

EXECUTIVE SUMMARY

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

The Expert Panel on Canadian Industry's
Competitiveness in Terms of Energy Use



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THE COUNCIL OF CANADIAN ACADEMIES

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This report was prepared for the Government of Canada in response to a request from the Minister of Industry. Any opinions, findings, or conclusions expressed in this publication are those of the authors, the Expert Panel on Canadian Industry's Competitiveness in Terms of Energy Use, and do not necessarily represent the views of their organizations of affiliation or employment.

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Expert Panel on the Canadian Industry's Competitiveness in Terms of Energy Use

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Message from the Chair

Over the past several decades energy prices have figured prominently in business decision-making in Canada. This report provides a comprehensive overview of how well Canadian businesses have adapted to upward-trending and increasingly volatile energy prices, and explores ways in which businesses can enhance their resilience with respect to energy prices.

I am privileged to have been able to chair the Expert Panel charged with examining these issues, and I want to take this opportunity to thank the panelists. The breadth of background, experience, and expertise within the Panel made each of our interactions an excellent learning experience for all of us, and led to a strong report that went beyond existing theory and statistical evidence to develop valuable survey-based information. My fellow Panel members gave generously of their time and energy and I am grateful for their active and constructive participation.

I also want to thank the Council staff who supported the Panel and played a key role in developing the research that provided the evidence on which our conclusions are based.

A handwritten signature in black ink, appearing to read "F. Gorbet", is written above a long, horizontal, slightly wavy line that serves as a signature underline.

Frederick W. Gorbet, O.C.

Chair, Expert Panel on Canadian Industry's Competitiveness in Terms of Energy Use

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The Expert Panel would like to thank Joe St. Lawrence of Statistics Canada for providing advice with data, and Derek Jansen of EKOS Research Associates for designing the survey.

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Report Review

This report was reviewed in draft form by the individuals listed below — a group of reviewers selected by the Council of Canadian Academies for their diverse perspectives, areas of expertise, and broad representation of academic, industrial, policy, and non-governmental organizations.

The reviewers assessed the objectivity and quality of the report. Their submissions — which will remain confidential — were considered in full by the Panel, and many of their suggestions were incorporated into the report. They were not asked to endorse the conclusions, nor did they see the final draft of the report before its release. Responsibility for the final content of this report rests entirely with the authoring Panel and the Council.

The Council wishes to thank the following individuals for their review of this report:

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The report review procedure was monitored on behalf of the Council's Board of Governors and Scientific Advisory Committee by **Norbert R. Morgenstern, C.M., FRSC, FCAE**, Professor (Emeritus), Civil Engineering, University of Alberta. The role of the report review monitor is to ensure that the Panel gives full and fair consideration to the submissions of the report reviewers. The Board of Governors of the Council authorizes public release of an expert panel report only after the report review monitor confirms that the Council's report review requirements have been satisfied. The Council thanks Dr. Morgenstern for his diligent contribution as report review monitor.

Executive Summary

Energy prices rose during the late 1990s and into the new century as economic growth in large developing economies in Asia fostered growing demand. While this trend benefitted those that explored for or produced energy or could help users limit their exposure to prices, it also created challenges for Canadian firms that make intensive use of energy. The onset of the recession in 2008 brought the upward trend in energy prices to an end, but was marked by a spike in oil price volatility. In July 2008 crude oil skyrocketed to nearly US\$150 a barrel; by December 2008 the price had plummeted to around US\$30.

Current price projections from energy agencies and researchers suggest that global economic recovery will likely result in upward pressure on energy prices overall, and particularly for oil, over the coming years. A structural trend of rising, but volatile, energy prices present both opportunities and challenges for Canadian firms, and will continue to have significant effects on Canada as a whole.

CHARGE TO THE PANEL

To better understand the implications of this uncertain energy future for Canadian firms, in July 2012 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?

- *Looking forward, what are the expected impacts of higher energy prices on Canadian businesses?*
- *How do Canadian businesses compare to foreign competitors in terms of their ability to adapt to a) sustained higher energy prices? b) energy price volatility episodes?*
- *Which industry sectors and communities are inherently a) most vulnerable to higher energy prices? b) best equipped to leverage higher energy prices as a competitive advantage?*
- *How prepared are industry sectors and communities to capitalize on opportunities or mitigate risks that result from higher energy prices?*

In response, the Council appointed a multidisciplinary panel of Canadian and international experts (the Panel) from the academic, business, and public sectors. At the onset of the assessment, the Panel met with the Sponsor to discuss the charge and how best to scope its work to make it manageable.

