ELECTRICITY SOURCES

WHAT IS COAL?

Coal is a hardened sedimentary rock made of ancient plant material. Coal deposits formed a long time ago, when the world's continents looked very different and there were vast ancient seas. Organic materials, such as the remains of plants and animals, would sink to the bottom of the sea and become covered by sediment (i.e., rocks and sand) and compacted. Over the course of millions of years, the organic matter was transformed under high pressure and very hot temperatures, resulting in what we refer to today as fossil fuels – crude oil, natural gas, and coal. As a fossil fuel, coal is burned to produce heat, which is converted to electricity. It is one of the largest sources of electricity on Earth, but also produces some of the highest greenhouse gas emissions. Coal fuelled the start of the Industrial Revolution and remains the cheap energy source of choice for emerging economies.

HOW IS ELECTRICITY PRODUCED FROM COAL?

Once out of the ground, coal is taken to a power plant where it is burned to heat water to make steam. The pressure created by that steam spins a turbine (this is mechanical energy), which in turn spins magnets inside a generator to produce electricity.

ELECTRICITY SOURCES

HOW DOES THE ELECTRICITY PRODUCED FROM COAL TRAVEL TO WHERE IT NEEDS TO GO?

There are three stages in the electricity system – generation, transmission, and distribution. Generation is about producing electricity, transmission is about moving it, and distribution is about delivering it to individual customers. Transmission lines carry electricity from generating stations to end users or consumers. When electricity is running through these lines, some electricity is lost due to resistance and dissipates as heat. To reduce the amount of electricity lost in transit, these transmission lines carry high voltage electricity.

WHAT IS THE ELECTRICITY PRODUCED FROM COAL USED FOR?

Electricity is used in our homes and businesses for things like lighting, heating and cooling, and powering appliances and electronic devices, such as refrigerators and computers.

HOW DOES USING COAL AFFECT THE ENVIRONMENT?

Of all the fossil fuels, coal produces the most greenhouse gas emissions, contributing to climate change and pollution. It also has an impact on the land because large areas of land are stripped of vegetation and mining disturbs the earth, leaving the landscape barren for many years. Power plants burn thermal coal to generate electricity, but the use of coal for electricity in Canada is gradually being phased out in an effort to step down the carbon ladder. Coal emits about twice the carbon dioxide of natural gas per unit of energy produced. It also produces nitrogen oxides and sulphur oxides (which cause acid rain), mercury, and other toxins, as well as the sooty particulates responsible for 18th-century London's ubiquitous grime. A number of Canadian communities, like Sydney, N.S., were built around coal mining, and collapsed when the mines closed; serious environmental problems left behind by the coal industry have only recently been addressed.

WHERE DO WE FIND COAL MINES AND COAL-FIRED POWER PLANTS IN CANADA?

The largest producer of coal in Canada is British Columbia. More than 95 per cent of the coal mined in British Columbia is metallurgical coal (used in steel production), with the remainder being thermal coal. There are seven mines in British Columbia that produce thermal coal. However, British Columbia doesn't get any of its electricity or heating from coal and exports most of it to international markets. Westshore Terminals close to Vancouver is the largest coal terminal on North America's west coast, which mainly sends coal overseas by ship to Asia. Many provinces such as Alberta and Ontario have moved towards non-emitting resources such as nuclear. Ontario completely phased out coal in 2014 and no longer has any coal plants in operation.

ELECTRICITY SOURCES

WHAT IS BIOMASS?

The main forms of biomass in Canada include byproducts of the forestry industry and municipal waste.

HOW IS BIOMASS USED TO PRODUCE ELECTRICITY?

Burning biomass, particularly firewood for heating homes, is widespread in Canada. Wood pellets, mainly made of sawdust and other waste from saw mills, are used both to produce heat and generate electricity. Other sources include agriculture and organic waste, such as animal manure and municipal sewage. Direct combustion, the most common method used for converting biomass, involves burning biomass in boilers. The heat from burning biomass is used to create steam, which spins a turbine (mechanical energy) connected to a generator. Co-firing, however, involves burning biomass with coal in a traditional power plant. This is one of the cheapest ways to produce electricity from biomass, but it is less environmentally friendly.

