2012-2013

Energy Flows

Students learn about the forms of energy, how energy is converted from one form to another, and how energy flows through systems.

SCIENCE OF ENERGY

Grade Level:

- Elementary
- Intermediate
- Secondary

Subject Areas:

- Science
- Social Studies
- Math
- Language Arts

NEED
National Energy Education Development Project

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NEED Mission Statement

The mission of The NEED Project is to promote an energy conscious and educated society by creating effective networks of students, educators, business, government and community leaders to design and deliver objective, multi-sided energy education programs.

Teacher Advisory Board Statement

In support of NEED, the national Teacher Advisory Board (TAB) is dedicated to developing and promoting standards-based energy curriculum and training.

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Energy Data Used in NEED Materials

NEED believes in providing the most recently reported energy data available to our teachers and students. Most statistics and data are derived from the U.S. Energy Information Administration's Annual Energy Review that is published in June of each year. Working in partnership with EIA, NEED includes easy to understand data in our curriculum materials. To do further research, visit the EIA web site at www.eia.gov. EIA's Energy Kids site has great lessons and activities for students at www.eia.gov/kids.

NEED
National Energy Education Development

1.800.875.5029
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Energy Flows

Table of Contents

Correlations to National Science Education Standards: Grades 5-8

This book has been correlated to National Science Education Content Standards.
For correlations to individual state standards, visit **www.NEED.org**.

Content Standard B | *PHYSICAL SCIENCE*

- **Transfer of Energy**
  - Energy is a property of many substances and is associated with heat, light, electricity, mechanical motion, sound, nuclei, and the nature of a chemical. Energy is transferred in many ways.
  - In most chemical and nuclear reactions, energy is transferred into or out of a system. Heat, light mechanical motion, or electricity might all be involved in such transfers.
  - The sun is a major source of energy for changes on the earth's surface. The sun loses energy by emitting light. A tiny fraction of that light reaches the earth, transferring energy from the sun to the earth. The sun's energy arrives as light with a range of wavelengths, consisting of visible light, infrared, and ultraviolet radiation.

Content Standard C | *LIFE SCIENCE*

- **Populations and Ecosystems**
  - For ecosystems, the major source of energy is sunlight. Energy entering ecosystems as sunlight is transferred by producers into chemical energy through photosynthesis. That energy then passes from organism to organism in food webs.

Content Standard F *SCIENCE IN PERSONAL AND SOCIAL PERSPECTIVES*

- **Science and Technology in Society**
  - Technology influences society through its products and processes. Technology influences the quality of life and the ways people act and interact. Technological changes are often accompanied by social, political, and economic changes that can be beneficial or detrimental to individuals and to society. Social needs, attitudes, and values influence the direction of technological development.

Correlations to National Science Education Standards: Grades 9-12

This book has been correlated to National Science Education Content Standards.
For correlations to individual state standards, visit **www.NEED.org**.

Content Standard B | *PHYSICAL SCIENCE*

- **Conservation of Energy and the Increase in Disorder**
  - The total energy of the universe is constant. Energy can be transferred by collisions in chemical and nuclear reactions, by light waves and other radiations, and in many other ways. However, it can never be destroyed. As these transfers occur, the matter involved becomes steadily less ordered.
  - All energy can be considered to be either kinetic energy, which is the energy of motion; potential energy, which depends on relative position; or energy contained by a field, such as electromagnetic waves.

Content Standard C | *LIFE SCIENCE*

- **Matter, Energy, and Organization in Living Systems**
  - The energy for life primarily derives from the sun. Plants capture energy by absorbing light and using it to form strong (covalent) chemical bonds between the atoms of carbon-containing (organic) molecules. These molecules can be used to assemble larger molecules with biological activity (including proteins, DNA, sugars, and fats). In addition, the energy stored in bonds between the atoms (chemical energy) can be used as sources of energy for life processes.
  - The chemical bonds of food molecules contain energy. Energy is released when the bonds of food molecules are broken and new compounds with lower energy bonds are formed. Cells usually store this energy temporarily in phosphate bonds of a small high-energy compound called ATP.

Content Standard D | *EARTH AND SPACE SCIENCE*

- **Energy in the Earth System**
  - Earth systems have internal and external sources of energy, both of which create heat. The sun is the major external source of energy. Two primary sources of internal energy are the decay of radioactive isotopes and the gravitational energy from the earth's original formation.

Content Standard F | *SCIENCE IN PERSONAL AND SOCIAL PERSPECTIVES*

- **Natural Resources**
  - Human populations use resources in the environment in order to maintain and improve their existence. Natural resources have been and will continue to be used to maintain human populations.
  - The earth does not have infinite resources; increasing human consumption places severe stress on the natural processes that renew some resources, and it depletes those resources that cannot be renewed.
  - Humans use natural systems as resources. Natural systems have the capacity to reuse waste, but that capacity is limited. Natural systems can change to an extent that exceeds the limits of organisms to adapt naturally or humans to adapt technologically.
- **Science and Technology in Local, National, and Global Challenges**
  - Science and technology are essential social enterprises, but alone they can only indicate what can happen, not what should happen. The latter involves human decisions about the use of knowledge.
  - Understanding basic concepts and principles of science and technology should precede active debate about the economics, policies, politics, and ethics of various science- and technology-related challenges. However, understanding science alone will not resolve local, national, or global challenges.

Teacher Guide

Grade Level

- Elementary Grade 5
- Intermediate Grades 6–8
- Secondary Grades 9–12

Time

- One 45-minute class period

Additional Resources

- For comprehensive background information on energy sources, download one of the *Energy Infobooks* from www.NEED.org.
- For hands-on science investigations about energy transformations, download *Science of Energy* or *Secondary Science of Energy* from www.NEED.org.

Background

To understand forms of energy, energy transformations, and the flow of energy through systems.

Concepts

- Energy is stored in many different forms.
- Energy is neither created nor destroyed, it is transformed from one form to another.
- Most of the energy on Earth can be traced back to nuclear fusion in the sun's core.
- Energy flows through all dynamic systems on Earth.

Materials

- Regular flashlight and hand generated flashlight (call NEED at 1-800-875-5029 for suppliers)
- Masters of pages 8, 10, 11, 12, 13, 14, 15, 17, 18, 20, 21, 23, 24, and 25
- Copies of worksheets on pages 9, 16, 19, 22, and 26 for each student
- Copies of pages 27-35, cut and folded along the dotted lines into *Energy Flow Cards*
- Pieces of string and tape for Variation II of *Energy Flow Card* activity
- Overhead or LCD projector
- Large wooden kitchen matches

Procedure

Step One: Preparation

- Obtain the materials you will use in the activity.
- Download copies or make masters and handouts you will use in the activity.
- Familiarize yourself with the activity.
- Decide if you will go through all of the energy sources.

Step Two: Introduction: Forms of Energy

- Introduce the activity by lighting a wooden match and asking the students to describe what is happening in energy terms. Explain the energy flow from the match back to the sun.
- Use the *Forms of Energy* master (page 8) to provide an introduction to the forms of energy.
- Distribute the *Forms and Sources of Energy* worksheet (page 9) and have the students complete it. Review the answers with the students.

Forms and Sources of Energy Answer Key:

- Nonrenewable: Chemical, Chemical, Chemical, Nuclear, Chemical
- Renewable: Chemical, Motion, Motion, Thermal, Radiant
- Percentage of energy provided by each form: Chemical: 87.55; Nuclear: 8.62%; Motion: 3.5%; Thermal: 0.22%; Radiant: 0.11%
- Percentage of energy provided by renewables: 8.22%
- Percentage of energy provided by nonrenewables: 91.78%

Step Three: Flashlights and Energy Flow

- Demonstrate a regular battery-powered flashlight and a hand generated flashlight. Ask the students to explain what is happening with each flashlight in terms of energy transformations. Use the *Energy Transformations in a Hand Generated Flashlight* master (page 10) to trace the energy flow of the hand generated flashlight. Discuss the differences between the two flashlights and the energy flows.

Step Four: Power Plants and Energy Flow

Energy Source	Introduction	Explain energy transformations and how the source is used to generate electricity using the following masters	Energy Flow Worksheet
Fossil Fuels	Review with students what fossil fuels are. Tell them that coal and natural gas are responsible for generating almost 70 percent of the electricity consumed in the U.S.	*Fusion*, page 11 *Photosynthesis*, page 12 *How Coal Was Formed*, page 13 *Oil and Natural Gas Formation*, page 14 *Burning Fossil Fuels to Generate Electricity*, page 15	*Fossil Fuel Energy Flow*, page 16
Wind	Tell students that wind generates over 2 percent of the electricity in the United States. After natural gas it is the fastest growing energy source for generating electricity.	*Fusion*, page 11 *How Wind is Formed*, page 17 *Harnessing the Wind to Generate Electricity*, page 18	*Wind Energy Flow*, page 19
Hydropower	Tell students that there are more than 2,000 hydropower plants generating electricity in the U.S. The amount of electricity generated by hydropower (currently about 6 percent) varies depending on rainfall amounts and droughts	*Fusion*, page 11 *The Water Cycle*, page 20 *Harnessing Hydropower to Generate Electricity*, page 21	*Hydropower Energy Flow*, page 22
Uranium	Tell students that nuclear energy is responsible for generating about 20 percent of the electricity in the U.S.	*Fission,* page 23 *Uranium Fuel Cycle*, page 24 *Using Nuclear Energy to Generate Electricity*, page 25	*Nuclear Energy Flow*, page 26

EXTENSIONS

- Have each student choose a renewable energy source and explain the energy conversions that occur when it is used to generate electricity.
- Discuss the similarities and differences between a thermal power plant and a nuclear power plant.

Step Five: Energy Flow Cards

- Distribute the *Series 1* cards (the series number is on the left hand corner of each card) to 10 students.
- Distribute the *Series 2* cards (the series number is on the left hand corner of each card) to 15 students.
- Distribute the *Series 3* cards (the series number is on the left hand corner of each card) to 10 students.

VARIATION I

- Have the students look at the cards and line up in the correct order, holding hands. At some junctions, a student will be connected to more than one other student.

VARIATION II

- Have the students use string and tape to connect the cards in the correct order. Some cards will be connected to more than one other card.
- Have the students in each series explain to the class how the cards are connected and why.

Step Six: Evaluation

- Have the students demonstrate comprehension of energy forms and flows by designing energy flow cards for a multiple-conversion process not discussed in class.
- Evaluate the activity using the form on page 39 and fax to NEED at 1-800-847-1820.

Extension

- Act out *A Cool Coal Story* on page 36-38.
- Have students write and act out an energy flow of their choice using something other than the cards (props, etc.).

Forms of Energy

All forms of energy fall under two categories:

POTENTIAL

Stored energy and the energy of position (gravitational).

CHEMICAL ENERGY is the energy stored in the bonds of atoms and molecules. Biomass, petroleum, natural gas, propane, and coal are examples.

NUCLEAR ENERGY is the energy stored in the nucleus of an atom—the energy that holds the nucleus together. The energy in the nucleus of a uranium atom is an example.

STORED MECHANICAL ENERGY is energy stored in objects by the application of force. Compressed springs and stretched rubber bands are examples.

GRAVITATIONAL ENERGY is the energy of place or position. Water in a reservoir behind a hydropower dam is an example.

KINETIC

The motion of waves, electrons, atoms, molecules, and substances.

RADIANT ENERGY is electromagnetic energy that travels in transverse waves. Solar energy is an example.

THERMAL ENERGY or heat is the internal energy in substances—the vibration or movement of atoms and molecules in substances. Geothermal is an example.

MOTION is the movement of a substance from one place to another. Wind and hydropower are examples.

SOUND is the movement of energy through substances in longitudinal waves.

ELECTRICAL ENERGY is the movement of electrons. Lightning and electricity are examples.

Forms and Sources of Energy

In the United States we use a variety of resources to meet our energy needs. Use the information below to analyze how each energy source is stored and delivered.

1 Using the information from the *Forms of Energy* chart on page 8 and the graphic below, determine how energy is stored or delivered in each of the sources of energy. Remember, if the source of energy must be burned, the energy is stored as chemical energy.

