPS IN RENEWABLE ENERGY

Bright sunshine and steady winds could create more renewable energy in Texas than in any other state.

things that were once living, like wood or garbage. It is one of the renewable energy sources that makes less pollution.

TEXAS HAS PLENTY OF RENEWABLE ENERGY

Renewable energy is found in many places in the United States. There are many types of renewable energy in Texas alone such as solar, wind and biomass. Scientists estimate that Texas could meet half of its needs for electricity by not wasting any and with renewable energy. That is a lot of efficient washing machines, computers, streetlights and TVs that use wind and solar power!

RENEWABLE ENERGY IS FREE

The sun shines every day for all of us, free of charge. And the wind blows for free. But non-renewable energy sources can cost a lot of money to find and move. We must take the fossil fuels from the ground and ship them long distances to places where they can be used. Oil must be refined before it can be used. This is expensive. We also have to pay to clean up the pollution they cause. And as coal and oil supplies get used up, their prices get higher.

The equipment to collect and use solar and wind energy, such as solar panels and wind turbines, also costs money. But when you think about the resource being free, the total cost of using solar and wind energy can make them smart choices. The rewards are greater since solar and wind energy do not pollute our planet.

Lab Title _____

Date _____

Purpose of this lab is to _____

Data Table. Wind Observations

Date	Time	Description	Beaufort Scale Rating	Direction

In each column above, write down a description of the wind speed in the morning, afternoon and evening. Then write down the Beaufort Scale indicator as well.

1. What time of day do the fastest winds occur? _____

2. From what direction are the winds coming? _____
(use a compass)

3. Would a wind turbine work well in your area? Why or why not?
(NOTE: A minimum average wind speed of 13 mph is needed to produce electricity economically throughout the year).

Beaufort Scale	Description	Observations
0	Calm (0-1 mph)	Smoke rises vertically
1	Light air (2-3 mph)	Smoke drifts slowly
2	Slight breeze (4-7 mph)	Leaves rustle, wind vane moves
3	Gentle breeze (8-12 mph)	Twigs move, flags extend
4	Moderate breeze (13-18 mph)	Branches move, dust & paper rise
5	Fresh breeze (19-24 mph)	Small trees sway
6	Strong breeze (25-31 mph)	Large branches sway, wires whistle
7	Moderate gale (32-38 mph)	Trees in motion, walking difficult
8	Fresh gale (39-46 mph)	Twigs break off trees
9	Strong gale (47-54 mph)	Branches break, roofs damaged
10	Whole gale (55-63 mph)	Trees snap, damage evident
11	Storm (64-72 mph)	Widespread damage
12	Hurricane (73-82 mph)	Extreme damage!

1. How is renewable energy different from non-renewable energy?

2. Why is energy from the wind and sun called renewable energy?

3. What types of fossil fuels do we use in Texas?

4. List 3 effects that non-renewable energy has on the environment:

1 _____

2 _____

3 _____

5. What are the major types of renewable energy in Texas?

6. How does renewable energy affect the environment?

7. List two types of renewable energy that could meet half of Texas' energy needs:

1 _____

2 _____

InfinitePower.org

Financial Acknowledgement This publication was developed as part of the Renewable Energy Demonstration Program and was funded 100% with oil overcharge funds from the Exxon settlement as provided by the Texas State Energy Conservation Office and the U.S. Department of Energy. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.



RENEWABLE ENERGY
THE INFINITE POWER
OF TEXAS

State Energy Conservation Office

111 East 17th Street, Room 1114
Austin, Texas 78774
Ph. 800.531.5441 ext 31796
www.InfinitePower.org

Texas Comptroller of Public Accounts
Publication #96-806B (03/05)