HOW DOES THE ELECTRICITY PRODUCED FROM BIOMASS TRAVEL TO WHERE IT NEEDS TO GO?

Biomass products, in solid, liquid, or gas forms, need to be transported to customers by truck, rail, or pipeline. However, individuals burning wood, a type of biomass, can use the energy for heating and cooking on the spot. Several district heating systems in Canada use biomass – sometimes waste from nearby sawmills – to generate heat and/or electricity for buildings in a community.

ELECTRICITY SOURCES

WHAT IS BIOMASS ENERGY USED FOR?

Biofuels, renewable liquid fuels made from biomass, are used to power vehicles or generate electricity through fuel cells. The two most common biofuels in Canada are ethanol, produced mainly from corn but also wheat and other feedstocks, and biodiesel, created from animal fats, cooking oil and canola oil.

HOW DOES ENERGY PRODUCTION FROM BIOMASS AFFECT THE ENVIRONMENT?

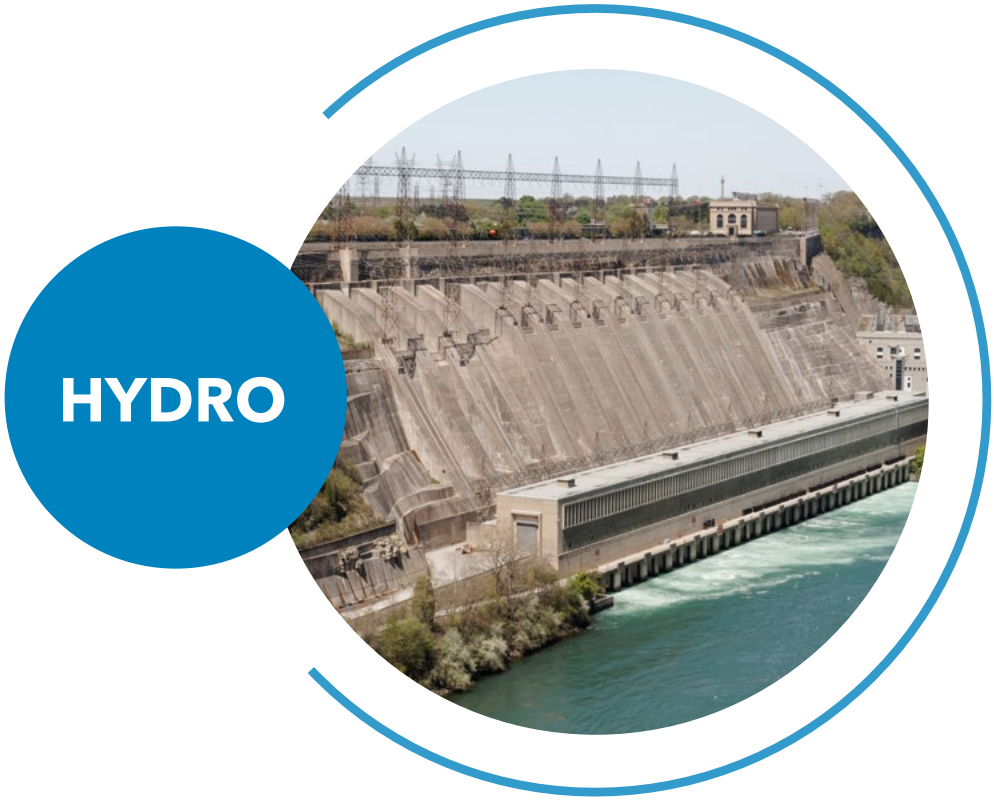
Burning biomass to generate electricity produces greenhouse gases (GHGs) and pollutants, the same as any fossil fuel. Biomass power generating plants release nitrogen oxides, sulphur dioxide, and carbon dioxide. However, the carbon dioxide produced from biomass energy may not result in an increase of atmospheric carbon dioxide if the biomass resources originate from a sustainable source. If sustainably managed, biomass is considered to be a carbon neutral, renewable energy source. However, the process of growing plants for biomass energy production requires water and land, and GHGs are emitted in the harvesting and transportation of the biomass. It is necessary to do more research into the long-term viability of using biomass energy, its environmental impacts, and the economic cost of pursuing it as an energy source.