NONRENEWABLE

Petroleum _____

Coal _____

Natural Gas _____

Uranium _____

Propane _____

RENEWABLE

Biomass _____

Hydropower _____

Wind _____

Geothermal _____

Solar _____

2 Look at the U.S. Energy Consumption by Source graphic below and calculate the percentage of the nation's energy use that each form of energy provides.

What percentage of the nation's energy is provided by each form of energy?

Chemical _____

Nuclear _____

Motion_____

Thermal _____

Radiant _____

What percentage of the nation's energy is provided by renewables? _____

By nonrenewables? _____

U.S. Energy Consumption by Source, 2010

NONRENEWABLE

PETROLEUM 35.10%
Uses: transportation, manufacturing

NATURAL GAS 25.17%
Uses: heating, manufacturing, electricity

COAL 21.26%
Uses: electricity, manufacturing

URANIUM 8.62%
Uses: electricity

PROPANE 1.63%
Uses: heating, manufacturing

RENEWABLE

BIOMASS 4.39%
Uses: heating, electricity, transportation

HYDROPOWER 2.56%
Uses: electricity

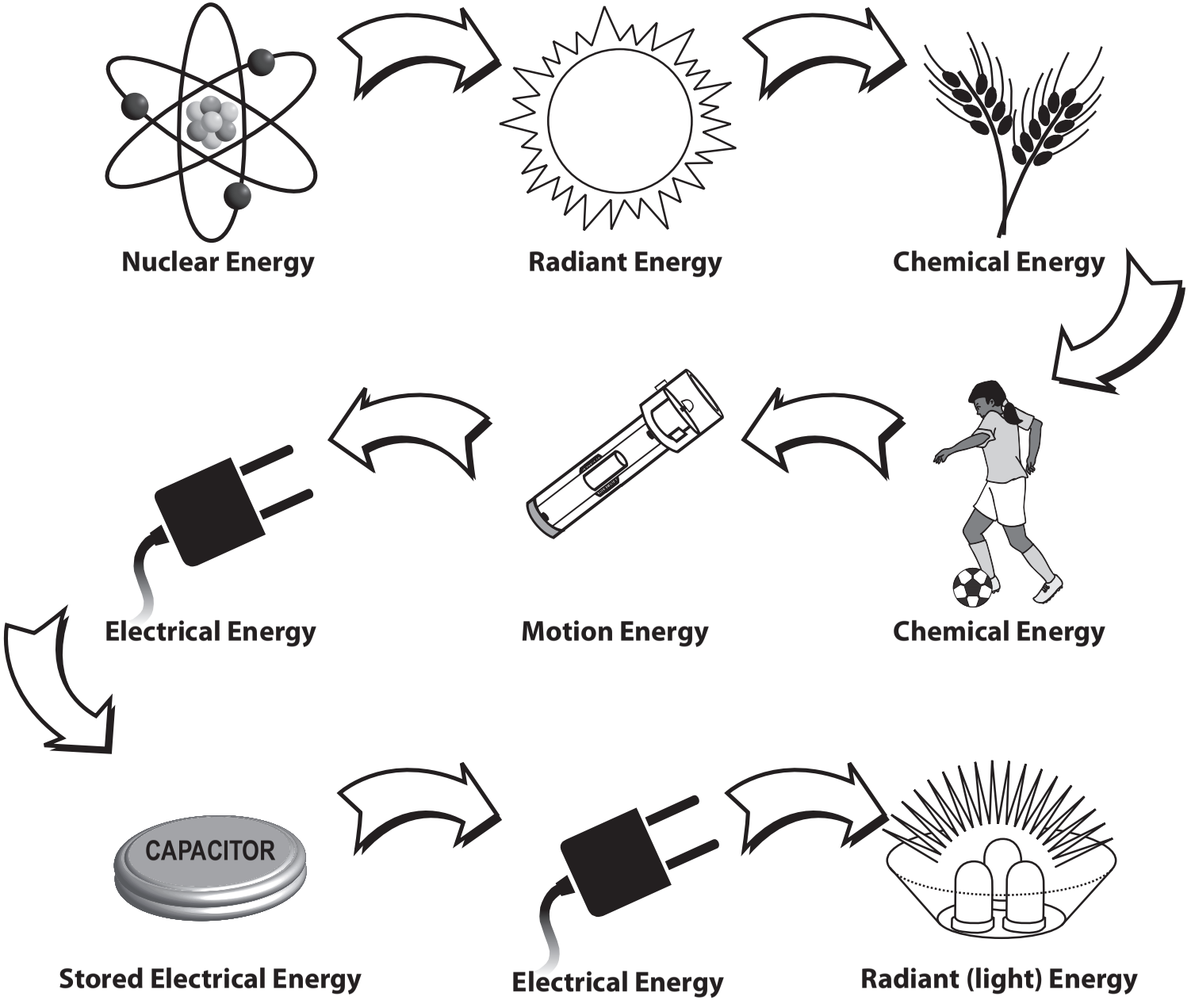
WIND 0.94%
Uses: electricity

GEOTHERMAL 0.22%
Uses: heating, electricity

SOLAR 0.11%
Uses: heating, electricity

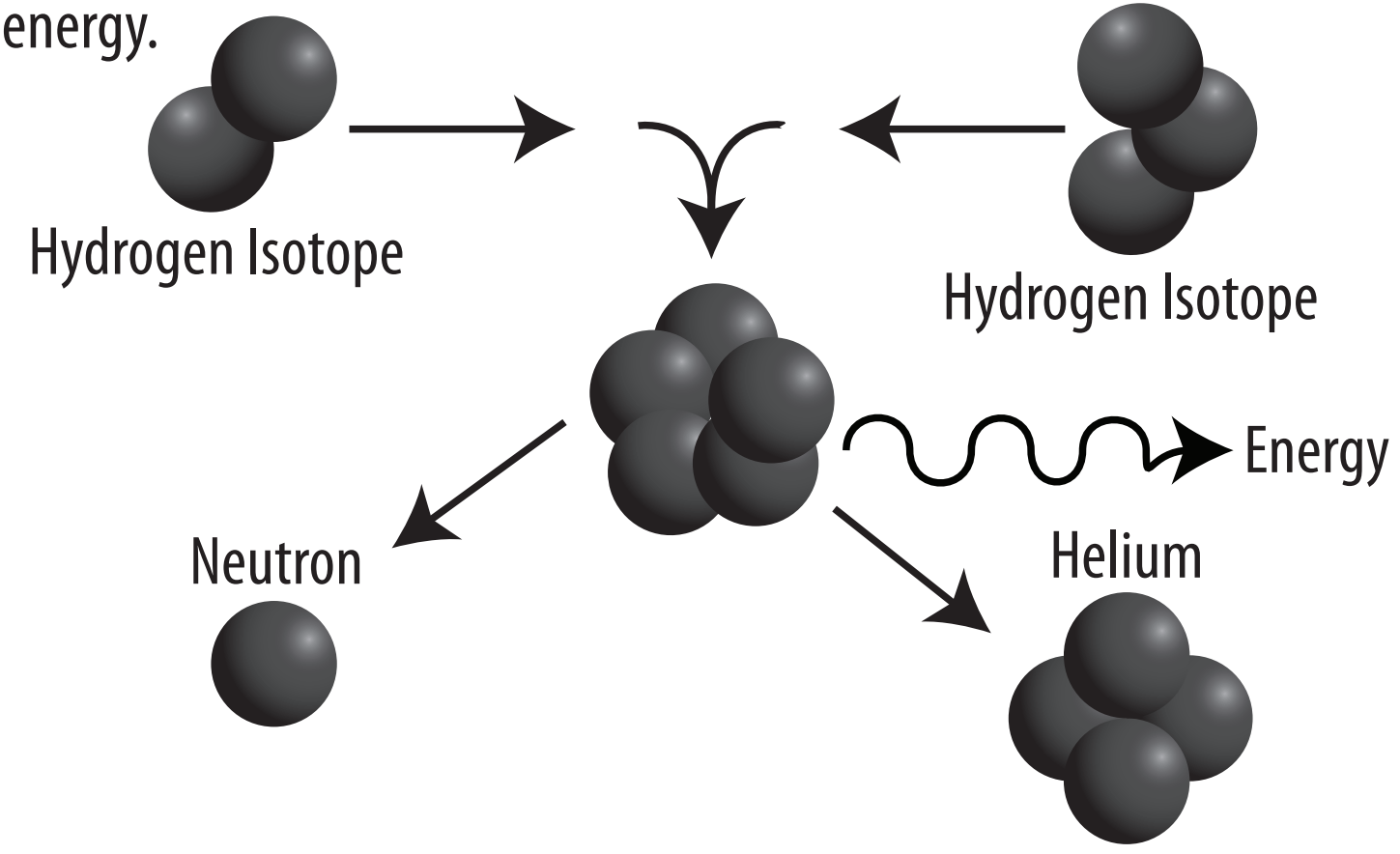
Data: Energy Information Administration

Energy Transformations in a Hand Generated Flashlight

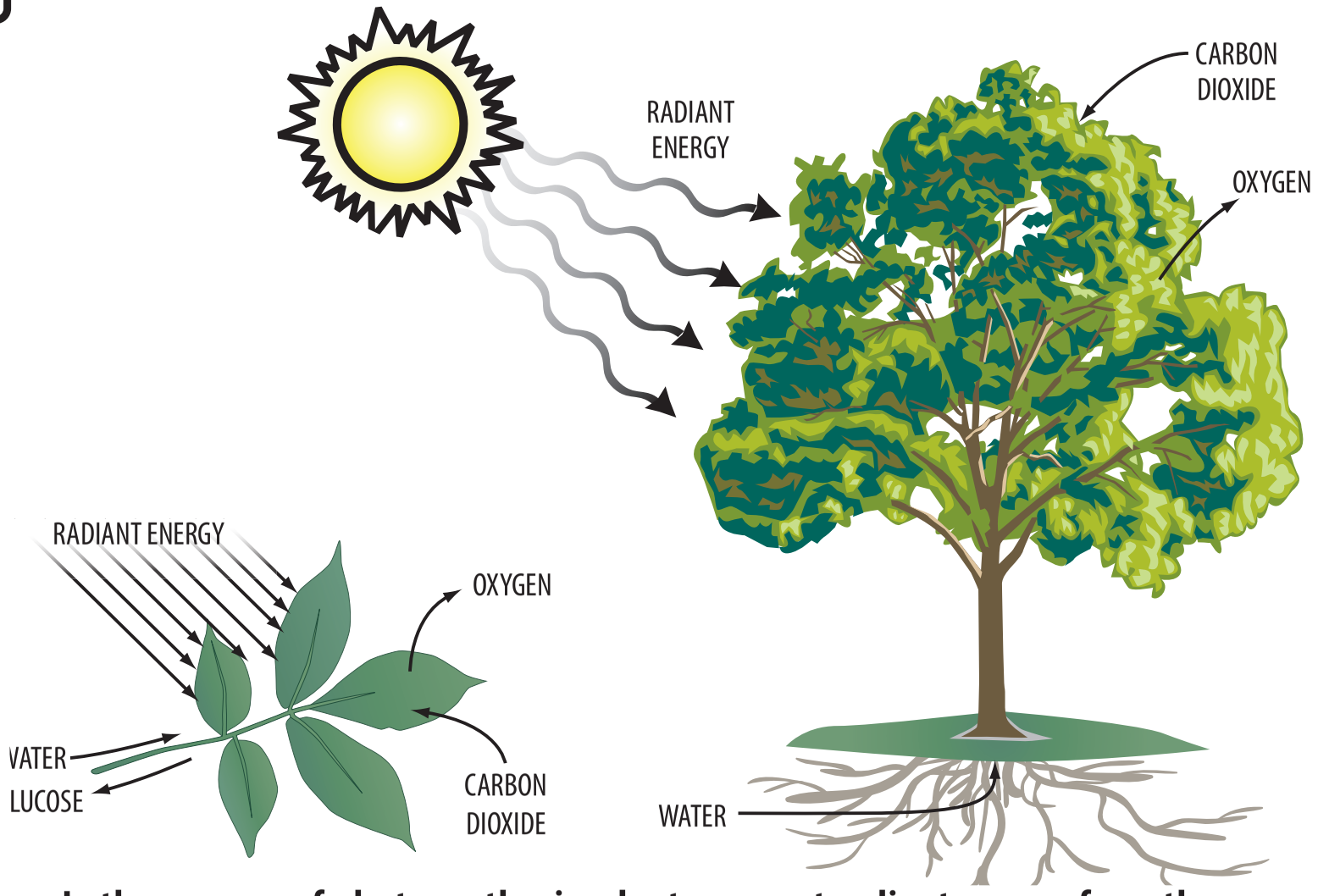


Fusion

The process of fusion most commonly involves hydrogen isotopes combining to form a helium atom with a transformation of matter. This matter is emitted as radiant energy.



