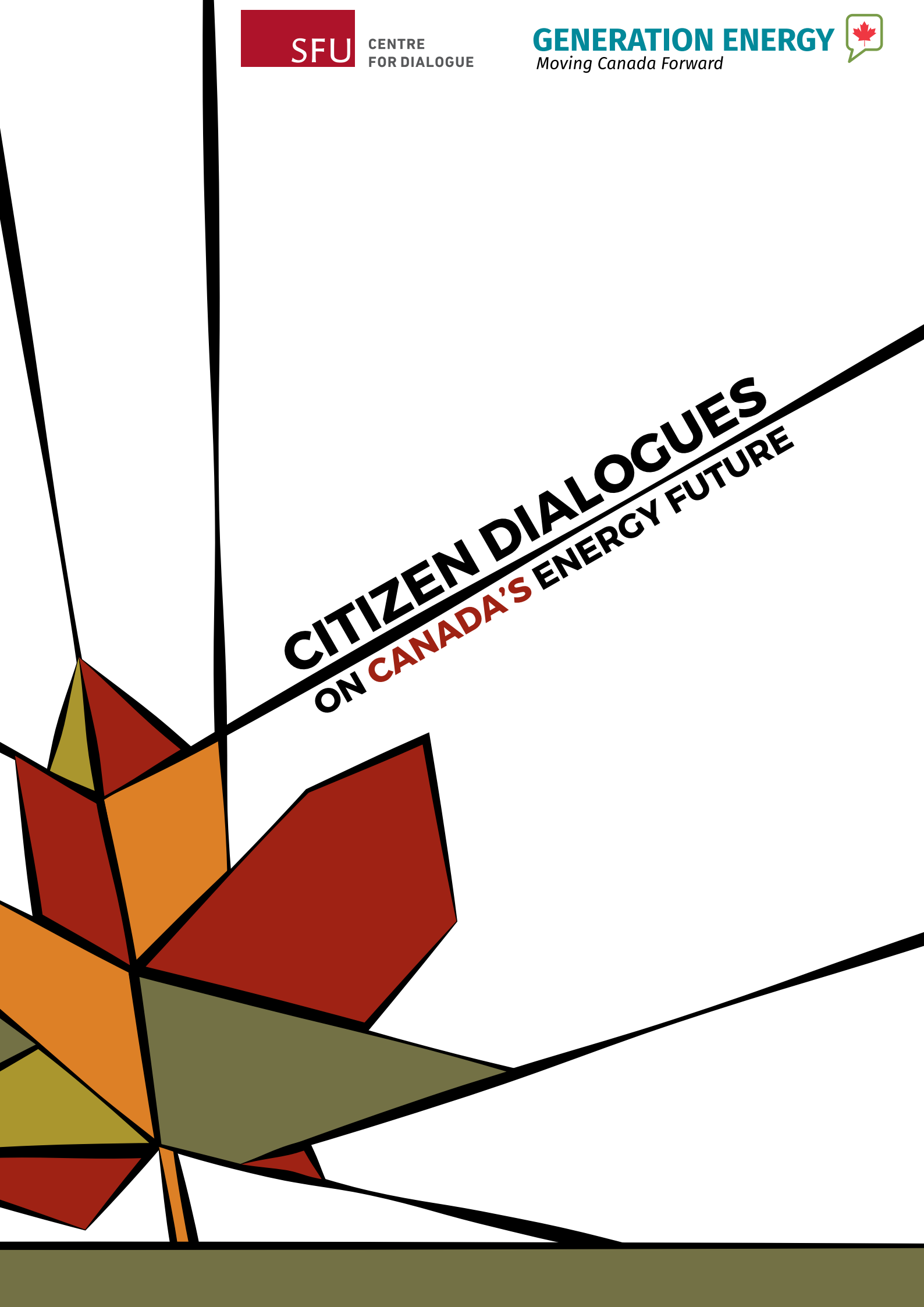
SFU CENTRE FOR DIALOGUE

GENERATION ENERGY
Moving Canada Forward

CITIZEN DIALOGUES ON CANADA'S ENERGY FUTURE



This discussion guide was independently prepared by Simon Fraser University's Centre for Dialogue and funded under a contribution agreement from Natural Resources Canada. It was written and designed by Christopher Gully, supported by background research and framing questions provided by staff at the SFU Centre for Dialogue.

Simon Fraser University's Centre for Dialogue fosters understanding and positive action through dialogue and engagement. Our Civic Engage program seeks to increase the capacity of governments and citizens to work collaboratively on policy decisions, where mutual curiosity and collaborative inquiry act as alternatives to adversarial approaches. This mission is supported by the Centre for Dialogue's status as a neutral facilitator and its reputation as a globally-recognized centre for knowledge and practice in dialogue.

SFU CENTRE FOR DIALOGUE

GENERATION ENERGY
Moving Canada Forward

Funded by Natural Resources Canada | Canada

Contents

www.canadaenergyfuture.ca

A new kind of energy: citizens in dialogue

Energy has the most profound implications in each of our lives and those of the people who surround us. It heats our homes through the winter, creates jobs, generates wealth used to fund our retirement and helps to pay for our healthcare when we are sick. Some forms of energy also produce emissions that alter our climate, impact our access to clean air and water, or degrade our natural heritage. When we talk about energy, we talk about our way of life, our identity as a people and our hopes and fears for the future that our children will inherit.

How energy is produced, transported and used in a country such as Canada can vary significantly within each province, territory, urban area, rural town or Indigenous community. These regional differences can make conversations about energy especially difficult.

All too often we shout at each other instead of speaking with each other, separated by vast geographical distances and the challenge of imagining what it is like to be from a place we may never have even visited.

The Citizen Dialogues on Canada's Energy Future are an attempt to approach this conversation differently. Over September and October 2017, these dialogues will deeply engage 150 Canadians on the topic of energy. Coming from different home towns, perspectives and backgrounds, these randomly selected participants will sit down with one another to learn about each other's lives and aspirations. Together, they will seek a shared path forward in shaping Canada's energy future, informed by the best evidence-based information available and the spirit of curiosity.

These dialogues are commissioned by Natural Resources Canada (NRCan) as part of its larger Generation Energy public consultation, and are independently designed and implemented by Simon Fraser University's Centre for Dialogue. The deliberative dialogue process used reflects a relatively new way for governments to engage citizens and demonstrates true leadership by NRCan within the global Open Government movement. This process will provide participants access to a wide variety of ideas and perspectives without censorship. It also means that participants will have to imagine themselves in the shoes of their elected representatives, with all the constraints and hard trade-offs this entails.

If you are reading this discussion guide in preparation for participating in these Citizen Dialogues, welcome! You have a rare and exciting opportunity to help inform your country's future. Whether starting your journey at a regional dialogue in Vancouver, Calgary, Toronto, Montreal or Halifax, you bring with you unique expertise about the role of energy in your life. Your words will help decision-makers better understand how their actions relate back to your interests and your values, and will contribute to a critical feedback loop in the democratic process.

Whether you are a participant, stakeholder or citizen, this guide will provide you with a factual overview of Canada's energy systems and will introduce you to a range of approaches for and perspectives about our energy future. Most readers, regardless of perspective, will find some ideas that feel familiar and agreeable and other ideas that seem strange and uncomfortable. This is healthy in a democracy. The conversations that result will surely present the opportunity of a generation to guide our shared energy future.

Robin Prest
Civic Engagement Program Director
Simon Fraser University's Centre for Dialogue

What is dialogue and how does it differ from debate?

Dialogue is a special kind of conversation that involves learning and working together to understand different points of view and trying to find common ground. Having a dialogue does not mean that all the differences disappear or that 100% consensus emerges, but it does encourage each of us to carefully consider perspectives and views that are different from our own.

The central question of this dialogue will be: **what should Canada's energy future look like over the course of a generation and how do we get there?**

For some of us, Canada's energy future is built upon continuing our strong history of resource development. Others see a much bigger role for local communities in decision-making. Some look forward to a future defined by renewable energy.

There is no wrong answer to this question.

Your opinions matter and are central to the success of this dialogue. The purpose of this discussion guide is to provide you with some perspectives that can aid you in understanding your own opinions and values, as well as those of others. This guide will also provide some factual background about Canada's energy system and some of the technologies and policies that might be part of Canada's energy future.

As you read this discussion guide, you will see a series of questions that are designed to make you think. As you consider your answers, ask yourself what facts and experiences you're drawing on to answer each question. You may also want to consider how other Canadians may answer differently.

PART 1
Let's talk about Canada's energy system

Even though we may not think about it all the time, not a day goes by when we don't use energy in one form or another. For individuals, affordable energy keeps us warm in the winter and cool in the summer, provides us with transportation when we need to go somewhere, and powers the devices that keep us connected across this vast country. For communities, it lights our streets, powers our public transit and pumps our water. For business and government, it can be sold to create revenue and is critical to producing and moving the goods we use every day in a competitive marketplace.

An energy system helps us achieve all of these things by linking sources of energy, such as coal or wind, with energy services that people want for their lives, such as lighting, heating and transportation.

Canada's energy system is a vital contributor to our economy and is strongly interlinked with our natural environment.

Energy in Canada is rich in both fossil fuels (such as oil, coal and natural gas) and renewable sources, such as water, wind, sun, and wood and other plants. While not included in official energy supply statistics, Canada also mines and exports a large amount of uranium, which is eventually used to power nuclear reactors in Canada and around the world.

Around 45% of Canada's **energy supply** comes from oil. The rest comes from natural gas (30%), coal (8.1%), hydro (7.7%), nuclear power (6.2%), biofuels and waste (3%), and finally very small amounts from wind and solar.

Looking only at electricity, renewable sources of power account for two-thirds of electricity generation, with the majority coming from hydropower. Only five countries in the world produce a similar or larger share of electricity from renewable sources. There are also four active nuclear power stations in Canada – three in Ontario and one in New Brunswick – that together supply about 20% of Canada's electricity. On average, electricity prices in Canada are lower than all other G7 countries, providing an important competitive advantage for our country's industries.

About 20% of **energy demand** in Canada is for the production of electricity and other

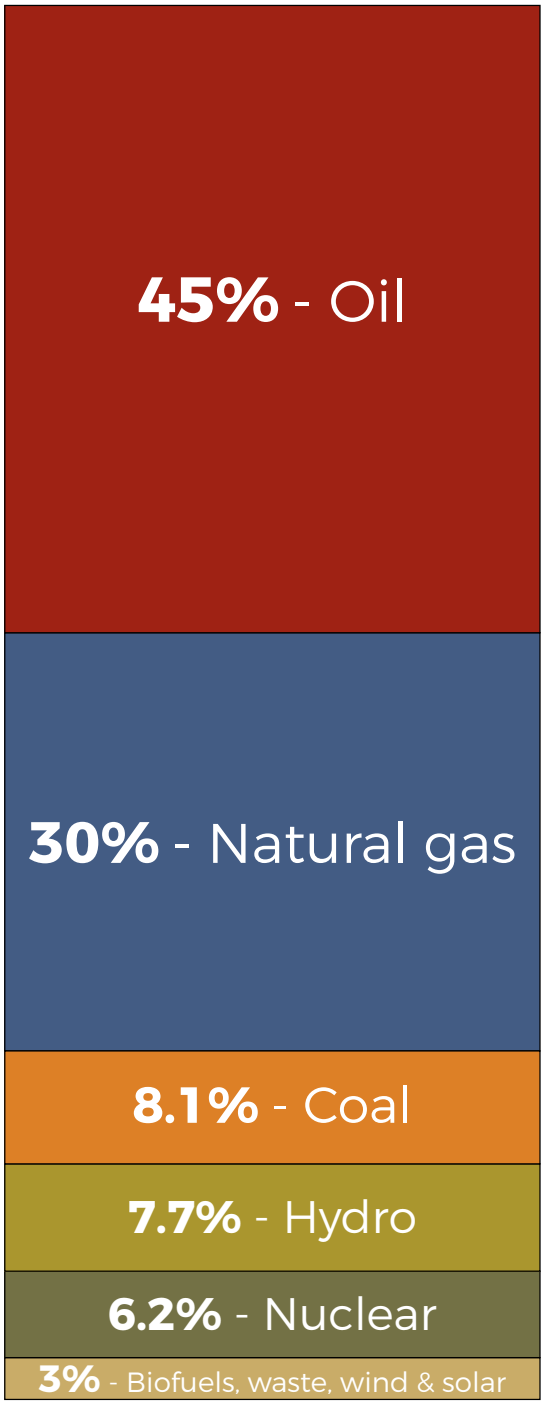
energy resources such as gasoline. Out of the remaining 80%, most of Canada's energy is used for industry and transport, together accounting for about half of all energy consumed. The residential sector accounts for about 14% of energy use, with the balance going towards the commercial and services sector, including agriculture.

