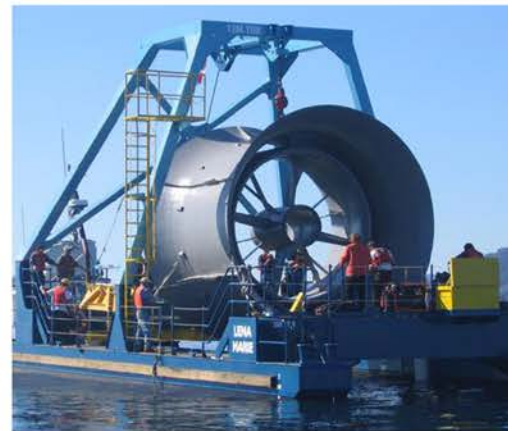




Energy Innovation Roundtables

Discussion Paper





Natural Resources
Canada

Ressources naturelles
Canada

Energy Innovation Roundtables

Discussion Paper

© Natural Resources Canada, 2013

For information regarding reproduction rights, contact Natural Resources Canada at copyright.droitdauteur@nrcan-rncan.gc.ca.

Cat. No. M34-18/2013E-PDF (Online)

ISBN 978-1-100-22651-4

Aussi disponible en français :

Table rondes sur l'innovation en matière d'énergie

Document de travail

Purpose

The purpose of this discussion paper is to provide some background information for key stakeholders from industry, associations, academia, governments, the financial community and non-governmental organizations as context for a dialogue on making Canada's energy innovation system more efficient and competitive.

By providing a brief overview of the global energy innovation landscape and the Canadian context, this paper should serve as a starting point for discussions on enhancing collaboration and partnerships between industry, academia, governments and non-governmental organizations to align efforts in strategic areas that support Canada's energy competitiveness, both at home and abroad.

This paper concludes by considering a set of priority technology areas for Canada, followed by a number of key questions, to serve as a basis for the discussion at a series of Energy Innovation Roundtables that will take place in the fall 2013.

New investments or funding programs are outside the scope and objectives of this discussion. The objective is to use existing resources more efficiently through better coordination, taking into account the trade-offs when deciding on where Canada should focus its efforts.

Global Energy Landscape

The global energy landscape is undergoing significant transformation. The last decade saw extraordinary growth in the demand for energy, largely driven by the emergence of fast-growing and densely populated markets in the Asia-Pacific region. The International Energy Agency (IEA), the world's leading multilateral energy organization, estimates that global energy demand will increase by over 35 percent between 2010 and 2035, largely driven by China and India¹.

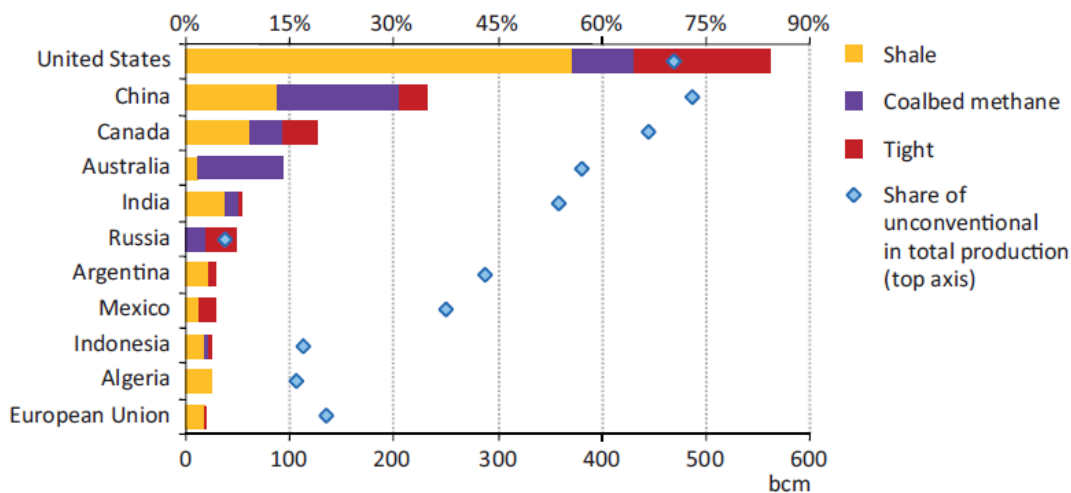
In meeting this demand, energy supply is also being transformed by factors such as geopolitical developments in the Middle East, growth in unconventional oil and gas resources, and increasing pressure in many countries to address environmental concerns, in particular emissions of greenhouse gases. While the world will continue to rely on fossil fuels