Photosynthesis

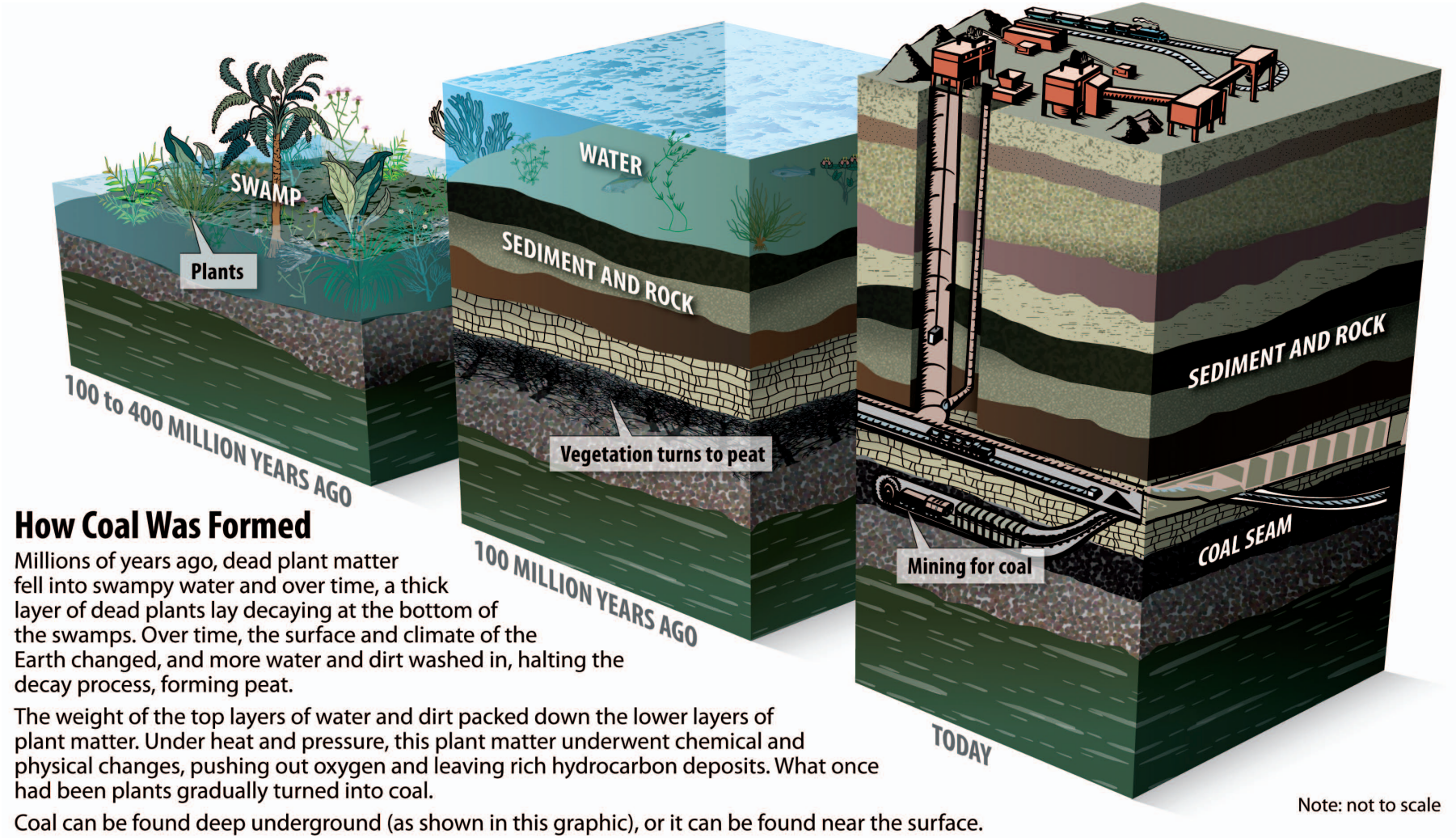


In the process of photosynthesis, plants convert radiant energy from the sun into chemical energy in the form of glucose (or sugar).

water + carbon dioxide + sunlight ⟶ glucose + oxygen

$6\ H_2O + 6\ CO_2 + \text{radiant energy} \longrightarrow C_6H_{12}O_6 + 6\ O_2$

How Coal Was Formed



How Coal Was Formed

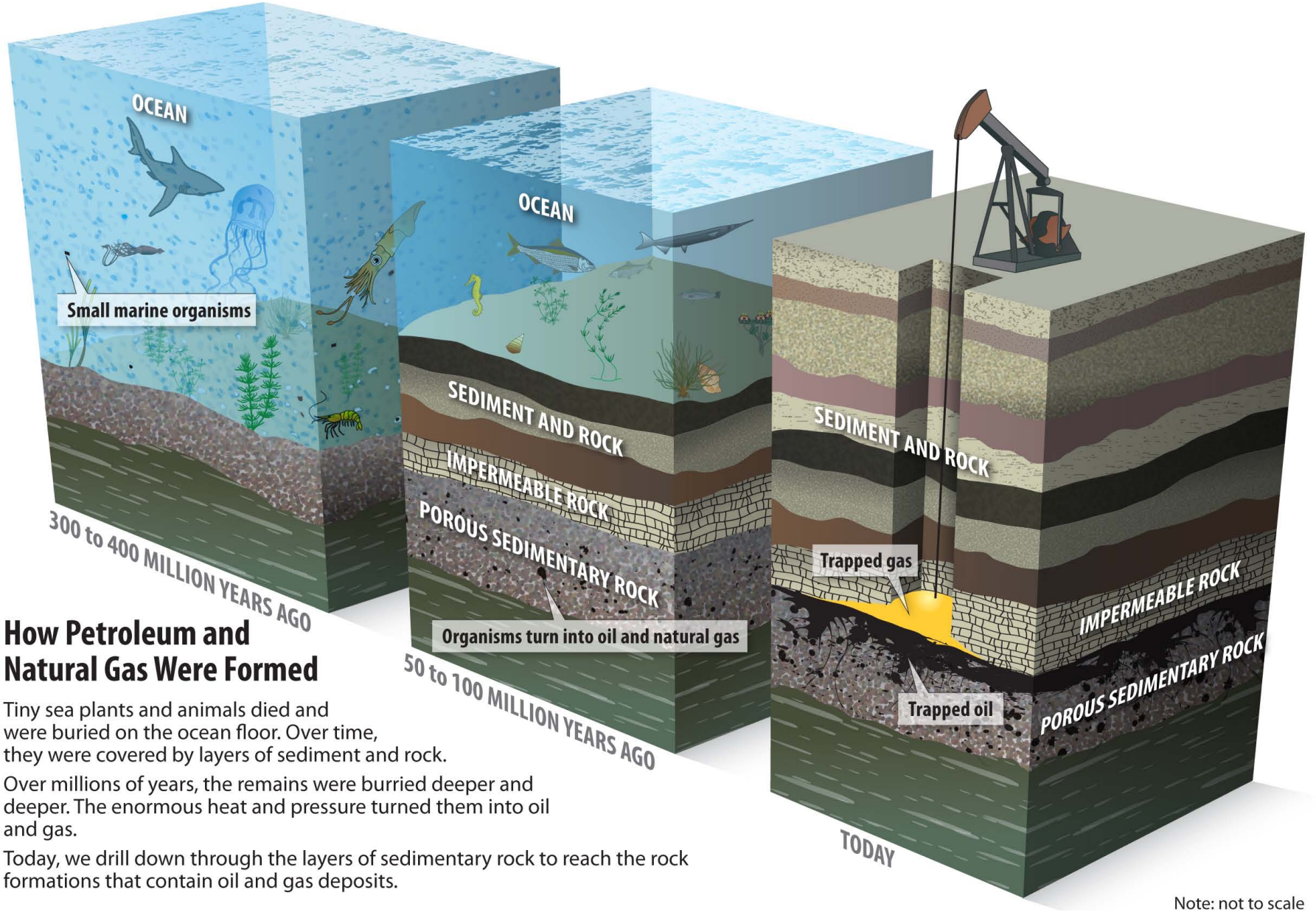
Millions of years ago, dead plant matter fell into swampy water and over time, a thick layer of dead plants lay decaying at the bottom of the swamps. Over time, the surface and climate of the Earth changed, and more water and dirt washed in, halting the decay process, forming peat.

The weight of the top layers of water and dirt packed down the lower layers of plant matter. Under heat and pressure, this plant matter underwent chemical and physical changes, pushing out oxygen and leaving rich hydrocarbon deposits. What once had been plants gradually turned into coal.

Coal can be found deep underground (as shown in this graphic), or it can be found near the surface.

Note: not to scale

Oil and Natural Gas Formation



How Petroleum and Natural Gas Were Formed

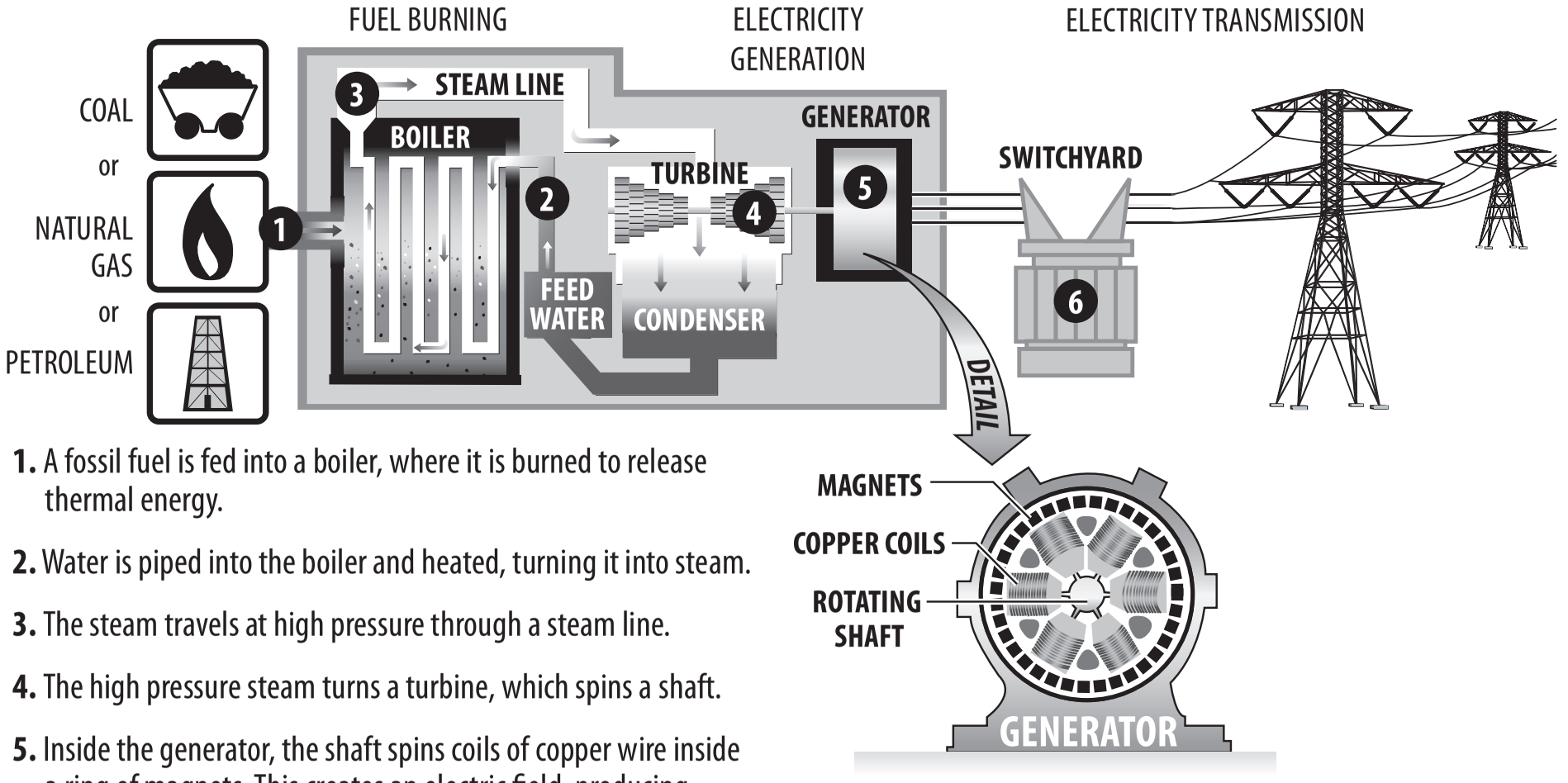
Tiny sea plants and animals died and were buried on the ocean floor. Over time, they were covered by layers of sediment and rock.

