

## **Nuclear Power Plant Failures in Japan Raise Safety Questions**

*March 17th, 2011*

Radiation leaks and fires at Japan's nuclear reactors following a massive earthquake and tsunami have refueled the debate over whether nuclear power is a safe option for generating electricity.

The March 11 earthquake and tsunami damaged several nuclear power plants around the Asian island nation of Japan. At the Fukushima Daiichi nuclear plant, the tsunami disabled the backup systems and workers are struggling to keep the nuclear fuel rods from overheating and melting down.

The 180 workers who remain at the plants are exposing themselves to potentially fatal doses of radiation: Japan is praising them as heroes.

The workers are pumping sea water into the facility, which will damage the power plant machinery, but officials are more worried about what will happen if the core explodes and nuclear materials escape the protective layers of steel and concrete.

Meanwhile, radioactive steam, created when water comes in contact with the nuclear fuel rods, must be released into the air, or else a buildup of pressure would cause a more damaging explosion. People within a 12-mile radius of the damaged plant have been evacuated, while those within a 19-mile radius were told to stay indoors.

### **Radiation is a part of life, but not in high doses**

Nuclear power plants create energy by splitting the atoms of the volatile chemical element uranium. The process creates invisible particles or rays of energy known as radiation that can harm people.

Humans experience radiation every day from a variety of sources. The sun's light is actually radiation that gets stronger the closer you get to the sun. For that reason, airline pilots and people who fly a lot get exposed to more radiation than average, but the dose is still safe for humans. X-ray machines and airport body scanners also put out small, but safe, doses of radiation.

In high doses, however, radiation can cause illness and even death. The most dangerous types of radiation emitted by the uranium splitting process are particles of the elements iodine and cesium.

Those elements are dangerous because they are similar to non-radioactive elements in the human body, so they can collect in the body and cause damage. In Japan, the government is issuing iodine pills to people near the damaged nuclear plant so their bodies can fill up on the good kind of iodine and absorb less of the bad.

### **How does a nuclear reactor work?**

In nuclear reactors, atom-splitting takes place in the extremely hot, radioactive core, which is protected by several layers of steel and other sturdy materials.



Scientists check residents near the damaged Fukushima Daiichi nuclear power plant for radiation. Four nuclear reactors at the plant were damaged by last week's massive earthquake and tsunami.

The energy generated by the fission process heats up water, which creates steam that, in turn, powers a turbine generator. The generator's rapid spinning creates electricity that is then distributed to homes and businesses via a power grid.

Some consider nuclear power a cleaner form of energy than fossil fuels like coal and oil because no carbon dioxide is released into the atmosphere during the nuclear fission process.

Others argue that nuclear power is dangerous and pollutes the environment because used up uranium fuel rods are still radioactive and have to be buried deep within the earth.

### **Comparisons to past nuclear disasters**

At Three Mile Island in 1979, one of the steam-generated turbines shut down, causing pressure to rise in the nuclear core of the plant. Coolant leaked and caused the nuclear core to overheat and melt.

Although no plant workers or members of the surrounding community were injured in the accident, it remains the biggest nuclear disaster in U.S. history.

Far more disastrous was the nuclear accident at the Chernobyl nuclear power plant in Russia (now Ukraine) in 1986.

A massive power surge during a systems test caused a reactor to overheat and explode, sending a radioactive plume into the air that eventually drifted over large parts of Russia and Europe.

Fifty plant workers died in the event, but it's estimated that thousands more died later as a result of cancer and other diseases caused by radiation exposure.

Currently, analysts are comparing the situation in Japan more to Three Mile Island than Chernobyl and are hoping the situation won't become worse.



In the world's worst nuclear disaster at the Chernobyl nuclear plant in Ukraine, radiation spread over a large area.

