



Maximizing Canada's Energy Advantage

Canadian Industrial Energy Efficiency

Energy and Mines Ministers' Conference

Halifax, Nova Scotia

July 2015



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Introduction

At the Energy and Mines Ministers' Conference (EMMC) 2014, the ministers recognized the significant contribution energy efficiency makes to economic growth and job creation in Canada and to the productivity and competitiveness of Canadian industries. The ministers agreed that reinforcing existing collaboration would help improve the competitiveness and productivity of energy-intensive Canadian industries. Such action would empower decision-makers to make informed energy choices and enhance the overall performance of Canada when it comes to using energy and safeguarding the environment.

Industry is the most energy-intensive sector in Canada, accounting for more than one-third of Canada's energy use. Substantial opportunities to improve industrial energy efficiency exist. When Canadian industries find ways to harness energy costs, they save money; improve productivity, competitiveness and environmental performance; and create jobs and economic growth.

Federal, provincial and territorial governments in Canada have in place a number of measures to provide information and resources to the industrial sector to help manage their energy use and improve national and international collaboration. Still, barriers remain to further adoption of energy efficiency by Canada's industries. Governments are uniquely positioned to help industry by addressing existing barriers and stimulating action.

This report builds on outcomes of EMMC 2014 and provides considerations for continued improvement of industrial energy efficiency in Canada. It includes an overview of the state of energy use by industry; the benefits of energy efficiency; barriers and proposed approaches; and opportunities to address those barriers in order to advance energy efficiency in the industrial sector.

"Environmentally responsible business practices go hand in hand with long-term economic growth and enhanced prosperity."

- Canadian Council of Chief Executives

"In today's global business environment, it is a challenge to gain competitive advantage via human resources, equipment or process efficiencies. Energy management provides industry with one lever it can use to lower its costs and improve its competitiveness."

- Andy Mahut, Executive Board Chair, Canadian Industry Program for Energy Conservation

The state of energy use in industry

Canada has vast energy, mineral and forest resources, which are critical to its economic prosperity. The industrial sector accounts for 24% of the Canadian economy and provides almost 3.5 million jobs to Canadians. The Canadian industrial sector spends more than \$42 billion each year on energy. This accounts for more than one-third of Canada's total energy use. The industrial sector also emits a corresponding proportion of Canada's greenhouse gas emissions. The sector generates approximately one quarter of all economic activity.¹

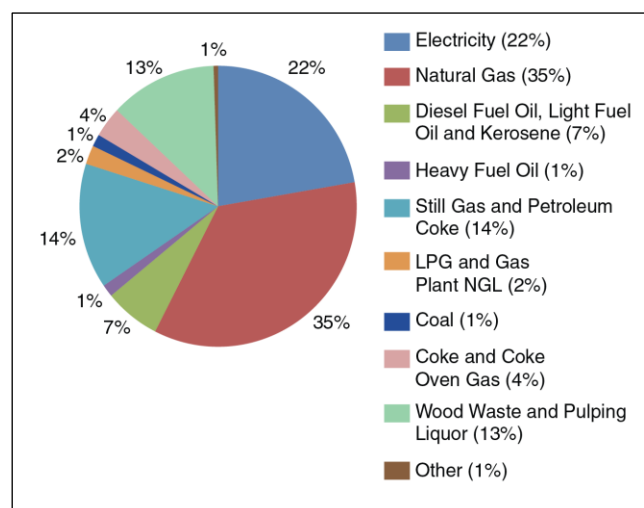
The industrial sector includes all manufacturing industries, mining activities, forestry and construction. While industrial activity takes place across Canada from coast to coast to coast, most industrial activity is concentrated in Alberta, British Columbia, Ontario and Quebec.

Energy is used by the industrial sector to produce heat, generate steam, and power motors and equipment. Natural gas and electricity meet more than half of industry's energy needs.

Many of Canada's industries are energy-intensive – they use a high proportion of energy to produce their goods and services. These energy-intensive industries are mining (including oil sands production), oil and gas, pulp and paper, petroleum refining, chemicals, smelting and refining, steel, and cement. For energy-intensive industries, energy can represent as much as 45% of overall operating costs.