¹ IEA World Energy Outlook, 2012

for at least 70 percent of its energy needs in the foreseeable future, the IEA forecasts that renewable energy is expected to grow to one-third of total global electricity output by 2035. Energy efficiency policies could also result in annual improvements of global energy intensity of 1.8 percent over 2010-2035.

Unconventional shale gas and light tight oil are poised to have a large impact on how the world relies on fossil fuels. For example, the IEA predicts unconventional shale gas to account for nearly half of the increase in global gas production by 2035, led by countries such as the U.S., China, and Canada. Already shale gas is having a major impact in North America, with plans for Liquefied Natural Gas terminals changing from import to export facilities, and a significant switch in the U.S. electricity generation from coal to cleaner burning natural gas. The IEA predicts that deployment of horizontal drilling and fracturing technology will enable U.S. to become the largest global oil producer and a net exporter of natural gas by 2020.

Projected unconventional gas production in 2035



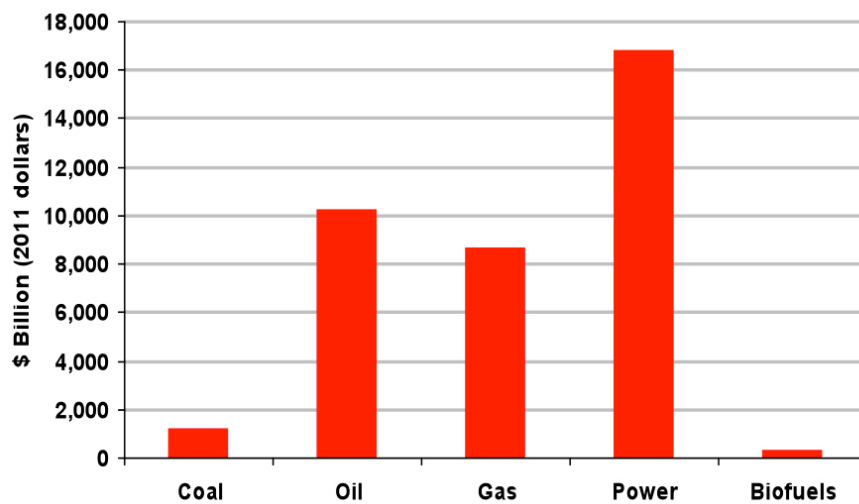
Source: IEA, World Energy Outlook, 2012

It is evident that technology innovation is playing a critical role in both shaping global energy markets and determining who will successfully compete in supplying cost-effective energy solutions to market in a world demanding increasingly better environmental performance. The

capability of countries to innovate will be a crucial determinant of their global competitiveness in decades to come.²

Successful economies will benefit from capturing an increasing share of both global demand for energy commodities and the more than \$37 trillion of investment in the world's energy supply infrastructure that the IEA predicts will be required by 2035³. Global markets for specific "clean" technologies alone are estimated to exceed \$3 trillion by 2020.⁴

Cumulative Global Investment in Energy-Supply Infrastructure



Source: IEA, World Energy Outlook 2012 NPS (New Policies Scenario)

Competition to innovate is intensifying between countries. Despite the recent economic downturn and continued fiscal pressure, energy research, development and demonstration (RD&D) spending among IEA countries has risen sharply over the last decade.⁵ Emerging economies are also investing heavily in energy RD&D. In 2008, Chinese spending alone equalled 25 percent of total IEA member investments.

² OECD, *Innovation and Growth: Rationale for an Innovation Strategy*, 2007.

