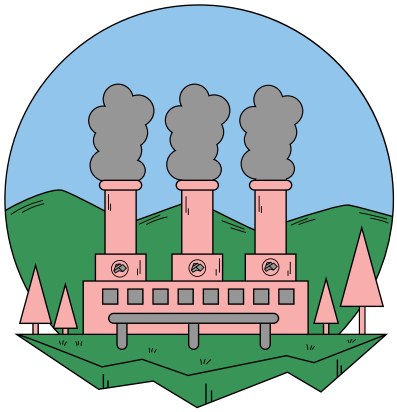
# Renewable Energy Sources

## Comparing Energy Sources

Energy can be grouped into two main categories based on its source—non-renewable energy and renewable energy.

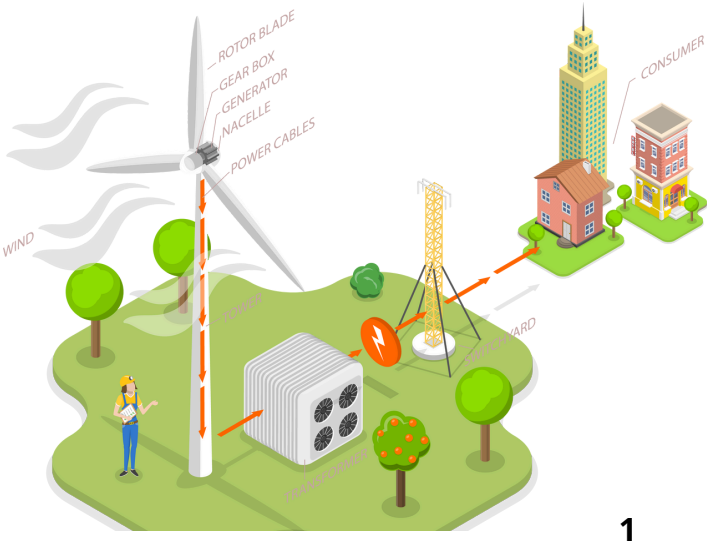
### Renewable Energy

Renewable energy is a form of energy that quickly replenishes itself after being used and is usually available in a never-ending supply. Renewable energy comes from the natural flow of sunlight, wind, or water around the world. As long as these resources continue to flow, we will have access to a steady supply of renewable energy.



Over the last 200 years, the energy that industrialized countries have relied on non-renewable sources such as coal and oil, sources that cannot renew or take millions of years to form. So, once they are used up, they are gone. In the case of oil, one of the fossil fuels, some experts predict that people will use up the Earth's supply in as little as 40–45 years. Oil, like coal and natural gas, comes from the fossils of plants and animals that were alive millions of years ago.

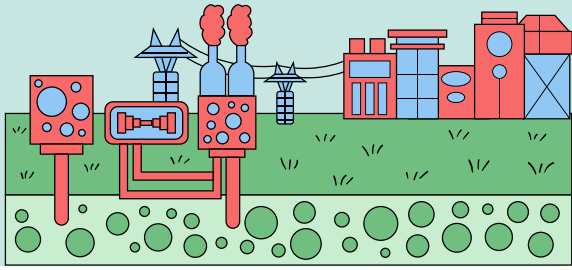
Renewable energy sources promise a way to power the future without using up the Earth's natural resources. They also produce energy in ways that are much less harmful to the environment. Fossil fuels release a lot of greenhouse gas pollution into the atmosphere, especially carbon dioxide ($CO_2$), which are harmful for the environment. In fact, the burning of fossil fuels is the main cause of climate change. Because oil, natural gas and coal (as well as uranium in the case of nuclear energy) must be mined, then processed in a plant and transported great distances, they also disrupt many natural habitats. Renewable energy is becoming more popular not only because it uses sources that are renewable, but also because it is much cleaner.



## Kinds of Renewable Energy

This backgrounder looks at six kinds of renewable energy and their sources:

- Solar energy — from the **sun**
- Wind power — from the **wind**
- Hydro power — from **falling water**
- Bioenergy — from **burning plant material**
- Geothermal energy — from the **Earth's natural heat**
- Tidal power — from the **ocean's tide**



## Solar Energy

The sun is the source of all energy on Earth. It drives the water cycle and wind, and it provides us with our food supply. Some societies have worshipped the sun, and many have found ways to harness the sun's heat and light for human use. For billions of years, the sun has poured out huge amounts of energy in several forms—including light, heat, radio waves and even x-rays. On Earth, direct sunlight is available from sunrise until sunset, except during solar eclipses. In one hour, the amount of solar energy falling on the Earth could power the whole planet for an entire year!