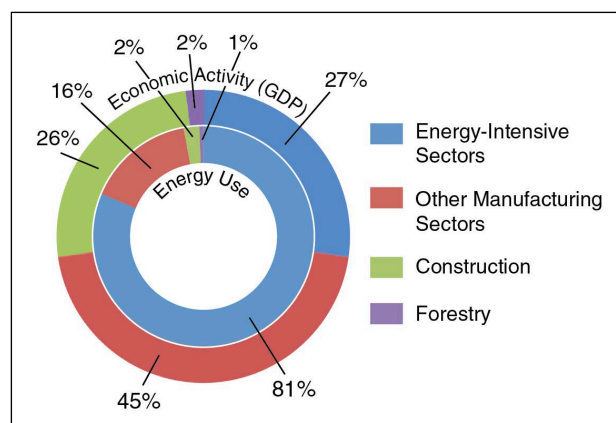
Industrial contribution to economic activity, as measured by gross domestic product (GDP), is not proportional to energy consumption, particularly for energy-intensive industries. For example, other manufacturing sectors contribute 45% of the industrial sector's GDP but account for only 16% of the sector's energy use. In contrast, energy-intensive industries represent 27% of the sector's GDP but use 81% of all industrial sector energy consumed. Mining and pulp and paper together account for approximately a quarter of industrial GDP but nearly half of total industrial energy use among energy-intensive sectors.

Figure 1. Natural gas and electricity are the main fuels used in the industrial sector



Source: Natural Resources Canada, *Energy Efficiency Trends in Canada 1990 to 2011*

Figure 2. Industrial contribution to economic activity is not proportional to energy consumption



Source: Natural Resources Canada, *Energy Efficiency Trends in Canada 1990 to 2011*

¹ Natural Resources Canada, *Energy Efficiency Trends in Canada 1990 to 2011*

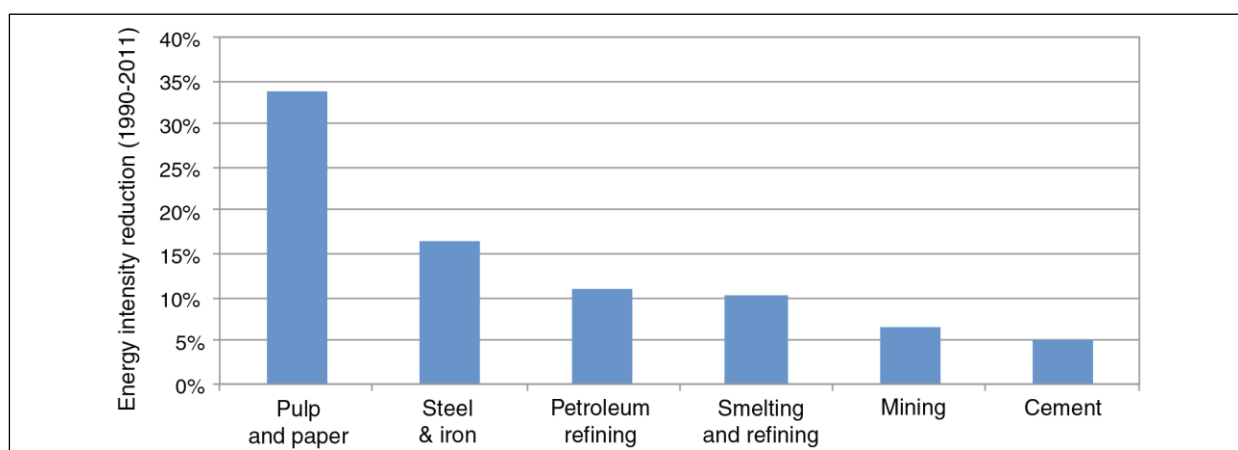
Opportunities and benefits of action

For industry, an improvement in energy performance translates into energy and operating cost savings, increased productivity and competitiveness and improved environmental performance. When industrial energy users spend their energy savings on expanding their businesses or factories, they create greater demand. This generates additional economic growth and creates more jobs throughout the economy.

Canada's industrial sector has made progress on reducing its energy use. Between 1990 and 2011, overall industrial sector energy performance improved by 15%.² Between 2001 and 2012, Canada's overall energy intensity as a function of GDP improved about 20% while the average intensity for all International Energy Agency (IEA) member countries improved only 15%.³

In Canada, six energy-intensive sectors have made energy performance gains of between 5% and 35% over the last two decades, resulting in improved overall productivity and better ability to compete in global markets.

