

Report in Focus

ENERGY PRICES AND DECISION-MAKING IN CANADA: PREPARING FOR THE ENERGY FUTURE

Canada has abundant energy sources, from vast oil sands to ample hydroelectric capacity, offshore oil, natural gas, and coal. Given this energy-rich environment, Canada has relatively low energy prices and an energy-intensive industrial structure with the business sector accounting for about three-quarters of total energy demand. However, energy prices are rising overall and Canadian businesses have faced price volatility for quite some time. At the peak of the recession in July 2008, crude oil had skyrocketed to nearly US\$150 a barrel; by December 2008 the price had plummeted to around US\$30.

Adding to the challenge of price volatility is the increasingly complex nature of the energy environment as a whole. Advances in oil and gas extraction, alternative energy sources, Canadian electricity prices, regulations, and new technological developments will all have an effect on the energy environment and the strategies undertaken by Canadian businesses. Understanding the implications of this complex and uncertain energy future is central to ensuring the resiliency of Canadian firms and the future of Canada's economic prosperity.

CHARGE TO THE EXPERT PANEL

To more fully understand the effects of the energy environment on Canadian business decision-making, the Minister of Industry, on behalf of Industry Canada, asked the Council of Canadian Academies (the Council) to respond to the following charge:



What are the opportunities and risks to Canada related to the potential for sustained higher energy prices?

In response, the Council appointed a multidisciplinary panel of Canadian and international experts (the Panel) from the academic, business, and public sector. The Panel adopted a three-pronged approach to evidence gathering. First, it examined Canadian and international research on how firms have reacted to changing energy prices in the past, highlighting sectors in Canada exposed to changing energy prices (i.e., those that are likely to see significant changes in economic output as a result of rising prices). Second, the Panel used economic data to develop brief sector profiles for assessing their past resilience to high energy prices. Third, it commissioned a new survey on business decision-making, which was administered to more than 1,000 Canadian firms.

Historically, Canadian businesses have successfully adapted to rising and volatile energy prices. However, an increasingly complex energy environment will serve to test the resiliency of Canadian firms in the future.

– Fred Gorbet, O.C., Chair, Expert Panel

The surveyed firms were chosen to reflect sectors exposed to energy prices. The survey also included two additional control sectors (“other manufacturing” and “other services”) that were not as exposed to energy prices.

To develop a context for its work, the Panel used the U.S. Energy Information Administration’s (EIA, 2013) projections to 2025 as its central benchmark (see Table 1).

The scope of the Panel’s report is limited to the specifics of the charge, which does not directly address carbon pricing, Dutch Disease, or the social and consumer impacts of changes in energy prices. The Panel’s assessment focused on the goods-producing sectors, and was concerned with firms that use energy as an input to conduct their business. The Panel was able to consider all changes in energy prices, not just increases, and examined all energy sources.

Table 1
The EIA Projections for Energy Prices, 2013 and 2025

	Prices (2011 US\$ per unit)	
	2013	2025
Brent Spot Price (\$ per barrel)	97	117
West Texas Intermediate Spot Price (\$ per barrel)	88	115
Natural Gas at Henry Hub (\$ per million BTU)	3	5
Coal, Delivered (\$ per million BTU)	3	3
Electricity (cents per kilowatt-hour)	9	9
	Prices (nominal US\$ per unit)	
	2013	2025
Brent Spot Price (\$ per barrel)	100	148
West Texas Intermediate Spot Price (\$ per barrel)	91	145
Natural Gas at Henry Hub (\$ per million BTU)	3	6
Coal, Delivered (\$ per million BTU)	3	4
Electricity (cents per kilowatt-hour)	10	12

Data Source: EIA (2013)

Key Findings

Exposure to energy prices varies by sector. A firm’s strategy depends on whether it is energy intensive, capital intensive, or produces energy-intensive products.

The Panel focused on Canadian sectors that are particularly exposed to energy prices and therefore potentially vulnerable to changes: the energy intensive resource-based, manufacturing, and transport sectors; the capital intensive oil and gas, mining, and electric power sectors; and the transport equipment sector (see Table 2). Focus was also placed on the direct impact of energy prices on Canadian business decision-making. The Panel drew on both theoretical and empirical literature to determine what types of firms were exposed to energy prices and the kinds of strategies they could employ to minimize their effects. The Panel concluded that a number of strategies can be used to respond to changes in energy prices, depending on whether

a firm is energy intensive, capital intensive, or produces energy-intensive products. First, firms in sectors that use energy or capital intensively have a strong incentive to respond to changing energy prices. Economic theory suggests these firms will confront changing energy prices by investing in more energy-efficient machinery and equipment, adopting new business processes, switching fuel sources, or hedging with financial instruments. Second, firms that sell energy-consuming products have an incentive to improve the energy efficiency of their products when energy prices increase.