Over millions of years, the remains were burried deeper and deeper. The enormous heat and pressure turned them into oil and gas.

Today, we drill down through the layers of sedimentary rock to reach the rock formations that contain oil and gas deposits.

Note: not to scale

Burning Fossil Fuels to Generate Electricity



1. A fossil fuel is fed into a boiler, where it is burned to release thermal energy.

2. Water is piped into the boiler and heated, turning it into steam.

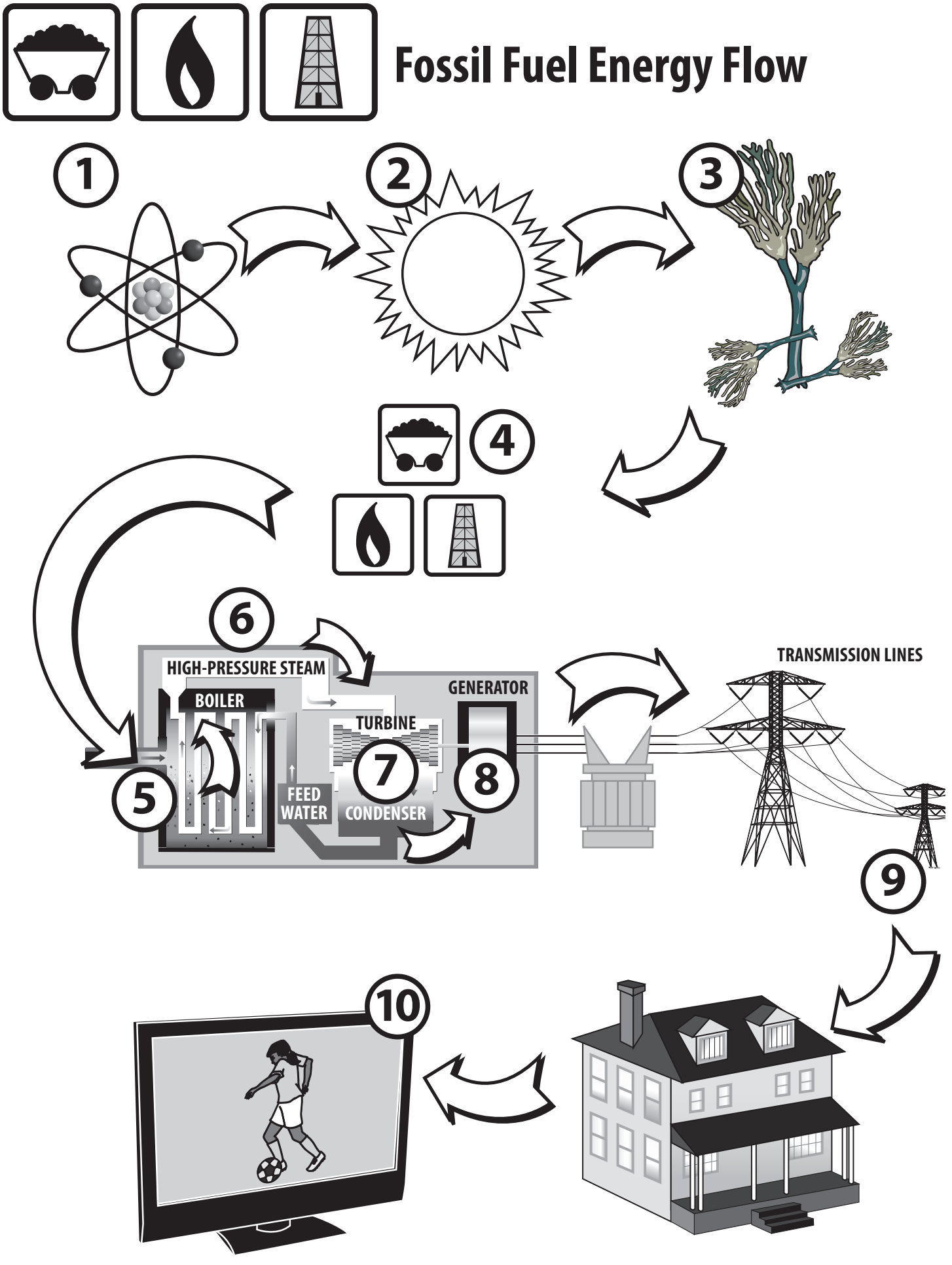
3. The steam travels at high pressure through a steam line.

4. The high pressure steam turns a turbine, which spins a shaft.

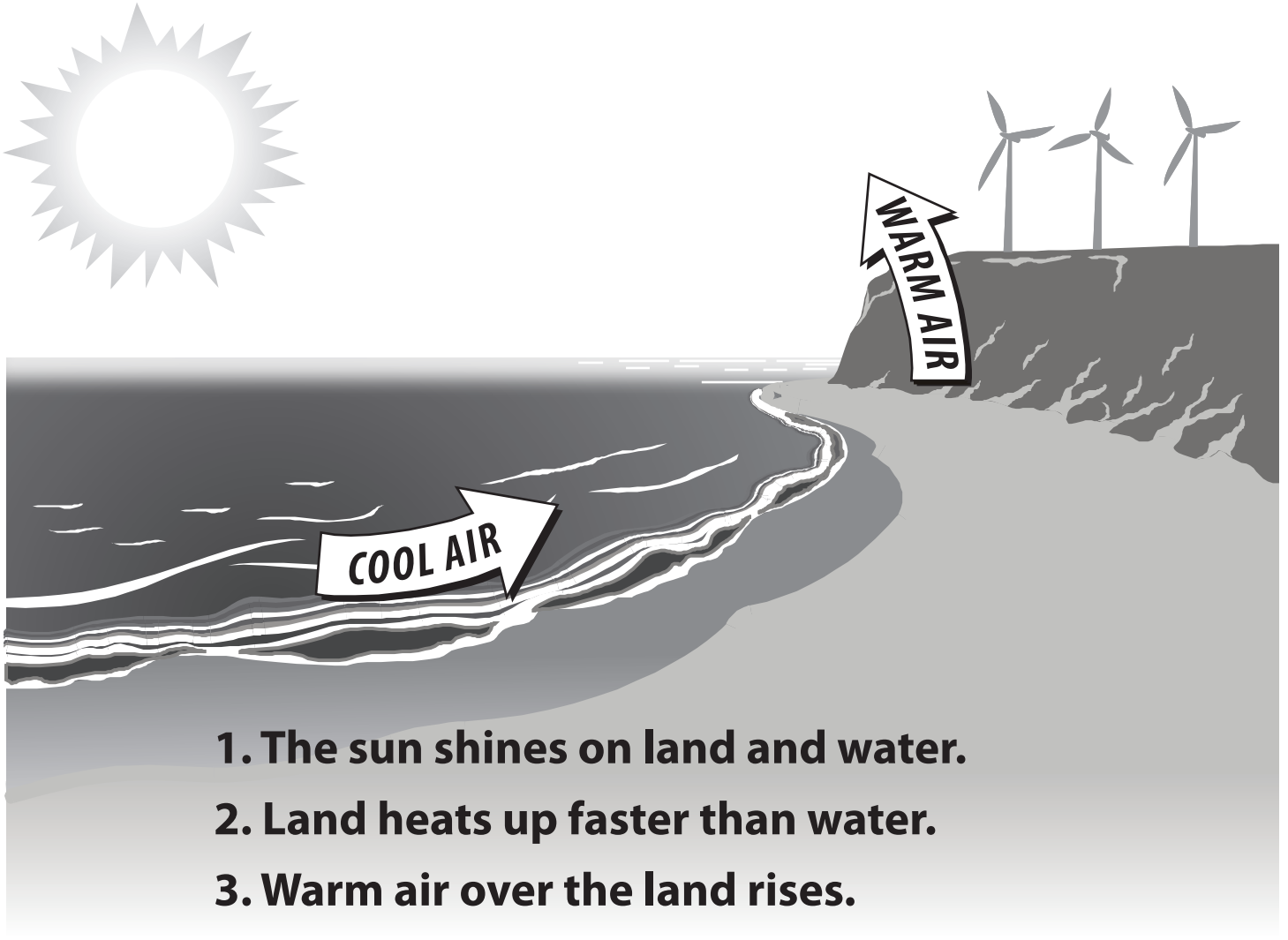
5. Inside the generator, the shaft spins coils of copper wire inside a ring of magnets. This creates an electric field, producing electricity.

6. Electricity is sent to a switchyard, where a transformer increases the voltage, allowing it to travel through the electric grid.

Fossil Fuel Energy Flow

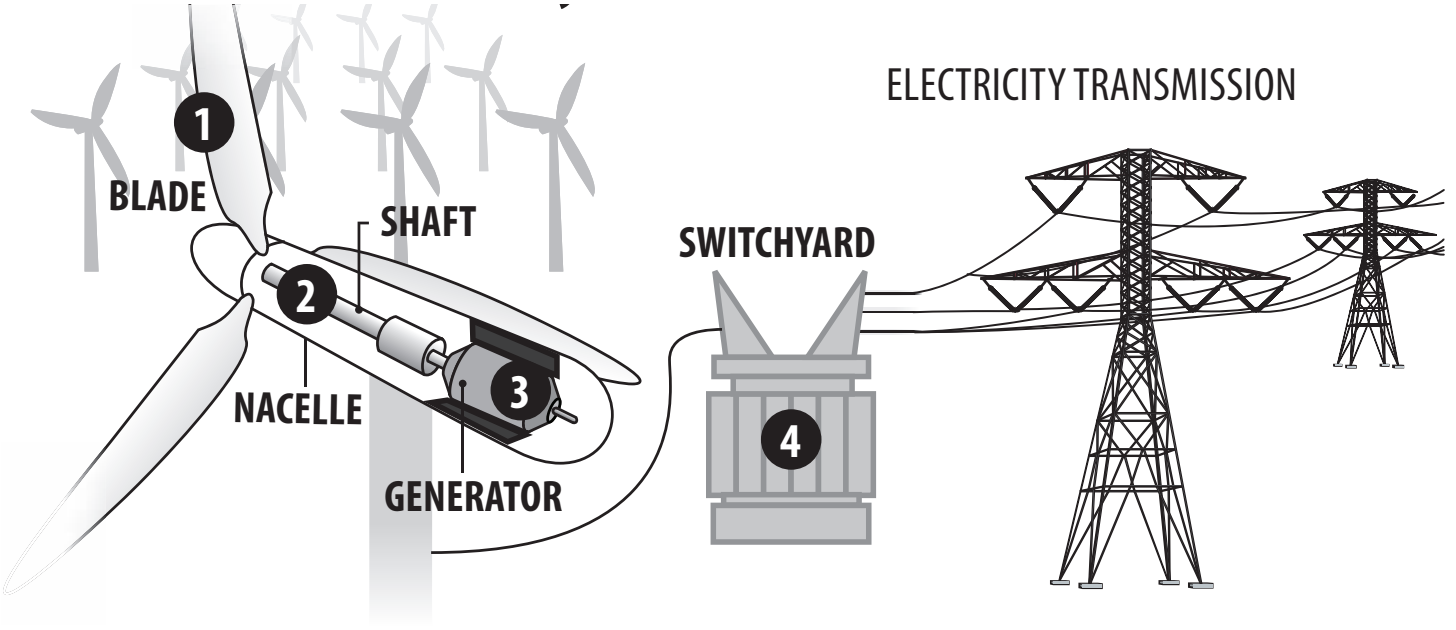


How Wind is Formed



1. The sun shines on land and water.
2. Land heats up faster than water.
3. Warm air over the land rises.
4. Cool air over the water moves in.