Figure 3. Energy performance, based on energy used (measured in petajoules) per physical output (tonnes of product output), has improved in energy-intensive industries since 1990



Source: Canadian Industrial Energy End-Use Data and Analysis Centre

The pulp and paper industry is one example: government, utilities and companies have, collaboratively, made significant improvements in the energy efficiency of Canada's pulp mills, saving these mills more than \$2.1 billion in energy costs over the past 25 years. Mining, which includes unconventional oil production, has also greatly improved its energy performance.⁴ Energy efficiency in unconventional oil production has improved by 45% since 1995.⁵ Without these improvements, this sector would be using 182% more energy today.

² Natural Resources Canada, *Energy Efficiency Trends in Canada 1990 to 2011*

³ IEA, *Energy Efficiency Market Report, 2014*

⁴ *Energy Efficiency Update 2014: Economic Benefits of Responsible Energy Use*, Energy and Mines Ministers' Conference 2014

⁵ Canadian Industrial Energy End-Use Data and Analysis Centre, based on physical output and energy use

Although Canada's industrial sector has reduced its energy use over the past decades, Canadian industry is facing a growing productivity gap with its major competitors. Between 2000 and 2011, Canada's industrial energy intensity increased by 4%, while energy intensity in the United States (U.S.), Australia, France and Sweden decreased by over 20%.⁶

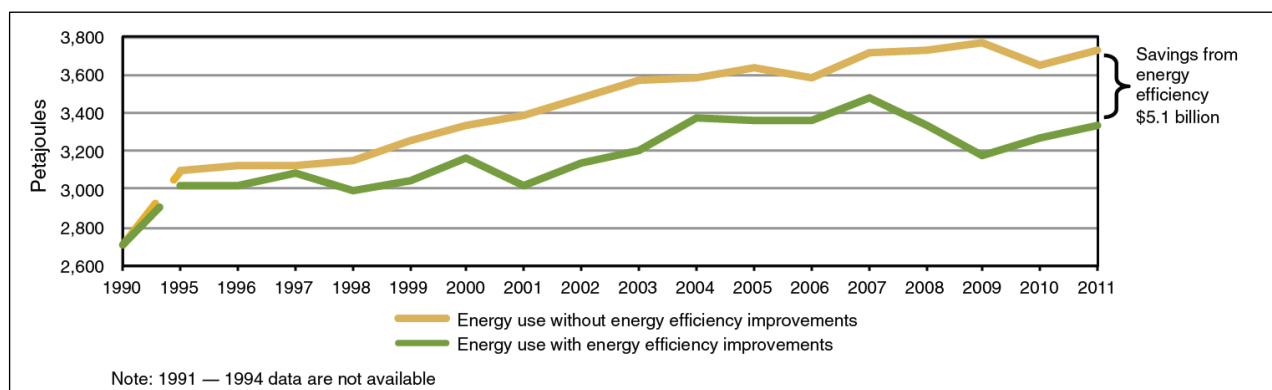
Challenges remain within specific industries as well. For example, compared to 2012, Canadian unconventional oil production is forecast to increase by 78% by 2020, 118% by 2025 and 144% by 2030.⁷ Without further energy efficiency gains, total energy use and greenhouse gas emissions will increase proportionately.

Considerable potential remains for energy efficiency improvements within the industrial sector. The IEA estimates that 70% of potential energy savings in Canada's industrial sector remains untapped from existing energy-efficiency technologies.⁸ Annex A provides examples of how companies have benefitted from energy efficiency improvements.

Reducing energy costs

For many industries, energy is one of the largest costs of doing business. Energy savings translate immediately to the bottom line. In 2011, Canadian industry saved \$5.1 billion in energy costs through energy efficiency investments made since 1990.⁹ These savings enabled industry to make investments in operations, improve profitability and contribute to other sectors of the economy.

Figure 4. Canadian industry saved \$5.1 billion in energy costs through energy efficiency investments made since 1990



Source: Natural Resources Canada, *Energy Efficiency Trends in Canada 1990 to 2011*

There is a significant opportunity for further cost savings. A March 2014 survey found that less than 30% of Canadian businesses believed they were doing all they could to save energy and more than 60% experienced energy cost increases in the last year.¹⁰

Energy efficiency can be improved using existing, readily available technologies. For example, combined heat and power, also called cogeneration, simultaneously produces electricity and thermal energy from a single fuel source, thereby saving energy costs. The impact of using existing technologies can be significant. Each of Canada's 72 pulp mills has saved on the average \$29 million in energy costs over the past two decades¹¹ through the implementation of existing technologies to reduce energy use.