### Did you know?

- Canada is one of the sunniest countries in the world even during the winter.
- Yet, in 2022, China installed 392 gigwatts (GW) of energy, while Canada installed only 4 GW.

The suns energy must be captured using solar collectors and modules into more usable forms such as heat or electricity. Solar energy can be collected in two ways:

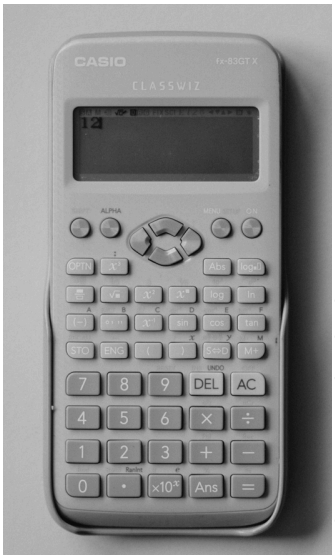
1. **Heat:** using glass-covered flat metal plates,
2. **Electricity:** using solar cells made from silicon or other semi-conductor materials.

### Heat Energy/Thermal Energy

Solar heating uses the sun's heat energy to provide heat for buildings, greenhouses, solar cookers and hot water heaters. That can simply mean using the sun's heat to warm a home through windows that face south. Solar heating can also involve the use of solar collectors that capture and store heat energy. A solar collector is a shallow box painted black on the inside, with a clear glass or plastic top. The sun's heat energy enters the box through the clear top and is absorbed by the black paint. The result is a lot of heat, which is contained by the box. The heat is carried away by water that flows through metal tubes that line the box. The sun-heated water is then carried through insulated pipes to a tank.

## Light energy

Light is absorbed through photovoltaic (PV) cells to produce electricity. Fine wires are sandwiched between two wafers with different electrical properties. Sunlight causes electrons to travel between the layers and produce electricity. The most common material used for PV cells is a special kind of silicon crystal. Silicon, in the form of sand or quartz, is one of the most common elements found on Earth. Photovoltaics are commonly used in calculators, rechargeable flashlights and radios, and they are mounted on rooftops to generate electricity for buildings.




Solar powered calculator. Source: Annie Spratt. *Retrieved from Unsplash:* https://unsplash.com/photos/white-casio-calculator-r_m-JKJVto0

Solar array farm. Source: American Public Power Association. *Retrieved from Unsplash*: https://unsplash.com/photos/solar-panel-boards-on-brown-ground-fm5_vCUa-Bc_

It is also possible to produce more electricity by mounting and connecting many PV cells on a panel to create a solar array. Sometimes reflective mirrors are used to produce even more electricity. To store power, batteries are used so that electricity can be available when sunlight is not. Large-scale standalone PV power plants are being built in several countries including the United States, Spain and Portugal. PV collectors have been used to meet home lighting and power needs in developing countries and remote locations. Some believe that solar energy would be the best way to provide them with a clean, affordable solution to the two billion people without electricity access.

Manufacturing solar collectors for heat energy does involve the controlled use of very small amounts of toxic materials. When solar panels are in use, they are completely safe and do not release any toxic materials into the environment. They can be placed on roofs, over parking lots or on unused land. The production of PV cells also involves the use of a number of chemicals and materials, especially silicon. PV cells are now being designed to use fewer chemicals. Once built and in use, PV cells have no toxic effects.

## Hydro Energy

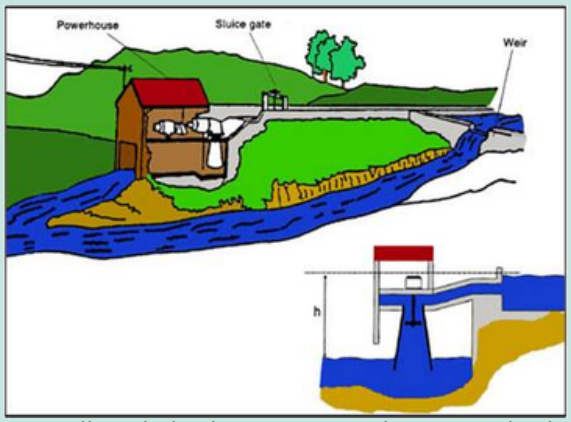
Hydro power involves storing vast amounts of water and then releasing them to turn giant turbines. Humans have used water power to supply energy for a long time. Archaeologists have discovered descriptions of water wheels used for grinding grain to more than 3,000 years ago. Today, hydro energy is used mainly to drive electrical generators at hydroelectric dams. As long as snow and rainfall fill the streams and rivers, moving water can be a renewable source of energy.