It is difficult to measure the exact carbon footprint of biomass and bioenergy, as the resource can come from dedicated land, such as crops grown specifically for biomass, or undedicated land, such as forest or landfill sites. In general, bioenergy collected and burned from dedicated land is less sustainable than bioenergy from wastes, such as landfill gas or animal waste.

WHERE DO WE FIND BIOMASS FACILITIES IN CANADA?

There are small-scale, independent biomass facilities across much of Canada. British Columbia is the only province that makes use of biomass on a large scale and biomass supplies the province with about five per cent of its electricity. Other provinces with large-scale biomass facilities include: Alberta, Ontario, Quebec, Nova Scotia, and New Brunswick. Biomass is also frequently used to provide heat in northern communities, through burning wood in conventional wood stoves.

ELECTRICITY SOURCES



WHAT IS HYDROELECTRICITY AND HOW IS IT PRODUCED?

Hydroelectricity is electricity that is produced from moving water, which is referred to as hydropower. Hydroelectricity is now the world's largest source of renewable energy. The most common way to produce a lot of hydroelectricity is to use a dam. Dams are large-scale facilities built on rivers or estuaries to hold back the flow of water. By damming a river, a reservoir is created, which stores water (this is potential energy). As the water is released, it moves through the dam (the motion of the water is kinetic energy) and strikes the blades of a turbine (producing mechanical energy), which is attached to a generator to create electricity. If there is an increased electricity demand, plant operators can release more water from dams. Similarly, if demand is low, operators can store water for future use. Hydroelectric power plant operators can also store surplus water during high flows, to be used during the low season.

HOW DOES THE ELECTRICITY TRAVEL TO WHERE IT NEEDS TO GO AND WHAT IS IT USED FOR?

There are three stages in the electricity system – generation, transmission, and distribution. Generation is about producing electricity, transmission is about moving it, and distribution is about delivering it to individual customers. Hydroelectricity is distributed along power lines to cities and towns. Transmission lines carry electricity from generating stations to end users or consumers. When electricity is running through these lines, some electricity is lost due to resistance and dissipates as heat. To reduce the amount of electricity lost in transit, these transmission lines carry high voltage electricity. Many hydroelectric facilities are in remote locations where there is good water flow, so transmission lines from the plants often span great distances. The cable towers are used to transport the high voltage electricity from the hydro plant to power stations which then lower the voltage in order for the electricity to be used by the public. Electricity is used in our homes and businesses for things like lighting, heating and cooling, and powering appliances and electronic devices, such as refrigerators and computers.

ELECTRICITY SOURCES

HOW DOES HYDROELECTRICITY PRODUCTION AFFECT THE ENVIRONMENT?

Large hydroelectric installations such as dam reservoirs require significant areas of land, causing long-term changes to the surrounding landscape and river ecosystems, which can affect wildlife by fragmenting habitats. This has a direct effect on the migration of fish species, reducing their populations. There are some ways to mitigate the negative impact on wildlife, such as with fish ladders that allow fish to migrate around obstacles. Dams can also affect habitats downstream by causing rivers to run dry, which is why most hydroelectric utility companies are required to release water periodically to maintain the natural balance. To create large hydroelectric facilities, reservoirs need to be created by flooding the land. An issue that arises from this is the decomposition of vegetation in dam reservoirs (whether that's forests or fields or an excess of algae), which releases methane gas when it rots underwater, contributing to climate change. However, hydropower has a much lower carbon footprint overall (even accounting for emissions during construction) than coal, oil, or natural gas. There are also run-of-river operations that are much more ecologically sustainable. Run-of-river operations harness hydropower by using natural landscape features such as fast-moving rivers to generate electricity. This kind of hydroelectricity has little to no ecological impact as it does not require a dam or reservoir to produce electricity. Run-of-river operations can be used in remote and less developed areas as the energy output is lower, but so are costs and infrastructure requirements.