*Analysts are comparing the situation in Japan to past nuclear disasters, most notably the nuclear power plant failures at Three Mile Island in Pennsylvania and Chernobyl in Ukraine.*

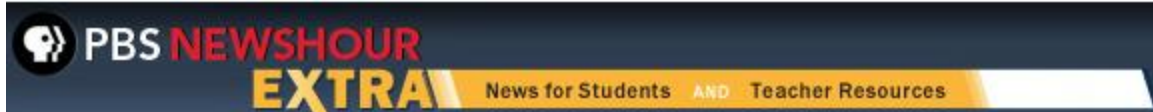
### **Other countries reexamine nuclear power plant safety**

Meanwhile, the rest of the world is re-examining its commitment to nuclear power. Germany announced it would perform "stress tests" on its oldest nuclear reactors and Switzerland suspended plans to build four new nuclear plants while it examines the safety of existing reactors.

In the U.S., President Barack Obama defended the country's commitment to nuclear power, stating that all forms of power have a downside but that nuclear power should continue to be an energy option for America. The U.S. currently gets about 20 percent of its energy from nuclear power.

"I've already instructed our nuclear regulatory agency to make sure that we take lessons learned from what's happening in Japan and that we are constantly upgrading how we approach our nuclear safety in this country," the president said.

**–Compiled by Veronica DeVore for NewsHour Extra**



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[http://www.pbs.org/newshour/extra/features/science/jan-june11/nuclear\\_03-17.html](http://www.pbs.org/newshour/extra/features/science/jan-june11/nuclear_03-17.html)

### READING COMPREHENSION QUESTIONS

1. What is the name of the nuclear power plant where the tsunami disabled backup systems and workers are worried about a nuclear meltdown?
2. How many workers are still at the plant, exposing themselves to radiation?
3. If someone lived 10 miles from the Fukushima Daiichi plant, would they be told to evacuate or stay indoors?
4. How do nuclear power plants create energy?
5. What is an example of non-dangerous radiation that humans experience?
6. What are the most dangerous types of radiation that result from the nuclear fission, or atom-splitting, process?
7. Why do some people consider nuclear power cleaner than coal or oil?
8. Why do some people think nuclear power pollutes the environment?

## Days 16-17: Read the article & answer reading comprehension and discussion questions

9. What two nuclear disasters is the Japanese incident being compared to? Which was more serious?

10. What two European countries are re-examining their nuclear power plants?

### DISCUSSION QUESTIONS

1. If you were one of the nuclear plant workers who was asked to stay behind and make sure a full meltdown didn't happen, would you do it? Why or why not?

2. Do you think nuclear power should be used? Why or why not?

3. President Obama said nuclear power is one of an "array" of power sources the U.S. needs to use. What are some others? Which do you think are best? Why?

4. Can you think of other sources of radiation besides those mentioned in this article? Are they dangerous to humans?

# Active Reading

## Section 1: Renewable Energy Today

Read the passage below and answer the questions that follow.

Solar cells, also called photovoltaic cells, convert the sun's energy into electricity. Solar cells have no moving parts, and they run on nonpolluting power from the sun. So why don't solar cells meet all of our energy needs? A solar cell produces a very small electrical current. Meeting the electricity needs of a small city would require covering hundreds of acres of land with solar panels. Solar cells also require extended periods of sunshine to produce electricity. This energy is stored in batteries, which supply electricity when the sun is not shining.

Despite these limitations, the demand for electricity from solar energy has grown about 30 percent per year over the past 20 years. Solar cells are becoming increasingly efficient and less expensive. Solar cells have great potential for use in developing countries, where energy consumption is minimal and electricity distribution networks are limited. Currently, solar cells provide energy for more than 3 million households in the developing world.

### IDENTIFYING MAIN IDEAS

One reading skill is the ability to identify the main idea of a passage. The main idea is the main focus or key idea. Frequently, a main idea is accompanied by supporting information that offers detailed facts about main ideas.

In the space provided, write the letter of the term or phrase that best completes each statement or best answers each question.

- \_\_\_\_\_ 1. Solar cells convert the sun's energy into
- a. light.
  - b. heat.
  - c. electricity.
  - d. pollution.
- \_\_\_\_\_ 2. Solar cells have great potential for use in
- a. cities.
  - b. private homes.
  - c. factories.
  - d. developing countries.