Canada generates about 60% of its electricity supply from hydroelectricity, mostly from facilities with large dams. Large-scale hydro developments are common in Canada, provinces of British Columbia, Manitoba and Quebec generate more than 88% of their power through hydroelectricity.

## 2 Kinds of Hydro Power

**Large Hydroelectric Dams** that are usually built on larger rivers. A dam captures the water so it can be released as needed. The water falls from the top of the dam to the bottom where the turbines are located. The spinning turbines are connected to generators that convert the energy into electricity. The more water there is and the steeper the slope, the more energy the water will produce. The water is then released and continues flowing downstream.

**Micro Hydro** works like a small dam. It diverts water from small rivers or streams to generate electricity and then returns the water downstream. Micro hydro, which generates up to 10 MW of electricity, produces about 6% of the world's hydro power.




A small-scale hydro system with a micro-hydro turbine.
Source: *Murdoch University.*

### Disadvantages with Building Dams

Hydroelectric generation does not produce significant greenhouse gas emissions but does have environmental impacts. Reservoirs destroy vast areas of highly productive forest and wildlife habitat, damaging freshwater ecosystems by blocking the movement of fish and other organisms. The world's largest hydro dam, the Three Gorges Dam in China, has created significant anxiety among local residents due to its potential for flooding or the catastrophic consequences if it were to collapse, releasing over 10 billion cubic meters of reservoir water. Additionally, the water in reservoirs may be polluted with mercury and other contaminants, as seen in many reservoirs in northern Canada.

Shoreline levels constantly change because water is released at different rates depending on electricity needs. Plants cannot survive on the shorelines due to this fluctuation. The plants in flooded areas rot and release carbon dioxide and methane into the atmosphere. Changing water levels also affect fish, as eggs on shorelines might not hatch, and the dam obstructs their movement upstream or downstream. Fish ladders can help but are not always effective.

Despite these disadvantages, hydro is a very clean power source: it generates about 18 grams of greenhouse gas pollution per kWh compared to 900 grams for coal and 400 grams for natural gas. Hydro power supplies about 20% of the world's electricity consumption, mostly from 45,000 large hydro dams. If designed to minimize environmental impact, hydro power is an excellent renewable energy source. Canada could more than double its current hydro power capacity from 78,000 MW to 156,000 MW.

## Bioenergy Energy

Humans have been using bioenergy since we learned to use fire thousands of years ago. Bioenergy is produced from biological materials, including **biomass**, which refers to wood, straw, manure, and other natural materials that contain stored energy. This energy can be released by burning the biomass directly or by converting it into biogas through micro-organisms. Biomass energy is still widely used worldwide for cooking, heating, electricity generation, and making transport fuels like ethanol and biodiesel.

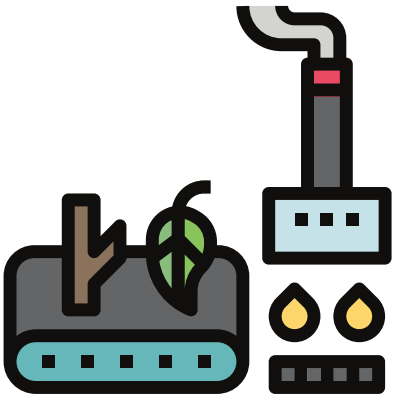
To produce heat or electricity, wood chips from sawmills, known as hog fuel, are commonly used as a biomass energy source. This material is burned in large boilers, similar to coal, and the heat produces steam. The steam powers a turbine that drives a generator. The generated electricity powers the sawmill, and any surplus electricity is fed into the electrical grid.

### Did you know?

- Until the mid-1800s, biomass was the major energy source worldwide. Today it supplies 19-90% of the energy in developing countries.

When biomass is used to produce natural gas, animal and human waste can be used to make clean- burning natural gas. Biomass from grains, corn and sugar cane can also be converted into ethanol and biodiesel that are used as transportation fuels. In Brazil, 83% of the cars run on ethanol. Because the biomass source for ethanol and biodiesel is also a source of food (corn, for example), there is some concern about giving up food for fuel.

