



Natural Resources
Canada

Ressources naturelles
Canada

GENERATION ENERGY

Moving Canada Forward

Setting the Context



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Message from the Minister



“Generation Energy is about inviting Canadians to share their ideas on how Canada will forge its energy future.”

— The Honourable Jim Carr, Minister of Natural Resources

As we celebrate the 150th anniversary of Confederation, Canadians can be very proud of what we have achieved as a nation with regard to energy. Our government has moved to make sure Canada is a global leader in the transition to cleaner energy and the lower-carbon economy.

Canadians can also be optimistic about the future we have before us. Canada, along with the rest of the world, is in the midst of a historic global transition to a low-carbon energy future. We have signed the Paris agreement on climate change, and we were a founding member of Mission Innovation, the global partnership to double national investments in clean energy and technological solutions. We are playing our part in leading the way as clean, non-emitting forms of energy and new technologies such as smarter homes and electric vehicles are reshaping how we produce and use energy every day.

We want our energy future to be shaped by the core values of Canadians. Among many other things, Canadians expect that energy will be developed safely and sustainably, that it will remain affordable and accessible; that Indigenous peoples’ rights will be respected in energy decision making; and that energy industries will continue to be a source of jobs and growth across the country.

There is a lot of work to do to get there, and we want Canadians to play a role in defining the path ahead. That is why I have launched **Generation Energy** – an open and inclusive dialogue to envision what we want our energy future to look like over the course of a generation.

We have a strong foundation to build on. Canada has an ambitious plan in place through the Pan-Canadian Framework on Clean Growth and Climate Change, and provincial and territorial governments are making progress to advance the Canadian Energy Strategy with federal involvement in key areas of work.

I am excited about this opportunity and invite Canadians to continue to engage us with your ideas. This will not be the end of the conversation – our goal is to create an ongoing and open dialogue with Canadians about energy as we move together into the future.

Sincerely,

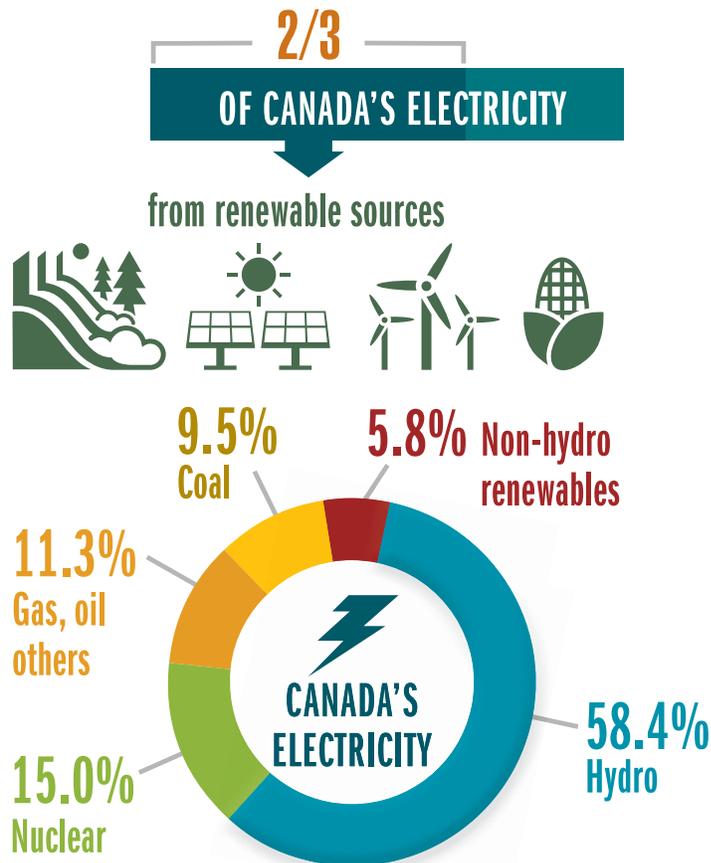
Jim Carr
Canada’s Minister of Natural Resources

Energy in Canada

From an energy perspective, Canada is very fortunate. We have a large land mass, a small population, and one of the largest and most diverse supplies of energy in the world. We are a global leader in hydroelectric power. We have the third-largest global supply of proven oil reserves and fourth-largest supply of uranium.