WHERE DO WE FIND HYDROELECTRICITY PRODUCTION IN CANADA?

Hydroelectric facilities have been built all over Canada, wherever the geography and hydrography were favourable. However, some provinces/territories produce far more of their electricity through hydropower than others. Yukon, British Columbia, Manitoba, Quebec, and Newfoundland and Labrador all rely on hydroelectricity for more than 80 per cent of their electricity needs. Quebec is the largest producer of hydroelectricity in Canada and is home to the largest power plant in the country, the Robert-Bourassa hydroelectric facility in the northern part of the province. British Columbia is the second-largest producer of hydroelectricity.

ELECTRICITY SOURCES

WHAT IS 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 natural gas fields, buried pockets of natural gas that are sometimes associated with oil fields. These underground deposits of natural gas formed a long time ago, when the world's continents looked very different and there were vast ancient seas. Organic materials, such as the remains of plants and animals, would sink to the bottom of the sea and become covered by sediment (i.e., rocks and sand) and compacted. Over the course of millions of years, the organic matter was transformed under high pressure and very hot temperatures, resulting in what we refer to today as fossil fuels – crude oil, natural gas, and coal.

HOW IS IT EXTRACTED FROM THE GROUND?

To extract natural gas, holes are drilled deep into the ground, allowing the natural gas to flow to the surface through the well. It is then processed at large facilities, which removes water and other impurities, and transported via pipeline.

HOW IS NATURAL GAS TRANSPORTED?

Natural gas is transported by pipelines that run mainly underground (sometimes, pipelines may run above ground, such as in permafrost regions). Liquid pipelines are used for transporting crude oil or natural gas liquids. Refineries convert these liquids into gasoline, diesel, and other petroleum products. Natural gas pipelines are used to transport natural gas from wells to processing plants, and then to customers throughout Canada. Pipelines are divided according to their purpose: gathering pipelines transport natural gas from wells to processing facilities, then feeder pipelines connect to the long-distance pipelines called transmission lines. These lines transport natural gas to storage facilities or connect to the distribution networks operated by utility companies.

ELECTRICITY SOURCES

WHAT IS NATURAL GAS USED FOR?

Natural gas is used for electricity generation, heating, and cooking. Electricity is used in our homes and businesses for things like lighting and powering appliances and electronic devices. Millions of Canadians rely on natural gas for heating their homes (using a furnace and natural gas fireplaces) and for hot water. For cooking, some households have stovetops that use natural gas burners.

HOW DOES NATURAL GAS PRODUCTION IMPACT THE ENVIRONMENT?

Natural gas produces fewer greenhouse gas emissions than coal and oil and is seen as an energy resource that could be used to transition to cleaner and more sustainable energy resources. Methane is also more efficient for electricity generation than coal. However, leaks from natural gas pipelines contribute to greenhouse gas emissions, which cause climate change. Methane traps more heat in the atmosphere than carbon dioxide, but carbon dioxide remains in the atmosphere for longer. Natural gas production is also water-intensive. Hydraulic fracturing, which is used to extract natural gas from the ground, requires a lot of water, and that water is mixed with chemical additives. This water needs to be carefully managed by ensuring that wells are properly constructed and maintained so that they don't allow fracking fluid to leak and contaminate nearby groundwater. The amount of water used in hydraulic fracturing is also a concern because it can put stress on local water resources in an area. This can be partially mitigated by recycling the water used in natural gas extraction.

WHERE DO WE FIND NATURAL GAS PRODUCTION IN CANADA?

Natural gas is produced in several provinces and territories in Canada, including Alberta, British Columbia, Saskatchewan, and New Brunswick.

ELECTRICITY SOURCES

WHAT IS FUEL OIL?

Fuel oil is a petroleum product made from crude oil, a natural resource that is found in large underground deposits, which exist both on land and underwater in the ocean floor. This a hydrocarbon mixture that was formed millions of years ago from organic matter that was transformed under high pressure and very hot temperatures.