Management theory suggests a critical need for better information, knowledge, and skills. Many firms struggle with a lack of accurate and flexible benchmarks, and there are concerns over the availability and reliability of energy price information. An unfortunate consequence of inadequate information is a lower rate of investment in energy efficient equipment. If a firm is uncertain about the duration of an energy price change, it is less likely to make investments in response.

Table 2
Aggregating Canadian Industries to the Sectors of Interest

Sector Defined by Panel	NAICS Industry	NAICS Code
Energy-intensive: resource-based	• Crop and animal production	111–112
	• Forestry and logging	113
	• Fishing, hunting, and trapping	114
Energy-intensive: manufacturing	• Paper	322
	• Chemical	325
	• Non-metallic mineral product	327
	• Primary metal	331
Energy-intensive: transportation services	• Air, rail, water and scenic and sightseeing transportation and support activities for transportation	481–483, 487–488
	• Truck transportation	484
	• Transit and ground passenger transportation	485
Capital-intensive: oil and gas	• Oil and gas extraction	211
Capital-intensive: mining	• Mining (except oil and gas)	212
Capital-intensive: electric power	• Electric power generation, transmission, and distribution	2211
Capital-intensive: other	• Pipeline transportation	486
	• Waste and remediation services	562
Transport equipment	• Transportation equipment manufacturing	336
Other manufacturing	• Wood product	321
	• Petroleum and coal products	324
	• Plastics and rubber products	326
	• Fabricated metal product	332
	• Machinery	333
	• Computer and electronic product	334
Other services	• Wholesale trade	41
	• Retail trade	44–45

The table lists the eight sectors in Canada selected by the Panel as exposed to energy prices, followed by two sectors that are less likely to be affected. The component NAICS industries for each sector are also displayed.

Firms have successfully adapted to energy price changes in the past, but there is no guarantee that this resilience will continue into the future.

The Panel examined the performance of the identified Canadian sectors from 2000 to 2008, which was a period of increasing energy prices. When energy prices are high, a company's ratio of energy to output is expected to be lower. Evidence from this period shows that most exposed sectors lowered the amount of energy they used in proportion to their output.

While Canadian firms have been historically resilient, there is variation across sectors. Some industries, such as the chemical, transport equipment, and paper manufacturing industries, have faced challenges since 2000. The chemical industry suffered from its reliance on natural gas at a time when its price was much higher than that of oil, and the motor vehicle manufacturing industry has struggled to accommodate rising gasoline prices. In most cases, however, energy prices were not the primary cause of these sectoral challenges — they just worsened already existing cyclical or structural hardships.



Despite higher global energy prices, it is unlikely the competitiveness of Canadian firms will be strongly impacted.

To the extent that the data allowed, industry-by-industry comparisons demonstrated roughly similar energy intensities between the United States and Canada. The Panel found that many Canadian sectors exposed to energy prices were able to contain energy costs to a greater extent than their counterparts in the United States. This suggests that there would be limited competitiveness challenges in terms of lost market share across most sectors if global energy prices were to increase. Consequently, being less energy efficient in physical terms compared to plants in other countries may not be a competitiveness concern for Canadian business. Other countries with higher energy prices have also developed plans to promote energy efficiency. This suggests that the cost of future adjustment in Canada might be relatively low because a reference point already exists. A lack of internationally comparable data hampered further analysis.

The Panel noted that some types of firms, like those in transportation services, would face competitiveness concerns as higher costs begin to follow higher energy prices. The firms could pass these higher costs on to the consumer, but this would further propagate the impact of energy prices throughout the Canadian economy. One very realistic possibility, at least for transportation services firms, is the increased use of natural gas or electricity.

The Panel's survey found that 42% of firms have changed their strategies in response to price volatility, and 59% of firms have invested in equipment to manage energy costs.

A majority of firms reported that controlling energy costs was important for competitiveness.

The results from the Panel's survey confirmed that a firm's exposure to changing energy prices is related to the energy and capital intensity of their sector. Of the firms surveyed, 66% reported that controlling energy costs was very or extremely important to their competitiveness (see Figure 1), with concern being greatest among those industries using oil-based products. Furthermore, 72% of firms felt the impact of higher costs through the direct purchase of energy. The survey also highlighted strategies that firms have used in the past and might use in the future to deal with periods of high and volatile energy prices. For example, 42% of firms surveyed changed strategy in response to the volatility of oil prices in 2008, and 59% of firms surveyed have invested in equipment to manage energy costs over the past few years.