**Active Reading *continued***

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**RECOGNIZING SIMILARITIES AND DIFFERENCES**

One reading skill is the ability to recognize similarities and differences between two phrases, ideas, or things. This is sometimes known as comparing and contrasting.

**Read the following questions and write the answers in the space provided.**

3. How are solar cells different from most other power sources?

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4. How are solar cells of today superior to solar cells that were produced 20 years ago?

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**VOCABULARY DEVELOPMENT**

**In the space provided, write the letter of the definition that best matches the term or phrase.**

- |                             |  |
|-----------------------------|--|
| _____ 5. photovoltaic cells | a. power usage                               |
| _____ 6. solar panels       | b. store energy collected by solar cells     |
| _____ 7. energy consumption | c. convert the sun's energy into electricity |
| _____ 8. batteries          | d. collections of solar cells                |

**RECOGNIZING CAUSE AND EFFECT**

One reading skill is the ability to recognize cause and effect.

**Read the following questions and write the answers in the space provided.**

9. Why are solar cells particularly suitable for developing countries?

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10. Why aren't solar cells used to meet all of our energy needs?

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# Active Reading

## Section 2: Developing Energy Technologies

Read the passage below and answer the questions that follow.

The average household in the United States spends more than \$1,500 on energy bills each year. Unfortunately, much of that energy is wasted. Most of the energy lost from homes is lost through poorly insulated windows, doors, walls, and the roof. So a good way to increase energy efficiency is to add to the insulation of a home. Replacing old windows with new, high-efficiency windows can reduce your energy bill by 15 percent. Two of the best places to look for ways to conserve energy are doors and windows. Much of the energy lost from a home escapes as hot air in winter or cold air in summer passes through gaps around doors and windows. Hold a ribbon up to the edges of doors and windows. If it flutters, you've found a leak. Sealing these leaks with caulk or weather stripping will help conserve energy. There are dozens of other ways to reduce energy use around the home.

### IDENTIFYING MAIN IDEAS

One reading skill is the ability to identify the main idea of a passage. The main idea is the main focus or key idea. Frequently, a main idea is accompanied by supporting information that offers detailed facts about main ideas.

In the space provided, write the letter of the term or phrase that best completes each statement.

- \_\_\_\_\_ 1. The average household in the United States spends \$1,500 a year on  
a. repairs to the home.  
b. windows and doors.  
c. insulation.  
d. energy bills.
- \_\_\_\_\_ 2. Much of the energy in homes in the United States is  
a. efficient.  
b. wasted.  
c. conserved.  
d. reduced.
- \_\_\_\_\_ 3. People can increase energy efficiency in their homes by  
a. keeping doors and windows closed at all times.  
b. replacing their roofs.  
c. adding to the insulation in their homes.  
d. using more hot air in winter and more cold air in summer.

**Active Reading** *continued*

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**VOCABULARY DEVELOPMENT**

**Read each question and write the answer in the space provided.**

4. The term *efficient* means “productive without waste.” Use this information to define *energy efficiency*.

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5. *Insulate* comes from the Latin word for “island” and means “isolate” or “protect.” From what does insulation isolate or protect homes?

\_\_\_\_\_

\_\_\_\_\_

**In the space provided, write the letter of the term that best answers the question.**

- \_\_\_\_\_ 6. What is used for sealing leaks around windows and doors?
- a. ribbon
  - b. insulation
  - c. weather stripping
  - d. replacement parts

**RECOGNIZING CAUSE AND EFFECT**

One reading skill is the ability to recognize cause and effect.

**In the space provided, write the letter of the phrase that best completes the statement.**

- \_\_\_\_\_ 7. Replacing old windows with new, more efficient windows can
- a. reduce an energy bill up to 15 percent.
  - b. cause leaks that lead to energy loss.
  - c. increase an energy bill as much as 15 percent.
  - d. eliminate the need for other improvements to the home.

