Energy primers

These primers provide students an introduction to many of the energy sources in

British Columbia.

In their groups, students will review all seven primers as they identify and evaluate the sources of energy in their assigned place in B.C.

Sources of all information, as well as additional research sources, are provided on the final page of the primers.

This package includes energy primers for:

- coal
- petroleum
- natural gas
- hydro
- solar
- wind
- geothermal

Coal energy primer

Coal is a form of rock that can be burned as an energy source. It can also be used for manufacturing materials such as iron and steel. Coal is one of the earliest forms of fossil fuels to be used as an energy source. It's the most abundant fossil fuel in the world. During the Industrial Revolution (1760 to1820) coal provided the energy for industrial expansion and growth and for steam engines and furnaces. Coal reserves in Canada make up less than one per cent of global coal stores.

Energy considerations	
Type	• non-renewable fossil fuel
Current state in B.C.	• In 2014, there were six operating mines in B.C. with more proposed for development. • Coal production in B.C. has dropped by over 16% since 2014. • About 70 to 90% of coal mined in B.C. is steel-producing coal and is exported. • Coal is not used as an energy source in B.C.
Costs	• Direct costs of using coal include exploration, construction of infrastructure, and operations such as extraction, refining, transporting and labour. • Indirect costs of using coal include environmental and social impacts.
Environmental	• Coal accounts for 20% of the world's greenhouse gas emissions. • Resource development decisions and activity have implications for the environment and well-being of communities in British Columbia, including First Peoples' traditional lands.
Key regions in B.C.	• Kootenay • Vancouver Island • Northeast • North Coast • Cariboo

Petroleum energy primer

During the 1900s, there was significant investment in the development of petroleum-based energy sources. Advanced drilling techniques and large stores of petroleum oil have led to petroleum becoming the largest source of energy in the western world. Canada is the fifth largest producer of oil worldwide, with most petroleum extracted and transported from the oil sands in Alberta. While B.C. has few active drill sites, it provides a gateway for export to the rest of the world.

Energy considerations	
Type	• non-renewable fossil fuel
Current state in B.C.	• There are no large-scale petroleum oil drill sites in B.C. • Significant infrastructure has been developed to transport petroleum oil via a network of pipelines and railways. • Over 96% of Canada's transportation industry is fuelled by petroleum energy.
Costs	• Direct costs of using petroleum include exploration, construction of infrastructure, and operations such as extraction, refining, transportation and labour • Indirect costs of using petroleum include environmental and social impacts. • Operating costs for petroleum have increased as a result of difficult extraction methods for remaining supply of oil in hard-to-access places.
Environmental	• Petroleum accounts for 13.5% of the world's greenhouse gas emissions. • Resource development decisions and activity have implications for the environment and well-being of communities in British Columbia, including First Peoples' traditional lands.
Key regions in B.C.	• Northeast

Natural gas energy primer

The cleanest burning fossil fuel, natural gas is considered to be highly versatile and produces no particulate matter. Canada has the fourth highest gas production in the world. There are many active natural gas drilling sites around B.C. New technologies are allowing recently decayed material, such as animal waste products, to be converted into renewable natural gas (RNG), which is a carbon neutral energy form.

Energy considerations	
Type	• non-renewable fossil fuel • renewable when produced from biogas
Current state in B.C.	• Natural gas is part of our everyday lives – heating our homes and water, cooking meals and drying clothes. It can also fuel vehicles and ferries. • Growing opportunities exist in renewable natural gas. • Hydraulic fracturing is a commonly used technique to extract natural gas, and is governed by strict regulations in B.C.
Costs	• Direct costs of using natural gas include exploration, construction of infrastructure, and operations such as extraction, refining, transportation and labour. • Indirect costs of using natural gas include environmental and social impacts.
Environmental	• Natural gas emits up to 30% less carbon dioxide than petroleum and up to 45% less carbon dioxide than coal. • The environment above and below ground may be impacted by natural gas extraction. • Methane leaks from natural gas operations may lead to greenhouse gas emissions. • Resource development decisions and activity have implications for the environment and well-being of communities in British Columbia, including First Peoples' traditional lands.
Key regions in B.C.	• Northeast • Cariboo

Hydroelectricity energy primer

Hydroelectricity has a long history in Canada and due to our country's geography and climate, we have significant resources. Canada is the second largest producer of hydroelectricity in the world. In B.C. the geography and access to flowing water has led to hydroelectricity being the main source of electrical energy in the province. Excess hydroelectricity produced in B.C. is exported to Alberta and the United States.