Increased preparedness in exposed sectors would mean greater resilience and better adaptation should energy prices change.

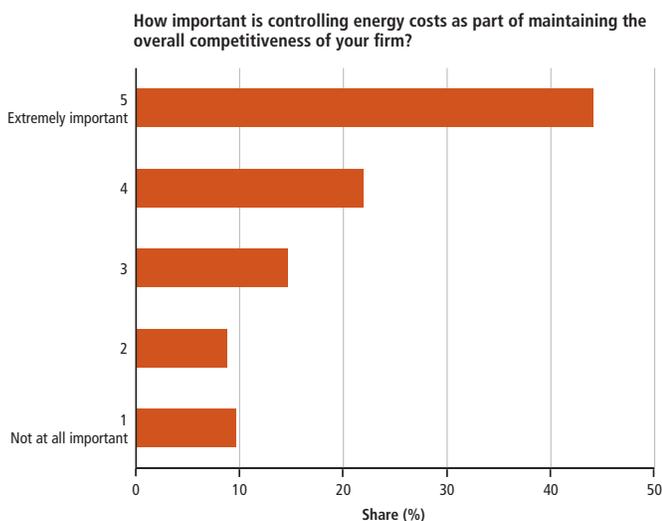


Figure 1
Importance of Controlling Energy Costs to maintaining Competitiveness

The figure shows survey respondents' assessment of how important controlling energy costs is to their competitiveness. Two-thirds of respondents said that energy was either extremely or very important to them.

Preparedness was a key concept for the Panel to assess the ability of Canadian firms to adjust to the complex energy world. There was, however, little direct evidence available on the extent to which firms were prepared for such change in the future. As such, the Panel considered three indicators of preparedness as drawn from the survey:

- timely, accurate, and relevant information about the evolution of energy markets;
- benchmarking data; and
- personnel specialized in understanding the implications of energy developments for the firm.

On the basis of these indicators, many firms in Canada are prepared for price changes. Of the firms surveyed, 63% met the criteria of at least one indicator of preparedness. The majority of those firms had access to information about energy markets. However, only 25% of respondents met the criteria of at least two indicators, and merely 5% met all three (see Table 3). The survey also demonstrated that access to relevant information and technically skilled people increased with the degree of exposure to energy prices. Comparing the extent of preparedness of Canadian firms with international competitors remained difficult as a result of data limitations.

Table 3
Determining the Degree of Sectors' Preparedness

Sector	Share of firms with access to:					
	Access to detailed information (%)	Benchmarking (%)	Specialized personnel (%)	Any of the three indicators (%)	Any two of the three indicators (%)	All three indicators (%)
Energy-intensive: resource-based	55	24	19	66	28	4
Energy-intensive: manufacturing	60	17	22	69	27	4
Energy-intensive: transportation services	58	24	27	67	32	10
Capital-intensive: oil and gas extraction	67	24	33	76	36	12
Capital-intensive: mining	47	28	25	65	30	5
Capital-intensive: electric	65	30	28	72	37	14
Capital-intensive: other	51	16	20	64	21	3
Transportation equipment manufacturing	50	13	15	58	15	5
Other manufacturing*	49	9	18	60	13	2
Other services*	38	13	21	52	18	2
All sectors	52	18	22	63	24	5

Source: Panel survey data

* Sectors that are not exposed to energy prices.

Analysis of the survey results suggests that there is a link between these indicators and changing strategy in response to energy price changes. While 43% of firms surveyed had changed strategy in response to the 2008 price shocks, this proportion increased to 63% of firms with access to timely, accurate, and relevant information, and 60% of firms with benchmarking information. However, only 18% of surveyed firms had access to information that allowed them to benchmark their energy efficiency against their competitors (see Box 1 for an example).

Despite this new evidence, questions still remain: do the more prepared firms quickly learn that they should change strategy, or do firms changing strategy strive to become more prepared? Nonetheless, the Panel was confident that increased preparedness in exposed sectors would mean

greater resilience and better adaptation should energy prices change. Overall, the survey data suggest that there is an opportunity for many Canadian firms to become better prepared for a future of high and volatile energy prices by accessing better and timelier information, particularly information such as: benchmarking data, sector-level data, and Canadian energy price projections.

BOX 1: Benchmarking in the Canadian Forest Products Industry

Every second year, the Forest Products Association of Canada surveys the entire industry (wood products and pulp and paper facilities) on energy use. Detailed data are gathered on all mills in Canada by type of production (78 pulp and paper and 107 wood products facilities). The response rate to the survey averages around 85%. The survey results are then returned to the respondents and their parent company when appropriate. Each respondent/parent company sees the performance of their own mill(s) and where it ranks in comparison with all other mills. Such information allows managers to benchmark their performance, and realize what operational improvements are possible. In 2012, a similar international exercise was carried out covering 10 countries based on data for 2011, and is planned to be repeated every five years.

