

NOW OR NEVER

Canada Must Act Urgently to Seize its Place
in the **NEW ENERGY WORLD ORDER**



The Standing Senate Committee on Energy, the Environment and Natural Resources

July 2012

The Honourable W. David Angus, *Chair*

The Honourable Grant Mitchell, *Deputy Chair*

Ce rapport est aussi disponible en français.

Des renseignements sur le comité sont accessibles sur le site :

<http://senate-senat.ca/enev-f.asp>

Information regarding the committee may be obtained through its web site:

<http://senate-senat.ca/enev-e.asp>

Information regarding the Senate may be obtained through its web site:

www.sen.parl.gc.ca

or by telephone at 1-800-267-7362

Hard copies of this document are also available by contacting the Senate Committees Directorate at 613-990-0088, toll free at 1-800-267-7362 or by email at enev@sen.parl.gc.ca.



THE COMMITTEE

Members of the Standing Senate Committee on Energy, the Environment and Natural Resources:

Honourable W. David Angus – *Chair*

Honourable Grant Mitchell – *Deputy Chair*

Honourable George Baker, P.C.

Honourable Bert Brown

Honourable Janis G. Johnson

Honourable Daniel Lang

Honourable Paul J. Massicotte

Honourable Richard Neufeld

Honourable Robert W. Peterson

Honourable Judith Seidman

Honourable Nick G. Sibbeston

Honourable John D. Wallace

Ex-officio members of the committee:

The Honourable Senators Marjory LeBreton, P.C. (or Claude Carignan) and James S. Cowan (or Claudette Tardif).

In addition, the Honourable Senators Banks, Boisvenu, Campbell, Carignan, Charette-Poulin, Chaput, Cowan, Dickson, Dyck, Eggleton, P.C., Fraser, Frum, Greene, Housakos, Kenny, Martin, McCoy, Meighen, Mercer, Merchant, Meredith, Milne, Moore, Nolin, Ogilvie, Patterson, Plett, Raine, Rivard, Robichaud, P.C., Rompkey, P.C., Runciman, St. Germain, P.C., were members of the committee or participated from time to time during this study.

Staff of the committee:

Ms. Lynn Gordon, Clerk of the Committee, Committees Directorate;

Ms. Maritza Jean-Pierre, Administrative Assistant, Committees Directorate;

Ms. Sam Banks and Mr. Marc LeBlanc, Analysts, Parliamentary Information and Research Services, Library of Parliament;

Ms. Ceri Au, Communications Officer, Senate of Canada.



ORDER OF REFERENCE

Extract from the *Journals of the Senate*, Thursday, June 16, 2011:

The Honourable Senator Mitchell, for the Honourable Senator Angus, moved, seconded by the Honourable Senator Moore:

That the Standing Senate Committee on Energy, the Environment and Natural Resources be authorized to examine and report on the current state and future of Canada's energy sector (including alternative energy). In particular, the committee shall be authorized to:

- (a) Examine the current state of the energy sector across Canada, including production, manufacturing, transportation, distribution, sales, consumption and conservation patterns;
- (b) Examine the federal and provincial/territorial roles in the energy sector and system in Canada;
- (c) Examine current domestic and international trends and anticipated usage patterns and market conditions, including trade and environmental measures and opportunities, likely to influence the sector's and energy system's future sustainability;
- (d) Develop a national vision for the long-term positioning, competitiveness and security of Canada's energy sector; and
- (e) Recommend specific measures by which the federal government could help bring that vision to fruition.

That the papers and evidence received and taken and work accomplished by the committee on this subject since the beginning of the Second Session of the Fortieth Parliament be referred to the committee; and

That the committee submit its final report no later than June 29, 2012 and that the committee retain all powers necessary to publicize its findings until 180 days after the tabling of the final report.

The question being put on the motion, it was adopted.

Extract from the *Journals of the Senate*, Tuesday, June 5, 2012:

The Honourable Senator Angus moved, seconded by the Honourable Senator Nolin:

That notwithstanding the Order of the Senate adopted on Thursday, June 16, 2011, the date for the tabling of the final report by the Standing Senate Committee on Energy, the Environment and Natural Resources on the current state and future of Canada's energy sector (including alternative energy), be extended from June 29, 2012 to September 28, 2012; and

That, notwithstanding usual practices, the committee be permitted to deposit with the Clerk of the Senate the above mentioned report if the Senate is not then sitting and that the report be deemed to have been tabled in the Chamber.

The question being put on the motion, it was adopted.

Gary W. O'Brien
Clerk of the Senate



TABLE OF CONTENTS

FOREWORD.....	1
VISION.....	5
CHAPTER I – INTRODUCTION: A PERILOUS PERCH.....	6
Canada’s Envidable Status as an Energy Power House is at Risk.....	6
The Foundation of our Energy Future is Collaboration.....	7
Market Diversification.....	7
Responsible Resource Development.....	9
A Call to Action.....	9
CHAPTER II - RESPONSIBLE DEVELOPMENT AS AN ENERGY FRAMEWORK.....	10
Economic Growth is the Driver of Prosperity.....	10
The Environment Must Be Vigorously Protected.....	11
Society’s Well-being is the Ultimate Goal.....	12
Energy Security.....	13
CHAPTER III - NATIONAL AND INTERNATIONAL ENERGY DYNAMICS.....	14
The New World Energy Order.....	14
Canada’s Energy Inheritance.....	15
Energy Prosperity is Good for the Whole Country.....	15
The Urgent Challenge of Accessing New Markets.....	16
Infrastructure Constraints for Natural Gas.....	16
Rising Energy Prices Impose Socio-Economic Burdens.....	17
The Social License to Build and Operate Must be Earned.....	17
Nuclear: The Deferred Renaissance.....	18
A Golden Age Dawns For Unconventional Resource Development.....	19
The Demand-Side Revolution.....	20
Mechanisms for Reducing GHG Emissions.....	21
The Expansion of the Regulatory System.....	23
CHAPTER IV - RESPONDING TO THE CALL: PRIORITIES FOR ACTION.....	24
Priority #1 — Canada must strive for collaborative energy leadership.....	24
Social License Needs Leadership.....	25
Individual Leadership through Energy Citizenship.....	25
Intergovernmental Leadership Challenges.....	25
Federal and Provincial Energy Jurisdiction.....	26
Leadership from First Nations.....	27
Local Governments Lead on the Frontlines.....	27
Priority #2 — Advance Nation-Building through Energy Infrastructure.....	28
The Electricity Systems Need Modernization.....	28
Pipelines to New Markets: “Better Pipe-long than Pipe-short”.....	29
Priority #3 — Natural Gas: A Game-changing Fuel.....	31
Shale Gale: New Twist on Natural Gas Supply Dynamics.....	31
Natural Gas is an Excellent Transportation Fuel.....	33



Priority #4 — Encourage Energy Efficiency and Conservation from Consumers.....	34
Greater Productivity through Higher Energy Efficiency and Conservation.....	35
Addressing Barriers.....	35
Establishing Energy Literacy.....	36
It's Time for a Canadian Energy Information Agency.....	38
Priority #5 — Frame a Strong Strategy for Energy Employment.....	38
Where Governments Can Find Solutions.....	38
Priority #6 — Strengthen the Foundation for Energy Innovation.....	40
Technology and Innovation Commercialization in Canada.....	40
"We Can and Must Do Better".....	41
Government is a Major Supporter of Canadian Innovation.....	42
The Need to Revise Energy-Directed R&D Funding.....	43
Examples of Current Successful Energy Innovation Projects.....	44
Priority #7 — Pursue High-Level Environmental Performance of Non-Renewable Energy Sources.....	46
The Oil Sands Must Improve their Environmental Performance.....	46
Technological Innovation May Change Coal's Uncertain Future.....	48
Priority #8 — Hydropower Superpower: Energy of the Past for the Future.....	49
Priority #9 — Foster Renewable Fuels.....	50
Wind: Growing Fast, but Starting Small.....	51
A Future for Solar.....	52
Biomass.....	53
Biofuels Have a Huge Opportunity to Grow.....	54
Geothermal.....	55
Going Forward with Renewables.....	55
Priority #10 — Regulatory Reform.....	56
"One Project, One Review".....	56
Aboriginal Partnership, Engagement and Consultation.....	57
Priority #11 — Guide Responsible Northern and Arctic Energy Exploration & Development.....	58
Increased Activity Entails Increased Responsibility.....	59
Unlocking Wealth through Regulatory Reform.....	60
Geopolitics of the North.....	60
Priority #12 — Maintain Strong Support for Canada's Nuclear Industry.....	61
A Solid History of Safety.....	62
A Commitment to Canada's Nuclear Energy Future.....	63
Emerging Nuclear Technologies.....	63
Priority #13 — Speak for Canada.....	64
The federal government speaks for Canada.....	64
CONCLUSION.....	65
APPENDICES.....	66
ENDNOTES.....	67



FOREWORD

Canada today is in the “cat-bird seat” as an energy power-house, poised to become the most energy productive nation in the world with exemplary levels of environmental performance and prosperity in all regions of our land. The road to realizing this bold vision, however, is fraught with peril and our once comfortable perch has become precarious in light of the new world energy order.

Canada and Canadians today face a real and urgent challenge to act now if we are to capitalize on and convert our remarkable energy opportunities into lasting prosperity. We must become energized immediately and substantially change the ways we deal with energy. We must do this now and in an efficient and productive manner.

Individual and corporate Canadians and our governments at all levels must develop a new enlightenment, an energy literacy which includes a profound recognition that energy pervades all aspects of our lives, and is a key element of our social fabric, one so influential and highly charged that it can be either a strong force of national unity or a negative agent of division and unrest.

In three short years, as our committee study on Canada’s energy sector and its energy future has run its course, the global energy landscape has changed substantially and we have seen Canada’s own energy situation transform before our very eyes. New technology breakthroughs, major new discoveries of shale gas, the development of alternative energy sources, new regulatory regimes, the nuclear disaster in Japan, major environmental considerations and new sensitivity to the need for appropriate social license to engage in resource development projects are but a few of the factors which have contributed to this dynamic change in the world energy order. As well, a new and aggressive competition for international energy markets has suddenly become a major factor.

As our study progressed amidst these changing conditions, the committee developed its vision of how Canada’s energy future could look, given its existing bountiful energy assets. The realization of this vision, however, will come with a price. The committee has articulated a pressing call for Canadians to become energized and has developed a series of action priorities. Our belief is that all these action items are achievable, provided there is inspired leadership and commitment at all levels with the view to having Canadians make the necessary changes to their energy behaviour on an urgent basis, be it on the production or consumption side. The challenge is tough, but the incentive is strong and attractive. Success will enable us to seize our magnificent energy opportunities and convert them into lasting prosperity for Canadians in all regions of the country. This report endeavours to identify key areas in which immediate action is required and these are set forth as priorities that must be addressed now.

At the outset of our study, we were acutely conscious of the fact that energy, the environment and the economy are inextricably intertwined, especially in Canada, such that any new energy sector projects, policies or other initiatives by government and/or the private sector now demand attention to the impact on each of these three “Es”. As well, we noted early on that there were many myths abroad in the land respecting energy matters in general, but particularly in the area of resource development and environmental protection. We determined to dispel some or all of these myths.



The committee heard evidence about climate change and the need for all Canadians to work together to curtail the polluting emission of greenhouse gases (GHG) into our precious and sensitive atmosphere and environment. However, this was not a study on climate change and global warming and our principal focus remained throughout on Canada's energy future. At the same time we quickly came to understand that energy is presently and, hopefully, always will be the mainstay of the Canadian economy and a critical key to our prosperity now and for generations to come.



Source: Senate of Canada

Senate Energy Committee meeting June 8, 2010

We conducted Phase I of our study from June 2009 to June 2010 by doing a general review of Canada's energy sector so we would become more energy literate and develop an understanding of the key issues, the pressing problems and challenges as well as the opportunities. Our report on Phase I was issued in June 2010 in the form of a discussion paper entitled "*Attention Canada! Preparing for our Energy Future. Towards A Canadian Sustainable Energy Strategy.*" In this interim report, we called for an immediate dialogue amongst Canadians on energy issues and basically, we were saying "Let's Talk Energy"! In an endeavour to promote and facilitate this dialogue, the committee established a dedicated website for its study, www.canadianenergyfuture.ca. Now that this study is complete, we hope Canadians will visit our official [Senate committee homepage](#) for the report and all related materials.

Our goal was to provide a public venue for energy stakeholders, governments, utilities and Canadians at large to express their views on energy issues and to follow the progress of the committee's public hearings and fact-finding exercises. The committee was active in the energy dialogue, using Twitter [@SCEENR_SAYS](#) to tweet its findings, with a view to engaging a wider audience.

Submissions made to the committee by stakeholders from across the nation, including complete transcripts of committee hearings, in both official languages, are available on the [committee's website](#) and should serve as a valuable energy databank.



Even as Phase II of the committee's study was getting underway, we were very pleased to note that a healthy dialogue on energy matters was beginning to happen, most actively amongst individual Canadians and energy stakeholders. We were able to identify at least fifteen organizations which were in the process of conducting studies about Canada's energy future and some of these studies are now complete and in the public domain. The committee also noted a markedly increased focus on energy matters by the national media. We believe this to be a most constructive contribution to the goal of achieving our vision for Canada's energy future.

The committee's primary goal in initiating its energy study was to encourage Canadians, young and old, individual and corporate, government and private, to focus on our nation's energy future in light of the following factors:

- Our perception that there existed a disturbing lack of energy literacy, awareness and sophistication amongst Canadians;
- The reality of dynamic global population growth estimated to exceed nine billion before 2050, meaning that global demands for energy will be increasing dynamically as time goes on, all this midst dire predictions of peak oil and depletion of traditional sources of fossil fuel¹;
- The fact that on a per capita basis Canada is and in all likelihood will remain amongst the top two or three consumers of energy in the world;
- Our view that despite its vast natural energy resources and reserves and well-developed infrastructure, Canada's energy system requires modernization so as to become more efficient, sustainable and respectful of the environment and the legitimate concerns of our aboriginal peoples;
- There existed a surprising and long-standing lack of any blue-print for or plan to develop a comprehensive pan-Canadian energy policy framework designed to promote lasting energy prosperity in all the diverse regions of our nation.

During Phase II of the study, the committee travelled across Canada hearing from and exchanging with energy stakeholders in all regions of the nation. We heard from dozens of individuals and organizations, energy experts and ordinary Canadians alike, as well as numerous federal, provincial and territorial government representatives, plus First Nations' leaders.

We had valuable input from at least six provincial premiers and a host of provincial and territorial ministers involved with energy, the environment and resource development. We derived the distinct impression that, since the Kananaskis Energy Ministers' Conference of July 2011, the "Go it Alone on Energy Matters" attitude which all or most provinces heretofore espoused is now, for very valid reasons relating to the new world energy order, becoming an attitude of collaboration and working together. Indeed, we have detected an increasing and necessary belief by provincial leaders that at the very least there is value in the provinces developing a common brand and a common message around the subject of Canadian energy. The committee is optimistic that these initiatives will expand into a positive and productive pan-Canadian collaboration on Canada's energy future.

We are very grateful to Peter Tertzakian, one of Canada's leading energy economists, who kindly provided me and committee members with valuable insights and guidance as we sought to make sense out of the great wealth of data, testimony and other input received during our three year study. Mr. Tertzakian interviewed Alberta Premier Alison Redford shortly after her election in April 2012 and the following



quotation from his interview with Premier Redford seems particularly relevant to the committee's findings and this report:

Premier Redford states her commitment to build cross-country consensus for an energy economy that benefits Canada, not just Alberta. The broad vision is to leverage all of Canada's world-class energy expertise, though the immediate agenda item is to champion fairways of interprovincial energy policy so that companies can find the most competitive and environmentally responsible way to get oil and gas to high-value global markets.²

These words are most encouraging. They confirm what we were told directly by Premier Redford and other provincial leaders and hopefully set the tone for discussions to be held later this year amongst first ministers in Halifax and energy and mines ministers in Charlottetown.

As committee Chair, I would like to pay special tribute to Senators Elaine McCoy of Alberta and Richard Neufeld of British Columbia, who were the driving forces in getting this energy study underway in mid 2009. Drawing on their valuable prior experience as provincial ministers, these two senators recognized the urgency of creating a national dialogue so that Canadians of all ages, in all regions of the country and in all pursuits would become aware of the urgent need to change their patterns of behavior on energy matters so that Canada can become the global energy leader it deserves to be, in line with the vision the committee has established during the course of the study.

I would like to take this opportunity to warmly thank everyone who took the time to testify, make submissions and share their ideas with committee members in workshops, meetings and at conferences. I am grateful to those who welcomed committee members into their science laboratories, research and development facilities, power generating plants, cutting-edge buildings and energy transmission facilities.

I would also like to thank all senators who participated in this study for their commitment, perseverance and patience. Our able analysts from the Library of Parliament, Marc LeBlanc and Sam Banks, remained focused from the beginning of the study to its completion and both made invaluable contributions. The support of our communications officer, Ceri Au, was very much appreciated, especially her instrumental role in the committee's innovative social media outreach. Our committee clerk, Lynn Gordon, was our guiding light, provided the direction, inspiration and administrative expertise without which the study would have foundered at an early stage. She organized the witnesses, the travel and the work schedule with skill and kept the Chair and the Deputy Chair clear of numerous pitfalls along the way. I extend thanks, as well, to all the rest of the support staff who contributed to this massive team effort. In conclusion, my special thanks to Senators Richard Neufeld and Daniel Lang who made valuable contributions as members of the steering committee and to Deputy Chair Senator Grant Mitchell of Alberta, who was cooperative, supportive and constructive from beginning to end and contributed much to enabling us to complete our study on a non-partisan basis.

Honourable W. David Angus, Q.C., Ad. E.
Chair, Standing Senate Committee on Energy, the Environment and Natural Resources

VISION

At its core, an energy strategy is about the future. It requires a vision. During the course of the study, the committee developed the following vision for Canada's energy future:

CANADA WILL BE THE MOST ENERGY PRODUCTIVE NATION IN THE WORLD WITH THE HIGHEST LEVEL OF ENVIRONMENTAL PERFORMANCE.