CHANGING ENERGY MARKETS

Although energy prices have fallen back from their 2008 peak, energy prices are expected to rise as the global economy continues to recover. However, rather than increasing the prices of all types of energy goods, energy markets will be much more complex. Advances in extracting oil and gas from shale formations will restrain energy prices in North America. Whether for use as a source of energy or as a feedstock, the price of natural gas is now significantly lower than the (energy-equivalent) price of oil, and is expected to remain so for some time. Electricity prices are generally influenced by government policy in most provinces, and therefore may not closely track prices in traded energy sources. Taken together, the decoupling of prices for different sources of energy implies that understanding business decision-making in the energy context hinges on the dynamics of prices of different types of energy – not just of a single energy price.

The development of shale gas and tight oil is transforming energy markets, particularly in the United States. Increasing U.S. demand for energy has traditionally pushed global energy prices upwards. However, increased domestic production will lower the need of the United States to import oil and gas from all countries. As the principal export market for Canadian oil and gas, this impact will be particularly significant for Canadian energy exporters. Energy-intensive firms in the United States will also benefit from increased supply conditions, which may challenge their Canadian competitors.

A range of other factors will also have an impact on energy choices going forward. Over the long term, energy prices will be affected by technological advances in energy efficiency, alternative energy sources, and technological solutions developed in industries not linked traditionally with energy markets, such as computer manufacturing and software engineering. Furthermore, increased environmental and safety regulations, such as for shale gas and greenhouse gases, will affect energy markets. Although the consequences of these changes were outside the scope of the Panel's charge, these phenomena underscore the growing complexity of the energy world, where drivers and impacts of business decision-making reflect more than just energy prices. The resilience of Canadian firms will be tested as energy markets become more complex.

EXAMINING THE EVIDENCE

Exposure of Canadian Firms to Energy Prices

Consistent with the agreed interpretation of the charge, the Panel concentrated on the direct impact of energy prices on Canadian business decision-making. 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 drew on the theoretical and empirical economics literature.

This literature shows that some types of firms are exposed to energy prices. First, firms in sectors that use energy or capital intensively in their production processes face strong incentives to respond to changes in energy prices. Their strategies may focus on reducing energy use by investing in energy-efficient machinery and equipment, adopting new business processes, switching fuel sources, or hedging with financial instruments. Second, firms that sell products that use energy intensively have incentives to improve the energy efficiency of their products when energy prices increase.

Based on its review of the literature and selected criteria, the Panel identified eight sectors that were exposed to energy prices: the energy-intensive resource-based, manufacturing, and transportation services sectors; the capital-intensive oil and gas, mining, electric power, and other sectors; and the transport equipment sector. These sectors, which were the focus of analysis for the report, account for slightly more than one-quarter of Canadian business sector output. They include some sectors that would benefit from higher energy prices, such as oil and gas and electric power.

Past Resilience of Canadian Firms to Energy Prices

An important aspect of business management is resilience: the capacity to bounce back from adverse events. To examine the past resilience of Canadian firms to changes in energy prices, the Panel examined the performance of selected sectors since 2000. The expectation was that higher energy prices would result in lower energy-output ratios. By this definition, most of the sectors identified as being exposed to energy prices had adjusted to past episodes of higher and more volatile oil prices. These adjustments lowered the quantity of energy used in proportion to output for most Canadian industries.

The data suggest that some industries had faced challenges since 2000, notably the chemical, transport equipment, and paper manufacturing industries. Chemical manufacturing had been challenged because it used natural gas rather than oil as a feedstock and the price of natural gas was much higher than the price of oil, leading to a competitive disadvantage. However, this picture is now

reversing as the relative price of natural gas declines in North America. Motor vehicle manufacturing — a constituent of the transport equipment sector — also struggled as gasoline prices rose. The paper manufacturing industry is energy intensive, but faced more fundamental technological challenges such as the digitization of media.

International Competitiveness of Canadian Business

To the extent that the data allowed, industry-by-industry comparisons demonstrated roughly similar energy intensities between the United States and Canada. Many Canadian sectors exposed to energy prices have managed 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, although global demand would tend to shift away from energy-intensive products. In Canada, prices of energy are generally low compared with many other countries, suggesting that Canada probably uses energy more intensively. Further, a pathway to greater efficiency has been laid out in other countries that have higher energy prices. This suggests that the cost of further adjustment might be relatively low in Canada because Canadian firms would find it easier to replicate what has been done by firms in other countries. Limits on the availability of internationally comparable data precluded further analysis.

Some types of firms, notably those in transportation services, would see competitiveness impacts through higher costs as a result of higher energy prices. If these firms could pass on costs to their customers, their competitiveness would be protected, but this pass-through of costs into prices would propagate the impact of energy prices throughout the economy. A further option becoming increasingly realistic in transportation services is to switch to using natural gas or electricity.