CONCLUSION

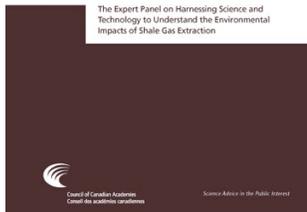
Overall, Canadian firms have been successful in adapting to changing energy prices in the past and the impact of changing energy prices has not undermined the competitiveness of most of the exposed sectors. Past performance, however, does not guarantee the same outcome for the future as energy markets become increasingly complex. In interpreting the available evidence, it must be recognized that energy prices, while important, are only one element in complex business decisions. Nonetheless, heightened preparedness will serve to strengthen and inform business decision-making and overall resilience in an uncertain and complex energy future.

EIA (U.S. Energy Information Administration). (2013). *Annual Energy Outlook 2013*. Washington (DC): EIA.

OTHER COUNCIL REPORTS THAT MAY BE OF INTEREST:
Environmental Impacts of Shale Gas Extraction in Canada

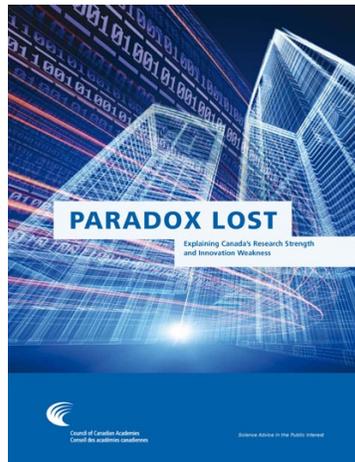
ENVIRONMENTAL IMPACTS OF SHALE GAS EXTRACTION IN CANADA

The Expert Panel on Harnessing Science and Technology to Understand the Environmental Impacts of Shale Gas Extraction


The State of Industrial R&D in Canada

PARADOX LOST

Explaining Canada's Research Strength and Innovation Weakness


THE STATE OF INDUSTRIAL R&D IN CANADA

The Expert Panel on the State of Industrial R&D in Canada



EXPERT PANEL ON CANADIAN INDUSTRY'S COMPETITIVENESS IN TERMS OF ENERGY USE: Frederick W. Gorbet, O.C. (Chair), Michelle Adams, Associate Professor, School for Resource and Environmental Studies, Dalhousie University (Halifax, NS); **Jean-Thomas Bernard, FRSC**, Chair of Electricity Economics, Université Laval (Québec, QC); Visiting Scholar, University of Ottawa (Ottawa, ON); **Paul Boothe**, Professor and Director, Lawrence National Centre for Policy and Management, Ivey Business School, Western University (London, ON); **Ujjayant Chakravorty**, Professor of Economics, Tufts University (Medford, MA); **Robert L. Evans, FCAE**, Professor Emeritus of Mechanical Engineering, University of British Columbia (Vancouver, BC); **Oliver Inderwildi**, Senior Policy Fellow, University of Oxford (Oxford, United Kingdom); Senior Manager and Global Leadership Fellow, Chemicals, Advanced Materials and Emerging Technologies, World Economic Forum (Geneva, Switzerland); and Visiting Professor, University of Turin (Turin, Italy); **David Lindsay**, President and CEO, Forest Products Association of Canada (Ottawa, ON); **Wade Locke**, Professor of Economics, Memorial University of Newfoundland (St. John's, NL); **John R. Muir**, Former Director, Energy Policy and Government Affairs, GE Canada (Mississauga, ON); **Ken Norrie**, Professor Emeritus of Economics, McMaster University (Hamilton, ON); **John Nyboer**, Adjunct Professor, School of Resource and Environmental Management, Simon Fraser University (Burnaby, BC); **Denise Young**, Professor of Economics, University of Alberta (Edmonton, AB)


 Council of Canadian Academies
 Conseil des académies canadiennes

The Council of Canadian Academies is an independent, not-for-profit organization that began operation in 2005. The Council undertakes independent, authoritative, science-based, expert assessments that inform public policy development in Canada. Assessments are conducted by independent, multidisciplinary panels of experts from across Canada and abroad. Panel members serve free of charge and many are Fellows of the Council's Member Academies. The Council's vision is to be a trusted voice for science in the public interest. For more information about the Council or its assessments, please visit www.scienceadvice.ca.

This *Report in Focus* was prepared by the Council based on the report of the Expert Panel on the Canadian Industry's Competitiveness in Terms of Energy Use.