CHAPTER I | INTRODUCTION: A PERILOUS PERCH

CANADA'S ENVIABLE STATUS AS AN ENERGY POWER HOUSE IS AT RISK

Energy is a matter of great importance to Canada, stirring both pride and controversy. Referred to as an “energy nation”, “energy powerhouse” or even “energy superpower”, Canada possesses vast resources and expertise in the production, transformation and transmission of energy. Our energy riches in oil, natural gas, hydro and uranium are world-

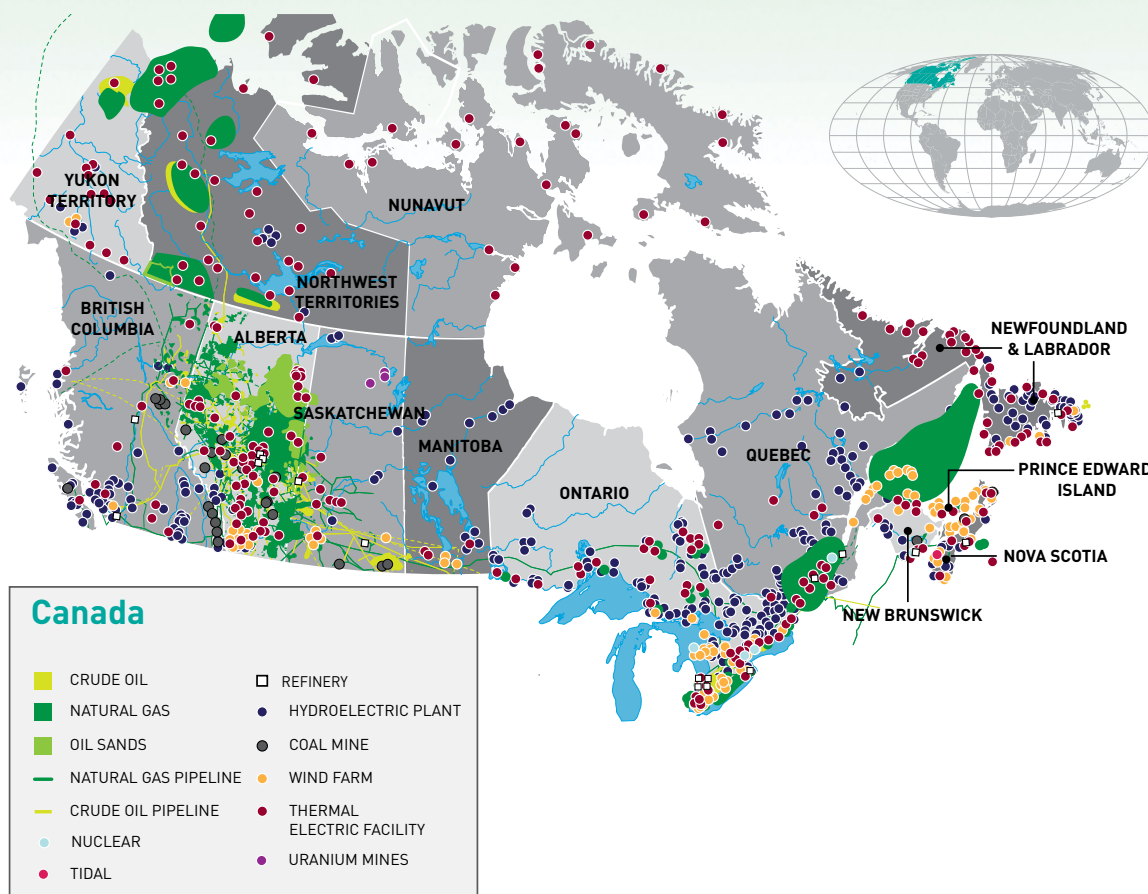
class and, with 75 percent of our country’s electrical power coming from non-emitting energy sources, Canada is a world leader in clean energy.⁴ We are actively preparing for our energy future by developing alternative energy sources such as wind, solar, biofuels, tidal and geothermal as well as innovative energy technologies like smart grids and carbon capture and storage. The energy sector employs over half a million Canadians and generates about 25 percent of the country’s export revenue. Government revenues from energy resources support our health care system, social safety net, and environmental and equalization programs.

Energy is a major part of what we are as a nation, but dynamic changes in the world energy order are threatening our energy future. It is therefore urgent that Canadians act now to meet the resultant challenges if Canada is to realize its potential of becoming the most energy productive nation in the world with the highest level of environmental performance. The committee has established thirteen priorities for action to achieve this vision.

I think Canada is at a turning point with respect to energy systems in a critically important time³

Brenda Kenny
President and CEO,
Canadian Energy Pipeline Association

Canada's Energy Resources



Source: Centre for Energy

THE FOUNDATION OF OUR ENERGY FUTURE IS COLLABORATION

Canada's energy resources are abundant, varied and distributed unevenly across the nation. Energy jurisdiction is shared amongst the federal, provincial, territorial, municipal and aboriginal governments. Energy issues at times have been a source of tension and even potentially divisive. Given the scope of the challenges and opportunities ahead, it is clear that there is a great need for better collaboration amongst all levels of government on energy matters.

This report emphasizes the need for all levels of government to collaborate to create a pan-Canadian energy strategy and to develop a unified voice for promoting Canada's energy interests at home and abroad.

MARKET DIVERSIFICATION

Canada has relied almost exclusively on the United States as an export destination for energy products such as oil, natural gas and electricity. Technological advancement, changing consumption patterns and regulatory reforms have radically altered the energy supply and demand dynamics of the United States and the world. Canada can no longer rely on the view that our neighbour to the south will always be a

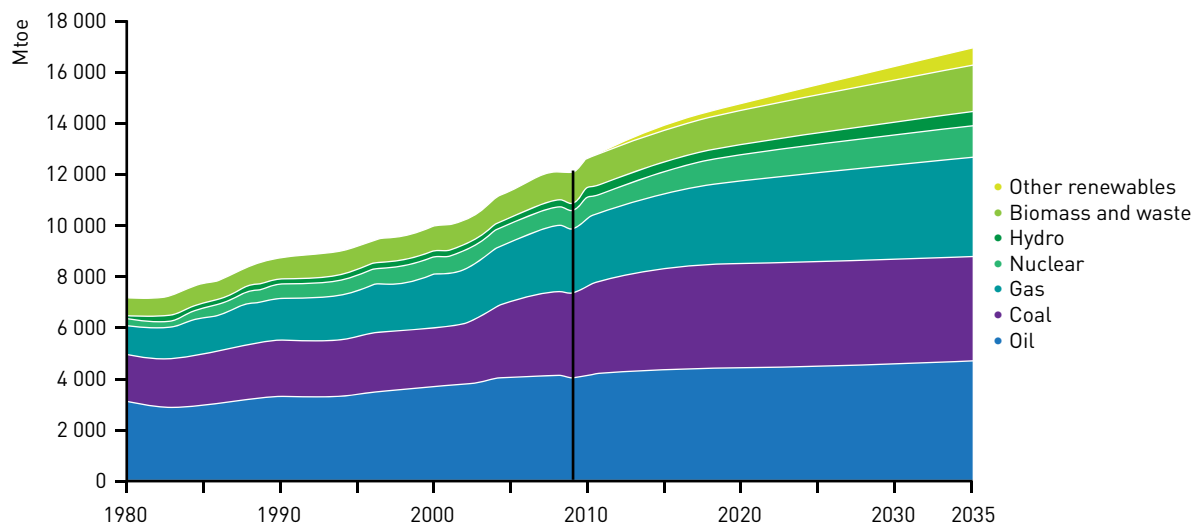


willing buyer of Canadian energy commodities. In addition, because we do not have access to diversified markets for our energy products, we cannot command the highest international prices. As a result, it is estimated by the Pacific Economic Cooperation Council that Canada loses \$28 billion a year in revenues from oil sales alone.

The world has entered the “Pacific Century”, characterized by the rapid industrialization of Asian economies like China and India, which will account for a commanding share of global economic growth over the next decades. There is perfect symmetry of interests between Asian demand for energy commodities, technology and expertise and Canada’s ability to supply them. However, transmission infrastructure is urgently needed to move resources to these markets.

Canada is facing increasingly aggressive competition. Other oil and gas exporting countries in the Middle East and South America as well as Australia, Russia, and the United States are aggressively competing to access these new Asian energy opportunities. Many witnesses were quick to point out that the window of opportunity for Canada may be open, but it will not remain open indefinitely. There is urgent need to act now.

World Primary Energy Demand



Source: IEA 2011 World Outlook based on New Policy Scenarios



RESPONSIBLE RESOURCE DEVELOPMENT

Energy is everyone's business and involves a complex set of interests and values. The guiding principle for our country in creating an exceptional energy system for the 21st century must be "responsible development". Development is responsible when it recognizes the interests and values involved with energy matters in four dimensions, namely economic, environmental, social and energy security. A change in one dimension automatically affects the others.

A CALL TO ACTION

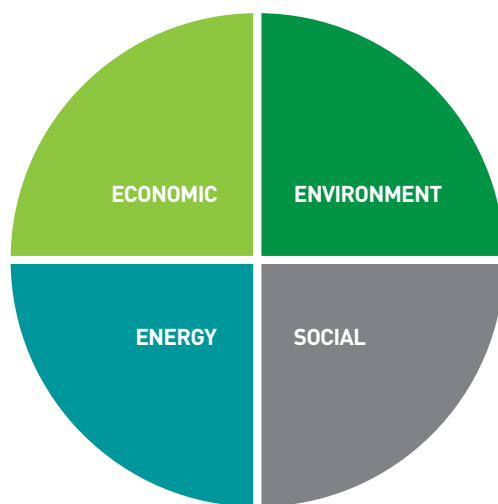
The report is a call to action, but should not be construed as a call to alter jurisdictional authority. Canada can generate a long term supply of secure, stable and affordable energy supporting a strong and lasting economic prosperity in all regions of the nation while meeting the highest level of environmental performance. The tools are at our disposal; we must use them effectively. In our view, this can be accomplished by urgently addressing the series of thirteen priorities for action that the committee has established.



CHAPTER II | RESPONSIBLE DEVELOPMENT AS AN ENERGY FRAMEWORK

Canada's energy future involves stakeholders from across the country with a diverse mix of views and values. Successful responsible development comes from balancing these interests.

Responsible Resource Development



ECONOMIC GROWTH IS THE DRIVER OF PROSPERITY

The energy economy creates jobs and increases both business and personal income. This translates to increased government revenues via corporate and personal income taxes, sales and excise taxes, royalties and lease sales. These revenues fund government services such as health care and education and provide the means for governments to address environmental challenges. Government plays a critical role in optimizing the conditions for growth by committing Canada to trade and open markets; improving education and training; and encouraging innovation and productivity. Investment in the energy sector is critical to economic growth. As seen in other countries, the lack of foreign capital and expertise leads to diminished energy sector productivity, growth, profitability, environmental performance and energy efficiency.

Canada subscribes to a market oriented rules-based approach to domestic and international trade of energy products and services. Unlike many other countries, foreign investment in the energy sector is welcomed. This openness to the world is crucial given Canada's relatively small population base, limited capital markets and the massive capital needed to develop our vast energy resources. We must never take this for granted.

Canada is the only net energy exporter in the G7. In fact, there are very few net energy exporters in the G20. Not many energy exporters exist even among rich nations.⁵

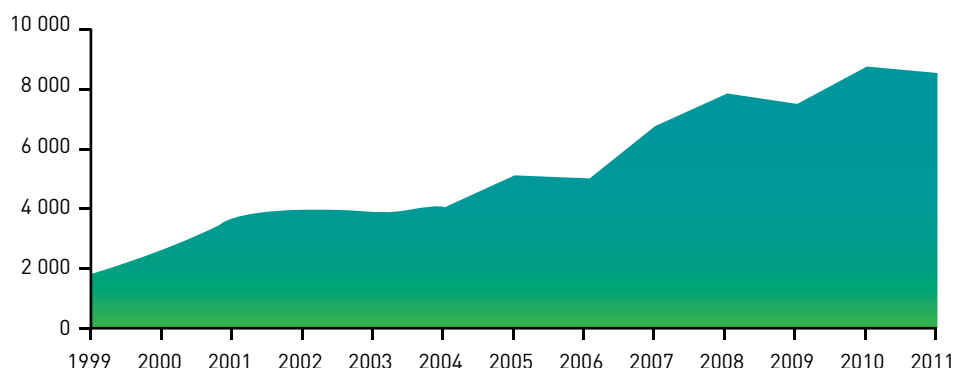
Murray Stewart
President, Energy Council of Canada



International investors are not only attracted by strong returns on investment and the prospect of long term supply, but also Canada's stable democracy, solid fiscal regime, sound regulatory framework, skilled workforce and advanced energy technologies.

Canadian Foreign Direct Investment: Oil and Gas Extraction Sector

(Millions \$)



Source: Statistics Canada

The notion of securing export markets for our energy products is sometimes called “security of demand”; a critical element of economic prosperity for Canadians. As a major energy exporter, Canada needs to be wary of having just one principal customer. To achieve “security of demand”, Canada must expand and modernize its energy export infrastructure in order to access new energy markets. For example, Canada’s ability to export natural gas overseas is constrained by the lack of LNG export terminals.

THE ENVIRONMENT MUST BE VIGOROUSLY PROTECTED

We need an energy policy that is about the future.... It needs to be focused on pursuing both the social well-being of Canadians and ecological sustainability, not simply on business opportunities.⁶

David Coon
Executive Director,
Conservation Council of New Brunswick

Canadians take pride in the beauty, biodiversity and cleanliness of the country’s vast natural environment. There is no question that energy resource projects, often because of their size and scope, have an impact on the environment. Canadians expect world-class environmental performance from Canada’s energy sector. Without this level of environmental performance, the energy sector would be at peril of losing the credibility required to earn the *social license* needed to build and operate.

Energy systems around the world are being reconfigured so as to reduce GHG emissions, but debate in Canada continues over the level of urgency for these reductions and the most cost-effective way to do them. Some advocate significant curtailment of fossil fuel production and use. On the other hand, the committee heard many experts place great faith in the ability of technological innovation to shrink



Canada's ecological footprint while integrating our vast hydrocarbon resources into a low-emitting energy system of tomorrow.

Solutions are being developed in a range of fields, including renewable energy, carbon capture and storage, cogeneration, clean coal, smart electrical grids and nuclear power. Canadians are only at the early stages of developing and adopting energy efficiency and conservation practices into how they live, work and play.



SOCIETY'S WELL-BEING IS THE ULTIMATE GOAL

By its very nature, energy infrastructure is obtrusive. Local residents often bear a disproportionate share of the costs from major energy projects, sometimes including diminution of income, property value and land use. Also, there may be real or perceived health and safety risks associated with living near energy facilities. Whether energy companies are erecting wind turbines, laying pipelines or building compression terminals, they must earn from society the license to build and operate by exhibiting responsible practices. Open and productive company-community stakeholder negotiations are integral to energy project development success.

More and more, everywhere we turn, whether it is power lines, pipelines or new energy production projects, local communities are saying no. It is becoming harder and harder to operate. We need a different kind of dialogue if we are to move past that issue.⁷

Michael Cleland
President, Canadian Gas Association

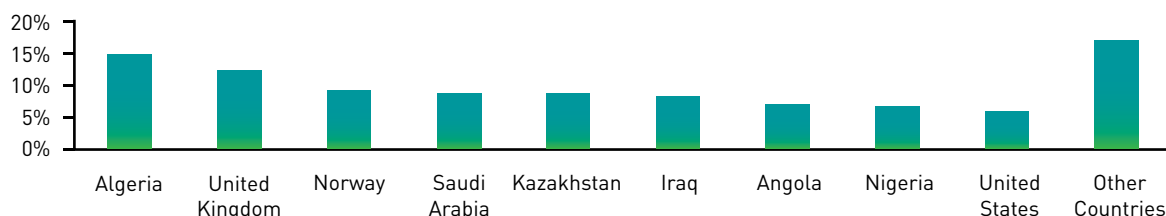


ENERGY SECURITY

Energy security refers to energy supply, reliability and affordability, and also includes an energy system's resiliency to withstand shocks and supply disruptions. A sign that a country has been successful in achieving energy security occurs when end users take for granted the reliable access to energy services for heating, lighting, mobility and industrial purposes.

While Canada produces enough oil to be self sufficient, the country still relies on crude oil from other countries -roughly 30% of total domestic production- to meet energy demand, mostly in eastern parts of the country. Essentially, Canada operates in a dual oil market where western refineries receive domestically produced crude oil, while eastern markets primarily rely on imported crude oil from multiple sources -although some oil is sourced from Newfoundland and Labrador offshore production. Ontario refineries receive a mixture of domestically produced and imported crude oil feedstock.⁸

Canada: Percentage of Total Imported Crude oil and Equivalent by Country (cubic meters) 2010



Source: Statistics Canada

Transportation costs associated with moving crude oil from Western regions is the main reason for the dual market, but so is the fact that eastern refineries have greater access to a wider choice of crude grades. As such, there is limited existing transportation infrastructure (pipeline) capacity to transport large amounts of western crude to eastern regions of the country.

Some have argued that building and enhancing East-West pipeline infrastructure would increase domestic energy security, but others question whether it makes economic sense to do so. On balance, however, if the committee's vision for Canada's energy future is to be realized, we believe that now is the time for such infrastructure projects to be undertaken in the spirit of nation building.

It should be added that sizable offshore oil and gas development is occurring off the coasts of Newfoundland and Labrador and Nova Scotia. Potential offshore development may be initiated in Quebec which may change the future energy security landscape of the country. The committee explored the status of offshore oil and gas development in Canada and related safety and regulatory regimes in a [report released August 2010](#) which is available on the committee's website.



CHAPTER III | NATIONAL AND INTERNATIONAL ENERGY DYNAMICS

There is a complex web of national and international energy market dynamics that will affect our ability to achieve our energy vision.

THE NEW WORLD ENERGY ORDER

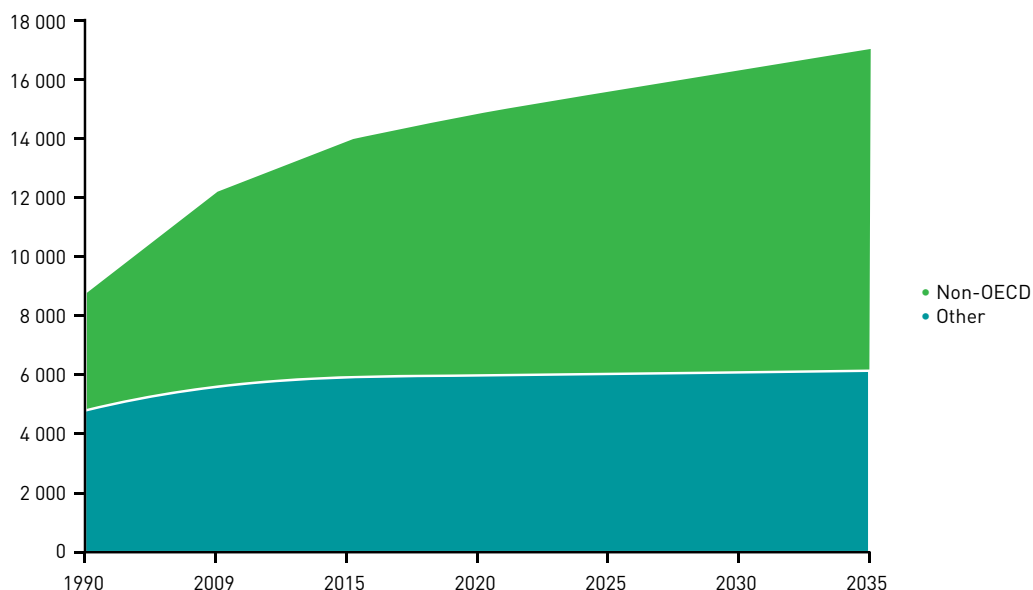
Energy is involved in all our activities, from heating our homes and preparing food to charging a smartphone and fuelling up at the service station. Energy consumption remained very low for most of human history, but since the 18th century, energy use in industrialized nations has risen almost continuously. The substitution of human and animal work by the mechanically harnessed energy of coal and then later oil, led to dramatic improvements in living standards. Today, energy is a necessity for modern living. A temporary loss of energy services is more than a simple annoyance; it can sharply curtail commercial and industrial activities or even result in life-threatening situations. Economists speak of a strong positive correlation between energy use and GDP growth, but there are real opportunities to change our socio-economic organization which would enable rising living standards without increased energy consumption.

