

Energy Efficiency as a Driver for Industrial Productivity in Canada

Corporate competitiveness and other economic outcomes from industrial energy efficiency programs – breaking the glass on Canada's productivity lag.

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1 Executive Summary

Industrial energy efficiency (IEE) plays a critical but underrecognized role in improving productivity, profitability, and economic performance across Canada's industrial sector. Energy efficiency program providers incentivize IEE projects to accelerate adoption. While IEE is traditionally evaluated based on energy savings and emissions reductions, this study reframes energy efficiency as a core driver of industrial productivity.

Industrial productivity reflects how efficiently firms convert inputs such as labour, capital, and materials (which includes energy) into economic output, measured by gross domestic product (GDP) per output or unit of production, while energy productivity is measured as GDP per unit of energy consumed (GDP/GJ). Energy is a controllable input, where energy costs often represent 2-10%, and in energy-intensive firms, up to 20-45% of the operating costs. Quantifying non-energy benefits (NEBs), such as improved uptime, reduced maintenance, better product quality, and higher throughput, can enable quantification of the impact of industrial energy efficiency on productivity.

At a macro level, the IEE projects generate broader economic benefits through capital deployment and reinvestment of energy savings, amplified by supply chain effects. When there is capital investment in IEE projects, the project spend locally has direct, indirect and induced effects that further amplify the productivity impact to the broader economy. Industry research shows that NEBs can provide additional savings of 45% to 200% of the energy cost savings. Where firms are reinvesting energy costs savings for further capital investments, cost savings associated with NEBs can also be applied as freed capital to further the economic impact, while supporting firm profitability and competitiveness.

Across the four provinces, Ontario, Alberta, New Brunswick, and Nova Scotia, over the past five years, and committed projects for the next 2 years (ERA), deliver **26.4 PJ in energy savings – equivalent to the annual energy use of ~310,000 homes in Canada. These 2,420 projects¹ are supported by \$176M in incentive funding contributing to a total \$1.07B in project investment, inclusive of incentives.**

¹ Any total values in the report include both completed (2,348) and committed (72) projects.

Current IEE program activity of 930+ firms over the past five years and committed projects for the next two years (ERA), is estimated to contribute \$5.01B in economic activity, representing a 1.56% GDP impact, and supporting over 39,000 jobs over a 12-year² period. **Each \$1M in incentive funding impacts roughly \$39M in economic activity and 308 jobs. For every \$1 invested by industry in energy projects, the estimated GDP impact is ~ \$5.**

Despite these benefits, participation in IEE programs remains low, with 1-25% of firms participating across the jurisdictions and only 13.9% of potential industrial energy use captured across the four provinces. Program design and funding structure can play a key role in the success of IEE programs. Utility-led and directly administered IEE programs, including ratepayer-funded Enbridge in Ontario, and both NB Power in New Brunswick and EfficiencyOne's independent, not-for-profit model in Nova Scotia, supported by ratepayer and public funding, may have achieved higher market penetration through targeted and consistent delivery over a period of 10+ years. Primarily public-funded programs (ERA and IESO) can enable larger capital deployment and can adapt to a diverse market need through a network of delivery partners. Program duration, alignment with capital planning cycles, and access to direct support from the program administrators further influence participation. **If current program participation expands to 75% of the industrial energy users in these provinces, the energy productivity improvement would be significant, from 1.4% to 16.8%, generating \$57.4B in economic impact.**

Furthermore, **a 30% in energy reduction in the entire industrial sector has the potential to improve energy productivity by 42.9% - a material impact to the Canadian economy.**

IEE investments at the firm-level can result in meaningful impact to their profit margins. For Canadian firms, in resource-extraction and energy-intensive sectors such as Mining, Oil and Gas, **25% in energy reduction in energy use can drive up to 6% increase in margins; in final goods-manufacturing firms, this can drive up to 4% increase in margins.**

Today, there are no macroeconomic models available to clearly quantify the industrial productivity impacts of energy savings. A modified Cobb-Douglas production function can illustrate the relationship between energy efficiency and industrial productivity by showing how output is influenced by key inputs such as labour, capital, energy, and technology. Current programs do not capture data such as baseline energy, labour impact and other operational benefits consistently to support a complete industrial productivity analysis. The study's program analysis indicates that each GJ of energy savings is supported by \$5.16 in funding. Based on industry research, it can be estimated that roughly **\$1B in Industrial Energy Efficiency funding could support the improvement of labour productivity by 1%.**

This study concludes that energy efficiency should be positioned not only as a tool for reducing energy consumption, but as a strategic lever for enhancing industrial productivity and competitiveness. The findings also point to significant **untapped potential in IEE programs.** By integrating productivity metrics into program design, improving data collection frameworks, and aligning funding structures with industrial decision-making, IEE programs can drive greater participation and unlock significant economic value across Canada's industrial sector. The full value of these investments, including non-energy benefits, freed capital for reinvestment, and long-term productivity gains, remains undercaptured in traditional IEE program evaluations. **Accelerating IEE adoption is not simply an energy policy objective, but a national strategic economic imperative that can drive sustained growth, resilience, and improved industrial productivity across Canada.**

² The useful energy lifetime taken for this study is 12 years. Source: <https://www.osti.gov/servlets/purl/1236443>

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3 Purpose of the Study

The industrial sector, defined by the transformation of raw materials into finished products, requires **energy as a critical input alongside labour, capital and materials**. The energy cost share in most industrial process ranges from 2-10% while resources-extracting, energy-intensive industries can go up to 20% and for some firms, up to 45%³.

The industrial sector dominates Canada's energy consumption, where it accounts for 41%⁴ of total energy use (Figure 1). Also in Canada, productivity growth has historically lagged peer economies. In 1984, the economy was producing 88% of the value generated per hour in the United States; by 2022, this had dropped to just 71%⁵, highlighting a growing competitiveness gap. Furthermore, with recent focus on productivity by both the Canadian government and industry, there is a market need to understand the relationships of energy efficiency and its role in industrial productivity.

This study represents one of the first cross-provincial analyses in Canada to link Industrial Energy Efficiency (IEE) with productivity outcomes through the analysis of committed IEE projects.

Energy input has historically been undervalued as a strategic lever within the industrial sector, despite being a core production input alongside labour and capital. Across the jurisdictions in scope, market penetration of IEE programs remains variable, from 6% to 76% of eligible facilities participating in the past five years and

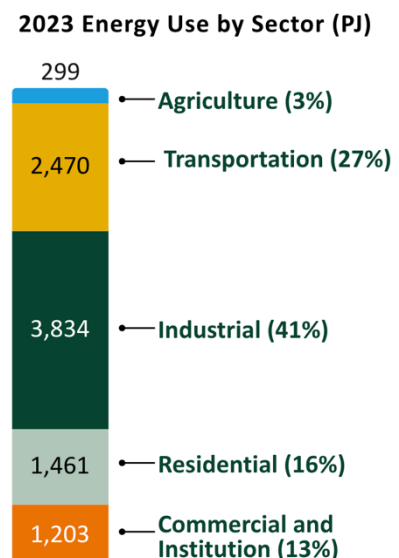


Figure 1: Energy Use (PJ) in Canada by Industry, 2023

³ Source: "Maximizing Canada's Energy Advantage, NRCAN, 2015. https://natural-resources.canada.ca/sites/nrcan/files/www/pdf/publications/emmc/15-0138_Industrial%20report_e_acc.pdf

⁴ Source: "Comprehensive Energy Use Database (CEUD), 2023," Natural Resources Canada, <https://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/home.cfm>

⁵ Bank of Canada – "Time to break the glass: Fixing Canada's productivity problem" (Carolyn Rogers), 2024

engaged for the next three years. This indicates that many firms are not actively leveraging the incentive programs. **Given the 41% share of industrial energy consumption across the nation, IEE programs and improving their incentive uptake, thereby implementing more IEE projects, can have a material impact on industry.**

IEE programs are traditionally evaluated based on energy savings and emissions reductions; however, this framing understates their broader impact on industrial performance and economic competitiveness. In practice, energy efficiency investments can improve process reliability, reduce downtime, lower unit production costs, and enable reinvestment within firms – outcomes that are directly tied to industrial productivity.

The industry and the IEE program providers are currently not fully capturing the key linkages between energy efficiency, productivity and the broader economic outcomes. This study builds on that gap, **positioning energy efficiency not just as a tool for energy or emissions reduction, but as a core driver of industrial productivity, profitability, and capital allocation, with direct implications on economic value creation.**

Objective: Identify and quantify the impacts of provincial energy efficiency (EE) projects on industrial productivity and economic impact in four provinces – Alberta, Ontario, New Brunswick and Nova Scotia – across Canada, evaluating the completed projects in the last 5 years and drawing future potential impacts.