Transporting energy is a key part of the energy system. Some sources of energy, such as coal or oil, are transported by ship, truck or train. In fact, energy resources, including coal, oil and natural gas, make up about 20% of everything moved by train in Canada.

But it is mainly one of the world's largest networks of pipelines, measuring over 800,000 km, that moves oil, gas and refined liquids over long distances across Canada.

Finally, electricity is transported through Canada's 160,000 km of power lines – enough to stretch from Victoria to St. John's and back over a dozen times. These power lines connect not only the provinces and territories, but they also connect Canada to the United States.

Canada's primary energy supply (2015)



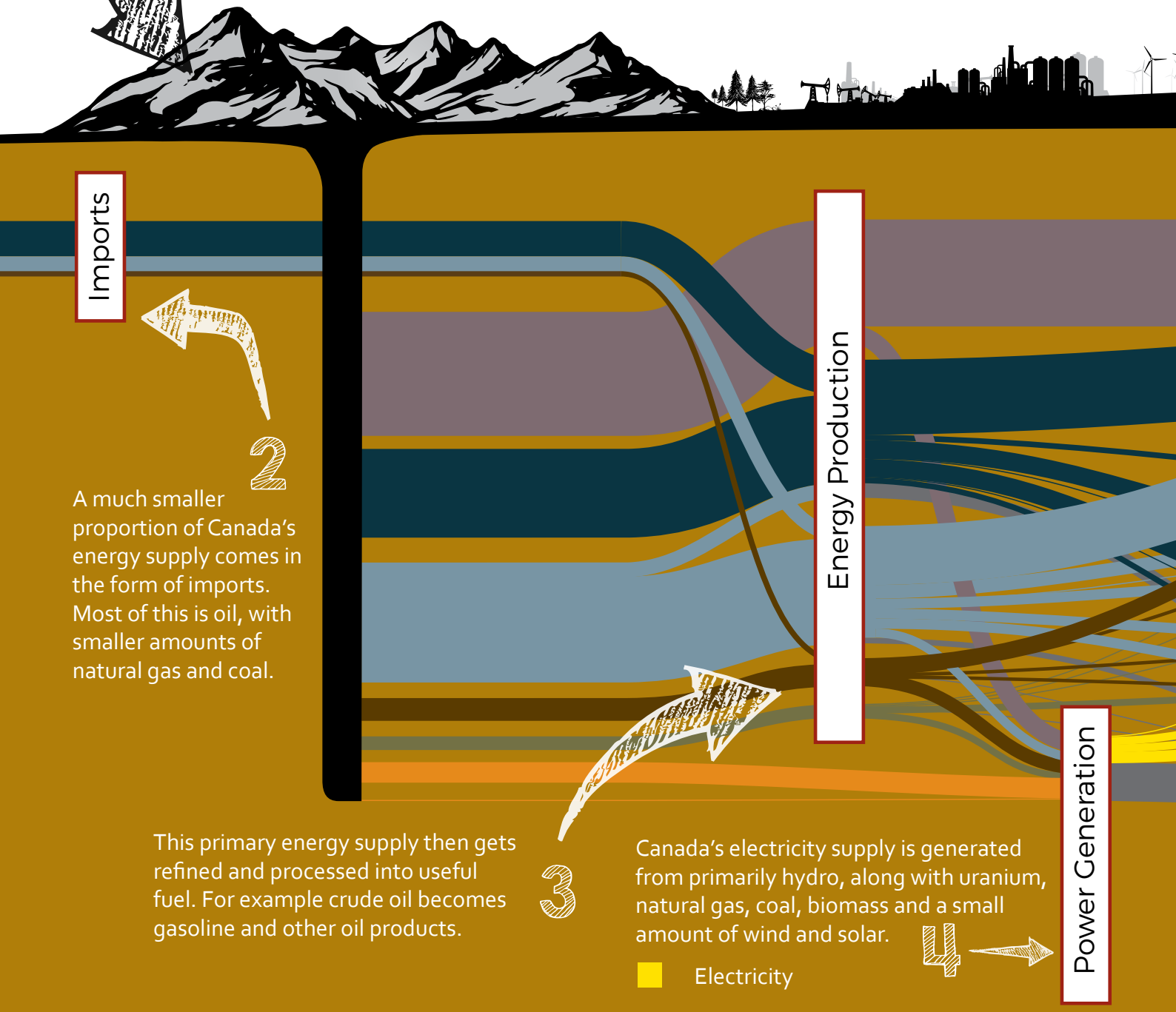
Q: How do you use energy in your daily life? How might this differ in other parts of the country?

Canada's Energy System in 7 steps

Primary Energy Supply

The majority of Canada's energy comes from the country's own natural resources. These resources are either mined or pumped from underground, grown, or collected from the natural environment. In the diagram below, you can see the proportion of each form of energy in terms of its energy value.

- Uranium
- Oil
- Natural Gas
- Coal
- Biomass
- Other Renewables (hydro, solar, and wind)



2

A much smaller proportion of Canada's energy supply comes in the form of imports. Most of this is oil, with smaller amounts of natural gas and coal.

This primary energy supply then gets refined and processed into useful fuel. For example crude oil becomes gasoline and other oil products.

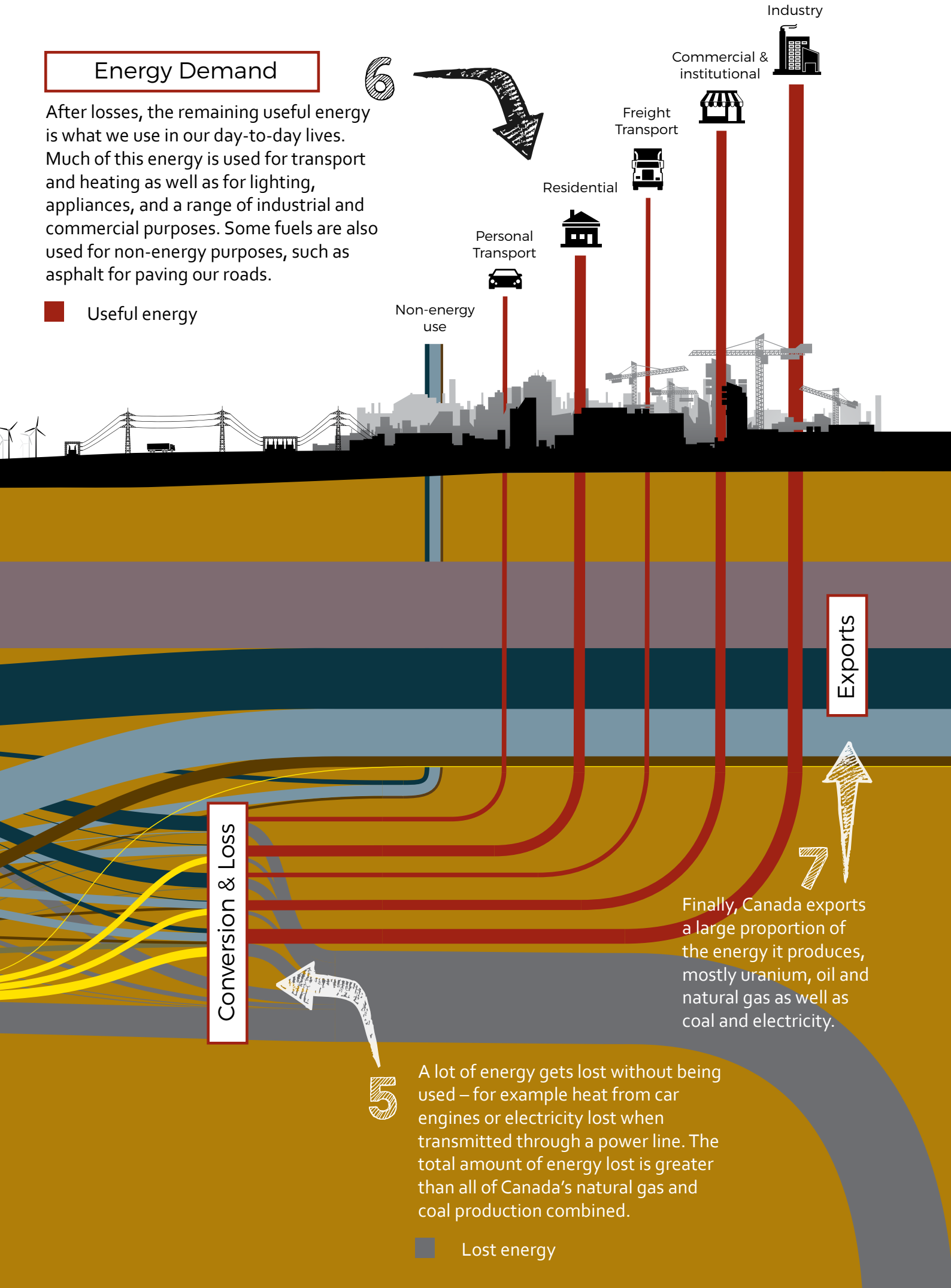
3

Canada's electricity supply is generated from primarily hydro, along with uranium, natural gas, coal, biomass and a small amount of wind and solar.

4

- Electricity

Sankey diagram adapted and simplified from Canadian Energy Systems Analysis Research 2014


Energy Demand
6
After losses, the remaining useful energy is what we use in our day-to-day lives. Much of this energy is used for transport and heating as well as for lighting, appliances, and a range of industrial and commercial purposes. Some fuels are also used for non-energy purposes, such as asphalt for paving our roads.
Useful energy
Industry
Commercial & institutional
Freight Transport
Residential
Personal Transport
Non-energy use
Exports
7
Finally, Canada exports a large proportion of the energy it produces, mostly uranium, oil and natural gas as well as coal and electricity.
Conversion & Loss
5
A lot of energy gets lost without being used – for example heat from car engines or electricity lost when transmitted through a power line. The total amount of energy lost is greater than all of Canada's natural gas and coal production combined.
Lost energy

Energy jurisdiction refers to who has the right to make legal decisions about how energy is owned, managed and moved.

The provinces own all of their land resources – for example coal, oil or uranium – except for those on Indigenous and federal lands. The provinces and territories are also responsible for electricity systems within their borders. Environmental management is an area of shared jurisdiction, meaning that provincial and federal cooperation is important on energy issues. However, the federal government normally has jurisdiction over energy infrastructure that crosses provincial boundaries and for energy policies that impact the national interest.

Because of this division of roles and responsibilities, it can sometimes seem like the provinces and territories all have separate power systems. However in reality the provinces are interconnected. This means that they have the ability to send and receive electricity across provincial borders. Yet Canada's provinces currently trade more electricity with bordering US States than they do with neighbouring provinces and territories.