I think we are at an important crossroads here where, in this country, we are blessed with some abundant resources. We are not the only ones in the world who have abundant resources. It is a good time for us to think about what we really want to make of them, what we stand for and what strategies we might need to put in place in the country to take maximum advantage of the opportunities that we have.⁹

Douglas Bloom
President, Spectra Energy Transmission West

Global Primary Energy Demand

Million Tones of Oil Equivalent (Mtoe)



Source: Data from IEA World Energy Outlook 2011¹⁰



One thing is certain: hundreds of millions of people in the emerging countries would like to have better lives and better economies. That means more energy. Energy means better lives and better economic growth. We can be sure that the global energy demands will grow.¹¹

Fatih Birol
Chief Economist, International Energy Agency

Since the end of the Cold War and the advent of China's open door policy, many countries have been knocking on the door of the "club" of industrialized countries. The rapidly growing populations of these "emergent economies" are, of course, eager to enjoy the same energy-intensive lifestyles as ours. The opportunities for Canada to supply the energy for what may be termed "the greatest economic transformation in history" are enormous, but so too are the environmental challenges. This is a time for real leadership for

governments and energy-informed citizens to find the path that responsibly solves the challenges, manages the risks and turns these great opportunities into long-term, responsible prosperity for all Canadians.

CANADA'S ENERGY INHERITANCE

[The energy sector] plays a critical role for Canada in serving the energy needs of all Canadians and in generating major income from foreign sales. There is virtually no other country in the world that does not look at our energy inheritance with envy.¹²

Honourable Perrin Beatty
President, Canadian Chamber of Commerce

Canada's importance as an energy nation derives from its vast energy resources, from non-renewables to renewables and alternative sources. These are cornerstones of Canada's economic prosperity, enviable quality of life and global influence. Moreover, Canadian world class energy expertise ranging from energy finance, business management and environmental remediation have come to represent a sophisticated knowledge economy integral to the natural resource development industry. In the eyes of the

world, Canada's brand has become inextricably linked with energy.

ENERGY PROSPERITY IS GOOD FOR THE WHOLE COUNTRY

Some commentators have argued that Canada's robust energy economy creates extreme "boom and bust" volatility that negatively impacts other sectors and creates fiscal uncertainty for governments. Demand and price for energy commodities like oil, coal and uranium are beyond our control as they are determined by the international marketplace. Other commentators have been anxious about Canada contracting the "Dutch disease", a condition where strong commodity exports and the concomitant net positive influx of foreign exchange leads to currency inflation and diminished competitiveness of domestic manufacturing.

One commonly suggested "corrective" to these concerns is the promotion of greater economic diversification. It is important to note that the Canadian economy — though certainly more resource-oriented than Organization for Economic Co-operation and Development (OECD)¹³ nations like Germany or Japan — already has highly diversified secondary and tertiary sectors. But the traditional method of dividing the economy into sectors is losing its relevance as the natural resource sector becomes increasingly complex, knowledge-intensive and service-oriented. Moreover, energy projects — whether in hydrocarbon extraction, hydro-power, nuclear research or clean tech development — generate supply chain and tax revenue effects which ripple positively throughout the entire national economy.



THE URGENT CHALLENGE OF ACCESSING NEW MARKETS

Canada has a single export market for its oil and natural gas, the United States. However, new discoveries, trends and technologies have given American oil and natural gas production a lift, just as structural changes in their economy have decreased domestic demand. In fact, Daniel Yergin, President of Cambridge Energy Research Associates, has predicted that by

2020 the U.S. may surpass Russia and Saudi Arabia to become the largest hydrocarbon producer in the world.¹⁵ The production surge is a result of the application of technologies like next generation multi-stage hydraulic fracturing (“fracking”) to unlock difficult shale gas deposits. Noted energy economist Philip Verleger makes the forecast that, within the coming decade, the United States will no longer need to import crude oil and will likely become a significant exporter of natural gas.¹⁶ Therefore, there is urgent need for Canada to identify other markets.

...it is never good for any producer of any commodity or product to be solely dependent on one market.¹⁴

Dave Collyer
President,
Canadian Association of Petroleum Producers

In addition, as long as we have only one buyer, Canadians will continue to be forced to sell our products at a significant discount relative to world prices. It would be, therefore, financially prudent to diversify our energy markets in order to achieve international prices for oil and natural gas exports.

There is a real urgency to access new markets for Canada’s energy exports and diversify the country’s energy trade to the burgeoning economies of Asia. Major new oil and natural gas pipeline projects would connect Canada’s growing petroleum supply to tidewater. This would permit, in turn, access to the Pacific Rim markets and international prices.

INFRASTRUCTURE CONSTRAINTS FOR NATURAL GAS

Energy commodities such as coal, uranium and biomass rely on rail, road and ship freight for bulk transport, and so their international exports are less likely to face short to mid-term infrastructure bottleneck issues. The case is different for Canadian oil and natural gas, which are increasing production without expanding pipeline capacity.

Canada sends 100% of its natural gas exports via pipelines to the United States, a trading partner which now has its own burgeoning supply of natural gas. However, advances in technology have made it economic to ship liquefied natural gas (LNG) via tankers, thus opening regionally “stranded” natural gas supplies — such as North America’s — to world markets.¹⁷



Natural gas is the cleanest fossil fuel



...the United States, our biggest customer, may become our biggest competitor. The U.S. government has already approved exports from several Gulf Coast LNG terminals, and one of these terminals has already announced two long-term agreements with LNG players. Asian markets are looking for their next long-term stable source of natural gas supplies, and in my view, we have a short window to capitalize on this opportunity.¹⁸

Douglas Bloom,
President, Spectra Energy Transmission West

British Columbia with its vast natural gas reserves is taking advantage of this trend and the development of the enabling infrastructure — including pipeline access to Pacific tidewater, new natural gas liquefaction plants and tanker loading facilities — is moving forward, but our window of opportunity will not stay open indefinitely.

RIISING ENERGY PRICES IMPOSE SOCIO-ECONOMIC BURDENS

The committee found that energy products and services are predicted to steadily increase in cost. High energy prices drive investment in alternative fuel sources, energy efficiency technologies and management practices, and conservation

measures. In the short and medium term, however, high-energy prices impose an economic and social burden throughout Canadian society. The burden is felt more acutely by low-income households where the energy bill claims a larger portion of household income.

Canada's high levels of consumption of energy goods and services make us vulnerable to energy supply disruptions and energy price increases. Compared to other energy forms and their variable price movements, oil has drawn the most attention. Rising prices place higher operating costs on nearly every business sector, but particularly transportation and manufacturing. Some economists associate sustained high energy prices as a main cause of economic downturns.

Canada's energy infrastructure requires huge reinvestment and modernization. In certain instances, these kinds of investments can legitimately be considered as nation building. Electricity prices, which are typically regulated by provincial utility boards, are arguably reflective of past investment and not future energy requirements. In times of budgetary constraint and economic difficulty, utilities will have less flexibility to finance the required infrastructure modernization without raising rates. Other, less visible, factors are also contributing to a rise in energy costs, such as environmental regulations and mandates aimed at reducing GHG emissions. This is causing large emitters to invest in expensive technologies to limit their environmental footprint.

Businesses and households usually look to governments to ease the burden of higher energy costs. Governments have an important role to play in informing and assisting energy consumers to seek energy efficiency and conservation solutions. The committee recognizes that the best way to mitigate rising energy costs is to increase energy efficiency, conservation, and technological innovation and also increase the options for fuel switching.

THE SOCIAL LICENSE TO BUILD AND OPERATE MUST BE EARNED

Social license to build and operate exists when a particular project or activity has ongoing approval within a community-at-large and/or amongst relevant stakeholders.



Many in the energy sector have expressed frustration at how difficult it has become for energy companies to obtain the necessary social license to develop and operate urgently needed energy infrastructure. By all indications, concerns and resistance will grow. From both a national and an international perspective,

Canada as an energy-trading nation must keep earning the social license from an ever broader audience to develop its energy resources and to sell its energy products. To do this, Canada must demonstrate its commitment to mitigating greenhouse gas emissions on a national scale just as Canadians need to embrace the highest standards of energy efficiency and conservation practices.

This is where the crunch comes between the urgency to capture changing markets and the need to earn the necessary social license.

NUCLEAR: THE DEFERRED RENAISSANCE

The term “nuclear renaissance” refers to the anticipated nuclear power industry revival driven by elevated fossil fuel prices and worldwide efforts to reduce greenhouse gas emissions. Several barriers have interrupted this renaissance, including: worries about nuclear accidents, security, nuclear weapons proliferation, high capital investments, and the long term storage of nuclear waste. The 2011 nuclear emergencies at Japan’s Fukushima I Nuclear Power Plant substantially heightened all these concerns.

The renaissance is, however, showing signs of revival. Many internationally prominent environmentalists have come out as strong supporters of nuclear energy because they see it as the only energy form with the potential of providing scalable, emissions-free base load power. China has 27 new reactors under construction. There are also a considerable number of new reactors being built in South Korea, India, and Russia. Despite a near halt in the building of new nuclear reactors over the last three decades, the U.S. is now planning to build at least five new reactors over the next ten years. In addition, France continues to produce close to 80% of all its electrical power from nuclear.



Darlington Nuclear Generating Station, Ontario Power Generation

Canada has a long history with CANDU nuclear technology. The committee visited the major nuclear facilities and installations in Ontario and was impressed by the professional culture and exceptional commitment to safety. The next few decades will provide opportunities for Canada to leverage its nuclear technology, research and management expertise in light of the growing global market. Also, a resurgence of nuclear power will increase the demand for uranium. Canada has the second largest reserves of uranium in the world, plus the mining expertise and facilities that add value by processing it.

A GOLDEN AGE DAWNS FOR UNCONVENTIONAL RESOURCE DEVELOPMENT

Like any non-renewable resource, traditional forms of oil and natural gas are only available in finite amounts. We are already experiencing the onset of their production decline worldwide. Fortunately, a host of new technologies has sharpened focus, innovation and capital on the vastly more abundant unconventional hydrocarbon reserves. They are, however, more challenging to produce. Unconventional oil and natural gas include heavy oil, oil sands, oil shale, gas and oil from coal, natural gas in ultra-tight formations, very deep natural gas, low quality and/or stranded natural gas, coalbed methane, and methane hydrates. These resources were used only in small amounts during the twentieth century, but are important additional sources of future energy supply.

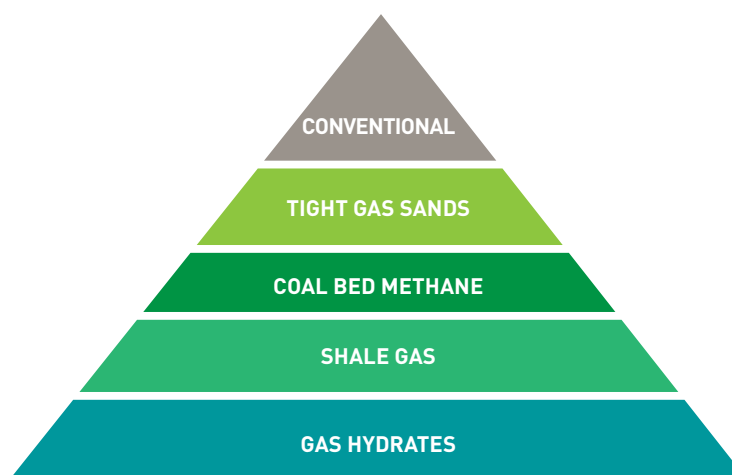
Resource Triangle

Conventional Resources:

Small volumes that are easy to develop

Unconventional Resources:

Large volumes that are difficult to develop



Source: CAPP

The Liard, Horn River and Montney “shale gas” plays in British Columbia, for instance, have world-class resource potential. Moreover, the development of significant “shale gas” and offshore oil reserves in Quebec and New Brunswick could mark a significant shift in Canada’s energy landscape since these provinces have virtually no upstream oil and gas industries at present.¹⁹

Examples of game-changing technologies that are unlocking vast unconventional reserves in Canada are steam-assisted gravity drainage (SAGD) for in situ oil sands production and multi-stage hydraulic fracturing used in combination with horizontal drilling for “shale gas” and “tight oil” production. Many of the technologies behind the “de-conventionalization” of hydrocarbon resource exploration and production were developed in Canada and will be responsible for driving this paradigm shift in unconventional resource extraction around the world. This is another example of Canada’s leadership in innovative energy productive technologies.



THE DEMAND-SIDE REVOLUTION

Despite the hope being placed in renewable energy forms, clean-tech devices, offshore drilling, efficiency gains and the containment of climate change, the vast new demands being placed on the world's resources, by the ever wealthier developing world, means global demand for affordable, clean and secure energy will put the old supply paradigm to the test. Since energy consumption is a function of socio-economic organization, we can increase energy efficiency through better urban design, public transit and commuting patterns — not to mention more energy efficient homes, offices and vehicles. Energy economists are therefore quick to point out how many of the solutions to the world's energy problems will be found on the demand side.

While Canada will benefit greatly from its world-class energy resources such as hydro, oil and natural gas, uranium and wind, the exponential advance of information and communication technology (ICT) has already begun to have a profound impact on the demand side. In fact, the cross-fertilization of information technology (IT) with energy technologies promises dramatic improvement in conservation practices and energy efficiency. Breakthrough innovations like telepresence technology, smart grid networks, voice over internet protocol (VOIP) and virtualization software could dramatically change energy needs by changing the way people live, work and play. Being a heavy-weight supplier of energy to the world is not enough. Canada's credibility as an energy nation also rests largely on being a leader in the areas of energy efficiency and conservation.

Statistics Behind Canada's Energy Story

Economic Growth

- Government revenues from federal, provincial and territorial taxes and royalties on the energy sector were \$35 billion in 2008.²⁰
- The energy supply sector accounted for approximately 7% of Canada's GDP in 2009.²¹
- Energy and energy services stocks represent 27% value of the TSX composite value, second only to financials at 30% in 2008.²²

Energy Consumption

- In 2008, Canadians spent \$189 billion — or roughly 13% of GDP — on energy.²³
- Canada imported \$40.7 billion of energy products, mostly crude oil, refined petroleum products and natural gas in 2010.²⁴

Employment

- The oil and gas extraction business is the largest private sector investor in Canada and was responsible for \$34.5 billion in investment, or 25% of non-residential capital investment in 2009.²⁵
- The total national GDP impact of projected \$1.1 trillion in oil & gas industry investments (including Northern Gateway Pipeline, Kitimat LNG, Mackenzie Valley pipeline, Deep Panuke offshore) over the next 25 years is predicted to reach \$3.6 trillion.

R&D

- In 2010-11, the federal government provided over \$811 million in support for energy R&D, the provinces provided \$366 million, for combined public support of \$1.177 billion in energy R&D.²⁶



Statistics Behind Canada's Energy Story (Continued)

- In 2009, Canada public support for energy R&D as a percent of GDP was higher than Australia, UK, France, and Germany and equal to the U.S.²⁷

Electricity

- According to the Conference Board of Canada the Canadian electricity sector will require \$294 billion in investment by 2030.²⁸
- The total length of transmission lines in Canada is 79,619 km²⁹, nearly double the circumference of the earth.

Renewable Energy

- Wind generation more than doubled between 2010 to 2011 and Canada now ranks 13th worldwide in wind power generation.
- One of the world's largest solar farms is located in Sarnia, Ontario.³⁰

Nuclear

- The nuclear industry provided over \$1.5 billion in federal and provincial revenues in 2008.³¹
- Nuclear power accounts for roughly 15 % of Canada's total electricity supply.³²
- Canada ranks seventh in the world in terms of nuclear power generation.³³

MECHANISMS FOR REDUCING GHG EMISSIONS

The two major approaches to emission reduction management are carbon pricing (i.e., carbon tax and/or cap-and-trade) and regulation (i.e., imposition of performance standards). The regulatory approach applied on a sector-by-sector basis is the current policy of Canada's federal government, although some provinces, notably British Columbia, Alberta and Quebec, have opted for carbon-pricing mechanisms. A carbon tax places a price on carbon which provides certainty and administrative ease without guaranteeing emissions reduction. A cap-and-trade program provides regulatory limits on overall emissions, but does not guarantee price. Typically, a cap-and-trade program provides the option of carbon offsets, whereby a company may purchase carbon credits by investing in activities that offset, reduce or sequester emissions. It is possible to design carbon-pricing programs that blend carbon taxes with a cap-and-trade mechanism in order to reach a balance between price and emissions reduction certainty.

The federal government has already established regulations in the transportation sector and is finalizing regulations for coal-fired power plants. The government is also consulting with provincial and territorial governments and key affected stakeholders as it moves to regulate emissions in other sectors of the economy. Dan McDougall, Assistant Deputy Minister, International Affairs Branch of Environment Canada told the committee that the oil and gas sector — including the oil sands — is next in line for GHG regulations since it represents the next largest carbon emitting sector.

A number of witnesses, from industry to environmental stakeholders, favoured carbon pricing because, in their view, it was seen as the most efficient way to drive behaviour and technology to reduce GHG emissions. By placing a price on each tonne of GHG emitted, part of the environmental costs of emissions are internalized within the cost of the operation and, ultimately, within the product. In this way, carbon



pricing becomes a financial incentive which motivates businesses and individuals to make choices that reduce emissions. While some provinces — and other countries — have already introduced some form of carbon pricing, its introduction in Canada at the national level would face significant opposition. The committee recognizes that public support for carbon pricing measures is tenuous at best since these measures would tend to elevate energy prices. It was acknowledged that regulatory approaches have a place in reducing emissions, especially in cases of market failures, that is, when businesses and consumers do not respond adequately to price signals.



Canada introduced new emissions standards for passenger automobiles

Current vehicle emission efficiency standards and codes for appliances, transportation and buildings are examples of regulatory approaches supported by most policy experts. These types of regulations were seen by some either as an alternative or as complementary to a national carbon pricing program.

Those in support of carbon pricing advocated making it revenue-neutral by using the funds raised to reduce personal and corporate income taxes and, in doing so, encourage investment and employment. It was also noted that national carbon pricing would be a non-starter if revenues from a province or territory were not returned to jurisdictions from which they came.

...while economy-wide carbon pricing is the most effective and efficient mechanism to incent deep, long-term emission reductions at the lowest possible cost, regulations are required in certain sectors where the price signal is insufficient, such as the automobile sector.³⁴

David McLaughlin,
President and Chief Executive Officer, National
Round Table on the Environment and the Economy



THE EXPANSION OF THE REGULATORY SYSTEM

The current federal government's proposed regulations, *Reduction of Carbon Dioxide Emissions from Coal-Fired Generation of Electricity*, from August 27, 2011, set out performance standards for new coal-fired units and those that have reached the end of their useful life. Expected to come into force in 2015, the standards will be based on parity with the emissions performance of high-efficiency natural gas generation.³⁵ The goal is to phase out high-emitting coal-fired generation and promote a transition towards lower or non-emitting types of generation, such as high-efficiency natural gas, renewable energy, or fossil fuel-fired power with carbon capture and storage. Indicators have been established to measure and evaluate the efficacy of the proposed regulations. The government has signaled that it favours regulations that emphasize outcomes over prescriptive measures. The committee notes that the federal government's coal-fired performance-based regulations reflect a strong commitment to address and reduce emissions in a manner that limits exposure of trade-oriented energy-intensive industries.

For the transportation sector, Canada introduced new emissions standards for passenger automobiles and new light duty vehicles for 2011-2016 models. New performance standards are being developed for heavy duty trucks. Canada is also working with the United States to develop further standards for new passenger automobiles and light trucks for the 2017 and later models. Other measures to reduce emissions include mandating a five percent renewable fuel content for gasoline and two percent for diesel.³⁶ The federal government is also committed to further improving fuel efficiency of the aviation sector by at least two per cent per year until 2020.³⁷

The committee was told by industry that certainty and predictability as to the regulatory regime is critical. Knowing how regulations will affect operations in the future serves to reduce risk and reduce investment costs. The federal government has signaled that it intends to expand its regulatory approach beyond the coal-fired power sector to other sectors such as oil and natural gas, chemicals, smelting, cement, iron and steel and mining. The committee believes that it is important that there be collaboration between federal, territorial and provincial partners in developing these regulations in order to assure a harmonized approach. If the vehicle and coal standards operate in the way that the government anticipates, the committee believes these are positive steps. It should be noted that the regulatory approach assumes an implicit cost of emissions.