We also know that energy has a significant role in our efforts to address climate change. Presently, energy production and use in Canada account for 81 percent of our total greenhouse gas emissions. Reducing these emissions is fundamental to reaching Canada’s goal of a low-carbon energy future, and innovation and clean technologies are already putting Canada on a path to greater resource efficiency and reduced environmental impacts that will help get us there. Whether it is hydro power in British Columbia, Manitoba and Quebec; oil and gas in the Prairies; offshore energy in Atlantic Canada; or renewable energy – such as wind, solar, marine, geothermal – across the entire country, our energy resources are a source of strength that continues to shape our economy and society.

Global leader in renewable electricity



Data sources: Statistics Canada and Natural Resources Canada

How we produce and use energy in Canada is constantly changing. For example, over the past several decades, our electricity mix has evolved as lower- or non-emitting forms of energy such as natural gas, wind and solar have replaced more traditional forms of fossil fuel generation such as coal. In fact, wind and solar photovoltaic energy are the fastest growing sources of electricity generation in Canada.ⁱ

How crude oil and natural gas are produced has also undergone a dramatic shift, as technological advancements have led to the rapid development of shale and tight oil and gas formations that had previously been inaccessible.

Ongoing developments in areas such as grid-scale electricity storage, renewable electricity generating technologies, carbon capture and storage, and electric and alternative fuel vehicles have the potential to further transform the energy system.

While we tend to think of our energy system as existing within the confines of our national borders, in reality it is part of a broader continental energy system. In fact, Canada, the United States (U.S.) and Mexico have become the largest integrated energy system and market the world has ever seen. With over 30 major transborder electricity connections and 70+ pipelines, energy flows back and forth across the Canada-U.S. border in a seamless and efficient manner. The U.S. and Mexico share a similar, albeit more limited, trading relationship. This interconnected energy system has become a source of reliable, secure, low-cost energy for all three countries.

Energy and the economy

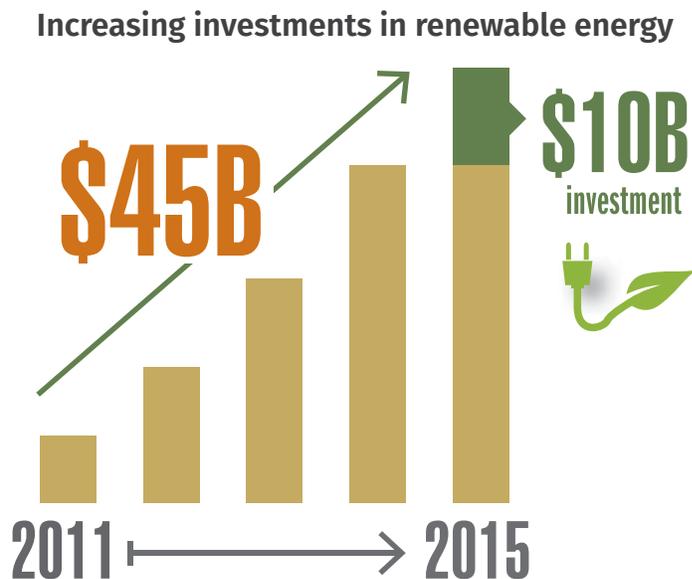
Canada's energy industries form a vital part of our economy, creating a significant number of jobs and economic opportunities in regions across the country. Canada's energy sector accounts for over 7 percent of our GDPⁱⁱ and directly employs more than 280,000 Canadians.ⁱⁱⁱ Hundreds of thousands more Canadians are indirectly employed in supporting industries^{iv} such as financial services, engineering services, construction and equipment manufacturing. In addition, energy resource development contributes an average of \$22 billion per year to federal, provincial and territorial governments in the form of taxes and royalties.^v

Canada is among the world's top producers and exporters of energy:

- 2nd largest hydro producer
- 2nd largest uranium producer
- 4th largest oil producer
- 5th largest natural gas producer
- 7th largest installed wind capacity

The energy sector represents the largest single private investor of capital in Canada and is a primary driver behind Canada's foreign direct investment. In 2015, capital expenditures in the energy sector amounted to \$90 billion.^{vi}