The energy sector is a vital part of Canada's economy.

The energy sector contributes to about 10% of the country's economy and adds over $20 billion each year to federal, provincial and territorial government budgets. It generates approximately 5% of all employment in Canada, including 280,000 direct and 625,000 indirect jobs.

Most energy jobs in Canada come from the oil and gas sector. Canada is the world's fourth-largest producer of natural gas and fifth-largest producer of crude oil. Canada also has the third-largest supply of oil reserves in the world. In Alberta, Saskatchewan and Newfoundland and Labrador, oil and gas accounted for approximately one out of every five dollars of economic activity in 2015.

There are a range of sectors important to Canada's economy that are energy intensive, including: steel, pulp and paper, aluminum, industrial chemicals, and fertilizers. These sectors make up about 5% of the economy of the country. However there are significant regional differences. For example, potash

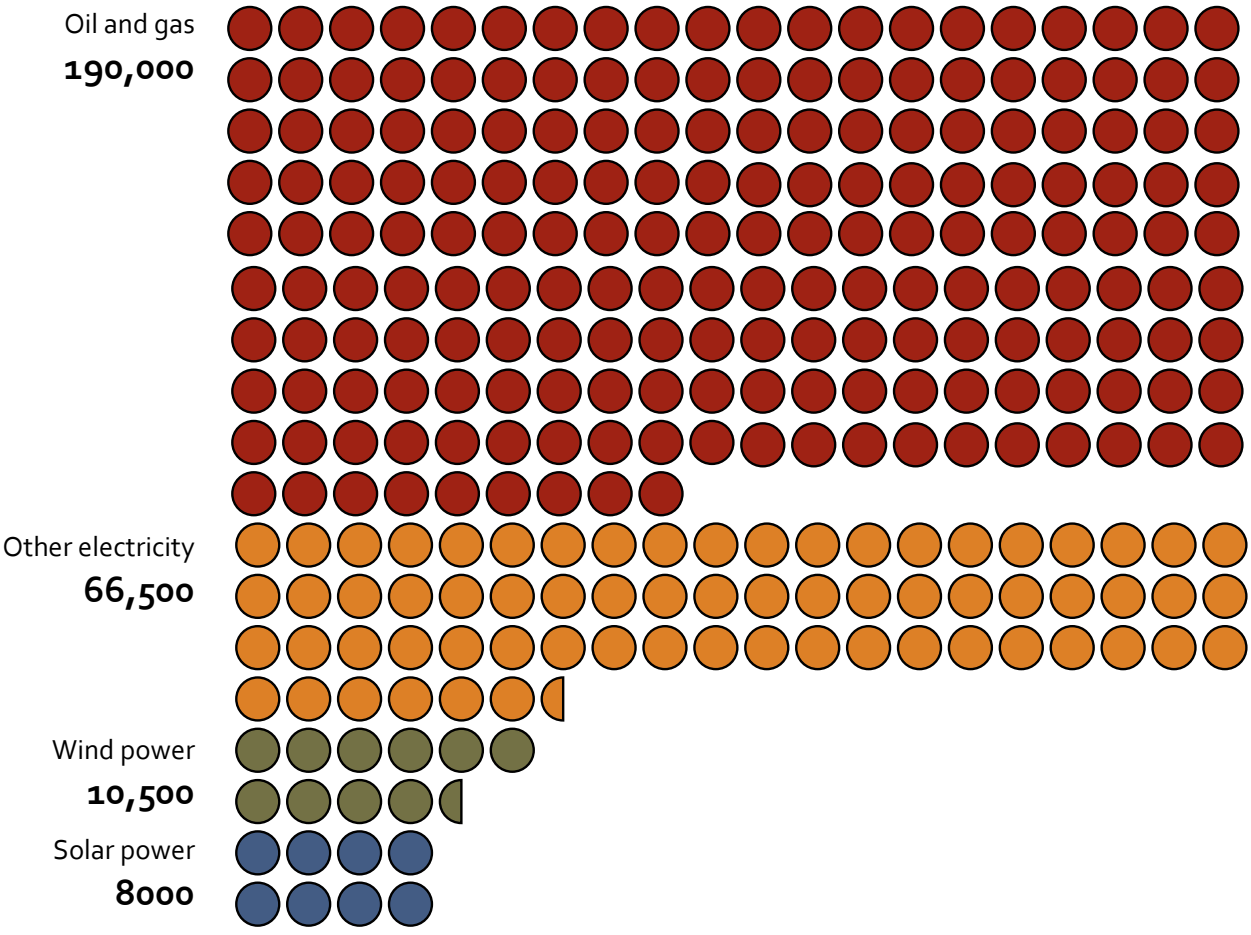
Q: How does energy impact your household budget and your local economy?

mining is a major industry in Saskatchewan, forestry products are key to British Columbia, and Quebec is a major producer of aluminum.

The electricity sector in Canada employs about 85,000 people, including about 10,500 working in the wind power industry and over 8,000 working on solar power. Canada also has the world's third-largest proven capacity for hydroelectricity.

Different provinces and territories use energy revenues in different ways. Many jurisdictions use energy revenues to increase investments in education, social programs and infrastructure. Others prefer to use energy revenues to keep taxes low. In earlier decades, Alberta saved a portion of its energy revenues in a trust fund to share the benefits of non-renewable resources with future generations. In recent years, British Columbia has discussed creating a similar prosperity fund.

Energy sector jobs in Canada (2015, estimated)



How much is a tonne of CO_2?

When people talk about reducing greenhouse gas emissions, they commonly talk about thousands or millions of tonnes of CO_2. But what does this actually mean?

One tonne of CO_2 equals about 3,500 km travelled in an average car – roughly the distance from Calgary to Toronto. When including all emissions sources, Canada emits approximately 20 tonnes of greenhouse gases (GHGs) for every resident per year. In 2013, this made us the 11th-highest emitter per person out of 185 countries tracked around the world, accounting for approximately 2% of global emissions.

Energy production and use is responsible for over 80% of Canada's total GHG emissions.

The energy sector is a major contributor to GHG emissions, releasing the equivalent of over 587 million tonnes of CO_2 in 2015 out of a total of 722 million tonnes across all sectors. Other sectors such as forestry and waste disposal also contribute to Canada's GHG emissions but are outside the focus of this discussion guide.

GHG emissions mean that the energy sector is a major contributor to climate change. That's because CO_2 is a greenhouse gas – it traps heat in the atmosphere that would otherwise be radiated away from earth. As more and more GHGs build up in the planet's atmosphere, they will continue to change the Earth's climate. Other gases such as methane (CH_4) and chlorofluorocarbons (CFCs) also contribute to global warming, but these are usually converted to CO_2 equivalents when discussing total GHG emissions.

One dramatic result of climate change is likely to be temperature change. While this is commonly referred to as global warming, this wording can be misleading. Though the average temperature of the planet is rising, a changing climate can result in colder temperatures in some regions and much hotter temperatures in others. It can also result in more extreme and erratic weather.

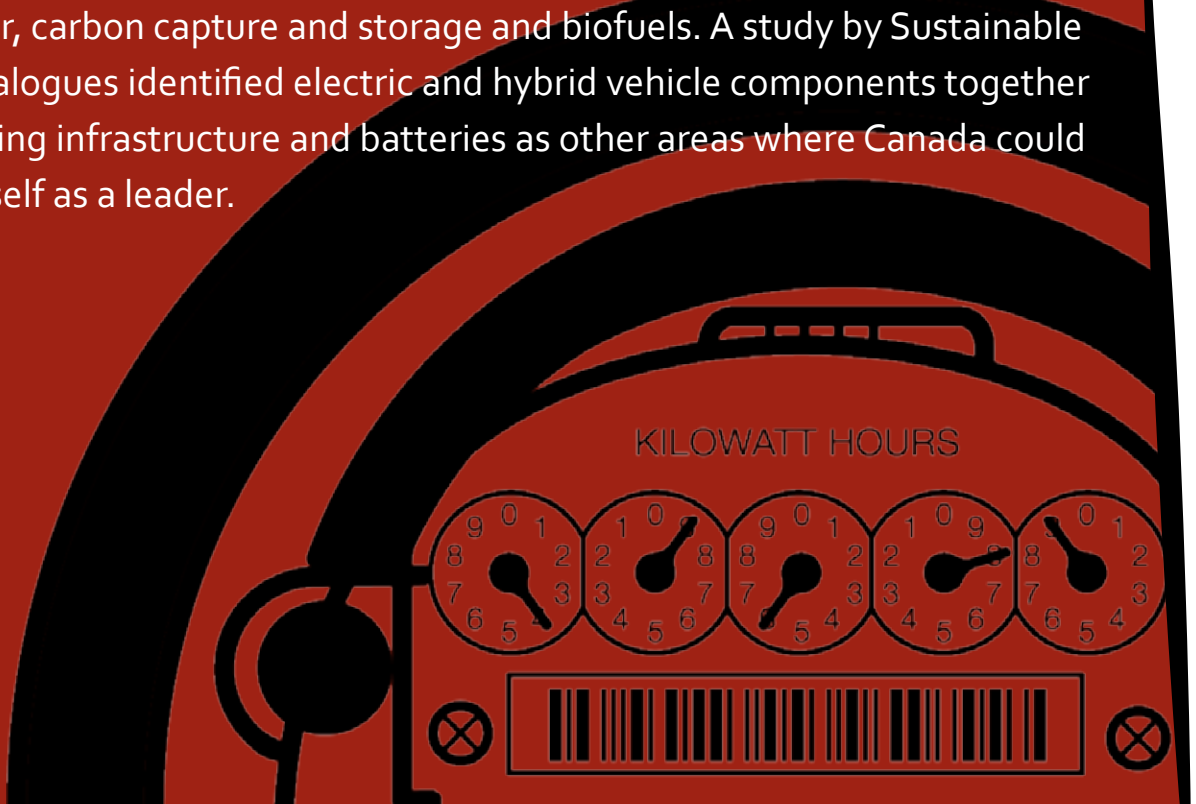
What's a clean job?

The exact definition of "clean energy" is sometimes disputed, especially for low-carbon technologies with other environmental impacts such as nuclear power plants or large hydroelectric dams.

According to Analytica Advisors, Canada has almost 800 clean technology firms operating across the country in a wide range of sectors including emerging renewable power generation technologies, smart grids, energy efficiency, recycling, transportation, wastewater and sustainable agriculture. Most of these businesses are located in Ontario, BC and Quebec. In comparison, Canada's aerospace industry is made up of around 700 firms, and the automotive sector about 450.

In 2015, Canada's clean technology industry generated over $13 billion in revenue and around 55,000 jobs.

In addition, Canada is part of a global market for clean energy goods and services that is estimated to be worth over $5.8 trillion. Canada is already globally competitive in unconventional hydro, bioenergy, waste to energy, solar power, carbon capture and storage and biofuels. A study by Sustainable Canada Dialogues identified electric and hybrid vehicle components together with charging infrastructure and batteries as other areas where Canada could position itself as a leader.



In Canada, the rate of warming since 1948 has been measured at twice the global rate, with greatest impact in the Canadian Arctic. This has serious implications for preserving our natural environment and way of life for the future generations.

Sea level rise will be of particular concern to Canada's coastal communities, disrupting fisheries in the Maritimes and Canada's Arctic and leading to long-term changes to livelihoods and cultural practices. Increased acid content in our oceans from CO_2 is already harming shellfish reproduction in Canadian waters, while temperature and rainfall fluctuations will present challenges for farmers in the Prairie Provinces and could result in rising food costs.