Energy considerations	
Type	• renewable
Current state in B.C.	• Hydroelectricity is the largest source of electrical energy in B.C., contributing 87% of the total electrical energy produced. • New hydro projects are currently being planned and developed.
Costs	• Direct costs of using hydroelectricity include construction of infrastructure, and operations such as labour and maintenance (including upgrades). • Indirect costs of using hydroelectricity include environmental and social impacts.
Environmental	• Hydroelectricity does not burn carbon-based fuels. • There are no direct greenhouse gas emissions, aside from initial construction of dams and infrastructure. • Methane is produced after flooding and decomposition. • Hydroelectricity impacts communities, land and aquatic ecosystems. • Resource development decisions and activity have implications for the environment and well-being of communities in British Columbia, including First Peoples' traditional lands.
Key regions in B.C.	• Northeast • Kootenay • Vancouver Island • Lower Mainland and Fraser Valley

Solar energy primer

Solar energy is primarily in two forms: photovoltaic, which is the conversion of solar energy into electricity; and thermal, which is the conversion of solar energy into heat. In Canada, photovoltaic energy use has more than tripled since 2008. The SunMine solar installation in Kimberley is B.C.'s largest solar project and Canada's first solar-tracking facility. There is also a small residential thermal industry in B.C.

Energy considerations	
Type	• renewable
Current state in B.C.	• Solar thermal energy is a growing industry, especially with green housing technologies. • Limited and varying amounts of sunlight and varied geography make solar difficult to implement on a mass scale in B.C.
Costs	• Direct costs of solar energy include construction of infrastructure, and operations such as labour and maintenance. • Indirect costs of solar energy include environmental and social impacts.
Environmental	• Solar energy does not burn carbon-based fuels. • There are no direct greenhouse gas emissions aside from initial production of panels, batteries, and other systems. • Decommissioning old solar power plants may have significant impact on the environment. • Solar thermal energy is often combined with a backup source of energy, such as natural gas.
Key regions in B.C.	• Vancouver Island • Kootenay (solar photovoltaic) • Residential areas throughout the province (solar thermal)

Wind energy primer

Wind power has been used for centuries, dating back to propelling sailboats around 5,000 BC along the Nile River. In the past 30 years, wind energy has been developed as a source of electricity. Wind energy accounts for around two per cent of Canada's total energy produced. In B.C., the coastal and flat plains regions are ideal locations due to the high wind speeds.

Energy considerations	
Type	• renewable
Current state in B.C.	• Wind energy is an emerging industry, with projects in development and/or construction across the province and in offshore locations, particularly along the North Coast. • The existing B.C. wind power plants contribute a minimal amount of electricity to B.C.'s energy grid.
Costs	• Direct costs of using wind energy include construction of infrastructure, and operations such as labour and maintenance. • Indirect costs of using wind energy include environmental and social impacts.
Environmental	• Wind energy does not burn carbon-based fuels. • There are no direct greenhouse gas emissions aside from initial production of turbines, foundations, and other systems. • Wind energy produces noise pollution. • There are some impacts on wildlife such as birds and bats.
Key regions in B.C.	• Northeast • Vancouver Island • North Coast

Geothermal energy primer

Geothermal energy is a newer technology that has emerged from the pursuit of cleaner, renewable energy. Countries near geological hot spots are ideal locations for geothermal energy; for example, Iceland generates nearly 80 per cent of its energy from geothermal sources. While there are no large-scale geothermal plants in Canada, small-scale geothermal energy has increased in B.C. in recent years.

Energy considerations	
Type	• renewable
Current state in B.C.	• Geothermal energy is an emerging industry with small-scale systems in B.C. • There is no significant contribution of geothermal energy into B.C.'s energy grid.
Costs	• Direct costs of using geothermal energy include exploration, construction of infrastructure, and operations such as labour and maintenance. • Indirect costs of geothermal energy include environmental and social impacts.
Environmental	• Geothermal energy does not burn carbon-based fuels. • There are no direct greenhouse gas emissions aside from initial production of geothermal systems.
Key regions in B.C.	• North Coast • Vancouver Island • Lower Mainland and Fraser Valley