⁶ IEA, *Energy Efficiency Market Report*, 2014

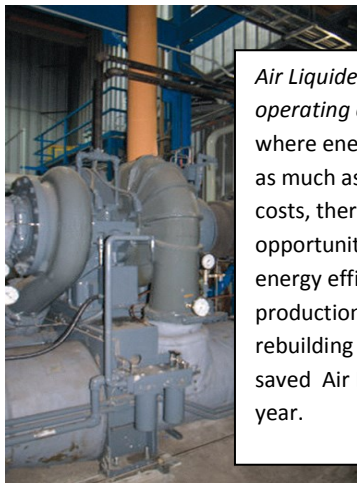
⁷ National Energy Board, *Canada's Energy Future 2013 - Energy Supply and Demand Projections to 2035 - An Energy Market Assessment*

⁸ IEA *World Energy Outlook 2012*

⁹ Natural Resources Canada, *Energy Efficiency Trends in Canada 1990 to 2011*

¹⁰ [Canadian Business Attitude on Energy Efficiency survey](#) (2014), the Gandalf Group for the Canadian Energy Efficiency Alliance, April 2014.

¹¹ *Energy Efficiency Update 2014: Economic Benefits of Responsible Energy Use*, Energy and Mines Ministers' Conference 2014



Air Liquide tackles 70% of operating costs. – In an industry where energy costs account for as much as 70% of operating costs, there is a significant opportunity to benefit from energy efficiency. Optimizing production across facilities and rebuilding a surplus compressor saved Air Liquide \$500,000 per year.



Flin Flon's Hudson Bay Mining and Smelting reduces operating costs by 90%. – By replacing pumps that had been used since the 1950's, Hudson Bay reduced their annual operating costs by 90%. In addition to cost savings, their new system is more reliable, requires less maintenance and operates at optimum efficiency.

Productivity and competitiveness

The production of virtually all goods and services requires energy. Reducing energy use per unit of output reduces total energy use and total energy costs and increases productivity. The IEA reports that productivity savings can be 2.5 times greater than energy savings.¹²

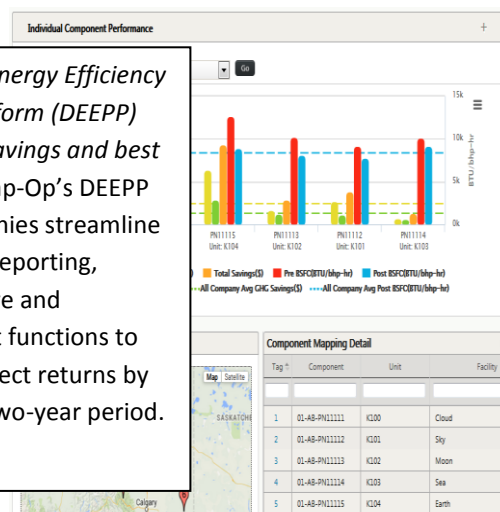
Energy efficiency projects also help industrial facilities become more competitive by extending the life of equipment, identifying redundancies, mitigating corporate risks and accessing new markets. Energy savings can also be passed to shareholders in the form of higher profits and dividends. Energy savings can be reinvested into the organization, thereby increasing the quantity and range of products and services offered, and creating jobs.

Investing in more productive and economical use of energy promotes economic growth and prosperity.¹³ European Union (EU) economies have been leading the world in reducing the domestic energy content of exports. This has helped firms mitigate adverse effects of increases in the relative price of energy. EU firms are also world leaders in investments in clean and energy-efficient technologies, products and services. To remain competitive, firms need to focus on opportunities offered by global environmental and societal goals and challenges.¹⁴



Imperial Oil Sarnia improves operations with steam leak repair program – Imperial Oil Sarnia replaced 9,000 steam traps and implemented a maintenance program. The company benefitted from improved productivity and over \$3 million in annual energy cost savings.

Distributed Energy Efficiency Projects Platform (DEEPP) automates savings and best practices - Cap-Op's DEEPP helps companies streamline equipment, reporting, administrative and management functions to improve project returns by 34% over a two-year period.