HOW IS CRUDE OIL EXTRACTED FROM THE GROUND?

In Canada, there are three methods used in crude oil production: conventional extraction, mining, and in situ. Conventional crude oil is extracted from a well using a drilling rig that pumps the oil to the surface. In Canada's oilsands, the two main methods of extraction are in situ (which means "in place") and mining. In mining, the surface layer of the boreal forest (which is the primary landcover in the oilsands region) and topsoil is removed to expose the oilsands. Then, huge digging machines scoop the heavy sands into trucks, which bring it to facilities for processing. It takes about two tonnes of oilsands and at least two barrels of water to produce one barrel of synthetic crude oil (i.e., usable crude oil). In situ production involves heating water and injecting the steam into pockets of bitumen (composed of heavy oil, sand, clay, and water). The steam warms the viscous substance to make it easier to extract and pump out. We also have offshore oil production, which means that drilling rigs are installed over the ocean floor.

HOW IS CRUDE OIL TRANSPORTED AND REFINED?

Crude oil is primarily transported by pipelines that run mainly underground (sometimes, pipelines may run above ground, such as in permafrost regions), and it is also moved by rail and ship. Liquid pipelines are used for transporting crude oil or natural gas liquids. Crude oil is processed into a wide range of products which are used for transportation, heating, electricity production, and manufacturing. Refineries convert crude oil into gasoline, diesel, and other refined

petroleum products (RPPs) like fuel oil. Refineries are large industrial structures (they can look like small towns because of their size and complexity) comprising many different parts and processes that produce different RPPs. The refinement process can include steps such as distillation (seperation), cracking (breaking long hydrocarbon molecule chains into smaller ones using heat and pressure), reforming (rearranging hydrocarbons to make new ones), alkylation (combining lighter hydrocarbons into more complex ones), blending (mixing together different compounds), and more.

HOW IS FUEL OIL USED TO GENERATE ELECTRICITY?

Fossil fuel power plants burn fuel oil or diesel to create heat, which is in turn used to generate steam to drive turbines (creating mechanical energy). The turbines generate electricity.

HOW DOES FUEL OIL PRODUCTION AFFECT THE ENVIRONMENT?

There are various methods used in fuel oil production, including drilling, mining, and steam-assisted gravity drainage. In drilling, the greenhouse gas methane may be produced, which is then vented or flared (both methods release emissions into the atmosphere). Various extraction methods for fuel oil also rely very heavily on water. Tailings ponds are constructed and managed to prevent contaminated water from entering rivers, lakes or underground aquifers. Tailings ponds allow sand, clay, and trace amounts of residual hydrocarbons to settle so that water at the top can be recycled for use in oilsands extraction processes. For surface-mining, land may be cleared of vegetation in order to be mined. It may take many years to return the land back to its original state through land reclamation practices. Burning petroleum products releases greenhouse gas emissions, which contribute to climate change.

WHERE DO WE FIND OIL PRODUCTION AND REFINERIES IN CANADA?

There are oil production facilities and refineries in several provinces and territories in Canada. The following are the biggest producers in the country: Alberta is the largest crude oil producer in Canada, accounting for more than 80 per cent of the country's production. More than three-quarters of this oil comes from the oilsands, which are found in three main deposits in Alberta: Athabasca, Cold Lake, and Peace River. Alberta also has the largest refining capacity in Canada with five refineries. Saskatchewan is the second-largest producer of crude oil in Canada. Newfoundland and Labrador is the third-largest crude oil producer in Canada and has the only offshore oil platforms in the country. Ontario has the second-largest refining capacity in Canada. Quebec has the third-largest refining capacity in Canada.

ELECTRICITY SOURCES

WHAT IS TIDAL ENERGY?

Tidal energy works by harnessing the power of ocean tides, which are caused in large part by the gravitational pull of the moon, as well as the sun and the rotation of the Earth. Tidal energy is renewable, meaning that the water used for energy production is not used up in the process and is infinite.

HOW IS TIDAL ENERGY USED TO PRODUCE ELECTRICITY?