³ International Energy Agency (IEA), *Tracking Clean Energy Progress 2013*, p. 49.

⁴ Analytica Advisors, *Spotlight on Cleantech*, Issue No. 3 (January 2012).

⁵ IEA, *Tracking Clean Energy Progress 2013*, p. 11.

Canadian Context

Energy innovation is particularly important for Canada to sustain the responsible development and use of its energy resources and to enhance Canada's long-term productivity, economic growth, and well-being.

Canada has been successful in translating an enviable resource advantage (e.g. Canada ranking fifth among countries in oil production, fifth in natural gas production, and second in uranium production and exports) into a key pillar of the country's economy – driving growth, creating jobs, attracting investment and commercial opportunities as well as enhancing our standard of living. In 2012, energy accounted for nearly 25 percent of Canada's total public and private capital investment and 28 percent of total domestic merchandise exports. Household and industry consumers of energy in Canada also benefit from a stable, secure, and cost-effective supply of energy.

Indicators for Canada's Energy Sector

	Gross Domestic Product (GDP) (2012)	Employment (2012)	Capital Expenditure (2012)	Domestic Exports (2012)	Stock of Foreign direct investment (2012)
Energy (% all Canada)	\$155 B (9.1%)	336,000 (1.9%)	\$96 B (24.6%)	\$119 B (27.8%)	\$150 B (23.6%)

Source: Statistics Canada

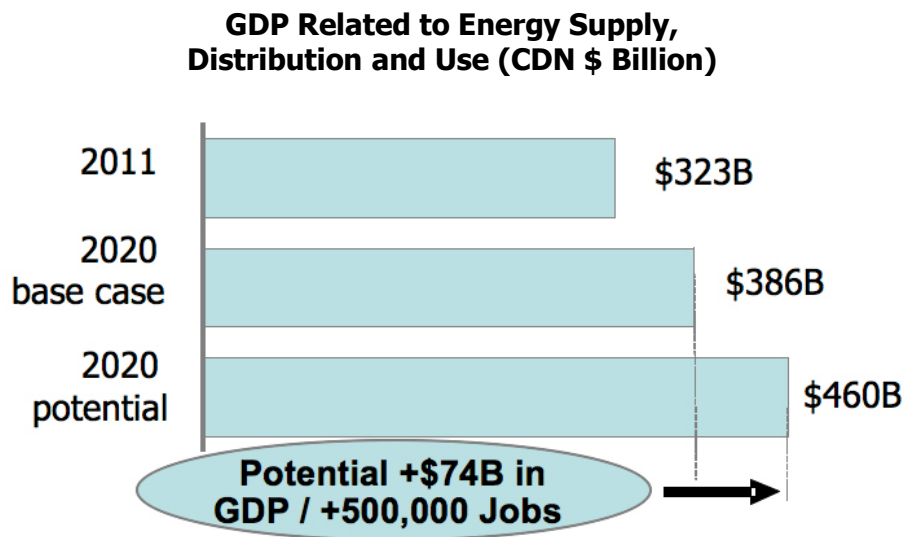
Opportunities and Priorities for Energy Innovation in Canada

To build on Canada's energy 'advantage', challenges need to be addressed regarding market access for Canadian exports, reducing the environmental footprint of energy production and use, and strengthening Canada's presence in global markets that are becoming increasingly competitive while also subject to volatility and fluctuating prices.

Energy technology solutions will play a critical role in addressing all of these challenges. However, energy technology development is itself subject to challenges given the relatively high capital investments that are required, their long-term payback, and the risks inherent in volatile energy markets and the evolution of regulatory policies.

Governments play a key role in addressing these challenges. The IEA highlights that governments have the ability to influence markets through policies that accelerate the development and deployment of energy technologies. Such measures create value through: global exports of energy technologies and services; incremental sales of energy products enabled by new technologies; and enhancing the competitiveness of energy-intensive industries and lowering costs for all consumers through cheaper and more efficient energy use.