¹² IEA, *Spreading the Net: The Multiple Benefits of Energy Efficiency Improvements*, 2012

¹³ Allianz Dresdner Economic Research, *European Growth and Jobs*, 2008

¹⁴ *European Competitiveness Report, 2012: Reaping the benefits of globalization*

Environmental performance

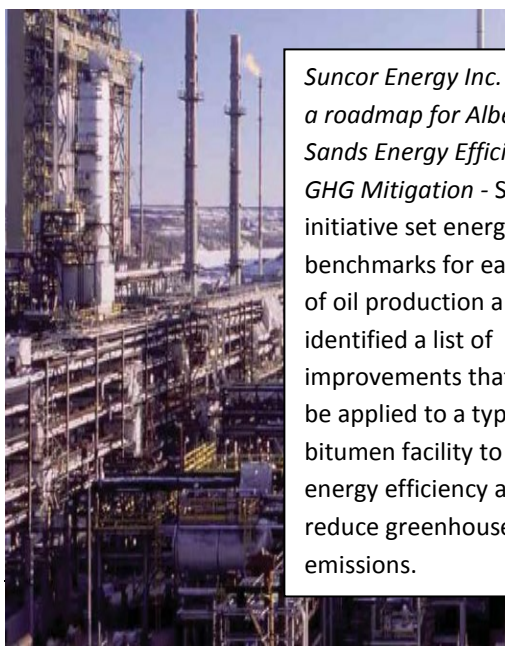
Concerns about the environment, including rising greenhouse gas and other air emissions, are leading to unprecedented challenges for Canada's resource extraction and industrial sectors. For example, the Council of Canadian Academies reports that the development of unconventional oil and gas is hindered by public concerns related to health and the environment.¹⁵

Responsible resource development is critical in balancing economic benefits and environmental impacts of major resource and industrial projects. The future development of Canada's resources and the health of Canada's industrial sector will depend heavily on the ability of government and the private sector to "do the right thing." Economic growth and environmental performance are inextricably linked.

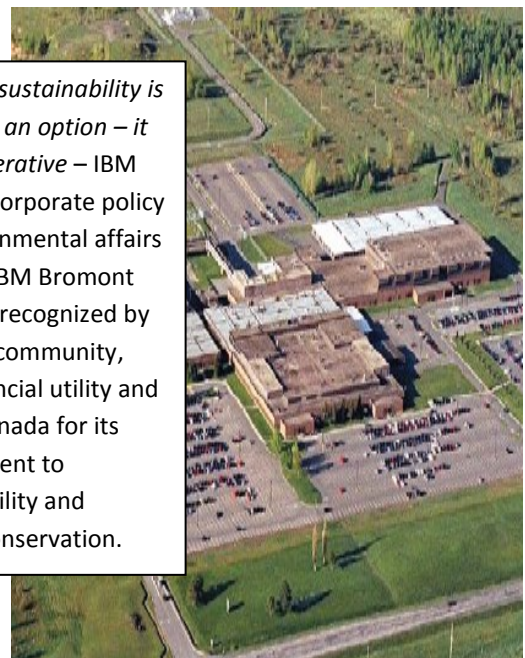
Energy efficiency can play an important role in improving environmental performance. Energy efficiency not only saves energy and costs, it also directly contributes to the reduction of greenhouse gas and other air emissions. Moreover, various independent studies show these measures are cost-effective at reducing greenhouse gases emissions.¹⁶ The IEA highlights that energy efficiency has been the most important driver to reducing energy use, and associated emissions, over the past decade.¹⁷ Energy-efficient practices have also been shown to reduce solid waste and input materials (such as water).¹⁸

The IEA estimates that energy efficiency could provide approximately half of the global emissions reductions needed to limit warming to 2°C.¹⁹ Many countries are using energy efficiency to slow the increase of energy consumption associated with their economic growth. Decoupling energy use from economic growth is the penultimate goal. Energy efficiency is a key measure in U.S. federal climate change action plans, and it is being aggressively implemented in many other countries, including China and India.

Companies can advance their corporate responsibility goals and improve their image by taking action to improve their environmental performance and communicating with local communities and a broader audience about their sustainable practices.



Suncor Energy Inc. develops a roadmap for Alberta Oil Sands Energy Efficiency and GHG Mitigation - Suncor's initiative set energy benchmarks for each stage of oil production and identified a list of improvements that could be applied to a typical bitumen facility to improve energy efficiency and reduce greenhouse gas emissions.



IBM says sustainability is no longer an option – it is an imperative – IBM issued a corporate policy on environmental affairs in 1972. IBM Bromont has been recognized by the local community, the provincial utility and across Canada for its commitment to sustainability and energy conservation.

¹⁵ *Environmental Impacts of Shale Gas Extraction in Canada*, Council of Canadian Academies, May 2014

¹⁶ McKinsey & Company. "[Unlocking energy efficiency in the US economy](#)," McKinsey Latest thinking, 2009; "[Mobilizing for a resource revolution](#)," 2012, "[Are you ready for the resource revolution?](#)" 2014, McKinsey Quarterly; "[Manufacturing growth through resource productivity](#)," McKinsey Insights & Publications, 2015.