Intended Outcomes:

1. Understand the relationship between energy efficiency and productivity.
2. Highlight industrial energy efficiency projects and their economic impacts.
3. Share best practices across provinces, informing future IEE program design and marketing strategies.

Intended Audience:

- **Firm-level decision makers**, who often focus on profitability, cost control, and Return on Investment (ROI). Energy efficiency is framed as a direct lever to improve margins, with incentives reducing upfront costs and accelerating payback. IEE projects support competitiveness and can enable reinvestment into innovation and core operations.
- **Program providers and administrators**, who focus on benchmarking program performance across sectors, understanding where impacts are highest, and refining program design and delivery. Ensures resources are directed toward measures and industries that drive the greatest economic and operational value.
- **Policy makers and industry stakeholders**, who focus on program frameworks, funding justification, and macroeconomic impact. These actors can position energy efficiency as a tool to enhance productivity, strengthen industrial competitiveness, and deliver broader economic benefits at the sector and national level.



4 Energy Efficiency and Industrial Productivity Background

Today, industrial firms operate in highly competitive global markets while navigating rising energy costs, carbon costs, and increasing regulatory pressure. Governments are simultaneously pursuing economic growth, energy security, and emissions reduction. In this landscape, the role of energy as a critical input within the industrial sector is evolving.

Traditional approaches to energy efficiency focus primarily on reducing energy consumption through equipment upgrades or isolated measures. These are no longer sufficient as energy efficiency must now be understood as part of a broader system of operational performance and capital planning. Advanced energy efficiency investments and optimization efforts increasingly deliver multi-dimensional impacts, including:

- Improved production throughput and product quality
- Enhanced process reliability and reduced downtime
- Changes in labour requirements through automation or upskilling
- Increased utilization and effectiveness of existing capital

Productivity is defined as output over inputs where *capital, labour and materials*, are inputs to industrial processes. When energy is reduced as an input, productivity can increase. The amount of output and the quality of output (thus higher revenue potential) can also impact the productivity function.



Productivity



more or better-quality output generated for the same or fewer inputs.

Energy productivity is defined as output (GDP) per unit of energy consumed. Energy efficiency investments often act as catalysts for broader productivity gains across all inputs and the type of energy efficiency measure will have multiple influences across the value chain.

$$\frac{GDP}{GJ} = \frac{Total\ GDP\ (\$)}{Total\ Energy\ (GJ)}$$

Furthermore, energy productivity, is inherently sensitive to changes in energy use as energy appears in the denominator. Represented in the graph below, this results in a nonlinear relationship, where deeper energy reductions yield increasingly larger improvements in energy productivity, independent of changes in output or operational performance.

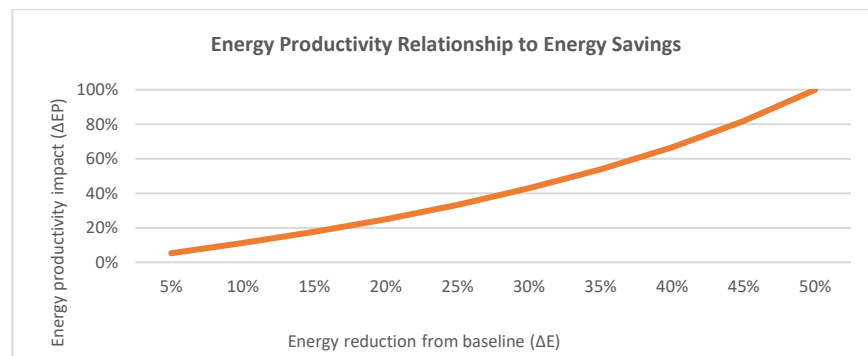


Figure 2: Energy Productivity Relationship to Energy Savings.

Industrial productivity has a unique distinction in which the outputs are physical goods (i.e. cars, steel, paper products, personal consumables etc.) that require three key inputs - labour, capital and resources - compared to the services sector that provides value-add primarily from only labour and capital inputs. When discussing industrial productivity, there is a holistic understanding of the relationships between the inputs and outputs, and what drivers affect one another. As such, when there are improvements with energy efficiency projects, a direct impact on the energy input, it drives the capacity for the industry to increase output and/or increase the value of the physical goods produced.

Labour Productivity, which is the effective use of the labour force through income wages and skill, is also a key part of this discussion. Energy efficiency projects have a secondary impact in which they sometimes introduce new technology to the firms. While not always the case, a more efficient chiller or new automation technology can change the way the labour force behaves, whether it be by upskilling to use the new tools or by reducing the demand on the maintenance teams.

Capital Intensity, the amount of fixed capital such as machinery, equipment and other assets required for production sales, and many energy efficiency projects will require some level of capital. For operational improvements, where low- to no-cost measures help make use of the existing capital for longer or function more effectively, there is an obvious implication on capital intensity. For projects where new capital is deployed, capital intensity can vary by the specific project type.

Multifactor Productivity (MFP) is an important variable to understand for the context of energy efficiency. The Organization for Economic Co-operation and Development (OECD) describes MFP to reflect “the overall efficiency with which labour and capital inputs are combined in the production process” where “MFP growth is measured as a residual – the portion of GDP growth that cannot be attributed to changes in labour or capital inputs. If input levels remain constant over two periods, any increase in output reflects changes in MFP.” For energy efficiency projects, especially with large capital investments, MFP can help quantify the added benefits of technology improvements and system improvements.



5 Scope of Analysis

5.1 The Industrial Sectors in Scope

The goods producing sector contributes to 25% of Canada's GDP as of 2025; services-producing industries make up the remaining three quarters. The scope of this study includes ~14%⁶ of Canada's total economy and over half of the goods-producing sector – broadly Mining, Oil and Gas (5.1%) and Manufacturing (8.6%), as seen in Figure 2.

The 'Industrial sector' for the scope of this study is defined by the North American Industry Classification System (NAICS) codes and only includes the Mining, Oil and Gas [21], and Manufacturing sectors [31-33], as described in Figure 3. Waste water treatment and utilities (including district energy and electricity generation), transportation, and agriculture (including forestry and logging) are not included.

⁶ Source: Statistics Canada. Table 36-10-0434-03 Gross domestic product (GDP) at basic prices, by industry, annual average (x 1,000,000)

Canada's GDP Breakdown and Industrial Sector in Scope

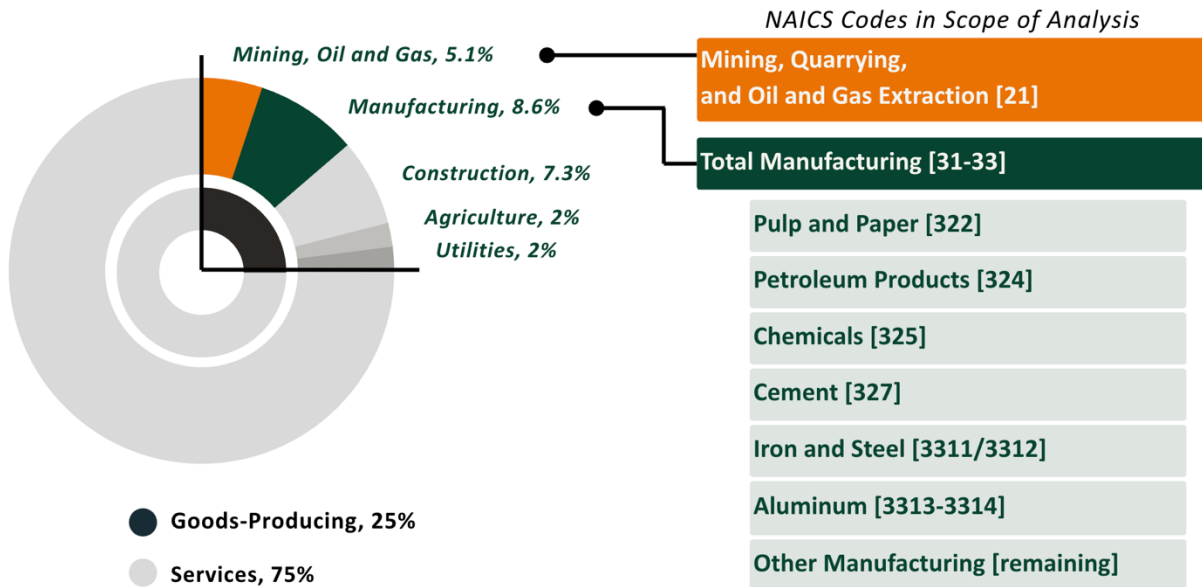


Figure 3: Industrial Sub-Sectors by NAICS codes in Analysis

Since the establishment of Government of Canada's Office of Energy Efficiency in 1997, federal and provincial governments have deployed substantial funding through a variety of programs to support industrial energy efficiency. The funding mechanisms can range from taxpayer incentives to ratepayer-funded programs, and can play a role in how projects are delivered, adopted, and scaled. The full value of energy efficiency is not yet recognized, particularly in how energy reductions affect industrial productivity.