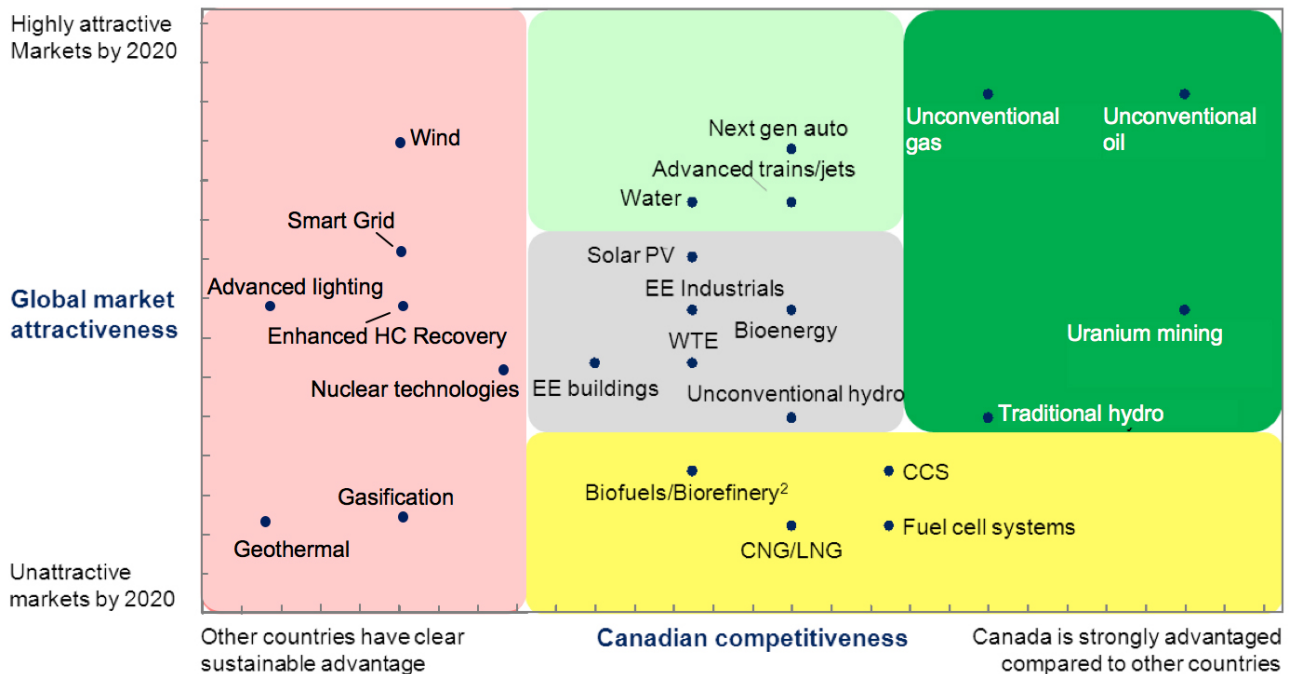
In 2012, NRCan commissioned McKinsey & Co. to undertake a report entitled “*Opportunities for Canadian energy technologies in global markets*”. The analysis suggests that the benefits associated with Canada realizing its full potential in energy technology could be significant. Based on observations in other countries, they estimate that a concerted focus on energy technology policy and innovation has the potential to increase growth in the energy sector by upwards of 2 percentage points. In Canada this would translate into approximately \$74 billion in incremental GDP and 500,000 new jobs by 2020.



Source: McKinsey & Co., 2012

Realizing the full potential in creating value through energy innovation will require collaboration to align and leverage Canada’s current strengths and competitive position. The following chart summarizes McKinsey & Co.’s evaluation of 24 technology areas based on global market attractiveness and the existence of Canadian advantages.