Tidal power generating stations are installed along coastlines in areas with a large tidal range. Electricity is generated from ocean tides when water passes through a barrage. The change between low tide and high tide causes water to flow through a turbine. This movement of the water (which is kinetic energy) turns the blades of a turbine. The turning of the turbine (mechanical energy) powers a generator that produces electricity. Tidal energy is reliable because it happens twice a day – two low tides and two high tides within about 24 hours. The science behind harnessing tidal energy is still in its infancy and research is being done to determine how to make the process more efficient.

HOW DOES THE ELECTRICITY TRAVEL TO WHERE IT NEEDS TO GO?

There are three stages in the electricity system – generation, transmission, and distribution. Generation is about producing electricity, transmission is about moving it, and distribution is about delivering it to individual customers. Transmission lines carry electricity from generating stations to end users or consumers. When electricity is running through these lines, some electricity is lost due to resistance and dissipates as heat. To reduce the amount of electricity lost in transit, these transmission lines carry high voltage electricity.

ELECTRICITY SOURCES

WHAT IS THE ELECTRICITY USED FOR?

Electricity is used in our homes and businesses for things like lighting, heating and cooling, and powering appliances and electronic devices, such as refrigerators and computers.

HOW DOES TIDAL ENERGY PRODUCTION AFFECT THE ENVIRONMENT?

Tidal energy is a renewable resource and its production does not directly contribute to climate change, but the manufacturing and set-up of a tidal station does produce some greenhouse gas emissions (e.g., transporting the turbines to the site location). Tidal turbines can have a harmful effect on wildlife, specifically fish, but it doesn't pose a huge threat to marine populations. There are ways to mitigate the effect on wildlife, such as with careful site selection, to avoid disruption to animal migration routes. Tidal is a new energy source and there is still more research that needs to be done into its repercussions for marine life. One advantage of tidal power plants over other renewable energy sources is that the station itself takes up a relatively small amount of land (as opposed to wind and solar farms).

WHERE DO WE FIND TIDAL INSTALLATIONS IN CANADA?

The Annapolis Tidal Power Plant was the only tidal power station in North America. Located in the Bay of Fundy, which has the highest tides in the world, the station had a generating capacity of 20 megawatts of electricity. Currently, there are no large-scale commercial tidal energy facilities in Canada, but there are some projects in development and research stages.

ELECTRICITY SOURCES

WHAT IS SOLAR ENERGY?

Solar energy comes from the sun. The amount of available solar energy varies depending on the season, weather, and location of the technology used to harness the sunlight.

HOW IS SOLAR ENERGY USED TO PRODUCE ELECTRICITY?

The sun's energy can be harnessed in several ways, including solar photovoltaic cells, active solar energy, passive solar energy, and concentrating solar power systems. Solar technologies use the sun's energy to heat homes and water and to generate electricity. The most common method of converting solar energy into electricity is through photovoltaic (PV) cells, which convert sunlight into electricity that can be used, stored, or added to the grid. PV cells are used on both the residential and commercial scale, and some solar farms cover many acres to produce electricity for thousands of homes.

HOW DOES THE ELECTRICITY TRAVEL TO WHERE IT NEEDS TO GO?

Electricity produced from solar energy is transported through power lines. There are three stages in the electricity system – generation, transmission, and distribution. Generation is about producing electricity, transmission is about moving it, and distribution is about delivering it to individual customers. Transmission lines carry electricity from generating stations to end users or consumers. When electricity is running through these lines, some electricity is lost due to resistance and dissipates as heat. To reduce the amount of electricity lost in transit, these transmission lines carry high voltage electricity.

ELECTRICITY SOURCES

WHAT IS THE ELECTRICITY USED FOR?

Electricity is used in our homes and businesses for things like lighting, heating and cooling, and powering appliances and electronic devices, such as refrigerators and computers.

HOW DOES SOLAR ENERGY PRODUCTION AFFECT THE ENVIRONMENT?