5.2 Industrial Energy Efficiency (IEE) Funding Programs from Alberta to the Atlantic

Five funding program administrators across four Canadian provinces along with the Government of Canada have contributed to this study, covering approximately five years of historical program data and three years of future program data, where available. The participating jurisdictions include Ontario, Alberta, New Brunswick, and Nova Scotia, and represent a mix of centrally administered and utility-delivered industrial energy efficiency programs.

The data provided spans multiple program streams, including custom retrofit programs (i.e. supporting capital projects), strategic energy management (SEM) initiatives, and other targeted industrial offerings such as prescriptive and process optimization programs. While the level of detail and completeness varies by administrator, the dataset collectively captures a representative cross-section of how IEE funding is deployed across different regions, sectors, and program structures in Canada (Figure 4).

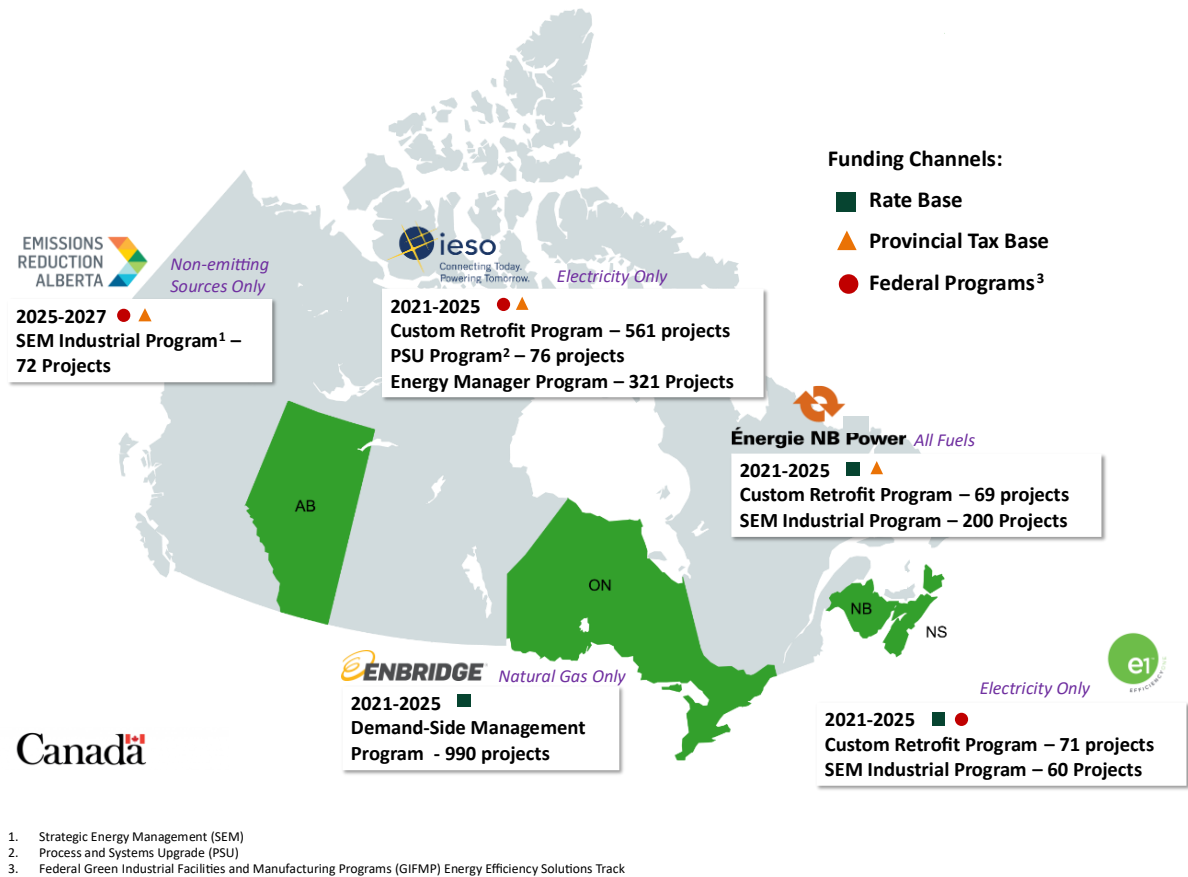


Figure 4: Current Programs by Federal and Provincial Funders.

This study focuses on understanding how program funds are allocated across energy efficiency project types and jurisdictions, and how these investments support industrial productivity, firm-level competitiveness, and broader economic impact. Differences in program design, delivery mechanisms, and reporting practices are considered as part of the comparative assessment across provinces.

5.3 Data Sources and Availability

Data availability varies across program funders in terms of completeness, level of detail, and consistency of reporting. While all participating administrators provided information on program activity, only some were able to share more granular data such as energy savings, project costs, incentive amounts, and project-level classifications. In several cases, differences in internal tracking systems and reporting frameworks limited direct comparability across jurisdictions. Furthermore, no jurisdictions explicitly capture Non-Energy Benefits (NEBs) and operational outcomes.

As a result, the analysis focuses on common data fields across funders to enable a consistent comparison, while noting that data related to industrial productivity (i.e. specific firm-level data) impacts are constrained by the level of detail available.

The analysis process consists of two approaches, analyzing historical IEE program data to understand energy efficiency program activity and to conduct thorough industry research on any frameworks currently evaluated for industrial productivity. An extensive literature review was completed on studies

examining the relationships between industrial energy efficiency and economic productivity, as well as speaking with relevant industry experts and economists.

The results draw on a combination of project-level program data and external economic and energy datasets. Project-level inputs provided by program administrators include:

- Energy savings associated with each project
- Cost data, including both incentive amounts and total project costs⁷
- Sector classification by NAICS to establish sub-sectors of the industry⁸

These inputs are complemented by external datasets used to contextualize results at a broader level, including:

- Extensive review of available literature on studies examining the relationships between industrial energy efficiency and economic productivity
- Gross domestic product (GDP) in chained dollars⁹ to reflect economic activity or “value-add”
- Statistics Canada input-output tables and multiplier tables
- Sector-level energy use summarized by the Office of Energy Efficiency Use database
- Sector-level energy use from the Canadian Energy and Emissions Data Centre (CEEDC)¹⁰, Simon Fraser University

The analysis will also consider market reach versus market penetration, where:

- Market reach – the share of industrial firms participating in the program, measured as the number of participating firms divided by the total number of industrial firms (31-33; 21) within the program administrator’s regional scope.
- Market penetration – the share of eligible energy use captured by participating firms, measured as participating firms’ energy use divided by the total energy use under the program administrator’s authority. For example, the IESO measures market penetration based only on electricity use in Ontario, since that is the energy use it administers. Similarly, utilities would measure market penetration only among their own account holders or service territory customers.

⁷ Project costs, referred to as ‘project spend’ in this study, include the participant’s costs for eligible costs, which can vary by program rules. Therefore, project spend may not capture the total project costs incurred by the firm. Across the programs reviewed, maximum incentive amount ranges from 50% - 75% of eligible project costs subject to each program’s rules.

⁸ Sector classification was completed as the firm data was available. Where specific firm level data was not available, the sub-sector is classified as ‘Other Manufacturing’.

⁹ Gross Domestic Product (GDP) are taken at basic prices (i.e. includes taxes paid and subsidies received on the factors of production, labour or capital) presented in chained 2017 dollars; that is removing effects of inflation to allow direct comparison of production levels over time. (Innovation, Science and Economic Development Canada)

¹⁰ CEEDC estimates are produced using an iterative algorithm to minimise differences across the matrix of energies and sectors. Proposed energy use values are compared to energy totals (across sectors) and sector totals (across energies). Constraints are applied during the estimation process based on historical use in each sector, related databases with corresponding information, and our analysts’ expert opinion.