When plants are burned as a biomass energy source, they release carbon dioxide into the atmosphere, just as they would if they decomposed naturally. Because they release the same amount of carbon dioxide either way, they are considered a climate-neutral source of energy. However, burning wood also releases carbon monoxide and particulates, such as ash, which are harmful to humans.




In Canada, ethanol is made from corn or wheat, and greenhouse gases are emitted when fossil fuels are used to farm these crops, process them, and transport the fuel. Taking this into account, a liter of ethanol produces about one-third less greenhouse gas pollution than burning oil. Additionally, biofuels should be made from non-food materials. Much of the plant waste that is left to rot in Canada could be used to make biofuels. If collected and processed properly, the annual plant waste produced in Canada could replace half or more of our gasoline use.

## Conditions for Biomass to Be Sustainable

The following conditions **must** be met for biomass to be a sustainable energy source:

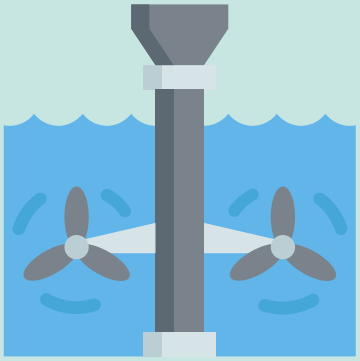
- Plant materials cannot be harvested faster than they can regrow (no more than 2% each year to allow for regrowth)
- Materials must not conflict with other uses like food, habitat, and lumber

## Tidal and Wave Power

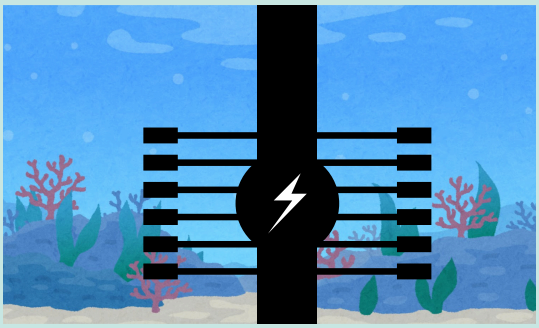
The ocean's tides result from gravitational forces exerted by the moon and sun, coupled with the Earth's rotation. Rising and falling tides can generate power like hydroelectric facilities using falling water. Due to the predictability of tides, tidal power plants offer reliable energy. England, France, and Canada all utilize tidal power, but less than other renewable sources. Worldwide, tides hold an estimated 3,000 gigawatts (GW) of energy, with 120 to 400 GW potentially available for generation through tidal barrages, depending on location and conversion potential.

## 2 Kinds of Tidal Energy

**Tidal barrage** power uses turbines placed in a dam-like structure across a basin, called an estuary. As the tide rises, water is stored in the estuary, and as the tide recedes, the water is released through the turbines to produce electricity. Mudflats are areas that are covered and then exposed as the tide comes in and goes out. This process negatively impacts wildlife, birds, and fish.



**Tidal fences** can also be used to harness tidal power. Tidal fences use slow-turning underwater turbines to generate electricity. They can gather energy effectively even where tides move as slow as three knots. Tidal turbines on the ocean floor do affect marine life, but much less than tidal barrage because they do not trap water in an estuary or make use of the critical mudflat habitats that some marine life relies on.



If tidal and wave turbines are connected together in large farms and then connected to the grid, they could be an excellent energy source. With some changes to the electrical grid, tidal power could be used to reduce greenhouse gas pollution.

## Geothermal Energy

Geothermal energy refers to the heat stored in the Earth's crust from the movement of continental plates and the Earth's molten core. On average, the temperature of the Earth rises about three degrees for every 100 meters you go deeper, but hotter temperatures are found in volcanic areas. Rocks that are 3,000 meters (approximately 10,000 feet) below ground is hot enough to boil water. As temperatures increase, the underground rocks turn into liquid magma. If magma reaches the surface, it is called lava. Most magma remains underground and heats the surrounding rocks and water. When that hot water or its steam travels up through faults and cracks in the rocks and reaches the Earth's surface, we see it in the form of hot springs or geysers, which are naturally occurring pools of hot water and steam.

## 2 Ways Geothermal Energy is Used

### Heat

**When used for heat:**

- Hot water from the Earth is circulated through pipes for homes, businesses, greenhouses or indoor swimming pools.
- Sometimes the water contains pollutants like sulfur, which must be removed before the water is used in a power plant.

### Electricity

**When used for electricity:**

- Steam out of the Earth's surface is used to turn turbines connected to generators to make electricity.
- Sometimes the steam contains minerals and gases like carbon dioxide that is released from the ground. The amount released is little compared to that released by non-renewable energy sources.