CHAPTER IV | RESPONDING TO THE CALL: PRIORITIES FOR ACTION

If Canada is to realize the committee's vision of Canada being the most productive energy nation in the world with high level environmental performance, the committee believes that the following 13 critical priorities for action need to be addressed urgently.

PRIORITY #1: CANADA MUST STRIVE FOR COLLABORATIVE ENERGY LEADERSHIP

Leadership is critical to realizing our vision of Canada as the most **energy productive nation in the world**. Canada should strive to be a global leader in energy production, conservation, innovation, efficiency and regulation, all with the highest levels of environmental performance. To do this, federal, provincial, territorial, municipal and Aboriginal governments must work together collaboratively to achieve ambitious goals within the bounds of their respective authority. Each Canadian needs to be engaged on the energy file, increasing energy awareness and changing behaviour to make Canada a model to the world in energy efficiency and conservation.

It is imperative that the Canadian governments begin an ongoing dialogue at the highest political level, setting the long term energy goals and securing the social license from Canadians and the world necessary to proceed. Energy issues can be a powerful force of national unity or they can be divisive and lead to unrest. The global energy order is changing in such a way that we have to make decisions now. If not, other nations will move ahead of us aggressively to meet the world's growing energy demands.

The Premier of Alberta, after consultation with and approval from some of her counterparts such as the Premier of Quebec, has started the dialogue to develop a collaborative pan-Canadian energy strategy. The annual meetings of Canada's energy ministers are key to this process. We believe all stakeholders should support and, where practical, participate in this critical energy dialogue.

The message that the committee heard throughout its hearings is that the federal, provincial, territorial and municipal governments, industry, environmental groups and Aboriginal leadership need to come together to chart a course for responsible development and marketing of our energy resources. The committee believes that it is imperative that political engagement has to take place at the highest levels in order to secure the social license from Canadians to proceed.

Canada is already a leader in global energy production. While we have huge energy resources, both conventional and unconventional, we cannot take this leadership for granted. If Canada is to maintain its place as a leader on the global stage it needs to sell its energy products, services and technologies to diversified export markets. Canada has had the good fortune of sharing a border with the United States, the world's largest energy market, but this proximity has resulted in a "monopsonist" trade relationship — which simply means that Canada, by and large, sells its energy products to a single buyer. This lack of market diversity leaves Canada vulnerable and is partly to blame for our not realizing higher international prices.



Social License Needs Leadership

Canada's pursuit of global leadership in energy performance must be balanced with environmental, social and energy security demands. Some commentators have even pointed out that an irresponsible approach could create opposition that would place Canada's energy ambitions in jeopardy. As more resources are sought in remote and challenging environments, at times requiring extensive new transmission and pipeline infrastructure to link to markets, the approval process for resource development projects will come under increased scrutiny.

The public has become increasingly vocal and openly distrustful about aspects of the environmental assessment process and about government and industry assurances regarding the health, safety and environmental effects of energy projects. The social license to build and operate is subject to our ability to achieve the highest levels of environmental performance. In that regard, the committee was pleased to note that the federal government has recently, in Budget 2012, taken steps to enhance the efficiency of the environmental approval process. Transparency and consultation in the approval process for energy projects must be continuously improved.

An important part of what all levels of government and utilities must do involves educating and working with customers to ensure that they understand what is happening to the energy industry and the implications on them. Ultimately, they will be the ones who will push back and resent what is being imposed on them, either through changes required in behaviours or, potentially, through price impacts.³⁸

Arunas Pleckaitis
Vice president, Enbridge Gas Distribution

Individual Leadership through Energy Citizenship

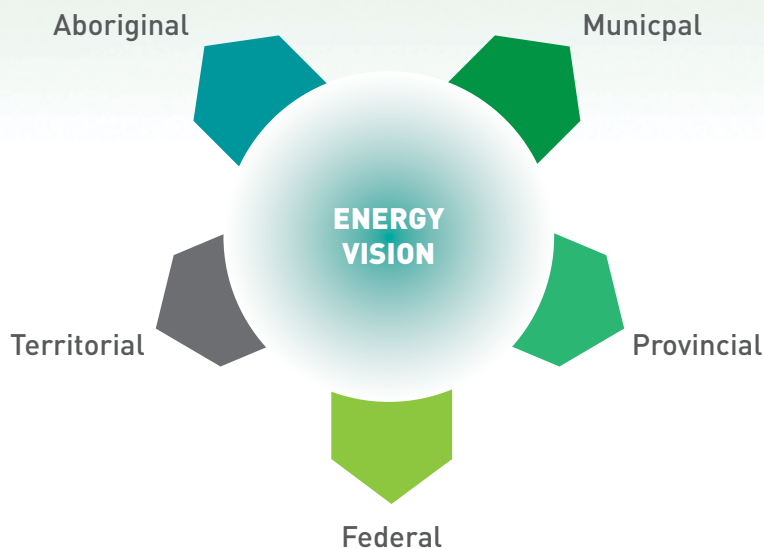
As citizens of an energy nation, Canadians need to see themselves as “energy citizens.” With energy citizenship comes the responsibility to be more energy literate. Energy literacy involves understanding how energy impacts society. Energy literate citizens are better able to understand the issues and participate in the urgent discussion of Canada's energy. Every Canadian can show leadership in this area.

Intergovernmental Leadership Challenges

Energy issues involve the federal, provincial, territorial, aboriginal and municipal governments, so intergovernmental relationships must be a defining quality of a pan-Canadian energy strategy. A one-size-fits-all energy approach lacks the flexibility for finding alignment between regional and national jurisdictions. The federal, provincial and territorial governments all have authority over different energy and environment related decisions, some of it overlapping.



Energy Vision Requires Interjurisdictional Collaboration



Given the multijurisdictional nature of energy and environment responsibilities, there is clearly a catalytic role for the federal government to perform in pan-Canadian collaboration and consensus-building. The committee believes that this is essential in order to realize our vision.

Federal and Provincial Energy Jurisdiction

The federal government has jurisdiction over international treaties; has taxation powers at every stage of the energy life-cycle; funds programs and provides incentives, including those specific to regions; and has jurisdiction over interprovincial and international trade. The federal government has legislative powers relevant to environmental matters that impact energy systems, navigable waters, fisheries and species at risk. North of the 60th parallel, the federal government has devolved management over natural resources to the Yukon, but continues to play a significant role in resource development in the Northwest Territories and Nunavut.

The federal government is also involved in energy matters related to economic development and energy security. Since the energy crises of the 1970s, the federal government has played a role in promoting energy efficiency and alternative energies. The federal policy influence over energy has expanded due to the growth in trans-boundary environmental concerns. The main federal energy regulatory agencies are the National Energy Board and the Canadian Nuclear Safety Commission. The federal government also shares regulatory responsibility over offshore oil and gas resources with Newfoundland and Labrador and Nova Scotia through the Canada-Newfoundland and Labrador Offshore Petroleum Board and the Canada-Nova Scotia Offshore Petroleum Board. It should be noted that on March 24, 2011, the federal government and the province of Quebec announced an accord on the management of offshore oil and gas resources in the Gulf of St. Lawrence.

The *Constitution Act, 1982* and the *1930 Natural Resources Transfer Agreements* give provinces ownership over the extraction and commercialization of natural resources within their borders, including energy resources. Provinces may impose royalties and taxes on energy production.



Leadership from First Nations

First Nations' authorities play a unique role in the development of energy resources. The constitutional recognition of existing Aboriginal and treaty rights, land claim agreements and resource-related agreements with federal, provincial and territorial governments differentiate Aboriginal people from other stakeholder groups. First Nations often own the resources on their lands, and as such, have authority to administer and authorize access to these resources as well as establish their own environmental permitting regimes. Canadian law has been evolving with respect to recognizing the Crown's duty to consult and to accommodate "when the Crown is contemplating conduct that could adversely affect potential or established Aboriginal or treaty rights."⁴⁰

Founded in a couple of aspects are a greater need to have treaty rights, Aboriginal title and rights, and concepts such as consultation and accommodation to arrive at a better shared understanding of what that means and how we can make it work. Layered on top of that is the need to have a greater shared notion of the development of an energy strategy.⁴¹

Shawn A-in-chut Atleo
National Chief, Assembly of First Nations

Some energy project proponents have expressed frustration with the current Aboriginal consultation process, owing largely to the lack of timelines and the lack of clarity concerning the division of responsibilities around consultation. Aboriginal peoples too have expressed frustration as the current process often forces them to go to court when they believe that the environmental assessment process does not adequately consider Aboriginal and treaty rights. Shawn A-in-chut Atleo, National Chief of the Assembly of First Nations, told the committee that it was important to dispel the myth that Aboriginal peoples are against all resource development. To avoid costly

litigation procedures, National Chief Atleo felt that superior results could be achieved through improved negotiation processes.

The committee notes that the government recognized the importance of the duty to consult in the changes to the regulatory process in Budget 2012.

Local Governments Lead on the Frontlines

Like all other orders of government, local governments are major consumers of energy. We own buildings, vehicle fleets, and spend millions annually on the procurement of products that have embodied energy from Canada and around the world. We are in a position to influence the energy consumption choices of our citizens...⁴²

Shannon Joseph
Policy advisor, Canadian Federation of
Municipalities

The role municipalities play in meeting our energy objectives cannot be overemphasized, as 80 percent of Canadians live in or near cities. Communities are responsible for various aspects of energy consumption, distribution and supply within a given geographical area. Some municipalities are owners of energy utility companies, and most municipalities manage energy and environmental sustainability programs and/or assist residents with conservation or energy efficiency initiatives.

The key determinants of energy use in cities



include urban design, population density, land use, zoning, transit and road planning. Reduced sprawl or higher density leads to greater “location efficiency” and less energy use. As density doubles, energy savings of between 20-40% can be achieved in urban transportation energy. Since communities account for nearly 60 percent of Canada’s energy consumption, the way they manage their energy systems will have a considerable influence on the country’s energy future.

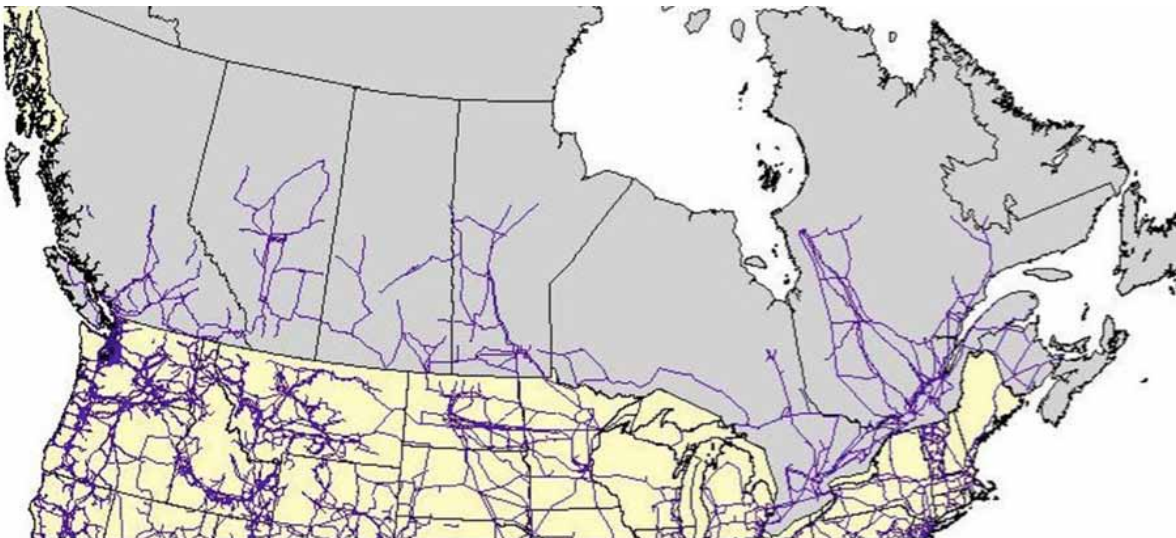
PRIORITY #2 — ADVANCE NATION-BUILDING THROUGH ENERGY INFRASTRUCTURE

Legacy infrastructure projects in Canada like the railway system, the Trans-Canada Highway and the Saint Lawrence Seaway have greatly facilitated the movement of people and goods, strengthened the national economy and knitted together the country’s regions. Today, Canada has the opportunity to further advance the building of the nation through modernizing and expanding our electricity systems and our oil and gas pipelines.

The Electricity Systems Need Modernization

Canadians enjoy the advantages of reliable, well-running electricity systems. However, considerable investment is required to maintain and extend their operation and benefit. As the committee heard from Pierre Guimond of the Canadian Electricity Association, *“another way of stating this is that the last investment decisions on building the system were made by my parents.”*⁴³ This may be too harsh. Provinces like Ontario, B.C. and Quebec have made major investments in modernizing their transmission facilities and utilizing smart grids and smart meters. Still, much more needs to be done.

Canada: Electricity Grid



Source: Global Energy Network Institute

Upgrading of existing electricity infrastructure will ensure security and reliability, particularly as provinces move to more decentralized energy systems. Canadian electrical systems are part of an integrated North American electrical grid. While energy is traded on a wholesale basis between provinces, the highest volume of trade occurs North-South with the United States. The substantial electricity demand in the United States is generally reflected in export prices that exceed our domestic

prices. Moreover, higher American electricity demand for air conditioning during the summer allows for the offsetting of electricity, while Canada enjoys a surplus of supply.



The total length of transmission lines in Canada is 79,619 km

Nevertheless, the need for increased capacity of the East-West electric grid continues to pre-occupy some policymakers. Several witnesses supported a national grid as a nation-building initiative to bolster energy security; conversely, some others argued that our geography makes such a move financially impractical. However, while not necessarily supporting a “grand” grid, most witnesses supported the need for greater interconnections and fewer barriers to trade between provinces.

Pipelines to New Markets: “Better Pipe-long than Pipe-short”

Pipelines usually transport oil and gas products from remote energy sources and production facilities to refineries and processing plants. In a sense, pipelines are “energy highways” for the cost-effective and safe travel of oil and natural gas over land to markets — and since they use much less energy than other methods of bulk transportation, pipelines have an inherently lower carbon footprint.

As the North American hydrocarbon supply and demand picture undergoes dramatic transformation, the vast Canadian oil and natural gas pipeline network struggles to keep pace. With booming oil sands development, national oil production is set to triple by 2025. As current takeaway capacity will be tapped out within a few years, several new oil pipeline projects have been proposed, but all face considerable obstacles. The economic benefits that would accrue to Canada and the United States from these projects are immense and would persist well into the future.



Pipelines are “energy highways”

Enbridge’s proposed Northern Gateway project and Kinder Morgan’s proposed TransMountain expansion would pipe Albertan crude oil to Pacific tidewater and thereby enable ocean transport by tanker to Pacific Rim countries. The committee recognizes that these proposals raise substantial outstanding safety, social and environmental questions; regulatory reviews for both are currently underway. In addition to these interprovincial projects, TransCanada Pipeline’s Keystone XL project is internationally oriented and would ship the same product to the world’s largest upgrading and refining hub on the Texas Gulf Coast. The ultimate fate of the Keystone XL pipeline rests with the United States government, but the tenuousness of the approval process is a stark reminder of the importance of export market diversification for Canada’s oil and gas.

The committee also looks favourably upon the prospect of shipping western Canadian crude to the East for refining and marketing in Ontario, Quebec, Atlantic Canada and international markets. This idea has long been touted as an obvious way to boost Eastern Canadian energy security and advance nation-building, but it has repeatedly been delayed because of inadequate market conditions. However, the economics for piping oil to the East have improved considerably, particularly because higher prices can be achieved for oil in Eastern Canada than in the American Midwest.

In considering new pipeline infrastructure from the perspective of policies that could drive a responsible energy future, we must acknowledge that the long-term national interest ripples across for decades, perhaps centuries, if we get it right or miss it. Imagine Canada today if there were no pipelines. By comparison in critical infrastructure, imagine what this nation would be like if we had failed to build the Canadian Pacific Railway or the St. Lawrence Seaway. Getting the right infrastructure in place has profound implications not only for today but also for generations.”

Brenda Kenny
President, Canadian Energy Pipeline Association



The committee was frequently told that it was preferable to be “pipe-long” rather than “pipe short” in order to avoid bottlenecks and price distortions. The value of Canada’s energy pipeline system should be seen on par with other major infrastructure.

PRIORITY #3 – NATURAL GAS: A GAME-CHANGING FUEL

Natural gas is a game changing fuel. It is the cleanest fossil fuel. Compared to the average emissions from coal-fired generation, natural gas produces half as much carbon dioxide, less than a third as much nitrogen oxides, and one percent as much sulfur oxides.⁴⁵ Natural gas has become extremely abundant which has made it very affordable. It is a reliable, versatile and efficient fuel. It is becoming a platform fuel for the Canadian economy. Eric Marsh of EnCana Corporation told the committee: *“The abundance of natural gas enables us to rebalance our energy portfolio, using it for power, electricity and transportation.”*⁴⁶

Shale Gale: New Twist on Natural Gas Supply Dynamics

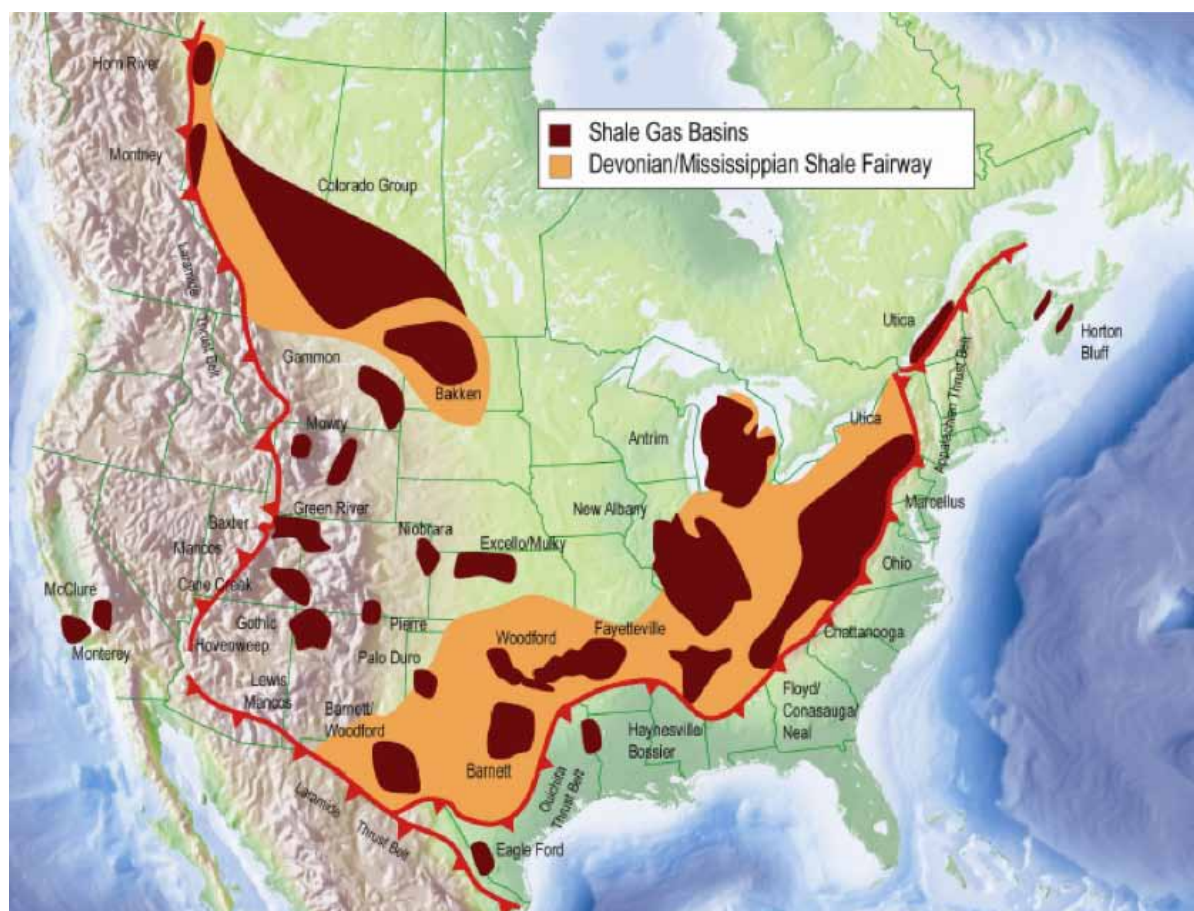
The natural gas situation has undergone radical transformation over the past decade owing to the development of new technologies that have improved the economics of extracting unconventional natural gas, such as shale gas, tight gas and coalbed methane. As conventional natural gas production continues to drop, unconventional natural gas production is more than compensating for this shortfall. The main Canadian shale deposits are found in the legacy oil and gas provinces of British Columbia, Alberta and Saskatchewan, but they have also been proved in Quebec, New Brunswick and Nova Scotia.