These values represent CEEDC’s best estimates of redacted energy use amounts and should not be considered a substitute for primary data collected directly from establishments in Canada.

Note also that because we estimate use across all energies and sectors simultaneously some error is likely, especially for smaller sectors. This means that the sum of energies may not add to the total within a sector.



6 Industrial Productivity Frameworks and Linkages to Energy Efficiency

Productivity can be discussed at multiple levels depending on the context, including energy productivity, industrial productivity, labour productivity, multifactor productivity, and broader economic productivity. The linkages found through literature review are discussed in this section.

6.1 Cobb-Douglas Production Function

Industrial productivity and energy efficiency are directly linked because energy is a core input into industrial production. The Cobb-Douglas production function provides a useful conceptual framework for illustrating this relationship, showing how output is impacted by inputs such as Labour, Capital, and Energy. Furthermore, it highlights the technology impact and productivity gains that cannot be directly attributed to the individual inputs, known as Multifactor Productivity. Although this study does not apply the model quantitatively, the framework helps demonstrate how IEE projects can improve industrial productivity.

The original form includes only capital and labour as inputs:

$$Y = z K^{\alpha} (N_d)^{1-\alpha}$$

In which Y is the output of consumption goods, K is the quantity of capital (plant, equipment and infrastructure) input to the production process; N_d is the quantity of labour hours input to the production process; α is the output elasticity of capital; and z represents multifactor productivity.

The function is frequently adapted in energy and productivity analysis to include energy as a separate input, where N_d is rewritten as L and z is rewritten as A). A paper in 2000 by the American Council for an Energy-Efficient Economy (ACEEE) identifies the use of the Cobb-Douglas production function that “showed a positive impact on GDP growth when energy is treated as a production factor.”

As such, by using the modified function that includes *Energy* as an independent variable, the production function can be used to model the relationship between energy and productivity gains for the firms. The modified Cobb-Douglas function is expressed as:

$$Y = A K^{\alpha} L^{\beta} E^{\gamma}$$

Y (Output): Total production or value added (GDP)

A (Multifactor productivity): Technological efficiency and other residual growth

L, K, E (Inputs): Labor, Capital and Energy, respectively.

α, β, γ (Elasticities): Output elasticities of labor, capital and energy, representing their respective shares of GDP, and typically assumes constant returns to scale (i.e. $\alpha + \beta + \gamma = 1$).

The production function is not limited to monetary analysis. Different units can be used for each variable, as described in the table below. For example, an industrial process could be modelled using labour hours and energy consumption per pound of output, allowing productivity impacts to be expressed in the same operational terms that industrial firms commonly use for reporting.

Table 1: Variables of the Cobb-Douglas Production Function

Variable	Definition	Typical Units (\$)	Typical Units (Production)
Y	Output	Revenue; Value-added	Units produced
K	Capital	Capital stock	Capital index; Machine hours
L	Labor	Hours worked; number of workers; labor index	
E	Energy	Energy costs ⁸	kWh; BTU; GJ
A	Multi-Factor Productivity (MFP)	Unitless	Unitless

The framework may also provide a practical tool for industrial firms to quantify the productivity impacts of energy efficiency projects. This could be done through changes in multifactor productivity or through a before-and-after analysis of key operational and financial indicators, such as output, energy use, labour hours, downtime, throughput, unit costs, and revenue-related impacts. In this way, the framework can help firms assess how energy efficiency investments contribute not only to lower energy costs, but also to broader improvements in operational performance, profit margins, and competitiveness. At a macro scale, production-function frameworks are also used by economists and statistical agencies to assess productivity at the sectoral, regional, and economy-wide levels.

Importantly, many energy efficiency measures also improve output through reduced downtime, better process control, and higher yields, meaning their impact extends beyond simple input reduction. These benefits improve how effectively capital, labour, and energy are used, which can appear in the model as higher productivity, represented by higher MFP (or the variable A), or output growth. Using this framework allows energy efficiency to be positioned not just as a cost-saving measure, but as a driver of both input efficiency and broader productivity gains across the production system.

6.2 Energy Efficiency Measures and IEE Program Framework

Unlike growth capital, which is driven by capacity expansion and revenue growth, or sustaining capital, that supports reliability and risk mitigation, energy efficiency projects are typically justified through energy cost savings. However, this framing understates their broader impacts on industrial productivity. In practice, IEE projects influence not only energy inputs, but also labour utilization, capital efficiency, and material throughput, thereby having the potential to improve overall energy productivity and industrial productivity.

IEE projects span a range of types from low-cost operational improvements to capital-intensive system upgrades and are financed differently depending on the project cost, scale and complexity. The types of energy efficiency measures - strategic energy management (SEM), operational improvement and capital upgrades - inform the frameworks of the three IEE program types available across the program administrators as described in the figure below.

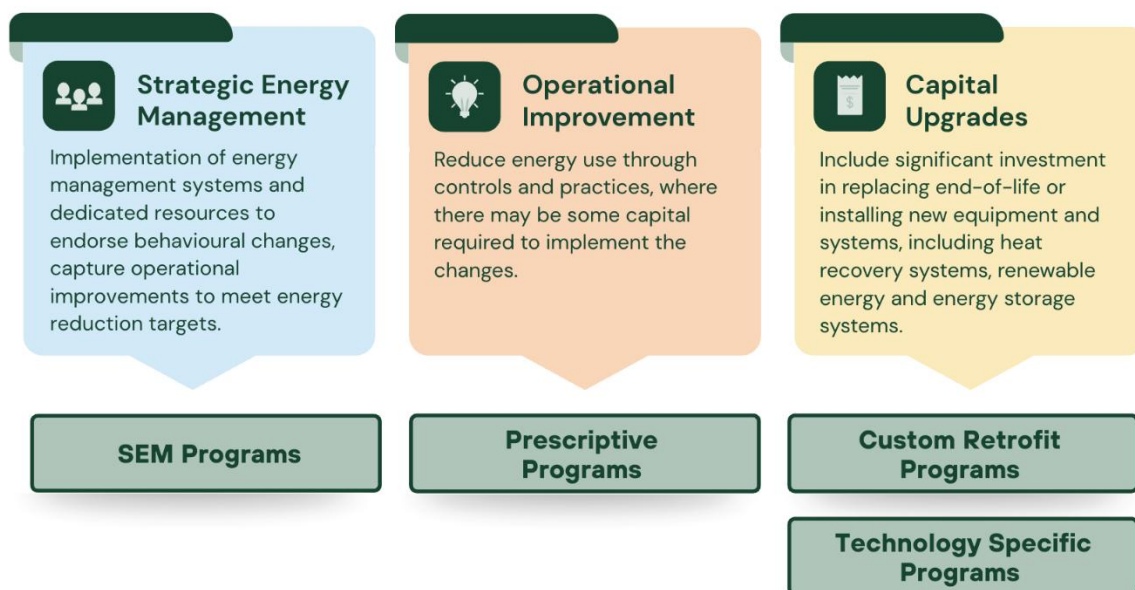


Figure 5: Industrial Energy Efficiency Program Overview

Historically, many EE opportunities struggle to compete within internal capital allocation processes, often falling below required financial thresholds and remaining on the “backburner.” Incentive programs play a critical role in addressing this gap by improving project economics and reducing payback periods, enabling projects that would otherwise not proceed.

More recently, the inclusion of non-energy benefits (NEBs), such as improved reliability, reduced downtime, and better product quality, have been utilized to further strengthen the business case, allowing more energy efficiency projects to meet internal investment criteria. During the analysis of this study, program administrators are noticing that the industrial firm’s senior leadership teams are now requesting for capacity and growth opportunities in energy efficiency investments, which can theoretically lead to either IEE projects being utilized as a strategic lever for firm growth or deprioritising of IEE projects due to business priorities. **Identifying industrial productivity context becomes crucial in ensuring the success of energy efficiency projects and their potential to contribute meaningfully to business priorities going forward.**

The table below maps the linkages between energy efficiency, industrial performance metrics, and productivity.

Table 2: Energy Efficiency linkages to the different types of Productivity

Level	Impact on Output	How EE Connects
Energy productivity	More GDP/output per unit of energy	Direct impact: lower GJ for same or higher output
Labour productivity	More output/value-added per worker or hour worked	Indirect impact: less downtime, better controls, more stable operations
Multifactor productivity	More output from the same combined inputs	Broader impact: process optimization, quality, reliability, management capability

6.3 Non-Energy Benefits and Quantifying Productivity Inputs

As mentioned above, energy efficiency investments can yield operational benefits beyond simple reduction in energy use for industrial firms. These are referred to as ancillary benefits, or non-energy benefits (NEBs).