Geothermal energy is widely used in the United States, Indonesia, Philippines, Italy, Turkey, New Zealand, Mexico, Italy, and Iceland. Some of the best sources for geothermal energy are in remote wilderness areas. The roads and pipes that are needed to access them can be hard on those areas. Meager Mountain, a volcanic complex in British Columbia, is the only site in Canada where geothermal energy is being actively pursued. Experts predict that it could produce as much as 100–250 MW of electricity. The government of British Columbia has mapped other possible geothermal sites in the province as well.

### Did you know?

- The total greenhouse gas emissions from geothermal energy plants are only 5% of those from fossil fuel power plants.
- Using steam as an energy source is more environmentally friendly than steam from coal or nuclear power plants because the steam is naturally occurring.

## Disadvantages of Geothermal Energy

Geothermal energy is extracted from underground water reservoirs. Removing water too quickly can cause a shortage in underground water reservoirs which can lead the ground above them to collapse.

## What Is the Future of Renewable Energy?

Renewable energy is the way of the future. Today, our energy needs are met mostly by non-renewable energy sources. Most people burn oil and gas for their cars, and a lot of electricity comes from burning coal. In years to come, we can expect to see more renewable technologies meet more of our energy needs.

Alternative sources of power are already being used by many towns and cities for heating and electricity. More individual Canadians are using solar panels, solar water heaters, wind power and geothermal heat sources for their homes and businesses. The cost of these renewable technologies is becoming more affordable all the time.

## Non-Renewable Energy

We harness energy from both renewable and non-renewable sources. Historically, much of our energy comes from non-renewable sources like coal, oil, natural gas, and radioactive elements. These sources are considered non-renewable because they do not replenish in a short period of time. In fact, the world's natural gas, crude oil, and coal deposits take millions of years to form, and once they are used up, they are gone.

Coal, oil, and natural gas are often referred to as fossil fuels because they come from the fossils of plants and animals that lived millions of years ago. They have been the main sources of energy in industrialized countries for about 200 years. Uranium, a mineral found in certain types of rock, is not a fossil fuel, but it is another non-renewable energy source. It has been used to create nuclear power for more than 50 years.

### Did you know?

- Experts predict that:
  - Humans could use up the Earth's oil in 40–45 years.
  - Natural gas supplies are expected to run out in 67–72 years.

This backgrounder looks at oil and gas, coal and nuclear power. It explains how they are used for energy and describes some of the ways their use impacts the Earth and its ecosystems.

### Crude Oil and Natural Gas

Oil is a non-renewable resource that was formed millions of years ago from fossilized animals. In its natural state, it is called crude oil, a smelly, black-brown fluid made up of different sized hydrocarbons as well as sulphur, oxygen and nitrogen. Crude oil can be found in layers of porous sedimentary rock deep below the Earth's surface. Some deposits may be more than two kilometres below the surface! Natural gas (which is actually a mixture of different gases) can often be found with crude oil, trapped in layers of spongy or porous rocks. When crude oil is found in semi-solid form mixed with sand, as it is in the Athabasca oil sands in Alberta, it is called crude bitumen or oil sands.

Oil and gas are widely used to produce heat and electric power as well as for transport fuel and other products. At a refinery, crude oil is made into products that we use every day.

| Crude Oil Products | Uses |
|---|---|
| Octane | Gasoline |
| Light Oils | Diesel, kerosene, jet fuel, light lubricants |
| Heavy Oils | Lubricants, heavy fuel oil |
| Pentane, hexane, heptane | Explosives, petrochemicals, fuels, plastics |

The gases that make up natural gas are separated from each other and made into many useful products.