In recent years, a significant and growing portion of these investments is being made in the development and adoption of clean energy technologies. Investment in new renewable energy from 2011–2015 across Canada was over \$45 billion. On a global scale, investment in renewable power capacity totalled \$266 billion in 2015 alone – more than double what was spent on new fossil fuel power.^{vii}



Data source: Clean Energy Canada, *A Pivotal Time for Clean Energy – Tracking the Energy Revolution, Canada 2016* and data compiled by NRCan

In fact, the transition toward cleaner energy and increasing global demand for clean energy technologies, products and services are also creating significant economic opportunities for Canadian businesses and industries. The global clean technology market is expected to exceed \$2 trillion by 2020. Canada's clean technology sector is growing quickly, and several Canadian companies are poised to be leaders. In 2015, the clean technology sector in Canada employed over 55,000 people and reached \$6.7 billion in export revenues.^{viii}

Energy exports provide another important contribution to Canada's economy. In 2016, total U.S.-Canada bilateral trade in energy was valued at \$98 billion.^{ix} The overwhelming majority of this trade was with the U.S., which is the destination for 99 percent of Canadian crude oil exports and 100 percent of natural gas exports.^x In addition, cross-border electricity trade is an important and growing means to ensure a reliable and stable source of power in both Canada and the U.S. In fact, over the last four years, Canada-U.S. electricity trade flow increased by 36 percent.^{xi}

\$98 billion in bilateral Canada-U.S. energy trade



Data source: Statistics Canada
International Merchandise Trade Database

Energy use

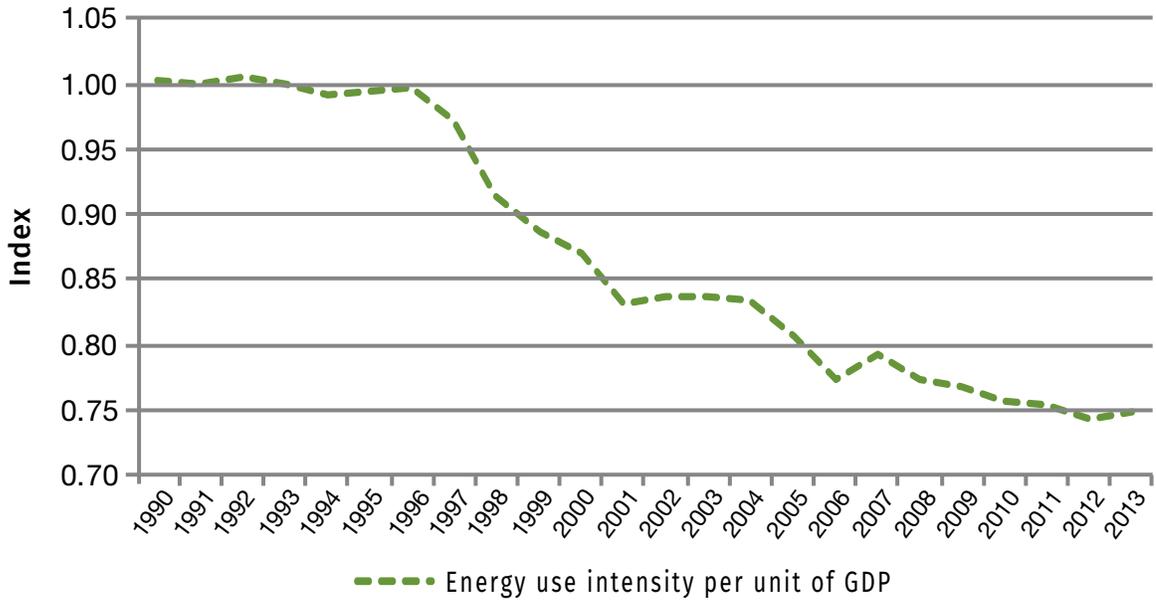
Energy lies at the core of Canadian life. We use it to cook our meals, charge our telephones and drive to work. It keeps us comfortable and connected and takes us places we want to go. Canadians experience the cost of energy on a daily basis – through monthly utility bills, at the gas pump, and in the price of food and other goods that we purchase. How we keep our energy affordable is more than a policy question for the future, it is a real-life challenge for Canadians.