Global Market Attractiveness and Canadian Competitiveness for Energy Technologies

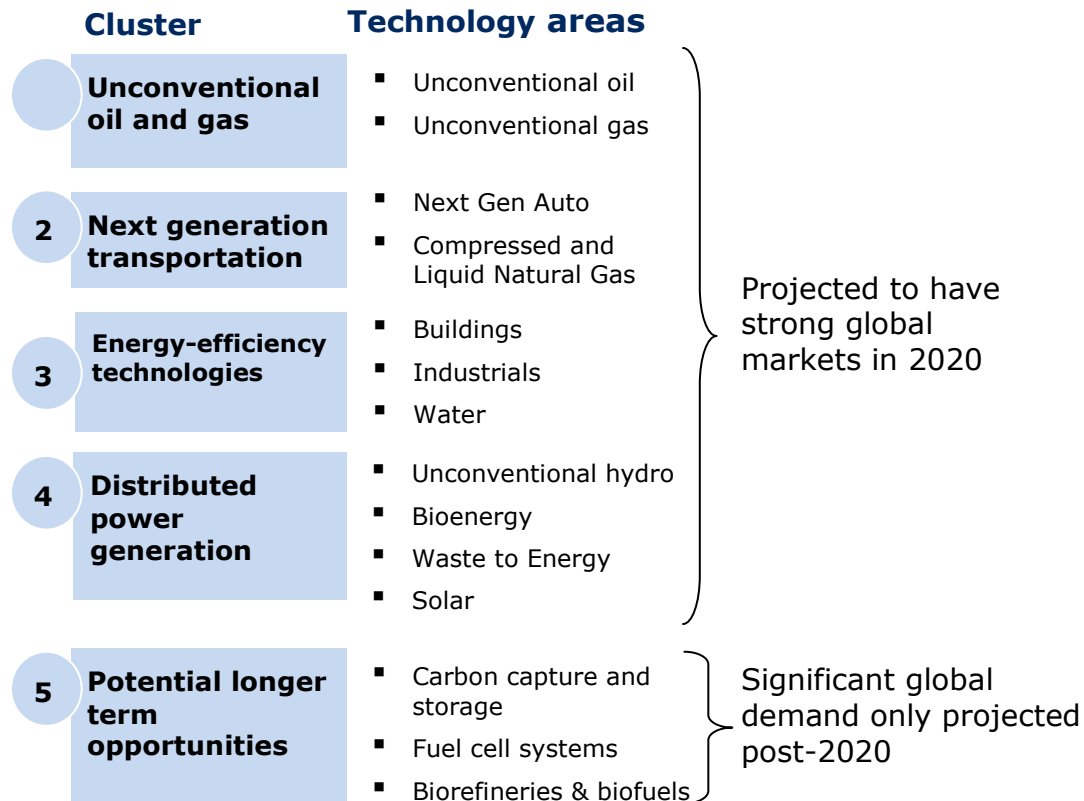


Source: McKinsey & Co., 2012

The different colour groupings in the above chart represent technology areas where:

- Canada has a clear/established advantage in global markets
- Canada could increase its global competitiveness
- Canada could take lead in emerging market
- Potential long term opportunity for Canada, with global markets not expected to mature until post-2020
- Other countries have clear sustainable advantage over Canada

McKinsey & Co. identified the following five strategic technology 'clusters' for prioritizing efforts to address specific barriers impeding Canada from leveraging its full potential:



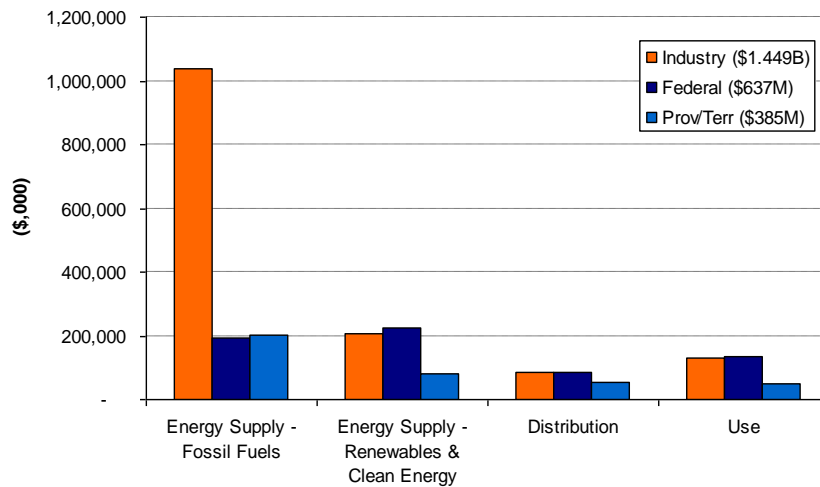
Building on a Strong Foundation for Canada's Energy Innovation Landscape