Harnessing the Wind to Generate Electricity



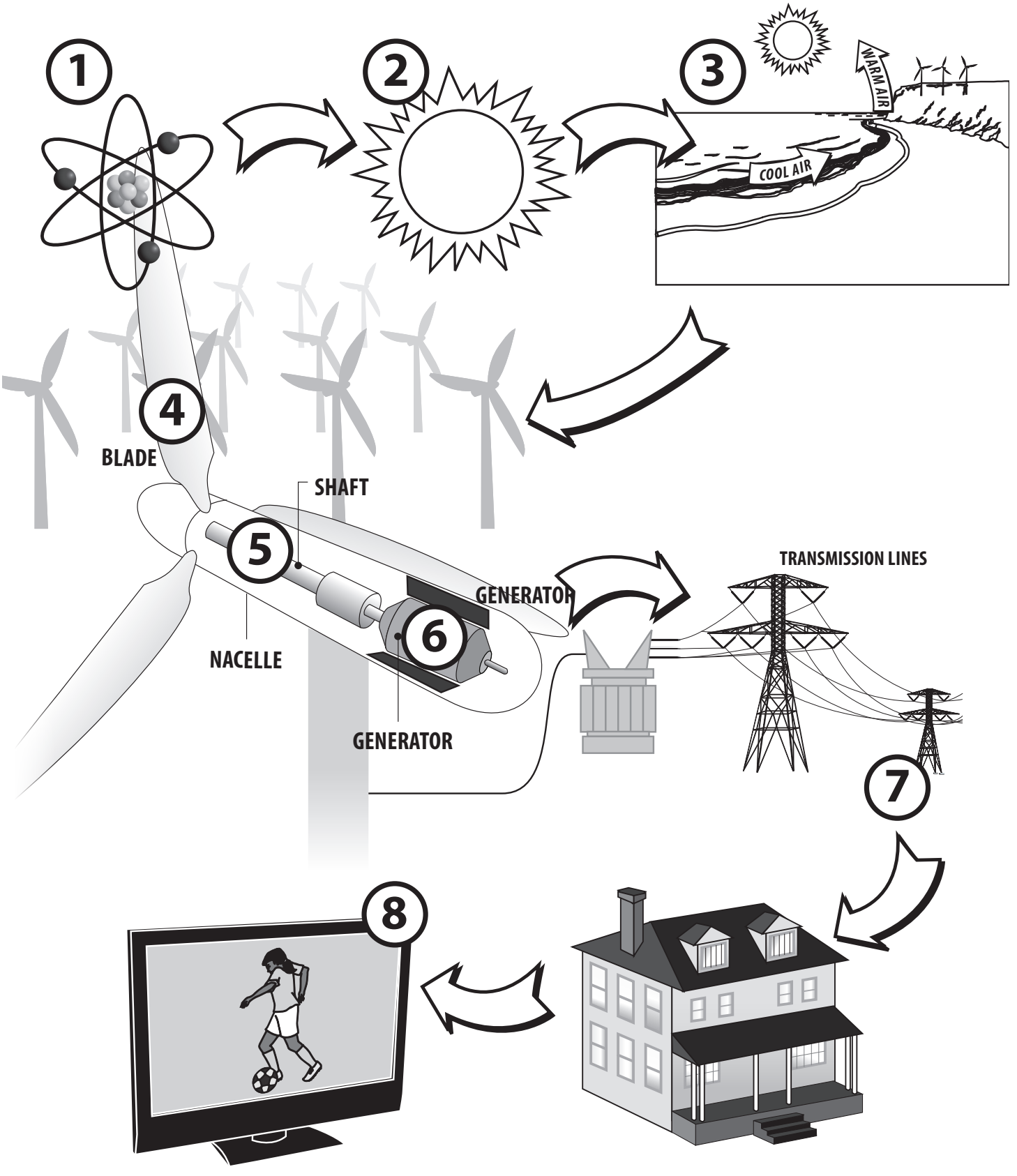
1. Wind turns the blades of the turbine.

2. The blades spin a shaft inside the nacelle.

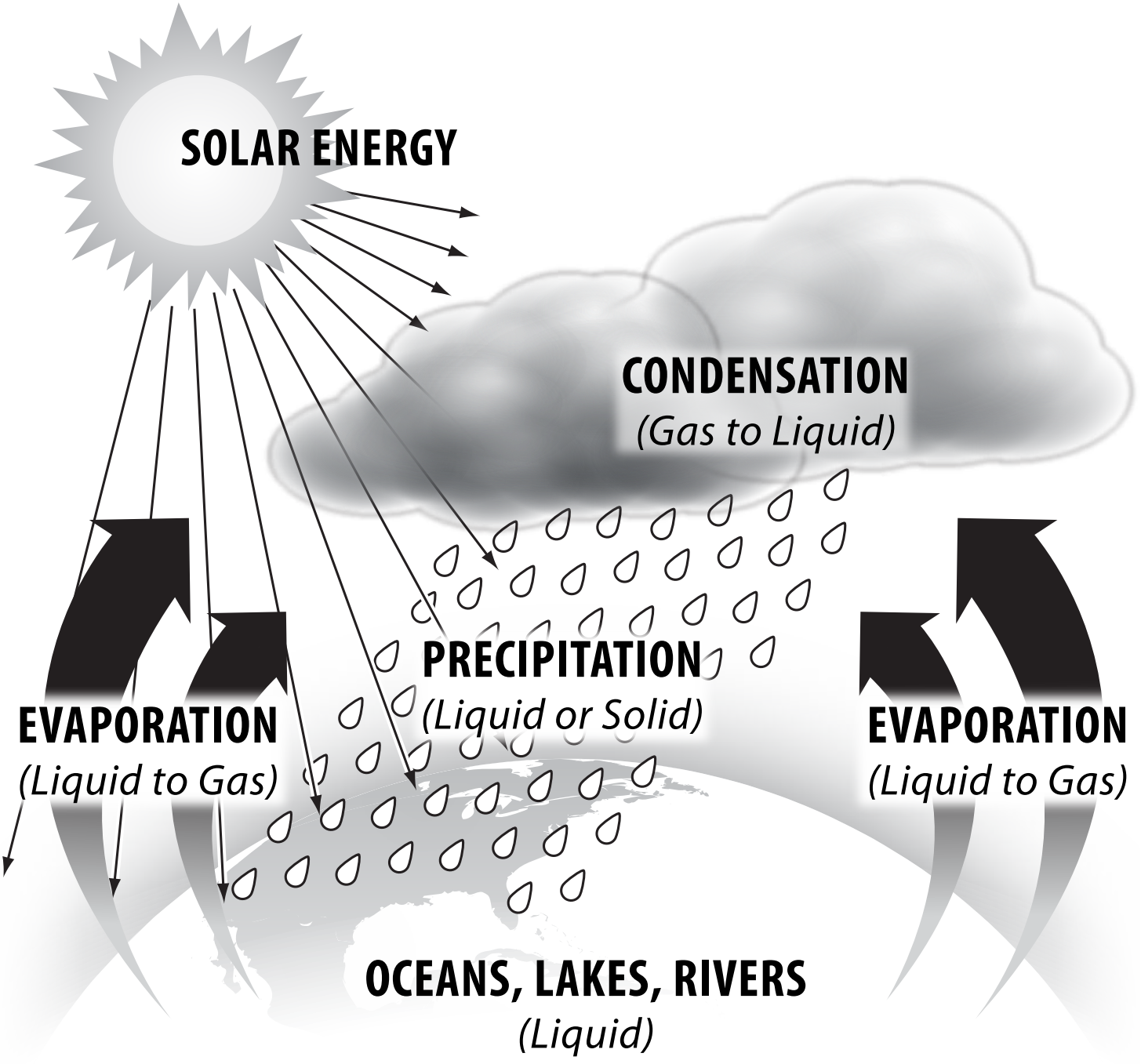
3. Inside the generator, the shaft spins coils of copper wire inside a ring of magnets. This creates an electric field, producing electricity.

4. Electricity is sent to a switchyard, where a transformer increases the voltage, allowing it to travel through the electric grid.

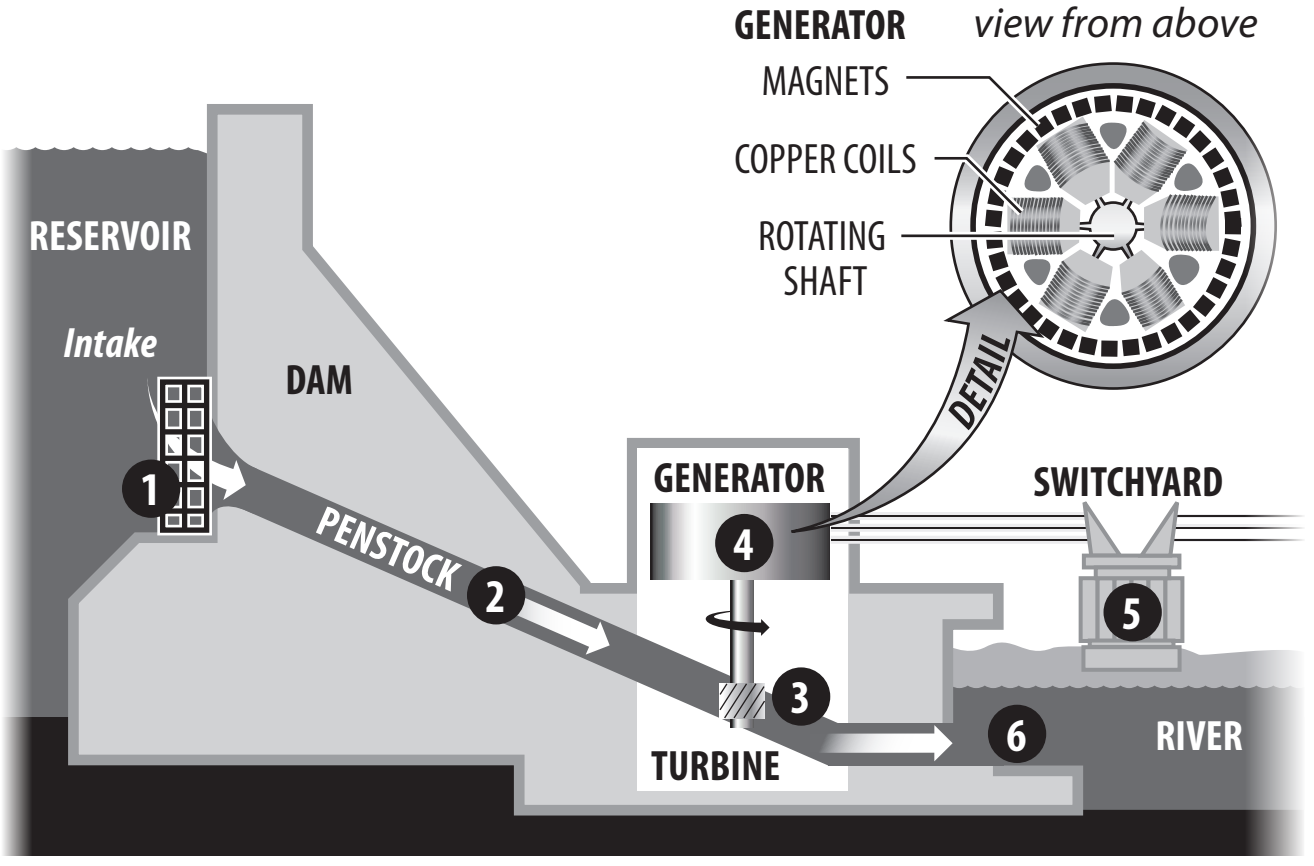
Wind Energy Flow



The Water Cycle



Harnessing Hydropower to Generate Electricity



1. Water in a reservoir behind a hydropower dam flows through an intake screen, which filters out large debris, but allows fish to pass through.