Since energy also powers our businesses and factories, it can be critical to the success of a number of industries across Canada that rely on energy as an important factor of their production and can be significantly impacted by higher energy costs.

Overall energy use in Canada has continued to increase over the past several decades and, because of a wide range of factors such as our cold climate and large land mass, Canada remains one of the highest per-capita users of energy. Between 1990 and 2013, total energy use in Canada increased by 28 percent. However, the good news is that we are becoming more energy-efficient. Over that same period, our energy intensity (energy use per dollar of GDP) declined by about 1.2 percent per year.^{xii}

Reducing our energy use can play a significant role in reducing both energy costs and environmental impacts such as greenhouse gas (GHG) emissions. Efforts being made by governments, businesses and individual Canadians to improve energy efficiency are having a material impact. Without energy efficiency improvements since 1990, Canadians would have spent \$38.5 billion more on energy and produced 90.5 megatonnes more GHG emissions annually.^{xiii} The International Energy Agency estimates that nearly 40 percent of the reductions needed to achieve the world's GHG emissions target could be achieved through energy efficiency improvements alone.

Energy use per dollar of GDP (1990-2013)



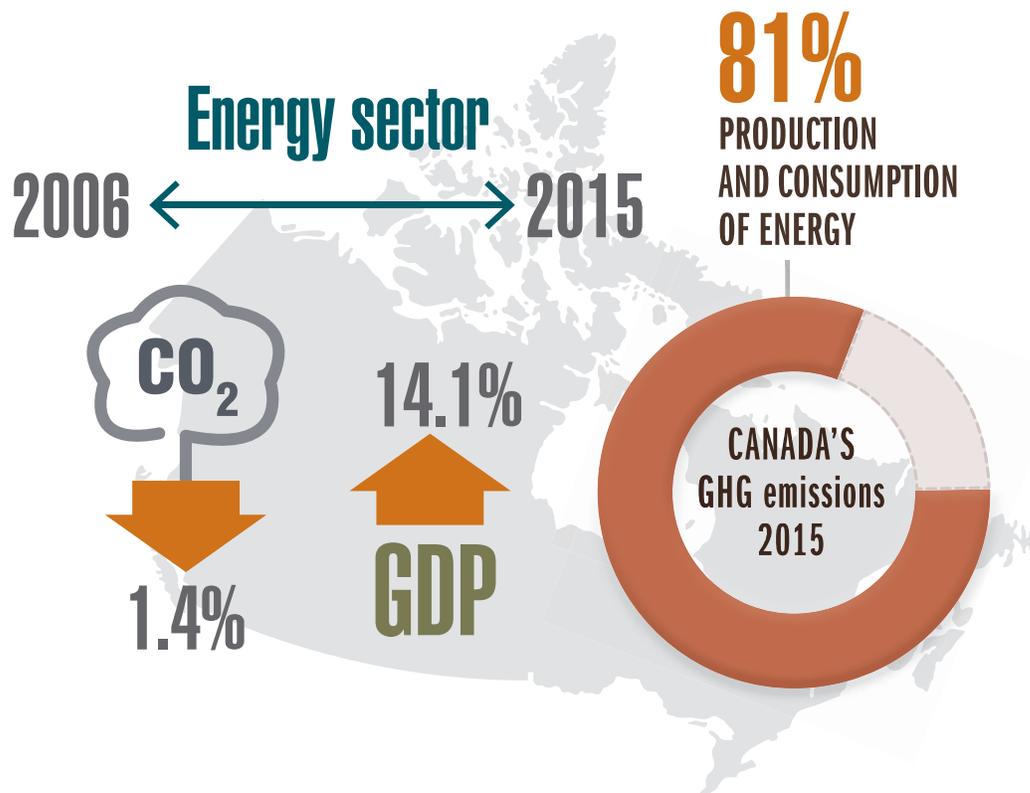
NRCan graph, based on the Office of Energy Efficiency's National Energy Use Database, 2016

Energy and the environment

Canadians expect energy production and use to be sustainable. They understand that a clean environment and a strong economy go hand-in-hand. They want to be confident that energy development in Canada proceeds in a way that protects our vital ecosystems and safeguards our health and well-being, both now and for generations to come.