Canada has a strong foundation for sustaining an overall enabling environment for energy innovation. This includes one of the world's most open investment environments; the strongest fiscal position and lowest corporate tax rates among G7 countries; an internationally recognized tax credit for Scientific Research and Experimental Development (SR&ED); a priority on expanding international market access for Canada through trade and investment agreements and direct assistance to Canadian firms seeking to do business abroad; and, a world-class education system.

Furthermore, Canada has policies and programs in place that more specifically address barriers in priority energy technology areas.

Overall investment in energy RD&D in Canada is robust. Canada ranks fifth among IEA countries in public expenditures on energy RD&D as a percentage of GDP. In 2010-11, public spending on energy RD&D in Canada totalled more than \$1 billion, with the federal government investing the majority at \$637 million. This was complemented by substantial industry investments in energy RD&D of nearly \$1.5 billion in 2010.

Canadian Investments in Energy RD&D



Source: Federal-Provincial IEA data 2011-12, Statistics Canada Industry data 2010

Governments have also pledged ongoing commitments to support energy innovation. For example, the 2013 federal budget provided an additional \$325 million over eight years to Sustainable Development Technology Canada (SDTC) for continuing to support and finance the development and demonstration of clean technology projects in Canada, leading to opportunities for exporting these technologies and services abroad. The development of firms may be further assisted by the federal Venture Capital Action Plan, announced in January 2013, to invest \$400 million in new capital over the next 7 to 10 years. This funding is expected to attract nearly \$1 billion in new private sector investments as part of fostering a strong entrepreneurial culture for high-potential businesses in Canada to grow and compete in global markets.

Provincial governments are also active. For example, in 2011, Nova Scotia announced a \$24 million Clean Technology Venture Capital Fund, managed by Innovacorp, a technology commercialization organization, to support the growth of emerging clean technology companies.

Overall, these investments are contributing to an evolving energy innovation landscape in Canada that is supported by a number of different government (federal, provincial, and municipal), industry, academic, investor, service provider (e.g. engineering firms), and other stakeholders.

From a policy perspective, it is also important to recognize that stakeholders have different spheres of influence over the suite of policy levers highlighted above; which is why alignment is essential to ensure that stakeholders are working in concert to support Canada's energy competitiveness and innovation.

Concluding remarks

Energy innovation represents a significant opportunity for Canada to create economic growth opportunities while realizing environmental benefits. Timely decisions and actions are required today to realize its full potential. This includes ensuring that current investments in energy innovation are cost effective and yield the greatest benefits to Canadians.

To be globally competitive and at the leading edge of energy innovation, key actors across Canada's diverse energy landscape should be seeking opportunities to enhance collaborative efforts and partnerships in pursuit economic and environmental goals. This is just as important as ensuring that overall public spending on energy RD&D is sustained.

Using partnerships to strengthen collaborations, as well as identifying new approaches and opportunities will be crucial to maximizing the impact of our existing RD&D investments.

Did you know?

- *Canada has more than 30 dedicated Research Chairs in energy*
- *Eight Centres of Excellence for the Commercialization of Research*
- *Six Network Centres of Excellence (NCE)*
- *Two business-led NCEs*
- *31 universities performing energy R&D*

Questions for the Roundtables:

Key questions to further inform what are the most critical opportunities and priorities for enhancing energy innovation in Canada:

1. Which energy technology areas offer the greatest potential returns for economic and environmental performance in Canada and export growth opportunities globally?
2. How can governments, industry, universities, and other stakeholders more effectively align their efforts?
3. Where should stakeholders focus their efforts in building stronger partnerships within Canada and internationally?