¹⁷ IEA, *Capturing the Multiple Benefits of Energy Efficiency*, 2014

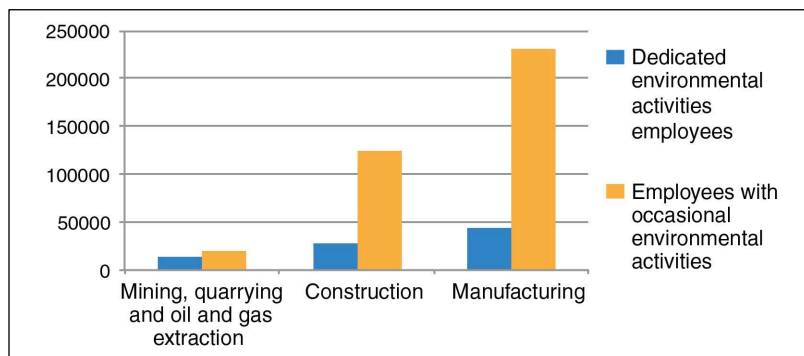
¹⁸ IEA, *Capturing the Multiple Benefits of Energy Efficiency*, 2014

¹⁹ IEA, *World Energy Outlook 2012 – Executive Summary*

Job creation

In Canada's industrial sector, more than 425,000 workers perform tasks related to environmental performance, which includes energy resource management. Mining, oil and gas, and forestry sector employees in this group spend at least half of their time performing tasks related to promotion of sustainable natural resource use, mitigation of environmental impacts and maintenance of ecological systems. In other less energy-intensive sectors, such as manufacturing and construction, environmental tasks take up a smaller portion of employee time. Despite environmental activities being increasingly integrated into mainstream work, demand for specialized employees in this sector is expected to grow, particularly in the fields of mining and forestry.²⁰

Figure 5. More than 425,000 industry jobs are dedicated or partially dedicated to environmental performance



Source: Eco Canada, Profile of Canadian Environmental Employment, 2013

Investment in energy efficiency improvements also creates jobs in Canada. It is estimated that every million dollars invested in energy efficiency programs generates a net increase of 52 jobs.²¹

Kamloop's New Afton mine uses energy management expertise to be a world leader
- New Gold is one of the lowest cost producers in the global mining industry. Working with an on-site energy manager and consultants and suppliers with experience in industrial facilities, New Gold anticipates reducing costs even further.



²⁰ ECO Canada, Profile of Canadian Environmental Employment, 2013

²¹ Environment Northeast (ENE) (now Acadia Center), March 2014

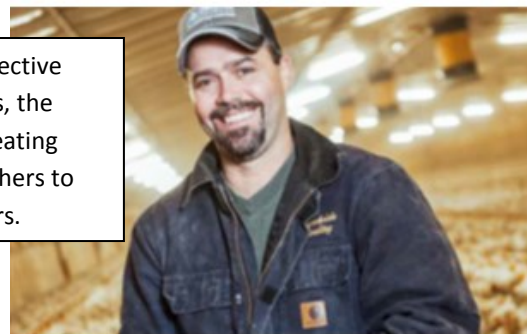
Economic growth

When businesses reduce energy costs through energy efficiency, two broader economic benefits ensue: stimulus for the energy efficiency industry through increased demand for efficient products and services and increased general spending by industry through funds made available by lower energy costs. These broad economic benefits manifest most prominently in increased economic activity, higher employment, lower energy prices and favourable trade balances.²² A recent study indicates that from 2002–2012, energy efficiency improvements across Canada increased GDP by about 1%, or \$16 billion per year, and added roughly 2.4% to the overall level of employment.²³

Within the industrial sector, efficiency and productivity are determining factors in any decision to expand or reduce operations. Moreover, a strong domestic energy efficiency industry increases the opportunity for Canadian companies to grow by tapping the \$300 billion global market for energy efficiency and clean technologies.²⁴

There is substantial opportunity to improve industrial energy efficiency and position Canada's industrial sector for the future, though a number of barriers still exist.

Brookside Poultry cuts annual heating costs in half – A reliable, cost-effective energy source is vital to Brookside Poultry. Working with local suppliers, the company installed a geothermal heating system and reduced annual heating costs by 50%. Karson Lewis, owner of Brookside Poultry, encourages others to consider renewable energy by sharing his experience with other farmers.