Changing weather patterns are predicted to increase flooding, storm damage or water restrictions across the country. Heatwaves and forest fires are expected to become more common, leading to increased uncertainty, displacement and health impacts for affected communities. Ecological impacts could also be severe, such as extinctions and the threat of invasive species such as the Mountain Pine Beetle in British Columbia. The thawing of permafrost will also be a major climate change concern for northern infrastructure.

There are also likely to be serious impacts in other countries around the world. For example, drought can lead to spikes in food prices, in the worst cases leading to famine in some developing countries. Floods and extreme storm events can also result in outbreaks of disease. Fossil fuels such as gasoline, diesel and coal also contribute to poor air quality and respiratory health in Canada, leading to an estimated $36 billion in annual costs, according to the International Institute for Sustainable Development.

Conflict over dwindling resources, including fresh water, could lead to regional instability. Finally, the very existence of many small island states will be threatened. In all cases, there is serious potential for an increased number of refugees, which in turn can put a strain on the immigration and refugee systems of countries such as Canada.

Q: How might climate change affect your local community?

Climate change is likely to have serious economic impacts.

For example, in 2011 there was $1.7 billion worth of property damage due to extreme weather events. Meanwhile, Canada's Ecofiscal Commission has estimated that $25 billion worth of Vancouver real estate could be heavily impacted by rising sea levels. Studies by the Government of Canada suggest that the cost of inaction is greater than the cost of action: climate change is predicted to cost Canada $21 to $43 billion per year by 2050, and these costs could be potentially much higher if there is no action taken to reduce GHG emissions.

Canada and the provinces have committed to reducing CO_2 emissions in order to help prevent the worst effects of climate change.

The federal government has "committed to creating a cleaner, more innovative economy that reduces emissions and protects the environment, while creating well-paying jobs and promoting robust economic growth." Specifically, the Government of Canada hopes that our country's total GHG emissions in 2050 will be 80% lower than they were in 2005. The government considers this to be consistent with a 1.5°C to 2°C temperature limit under the Paris Agreement on Climate Change.

Recently, Canada's federal, provincial and territorial governments came together to develop a framework for taking the first steps toward fulfilling the country's Paris commitments. The result was The Pan-Canadian Framework on Clean Growth and Climate Change, agreed upon by the federal government, eight provinces and the three territories.

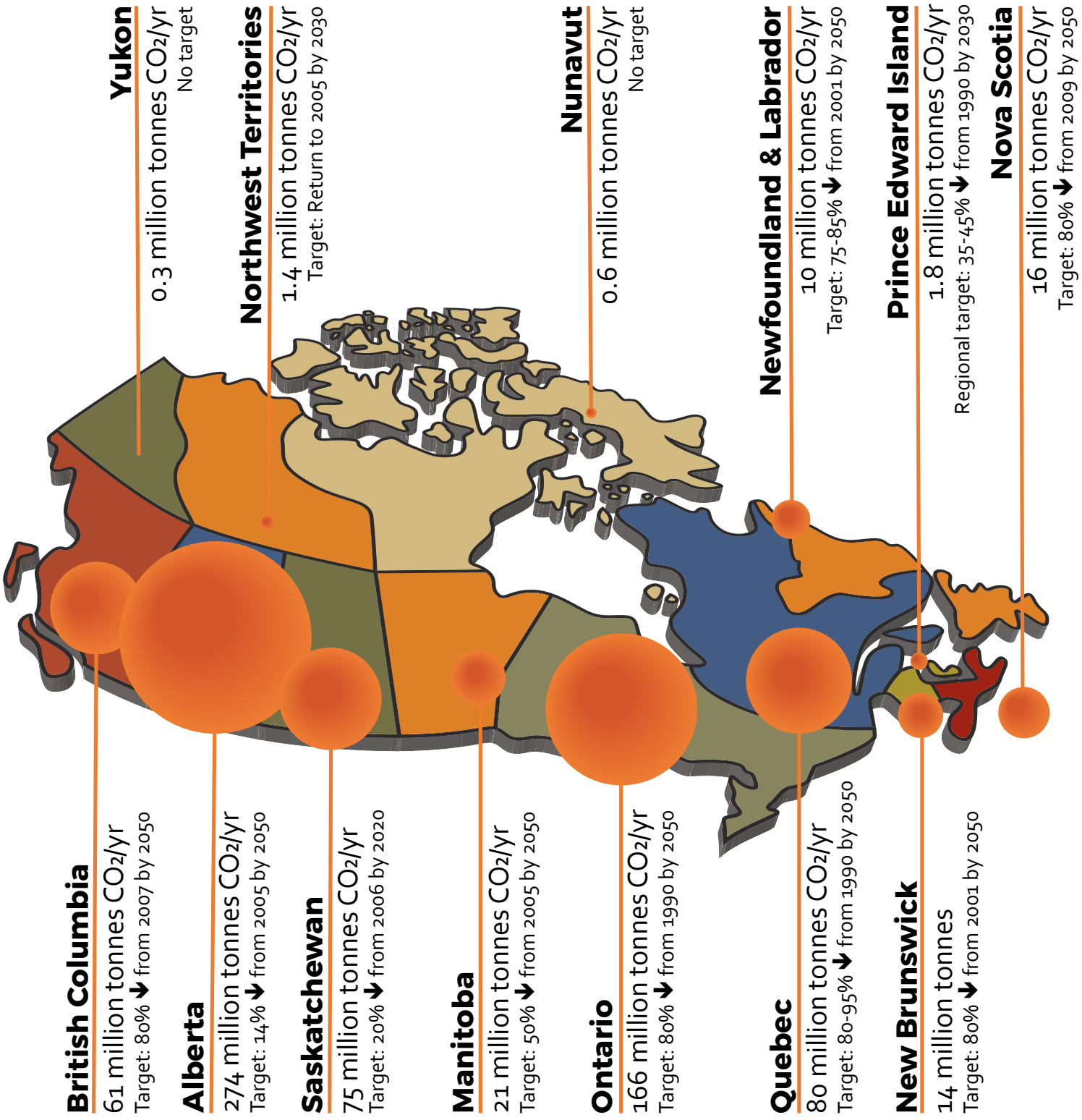
The Framework is built upon four main pillars: 1) putting a price on carbon; 2) taking complementary climate actions like phasing out coal-fired electricity or promoting carbon capture and storage; 3) adapting to the impacts of climate change; 4) taking actions to support innovation, clean technology and job creation.

The Framework also reiterates a previous goal of a 30% reduction in GHG emissions by 2030, as compared to 2005. Many provinces have their own long-term GHG emissions reduction targets, both informal and legislated, but no province is yet on track to meet its stated target. The territories and some of the provinces only have short-term targets.

Canada GHG emissions by sector (2015, millions of tonnes)

oil and gas production	transportation	buildings	electricity	heavy industries	agriculture	waste & other
189.5	173	85.6	78.7	74.6	72.8	47.6

GHG Emissions by Province and Territory (2015) and emissions reduction targets



PART 2
Energy trends in Canada and the world

The way that Canada and the world produce and use energy is changing.

While there are a wide range of changes taking place, broadly speaking these changes can be broken down into electrification, decarbonisation, energy efficiency and innovation.

Electrification is a global trend of moving toward electricity as a source of power for transportation, heating and industry.

Economics, concerns over air quality and GHG emissions reduction targets set by governments are starting to drive a shift away from fossil fuels toward low-carbon electricity. For the first time ever, in 2016 less money was spent on new oil and gas production than on new infrastructure for the production, transmission and distribution of electricity. The reasons for electrification are varied, ranging from consumer demand (in the case of electric vehicles) to increased automation, such as robotics (in manufacturing).

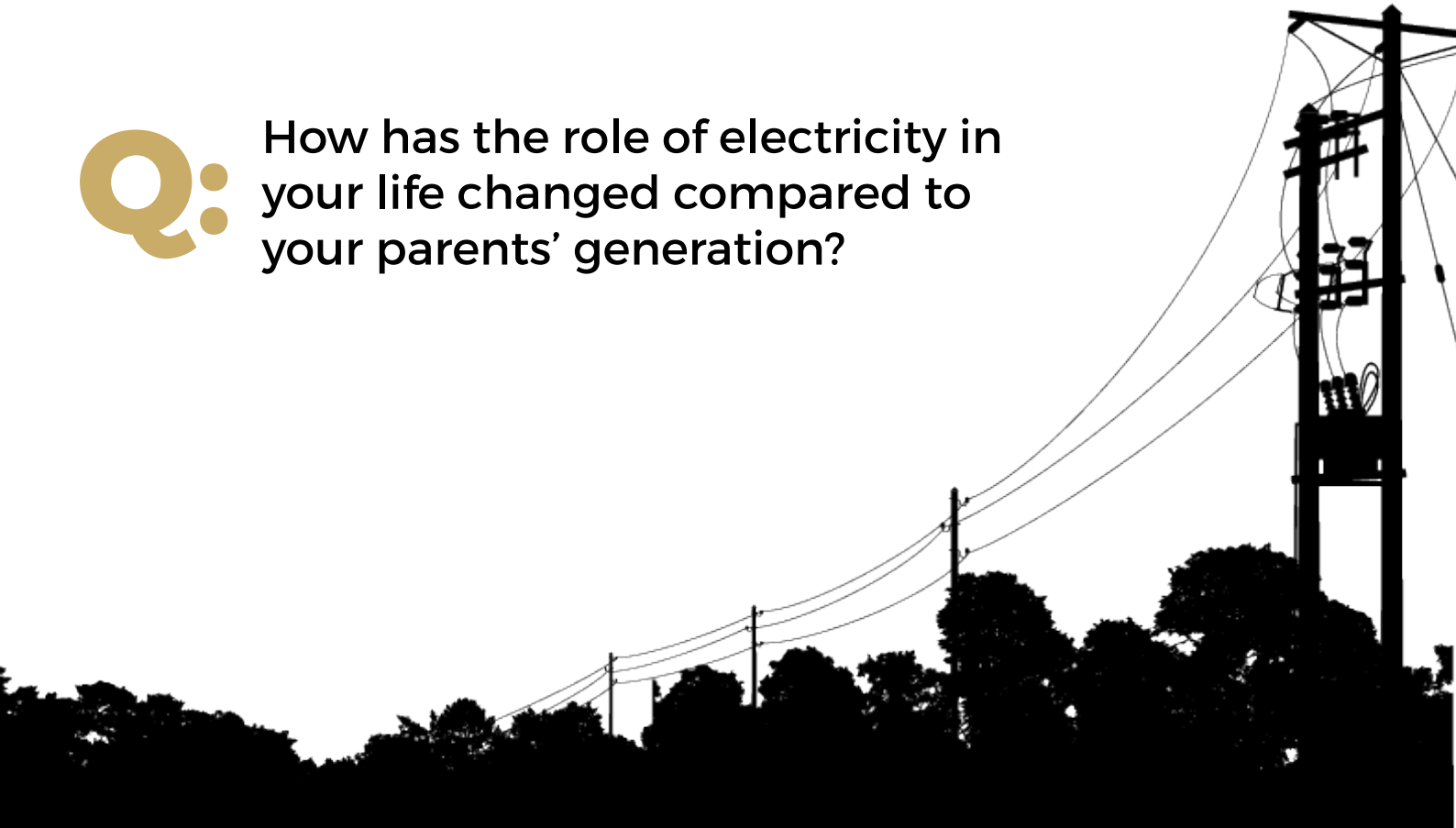
Electric passenger vehicles are already becoming more common, spurred in part by battery prices dropping 73% between 2008 and 2015. There are now over 2 million electric vehicles on the road across the globe, with Volvo and BMW announcing in 2017 that in a few years all new cars will feature electric or hybrid electric motors. While Canada still has relatively few electric vehicles, Quebec has set a target to have one million on the road by 2030.