For example, energy efficiency investments that provide NEBs can include:

- Controls upgrades that increase quality or reliability beyond simply conserving energy; this can also apply to implementation of structured management systems such as ISO 50001
- Capital equipment upgrades that provide more reliable equipment
- Infrastructure upgrades such as lighting systems that can also provide opportunities to optimize workplace lighting for occupant comfort, and switching to LED lighting can reduce labour required for bulb replacement

The range of potential non-energy benefits is wide, and can include:

- Direct productivity benefits that are often financially quantifiable, such as improved equipment reliability/reduced downtime, increased production rates, reduced waste, reduced defects
- Indirect productivity benefits, such as increased safety, air quality improvements, or reduced emissions

Two widely referenced studies examined case studies of IEE projects in OECD countries and quantified the NEBs associated with the IEE projects as showcased below.

Table 3: Non-Energy Benefits Literature Review

Study: "Productivity Benefits of Industrial Energy Efficiency Measures" ¹¹	Study: "Ancillary Savings and Production Benefits in the Evaluation of Industrial Energy Efficiency Measures" ¹²
Scope and Results: Examined 77 IEE projects across six OECD countries that had some documentation of NEBs	Scope and Results: Examined 81 energy efficiency projects developed into case studies for the U.S. DOE • 54 of the 81 projects had quantifiable NEBs

¹¹ Worrell, Laitner, Ruth & Finman, "Productivity Benefits of Industrial Energy Efficiency Measures", Energy, 2003

¹² Lung, McKane & Leach, "Ancillary Savings and Production Benefits in the Evaluation of Industrial Energy Efficiency Measures", 2005 ACEEE Summer Study on Energy Efficiency in Industry

• 52 of the 77 projects had sufficient data to quantifiable monetary value of NEBs • These found a wide range of ratios of NEBs versus energy savings, but in 63% of the cases the value of NEBs exceeded the energy savings • Average ratios were: ○ Total project investment \$54 million ○ Annual energy savings \$12.9 million ○ Annual NEB savings \$15.7 million	• Average ratios were: ○ Total project investment \$68.2 million ○ Annual energy savings \$45.9 million ○ Annual NEB savings \$21.1 million
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Between the two studies, NEBs average between 45% and 122% of the energy cost savings and is used in the program data analysis and productivity impacts in this study. Furthermore, a working paper from the ACEEE¹³ uses the modified Cobb-Douglas production function to illustrate that non-energy benefits can capture and amplify the economic impacts of energy efficiency measures.

Some of the relationships between industrial energy efficiency projects, their NEBs and their potential impact on output, MFP, sales and value-add are captured in the table below.

Table 4: Impact of IEE projects' non-energy benefits on Output, MFP, Sales and Value-Added.

Industrial Non-Energy Benefit	Impact on Output (Y)	Impact on Multifactor Productivity (A)	Potential Impact on Sales and Value-Added
Less downtime	More production	Better use of capital, labour and energy	Higher sales
Better process control	Fewer defects		Higher sales
Higher product yield	More saleable output		Higher sales
Lower maintenance	Lower operating costs		Higher value-add
Faster production	More output per hour		Higher sales
Better product quality	Higher value products		Higher value-add

Each of the non-energy benefits described in the table can have a unique effect on both GDP, output as well as MFP. These relationships can be better studied specific to project and industry type.

6.4 Energy Bill Savings and Reinvestment for Firm Growth

Industrial productivity ultimately matters because it influences a firm's ability to compete. While energy efficiency is often evaluated through avoided energy costs, its broader value is realized through its impact on operating performance and long-term competitiveness. For industrial firms, reducing energy use can lower production costs and improve margins. Energy cost savings and associated non-energy benefits can be quantified to be utilized as freed up capital that can be reinvested into operations,

¹³ Laitner & Lung, "Non-Energy Benefits from Energy Productivity Improvements: A Cobb-Douglas Approach to Measuring Impact on GDP", working paper for the Economic and Social Analysis Program of the ACEEE, 2009

equipment, workforce development, or growth initiatives (Figure 6). More details on assumptions can be found in the methodology section.

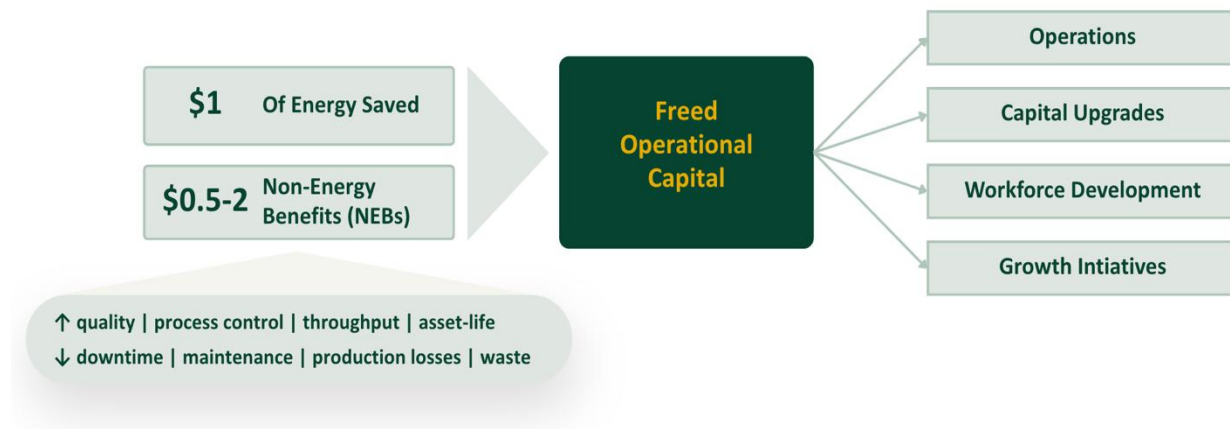


Figure 6: Energy and NEB Cost Savings Reinvestment Flow

These benefits are particularly important in energy-intensive sectors, where energy price volatility, equipment reliability, and production disruptions can materially affect profitability. As well, this framework translates productivity impacts into business-relevant outcomes. **Together, these impacts position industrial energy efficiency as more than a cost-saving measure – it becomes a lever for firm competitiveness and economic resilience.**

6.5 Industrial Productivity and Economic Growth

Economic Productivity refers to the efficiency with which an economy, sector, or firm converts inputs such as labour, capital, materials, and energy into economic output or value, and is typically reflected in measures such as output per hour worked or multifactor productivity.

Economic Impact refers to an increase in economic activity driven by additional spending, investment, or demand within the economy, such as government spending, construction activity, or consumer purchases, which may increase GDP or employment even if the underlying efficiency of production does not improve. Statistics Canada input-output (IO) tables and the associated IO multipliers generally assume fixed production relationships and therefore implicitly assume static productivity within the structure of the model.

Although often hidden in the overall productivity discussion, industrial energy productivity is important in overall economic productivity through several mechanisms:

- At the firm level, energy efficiency implemented with a positive ROI should have the benefit of maintaining or increasing output with lower input costs – increasing the overall firm productivity.
- There is evidence that energy efficiency investments provide “non-energy benefits” (NEBs). Financially quantifiable NEBs include increased labour productivity and improved yields, which further increase direct productivity benefits.
- At the firm level, reduced input costs should lead to funds available for reinvestment, and there is evidence that available cash flow encourages reinvestment.

- At the economy level, energy is available for other uses and/or capital is freed-up that would otherwise have been invested in energy. This further increases the economy level productivity.
- Capital reallocation can also take place, which may grow more productive sectors of the economy. Ultimately, allocation of capital to the most productive firms and sectors is the most powerful lever of overall productivity.

This set of relationships is summarized in Figure 7.

