1. UNDERSTANDING CANADA'S ENERGY MIX

Teacher information card

ENERGY PRODUCTION IN CANADA

Crude oil 43%

Natural gas 33%

Coal 8%

Hydroelectricity 7%

Other renewables (wind, solar, biomass, and tidal) 4%

Natural gas liquids (NGLs) 3%

Nuclear 2%

Note: There is a difference between energy and electricity. Energy, as it's referred to here, is usable power (as heat or electricity) and the resources for producing such power. Electricity is a form of energy that can be produced naturally (lightning) or generated (through moving water, by burning natural gas or coal, or through nuclear power, for example).

ENERGY ICON	GENERAL INFORMATION
Hydroelectricity	**Hydroelectricity is the production of electricity through the movement of water.** Hydroelectricity is carried to communities through transmission lines. Water passes from reservoirs through dams and turbines, which are attached to generators. The water turns the turbines to produce electricity. Hydroelectricity is a renewable source of energy because it relies on the kinetic energy from the constant movement of rivers and streams. Hydropower accounts for about 60 per cent of Canada's electricity and 7 per cent of all energy produced in the country. Canada has a wealth of fresh water, rivers and streams, which means that hydroelectricity is produced in all provinces and territories except Prince Edward Island. The largest producer is Quebec — almost all of its electricity is generated through hydropower.
Coal	**Coal is a hardened sedimentary rock made of ancient plant material.** There are two types of coal: thermal coal, which can be burned to produce heat (and electricity), and metallurgical coal, which is used to produce steel. Thermal coal is the most common source of electricity on the planet. Coal exists in underground seams and must be mined. This can be done in different ways depending on the landscape and the characteristics of the coal seam, including its depth, length, continuity and structure. To get at coal deep underground, mines can plunge over one kilometre into the Earth. Mines can also be on the Earth's surface or on top of mountains, where layers of soil and vegetation are stripped away to get at shallow coal seams.
Nuclear	**Electricity is generated by nuclear energy through heat.** Power plants house nuclear reactors that split uranium atoms in a process called nuclear fission that generates heat. The heat mixes with water to create steam, which moves large turbines and generates electricity. Energy generated by nuclear power plants is carried to communities through transmission lines. Canada's four nuclear power plants account for about 15 per cent of electricity generated in Canada and 2 per cent of all energy produced in the country. (A fifth plant, Gentilly-2 Nuclear Facility in Quebec, was shut down in December 2012.)
Natural gas	**Natural gas is primarily made up of methane,** but can also contain other hydrocarbons such as ethane, propane, butane and pentanes. Natural gas is most often extracted from gas fields. These pockets of gas are sometimes found between layers of shale rock, as well as near coal seams and oil fields, because all three fossil fuels were created by the same natural processes over millions of years. More than 50 per cent of Canadian natural gas production is exported, all of which is sent to the United States. Natural gas is usually transported around the country by a 480,000-kilometre network of pipeline, enough to reach the moon and wrap around it nine times.

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Crude oil

Crude oil is a high-energy product composed of ancient microscopic organisms that have undergone millions of years of pressure and heat deep underground. Oil is Canada's most important source of energy and is used to make many consumer products. However, it is a finite resource, meaning that although the same natural process of oil creation is ongoing, new reservoirs take a very long time to form.

What we call crude oil — what we pull out of the ground — can be turned into many different fossil fuel products, such as kerosene and gasoline, and usually contains dissolved gases like methane, ethane and propane.

Crude oil has traditionally been extracted by drilling. In the early days of oil extraction, getting this resource out of the ground was a simple process, and in many places the pressure was so great that oil would shoot out of the ground when a well was drilled. Today, as supplies are waning, more energy-intensive, expensive forms of extraction have become common: deepwater offshore drilling, fracking and horizontal drilling to extract tight oil (or shale oil), coal liquefaction, and mining bituminous sands (oil sands).

According to a study by the U.S. Geological Survey, an estimated 13 per cent of the world's undiscovered oil is in the Arctic.

Wind

Wind power is a type of renewable energy that uses the natural movement of air to generate electricity. The wind turns large turbine blades, which are connected to a generator. As the blade turns, electricity is made.

Wind energy production continues to develop throughout Canada. Although wind farms can be found in almost every province, wind energy only accounts for about 3.5 per cent of Canada's total electricity production and for less than 1 per cent of all energy produced in the country.

Solar

Solar energy is transmitted by the sun to the Earth's surface and captured in special panels, called photovoltaic panels. Solar energy is common in Canada but still only produces less than 1 per cent of the country's energy. The amount of solar energy available in Canada varies based on season, latitude and climate. There are fewer solar projects in the North, for example, because there is less direct sunlight. The most common areas in Canada for solar power production are the Prairies, Ontario and Quebec.

Biomass

Biomass is a renewable energy source that uses organic materials — including municipal and industrial waste and agricultural products — to produce energy. Biomass makes up less than 1 per cent of Canada's total energy production. Biomass is used to create alternate forms of fuel, such as ethanol. Biomass from corn and wheat crops is used to produce about 1400 million litres of ethanol every year.

Geothermal

Originating from the Earth's core, geothermal energy is stored deep within the Earth as heat. Geothermal energy projects are not common in Canada. There are currently no geothermal power plants and only a few demonstration projects, mainly on the West Coast.

NGLs and HGLs

Hydrocarbon gas liquids (HGLs) include natural gas liquids (NGLs) (propane, butane, and ethane) and olefins produced by natural gas processing plants and upstream processing or by crude oil refineries. These gases can be easily liquefied and therefore are commonly referred to as liquids.

Tidal

The production of tidal energy is geographically limited to coastlines because that is where tides occur, caused by the gravitational pull of the sun and moon. Marine renewable energy in general, of which tidal power is only one type, is still in the experimental stages, and there are very few power production facilities in Canada. The Annapolis Tidal Station in Nova Scotia is the only tidal power plant in North America and one of only a few in the whole world. It has a daily output of about 80-100 megawatt hours.

For more information on energy sources in Canada, visit Energy IQ, Canadian Geographic Education's energy education resource, at energyiq.canadiangeographic.ca and Natural Resources Canada's Energy Fact Book at nrcan.gc.ca/sites/www.nrcan.gc.ca/files/energy/pdf/EnergyFactBook_2016_17_En.pdf.