The National Energy Board estimates that Canada has at least 1,000 trillion cubic feet of potential shale gas reserves.⁴⁷ By comparison, the U.S. Energy Information Administration (EIA) estimates 482 trillion cubic feet of technically recoverable unproved shale gas resources in the United States.⁴⁸ Currently, nearly all shale gas production in Canada is occurring in northern British Columbia. In fact, Shell Canada recently announced its decision to build a pipeline from the northeast of the province to Kitimat, B.C. to enable the export of natural gas.



The promise of shale gas does raise some environmental concerns which include water use, GHG emissions and the risk of groundwater contamination from extraction procedures. Quebec and New Brunswick have significant shale gas reserves, but are moving slowly to put the regulatory regimes in place to enable development. The committee believes that responsible shale gas production in Quebec, New Brunswick and other regions would create enormous economic benefits, well-paying jobs, enhanced energy security and the environmental advantages of a cleaner burning fuel.

Shale Gas Plays of North America



Source: National Energy Board

With western Canadian natural gas prices lagging international prices — and, at times, even production costs — several LNG projects have been proposed for Canada's West Coast. Even with factoring in all the auxiliary costs of LNG liquefaction, cryogenic transport and re-gasification, the wide trans-Pacific price differential makes it still very attractive for Canadian shippers to sell into Asian natural gas markets. However, American plans to boost LNG export capacity are also well advanced, an important consideration given they are, to a large extent, targeting the same lucrative export markets. Interestingly, British Columbia's Kitimat LNG, the earliest applicant for LNG export facilities on the West Coast, was originally conceived of as an import terminal. In 2008, this original proposal was reversed in light of the transformed North America natural gas situation.



Senators learn about natural gas engines at Westport's Vancouver facility - Nov 28, 2011

Natural Gas is an Excellent Transportation Fuel

With the prospect of lower exports of natural gas to the U.S., many efforts are underway to find new uses for natural gas. Natural gas, mainly in the form of liquid and compressed natural gas, provides an opportunity for the diversification of fuel used in transportation to move away from higher emission gasoline and diesel fuels. There is an increasing demand for low cost, lower-emission natural gas for transportation, in urban fleets and heavy duty transportation trucks, and rail and marine transportation. The high infrastructure costs and a lack of factory-direct natural gas passenger vehicles mean that natural gas is not currently a mainstream option for individual consumers. The trucking industry is beginning to transition to liquid natural gas-powered vehicles; however, this is tempered, in part, by high conversion costs.

In addition, transportation companies are reluctant to adopt long-haul natural gas trucks until there are adequate numbers of refuelling stations along critical routes, while suppliers are reluctant to build these stations until they know there will be sufficient demand for their product. Infrastructure investment could be minimized and benefit maximized by focusing on the three principal transportation corridors of Edmonton/Calgary/Vancouver, Windsor/Quebec, and the Atlantic provinces, which collectively account for Canada's core truck transportation routes.



PRIORITY # 4 — ENCOURAGE ENERGY EFFICIENCY AND CONSERVATION FROM CONSUMERS

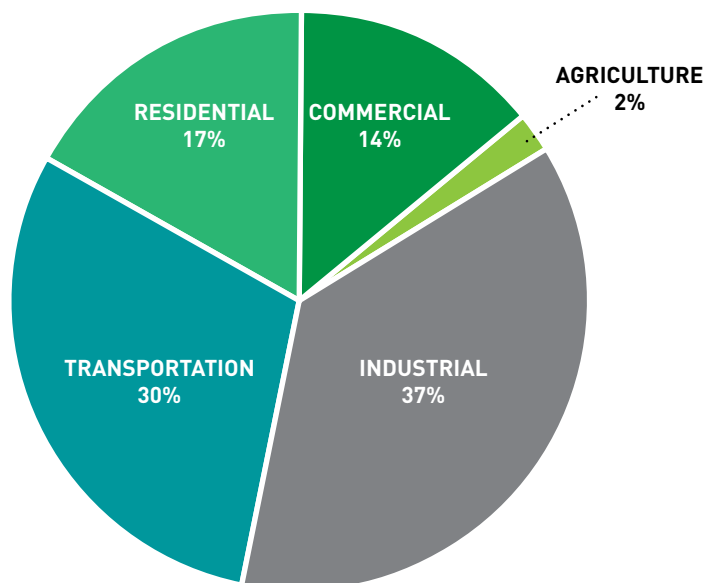
For many witnesses, energy efficiency and conservation initiatives together represented one of the most important elements of any vision of Canada's energy future, a cornerstone for economic, environmental and energy security goals. During the course of an energy form's "life-cycle", energy is lost at every stage. With electricity this is evident in the imperfect capturing of kinetic energy by water-driven turbines or in the heat loss when transported along transmission lines or even when electricity is consumed by an old incandescent light bulb.

Similarly, the amount of caloric energy contained within a unit of subterranean crude oil decreases as it moves through the stages of extraction, piping, refining, and combusting. Consequently, the so-called energy saving "downstream" can mean energy savings by several orders of magnitude "upstream". The committee believes that this is an area where Canada can improve quickly and effectively and, with proper commitment, could — and should — take a position of global leadership.

We need to start at the demand end of the system. The issue is, what energy services do Canadians need and want, and how do we deliver those energy services in a way that is environmentally responsible, efficient, affordable and reliable⁴⁹

Michael Cleland
President, Canadian Gas Association

Canada: Energy Use by Sector 2009



Source: Natural Resource Canada



Greater Productivity through Higher Energy Efficiency and Conservation

We found that in all the cases, the savings delivered by efficiency investments were substantial, whereas the actual initial investment was not as significant.⁵⁰

Leslie Malone
Policy Associate, Environment Northeast

Canadians are amongst the largest per capita energy consumers in the world. In part, this stems from the country's affluence, vast size and cold climate. Through proven energy efficiency and conservation measures, Canadians could reduce energy use while continuing to grow the economy, save money and protect the environment. Energy efficiency is seldom appreciated as a kind of energy resource.

...we take the view, as I think many people do, that energy not spent — called 'negajoules' — is the most effective way to reduce costs. Of course, as a result, we also reduce greenhouse gas emissions.⁵¹

Darrell Dexter
Premier of Nova Scotia

It can be argued that there is currently a disconnect amongst Canadians with respect to the importance of their individual contributions to energy efficiency and conservation. Many are not aware that, when seen from the perspective of the entire "wells-to-wheels" energy cycle, most GHG emissions occur at the consumption level. A lack of public understanding regarding the aggregate impact of individual consumption

has given rise to the widely-held view that responsibility for improvement of Canada's environmental performance rests disproportionately with the industrial and energy sector. There is a strong role for individual Canadians to embrace conservation in their own lives.

Addressing Barriers

Government initiatives help accelerate the uptake of newer and more efficient technologies. Energy efficiency certification, labels and marketing programs can also help inform consumers of the energy demands and monetary costs of their purchases. Governments are involved in funding research, development and deployment in a full range of energy efficiency technologies. In consultation with industry and non-government organizations, the government plays an important role in setting standards, codes and regulations for the energy efficiency performance of appliances, homes, buildings, vehicles, industrial facilities and equipment. The regulatory process offers the means to promote both consumer product efficiency standards as well as investment in smart meters for households, microgrids, home solar and small geothermal — all of which positively impact household consumption and utilization rates.

Since savings from energy efficiency investments are potentially so significant, the question needs to be asked why publicly-funded energy programs are even needed. Research indicates that some of the reasons consumers and businesses tend to under-invest in energy efficiency can be traced to a lack of appropriate energy price signals; the lack of information on cost and benefits of energy-saving technologies; as well as to the pervasiveness of energy inefficient, yet still productive capital stock such as industrial and commercial buildings.



Moreover, many small businesses and individuals do not have access to the initial capital outlay needed to acquire and install energy efficient technologies and products, and non-market barriers often make it difficult or impossible to adopt them later. For example, when taxi fleets in Calgary wanted to deploy hybrid taxicabs, an airport regulation prescribing the size of trunks made them ineligible for the lucrative airport trade. Many months passed before this dilemma could be resolved. Similarly, developers, building operators and homeowners frequently encounter inspectors and zoning officials who are unfamiliar with new technologies and tend to impose extra conditions that make it impractical to proceed.

The impact of publicly funded energy programs goes far beyond mere rebates, although these are a valuable tool to secure initial participation by both equipment suppliers and end-users. Knowledge transfer and updating rules and regulations to meet the new needs of a transformed marketplace are critically important factors that private businesses and homeowners cannot address alone.



Credit: Encana Corporation

Canada needs a world-leading energy workforce

Establishing Energy Literacy

The committee believes that improving energy literacy among Canadians is essential for our prosperity now and in the future. Indeed, a fundamental goal of this report and our interim report of June 2010 is to highlight the need to increase the energy awareness of Canadians. To this end, the committee has provided a public internet venue for energy stakeholders, governments, utilities and concerned citizens to express their views surrounding energy issues (Canadianenergyfuture.ca).



Canadians Spent \$189 Billion on Energy in 2008



Currently, energy information sources in Canada are spread out among an array of federal, provincial and territorial departments and agencies. At the national level, Natural Resources Canada is a central source of energy information and education, particularly through the Office on Energy Efficiency. In addition, Environment Canada, Statistics Canada and various other departments and agencies regularly provide a wealth of energy related information. The National Energy Board is also a trusted source of energy forecast, analysis, information and statistics. There are also specific initiatives such as the Centre for Energy web-portal, which compiles energy information from across Canada; Let's Talk Energy, a six-year initiative of the Canadian Science and Technology Museums Corporation; and the Energy Literacy Initiative which involves the release of the *Primer on Energy Systems* in Canada to name a few.

There are low levels of literacy in Canada about energy: how energy underpins virtually everything we do in society and, apart from being great energy producers in Canada, how we are huge energy consumers. That information is generally not available...³⁹

Peter Boag
President, Canadian Petroleum Products Institute

Canadians also learn about energy issues through word of mouth, newspapers, blogs, television and other media. It can be provided in workshops, conferences, publications and exhibits. As information can come in many forms and multiple sources, the consistency, credibility and unbiased nature of energy information, and the establishment of a key point of reference, becomes a key concern.

The committee recognizes that energy information and awareness is one of the priority action items leading to the federal, provincial, territorial Energy and Mines Ministers' Meeting scheduled for September 2012 in Charlottetown, Prince Edward Island.



It's Time for a Canadian Energy Information Agency

The committee considers it a key priority for the federal government, along with interested provincial and territorial partners, to consolidate energy information from existing sources and establish a Canadian Energy Information Agency modeled after the U.S. Energy Information Agency. The proposed Agency would be national in scope, with a mandate to collect, analyze and disseminate independent energy information to Canadians, policymakers, and various energy stakeholders. It would also provide systematic lifecycle analyses.

This Agency would also disseminate reliable information on Canadian energy to the rest of the world.

PRIORITY #5 — FRAME A STRONG STRATEGY FOR ENERGY EMPLOYMENT

For energy nation pursuing global leadership in responsible energy production, Canada needs a world-leading energy workforce. Some witnesses cited impending labour shortages as the single biggest impediment to Canada's economic growth. It has been reported that the lack of workers in the oil and gas sector has caused rising production costs and even postponed projects. As the country undergoes a dramatic demographic transformation with the baby-boom cohort starting to leave the workforce, we are beginning to experience labour shortages, particularly for skilled workers in the energy sector. For example, over 114,000 job vacancies will likely emerge in Alberta alone over the next decade. Governments must work proactively in this area to ensure that we are recruiting and training the workforce that we need.

Where Governments Can Find Solutions

For the most part, employment and labour relations fall within the jurisdiction of the provinces which are in charge of workforce training, education, professional credential designation and recognition. The federal government has authority over certain labour matters including immigration policy, employment insurance, Aboriginal employment and skills development financing.⁵² There are also areas where cooperation amongst governments is required, such as:

(a) Labour Market Agreements

Labour Market Development Agreements (LMDAs) are bilateral agreements between the federal government and the provinces and territories. Through these agreements, the federal government provides funding that enables provinces and territories to deliver skills and employment training programs.

The Agreement on Internal Trade (AIT) was signed in 1994 by the federal, provincial and territorial governments. Chapter 7 of this agreement makes it easier for people, investments, and services to move across Canada. Approximately 20 percent of workers in Canada work in regulated occupations or trades.⁵³ Common barriers to labour mobility are: (a) residency requirements, (b) occupational licensing, certification and registration, and (c) differences in occupational standards.

We need a good system of national standards so we have mobility so the people trained in Nova Scotia or Newfoundland or Quebec or Alberta can move to other parts of the country freely and readily and be recognized and certified. Those are the things that we need for Canadians.⁵⁴

Ken Webb
Vice-President, Academic of Red River College



The committee recognizes that AIT has fostered labour mobility, but so too have federal and provincial labour minister forums that have been specifically organized to push for pan-Canadian recognition of professional qualifications.

The committee strongly supports ongoing efforts to remove remaining barriers to labour mobility.

(b) Aboriginal Opportunities

While the rest of the country — and especially the energy industry — faces looming shortages of working age people, 400,000 Aboriginal youth will be eligible for the workplace between 2012 and 2020. This represents a highly valuable potential source of skilled labour. The federal government is assisting Aboriginal communities to prepare working age citizens for resource sector work. The Honourable John Duncan, Minister of Aboriginal and Northern Development, told the committee that the focus today is on getting people through secondary education. The 2012 federal budget provides \$275 million over three years to support First Nations' education and training and improve incentives for their labour market participation. The committee is of the opinion that Canada will be hard-pressed to meet labour demands of resource developments in remote places without more effectively mobilizing the Aboriginal workforce.

(c) Immigration

Immigration is a key lever for Canada in meeting its labour challenges in the energy sector. The federal government has designed a number of programs to attract foreign skilled workers and immigrants to targeted sectors. Provinces have raised concerns about the backlog of applicants with the Federal Skilled Worker Program and the approval wait times. Concerns have also been raised about the Provincial Nominee Program that allows a province or territory to nominate workers that have the skills, education and work experience necessary to make an immediate impact on the economy, but some provinces have criticized the program's regional variable caps as being too low. In its 2012 budget, the federal government committed to modifying the Provincial Nominee Program to improve employer access to foreign workers.

(d) Trades and Apprenticeship

The federal government provides apprenticeship grants of up to \$4,000 in taxable non-repayable grants to apprentices registered in designated Red Seal trades. Two types of taxable grants are available to registered apprentices: the Apprenticeship Incentive Grant (\$1,000 per year, up to a maximum of \$2,000 per person subsequent to completion of first or second year level of an apprenticeship program) and the Apprenticeship Completion Grant (a maximum of \$2,000 available subsequent to apprenticeship training and receipt of journeyperson certification in a designated Red Seal trade).

Human Resource and Skills Development Canada funds sectoral councils such as the Petroleum Human Resources Council, the Electricity Sector Council and others through its Sectoral Partnership Initiative. Sector councils are permanent organizations made of multiple stakeholders to address labour issues and industry-specific concerns. The federal government provides additional funding to sectoral councils to sponsor specific labour initiatives such as the Career Focus Initiative Project, an Electricity Sector Council's initiative providing on-the-job training and mentoring for young adults.

Nevertheless, continuous improvements to all these programs are needed because Canada risks falling behind in its global search for skilled labour, especially in the energy sector.



PRIORITY #6 — STRENGTHEN THE FOUNDATION FOR ENERGY INNOVATION

Innovation brings forth solutions through the creative use of knowledge, and its vitality depends on talented and motivated individuals with access to advanced technology and financial support. Technology is the means of transforming energy resources into energy services. For instance, technology enables oil deposits to be extracted, upgraded, and then refined into marketable gasoline for vehicular mobility.

Our underlying thesis is that we can do good things for energy and the environment, and do so in a business-like way...⁵⁵

Vicky Sharpe
President and Chief Executive Officer,
Sustainable Development Technology Canada

Witnesses were united in viewing the realization of Canada's full potential for future prosperity as being dependant on the effective optimization of innovative forces throughout the energy system's value chain from production and distribution right through to consumption. As David Stewart-Patterson of the Conference Board of Canada told the committee, *"we have expertise in this field, and because it is such a big chunk of our economy, we should be using that expertise. As we talk about how to apply Canadian ingenuity to promote economic growth and innovation within our economy, that is clearly one of our strengths in terms of knowledge areas. If you look at the evolution of energy technology in this country, the growth has been astounding."*⁵⁶

Technology and Innovation Commercialization in Canada

According to the Energy Policy Institute of Canada, almost all of the world's energy R&D is undertaken in International Energy Agency (IEA) member countries. Canada's overall 4% share of the two-year average can be compared to its 11.5% overall share of total energy production from IEA member countries. The current method of measurement of investment does not, however, take into account the amount invested by energy companies in their laboratories and in field experiments, an amount estimated at \$1 billion annually.

It's a long, laborious path from idea to commercialization; even when a commercially viable energy technology exists, it can still take years before it is deployed. Witnesses stressed that sustained long-term investment commitment is needed in energy R&D by both the private and public sectors. Skilled researchers and other workers must have reasonable expectation that their work will be supported, and that they can build a career developing new energy technologies in Canada. Currently, most of the federal government's direct support for R&D activity is provided through short-term programming such as the Clean Energy Fund and ecoENERGY Innovation Initiative. These programs have a horizon of five years, which is much too short when energy technology can take decades to develop. It should be noted that the federal Program of Energy Research and Development (PERD), which supports Canadian laboratories, provides roughly \$55 million on a permanent basis per year.



Senators visit CanmetENERGY facility in Devon, AB

Another successful initiative funded by the federal government is Sustainable Development Technology Canada (SDTC). SDTC focuses on helping Canadian entrepreneurs take their innovative technologies and expertise to global markets. In its 2010 *Go To Market* report, it identified over 300 companies whose commercialized products and services have the potential to contribute positively to export trade and reduce greenhouse gases through energy production and consumption. The committee urges the federal government to ensure that this initiative continues and to consider whether it should focus more resources in this field.