Canada has a strong record of energy safety and environmental protection. Our regulatory regimes have helped ensure a safe and secure supply of energy across the country and are continuously being reviewed and improved. However, because of air emissions, marine and land-based spills, accidents and malfunctions, and impacts to species and biodiversity, energy continues to have profound effects on our environment and health.

Energy and greenhouse gas emissions in Canada



Data source: Environment and Change Climate Canada, National Inventory Report

As mentioned, energy has a significant role in our efforts to address climate change. Presently, energy production and use in Canada account for 81 percent of our total GHG emissions.^{xiv} Optimism should be drawn from the fact that although our economy has been growing (real GDP has increased 14.1%) in the last 10 years (2006–2015), our greenhouse gas emissions have begun to decrease (GHGs have declined 1.0%). Reducing these emissions is fundamental to reaching Canada’s goal of a low-carbon energy future. Innovation and clean technologies are already putting Canada on a path to greater resource efficiency and reduced environmental impacts that will help get us there. The following are three examples of current technology. Carbon capture storage and use projects are reducing carbon emissions from electricity production. Net-zero energy-ready homes and buildings that could potentially rely on their own renewable energy supplies for all their energy needs are being designed and built. New extraction technologies for oil sands operations that have the potential to significantly reduce extraction emissions and water usage are being designed and implemented.



Emerging trends

Canada's energy system, and moreover, energy systems around the world are not static, but rather in a constant state of dynamic flux. Predictions regarding the state of Canada's energy system over the course of a generation and beyond are uncertain at best. However, the following key factors are already reshaping Canada's energy system and/or are expected to have a major influence in charting our course for the future:

- The global transition to a low-carbon energy future, including rapid development and deployment of clean energy technologies and lower- or non-emitting forms of energy;
- Shifting global markets and demand patterns (from an almost exclusive reliance on the U.S. to increasing trade with emerging economies such as China and India);
- Significant declines in the relative costs of renewable energy technologies;
- Greater participation of Indigenous people in energy projects and energy decision making;
- Progress in using energy more efficiently across all sectors of society;
- Increased electrification across the economy, including for heating and vehicles;
- The evolving role of key energy sources such as natural gas, nuclear and renewables;
- The emergence of breakthrough technologies in new areas such as artificial intelligence, quantum computing and machine learning;
- Deeper continental energy integration across Canada, the U.S. and Mexico;
- Increased urbanization and the continued use of cities as laboratories of experimentation and change; and,
- The evolving global energy security landscape, global conflict and geopolitical risks.

Taken together, these and other unforeseen factors may drastically redefine our energy outlook and/or fundamentally transform Canada's energy system over the coming decades in ways not yet fully understood.

Government policy is helping to define our energy future

Several recent government policy actions across Canada are already having a profound impact in reshaping Canada's energy system. For example:

- In July 2015, Canada's premiers endorsed the Canadian Energy Strategy, which is enabling a cooperative approach among provinces and territories to sustainable energy development that enhances the ways that energy is produced, moved and used in Canada.^{xv} Since then, the federal government has been involved in advancing certain areas of work under the strategy.
- Canada is one of 197 countries representing 97 percent of global GHG emission production to sign the Paris Agreement, under which all countries agreed to work together to limit global temperature rise to well below 2°C. Further to the agreement, in November 2016, Canada released Canada's Mid-century Long-term Low-greenhouse Gas Development Strategy for a clean growth economy, which provides a framework for what a longer-term low GHG society could entail.^{xvi}
- In December 2016, Canada's First Ministers (excluding Manitoba and Saskatchewan) adopted the Pan-Canadian Framework on Clean Growth and Climate Change (PCF), an ambitious plan to meet or exceed Canada's international climate change targets. The framework builds on provincial and territorial measures to reduce GHG emissions and was developed in collaboration with Indigenous peoples. It includes a commitment to price carbon pollution; a suite of complementary actions to reduce emissions; measures to adapt to the impacts of climate change; and actions to accelerate innovation, support clean technology, and create jobs.^{xvii}
- In recognition of the role of innovation, Canada is participating in Mission Innovation, along with 22 other countries and the European Union. Through the Mission Innovation initiative, launched in 2016, Canada aims to double investments in energy research, development and demonstration from \$387 million to \$775 million over five years, while enhancing international collaboration and encouraging private sector and business leadership.
- Canada's Budget 2017 built upon this momentum with investments in clean energy and technology, infrastructure, and specific emissions-reductions opportunities. These include \$21.9 billion for green infrastructure; \$100 million for next generation smart grid, storage and clean electricity technology; \$200 million to support emerging renewable energy technologies; \$220 million to support more sustainable, renewable solutions for rural and remote communities; \$120 million for charging stations for electric vehicles and refuelling stations for natural gas and hydrogen vehicles; and \$182 million for new building codes and new net-zero energy buildings across Canada.