Solar energy is a renewable resource and its production does not directly contribute to climate change, but the manufacturing of solar panels does have an impact on the environment. While the operation of solar panels does not produce any emissions, there are environmental consequences when solar equipment is no longer in use. Photovoltaic systems often use lead-acid batteries, and although these batteries are becoming more recyclable and have longer life spans, they have the potential to contaminate groundwater at landfills. Some of the materials used for solar panels, such as cadmium and lead, are toxic. These minerals, as well as other compounds, are difficult or expensive to recycle and are considered hazardous waste, which means that they can't simply be dumped at a regular landfill because the toxic materials could get into the soil. However, methods for recycling solar panels do exist and, as the need for it grows, countries will have to create and enforce standards for proper recycling. Land being used for solar farms can negatively affect animal habitats and can cause habitat fragmentation.

WHERE DO WE FIND SOLAR FARMS IN CANADA?

More than 98 percent of Canada's solar power generation capacity is located in southern Ontario. Solar power generation depends on the availability of sunlight, so it is very seasonal and is affected by climate and latitude. In general, solar panels generate less electricity in the fall and winter, particularly in northern Ontario, where days are shorter in the winter. Quebec and the Prairies also produce some solar energy. Although small solar panel installations for homes and businesses are done all across the country, the majority of small-scale solar energy production happens in southern Canada.

ELECTRICITY SOURCES

NUCLEAR

WHAT IS NUCLEAR ENERGY?

Nuclear energy is a type of thermal energy that uses uranium to generate electricity. Nuclear power generation is perhaps one of the most complex energy production processes. It creates a lot of energy from a relatively small amount of a radioactive element called uranium (a heavy metal). The mineral uranium has to first be mined and milled, then processed into a usable fuel source before it can finally be used for nuclear energy production. When the uranium ore is extracted from the earth, it is crushed and chemical processes are used to remove impurities. The production of nuclear energy can be found in both large multi-core reactors and small modular reactors. Small modular reactors are an emerging technology that can provide a solution for remote regions to allow for a transition from diesel.

HOW IS NUCLEAR ENERGY PRODUCED?

Through a process called fission, uranium atoms are split apart, which releases a lot of energy and causes more atoms to split apart (this chain of events is called a nuclear reaction). The entire process takes place inside a nuclear reactor. Water is used as a moderator (to slow down the reaction) and nuclear reactors have something called control rods to control the process and the rate at which fission occurs. The heat from this process converts regular water into steam, which then passes through a turbine (creating mechanical energy) to generate electricity. This process produces no sulphur dioxide, nitrous oxides, or carbon dioxide emissions, which are major components of greenhouse gases (i.e., nuclear energy production doesn't directly contribute to climate change). However, radioactive waste from uranium mining, processing, and energy production must be stored for anywhere from a few months to a few thousand years until the radioactivity of the waste has dropped to safe levels. Nuclear can produce enough energy for large cities from a single production facility, making it an option worth exploring to address Canada's energy demands and climate obligations.

ELECTRICITY SOURCES

HOW DOES THE ELECTRICITY TRAVEL TO WHERE IT NEEDS TO GO?

There are three stages in the electricity system – generation, transmission, and distribution. Generation is about producing electricity, transmission is about moving it, and distribution is about delivering it to individual customers. Transmission lines carry electricity from generating stations to end users or consumers. When electricity is running through these lines, some electricity is lost due to resistance and dissipates as heat. To reduce the amount of electricity lost in transit, these transmission lines carry high voltage electricity.

WHAT IS THE ELECTRICITY USED FOR?

Electricity is used in our homes and businesses for things like lighting, heating and cooling, and powering appliances and electronic devices, such as refrigerators and computers.

HOW DOES NUCLEAR ENERGY PRODUCTION AFFECT THE ENVIRONMENT?