“We Can and Must Do Better”

A vibrant energy technology sector should stimulate new wealth-creating “innovation clusters” that span industry, government and academia. Called by some a “self-fulfilling prophecy,” such clusters attract the best talent from within and without Canada to study and work. Made-in-Canada solutions like carbon capture and storage (CCS) and Steam-Assisted Gravity Drainage (SAGD) for the oil sands will assist in earning the social license to operate for energy-intensive Canadian producers and will improve Canada’s international reputation.



Credit: Atomic Energy Corporation Limited

The nuclear industry in Canada employs over 70,000 people

The Canadian energy sector is a major user of and large investor in technology. On the whole, however, the Canadian energy sector lags behind other industries with regard to research spending intensity.⁵⁷ The Science, Technology and Innovation Council in its 2010 *State of the Nation Report* cited Canada's relatively large energy extraction sector as being the main reason why Canada ranks low overall in business R&D compared to other nations. Part of the problem may be due to underreporting, as research expenditures classified as "ongoing engineering" are inadmissible for tax treatment. Another reason for relatively low energy sector R&D investment is that energy products require less R&D than knowledge-based products from, for instance, the telecommunications sector. (Nuclear energy technology is, of course, a notable exception.) Moreover, a large part of energy sector innovation is embedded in the capital equipment purchased, often from other countries, by energy producers and users.⁵⁸ Still, there is no question that Canada is a world leader in many energy fields, including hydrogen fuel cell technology, cold weather applications of wind energy, hydropower, offshore drilling and liquid natural gas vehicles. The committee feels we can and must do better.

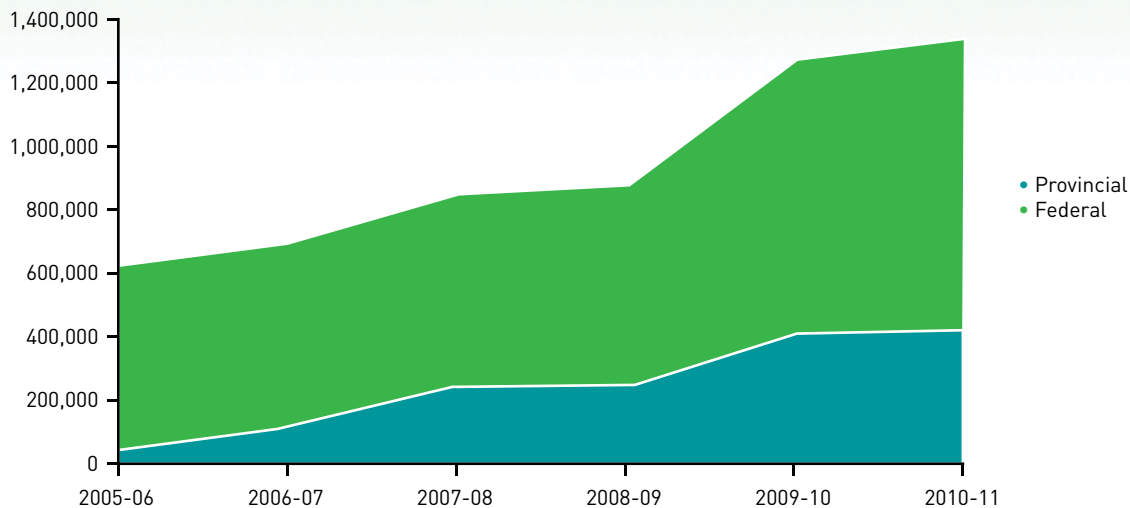
Government is a Major Supporter of Canadian Innovation

Federal and provincial governments have in-house scientific expertise, laboratories, direct funding programs, financing programs, tax incentives and other programs to help assist energy research and development and the commercialization of emerging energy technologies. While private sector energy R&D investment has historically been twice the size of public R&D funding, federal energy R&D spending is often the primary source of funding for basic research and a catalyst for emerging technologies.⁵⁹ Energy innovation leadership hinges on the ability to leverage Canadian research, especially at the university level, through to development and commercialization. The committee therefore strongly supports the Government of Canada's Industrial Research Assistance Program (IRAP) and encourages a focus on energy technologies.



Canada: Energy Research Development and Deployment

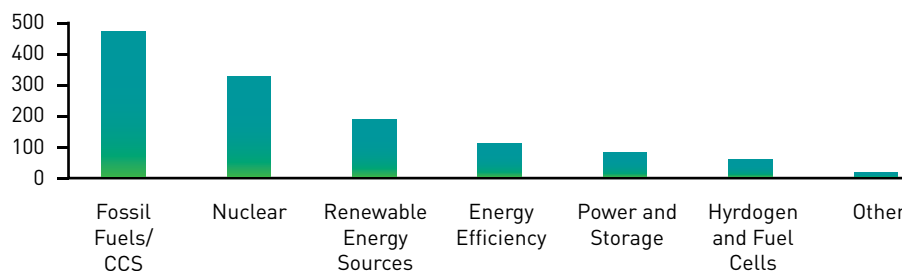
(\$'000)



Source: Natural Resources Canada⁶⁰

In 2010-11, the level of federal R&D spending was nearly two and half times the combined spending of all the provinces. In 2010, the largest recipient of R&D public funding was the non-renewable fuels industry, largely for carbon capture and storage technologies, followed by nuclear energy, renewable energy and energy efficiency. Federal research and development policy and planning in this area are led by Natural Resources Canada. This department works with other federal departments, agencies and outside stakeholders in developing R&D energy policy.

Canada: RD&D Funding 2010 \$millions



Source: International Energy Agency⁶¹

The Need to Revise Energy-Directed R&D Funding

Some witnesses have pointed out that with limited federal funds, the focus is on equity in regional funding allocations rather than technology priority pathways. There was a fear that public R&D funding was being spread too thin, whereas it should be focused on targeted priorities based on what we do best,



where we have a competitive advantage, or what we can leverage from our existing manufacturing base. Also, the placement of funding priorities should be guided by unique Canadian needs such as the oil sands or northern development.

The committee agreed that federal energy-directed R&D funding requires regular revision so as to adjust priorities to change, and that the revision be communicated effectively to the private sector, research groups and other energy R&D stakeholders. Other witnesses cautioned against the use of programs aimed at picking technology winners and losers — particularly when considering technology deployment (i.e., what goes to market). They argued that the government should focus on performance-based incentives, instead of technology-based ones. The position argued that, with respect to R&D, the government should restrict its role to funding projects on the basis of their relevance. The marketplace must be the ultimate arbiter of what types of technology are developed to meet these goals.

Examples of Current Successful Energy Innovation Projects

Carbon Capture & Storage

Some witnesses consider carbon capture and storage (CCS) as one of the few technologies available that can abate carbon emissions on a large scale. There are many different methods of CCS, but the most common being explored in Canada is geo-sequestration. This method entails capturing carbon emissions from industrial facilities, such as a coal-fired electricity plants or oil sands upgrader facilities, and then injecting the compressed emissions underground for storage. The feasibility of carbon storage is limited to regions that have the appropriate geological formations. Western Canada offers excellent opportunities for CCS because coal generation and oil sands production are located relatively near large storage sites that have depleted oil and gas reservoirs. The Weyburn-Midale CO₂ project is a good example. The project involves the injection of carbon dioxide from a North Dakota gasification plant into a depleted oilfield near Weyburn, Saskatchewan, thereby extending its production life. The recycled CO₂ is permanently stored and monitored after the enhanced oil recovery period is completed.

Biofuels

A Nova Scotia-based company, Ocean Nutrition, discovered a unique strain of algae promising to be 60 times more productive in making oils than other types of algae. At the same time, algae absorbs carbon dioxide. Sustainable Development Technology Canada (SDTC) is helping to fund Ocean Nutrition's research through a four-year demonstration project aimed at scaling up the fermentation process that will allow for larger scale production of algae jet fuel.

Hydrogen Fuel Cells

Canada is a world leader in hydrogen and fuel cell technologies with industry-leading capabilities in hydrogen production, purification, distribution, storage and fuelling and fuel cell systems.⁶² The market focus of the industry is split amongst three broad categories: 1) hydrogen production and fuel infrastructure; 2) stationary applications to produce electricity; and, 3) mobile applications (including hydrogen fuel cell powered vehicles, hydrogen internal combustion engines, hydrogen compressed natural gas vehicles and related technologies).

Ocean Energy

The Fundy Ocean Research Centre for Energy (FORCE) in the Bay of Fundy, Nova Scotia, is a test centre for tidal energy technology that enables developers, regulators, scientists and academics to study the performance of tidal energy turbines. The infrastructure will consist of three berths where test turbines are housed and connected by submarine cable to grid. On the West coast, Canada's first tidal in-stream turbine demonstration project, with a capacity of 65 KW, has been installed at Race Rocks, British Columbia.



Harnessing the power of the tides

District Energy

District energy facilities produce steam, hot or chilled water, and are typically located in urban settings. District energy systems are similar to electric systems, but instead of electricity they provide thermal heat or cooling via water. This is done by heating or cooling water in a central location, then piping the water through a closed loop underground distribution system to nearby commercial, institutional or residential buildings. District heating systems can also capture the waste heat from industrial operations for water heating purposes. District energy eliminates the need for each building to have its own boiler, furnace, or air conditioner, thereby increasing energy efficiency and reducing carbon emissions. District heating systems have a presence in many communities throughout Canada and can decrease building capital and maintenance costs. The committee was impressed by the ENMAX Calgary Downtown District Energy Centre when it visited this facility in early December 2011.



The ENMAX District Energy Centre is located in Calgary, AB



PRIORITY #7 — PURSUE HIGH-LEVEL ENVIRONMENTAL PERFORMANCE OF NON-RENEWABLE ENERGY SOURCES

Modern industrialized societies have a heavy built-in structural reliance on fossil fuels, the most significant source of carbon dioxide emissions. This reliance is associated with long-lived infrastructure and distribution networks.

The committee supports the Canadian energy sector's ambitious goal of environmental performance leadership in non-renewable energy resource development. The subject of environmental performance is broad, including the measurement of ecologically adverse impacts of energy sector activities on water, land and air.

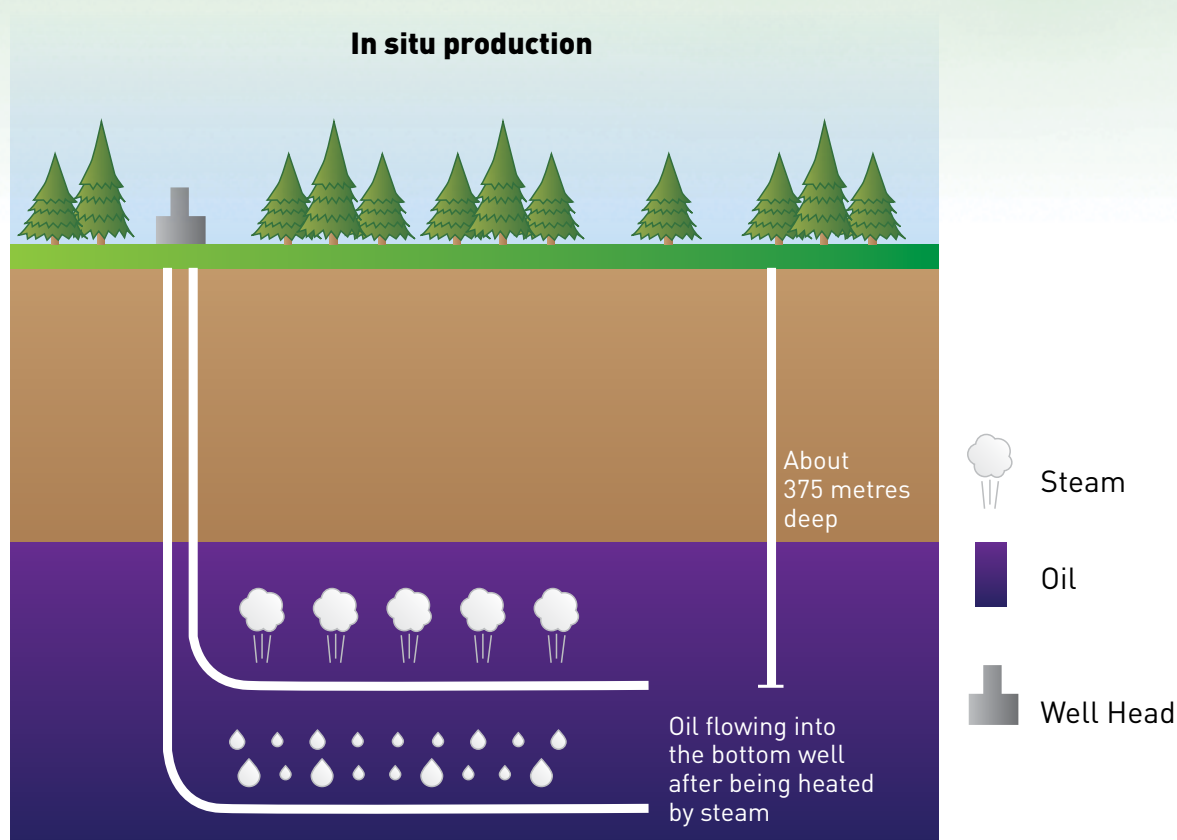
The Oil Sands Must Improve their Environmental Performance

Canada's oil sands have been referred to as the largest industrial project in the world. At 174 billion barrels, they represent the third largest oil reserve in the world, after those in Saudi Arabia and Venezuela. As technology evolves, this reserve estimate could rise to over 300 billion barrels. Over the next 25 years, oil sands development could contribute up to \$4.7 trillion to Canada's gross domestic product, creating tens of thousands of jobs per year.⁶³ The oil sands initially began as an innovative and technical solution for extracting crude oil from bituminous sands in the 1960s. As time advanced, so too have technologies and awareness of the environmental impact of industrial development.



Over the next 25 years, oil sands development could contribute up to \$4.7 trillion to Canada's GDP

Since 80 percent of the oil sands are too deep to be mined, much of the oil sands resource is only recoverable through *in situ* drilling techniques. But regardless of how it is produced — by mining or *in situ* — great amounts of water and natural gas are needed. This aspect of the oil sands has been capturing global attention, but many witnesses have pointed out that this attention is widely disproportionate to the actual impact of the oil sands on the environment.



Source: Natural Resources Canada

Much disinformation has been circulated. For example, some activists have claimed that the oil sands are or will destroy massive tracts of boreal forest. The fact is that only 602 km² had been disturbed by mining operations as of March 2009, and even a full build-out would affect just 4,800 km², as was clearly stated by the Royal Society of Canada in its report, *Environmental and Health Impacts of Canada's Oil Sands Industry*. To put this number in perspective, 4,800 km² is about two-thirds the size of greater Toronto metropolitan area. The James Bay Hydropower Project permanently flooded 9,715 km².

Industry, governments and stakeholders are now working together to address the environmental performance issues arising from oil sands development, but more needs to be done. Processing tailings and accelerating land reclamation remain issues. The federal and Alberta governments have collaborated to initiate a world-class monitoring program for the oil sands region. The program will integrate all environmental components — air quality, water quality, water quantity, aquatic ecosystems, terrestrial biodiversity and habitat — and will address cumulative effects. Data will be made publicly available and peer-reviewed periodically. Still to be determined is how the program will be administered.

Other areas that are increasing the sustainability of oil sands production have been indicated by Carmen Dybwad of the Canadian Energy Research Institute, “*Vapour extraction; toe-to-heel air-injection (THAI); electro-thermal dynamic stripping; optimized SAGD; solvent assisted SAGD; cold solvent process; in-situ upgrading; enhanced solvent extraction process; and wedge wells. Not only do these bitumen extraction technologies have the potential to decrease water consumption, they will also decrease the use of natural*



gas and natural gas emissions of GHGs. As a result, they will decrease the total supply cost of oil sands production.”⁶⁴

Technological Innovation May Change Coal’s Uncertain Future

Canada has an abundance of coal, estimated to be nearly nine billion tonnes of proved coal reserves, enough to last 100 years. Over half of its production is used domestically for electricity generation and various industrial applications; the remaining production is exported. Canada also imports coal, primarily for electricity generation, as well as for metallurgical applications. Coal is second only to oil as the most relied upon source of energy used today in the world, a position many predict will be maintained for decades. Its staying power as a critical energy source is due to its affordability, reliability, abundance, broadly distributed reserves across the world and high-energy intensity.



Credit: Sherritt Coal

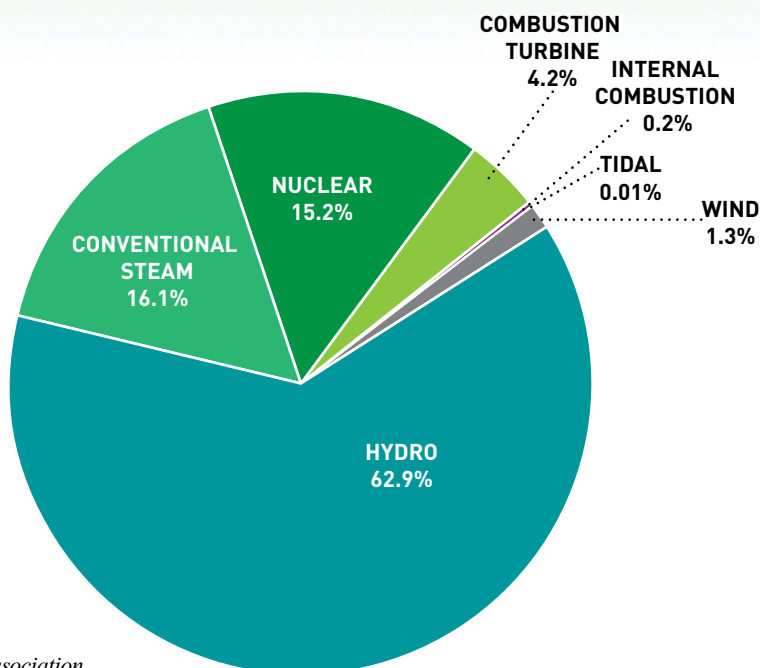
The Genesee mine is located near Edmonton, AB.

Coal consumption may eventually decline in Canada as a result of environmental policies, but it could also continue to thrive with the development of new technologies aimed at reducing emissions such as carbon capture and storage, supercritical plants and coal gasification. Canada has 51 coal-fired power units, 33 of which are coming to the end of their economic life by 2025. Coal-fired plants are responsible for 13% of GHG emissions in Canada or 73% of the emissions from the electricity generating sector. It was therefore the first sector to attract proposed federal regulations to reduce emissions expected to come into force by 2015. The regulations are setting out performance standards for new coal-fired plants and for those that have reached the end of their useful life. The standards will be based on parity with emissions of high-efficiency natural gas generation and will promote the adoption of energy efficient and carbon abating technologies.



PRIORITY # 8 HYDROPOWER SUPERPOWER: ENERGY OF THE PAST FOR THE FUTURE

Canada: Electricity Generation in Canada by Fuel Type 2011 (TWh)



Source: Canadian Electricity Association

Canada is one of the largest producers of hydropower in the world. Roughly 63% of Canadian electricity is produced through hydro.⁶⁵ Hydro is a reliable low-emitting large-scale source of energy, utilizing proven technology. Hydropower is primarily used to meet base-load demand because of its relatively low operating costs and energy storage characteristics.



Canada is one of the largest producers of hydropower in the world



The committee believes that hydropower is a key priority for the country and every opportunity for its responsible expansion must be undertaken. Provinces with large hydroelectric profiles can utilize the storage advantage of hydropower in the trade of electricity with other jurisdictions. Energy can be stored in reservoirs during off-peak demand when wholesale electricity prices are low and then released during peak demand periods when prices are high. Most importantly, where it displaces fossil fuel production of electricity it can make a significant contribution to reducing GHG emissions.