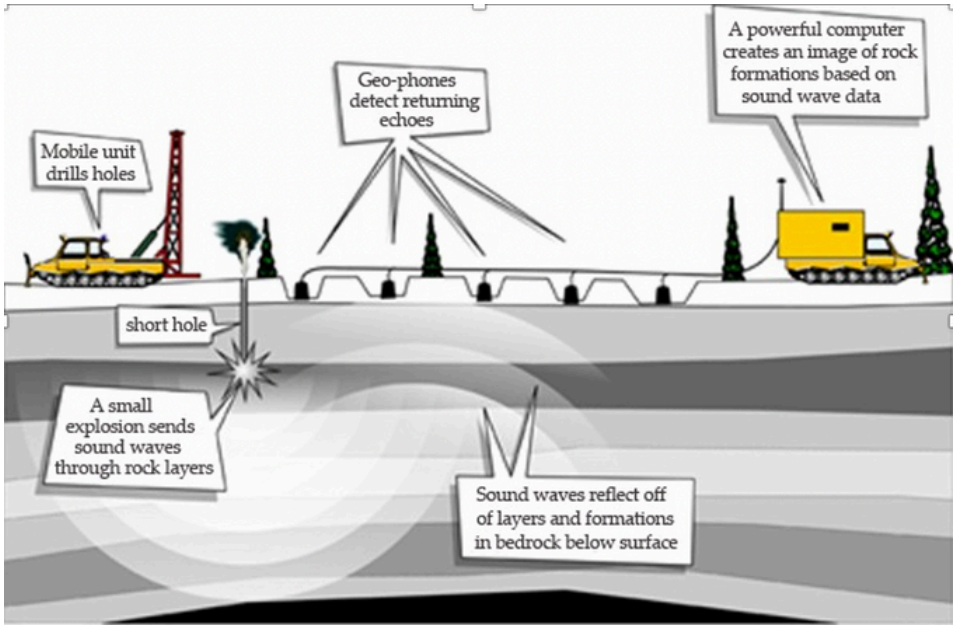
| Natural Gas Products | Uses |
|---|---|
| Methane (referred to and sold as natural gas) | Furnaces, hot water heaters, clothes dryers, stoves, barbeques, fireplaces, some vehicles |
| Ethane | Polyethylene plastic |
| Propane | Barbeques, some vehicles |
| Butane | Camp stoves, lighters |

**Did you know?**

- More than half of the energy used by Canadians comes from oil and gas. 49% of our use is oil and 25% is gas
- Canadians are some of the biggest consumers of oil in the world using about three tonnes of oil each year.
- Using all that oil and gas per person also makes Canadians the second highest emitters of greenhouse gas pollution

## Seismic Surveying

Seismic surveying uses vibrations and the recording of echoes to detect possible oil or gas deposits underground. Holes are drilled into the ground in a grid pattern over a large area to hold explosives. When the explosives explode, they create vibrations. Microphones, called geophones, are placed in a grid pattern to record the echoes from the vibrations. Surveyors use computers to make sense of the sound waves and figure out where the oil and gas are located. This process is shown in the image below.




Source: *The Pembina Institute*

Once the surveying process is complete, a drilling rig is brought in by truck. The drilling rig bores a hole down through the upper layers of the Earth's crust to get to the deposit. Conventional crude oil is pumped to the surface with the help of a pump jack, which works like the lift pump of an old-fashioned water well. Raw natural gas is extracted through drilled gas wells.

In Canada, after oil or gas is extracted from the ground, it is shipped in pipelines to a refinery. A pipeline requires a right of way, which is a cleared path through forest or farmland where the pipe will be laid underground. There are thousands of kilometres of pipeline right of ways across many parts of Canada.

## Environmental Impact on Seismic Surveying

Seismic surveying destroys the environment when new roads are constructed to bring in equipment during the surveying and drilling stages. Explosives set off during surveying and drilling have an impact underground. When the well is drilled, the rock chips, mud, water and other materials that are produced must be disposed. These materials can be a problem for the environment if they contain traces of oil, salt or other harmful substances.

## How Local Ecosystems are Affected by Oil and Gas

Oil and gas pipelines disrupt and destroy natural habitats. Caribou is just one of many species that have been affected by oil and gas developments. Oil sands developments use up a huge amount of freshwater to wash the oily materials out of the soil and sand in which they are trapped. The waste material ends up in what is called tailings ponds. These big ponds of waste are toxic.

### Did you know?

- The border of the Northern Yukon in Canada, is an important calving ground for caribou that sits above oil reserves.
- Oil and gas companies have wanted to drill for oil in Alaska for many years, but conservationists like the Arctic National Wildlife Refuge (ANWR) have managed to protect the caribou and their calving ground.

At the Alberta Oil Sands, 500 ducks died when they landed in toxic tailings ponds near Syncrude's Aurora North Site mine. Most of the ducks that landed were too heavily coated in oil and toxic waste to survive. When drilling at sea, drilling rigs disturb the ocean bed. The noise affects the movement of whales and other wildlife nearby. When the extracted oil is transported in large tanker ships, there is always the risk of a spill. A tanker spill can destroy salmon stocks and whale populations as well as shoreline habitat for many species.