Electrification of heating is also becoming more common, and is already the norm in Quebec. While electricity is still more expensive than natural gas for heating in many cases, it could become economical as buildings increase their thermal efficiency by collecting heat from the sun or improving insulation.

With increased electrification and the unpredictability of several renewable energy sources, options to store and share energy are increasingly important. For example, when the sun is shining but people aren't using their lights or televisions, electricity generated by solar power can be stored for later. Alternatively, more electricity connections across provincial boundaries might allow hydro-rich provinces to share flexible, low-carbon baseload electricity with other provinces that are rich in variable wind and solar generation.

When we hear energy storage, most of us probably think of batteries. Today, batteries for storing large amounts of energy are becoming increasingly affordable thanks to the growing popularity of electric vehicles. But there are other energy storage options available, like compressing air or pumping water into dams to create hydropower. Cost reductions are still necessary to make many of these technologies affordable on a large scale.

Q: How has the role of electricity in your life changed compared to your parents' generation?



Decarbonisation is the reduction, and eventual elimination, of CO_2 from the production and use of energy.

In combination with electrification, decarbonisation is a key part of many government plans for GHG emissions reductions, with a long-term goal of an electrified economy running on power sources that do not emit CO_2.

In the past, most low-carbon or renewable energy technologies have been considered too expensive to attract investors. However, the trend towards putting a price on carbon emissions has made renewables increasingly competitive with fossil fuel energy sources such as natural gas or coal. Once operational, renewables generate electricity without releasing any additional GHGs into the atmosphere. These include hydropower, wind, solar, biomass and some emerging technologies such as tidal and geothermal.

For now, hydropower supplies over half of the electricity in Canada and has been the country's main source of power for over 100 years. Wind power is also rapidly becoming cost effective. Although it makes up less than 5% of Canada's power generation, wind capacity doubled in Canada between 2011 and 2015. While solar power only makes up 0.5% of total generation in Canada, costs are falling rapidly: Canadian Solar reported a 69% drop in the price solar panels produced between 2011 and 2016. Solar is now one of the fastest growing sources of power in the country. Rooftop and utility scale solar generation is possible in many parts of the country but is particularly promising in the prairie provinces.

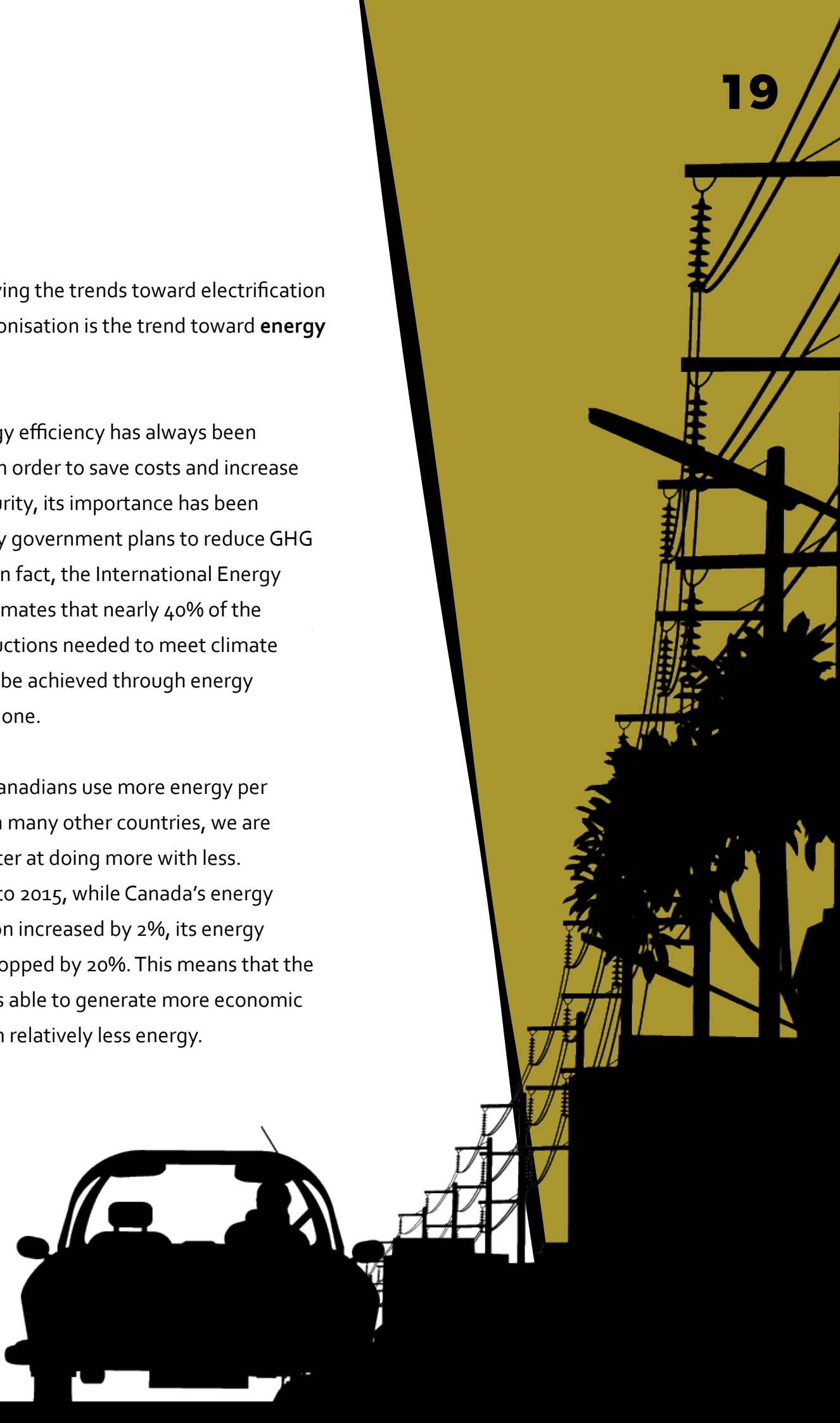
Low-carbon energy can also be created from wood or plant waste through combustion or conversion into biofuels, which may eventually replace fossil fuels for trucks, ships and airplanes. However, this technology is still in development and it could be many years before it is possible to fully decarbonize heavy transportation.

Think back to a time you bought an appliance or vehicle, or renovated your home. How much of a consideration was energy efficiency?

Accompanying the trends toward electrification and decarbonisation is the trend toward **energy efficiency**.

While energy efficiency has always been important in order to save costs and increase energy security, its importance has been amplified by government plans to reduce GHG emissions. In fact, the International Energy Agency estimates that nearly 40% of the energy reductions needed to meet climate targets can be achieved through energy efficiency alone.

Although Canadians use more energy per person than many other countries, we are getting better at doing more with less. From 2005 to 2015, while Canada's energy consumption increased by 2%, its energy intensity dropped by 20%. This means that the country was able to generate more economic growth with relatively less energy.



How Canada is increasing its energy efficiency depends on the sector. In homes and offices, stronger building codes are encouraging significant gains in efficiency. Retrofitting existing homes and offices is also critical because most buildings that will be present in 2050 have already been built. In the transport sector, while the future of cars and trucks may be electricity or biofuels, emissions standards are driving increased efficiency in today's gas-powered vehicles.

Urban design and zoning can have a major impact on the energy efficiency of homes and transportation. Green urban planning often includes higher levels of density to allow for more public transit and walkable communities. Proponents of such changes often point to better health outcomes due to the shift towards walking and cycling.

Innovation is driving improvements in Canada's energy sector.

Many innovations are emerging as a result of the digitalisation of the economy. One key innovation in the power sector is the smart grid, which is allowing for more efficient transmission of power and balancing of supply and demand. Another is the use of "big data", which is giving energy companies, regulators and governments greater insight into how, when, and why people use energy. Both of these innovations are resulting in greater energy efficiency for homes and businesses.

An important trend for Canada is the effort to increase energy and operational efficiency of the oil and gas industry. In Canada, an alliance of 13 oil-sands producers known as Canada's Oil Sands Innovation Alliance (COSIA)

Would you accept increased energy costs or more density in your community to reduce GHG emissions?

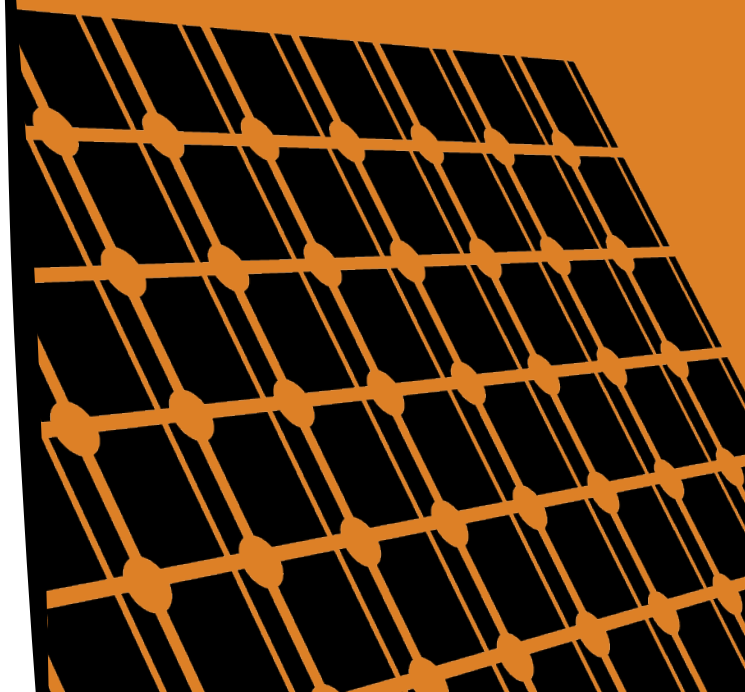
has shared 936 distinct technologies and innovations worth over $1.33 billion to reduce environmental impact, a unique effort for companies in a highly competitive industry. Between 2005 and 2013, total GHG emissions from the oil sands almost doubled to 62 million tonnes of CO_2, while between 2010 and 2015, technology improvements reduced the intensity of oil sands emissions by 16% per barrel. A new annual cap of 100 million tonnes per year on oil sands CO_2 emissions may eventually limit peak production levels. For example, the Fraser Institute estimates this could cost $10 billion per year due to lost revenues, the equivalent of $1000 per tonne of CO_2.

Another innovation in the energy sector is the increased use of hydraulic fracturing, or "fracking". This is the process of pumping millions of litres of water and chemicals into deep shale formations at high pressures. This fluid cracks the shale or expands existing cracks, giving natural gas a free path to flow upward to the well.

Secure, affordable and sustainable

Energy in all forms is vital to Canada's economy. It keeps our homes warm, powers our appliances and transports us across the vast distances that make up our country. It also powers our manufacturing sector, industrial processes, office buildings and institutions.

A challenge for Canada is how to maintain a secure supply of this critical resource while maintaining affordability and improving environmental sustainability. Finding the right balance will be a key part of defining Canada's energy future.



Fracking technology has dramatically altered the global energy landscape over the past 15 years. Advances in horizontal drilling have enabled the energy industry to tap into vast amounts of natural gas that were previously unreachable. After the United States, Canada has the second largest number of active drilling rigs making use of fracking, allowing for inexpensive energy for heating and increased energy security. Opponents of fracking argue that the injection of chemicals risks groundwater contamination and that fracking can result in venting large amounts of methane, a potent greenhouse gas. Most of the fracking activity in Canada takes place in Alberta, but there is significant activity or potential in British Columbia, Saskatchewan, Quebec and New Brunswick.