Large-scale hydro projects are under consideration in Manitoba, Newfoundland and Labrador, Quebec, British Columbia and Northwest Territories. There is also potential for further development in medium to small hydro and “run-of-river” developments in British Columbia, Ontario and Quebec. Particularly bullish about the prospects for Canadian hydropower was Jacob Irving of the Canadian Hydro Power Association, who told the committee: *“we are one of a few lucky places on the planet that can lay claim to being a net energy exporter of all different forms. We have two strong energy pillars in Canada. One is our hydrocarbon pillar; our oil and gas reserves; the other one is hydro power [...] There are many challenges to get there, but when you think that Canada has nine percent of the water on the planet stretched over the world’s second-largest land mass, it stands to reason that we have a lot of hydro power potential within this country, and we have not touched it all yet.”*⁶⁶

British Columbia, Manitoba and Quebec are actively exporting electricity to the U.S. markets, and the Atlantic provinces are collaborating to develop an interconnected grid that would include access for power from the Lower Churchill Falls to the U.S. There are long term opportunities to grow electricity export markets in the United States since many U.S. utilities have adopted renewable energy portfolio standards requiring increased renewable energy in their energy mix. Currently, large hydro does not qualify as renewable energy under many U.S. renewable energy portfolio standards, but there are signs that this policy is changing as the U.S. moves to address GHG emissions.

PRIORITY # 9 — FOSTER RENEWABLE FUELS

Renewable energy is an energy source that can be naturally replenished or renewed within a human life span. In developed countries, the most common product of renewable energy sources is electricity. Canada has substantial renewable energy resources due to its vast and diverse geography, including massive supplies of water, wind, solar, geothermal, biomass and marine energy.

*Whether that is wind, geothermal or whatever it happens to be, I think that would be the single, most potent policy you could put in place to help in the adoption and transition towards renewable energy.*⁶⁷

Jonathan Barry
President, Seaforth Energy

Many initiatives around the world have advanced the development of renewable energy largely in response to a need to address greenhouse gas emissions and to diversify energy supply. There are renewable energy mandates and targets; market “push” programs that put a price on emissions, and technology “pull” programs such as R&D programs; as well as demonstration projects. B.C. Hydro’s Clean Power RFP and NRCAN’s Canmet ENERGY program are examples of initiatives to develop, implement and market renewable energy forms. The electricity transmission infrastructure requires modernization to unlock the full potential from renewable resources such as wind, solar, hydro or biomass energy. Technological progress is constantly improving the economic attractiveness of private

industry investment in this area. Nevertheless, the committee feels that some of these renewable energy forms like next generation biofuels and solar are still in their infancy and may qualify for needed government support, and in some cases will require the development of appropriate regulations, to get them through this critical development phase.

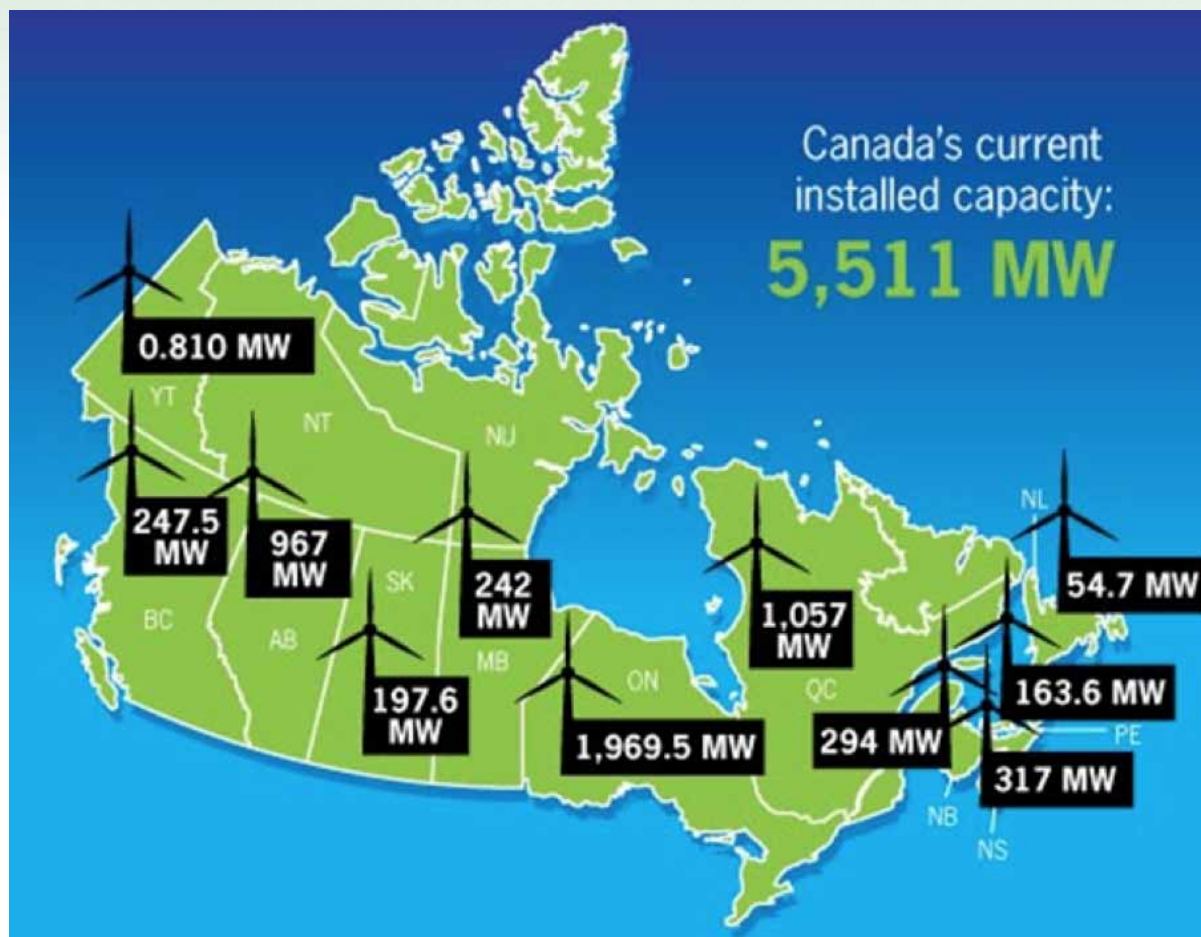
Although some renewable energy forms like next generation biofuels and solar are still not cost-competitive in current mass markets, more and more Canadians are turning to renewables for particular applications. The forest products industry, for example, has adopted biomass as the primary fuel to generate electricity for its pulp and paper manufacturing processes across the country, largely because wood waste is commonly available to its members. A significant number of municipalities now install solar-powered street lamps and it is not uncommon to see solar-powered road signs along any stretch of highway under construction. One company in Toronto has even installed an innovative cooling system based on renewable energy that supplies 30 buildings, including 20 high-rise office towers, two hotels, a hospital, city hall and Queen's Park. These installations may well be just the tip of the iceberg.

Wind: Growing Fast, but Starting Small

Wind energy is a rapidly growing source of energy both within Canada and abroad, owing to the advancement of new technologies, relatively short construction times, declining operating and construction costs, and ongoing efforts to reduce greenhouse gas emissions. While the installed capacity of wind energy is growing rapidly in Canada, Canada's relative abundance of low cost electricity may act as a barrier to the wind energy's rapid advancement, compared to its prospects in other parts of the world. Some witnesses raised concerns that the intermittent nature of wind creates additional challenges in managing and maintaining the stability of electricity systems. Power output from wind sources of high variability can be difficult to predict. In response, other witnesses pointed out that average power output becomes easier to manage when wind turbines get distributed over a sufficiently wide area.



The installed capacity of wind energy is growing rapidly in Canada



Source: Canadian Wind Energy Association

Wind energy is also seen as a complement to hydropower, since water reservoirs can be stored when the wind is blowing and released when there is little or no wind. Some witnesses drew attention to the opportunity for Canada to pursue wind energy more aggressively due to its significant hydroelectric capacity and its proximity to American markets. Advances in energy storage and smart grid technologies are seen as necessary to help mitigate and manage the challenges posed by the intermittency of wind and other emerging energy sources.

A Future for Solar

There are two major categories of solar energy: active thermal and solar electric photovoltaic (PV) systems. Thermal solar energy uses the radiant energy of the sun to heat water or ventilate air for use in buildings. We can develop more energy-efficient commercial and residential spaces by orienting buildings to take advantage of the sun's heat. Solar photovoltaic panels, which consist of cells that transform the sun's energy into electricity, may be connected to the electric grid. Solar thermal can be used to produce electricity by heating water to spin a steam turbine. There are no solar thermal electricity plants in operation at this time but there are studies exploring its potential, especially in Western Canada.



Professor David Keith, Canada Research Chair in Energy and the Environment, University of Calgary, told the committee that although he was enthusiastic about solar thermal in principle, he considered its prospects for significant electricity generation in Canada to be relatively modest.



Solar photovoltaic panels transform the sun's energy into electricity

Chris Young of Enfinity Canada was optimistic about traditional thermal uses when he introduced the Drake Landing Solar Community in Alberta to the committee, describing it as: “...*the first of its kind in North America. It is a master planned neighbourhood of 52 homes, served by a district heating network that is 90 percent fuelled by solar energy. Heat harnessed during the summer is stored underground in boreholes and saved for the winter to serve the homes’ space heating needs. This project was, again, largely thanks to support from the Government of Canada. We understand that this will serve as a demonstration project for a project perhaps 20 times its size within the coming years.*”⁶⁸

Biomass

“Biomass” is the second largest renewable energy source in Canada and refers to any plant-derived organic material — either solid, liquid or gas — available on a renewable basis. Sources include forest biomass, agriculture biomass, municipal solid waste and landfill gas. Historically, biomass was relied upon almost exclusively for winter heating, but technology has expanded its application so that today it is used to produce electricity and transportation fuel, as well as heat in larger building systems or industrial processes. In phasing out the use of coal to produce electricity by the end of 2014, Ontario Power Generation has been exploring options to convert some of its coal-fuelled electricity to forest or agriculture-sourced biomass.

Forest biomass encompasses all parts of the tree including the trunk, bark, branches, needles and leaves. It is considered to be carbon neutral. The prospect for biomass-fired electricity generation has increased as governments consider options for displacing some of the electricity produced from fossil fuels. Some



provinces are testing ways in which coal as a feedstock in electricity generating plants can be replaced by biomass such as wood pellets. Canada is a significant producer of wood pellets.⁶⁹ Nearly 85 percent of pellets produced in Canada are exported, mostly to European countries.

Biofuels Have a Huge Opportunity to Grow

Biofuels such as ethanol from corn and wheat and biodiesel from vegetable oil and animal fat are produced as substitutes for gasoline and diesel. Biofuels are often identified according to their “generation,” based on the maturity of the technology, the level of their GHG emissions and/or the applied feedstock. To date, only first generation biofuels have been produced on a commercial scale. “First Generation” biofuels are based on established technologies from feedstocks such as corn, wheat, sugar cane, sugar beet, canola, palm and animal fats. “Second Generation” biofuels uses the fibrous remains of the plant to create fermentable sugars. “Third Generation” biofuels are derived from algae, but that technology is still at the research phase.⁷⁰



All major oil refineries in Canada now blend ethanol and biodiesel

The exponential growth of the biofuels sector over the past decade owes much to the federal and provincial governments working together with renewable fuels producers, agriculture producers and others. With investments of \$2.3 billion towards the construction of new production facilities, the biofuels industry generated almost 2 billion litres per year of domestic production capacity or 2% of worldwide biofuels production. Federal and provincial governments can be credited for this development as the introduction of requirements for renewable fuel content in transportation fuels created positive market conditions. Governments also provided capital and operating grant support to help build capacity. All major oil refineries in Canada now blend ethanol and biodiesel.



Geothermal

Geothermal energy is derived from the natural heat produced within the earth. Geothermal energy can be captured and used in three ways: steam-generated electricity, steam-sourced energy for heating and heating/cooling via geo-exchange. The third type, geo-exchange, involves benefiting from the temperature differential between below-ground temperatures and the outside air or groundwater to heat and/or cool buildings. Geothermal takes advantage of the ground's heating and cooling properties to heat or cool entire buildings. This heat 'exchange' between the ground and the building is accomplished by using standard pump and compressor technology.

The committee was told that geoexchange technology can save the consumer up to 70% on heating bills because it transfers existing heat without combustion. Geoexchange systems are clean and safe and witnesses felt that there was tremendous opportunity for growth in geoexchange units.

Higher temperature geothermal resources with the potential for electrical power generation and thermal energy applications are mostly found in western regions of the country. The high capacity factor of geothermal power makes this energy source an attractive renewable base load electricity supply option, especially in northern regions. However, there are no geothermal power plants in operation in Canada. Some witnesses cited obstacles such as sizable costs and risk associated with deep geological drilling, lack of geophysical survey information and in some cases the lack of regulatory frameworks for permitting geothermal wells.

Going Forward with Renewables

It is difficult to measure the true potential of renewable fuels since they don't lend themselves to quantification as easily as conventional coal reserves, for example. Part of the conundrum is the fact that implementation technologies are evolving even as we begin to deploy our renewable resources. What was impractical just a decade or so ago in many cases may be feasible today. Installed wind capacity, for instance, has experienced a 3,000% increase since 1993 partly due to interconnection and dispatch improvements.

Well-timed, strategic investments can help foster the use of renewable fuels. Modernizing Canada's electric grid will pay dividends on many levels, including the integration of a number of renewable fuels into our overall energy mix. Focusing R&D on urban energy pathways would also stimulate the adoption of innovative applications. Continuing to amass targeted energy resource data will further help. Efforts to promote energy literacy and supporting leading edge demonstration projects will similarly boost deployment of new technologies.

According to the International Energy Agency (IEA), renewable energy deployment has been expanding rapidly. Growth rates are broadly in line with those required to meet the levels required in IEA projections of a sustainable energy future. To achieve our goal as the most energy productive nation in the world, Canada needs to meet or exceed international performance standards.



PRIORITY #10 — REGULATORY REFORM

The committee heard from many witnesses, including members of both provincial and territorial governments, who believed that the design of Canada's environmental assessment regime needed to be streamlined. These witnesses were concerned that the then current regime was unnecessarily complex, burdensome, and caused uncertainty and delay without assuring additional environmental safeguards. This view was shared by Jacob Irving, President of the Canadian Hydropower Association, "*we have issues in realizing our untapped potential and realizing our development. Many of them do boil down to regulation at the provincial and federal level. It can be complex and uncertain for our developers across Canada.*"⁷¹ There even was some suggestion from the environmental community that there were inefficiencies in the system and spending money wastefully on environmental assessment was counter-productive.

Many witnesses held the view that the different environmental assessment regimes in Canada had evolved with little consideration of their interaction. Project reviews had involved separate federal departments with multiple claims on the environmental assessment process. In some cases, a project may have been subject to virtually the same environmental assessments from federal and provincial governments.

Two years ago, the federal government moved to streamline its own process by reducing the number of decision makers from forty to three.

"One Project, One Review"

At the Canadian Energy and Mines Ministers' Conference in Kananaskis, Alberta, in July 2011, regulatory reform was identified as a key priority in the discussion concerning a national energy strategy. It was agreed that the long term goal of governments was "one project, one review", within a clearly defined period. The achievement of this goal would require the implementation of system-wide improvements.

In moving forward with the "one project, one review" objective, the 2012 Federal Budget announced reforms to modernize the environmental assessment process. The reforms are wide in scope and address many concerns raised by witnesses during the committee's deliberations. It simplifies the current multiple assessment process by moving to only two kinds of reviews: a standard environmental assessment and a review panel. It sets out specific maximum timelines for both one year for standard environmental assessments and two years for review panels, thereby introducing more predictability to the process.

Moreover, the reformed structure moves away from multiple regulatory bodies and consolidates responsibility over environmental assessments with the Canadian Environmental Assessment Agency, the Canadian Nuclear Safety Commission and the National Energy Board, within their mandates.

In the past, environmental assessments could be initiated regardless of the size or scope of the project. Many small projects underwent a full federal environmental assessment even when they posed little or no risk to the environment. Federal reforms address this issue by reducing the number of assessments for small projects and in return it frees up resources to address major projects that have larger environmental implications.



We believe strongly that there is a significant opportunity for better cooperation between the federal and provincial governments. In many cases there is no need to do the same assessment twice but with a slightly different set of questions. In essence, it is the same work twice. We have heard that there has been significant delay, and often it is because the federal government is not as able to be as timely.⁷²

Shirley-Anne George,
Senior Vice President,
Policy for the Chamber of Commerce

By way of substitution and equivalency provisions, the reforms allow provincial level environmental assessments which meet Canadian Environmental Assessment Act requirements. Witnesses had supported more cooperation between jurisdictions.

Reforms also increase the level of penalties and introduce enforceable assessment decision statements to ensure project developers comply with measures to protect the environment. Federal inspectors have the authority to perform inspections to ensure that project developers meet the conditions of the decision statement.

The committee supports this initiative to improve efficiencies in regulation at the federal level and urges the federal government to employ the new framework in such a way that it demonstrates global energy leadership. Canada's international credibility relies upon it.

Aboriginal Partnership, Engagement and Consultation

The committee heard many witnesses express frustration with the current Aboriginal consultation process, in part because of a lack of timelines and the lack of clarity with respect to the Crown's (or the project proponent's) responsibilities around consultation. As mentioned in a preceding section, Shawn A-in-chut Atleo, National Chief of the Assembly of First Nations, considered the process flawed as it often forced Aboriginal peoples to take matters to litigation when the environmental assessment process appeared to inadequately consider Aboriginal and treaty rights.

The reforms to environmental reviews in the 2012 Federal Budget include several measures to improve this consultation process, such as establishing protocols or agreements with Aboriginal groups to clarify expectations as well as to set the level of consultation for project reviews. The committee feels strongly that, with respect to resource development projects, the federal government must continue its efforts to improve the interaction between Aboriginal groups, industry, and federal and provincial authorities.



PRIORITY #11 — GUIDE RESPONSIBLE NORTHERN AND ARCTIC ENERGY EXPLORATION & DEVELOPMENT

Canada's Northern and Arctic regions contain vast untapped resource endowments including minerals, metals, oil, natural gas and gas hydrates. The development of these resources may reshape the country's energy landscape and has the potential to create tremendous economic and social benefits for Northerners, Aboriginal peoples, and all Canadians. The committee considers responsible development of Canada's Northern and Arctic resources to be a vital priority.

Though Northern Canada, defined as regions above the 60th parallel, accounts for roughly 40% of Canada's total land mass, much of the landscape and seabeds have yet to be geologically mapped out and explored. This region includes the continuation of the oil and gas rich Western Canada Sedimentary Basin up to the Beaufort Sea and into Canada's Arctic offshore basins. It is estimated that the North holds up to one third of the potential for conventional oil and natural gas in Canada.

Robust prices for oil and natural gas liquids have been a positive force driving the renewed global private sector interest in Canada's rich northern oil and gas resources. Holding up to one third of Canada's potential for conventional oil and natural gas, oil and gas and exploration and development activity in the North is showing real signs of progress, a progress that promises to bring durable economic benefits to all northern residents.⁷³

Honorable John Duncan, Minister of Aboriginal Affairs & Northern Development



Resource Knowledge: Oil and Gas



Geoscience Knowledge - Oil and Gas

■ Information meets Modern Standards ■ Partially Understood ■ Outdated, Inadequate Information

June 2007

Source: *Aboriginal Affairs and Northern Development*

Hydrocarbon extraction in the North dates back to 1920 with the discovery of oil at Norman Wells in the Northern Territories, where production continues right up to today. Following the oil price shocks of the 1970s, Canada's Northern region played an important, but short-lived role in the federal government's strategy to enhance the country's ongoing energy security.