The Exxon Valdez spill in 1989, for example, resulted in 42 million litres (that's about 17 Olympic-sized swimming pools) of oil in Prince William Sound in Alaska. The spill killed thousands of birds, animals and whales. There are fewer spills now than there were in the 1970s, they do still occur. The last major oil spill that happened was the Deep Water Horizon oil spill of 2010. A recent example is the oil spill in Singapore on June 14th, 2024, when two vessels collided.

Example of an oil spill.

The refining process also creates problems for the environment. The refining process releases chemicals and large amounts of the greenhouse gas carbon dioxide ($CO_2$) into the atmosphere. Oil creates more $CO_2$ than natural gas, but less than coal. In some parts of Canada, the $CO_2$ produced during oil production could be disposed of underground in deep water bodies. However, this method is not yet widely used.

Of course, burning oil and gas releases even more $CO_2$. Vehicles that run on gasoline are the leading cause of air pollution. They release $CO_2$ and other greenhouse gases into the atmosphere as does burning natural gas to heat buildings and water. Oil and gas bring us many products and conveniences, but they do so at a very high cost to the environment.

## Coal

Coal is a non-renewable energy source formed millions of years ago from decayed and fossilized plants. It is a brownish-black rock made mostly of carbon and sulphur. Coal burns easily and releases heat energy. It is used to create heat for industry (to make steel, for example) and to create electric power.

Coal played an important role in human history when countries used it to become industrialized and move away from subsistence agriculture. In the late 1800s, coal began to be mined in large quantities to fire the boilers of steam locomotives. Today, coal is the number one source of electricity worldwide. It is the most available of the fossil fuels and supplies of coal are expected to last another 169 years. Over the years, Canadians have reduced coal consumption from 43 million tonnes of coal equivalent in 2016 to 18.4 million tonnes in 2021.

In Canada, coal-fired power plants are mainly found in Alberta, Saskatchewan, Ontario and Atlantic Canada. Most of the coal we use in Canada is to generate electricity.

Coal is often found in seams which means it is found compressed between two rock layers that cover a large area. It can be found fairly close to the surface or deep underground. The coal that is found closest to the surface is easier, less costly, and safer to extract. Mines close to the surface are called strip mines.

**Did you know?**

The Government of Canada plans to stop the use of coal-fired power by 2030.

Coal-fired power plants are often located close to coal mines to reduce the cost of transporting coal to the power plant. Coal arrives in large trucks at the power plant where it is crushed and pulverized into a black powder that is blown into large furnaces (or boilers) that heat water to create steam. The steam is then used to turn turbines that are connected to generators.

The generators produce electricity that is transmitted through transmission and power lines to businesses and homes. The power lines are all connected through a system called the electrical grid or power grid. Most places in Canada receive their electricity through the electrical grid, except for very remote locations. Similar to oil and gas pipelines, transmission towers require right of ways which are often referred to as transmission corridors. These transmission corridors cut across entire provinces. Whenever you see a large transmission tower, you are looking at a part of the electrical grid.

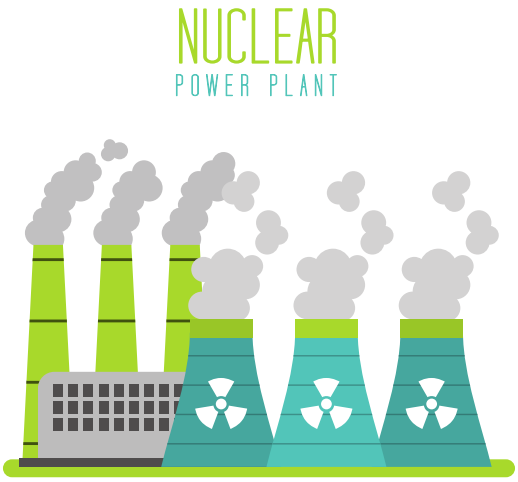
## Environmental Impact on Coal

Coal mining, especially strip mining, involves removing huge amounts of soil. This disrupts and destroys local habitats of plants and animals through soil erosion, dust and noise, and water pollution. In some places, mining has taken the tops off entire mountains, dropping waste materials

into the river valleys below. Compared to coal mining, the burning of coal has a larger environmental impact. Coal is the dirtiest of fossil fuels because when it burns it produces such large amounts of greenhouse gas. Burning coal releases large amounts of greenhouse gas namely carbon dioxide into the environment than oil, and double that of natural gas. It also releases mercury and sulphur into the atmosphere as well as creates solid waste (called slag). To make coal power "clean," some people are now suggesting that we capture the carbon dioxide produced by coal power plants and store it underground. **Carbon capture and storage** is still a new idea, and it will be difficult to find enough of the right locations to make it work for all the coal burned around the planet.