2. The water travels through a large pipe, called a penstock.

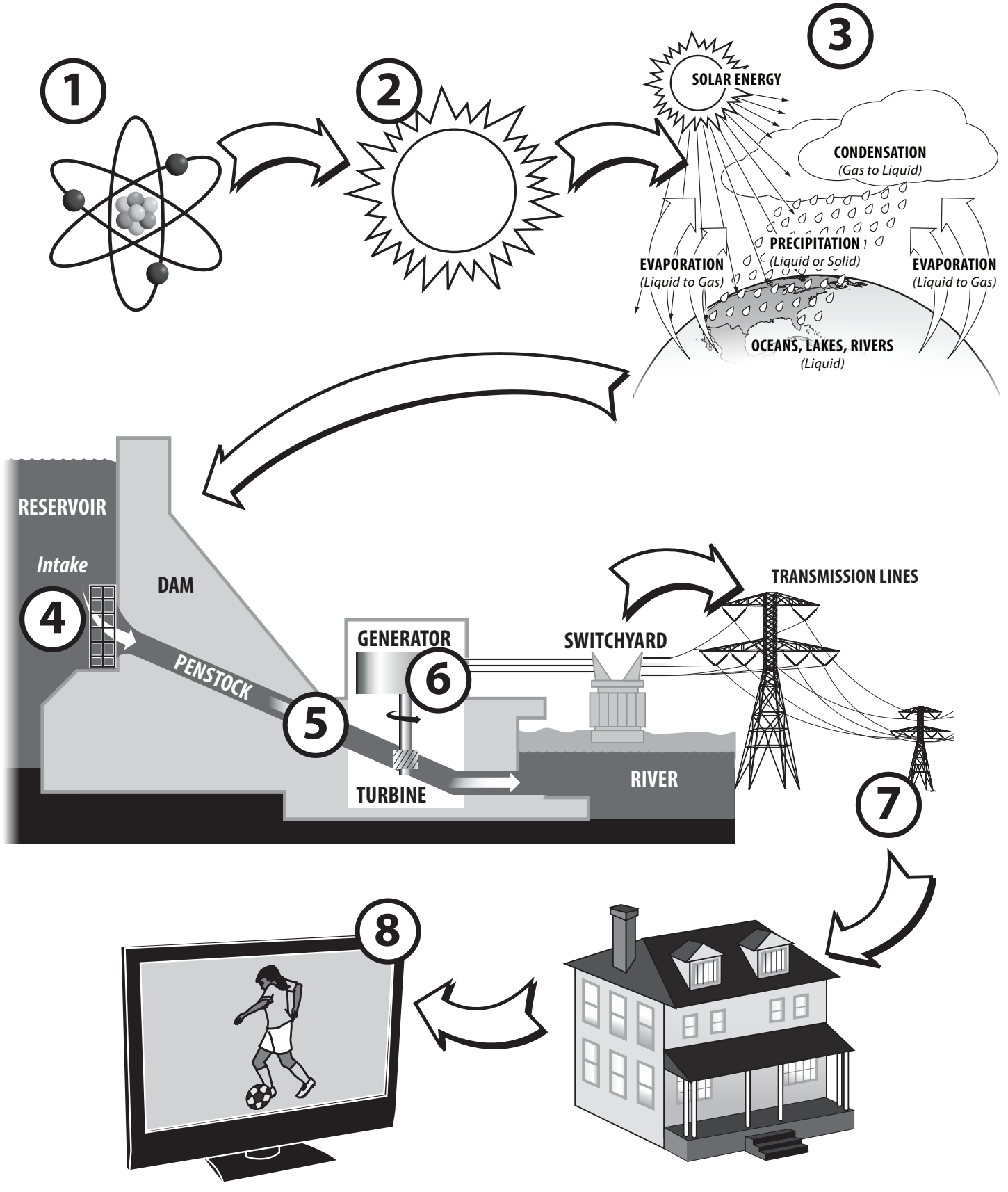
3. The force of the water spins a turbine at a low speed, allowing fish to pass through unharmed.

4. Inside the generator, the shaft spins coils of copper wire inside a ring of magnets. This creates an electric field, producing electricity.

5. Electricity is sent to a switchyard, where a transformer increases the voltage, allowing it to travel through the electric grid.

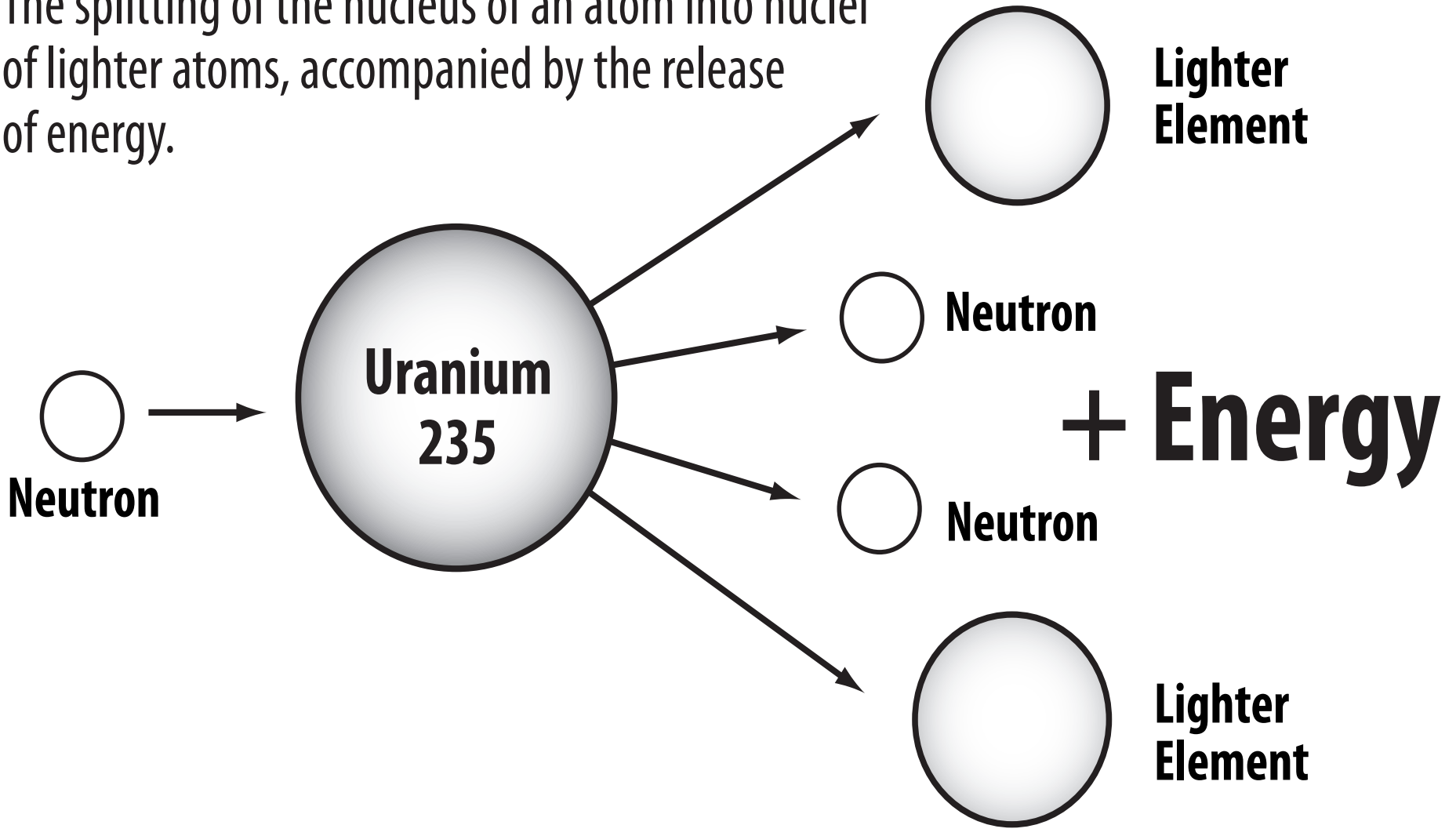
6. Water flows out of the penstock into the downstream river.

Hydropower Energy Flow

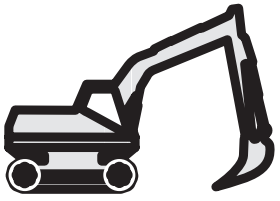


Fission

The splitting of the nucleus of an atom into nuclei of lighter atoms, accompanied by the release of energy.



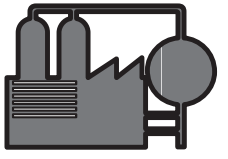
Uranium Fuel Cycle



Uranium ore is mined

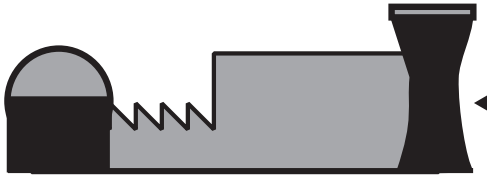
Uranium ore is milled into yellowcake

Yellowcake is turned into UO_2 and then a gas, UF_6



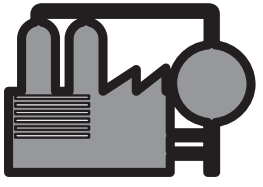
Gas is enriched to increase the amount of U-235

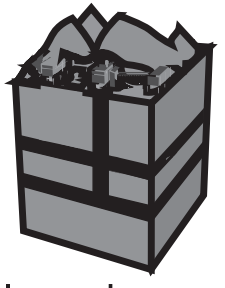
Enriched UF_6 is converted back to UO_2 and made into ceramic fuel pellets



Pellets are put into fuel rods and used to make electricity

Used fuel is stored at the power plant site

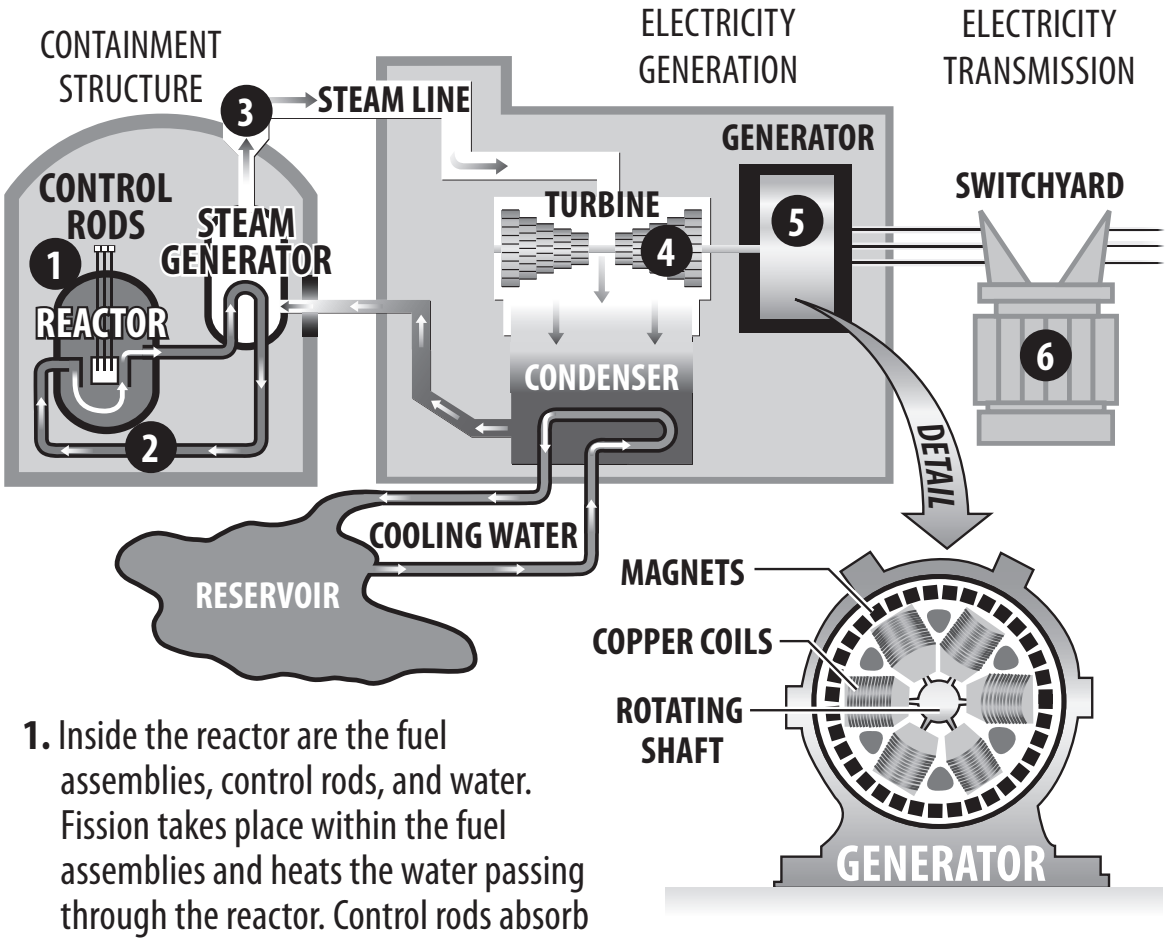




In the future the used fuel may be reprocessed or stored in an underground repository

Using Nuclear Energy to Generate Electricity

in a Pressurized Water Reactor



1. Inside the reactor are the fuel assemblies, control rods, and water. Fission takes place within the fuel assemblies and heats the water passing through the reactor. Control rods absorb neutrons to control fission.