Energy Use and Decision-Making of Canadian Firms

To supplement and enrich the evidence from the literature review, analysis of the statistics, and sectoral histories, the Panel commissioned a survey of more than 1,000 Canadian firms. Consistent with the Panel's mandate, the surveyed firms were chosen to reflect those sectors exposed to energy prices, and are therefore not representative of Canadian business as a whole. The survey covered the eight sectors the Panel identified as exposed, as well as two additional sectors (wholesale and retail trade) that were not as exposed to energy prices for comparison.

The survey confirmed that firms' exposure to changing energy prices is related to their sectors' energy and capital intensity. Two-thirds of the firms surveyed reported that energy costs were very important or extremely important to their competitiveness, with concern greatest among those industries that use oil-based products. However, firms in other sectors also expressed concern that they would suffer significant adverse effects from energy price increases.

The survey provided other valuable information about how firms view their exposure to energy prices and about the strategies they have used in the past and might use in the future to deal with periods of high and volatile energy prices. Key findings from the survey included the following:

- Controlling energy costs was very or extremely important to the competitiveness of 66% of firms.
- The impact of higher costs through direct purchase of energy has been felt by 72% of firms.
- In response to the volatility in oil prices in 2008, 42% of firms changed strategy.
- To manage energy costs, 59% of firms have invested in equipment over the past few years.

Preparedness of Canadian Firms for Future Energy Markets

Preparedness was a key concept for the Panel to assess the resilience of Canadian firms in adjusting to new circumstances. Although most firms cannot meaningfully change their exposure to energy prices in the short run, they can act to improve their resilience by being prepared for future changes in energy markets. There was, however, little evidence available to the Panel on the characteristics of firms that might be prepared for future change. Hence, based on its review of the management and economic research, the Panel developed indicators of preparedness consisting of the availability of:

- 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.

Many Canadian firms are prepared in terms of these three indicators. Of surveyed firms, 22% employed a person who undertook financial or economic analysis of energy prices and 16% employed a person who undertook technical analysis related to energy use; 52% sought out detailed information on energy prices; and 18% had information allowing them to benchmark against their competitors. Overall, 63% met the criterion of at least one indicator of preparedness with the majority having access to information about energy markets. About 25% of respondents met the criteria of at least two indicators, but only 5% met all three.

It was difficult to compare the extent of preparedness of Canadian firms with competitors because data limitations made it impossible to examine whether the degree of adjustment was greater in other countries, or whether firms in other countries had access to such resources. The survey did make it clear that although a relatively small proportion of firms had access to relevant information and technically skilled people, access increased with the degree of exposure to energy prices. The data did not allow the Panel to draw any inferences about whether structural barriers or high costs limited the number of firms with access.

Analysis of the survey results suggested that there was a link between the indicators of preparedness and changing strategy in response to energy price changes. For example, in response to price shocks in 2008, 59% of firms with benchmarking information, but only 40% of those without, took action. Causality is unclear. Do firms intending to change strategy seek information and dedicated staff, or do firms with information and dedicated staff learn they should change strategy? However, what does seem clear is that being prepared would be an advantage if energy prices were to change. Overall, the survey data suggest that there is an opportunity for many Canadian firms to become better prepared, through better and timelier information and access to specialized personnel, to meet future challenges and thus capitalize on opportunities.

OPPORTUNITIES AND RISKS FOR THE CANADIAN BUSINESS SECTOR

The increased availability of shale gas and tight oil in North America will result in future patterns of energy prices that are unlike those of the past. Together with the impacts of new technologies and heightened awareness of environmental and safety impacts of developing, transporting, and using fossil fuels, this will result in new opportunities and risks for Canadian firms.

The Panel found that the expected trends in energy prices would provide opportunities for some sectors. Industries that use natural gas as a feedstock will have inherent opportunities to benefit as oil prices continue to increase relative to natural gas prices. This trend will enhance the competitiveness of the Canadian chemical manufacturing industry in particular. The oil and gas extraction industry will see the value of its products increase. Firms that provide goods and services to these industries, including for exploration, production, and transmission, will have opportunities particularly as current uncertainties about pipeline development become resolved. Given that firms often react to changing energy prices by investing in equipment and improving their operating processes, those that produce energy-efficient equipment are also well placed to leverage higher energy prices as a competitive advantage.

The Panel concluded that the risks associated with rising energy prices were likely to be most serious for those firms using oil-based products and with a limited ability to switch to other fuels. Manufacturing, which tends to use electricity and natural gas in the production process, will not be as directly affected as transportation services, for example, but the higher cost of transportation services will feed through to all firms moving products to market. The transportation services industry will itself be challenged by the higher price of oil but may increasingly find opportunities to substitute natural gas or electricity as relative prices change and technology permits.