Increased Activity Entails Increased Responsibility

In recent years, the Northern and Arctic regions have seen a resurgence of global investment activity. Minister of Aboriginal Affairs and Northern Development, the Honourable John Duncan, told the committee that many oil and gas companies have acquired land and offshore interests in the region, and are undertaking exploration activities.

These developments are occurring in the wake of climate change and corresponding rapid increases in northern surface temperatures along with a shortening of ice-forming seasons. These environmental changes are opening previously inaccessible regions and increasing new options for marine transport that may influence global shipping routes.



While investors are attracted to the vast resource potential of the North, they face many obstacles, including higher operating costs and lack of supporting infrastructure. Also, exploration and production operations are subject to harsh environments, requiring additional precautions and robust emergency response capabilities in all seasons. The successful management of the health and safety risks associated with energy production in the harsh and fragile environments of the North depend upon a commitment to continuous improvement in best practices and technology.

From a public policy perspective one of the main overarching challenges is the need to balance economic opportunities with the imperatives to protect the region's fragile ecology and to respect the communities of Northerners and Aboriginal peoples, for whom the land and the Arctic waters are the basis for their food, income and culture.

Unlocking Wealth through Regulatory Reform

The federal environmental assessment process in the territories is distinct from those of the provinces. For the most part, environmental assessments are administered through regimes established in comprehensive land claim agreements, some of which have been codified in law. These regimes are set out in *The Yukon Environmental & Socio-Economic Assessment Act* (Yukon Territories); *Mackenzie Valley Resource Management Act* and *The Inuvialuit Final Agreement* (Northwest Territories); and *The Nunavut Land Claims Agreement* (Nunavut Settlement Area). In some cases the *Canadian Environmental Assessment Act* applies to projects in the territories.

In some northern regions, the environmental assessment process is characterized by multiple regulatory authorities. The Honourable David Ramsay, Minister of Industry, Tourism and Investment of the Northwest Territories, told the committee that exploration activity was declining despite the existence of substantial resources. The Minister cited the complex regulatory process and two unsettled Aboriginal land claims which are creating uncertainty for investors in the Northwest Territories.

Resource development is seen as a critical economic driver that can raise living standards in the North. Land claim settlements have led to immediate improvements in resource development conditions, particularly in the Yukon and Nunavut. The removal of redundant environmental regulatory barriers as well as the settling of remaining land claims in the Northwest Territories could help to unlock enormous resource wealth and lift its economic prospects.

Geopolitics of the North

The Arctic, seen by some as the earth's "last frontier", still lacks a formal framework for its government. Sovereignty over the North Pole as well as much of the Arctic Ocean has yet to be settled, although the claims of various countries rest on the still indefinite geology and extension of the region's continental shelves. Moreover, Canada and the United States do not agree over the territorial boundary along the Beaufort Sea where significant oil and gas reserves are believed to exist. Under dispute are also which sea passages qualify as "international seaways", including the "Northwest Passage".

With so much at stake, Canada's federal government must continue its leadership in seeking solutions that will recognize and fortify Canada's legitimate interests over subsurface mineral and energy resource rights in the North and Arctic.



PRIORITY #12 MAINTAIN STRONG SUPPORT FOR CANADA'S NUCLEAR INDUSTRY

I believe in nuclear power. I think it is a great source of energy. I think it is something that we should encourage more in Canada.⁷⁴

Hon. Richard Brown,
Minister of the Environment, Energy and Forestry,
Government of Prince Edward Island

Canada looks back on 60 years of nuclear innovation and development. Ontario, Quebec and New Brunswick have nuclear facilities that together constitute almost 15% of the country's total electricity generation, and over 55% of Ontario's electricity. All nuclear reactors in Canada are CANDU reactors designed and built by the Atomic Energy Canada Limited (AECL), with 20 in Ontario and one in each of the provinces of Quebec

and New Brunswick. There are also 12 CANDU reactors operating in six foreign countries.

Canada's CANDU Reactors				
Nuclear Station	Province	MWe	In service date	Operator
Pickering A	Ontario	4 x 515	1971-73	OPG
Pickering B	Ontario	4 x 516	1983-86	OPG
Darlington	Ontario	4 x 881	1990-93	OPG
Bruce A	Ontario	4 x 750	1977-79	Bruce Power
Bruce B	Ontario	4 x 860	1984-87	Bruce Power
Gentilly 2	Québec	1 x 635	1983	Hydro Québec
Point Lepreau	New Brunswick	1 x 635	1983	NB Power

Source: Natural Resources Canada

All three provinces with nuclear power-generating units have committed to a future with nuclear energy, albeit in varying degrees. New Brunswick is currently refurbishing its nuclear reactor at the Point Lepreau Generating Station. Quebec has committed to refurbishing its nuclear reactor Gentilly 2. Ontario has ten reactors that will require refurbishment over the next ten years, each of them representing investments of several billion dollars.

Ontario has not yet announced what model will be chosen for the “new build” expansion by Ontario Power Generation (OPG) at its Darlington nuclear power generating station. If it does not choose CANDU technology, it would be a first “foreign reactor model” for Canada.

The nuclear industry in Canada employs over 70,000 people (including uranium mining) in highly skilled, highly paid jobs across Canada. Canada's National Research Universal (NRU) reactor located in Chalk River Ontario is the world's fourth largest research reactor and the largest producer of isotopes for applications in medicine and industry. The NRU reactor has helped Canada become a world leader in materials research using neutron beams, and has also developed leading-edge robotics for remote work on reactors.



A Solid History of Safety

The nuclear industry is one of the most regulated and monitored industries in the world. Canada has a long history of nuclear safety and technology innovation. However, some witnesses expressed unease about nuclear power owing to the potential risk of health and environmental harm and ongoing issues relating to nuclear waste disposal. These concerns became amplified in the wake of the devastating earthquake and tsunami in March 2011 that caused severe radioactive leaks from the damaged Fukushima Daiichi reactors in Japan.

The committee notes that the Canadian Nuclear Safety Commission (CNSC), the federal regulator for the nuclear industry, reacted quickly to widespread concerns triggered by the Fukushima Daiichi tragedy and required all Canadian nuclear plants to “re-examine their safety cases, underlying ‘defense-in-depth’ against external hazards, severe accident scenarios and emergency preparedness procedures and guidelines.”⁷⁵ The task force initiated by the CNSC reviewed all Canadian nuclear operations, the Commission’s regulatory frameworks and lessons learned from the events in Japan. Its report was published on October 28, 2011.



Credit: Bruce Power

Canada has a long history of nuclear safety and technology innovation

Eighty-five thousand used fuel bundles are produced annually in Canada; two million have accumulated over the past 40 years. Owing to the high radioactivity of these used fuel bundles, each reactor site is equipped with temporary storage facilities in which water-filled pools provide a safe area for bundles to cool and radioactivity to decrease. After approximately 10 years, used fuel bundles are typically placed in dry storage containers, silos or vaults.

The responsibility for storing the used fuel lies with the used fuel owners, who have established a trust fund for the purpose of long term storage. Established in 2002, the Nuclear Waste Management Organization (NWMO) investigates ways to manage Canada’s used nuclear fuel, and has been tasked by the federal government to establish a deep geological repository for used fuel. The NWMO has initiated



a multi-year process for selecting an informed, willing community to host this important facility. The committee had been advised that there are several communities in Canada that have expressed interest in engaging in the site selection process. It will take a number of years to assess an appropriate site and work with communities to determine the eventual location of the repository.

A Commitment to Canada's Nuclear Energy Future

The committee shares the conviction of many witnesses that nuclear energy should be part of Canada's energy future. Nuclear energy's capacity to produce large volumes of safe, reliable, emission-free, base-load electricity make it an important element of Canada's efforts to reduce emissions. Professor David Keith informed the committee that he believes that there is no question that nuclear power has to be on the table in a serious way; he argues that we must find a way to make it part of the solution.

The committee also recognizes that the provinces must choose the best nuclear technology and design on a project-by-project basis in line with their respective energy, economic and financial priorities.

Emerging Nuclear Technologies

The committee believes that a priority should be placed on developing emerging nuclear technologies. Some witnesses talked about the possibility of developing small modular nuclear reactors which could be used in oil sands operations to produce steam for in situ production or, in some cases, for power generation in remote northern regions.

One thing that has been talked about is the ability to have small modular reactors that you would site around in areas where you do not need a big demand or, indeed, you need local sources. The oil sands [are] a great example of that.⁷⁶

Duncan Hawthorne,
President and Chief Executive Officer,
Bruce Power

The committee also heard from witnesses who believe in the game-changing potential of nuclear fusion technology. Nuclear fusion is the mechanism that fuels the sun and the stars and may one day provide nearly unlimited source of energy. The challenges are enormous, but progress has been made towards safely harnessing fusion energy for electricity generation. Allan Offenberger, professor emeritus of Electrical & Computer Engineering at the University of Alberta, told the committee that

new laser technology may hold the key to making this goal a reality.



PRIORITY #13 — SPEAK FOR CANADA

The federal government speaks for Canada



Canada is poised to play a larger role in meeting global energy needs by expanding and diversifying its energy markets. As never before in the country's history, Canada is attracting global attention due to its enormous resource endowments. However, if the committee's vision of Canada's energy future is to be achieved, we must successfully engage the world. Many witnesses felt that Canada's energy image was being defined beyond our borders and, at times, with misinformation and even disinformation. The argument was made for the federal government to devote more resources to better and more accurately represent Canada's energy interests on the world stage. To do this with credibility, we must be able to stand on a record of environmental performance of the highest level.

The provincial and territorial governments have, of course, a critical role to play in telling their respective stories and seeking economic opportunities abroad, but, ultimately, the world — and Canadians themselves — look to the federal government to speak for our nation. The committee believes that the federal government must fulfill a leadership role in clearly, accurately and forcefully communicating Canada's energy story to the world.



CONCLUSION

CANADA WILL BE THE MOST ENERGY PRODUCTIVE NATION IN THE WORLD WITH THE HIGHEST LEVEL OF ENVIRONMENTAL PERFORMANCE.

During the three short years of this energy study, the world has witnessed dramatic changes in the energy sector. Multi-stage hydraulic fracturing (fracking) of shale gas and tight oil has taken on a life of its own, and altered the future of global energy supply drastically. Canada is confronting the implications of having a single energy purchaser, the United States, which is on the verge of achieving energy independence. In addition, greenhouse gas emissions are of great public concern and must be dealt with responsibly and effectively. In order for Canada to become the most energy productive nation in the world, it must meet current challenges with agility and speed, relying upon the complete range of traditional and alternative energy sources while maintaining a high level of environmental performance.

If Canada is to successfully meet these challenges, there is an urgent need for us to change. Change means diversifying our markets. Change means innovating. Change means consuming energy efficiently. Change means improving our environmental performance. Change means earning social license. Change starts with each of us as energy citizens.

Through the collaborative leadership of governments, industry, environmental stakeholders and individual Canadians, we can answer the call to action.

The window of opportunity is open to us. We must act now.



APPENDICES

1. List of Witnesses
2. Provincial & Territorial Energy Strategies
3. Provincial & Territorial Environmental Strategies
4. Major Federal Energy & Environmental Policies
5. Federal, Provincial & Territorial Energy Jurisdiction

Note: The documents listed above may be found on the committee's website (<http://senate-senat.ca/enev-e.asp>) announcing **the report**.



ENDNOTES

- ¹ World Bank, Population Projections
- ² Peter Tertzakian, ARC Financial Corp., An interview with Premier Alison Redford, April 30, 2012
- ³ Standing Senate Committee on Energy, the Environment and Natural Resources (ENEV), Evidence, Third Session, 40th Parliament, November 30, 2010
- ⁴ Government of Canada, Canada's Action on Climate Change, Clean Energy in Canada
- ⁵ ENEV, Evidence, Third Session, 40th Parliament, March 16, 2010
- ⁶ ENEV, Evidence, Third Session, 40th Parliament, March 1 2011
- ⁷ ENEV, Evidence, Third Session, 40th Parliament, March 18, 2010
- ⁸ Natural Resources Canada, Energy Sources, Refinery Economics
- ⁹ ENEV, Evidence, First Session, 41st Parliament, November 30, 2010
- ¹⁰ Organization for Economic Co-operation and Development (OECD). Graph prepared by the Library of Parliament.
- ¹¹ ENEV, Evidence, First Session, 41st Parliament, February 16, 2012
- ¹² ENEV, Evidence, Third Session, 40th Parliament, May 4, 2010
- ¹³ OECD represents 34 member countries mostly from Europe, North and South America. It consists mostly of advanced economies but also includes emerging economies.
- ¹⁴ ENEV, Evidence, Third Session, 40th Parliament, February 17, 2011
- ¹⁵ National Public Radio, Is U.S. Energy Independence Finally within Reach?
- ¹⁶ Ibid.
- ¹⁷ Natural gas can be shipped overseas as a liquid. Natural gas becomes a liquid when it is chilled at -160° C. Liquefied natural gas (LNG) is simply natural gas in its liquid state. As a liquid, the volume of the natural gas is reduced to facilitate the transport of large quantities of gas over long distances in ocean tankers. Upon delivery at an LNG receiving terminal, the LNG is re-heated and converted back to a gas, which is then sent through pipelines for delivery to end-users.
- ¹⁸ ENEV, Evidence, First Session, 41st Parliament, November 29, 2011
- ¹⁹ National Energy Board (NEB), Canada's Energy Future: Energy Supply and Demand Projections to 2035
- ²⁰ Canada's Energy and Mines Conference Kananaskis Alberta July 19 2011, Canada as a Global Leader and Action Plan
- ²¹ Ibid
- ²² Energy Policy Institute of Canada, A Strategy for Canada's Global Energy Leadership, Framework Document, January 2011
- ²³ Natural Resources Canada, Energy Efficiency Trends in Canada 1990 to 2008
- ²⁴ Statistics Canada, Canada International Merchandise Trade Database
- ²⁵ Canada's Energy and Mines Conference Kananaskis, Alberta, July 19 2011, Canada as a Global Leader and Action Plan
- ²⁶ Natural Resources Canada
- ²⁷ Ibid
- ²⁸ Conference Board of Canada, *Canada's Electricity Infrastructure Building a Case for Investment*, April 2011
- ²⁹ Natural Resources Canada
- ³⁰ Ontario Progress Report 2011
- ³¹ Canadian Energy Research Institute, Economic Impact of the Nuclear Industry in Canada, June 2008
- ³² Nuclear Energy Agency, Country Profile Canada
- ³³ World Nuclear Association, Nuclear Share Figures 2001-2011
- ³⁴ ENEV, Second Session, 40th Parliament, Evidence, November 26, 2009
- ³⁵ Canada Gazette, Reduction of Carbon Dioxide Emissions from Coal-Fired Generation of Electricity Regulations, Vol. 145, No. 35, August 27, 2011
- ³⁶ The federal renewable fuel content does not apply to aircrafts, competition vehicles, for use in scientific research, in the North (Yukon, the Northwest Territories, Nunavut, Quebec north of 60°N), in the case of gasoline, in Newfoundland and Labrador and in the case of diesel fuel and heating distillate oil in military combat equipment.
- ³⁷ Transport Canada, News Release, June 4, 2012
- ³⁸ ENEV, Third Session, 40th Parliament, Evidence, February 3, 2011



- ³⁹ ENEV, Third Session, 40th Parliament, Evidence March 18, 2010
- ⁴⁰ House of Commons, First Session, 41st Parliament, Standing Committee on Environment and Sustainable Development, Statutory Review of the Canadian Environmental Assessment Act Protecting the Environment, Managing our Resources, March 2012
- ⁴¹ ENEV, First Session, 41st Parliament, Evidence, November 24, 2011
- ⁴² ENEV, First Session, 41st Parliament, Evidence, October 27, 2011
- ⁴³ ENEV, Third Session, 40th Parliament, Evidence, October 19, 2010
- ⁴⁴ ENEV, Third Session, 40th Parliament, Evidence, November 30, 2010
- ⁴⁵ U.S. Environmental Protection Agency, Clean Energy, Air Emissions.
- ⁴⁶ ENEV, Third Session, 40th Parliament, Evidence, December 9, 2010
- ⁴⁷ National Energy Board, Energy Brief, Understanding Canadian Shale Gas, November 2009 at page 2.
- ⁴⁸ United States Energy Information Administration, Annual Energy Outlook 2011, April 2011, at pages 2 and 37.
- ⁴⁹ ENEV, Third Session, 40th Parliament, Evidence, March 18, 2010
- ⁵⁰ ENEV, Third Session, 40th Parliament, Evidence, March 2 2011
- ⁵¹ ENEV, Third Session, 40th Parliament, Evidence, February 28, 2011
- ⁵² Section 92(13) of the *Constitution Act, 1867* states that provinces may exclusively make laws in relation to “Property and Civil Rights”; an expression which includes employment contracts and labour management. Most labour relations and employment relationships, therefore, are subject to provincial legislation. However, the federal government has jurisdiction over specifically designated federal works and undertakings, including inter-provincial transportation, banking, telecommunications and radio broadcasting. As well, Section 91(24) of the *Constitution Act, 1867* provides that Parliament has primary legislative authority with respect to “Indians and Lands Reserved for Indians.” Thus, if an operation touches on an integral part of, or is necessarily incidental to, “Indians or Lands reserved for Indians,” the operation will be governed by federal legislation.
- ⁵³ Human Resource and Skills Development Canada
- ⁵⁴ ENEV, First Session, 41st Parliament, Evidence, December 7, 2011
- ⁵⁵ ENEV, Third Session, 40th Parliament, Evidence, May 11, 2010
- ⁵⁶ ENEV, First Session, 41st Parliament, Evidence, November 17, 2011
- ⁵⁷ The Report of the National Advisory Panel on Sustainable Energy Science and Technology, Powerful Connections: Priorities and Directions in energy Science and Technology in Canada (2006) <http://publications.gc.ca/site/eng/292511/publication.html>
- ⁵⁸ Ibid.
- ⁵⁹ Government of Canada, Economic Scan of Canada's Energy Sector, Produced for the Energy Sector Sustainability Table, 2008
- ⁶⁰ Graph prepared by the Library of Parliament.
- ⁶¹ Ibid.
- ⁶² Industry Canada, “Industry Profile,” Hydrogen and Fuel Cells.
- ⁶³ Canadian Energy Research Institute (CERI), Economic of Staged Development of Oil sands Projects in Alberta (2010-2035)
- ⁶⁴ ENEV, Second Session, 40th Parliament, Evidence, November 24, 2009
- ⁶⁵ Natural Resources Canada, About Renewables
- ⁶⁶ ENEV, Third Session, 40th Parliament, Evidence, November 16, 2010
- ⁶⁷ ENEV, Third Session, 40th Parliament, Evidence, February 28, 2011
- ⁶⁸ ENEV, First Session, 41st Parliament, Evidence, September 29, 2011
- ⁶⁹ Wood pellets of ground and compressed wood fiber (usually from sawmill waste).
- ⁷⁰ National Research Council Canada, “Going green: biofuels from algae” Dimensions, Issue 4
- ⁷¹ ENEV, First Session, 41st Parliament, Evidence, November 16, 2011
- ⁷² ENEV, Third Session, 40th Parliament, Evidence, May 4, 2010
- ⁷³ ENEV, First Session, 41st Parliament, Evidence, October 25, 2011
- ⁷⁴ ENEV, Third Session, 40th Parliament, Evidence, March 2 2011
- ⁷⁵ Canadian Nuclear Association
- ⁷⁶ ENEV, Third Session, 40th Parliament, Evidence, April 20, 2010