2. Water is piped through the reactor where it is heated. It then travels to the steam generator where the hot water in pipes heats a secondary system of water.

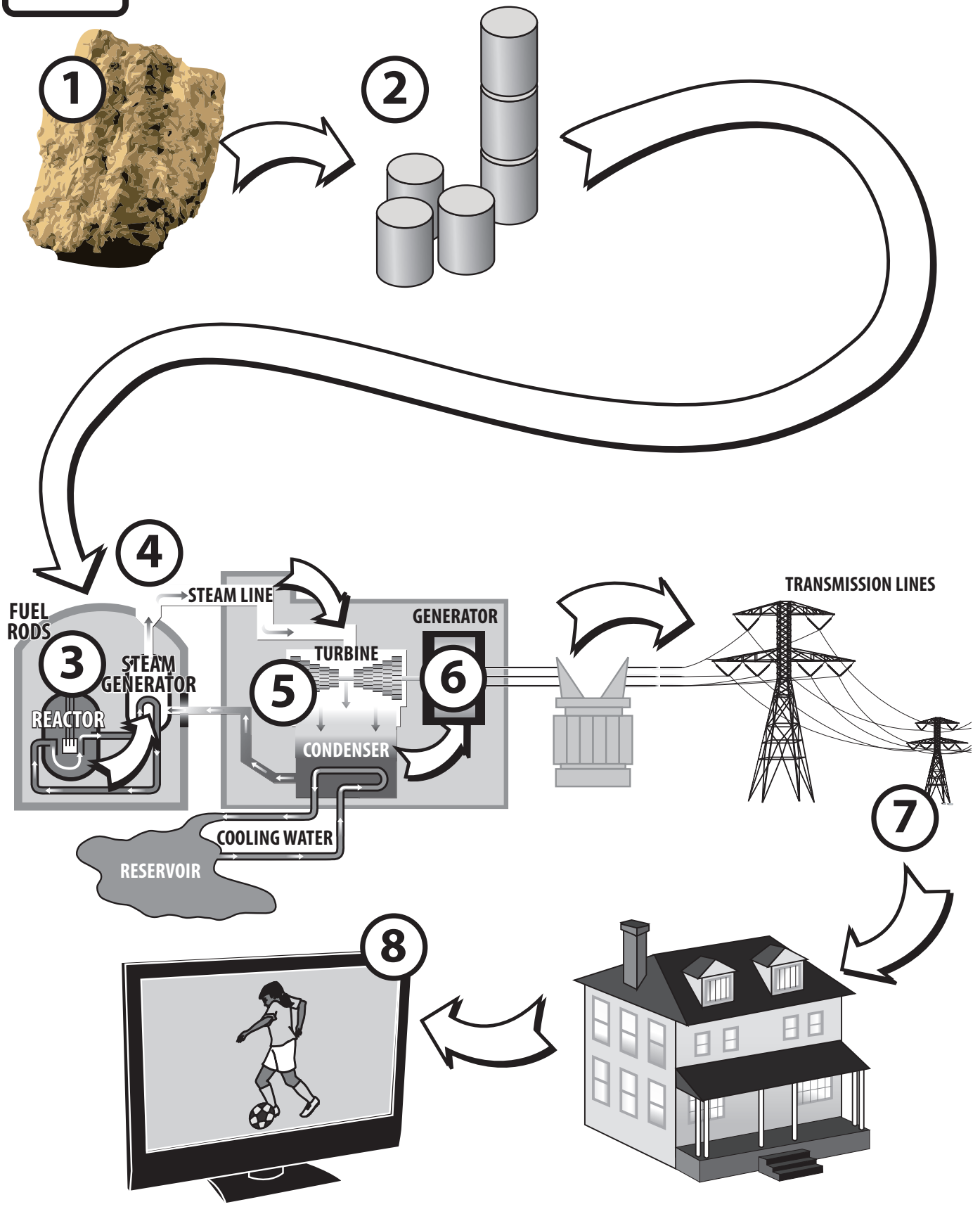
3. The steam generator keeps the steam at a high pressure. The steam travels through a steam line to the turbine.

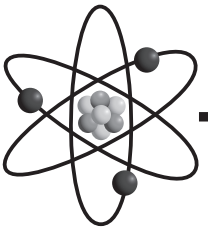
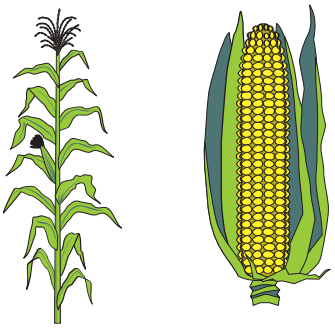
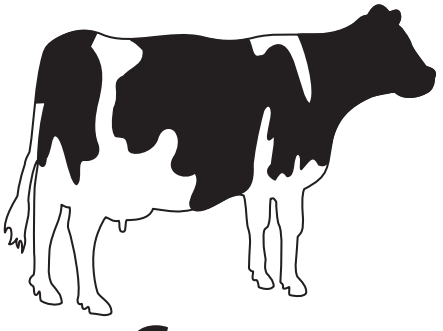
4. The high pressure steam turns the turbine as it passes through, which spins a shaft. The steam then travels through the condenser where it is condensed by cooling water and is pumped back into the steam generator to repeat its cycle.

5. The turbine spins a shaft which travels into the generator. Inside the generator, the shaft spins coils of copper wire inside a ring of magnets. This generates electricity.

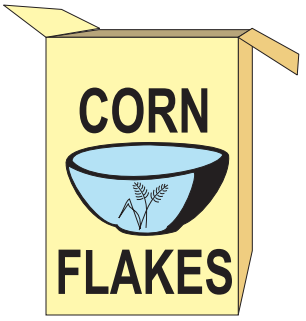
6. Electricity is sent to a switchyard, where a transformer increases the voltage, allowing it to travel through the electric grid.

Nuclear Energy Flow



1  + Radiant Energy **Sun**	**Through the process of fusion, I convert nuclear energy into radiant energy.**
1  **Human Being**	**I store chemical energy from food in my cells and turn some of it into other forms of energy.**
1  **Green Plant**	**Through the process of photosynthesis, I convert radiant energy into chemical energy and store it in my cells.**
1  **Cow**	**I store chemical energy from food in my cells and turn some of it into other forms of energy.**

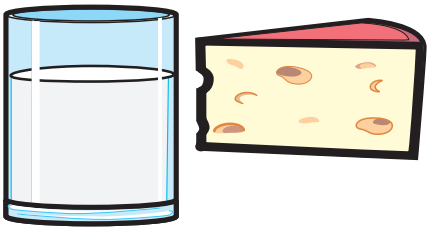
1



Cereal

I have chemical energy stored in my cells.

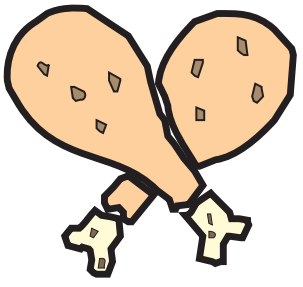
1



Milk and Cheese

I have chemical energy stored in my cells.

1



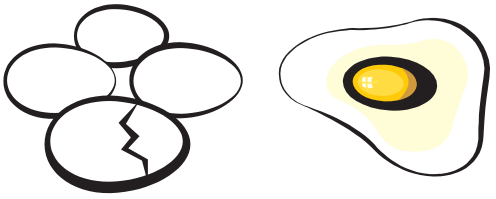
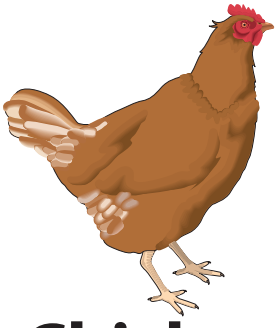
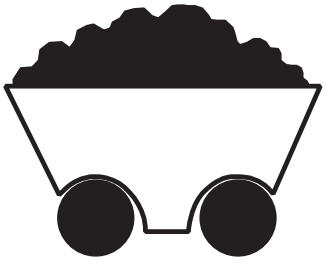
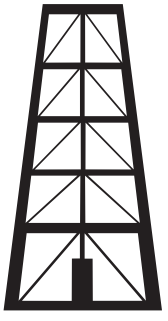
Drumstick

I have chemical energy stored in my cells.

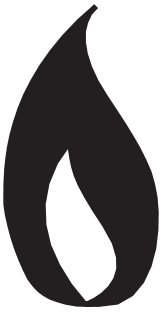
1

Steak

I have chemical energy stored in my cells.

1  **Eggs**	**I have chemical energy stored in my cells.**
1  **Chicken**	**I store energy from food in my cells and turn some of it into other forms of energy.**
2  **Coal**	**I am a fossil fuel. The chemical energy stored in me came from the remains of ancient ferns.**
2  **Petroleum**	**I am a fossil fuel. The chemical energy stored in me came from the remains of ancient sea plants and animals.**

2



Natural Gas

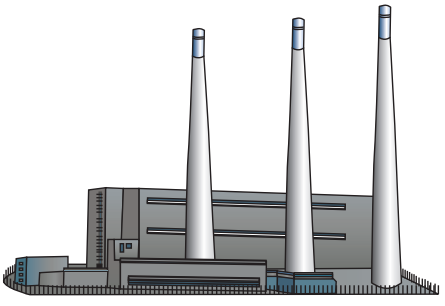
I am a fossil fuel. My chemical energy came from the remains of ancient sea plants and animals.

2

Light Bulb

I turn electrical energy into radiant and thermal energy.

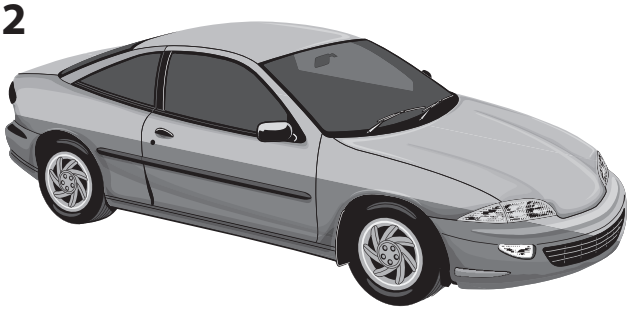
2



Thermal Power Plant

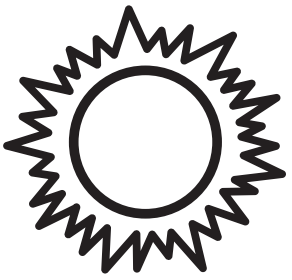
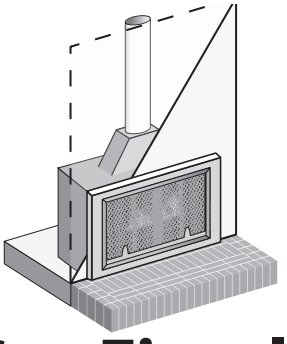
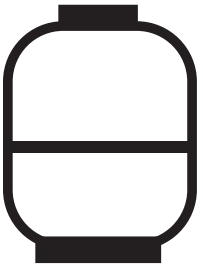
I convert chemical or nuclear energy in fuels into thermal energy then into electrical energy.