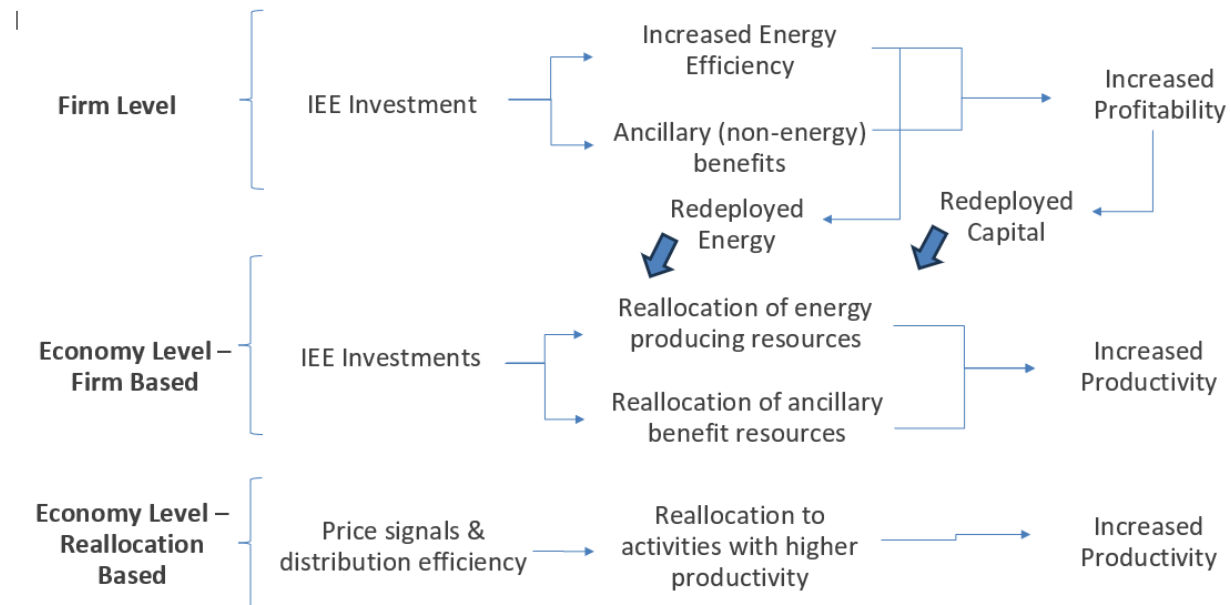
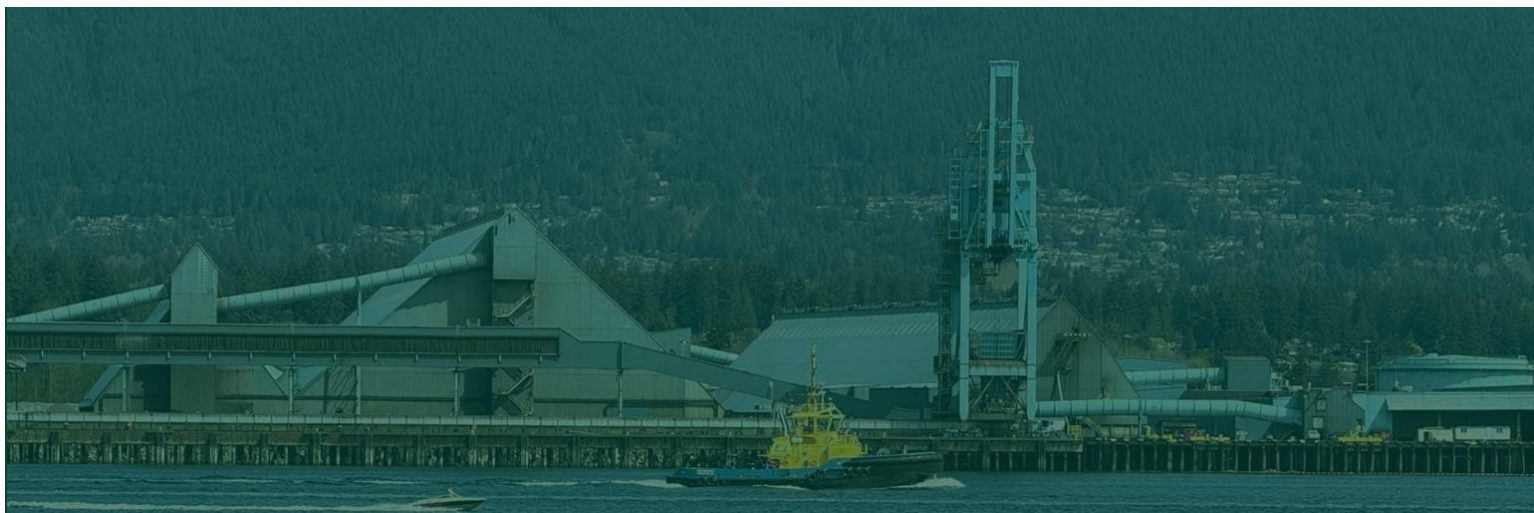


Figure 7: Overview of IEE-Productivity Linkages.

While research on facility-level impacts and economy level impacts all point to improvement in IEE having a positive impact on productivity, it also identifies a complex relationship that is subject to a wide range of factors. Firm context, types of IEE activities, and decisions on reallocation of resources are key considerations of productivity benefits for any IEE activity or program.

At the broader economic level, industrial energy efficiency investments can also support economic growth through direct, indirect, and induced effects. Direct effects are generated through the initial project spending itself, including investments in engineering, equipment, construction, installation, energy management, and measurement and verification activities. Indirect effects occur as this spending flows through the supply chain, creating demand for manufacturers, suppliers, contractors, professional services, and other businesses that support project delivery. Induced effects are generated when workers and businesses benefiting from the direct and indirect activity spend their additional income in the broader economy.

Together, these effects can contribute to GDP growth, support job creation, and strengthen industrial competitiveness. While the scale of impact depends on the size, location, and type of investment, energy efficiency projects can create economic value not only by reducing energy costs for participating firms, but also by impacting economic activity across the broader economy through capital deployment, supply chain demand, and employment.



7 Canada's Landscape for Industrial Productivity

7.1 Energy Productivity and Historical Trends

Over a 10-year period (2014-2023), the two industrial sectors, Mining, Oil and Gas (NAICS code 21) and Manufacturing (NAICS Codes 31-33), have shown distinct trends and relationships as illustrated in the figure below. Manufacturing represents the larger share of both industrial energy use and GDP contribution, reflecting its broad base across food, chemicals, paper, metals, transportation equipment, and other sub-sectors. Mining, oil and gas represents almost an equal share of total energy use to manufacturing however has a smaller share of GDP.

The energy productivity (GDP/GJ) trends show that manufacturing has remained above mining, oil and gas, and brings the total industrial average up. Both industries have been impacted by the years of the COVID pandemic and is shown in the year-over-year graph. Although both industries are showing positive trends of energy productivity, they still have not recovered to the levels pre-COVID.