“To compete in global markets, you have to be efficient.”

- Canadian Fuels Association

“Today, there is no debate: resource productivity must be among the top priorities – if not the top priority – of industrial manufacturers around the world.”

- McKinsey & Company²⁵

“Today, the issue of energy efficiency is even more important for industry, as manufacturers look to reduce waste in order to strengthen their competitive position in the marketplace . . .”

- Canadian Manufacturers and Exporters

²² IEA, *Capturing the Multiple Benefits of Energy Efficiency*, 2014

²³ Navius Research, *Energy Efficiency and Economic Growth: A Retrospective Analysis for Canada from 2002 to 2012: Working paper*, March 2015

²⁴ IEA, *World Energy Investment Outlook*, 2014

²⁵ mckinsey.com/insights/operations/manufacturing_growth_through_resource_productivity

Barriers to energy efficiency

Canadian industry faces a number of frequently cited barriers to improved energy efficiency.

Lack of support for energy-efficient practices from senior managers: “How do I show my management the potential savings?”

Industry’s focus is on meeting production and profit targets rather than managing energy use.²⁶ Senior management may not be aware of, nor support, investments of time and money in energy efficiency. This creates a culture that puts little value on the management of energy. Energy efficiency actions and improvements are still not widely viewed as a strategic investment in future profitability, even though they contribute to the competitiveness and productivity of companies.²⁷

Lack of knowledge about available products and services: “Where do I start looking for potential savings?”

This knowledge deficit stems from insufficient staff training and industry-specific technical expertise and a lack of energy use assessments. The American Council for an Energy-Efficient Economy notes that these three factors are key barriers to industrial energy efficiency.²⁸

Lack of resources and expertise to implement comprehensive systems and projects: “What is the best option for our facility?”

Most businesses recognize energy efficiency as increasingly important, but struggle with its implementation. While companies appear to embrace the concept, they grapple with how to implement enterprise-wide energy saving measures.

Lack of funds for implementation: “How can we fund this project?”

Lack of funds or financing options, as well as competition for limited corporate resources, is a barrier to industrial energy efficiency. Energy efficiency projects are often not pursued, as senior executives consider the return on investment too low and the risks of these investments too high. Limited corporate funds are therefore invested in projects perceived as less risky with higher returns.

Low energy prices: “Is it worthwhile to invest in energy efficiency?”

Low natural gas prices and, more recently, low oil prices have increased the payback period – the time it takes for investors to recoup capital costs in energy savings – for many energy efficiency options. With a longer payback period, companies are even more reluctant to commit the capital investment necessary to implement energy efficiency measures.

²⁶ The Institute for Industrial Productivity

²⁷ IEA, *Energy Management Programmes for Industry*, 2012

²⁸ American Council for an Energy-Efficient Economy, R. Neal Elliott and Nate Kaufman, [Barriers to energy efficiency investments and energy management in the U.S. industrial sector](#). 2009

Promoting energy efficiency in industry

Industry-focused energy efficiency programs in Canada focus on six key actions to help industry overcome the barriers it faces when implementing more energy-efficient practices. Annex B includes a list of industrial energy efficiency programs across Canada.

- 1. Foster understanding of the business case for energy efficiency improvements** – Providing decision makers with reliable, clear information about investment costs, savings and available assistance supports informed energy efficiency decisions. Corporate culture plays an important role in the adoption of energy-efficient practices. Support from senior managers is often cited as the reason for successful implementation of energy saving projects.
- 2. Provide clear, useful information about the available products and services** – Information about current technologies, costs, best practices and benchmarking of energy use can help energy-intensive and manufacturing sector companies understand how they use energy and what options are available to make energy use more efficient.
- 3. Provide support to implement projects** – Technical experts reduce the costs associated with developing in-house expertise and alleviate the burden on existing employees to become energy efficiency specialists. Funding for consultants and referral of qualified technical experts can help industry find solutions that yield the greatest benefits at the lowest cost.
- 4. Provide financial support to help energy efficiency projects compete** – Decision-making around energy efficiency initiatives is based on cost-benefit considerations. While many effective energy efficiency solutions, such as those that raise awareness or change behaviours, can be realized with little or no cost, projects with a longer payback period can be perceived as having greater risks and uncertainties. Financial support enables energy efficiency projects that have a lower return on investment or perceived higher risk to compete with other corporate priorities.
- 5. Leverage established relationships with key stakeholders** – Leveraging established partnerships, networks, industry groups and service providers is an effective way for governments to disseminate information about potential cost savings, improving productivity and other potential opportunities. Providing messages that are tailored to specific audiences, and communicating information that is relevant to those audiences, can help demonstrate the benefits of energy efficiency to the industrial sector.
- 6. Recognize leaders and celebrate success** – Success stories provide a valuable resource to industry by showing best practices and lessons learned. Drawing attention to industry's efficiency leaders encourages other companies to take action to improve environmental performance and use resources responsibly.