2



Automobile

I convert chemical energy in petroleum into motion, sound, and heat.

2  **Sun**	**Through the process of fusion, I convert nuclear energy into radiant energy.**
2  **Gas Fireplace**	**I convert the chemical energy in natural gas into thermal energy.**
2  **Propane**	**I am a fossil fuel. The chemical energy stored in me came from the remains of ancient sea plants and animals.**
2  **Propane Grill**	**I convert the chemical energy in propane into thermal energy.**

2

Ancient Fern

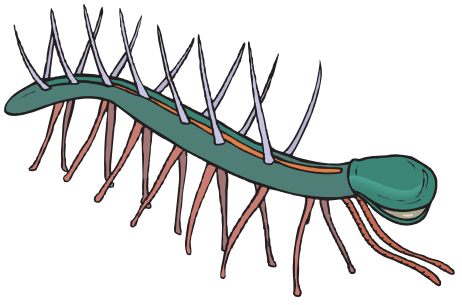
Through the process of photosynthesis, I converted radiant energy into chemical energy and stored it in my cells.

2

Ancient Sea Plant

Through the process of photosynthesis, I converted radiant energy into chemical energy and stored it in my cells.

2



Ancient Sea Animal

I stored chemical energy from food—ancient sea plants—in my cells.

2

HEAT AND PRESSURE

I turned ancient plants and animals into fossil fuels.

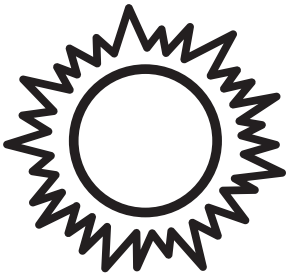
2

U^{235}

Uranium

I am a common rock found around the world. My nuclear energy comes from the splitting of my atoms.

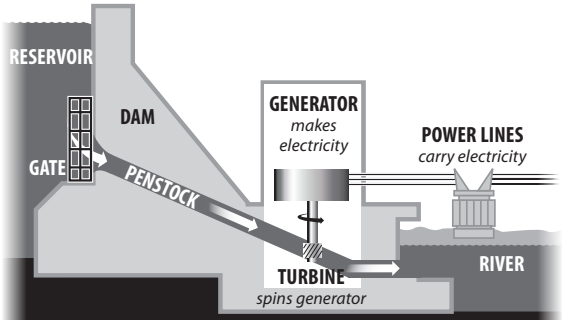
3



Sun

Through the process of fusion, I convert nuclear energy into radiant energy.

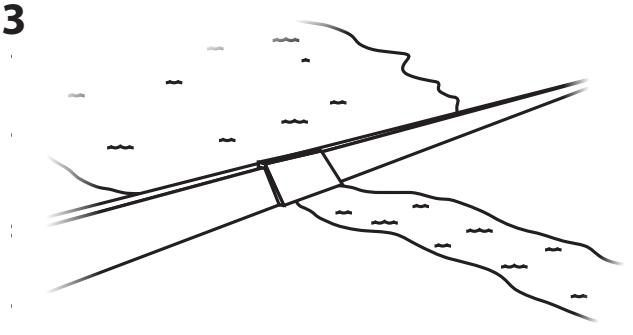
3



Hydropower Plant

I convert the kinetic energy of moving water into electrical energy.

3



Reservoir

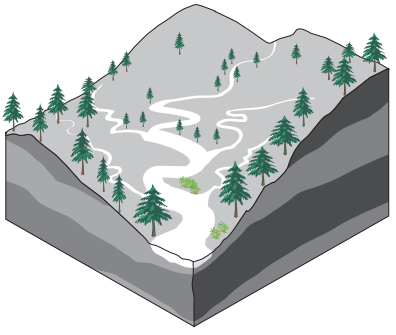
I stay full because of the water cycle. I hold water as potential energy.

3

Water

I am a renewable energy source. The sun drives the water cycle and keeps me replenished in lakes, rivers, and oceans.

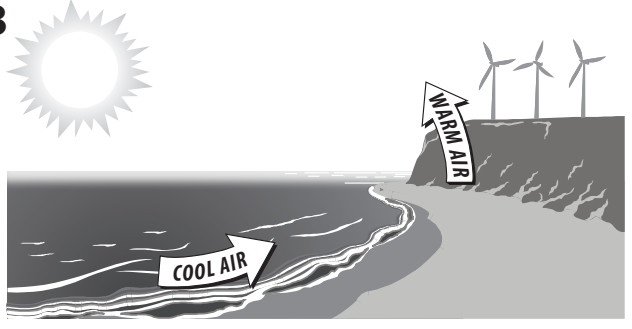
3



River

Through the water cycle I am always flowing and am fed by smaller streams and creeks.

3



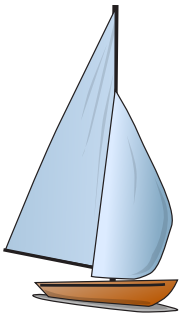
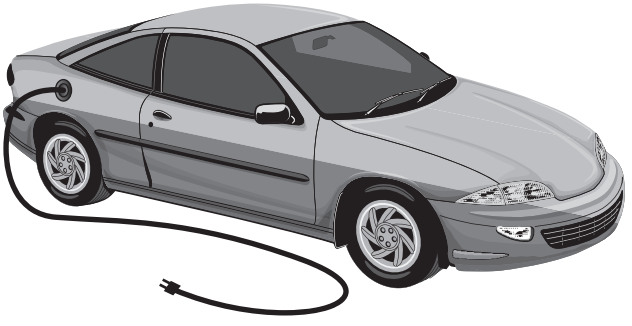
Wind

I am renewable. The motion energy in me came from the sun's uneven heating of land and water.

3

Wind Turbine

I convert the kinetic energy in wind to electrical energy.

3  **Sailboat**	**I harness the wind's kinetic energy to move across water.**
3  **Television**	**I convert electrical energy into light, heat, and sound.**
3  **Electric Car**	**I convert electrical energy into motion, sound, and heat.**

A Cool Coal Story

Students will demonstrate the flow of energy to produce electricity using props. Depending on the audience, signs with the different forms of energy can be used by the students to identify the energy transformations. This activity can also be used to demonstrate other energy flows, like biodiesel, ethanol, natural gas, etc.

Sun		Nuclear Fusion—produces energy	
	Prop	Yellow Ball	1 Student
Radiant Energy		Nuclear energy in the sun is transformed to radiant energy and travels through space to Earth. Radiant energy travels in WAVES.	
	Prop	Long pieces of yellow ribbon	3-4 Students 'wave' them in the air
Chemical Energy		Radiant energy is absorbed by green plans and through photosynthesis converts radiant energy to chemical energy	
	Prop	Green Plants	I use 'silk' leaves
Stored Chemical Energy		Green plants die and are compressed under extreme pressure over a LONG period of time and become COAL. Chemical energy is stored in the coal.	
	Prop	Students step on leaves	
Coal		Coal is mined and taken to a power plant. (Additional details may be added if desired.)	
	Prop	Pieces of coal OR wads of black construction paper	
Thermal Energy		Coal is burned in the furnace. Stored chemical energy produces thermal energy.	
	Prop	Empty box simulates furnace	
Thermal Energy		The thermal energy heats the water. Water becomes steam.	
	Prop	Hot pot or bottled water	
Steam		Steam travels down pipes (plastic tubing) to the turbine.	
	Prop	Connect tube to container of water used above.	
Motion/Mechanical Energy		Steam causes the turbine blades to spin.	
	Prop	Student stands with arms outstretched and bent upwards at the elbow OR use blades from kid wind activity. Student 'spins' when steam hits the blades.	
Electrical Energy		The turbine is connected to the generator causing the magnets to spin around the copper coils producing electrical energy.	
	Prop	Three students hold bar magnets, one student is 'wrapped' in copper colored ribbon or wire. Students with magnets 'spin' around copper wire.	
Electrical Energy		Electrical energy travels down the power lines to our homes.	
	Prop	Use a twisted rope to designate high voltage lines and then pull away the smaller pieces to designate the low voltage lines that come into our homes.	
Electrical Energy		Electrical energy powers our homes. When the demonstration is complete, pull the chain on the light bulb and it comes on.	
	Prop	Use a 'magic' light bulb that is connected to a piece of extension cord or one of the "as seen on TV" bulbs. Some magic shops have 'magic' light bulbs.	
Variations		*Other energy flows can be demonstrated, substituting other sources for the coal (corn to ethanol; soybeans to biodiesel; decomposing garbage to methane, etc.*	

A Cool Coal Story

A long, long time ago before even the dinosaurs roamed the Earth, the sun shone in the sky and giant plants grew in swampy forests. Like all living things, these plants died.

And more plants grew and died. This happened over and over for millions of years—plants grew and died and fell into the swamp.

The plants on the bottom got squished—really, really squished. After millions of years of being really squished those plants turned into COAL.

Now the coal is buried in the ground. Big machines—giant bulldozers and steam shovels—dig it up.

The machines load the coal onto trains and barges to take it to the power plant.

Inside the power plant there is a giant tub of water with a big oven in the middle. The coal is put into the big oven and burned.

The smoke from the fire is cleaned with big scrub brushes before it goes up the smokestack and into the air.

Inside the oven it gets really hot. So hot, the water in the tub boils and turns into steam. The oven is called a boiler because it boils the water and turns it into steam.

That steam comes roaring through a big pipe and turns a giant pinwheel, called a turbine.

The middle of the pinwheel has coils of wire wrapped around it. On the blades of the pinwheel are big magnets. When the magnets spin around the wire, it makes electricity. That is amazing!

Now, we can't go down to the power plant to buy a bag of electricity. So, the electricity comes to us.

A wire from the turbine runs out of the power plant and up a tall, tall pole. The electricity flows up the wire to the top of the pole. It flows through high-power lines from pole to pole until it gets to our town.

CONTINUED ON NEXT PAGE

Then it flows into lots of small wires to our houses. Inside our houses—hidden in the walls—are lots of wires. They go to all the switches and all the outlets all over our house and the electricity flows through them.

When we flip on a light switch, the electricity flows into the light bulb and makes light.

When we plug a radio into an outlet, we get music. The electricity flows through the cord to make it work. Electricity runs our washers and dryers, our TVs and video games.

Most of the electricity in our country is made by burning coal. The energy in the coal came from the sun.

Energy Flows Evaluation Form

State: _____ **Grade Level:** _____ **Number of Students:** _____

1. Did you conduct the entire activity?	❑ Yes	❑ No
2. Were the instructions clear and easy to follow?	❑ Yes	❑ No
3. Did the activity meet your academic objectives?	❑ Yes	❑ No
4. Was the activity age appropriate?	❑ Yes	❑ No
5. Were the allotted times sufficient to conduct the activity?	❑ Yes	❑ No
6. Was the activity easy to use?	❑ Yes	❑ No
7. Was the preparation required acceptable for the activity?	❑ Yes	❑ No
8. Were the students interested and motivated?	❑ Yes	❑ No
9. Was the energy knowledge content age appropriate?	❑ Yes	❑ No
10. Would you teach this activity again?	❑ Yes	❑ No

Please explain any 'no' statement below.

How would you rate the activity overall?	❑ excellent	❑ good	❑ fair	❑ poor
How would your students rate the activity overall?	❑ excellent	❑ good	❑ fair	❑ poor

What would make the unit more useful to you?

Other Comments:

Please fax or mail to: **The NEED Project**
P.O. Box 10101
Manassas, VA 20108
FAX: 1-800-847-1820

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