Another innovative technology attracting attention is carbon capture, utilization and storage, or CCUS. The most common type of CCUS captures CO_2 before it leaves the power plant or industrial facility. It is then either stored underground directly or re-used for a variety of industrial purposes ranging from soft drinks to enhanced oil recovery. The world's first ever coal-fired power plant with CCUS began operation in Saskatchewan in 2014. Similar technologies are also in early stages of development that might one day remove existing CO_2 from the atmosphere to make carbon-neutral products such as fuels or cement.

CCUS could also play a role in cutting emissions from industry while maintaining competitiveness. Iron, steel, cement, chemical and fertilizer industries all require high temperatures that currently require the use of fossil fuels. However, if the cost of addressing carbon emissions is too high, these industries might be priced out of the marketplace by other countries that do not act. This would not result in any emissions reductions but would instead transfer emissions and economic activity to other countries.

Q: How do you think the next generation's use of energy will be different than today?

How much will the low-carbon energy transition cost?

Predicting the cost of meeting Canada's 2050 GHG reduction targets is difficult, given the unpredictability of energy prices, technology breakthroughs, consumer behavior change and the policies of Canada's trading partners. The National Round Table on the Environment and the Economy estimates that reducing GHG emissions by 65% would cut between 3% and 5% from the economy in 2050. However, because the economy is expected to more than double in this time period, Canada would still produce more wealth than today.

A 2012 study by Navius Research estimates the costs for meeting Canada's climate commitments at $433 billion by 2050. A forthcoming 2017 study by the Conference Board of Canada puts this cost much higher at up to $3.4 trillion dollars, or more than $93,000 per Canadian spread out over thirty-three years. The study concludes that "although the cost of action may seem high, the cost of inaction could be much higher still."

These changes are not only taking place in Canada. All over the world, countries are changing the way they produce, transport and benefit from energy.

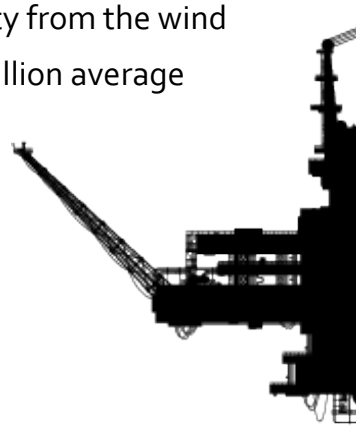
Despite relying on coal for over 50% of its electricity, **China** has become the undisputed leader of renewable energy growth. Over the next five years, more than a third of total global solar power and onshore wind capacity will be located in China. According to the International Energy Agency, China accounted for about half of all global wind additions in 2015, installing two wind turbines every hour.

The **United States** has significantly increased its energy security over the last decade thanks to shale oil and unconventional gas. The country has significantly reduced its GHG emissions in the process thanks largely to a switch from coal-fired power to natural gas as well as increasing amounts of renewable energy.

Current leadership is now seeking to revitalize the coal industry in order to create jobs and stimulate economic growth, while the solar industry created more new jobs in 2016 alone than the total number of coal miners still working in the US.

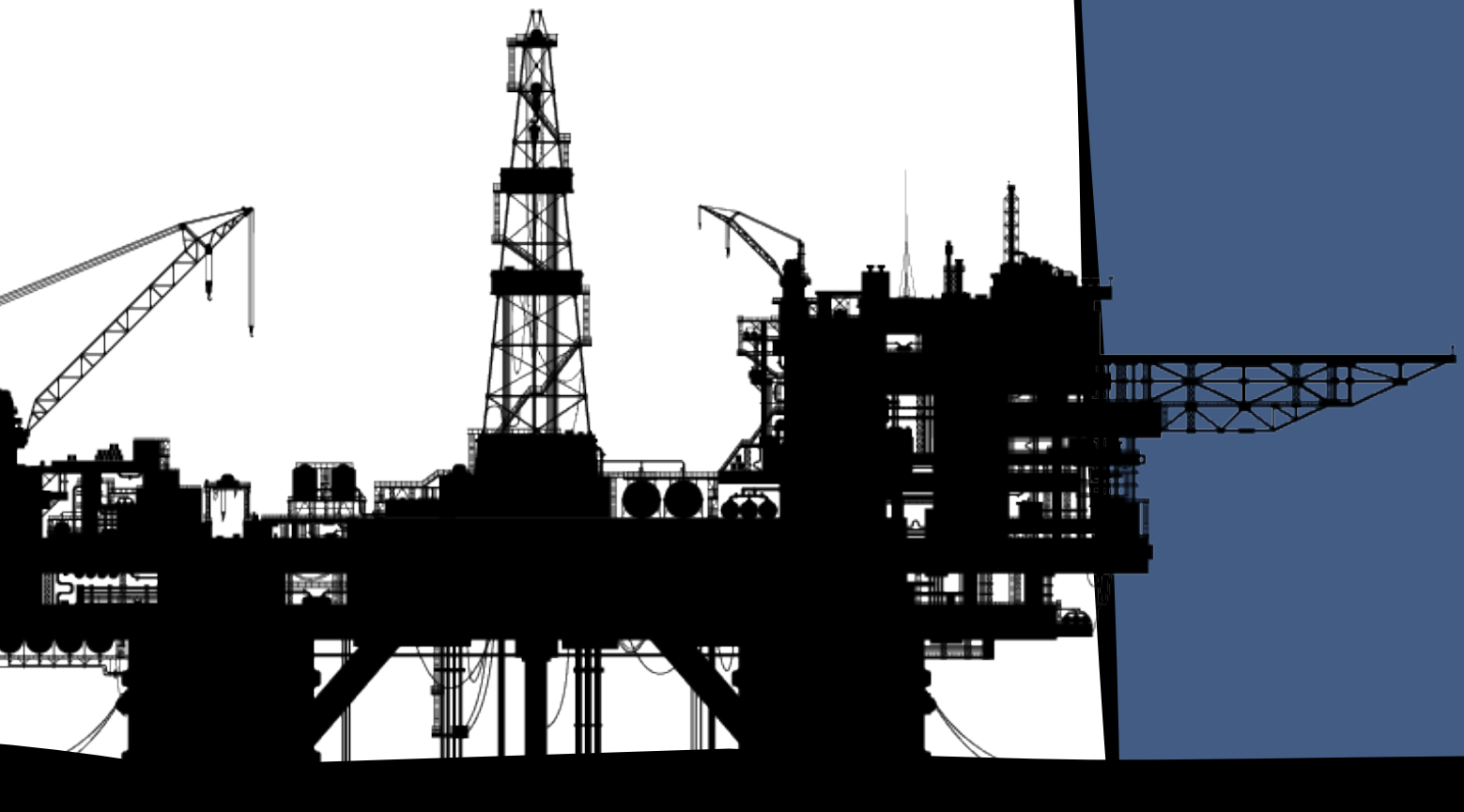
Australia is also heavily dependent on coal, accounting for about 70% of its electricity generation and substantial export revenue. At the same time, Australia is on track to overtake Qatar as the world's number one exporter of liquefied natural gas (LNG). These resources are providing both energy security and significant economic benefits to the country.

Denmark has been charting a course as a wind power pioneer for a number of years, despite being a major exporter of oil and gas. Over the course of 2016, wind power provided approximately 45% of Denmark's electricity, and on February 22, 2017 the country generated 97 gigawatt hours of electricity from the wind alone, enough to power 10 million average European households.



Other countries that have benefitted significantly from fossil fuels are now taking steps to ensure economic prosperity when demand begins to slow. For example, **Norway** deposits all of the state revenue gained from oil and gas into a prosperity fund. This enormous fund of over $1.1 trillion provides a buffer for the country against future economic shocks.

Meanwhile the **United Arab Emirates**, another country made rich by oil and gas revenue, is investing heavily in renewable power. The country has also established Masdar Institute of Science and Technology, a university that focuses heavily on alternative energy, and is the host country of the International Renewable Energy Association (IRENA).



PART 3
Charting the path forward

In the previous section, we discussed energy trends in Canada and around the world. Many of these focused on large-scale technological and policy changes instituted by governments and businesses. But energy affects all of us, from individual citizens and families to communities, governments and a whole range of other actors.

Depending on how energy affects each of us, we may have different opinions on how the country's energy systems should be managed. Likewise, we also have different roles in making decisions about Canada's energy future.

For **citizens**, there are a wide range of considerations when making choices about our energy future. Recent research suggests that while economic considerations (How much will this cost? Who is going to pay?) are important, the most important factor in whether or not citizens accept an energy project is their values. These can include caring about the environment or a local community, a belief in individual freedom of choice and responsibility, or a deep commitment to consultation and collaboration.

Rural communities may be concerned about how government policies affect the resource extraction industries that power their economies, or the price of the fuels for transportation or heating they rely on. At the same time, these communities may also want to take advantage of economic opportunities to generate and sell renewable energy.

Indigenous governments and communities have become increasingly involved in the decision-making process regarding their energy futures. Court cases have affirmed the duty of the Crown to meaningfully consult with and accommodate First Nations.

Some Indigenous communities have partnered with industry to create opportunities for energy-related jobs, training and revenues. Others have taken positions against energy infrastructure projects to protect traditional livelihoods and the natural environment.

Some remote Indigenous communities, including Northern communities, have initiated renewable energy projects to move away from diesel-powered electricity.

Cities argue that they are critical voices in the energy discussion given that they are home to 80% of Canada's population. They also have multiple tools for encouraging energy transitions, including zoning, transportation and transit planning, procurement, and waste management.

Utilities — the entities that provide energy to consumers — have an active role in Canada's energy future, using data services to determine how to most efficiently provide reliable and affordable power. Meanwhile **energy producers** are making investment decisions that can have significant long-term impacts on Canada's energy system, driven in part by government policies.

Q: What values are you most proud of as a Canadian? In what ways should these values guide our shared energy future?

The **provinces** have the greatest share of authority when it comes to the development and distribution of energy resources. For example, decisions made on natural resource royalties, the pace and scale of development and electricity system planning can all deeply impact the direction of Canada's energy future.

For the provinces, a major concern will always be how they can get the most value for their domestic energy resources – including not only fossil fuels but also electricity generated from low-carbon sources.

The **federal government** must seek to find common ground among all of these voices while at the same time showing leadership to achieve pan-Canadian goals.

It also has the responsibility of maintaining or promoting Canada's reputation globally, whether that is as a major energy producer, an attractive location for foreign investment, or a leader in the low-carbon energy transition.

PART 4
Approaches for Canada's energy future

Given the wide range of voices described in the previous section, it is no surprise that there is a wide range of opinions and priorities when it comes to the future of Canada's energy system.

In this section, we will define seven approaches to Canada's energy future.

Although presented separately, many of these approaches could be adapted or combined based on the needs and preferences of Canadians.

These approaches are based on research into positions held by stakeholders and citizens and reflect as broad a range of perspectives as possible. These approaches do not necessarily reflect the perspectives of the SFU Centre for Dialogue, nor do they necessarily reflect government positions. You will likely find ideas you agree with and ideas you disagree with in these approaches or the way they are presented here. The point is to try on a range of perspectives, informed by the potential positive and negative consequences of each approach.

Approach 1: Let the market decide

This approach emphasizes the power of the market in changing behaviours and shaping the economy. By putting a price on something, such as carbon emissions, we can leave it up to market forces to find the most economical and efficient path towards GHG reductions.

Under current federal government plans, a minimum carbon price of $50 per tonne of CO_2 would be in place by 2022. The Government of Canada estimates that this will add about 11 cents to a litre of gasoline. However, using a carbon price alone to drive our 2050 emissions reductions targets would cost between $200 and $300/tonne of carbon by 2050. This could add between 50 and 70 cents to a litre of gasoline. However major delays in taking action on emissions reductions could raise the necessary carbon price to as much as $750/tonne according to some estimates.