Governments across Canada are also actively working to make our homes, businesses and industries more energy-efficient and investing in new infrastructure and clean energy technologies. Finally, the Government of Canada is listening to Canadians on how we can strengthen our environmental regulations and regulatory processes for major energy infrastructure projects.



A call to action: Envisioning Canada's energy future

With Canada celebrating its 150th anniversary, there is no better time to come together as a nation to define the pathways to our collective energy future. The choices we make today will direct the trajectories of change.

To that end, the Government of Canada is launching **Generation Energy** – a discussion over the coming months with Canadians about how we make, move and use energy in our energy future. We want to ensure that the decisions made about how we produce and use energy over the course of the next generation reflect the core values and perspectives of Canadians. Our dialogue seeks to answer some fundamental questions:

- **What does Canada's energy future look like over the long-term?**
- **What generational goals should we strive to achieve?**
- **What values should guide us?**
- **What are the pathways and guideposts along the way?**

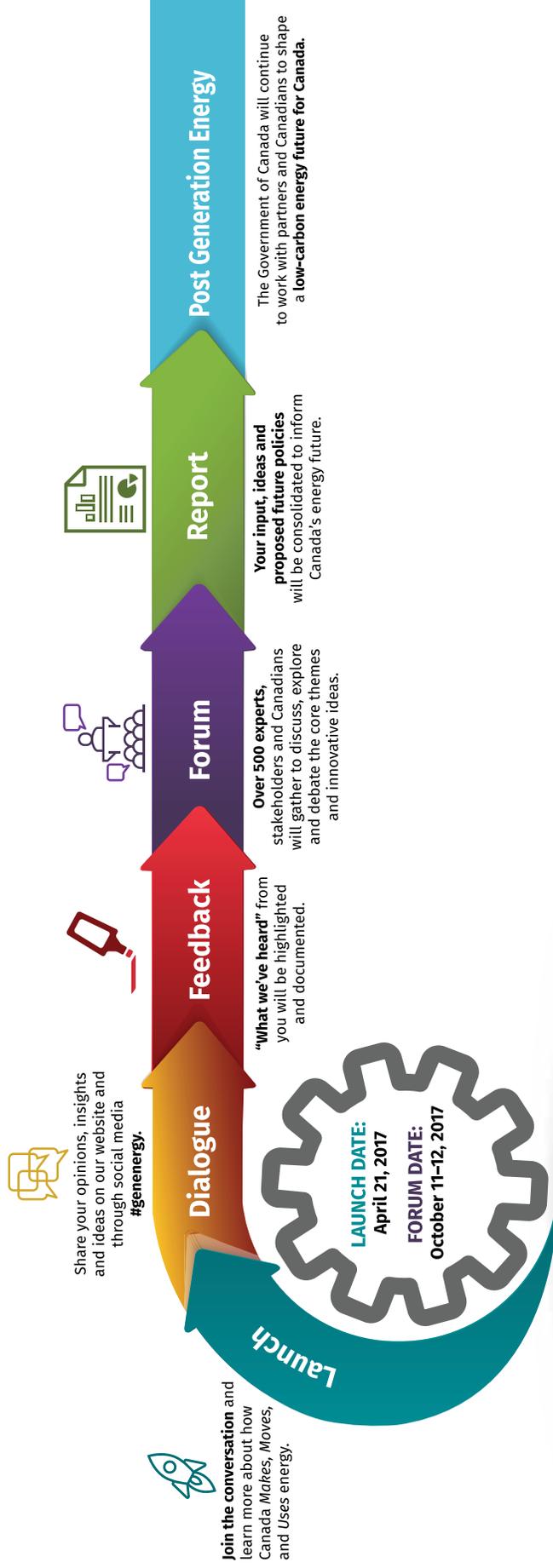
These questions are a starting point and will evolve as our discussion broadens. Your involvement is important. Through Generation Energy, we are asking individual Canadians, stakeholders and experts to collaborate with us to create a vision for energy in Canada and to explore pathways to getting there. There are many ways that you can join the conversation. For more information and details on events and to share your perspectives go to www.generationenergy.ca.