**Read each question and write the answer in the space provided.**

8. The greatest loss of energy in a home results from poor insulation in what four areas of the home?

\_\_\_\_\_

\_\_\_\_\_

9. How can a person detect leaks around windows and doors?

\_\_\_\_\_

\_\_\_\_\_

10. What happens to much of the energy that is used to heat and cool homes?

\_\_\_\_\_

\_\_\_\_\_



## Renewable Energy

Energy is the power derived by using chemical or physical resources, and it is the strength and vitality required for sustained mental or physical activity. People and animals get energy from eating food. The plants receive their energy from the Sun, and in turn people eat the plants and animals that have also eaten plants—all made possible by the food chain.

Non-renewable energy sources are those that take millions of years to form and will run out some day. It is energy that comes from fossil fuels such as coal, crude oil, and natural gas. Fossil fuels are mainly made up of carbon and were formed millions of years ago. However, renewable energy sources will never run out, are better for the environment and do not cause pollution. They can sometimes cost a little more money. Renewable energy sources include the Sun, wind, water, heat from the earth, and biomass (plants).

Renewable energy is often called green energy because it is a natural energy, always available and does not have to be formed like nonrenewable energy. The green energy is always there. For example, the Sun consistently shines, water is abundant, and the winds blow throughout the year. The five types include solar, energy from the Sun; geothermal, energy from heat within the Earth; hydroelectric, energy from moving water; biomass, energy from dead plants and microorganisms and finally, energy from the wind.

For solar, the energy from the sun is captured in one of two ways. Active uses special technology and equipment to use the energy and focus the sunlight in a specific spot, generating electricity. Passive uses no equipment, uses the sunlight as it naturally changes throughout the day.

Windmills have been used since ancient times, to grind grain, power boats, or for pumping water. Today, wind turbines include tall towers and 2 or 3 propeller-like blades at the top that are turned by the wind. The blades turn a generator inside the tower to produce electricity. Groups of these turbines are called wind farms, found on farmland, in narrow mountain passes, or in the ocean.

Geothermal energy uses heat from the core of the Earth. The heat is always moving towards the surface. Underground rocks melt into magma and come to the surface as lava. Underground sources of water can shoot out as geysers. The sources can be accessed using geothermal heat pumps, bringing the heat aboveground to be used as energy. In some areas of the world, steam can be pumped directly to a power plant, produced by water heated underground.

Hydroelectric energy is made by flowing water as power plants usually located on large dams control the flow of the water, and as dams block a river, they create artificial lakes or reservoirs. Water from the lakes or reservoirs is forced through tunnels, and as it flows, it turns huge turbines to generate electricity. Niagara Falls in New York is an example of a place where hydroelectric energy is produced.

Biomass energy comes from the recently living plants or microorganisms. The energy in plants comes from the sun but is still present when it dies. Examples include trees, branches, scraps of bark and recycled paper, as well as manure, garbage, and some crops. The energy comes from burning the biomass. Some biomass can be converted into biofuels as its mixed with regular gasoline.

As with both renewable and nonrenewable energy sources, there are advantages and disadvantages. In the United States, as of 2016, about 10% of total energy consumption was from renewable energy sources, and about 55% of that use is for producing electricity. One of the most important advantages of renewable energy is its role in reducing greenhouse gases. The use of renewable energy in the U.S. and the world will continue to grow into the future.

1) Hoover Dam in the Southwest provides energy for millions of people. Which of the following types of renewable energy is being used?

- A: Geothermal
- B: Solar
- C: Wind
- D: Hydroelectric

2) Areas near volcanoes throughout the world may be sources for which type of nonrenewable energy?

- A: Hydroelectric
- B: Biomass
- C: Geothermal
- D: Solar

3) Which of the following nonrenewable energy sources includes the use of include trees, branches, scraps of bark and recycled paper, as well as manure, garbage, and some crops?

- A: Geothermal
- B: Biomass
- C: Hydroelectric
- D: Wind

4) Which of the following comes to the surface during the use of geothermal energy?