Eighty per cent of Canada's population already lives with some form of carbon pricing. British Columbia returns all revenue from its carbon tax to individuals and businesses through tax deductions and tax credits. Ontario is capping its total allowed carbon emissions and allowing large emitters to buy and sell the right to release CO_2, while Quebec is using revenues from a similar system to reinvest in its transition to a low-carbon economy.

Cutting subsidies – money paid by the government to assist or encourage an industry – could also reduce emissions and at the same time remove distortions to the market. The International Institute for Sustainable Development estimates that over $3 billion is paid each year to oil and gas producers in Canada in the form of reduced property taxes, other tax deductions and direct cash transfers.

Pathways under this approach:

- Institute a carbon price that grows progressively larger in order to discourage emissions.
- Remove subsidies on fossil fuels to ensure a level playing field for all industries and technologies.

PROS & CONS

- Economists tend to identify carbon pricing as the most cost-effective way to spur innovation and increase efficiency.
- Carbon pricing is widely supported by businesses who prefer the flexibility of a carbon price over regulations on specific sectors or methods that may not adapt with changing markets and technologies.
- Revenue from carbon pricing can be used to lower income and business taxes or fund the transition to a low-carbon economy.
- Removing oil and gas subsidies makes it easier for low-carbon technologies to compete with fossil fuels.

- Some argue that carbon pricing is not as politically viable as other low-carbon solutions, such as fuel standards for passenger vehicles or other regulations.
- Carbon pricing can affect low-income individuals and families disproportionately, as fuel costs often make up a larger share of their expenses and they benefit less from other tax breaks.
- If other economies in the region and around the world do not institute a similar carbon price, then some parts of the Canadian economy such as mining or manufacturing could face an economic disadvantage.
- Oil and gas subsidies are small compared to the more than $20 billion in taxes and royalties that the provinces and federal government receive from the energy sector each year.

Q: How should Canadians weigh the economic efficiency of carbon pricing against potentially unequal impacts on different industries, regions and families?

Approach 2: Regulate and invest

This approach emphasizes the role of federal and provincial government regulations and infrastructure projects in shaping many important aspects of Canadians' day-to-day lives: from the safety features on cars to standards for new bridges and roads, to the energy efficiency of new buildings. Encouraging the government to set emissions targets and make targeted investments is one option to help meet our energy goals for climate and the economy.

There are a number of regulations that governments can use to reduce emissions or encourage an energy transition. For example, an emissions cap is a hard limit on emissions set by the government, such as Alberta's plan to cap emissions from the oil sands at 100 million tonnes of GHGs per year from current levels of 71 million tonnes.

There are many other policies that Canada's municipal, provincial, territorial and federal governments can employ to encourage the energy transition. These can include intensity-based emissions standards for vehicles, power plants or buildings or pollution controls that regulate specific greenhouse gases (e.g. methane). They could also take the shape of bans that completely prevent industry or other governments from using a certain technology, such as existing plans to end most coal-fired power generation.

Governments also have the ability to fund national infrastructure projects, such as an east-west electricity grid that would allow provinces that benefit from more predictable forms of renewable electricity to partner with provinces that have potential for more intermittent forms of renewable energy.

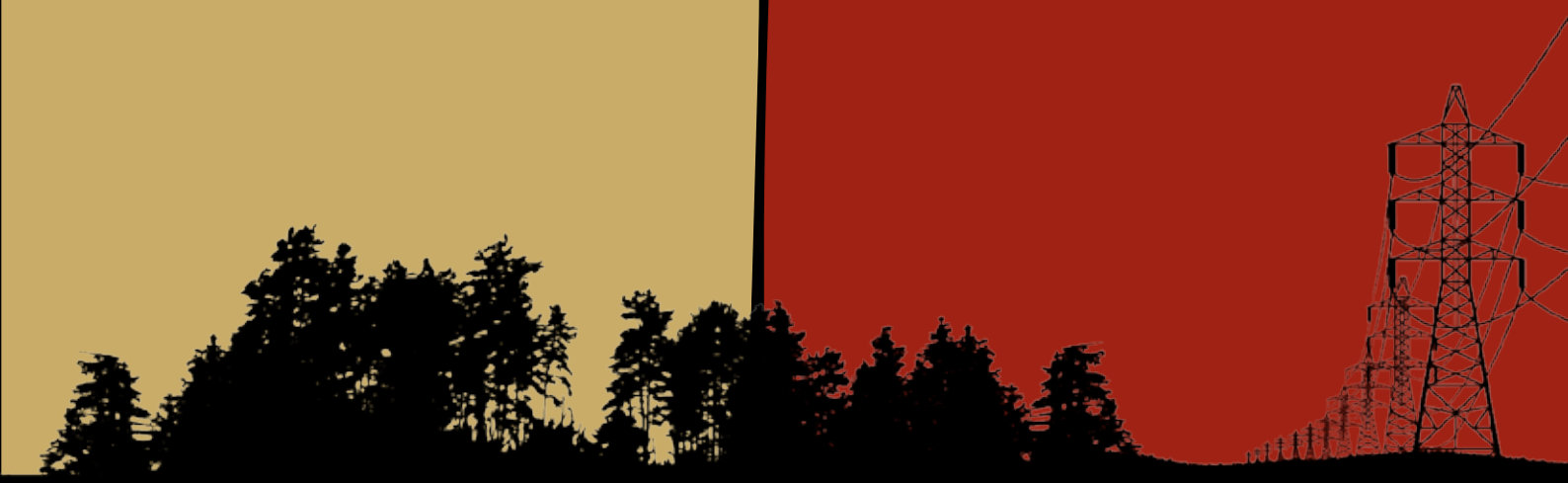
Pathways under this approach:

- Fund strategic national infrastructure projects such as building out the east-west electric grid and electric vehicle charging stations.
- Mandate hard emissions caps on the energy sector and other industrial sectors.
- Set progressively stronger emissions intensity standards for the energy sector and other industrial sectors (e.g. emissions per barrel of oil produced)
- Set progressively stronger energy efficiency standards for vehicles, appliances and buildi

PROS & CONS

- Regulations and investments allow governments to consider linkages between issues such as GHGs, clean air and water and human health.
- Governments have increased ability to determine how the costs and benefits of the low-carbon economy will be shared.
- Political negotiation ensures that all perspectives can be heard and that specific regions and industries can be protected from regulations, if warranted.

- Regulations reduce economic freedom and impose costs that will ultimately be passed on to consumers.
- Government regulations and investment can fail to keep up with changing technologies and markets, or be influenced by short-term political considerations.
- National infrastructure projects are expensive and require agreement between federal, provincial and indigenous governments.



Q: How do you find a balance between governments initiating change and individuals having the right to make their own energy choices?

Approach 3: Innovate with technology solutions

Many countries in Europe, as well as large emerging economies like China, are becoming leaders in the low-carbon energy transition, including renewable power, carbon capture, storage and utilization, electric vehicles and energy efficiency. This approach emphasizes the idea that Canada can compete with these countries and other economies as they move into a low-carbon future by investing in research and innovation. One means of doing so is through directing subsidies or financing toward innovative, promising low-carbon technologies.

Technical innovation refers to the development and adaptation of solutions that haven't yet been invented, or are not yet practical. Technology innovations can range from high-density batteries for electric vehicles to gasification and carbon capture for coal-fired power plants.

Yet low-carbon innovation isn't just technical innovation. It also involves coming up with new business practices, social approaches and financing mechanisms. One means of encouraging low-carbon transition is the "green bond." A green bond is a way for companies, governments or institutions to raise money to invest in climate-related or environmental projects. For example, Export Development Canada issued a $377 million green bond in 2014 to support loans for projects that mitigate climate change.

Pathways under this approach:

- Invest in research and development of low-carbon technologies and provide incentives for innovation and low-carbon energy start-ups.
- Subsidize and support the early adoption of low-carbon technologies, for example, through electric vehicle rebates and green bonds.
- Invest in carbon capture, utilization and storage and other technologies that allow the use of fossil fuels to continue with far fewer emissions than we see today.
- Finance research into potential new technologies that remove existing CO_2 from the atmosphere to make products such as carbon neutral cement.

PROS & CONS

- Investing in innovation could put Canada on a low-carbon pathway and help Canada remain competitive in a changing global economy.
- Putting more money into research and development can attract the world's top talent to Canadian businesses and universities and prevent companies from leaving Canada.
- Investing in carbon capture, utilization and storage might allow Canada to continue to benefit from a wealth of natural resources while also reducing emissions.

- Successful innovation isn't guaranteed, and precious time and money could be wasted if governments bet on specific technologies that don't end up reducing emissions.
- Carbon capture and storage can be expensive and could price certain Canadian goods out of the market.
- Certain innovations may require individuals to change their habits and preferences, which can be challenging for some.

Q: How much should Canadians rely on yet-to-be-proven energy technologies to create jobs and reduce GHG emissions?

Approach 4: Go local, go green

This approach emphasizes the role of individuals and communities in choosing how to invest in their futures, as well as the potential for a low-carbon energy transition to begin with action at the local level. Policies can focus on local solutions such as local power generation, public transit, walkable communities and shared energy systems. Dialogue with all stakeholders, including Indigenous peoples, rural communities and marginalized communities is vital to ensuring a sustainable and equitable energy future.

Rooftop solar panels and small-scale hydro power generation can be controlled and implemented at a local level so that communities gain increased self-sufficiency. There are almost 300 remote communities in Canada that are not connected to the main electricity system. Over half of these communities generate electricity and heat their home with diesel, which is both expensive and detrimental to the health of people and the environment. For these communities, renewable energy could provide long-term energy security.

Pathways under this approach:

- Create a jobs program with a focus on equity and retraining for the low-carbon economy.
- Support local power production for Indigenous peoples and rural communities to promote energy sovereignty and create economic opportunities.
- Invest in livable cities through expanded public transit, shared energy systems and people-centered urban planning.
- Provide financing to retrofit existing homes and buildings for energy efficiency.

PROS & CONS

- Walkable communities and green urban planning can also lead to positive health and social outcomes.
- Rural economic development opportunities exist in the shift towards low-carbon energy.
- Partnerships with local communities and Indigenous peoples could open up new relationships to address a range of social, political and economic issues.

- Replacing diesel power in remote communities could be expensive without a large consumer base to share the costs.
- Government spending may favour urban over rural areas because the GHG reductions are greater.
- Proposals to increase density or install local power production can result in opposition from residents who fear changes to existing lifestyles and communities.

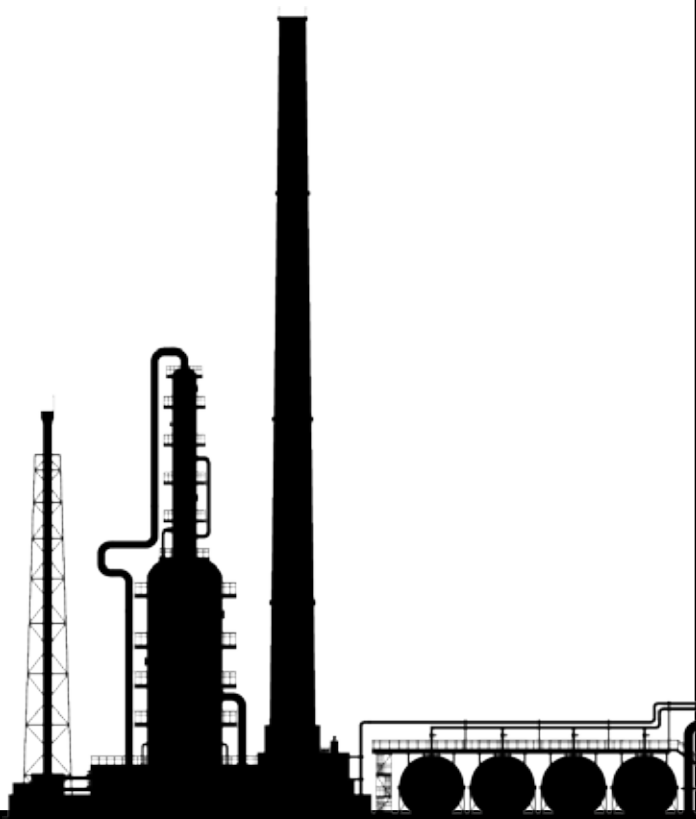
Q: What is a fair way of sharing the opportunities for low carbon growth and investment among different regions?