In general, the availability of increased energy supplies in the United States may alter Canada's economy in several respects. First, most of its energy exports have traditionally headed south of the border, but the demand for these exports will decline. Second, Canadian firms have been partly sheltered from changes in global energy markets because the abundance of energy sources in Canada has kept prices relatively low. Although adjusting to shocks in global energy markets has been challenging, Canadian firms have adapted and energy-intensive sectors have generally performed well. However, many observers believe that the greater abundance of energy in the United States will support increased opportunities for U.S. firms in manufacturing and this may result in new competitive challenges for Canadian firms.

FINAL REFLECTIONS

Overall, the evidence suggested that Canadian firms have been successful in adapting to changing energy prices in the past. When coupled with the lower levels of energy prices faced by many Canadian firms, the impact of changing energy prices has not undermined the competitiveness of exposed sectors. Canadian firms, for the most part, have been resilient. Where challenges have been evident, they have often resulted from factors other than energy price changes.

Past experience, however, does not guarantee continued resilience in the future as energy markets become increasingly complex. Traditionally, firms may have invested in more modern equipment or improved their operations to improve their energy efficiency. Now, a range of technologies can be employed to take advantage of different energy sources. The outlook, however, for the prices of different sources of energy is diverging.

A compelling conclusion of the Panel's work is that there is a link between having good and timely information and the preparedness of firms to adjust to changing energy markets. Firms that are exposed to energy price increases or volatility can improve their preparedness to act by investing in information,

including benchmarking information, and specialized resources focused on the financial and technical implications of energy prices for their business. But, in interpreting this evidence, it must be recognized that energy prices, while important, are only one element in complex business decisions.

Based on its experience in responding to the charge, the Panel identified several issues that were out of scope for this assessment or for which evidence was not available, but which may well be worth pursuing in a future research agenda:

- the impacts of new technologies on energy choices, in particular those related to the ability to substitute away from oil to electricity or natural gas in transportation, but also those that can mitigate the environmental and safety concerns in developing fossil fuels;
- the opportunities for Canadian firms through development of alternative sources of energy and new ways of using energy;
- the implications for Canada of greater energy abundance in the United States such as the prospects for export markets and the competitiveness of energy-intensive firms in the United States versus Canadian competitors; and
- the specific information, data, and skill sets needed for business to adjust to and capitalize on a more complex energy future, the barriers to gathering and accessing such information and skill sets, and potential strategies to eliminate such barriers.

Glossary

Adaptability – Actions taken and strategies employed directly by firms in response to changing and volatile energy prices. Adaptability is enhanced by preparedness and is an important aspect of resilience.

Elasticity – The ratio of the percentage change in one variable relative to the percentage change in another, thereby measuring the responsiveness of the first variable to a causal impact of the second. For example, the price elasticity of a product is the percentage change in the quantity demanded of a product in response to the percentage change in its price. An elastic (inelastic) product is one where the percentage change in the quantity demanded is greater (less) than the percentage change in price.

Energy Conservation – The reduction in the total amount of energy consumed after undertaking a “conservation action.” As such, energy conservation may or may not be associated with increased energy efficiency or reduced energy intensity, depending on how demand for energy services changes.

Energy Efficiency – The energy services provided or physical goods produced per unit of energy input.

Energy Intensity – The cost of energy input per unit of economic value. For individual industries or sectors, this is measured as energy used per unit of gross output, and for the economy it is measured as the ratio of energy expenditures per unit of gross domestic product.

Exposure – The Panel’s definition of industrial sectors that are exposed to energy prices includes energy-intensive industries, whose energy intensity is greater than 5%; capital-intensive industries, where capital services are 40% or more of gross output; and the transport equipment sector because the goods produced by this sector consume significant amounts of energy.

Preparedness – The degree to which firms are ready to adapt to changing and volatile energy prices. The Panel’s indicators of preparedness consist of the availability of timely, accurate, and relevant information about the evolution of energy markets; benchmarking data; and personnel specialized in understanding the implications of energy for the firm. There is a link between these indicators of preparedness and firm adaptability. Moreover, business demand for these components is increasing in the degree of firm exposure to energy prices.

Primary Energy – Sources of energy that can be extracted or captured directly from natural resources. These include, for example, crude oil, natural gas and natural gas liquids, thermal coal, hydroelectric power, nuclear-generated electricity, and electricity produced from renewable sources.

Resilience – The capacity of a firm, an industry, or group of industries to adapt and adjust to (or “bounce back” from) adverse energy-related events. Past and future resilience can be explored by looking at historical data and indicators of preparedness, respectively.

Secondary Energy – Secondary energy denotes electricity produced from primary sources or energy carriers produced from primary sources. These include, for example, electricity produced from oil, natural gas, or coal, as well as refined petroleum products made from petroleum crude or hydrogen made from reforming natural gas.

Vulnerability – Sectors where exposure to energy prices may lead to negative competitiveness and other impacts.