Working together for maximum effect

Programs supporting industrial energy efficiency are delivered by governments, utilities and Crown corporations. Most programs that provide funding or cost-shared assistance require a direct financial contribution from industry.

Program structure varies across jurisdictions. Some jurisdictions offer a single, industry-focused program with a wide range of services, resources and support to industrial facilities looking to improve their processes through energy efficiency. Others offer a suite of focused programs that can be combined, as needed, to address the requirements of industrial facilities.

More focused industrial energy efficiency programs may provide support for a specific technology or practice, offer incentives for specific activities (such as updating equipment or shifting electricity demand), or encourage a systematic, ongoing approach to optimizing energy (such as energy management and energy management information systems).

Information on industrial best practices, sector-specific benchmarking studies and case studies of industrial facilities are also valuable for disseminating information on industrial energy efficiency success and leaders.

Federal, provincial and territorial collaboration

Federal, provincial and territorial governments work together to deliver services and provide opportunities to share information. Jurisdictions collaborate by designing complimentary program offerings, cross-promoting programs and services, collaborating through joint outreach initiatives and partnering to conduct pilot projects and training.

Governments are also collaborating internationally to bring resources, instruments and information to support Canadian industry efforts to improve energy efficiency. Representatives from Canada have been instrumental in providing Canadian input to the development of the International Organization for Standardization's ISO 50001 Energy Management Systems standard and efforts are ongoing to increase adoption of the standard by participating in international forums such as the Energy Management Working Group. Governments in Canada also work internationally to learn from their industrial energy efficiency successes. For example, BC Hydro, with support from the province's Ministry of Energy and Mines, has worked with the U.S. Department of Energy and the Canadian Standards Association to develop methodologies for benchmarking specific industrial systems.

Looking forward

Governments across Canada are uniquely positioned to help industry overcome barriers, catalyse action and provide national consistency. A wide selection of government energy efficiency programs for industry exists across jurisdictions. Working together, governments have an opportunity to leverage and align existing programs and services, as well as use energy efficiency measures to reinforce climate change policies. Initial areas of focus for enhanced intergovernmental collaboration could include:

- **Building on past success**, exploring possibilities for enhanced collaboration.
- **Conducting sector-specific outreach** to provide industry with information that is tailored to energy-intensive sector and manufacturing needs through established networks.
- **Improving industry's access to information and services** by optimizing funding and eliminating administrative duplication where possible.
- **Informing a broad audience about industrial energy efficiency success stories** to provide practical examples to industry and improve confidence in industrial sector energy use.

An increase in the collective actions of governments across Canada to promote and enable industrial energy efficiency will encourage greater energy savings, improve productivity and competitiveness, and strengthen confidence in the environmental performance of Canada's industrial sector.

Building on past successes - collaborative industrial energy efficiency projects (see Annex A)

- More than 3,000 industrial organization representatives across Canada improved energy management through joint training initiatives, webinars and peer-to-peer sessions offered by Natural Resources Canada, in partnership with governments, utilities, non-profit organizations and industry associations. Topics included process integration, energy management and sector-specific interests.
- More than 300 energy efficiency and industry leaders shared experiences and learned best practices at Energy Summit 2014, a national conference delivered jointly by the Excellence in Manufacturing Consortium and Natural Resources Canada, in partnership with the Ontario Power Authority and with support from Enbridge Gas Distribution and Union Gas Limited.
- Ontario manufacturing plants participated in an energy management benchmarking study and identified 29% sector-wide energy savings by 2030. The 2010 study was led by Canadian Manufacturers and Exporters, with contribution from Natural Resources Canada, the Ontario Power Authority, Union Gas, Enbridge, Hydro One and several Ontario ministries (Energy and Infrastructure, Environment and Economic Development and Trade).

Attachments

- **Annex A: Industrial Energy Efficiency Collaboration Success Stories**
- **Annex B: Industrial Energy Programs Available Across Canada**
- **Infographic**