What we hear across the country will be compiled, documented and shared through our on-line platform. It will also form the basis of an energy forum in fall 2017, where stakeholders, experts and individual Canadians will discuss and synthesize key ideas and themes.

In 2018, we will release a Generation Energy report that will inform Canada's future energy policy and ensure that it reflects the core values and perspectives of Canadians. However, this will not be the end of the conversation – our ultimate goal is to create an on-going and open dialogue with Canadians about energy as we move together into the future.

GENERATION ENERGY

Process



For more information on Canadian and global energy systems, visit:

NRCan's *Energy Fact Book* 2016–2017

nrcan.gc.ca/sites/www.nrcan.gc.ca/files/energy/pdf/EnergyFactBook_2016_17_En.pdf

National Energy Board

neb-one.gc.ca/index-eng.html

Statistics Canada

www5.statcan.gc.ca/subject-sujet/theme-theme?pid=1741&lang=eng&more=0

U.S. Energy Information Administration

eia.gov/

International Energy Agency

iea.org/

References

- ⁱ National Energy Board, *An Energy Market Assessment*, 2016. Available on-line at neb-one.gc.ca/nrg/ntgrtd/ftr/2016/index-eng.html
- ⁱⁱ NRCan estimate based on Statistics Canada National Accounts data, 2016
- ⁱⁱⁱ NRCan estimate based on Statistics Canada National Accounts data, 2016
- ^{iv} NRCan estimate based on Statistics Canada National Accounts data, 2016
- ^v Statistics Canada CANSIM Table 180-003 and Canadian Association of Petroleum Producers' *Statistical Handbook for Canada's Upstream Petroleum Industry*, Table 01-01C, 2016
- ^{vi} Statistics Canada CANSIM tables 029-0045, 029-0046, and 029-0051, 2016
- ^{vii} Frankfurt School FS-UNEP Collaborating Centre for Climate & Sustainable Energy Finance: *Global Trends in Renewable Energy Investment*, 2016. Available online at: <http://fs-unep-centre.org/publications/global-trends-renewable-energy-investment-2016>
- ^{viii} Analytica Advisors, *2017 Canadian Clean Technology Industry Report*, 2017
- ^{ix} Statistics Canada International Merchandise Trade Database, 2016

- ^x NRCan's *Energy Fact Book* 2016–2017. Available on-line at nrcan.gc.ca/sites/www.nrcan.gc.ca/files/energy/pdf/EnergyFactBook_2016_17_En.pdf
- ^{xi} NEB Commodity Tracking System Statistics as of 8 February 2017: Table 3A – Export Sales Summary Report by Destination and Source
- ^{xii} Office of Energy Efficiency's National Energy Use Database, 2016
- ^{xiii} Office of Energy Efficiency's National Energy Use Database, 2016
- ^{xiv} Environment and Climate Change Canada's National Inventory Report
- ^{xv} Environment and Climate Change Canada's National Inventory Report, Statistics Canada CANSIM Table 380-0106 and CANSIM Table 379-0031
- ^{xvi} Canada's Mid-century Long-term Low-greenhouse Gas Development Strategy, 2016. Available on-line at unfccc.int/files/focus/long-term_strategies/application/pdf/canadas_mid-century_long-term_strategy.pdf
- ^{xvii} Pan-Canadian Framework on Clean Growth and Climate Change. Available on-line at www.canada.ca/en/services/environment/weather/climatechange/pan-canadian-framework.html