- A: Lava
- B: Magma
- C: Geysers
- D: All the above

5) Renewable energy is often called which of the following?

- A: Blue energy
- B: Green energy
- C: Red energy
- D: Yellow energy

6) All the following are fossil fuels EXCEPT:

- A: Coal
- B: Crude oil
- C: Solar
- D: Natural gas

## Alternative Energy Sources

A number of different energy sources are used every day. Where does this energy come from? Burning of fossil fuel is a main energy source. Sources other than this fossil fuel are known as **alternative energy sources** and there are several of them being used every day.

The water used by whitewater rafters has a tremendous amount of energy. That **water energy** can be harnessed to perform work by using waterwheels. Running or falling water turns the wheel. The turning wheel spins an axle which can be attached to machinery to do various work. In a mill the waterwheel turns and a big stone grinds grain. In a sawmill waterwheels turn the axle and a blade cuts wood. Finally, in a hydroelectric plant the running or falling water spins a generator to create electricity.

Not only does water spin a wheel, but **wind** can do so as well. Windmills work in the same manner as a waterwheel. For many years, windmills were usually used mainly for milling grain, pumping water, or both. Today, though, all of that has changed. **Windmills** are used as wind turbines that can generate electricity. As the wind propels the blades, energy is created and stored to be used to perform work. As long as there is movement, energy can be produced, and the wind is an excellent alternative energy source. In many parts of the Midwest where there is an abundance of wind, energy is produced for homes and businesses.

The internal heat of the earth is another energy source. The interior of the earth is very hot as is evidenced by hot water or steam coming out of the ground in certain places on the Earth. The earth's internal heat is called **geothermal energy**. Geothermal energy can be used to heat homes and produce electricity. There are homes in Boise, Idaho that have been heated solely by hot springs since the 1890's. Also at the Geysers in California, steam drives turbines that generate electricity. This steam comes from underground water that is heated by geothermal energy.

Every day the sun provides energy. Solar energy is often thought to just be sunlight. Sunlight is full of energy. It is the sunlight that gives water the energy to evaporate and rise into the atmosphere. People are finding new ways to harness the power of sunlight. One major way is to trap or concentrate sunlight with the use of **solar panels**. This trapped sunlight can be used to heat homes and water. Also **solar cells** are devices that convert sunlight into electric energy.

As the use of alternative energy sources increases, the consumption of the earth's fossil fuels will also decrease. One watt of energy that is used by solar cells is one less watt used by power plants burning oil or coal. If society hopes to see the next generation have the resources needed to heat homes and drive cars, alternative energy sources are needed today.

Fossil fuel is the most common source of energy today, but it is not considered clean energy. There are various other sources of alternative energy that must be incorporated if the next generations are expected to have energy. Water, wind, the internal heat of the earth, and the sun are all being harnessed to create energy. Geothermal energy and solar energy are more common. Homes are being heated and cooled, cars are being driven, and electricity is used all from these various alternative sources of energy. All are examples of clean energy, which is better for the environment because it does not cause pollution.

1) Sources of energy other than fossil fuel are called which of the following?

- A: Alternative sources of energy
- B: Geothermal energy
- C: Solar energy
- D: Water energy

2) Water energy can be harnessed by using which of the following tools?

- A: Windmills
- B: Waterwheels
- C: Aqua cells
- D: Hydroelectric wheels

3) The earth's internal heat is called which of the following?

- A: Solar energy
- B: Core energy
- C: Geothermal energy
- D: Steam energy

4) Which of the following is a device that converts sunlight into electric energy?

- A: Solar cells
- B: Solar panels
- C: Converters
- D: Hydro panels

5) Which of the following is a tool used to trap or concentrate sunlight to be used for energy?

- A: Solar cells
- B: Solar panels
- C: Solar devices
- D: Solar sensors

6) Which of the following is **NOT** an alternative source of energy?

- A: Water
- B: Wind
- C: Sun
- D: Plants