Nuclear power doesn't directly produce greenhouse gases, but it can pose a risk to the environment with the challenge of ensuring safe long-term storage of hazardous waste. Radioactive materials need to be stored in containers that are leak-proof (which need to be stored in sealed facilities) to ensure they do not get into the groundwater because they can remain radioactive for thousands of years. Spent fuel rods are the most dangerous to safely store in the long term because of their very long radioactive decay. There are also greenhouse gas emissions and environmental impacts when it comes to the mining of uranium for use in power generation and the construction of nuclear power plants. Nuclear power is the most water-intensive method of power generation (water is used in any type of thermal power generation, with coal being the second-most intensive energy for water use). Water is boiled to produce steam to turn a turbine (i.e., mechanical energy) to produce electricity, and then this water needs to be cooled down before it can be released back into the environment – warmer water can harm wildlife and kill aquatic plant life. Other environmental concerns about nuclear energy include incidents like the 2011 tsunami in Japan, which damaged the Fukushima Daiichi Nuclear Power Plant, causing hydrogen gas explosions and radiation leaks.

WHERE DO WE FIND NUCLEAR ENERGY PRODUCTION IN CANADA?

Canada has the world's largest deposits of high-grade uranium located in the Athabasca Basin of northern Saskatchewan. Saskatchewan's mines produce all of Canada's uranium, three-quarters of which is exported and the rest is used for nuclear energy production in Canada. Ontario has three nuclear power plants: Bruce, Darlington, and Pickering. New Brunswick is the only province outside of Ontario that produces nuclear energy.

ELECTRICITY SOURCES

WHAT IS WIND ENERGY?

Wind power is a clean and renewable energy source. Wind turbines harness energy from the wind using mechanical power to spin a generator and create electricity.

HOW DO WE USE THE WIND TO PRODUCE ELECTRICITY?

Wind turbines use blades to collect the wind's energy by using kinetic energy (the movement of the wind over the turbine blades). Wind flows over the blades creating lift, which causes the blades to turn. The blades are connected to a drive shaft that turns a generator (mechanical energy) to produce electricity. The best places for wind farms are areas with strong winds, such as hills, open fields, near coastlines, and offshore. Smaller wind turbines can be used to power cottages, farms, or remote communities. Larger wind farm installations provide power to the electricity grid, sending electricity to thousands of consumers.

HOW DOES THE ELECTRICITY TRAVEL TO WHERE IT NEEDS TO GO?

Electricity produced from wind energy is transported through power lines. There are three stages in the electricity system – generation, transmission, and distribution. Generation is about producing electricity, transmission is about moving it, and distribution is about delivering it to individual customers. Transmission lines carry electricity from generating stations to end users or consumers. When electricity is running through these lines, some electricity is lost due to resistance and dissipates as heat. To reduce the amount of electricity lost in transit, these transmission lines carry high voltage electricity.

ELECTRICITY SOURCES

WHAT IS THE ELECTRICITY USED FOR?

Electricity is used in our homes and businesses for things like lighting, heating and cooling, and powering appliances and electronic devices, such as refrigerators and computers.

HOW DOES WIND ENERGY PRODUCTION AFFECT THE ENVIRONMENT?

Since wind power does not produce greenhouse gas emissions, it is considered a more environmentally friendly energy source. Wind energy is a renewable resource and its production does not directly contribute to climate change, but the manufacturing and set-up of wind farms does produce some greenhouse gas emissions (e.g., transporting the turbines to the site location).

The land used for wind farms can be multipurpose because the actual turbines do not take up too much space, which allows for the surrounding space to be used for animal grazing, trails, or even agriculture.

Wind turbines can have a harmful effect on wildlife, specifically birds and bats, but it is relatively low and doesn't pose a huge threat to their populations. There are ways to mitigate the effect on wildlife such as with careful site selection, to avoid wildlife migration corridors, or pausING turbines during periods of low wind speed so as not to confuse birds or bats by slow-moving blades.

WHERE DO WE FIND WIND FARMS IN CANADA?

Ontario leads Canada in installed wind energy capacity. Quebec, Alberta, and Prince Edward Island are also leading producers of wind energy. In fact, wind energy accounts for nearly all of the electricity generated on Prince Edward Island and meets about a quarter of the island's electricity demand. In Quebec, vast hydroelectric supplies can be used to back-up intermittent generation sources such as wind. Small and isolated wind-generated electricity systems are also found all across Canada.