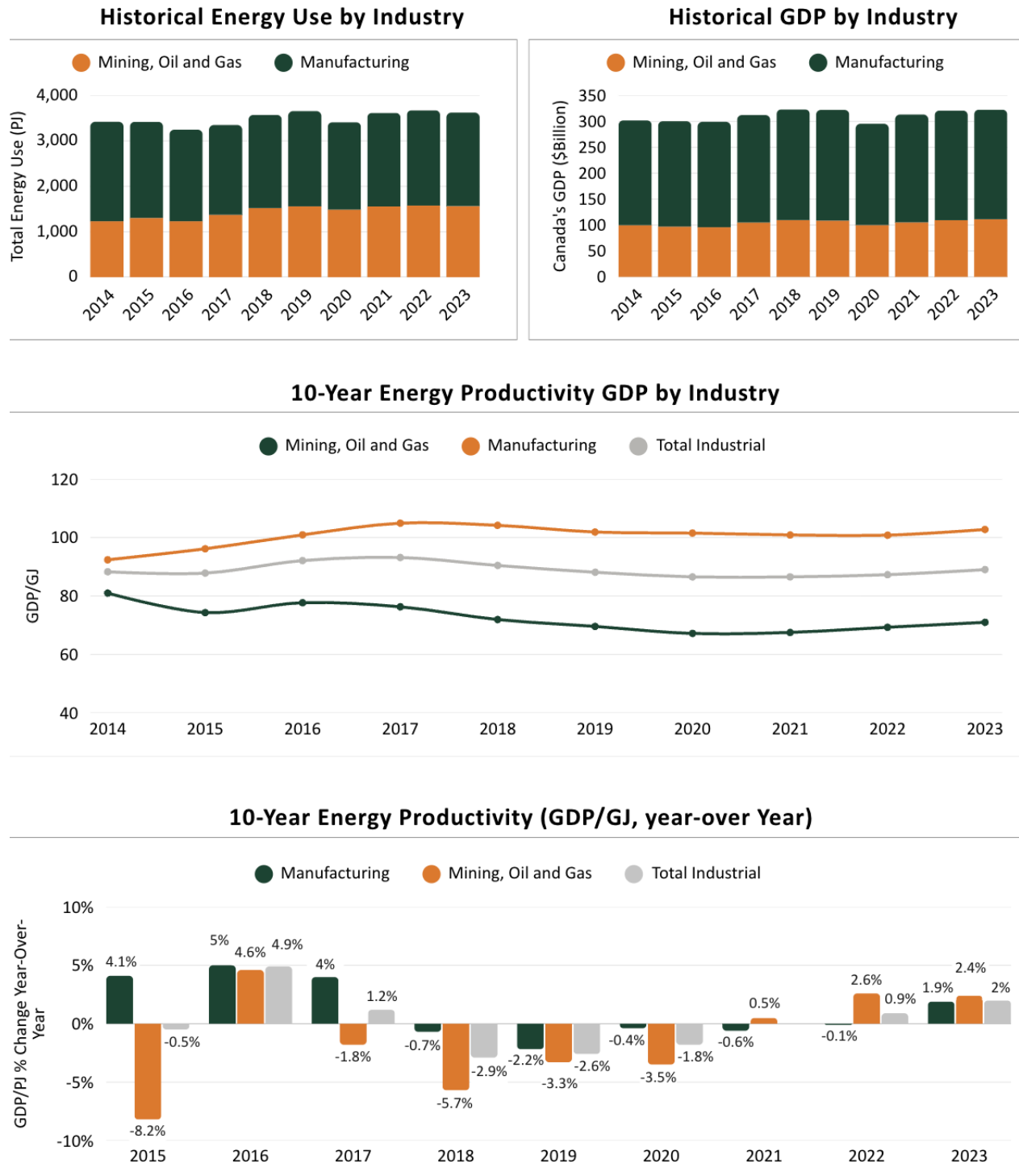


Figure 8: Mining, Oil and Gas and Manufacturing Energy Productivity Analysis

7.2 Canada's Fuel Types in the Industrial Sector

Canada's industrial energy use is primarily in natural gas and electricity, with natural gas representing the largest fuel source, more than twice the electricity. This reflects the thermal nature of many industrial processes, where natural gas and other fuels are used not only as purchased energy inputs, but also to produce onsite energy sources such as steam, process heat, and cogenerated electricity.

In commonly identified energy-intensive sectors such as mining, oil and gas, pulp and paper, petroleum refining, chemicals, smelting, and iron and steel, fuels such as natural gas, diesel, coke, refined fuel gas, wood, and petroleum coke can require a higher thermal capacity in their production processes (i.e. boilers, furnaces, kilns, dryers) and on-site electricity generation. This means that productivity opportunities are not limited to electricity efficiency; they can be largely impacted by the thermal systems, fuel-switching opportunities, waste heat recovery, process integration, and better optimization of onsite energy generation.

By sub-sector, the concentration of energy use in mining, oil and gas and major manufacturing industries suggests that targeted interventions in these high-energy-use sectors can materially improve operating costs (Figure 9), resilience to fuel price volatility, and long-term industrial competitiveness.

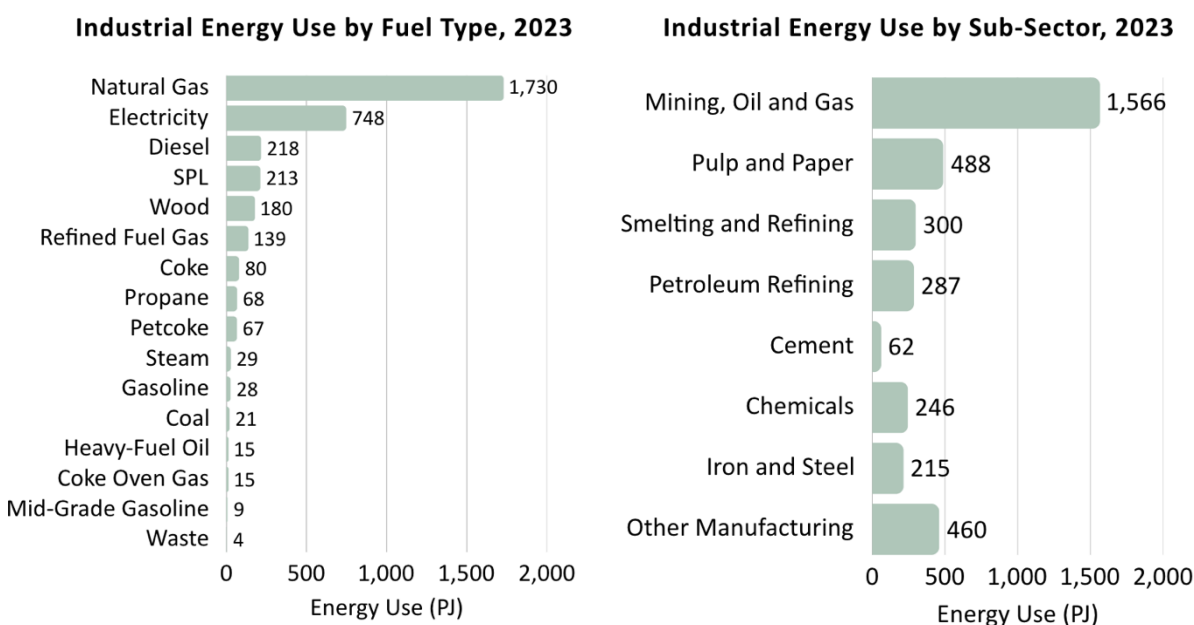


Figure 9: Canada's Industrial Energy Use Analysis

The primary industrial sub-sectors also vary by provinces, and with that the prominent fuel types, as seen in figure below. In New Brunswick and Nova Scotia, there is a wider mix of both energy-intensive and other manufacturing which is represented by the significant use of other fuels and electricity consumption over natural gas. Alberta's concentration of larger mining, oil and gas firms confirm the use of natural gas being the dominant fuel source. The mix of varied industrial sub-sectors and the use of cogeneration systems are represented in Ontario with close to 50% of the fuel type being natural gas and almost a quarter being electricity use. Further breakdown of energy use by sub-sector and fuel type can be found in Appendix A-1.

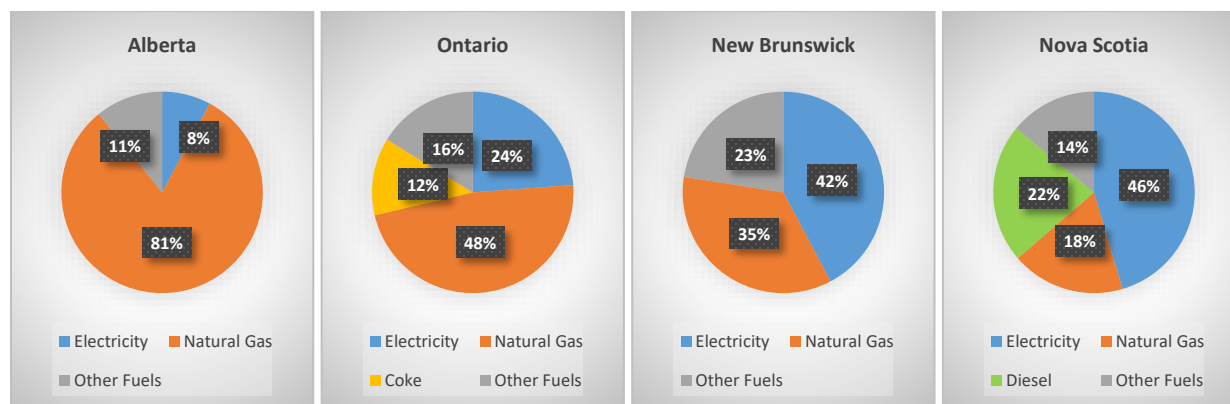


Figure 10: Energy Fuel Type by Province (Alberta, Ontario, New Brunswick, Nova Scotia).

7.3 Resource-Extraction and Final Goods Processing

Energy plays an essential role as an input resource to the industrial processes – without energy, it is inherently impossible to produce output. However, the energy cost share for firms varies by the industry type and ranges from 2%-45%, as seen in table below.