Approach 5: Wait and see

This approach emphasizes that Canada's economy is relatively strong, and that natural resource development has been a key part of economic growth. Low energy costs have afforded Canadians a high quality of life. Making major structural changes to the economy through carbon pricing and regulations may have unintended and economically damaging consequences.

For example, the energy industry generates significant revenue for government programs. In 2014, the government received more than $20 billion in taxes, royalties and land sales from the energy sector. Keeping Canada's fossil fuel subsidies will ensure that this source of revenue for the provinces and federal government remains in place.

As the United States slows or repeals efforts on climate change and renewable energy, Canada could find itself at a competitive disadvantage if it takes strong action to reduce emissions. Virtually all of Canada's oil and natural gas exports go to the United States, generating $96 billion per year. If a carbon price or increased regulation on industry made Canada's energy products less affordable, this could have damaging impacts on this important trading relationship.



Pathways under this approach:

- Maintain fossil fuel subsidies to keep Canada's oil and gas industry competitive.
- Monitor compliance toward domestic and international climate obligations but don't lock in costly choices until our close trading partners do the same.

PROS & CONS

- Low-carbon infrastructure can be expensive. New Brunswick, for example, expects significant increases in the price of electricity due to the phasing out of coal power.
- Maintaining policy equivalence with the United States will keep Canada competitive with our largest trading partner.

- Without taking action, the amount of carbon the world can emit without triggering run-away climate change will be quickly used up, resulting in catastrophic effects for the economy, society and the environment.
- Avoiding compliance with climate obligations will damage Canada's international reputation and weaken its voice on other matters, such as trade.

Q: How should Canadians balance growing the economy with protecting the climate? Are these goals in conflict?

Approach 6: Maximize energy exports

This approach emphasizes the fact that Canada has the third largest oil reserves in the world, after Saudi Arabia and Venezuela. It is also currently the world's fourth-largest producer of natural gas. By building additional energy transportation infrastructure, such as oil or gas pipelines or facilities to ship liquid natural gas (LNG), Canada can more quickly and easily get its valuable resources to those markets overseas that are likely to be dependent on fossil fuels for decades to come.

The energy sector is responsible for about 30% of Canada's exports, and almost all crude oil and natural gas exports go directly to the United States. In recent years, the United States has experienced a rapid growth of its own oil and gas industry due to innovative new technologies and extraction methods. This has increased energy security for the United States but decreased its reliance on imports from Canada. Meanwhile, in emerging economies like China and India, demand is expected to rise for many years.

Moving Canada's energy resources to overseas markets could require additional oil and gas pipelines, or infrastructure to ship liquid natural gas (LNG) to overseas markets.
Outside of fossil fuels, Canada is also well-placed to support the global demand for nuclear power as our country remains the world's second-largest supplier of uranium.

Pathways under this approach:

- Maximize the development of oil and gas reserves.
- Maximize the export of uranium and Canadian nuclear technology.
- Diversify oil and gas export markets beyond the United States to Asia and beyond by building new infrastructure such as pipelines.
- Use revenues from oil and gas to invest in a prosperity fund for future generations or to pay for the transition to a low-carbon economy.

PROS & CONS

- Energy projections predict that demand will likely continue to rise for many decades to come, so Canada can take advantage of this opportunity.
- Diverse export markets could help fund the transition to a low-carbon economy, and nuclear power provides the world with a low-carbon energy option.
- Providing more oil to world markets will provide an alternative for countries who don't want to buy oil from countries that severely limit human rights and personal liberties.

- Increasing oil and gas exploration and production will increase GHG emissions and will likely prevent Canada from meeting its international climate obligations.
- Increasing nuclear power generation raises health and safety concerns due to the risk of nuclear accidents and the challenge of finding long-term storage for nuclear waste.
- If demand for Canada's fossil fuel resources diminishes, Canada could be in economic trouble if it has failed to transition to a low carbon economy.

Q: How could energy exports help or hinder Canada as it works to meet its economic, social and environmental priorities?

Approach 7: Cut emissions now

This approach emphasizes that climate change is an urgent challenge that, left unchecked, will have major economic, health and societal impacts for generations to come. Given Canada's significant contribution to global GHG emissions, action taken by our country to quickly reduce emissions would not only improve air quality in our country but also make a real difference for meeting global climate goals.

In addition, given the importance of Canada to global energy markets, strong decisions taken today that prevent further growth of Canada's oil and gas industry could increase the prices of fossil fuels at home and abroad. This could accelerate the low-carbon energy transition worldwide.

Quick and decisive action would also position Canada as a global leader on climate change, gaining not only political capital but also encouraging international investments into a growing low-carbon economy.

Pathways under this approach:

- Mandate rapid and legally binding caps on Canada's GHG emissions.
- Ban new investments in the extraction and movement of fossil fuels.
- Phase out industries with the highest GHG emissions.

PROS & CONS

- By taking action quickly, Canada is more likely to meet its global climate commitments.
- The generation of wealth should not come at the expense of a clean and healthy environment or the security of hundreds of millions of vulnerable people worldwide.
- Transitioning away from oil makes us less vulnerable to declining prices, especially in the event that developing countries adopt electric vehicles quickly and no longer need gasoline.

- Phasing out Canada's oil and gas industry could lead to dramatic levels of unemployment and revenue shortages, especially in Alberta, Saskatchewan and Newfoundland and Labrador.
- Commercially ready alternatives to fossil fuels are not yet available for many critical parts of the economy, such as air travel, synthetic materials, petrochemicals and some medicines.
- Dramatic action is unfair to companies and pension funds that have made long-term investments in good faith based on current government policy.

Q: Who has the right to emit GHGs and why? Who should pay the cost of reducing GHG emissions?

What do you think?

Over the course of this discussion guide, you have been presented with some key questions. You have learned about Canada's energy system today, broad trends facing the energy system, the role of different stakeholders, and some of the potential pathways forward. What are your thoughts or opinions?

These sample questions are intended to get you thinking about your own values and perspectives, as well as those of others, and to imagine what the future might hold for Canada's energy system.

- What roles does energy play in your life and the lives of others?
- What are the energy needs of today's generation? How might these be the same or different from future generations?
- How should Canadians balance the needs of different communities, regions and industries?
- What values should guide us as we build Canada's energy future?
- How important is it that Canada is viewed as a leader on climate change on the international stage?
- How would climate change impact your community if Canada fails to act?
- How should issues such as energy prices, jobs and international competitiveness impact our energy decisions?
- Are you willing to pay more for energy or change your lifestyle to meet Canada's energy goals?
- Can you think of any additional approaches towards Canada's energy future?

Now it's your turn to both listen to others and make your voice heard as you and your fellow Canadians help to shape Canada's energy future.

References and Further Reading

- Analytica Advisors, "2017 Canadian Clean Technology Industry Report: Synopsis", Analytica Advisors Inc. (2017)
- Bagnoli, Philip, "Canada's Greenhouse Gas Emissions: Developments, Prospects and Reductions", Office of the Parliamentary Budget Officer (April 2016)
- Boyle, Jessica et al, "Climate Change Adaptation and Canadian Infrastructure", International Institute for Sustainable Development (November 2013)
- Canada's Ecofiscal Commission, "The Way Forward: A Practical Approach to Reducing Canada's Greenhouse Gas Emissions", Canada's Ecofiscal Commission (2015)
- Canadian Association of Petroleum Producers, "Crude Oil: Forecast, Markets and Transportation", CAPP (June 2016)
- Canadian Association of Petroleum Producers, "Global Leaders on Climate", CAPP (January 2017)
- Canadian Solar, "Investor Presentation Q4 2016 Update", Canadian Solar (2016)
- Clean Energy Canada, "The Transition Takes Hold", Clean Energy Canada (2017)
- Cleland, Michael and Gattinger, Monica, "System Under Stress: Energy Decision-Making in Canada and the Need for Informed Reform", University of Ottawa (March 2017)
- Cleland, Michael et al, "A Matter of Trust: The Role of Communities in Energy Decision-Making", University of Ottawa and the Canada West Foundation (November 2016)
- Quebec Commission on Energy Issues, "Mastering our Energy Future: For the economic, environmental and social benefit of all" (2014)
- Environment and Climate Change Canada, "Canadian Environmental Sustainability Indicators: Greenhouse Gas Emissions", Government of Canada (2017)
- Environment and Climate Change Canada, "National Inventory Report 1990-2015: Greenhouse Gas Sources and Sinks in Canada - Executive Summary", Government of Canada (2017)
- Environment and Climate Change Canada, "Climate Data and Scenarios for Canada: Synthesis of Recent Observation and Modelling Results", Government of Canada (2017)
- Environmental Defense Canada et al, "The Elephant in the Room: Canada's Fossil Fuel Subsidies Undermine Carbon Pricing Efforts", Environmental Defense Canada (November 2016)
- Government of Quebec, "Energy Policy 2030: Energy in Quebec, a source of growth" (2016)
- Government of Canada, "Pan-Canadian Framework on Clean Growth and Climate Change", Government of Canada (2016)
- Government of Canada, "Canada's Mid-Century Long-Term Low-Greenhouse Gas Development Strategy", Government of Canada (2016)
- Haffner, John and Vriesendorp, Willem, "Vision 2050: The Future of Canada's Electricity System", Canadian Electricity Association (2014)
- International Energy Agency, "Energy Policies of IEA Countries: Canada 2015", International Energy Agency (2016)
- McWhinney, Rob, "Process Efficiencies of Unconventional Oil and Gas", Canadian Energy Research Institute (June 2015)
- Melton, Noel et al, "Investment and Lock-in Analysis for Canada: Low Carbon Scenarios to 2050", Navius Research Inc. (2012)
- National Energy Board, "Canada's Adoption of Renewable Power Sources: Energy Market Analysis", National Energy Board (May 2017)
- Natural Resources Canada, "Energy Fact Book: 2016 – 2017", Government of Canada (2017)
- Natural Resources Canada, "Generation Energy: Moving Canada Forward – Setting the Context", Government of Canada (2017)
- Petro LMI and EnForm, "Canada's Oil and Gas Industry: Labour Market Outlook 2017 to 2021", Government of Canada (March 2017)
- Policy Horizons Canada, "Canada in a Changing Global Energy Landscape", Government of Canada (2016)
- Potvin, Catherine et al, "Re-Energizing Canada: Pathways to a Low-Carbon Future", Sustainable Canada Dialogues (2017)
- Royal Dutch Shell, "A Better Life with a Healthy Planet: Pathways to Net-Zero Emissions", Royal Dutch Shell (May 2016)
- Smith, Robert and McDougal, Kieran, "Cost of Pollution in Canada", International Institute for Sustainable Development (2017)
- US National Intelligence Council, "Implications for US National Security of Anticipated Climate Change", US National Intelligence Council (September 2016)
- Warren, F.J. and Lemmen, D.S., editors, "Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation", Government of Canada (2014)