## Nuclear Power

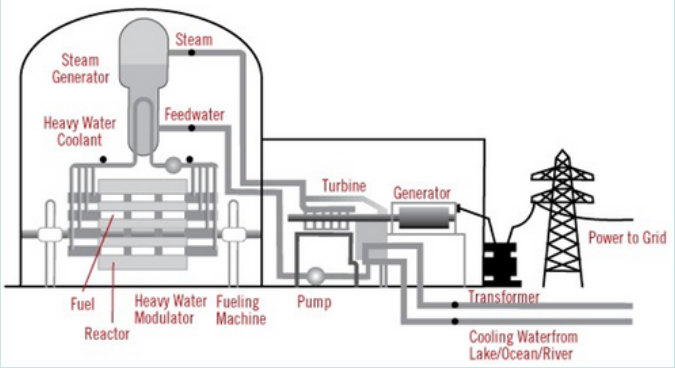
Nuclear energy comes from the element uranium, a non-renewable resource found in Canada, Australia, West Africa, and Kazakhstan. Canada currently has six commercial nuclear power plants: five in Ontario and one in New Brunswick. The last time a nuclear power plant was built in Canada was in the 1980s.




Nuclear power was first used to make electricity in 1951. There are now 443 nuclear power reactors in operation in the world, and together they produce about 10% of the world's energy. Of the 30 countries using nuclear energy, France uses it most, creating nearly 70% of its electricity using nuclear power. About 15% of Canada's electricity is generated by nuclear power plants.

### Uranium Mining

Uranium is mined from the earth and then refined and made into fuel bundles before it can be used in a power plant. The key component in the nuclear power plant is the nuclear reactor. Water is heated in the reactor core through the fission of uranium atoms to make steam. The generator part of the reactor splits the nuclei (which is at the centre) of uranium atoms, creating heat as well as flying particles of atoms that collide and start a chain reaction. This process can be seen in the image on the right. The chain reaction must be carefully controlled to produce a steady output of energy. An uncontrolled chain reaction results in huge releases of energy that can cause a reactor meltdown. In the past, nuclear accidents have shown how dangerous it can be to rely on nuclear power. The Chernobyl disaster in 1986 released toxic wastes across Europe and caused many human deaths.




*Source: The Pembina Institute*

Nuclear power does not create nearly as much greenhouse gas pollution as fossil fuels do. Nuclear power produces 25 grams of greenhouse gases per kWh of electricity. Compare that to 900 grams for coal and 450 grams for gas-powered plants.

## Safety Concerns of Nuclear Power

Uranium mines are small in size compared to coal mines, but they produce radioactive waste at the site as well as heavy metals. One of the biggest challenges of nuclear power is what to do with the used up (or spent) fuel bundles. They can be reprocessed, or they can be transported to long-term storage sites, but neither of these options provides a safe, permanent solution.

How to dispose of radioactive waste is a big concern around the world and here in North America. Canadian heavy water CANDU nuclear reactors release the highest rates of radioactive material Tritium in the world. The United States currently has about 50,000 tonnes of waste fuel from reactors which it stores above ground at nuclear power plants. The Canadian government is looking into several options for Canada's spent fuel bundles.

## What Is the Future of Non-Renewable Energy?

There are many good reasons for using non-renewable energy sources wisely. One reason is to ensure that these natural resources will be available for future generations. Another reason is to limit the harm they do to the environment.

The industrialized countries of the world, such as Canada and the United States, now depend heavily on non-renewable energy sources, and especially fossil fuels, to meet their energy needs. However, people are making more and more use of renewable sources. They do not release harmful emissions into the atmosphere like coal, oil and gas do. Also, because renewable energy sources are not extracted from the Earth, they do not need much processing. Overall, they are much easier on the environment.

In the future, we can expect to see more use of low-impact renewable energy sources. The transition away from fossil fuels will take time, but Canada is in a strong position to help lead the way.

### Questions

1. Give some examples of non-renewable energy sources. Describe why they are considered non-renewable.
2. Give examples of renewable energy. Explain why they are considered renewable.
3. What are some of the advantages of renewable energy over non-renewable energy?
4. Can you describe any examples of how renewable energy is being used in your region?