Table 5: Energy Cost Share by Sub-Sector

Industrial Sub-sector	Firm-level energy share of input costs by sub-sector ^{14,15}	Energy Use Areas
Mining, Oil & Gas	High (20–45%)	Extremely energy intensive; fuels dominate, remote operations
Primary metals (inc. Iron, Steel and Aluminum)	Moderate to High (>10%)	Thermal + electrical (smelting, refining)
Pulp & Paper	Moderate to High (15–40% ¹⁶)	Thermal-heavy processes (steam, drying)
Petroleum Products	Moderate to High (>15%)	Refining; thermal + process integration
Chemicals	Moderate (10–15%)	Process + thermal + feedstock
Other Manufacturing	Low (2–5%)	Includes food, automotive, light manufacturing

There is a unique distinction between the resource-extractive and energy-intensive industries and the final goods manufacturing and their performance on energy productivity. As seen in the figure below, there is a significant gap between final goods manufacturing, that is captured under ‘Other Manufacturing’ and industries where primary resources are being either extracted or processed as inputs to the former industry sub-sector. As Canada is primarily a resource-based industry, this becomes

¹⁴ Source: “Industrial Energy Use in Canada – Emerging Trends,” Canada Energy Regulator, <https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/market-snapshots/2019/market-snapshot-industrial-energy-use-canada-emerging-trends.html>

¹⁵ Cement is not identified separately in this chart, however, indicates a high energy cost share of >30% (Source 14)

¹⁶ Source: Technical Association of the Pulp and Paper Industry (TAPPI), <https://www.tappi.org>

important when discussing the opportunity of energy efficiency as it relates both to the energy cost share within a firm and then the broader economic impact.

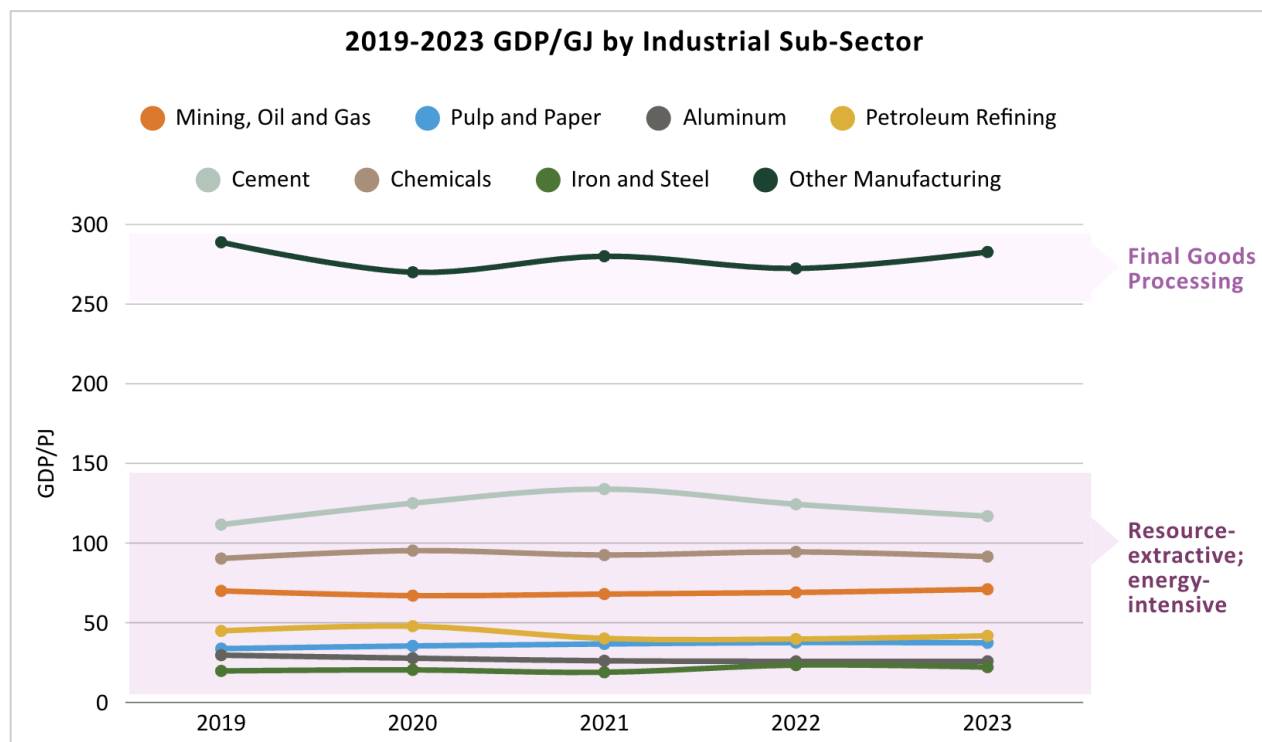


Figure 11: Canada's Energy Productivity by Sub-Sector

Canada's industrial base is heavily weighted toward resource extraction and intermediate processing, which are inherently energy-intensive and lower energy productivity (GDP/GJ). These sectors act as inputs to higher-value finished goods, which explains why provinces or sub-sectors with more downstream processing (ex: finished metals and other finished goods) show higher energy productivity even within the same industry. This is seen in Figure 11 with the final goods manufacturing of Iron and Steel Industry having a higher energy productivity compared to the resource-extraction and energy-intensive Mining, Oil and Gas sector.

Therefore, differences in energy productivity are not solely driven by efficiency, but also by where the industrial process is in the value chain. It has been recognized recently that attracting investment for downstream processing in Canada is important vs. exporting raw materials to be processed for higher value in other countries, and some investment from the government and industry has accelerated in this area.

7.4 Industrial Exports and Energy as a Resource

Exports from the two sectors contribute a significant amount where Manufacturing makes up 46% of total exports in 2024 and Mining, Oil and Gas is 20%, which in total makes up 2/3 of all exports.

The industrial sector plays a large role in Canada's export base with energy products (oil, natural gas, refined fuels) representing the largest share of total exports and a major contributor to national GDP. Alongside energy extraction, other energy-intensive industries, such as primary metals, chemicals, and

pulp and paper, can play a critical role in export revenue and economic output. Additionally, these industries produce intermediate goods that feed into global supply chains (seen in table below), reinforcing Canada's position as a resource-driven economy.

Table 6: Canada GDP and Exports by Sub-sector

Sector	2024 (CAD millions)			Notes
	GDP Contribution by Industry ⁽ⁱ⁾	Exports ⁽ⁱⁱ⁾	Imports ⁽ⁱⁱ⁾	
Manufacturing	289,181	368,726	699,121	GDP represents NAICS 31-33
Mining, Oil & Gas	162,062	231,565	44,434	GDP represents NAICS 21
of which is Energy		174,191	39,892	
of which is Electricity		3,132	1,340	

[i] GDP Contribution by Industry based on Stats Canada table 36-10-0434-03

[ii] Import - Export data based on Stats Canada table 12-10-0163-01 and 12-10-0176-01, structured according to NAICS codes

This structure is important because it means that energy is not just an input to production in Canada – it is also used to generate energy that is then exported. As a result, industrial performance, energy demand reduction, and export capacities are tightly linked. Canada exports a significant portion of both its energy production and industrial output, which means that improvements in efficiency do not just reduce firm's energy costs, but can also influence the value added from being able to export energy (ex: Hydro Quebec, although not in scope for the study, exports electricity to New York).

Efficiency improvements effectively free up energy resources that can be reallocated elsewhere in the economy. This is particularly relevant in a system where energy is both consumed and exported at scale. The 2025 study from the University of Calgary, "The Role of Energy Efficiency in Productivity: Evidence from Canada,"¹⁷ examines the productivity benefits of more efficient allocation of energy resources across the Canadian economy using provincial input-output tables and a modified Cobb-Douglas framework. The study finds that there is an aggregate productivity loss of 5–8%, with energy misallocation accounting for up to 1.5% percentage points of that gap, despite energy representing only 8% of input costs. This means that even though labour and capital have much larger shares in the industry and the economy, energy plays a disproportionate role in Canada's productivity. While this focuses on resource allocation rather than technical efficiency, there is an opportunity to better manage energy as a resource.

Improvements in industrial energy efficiency can increase the effective supply of energy without additional extraction or generation infrastructure. This allows energy to be redirected toward higher in the value chain, whether that is supporting electrification, enabling growth in other sectors, or increasing export capacity. For energy-exporting regions, this effectively enhances export potential without requiring new resource development. In electricity-constrained systems, it can defer infrastructure investments and improve grid reliability.

¹⁷ Source: Laaguidi, M., "The Non-Energy Benefits for Industrial Electric Technologies," American Council for an Energy-Efficient Economy (ACEEE) Summer Study on Energy Efficiency in Industry, 2021.
<https://www.aceee.org/sites/default/files/pdfs/ssi21/panel-2/Laaguidi.pdf>

Canada's raw resource-extraction and energy-intensive industries present both a challenge and an opportunity. While energy intensity is inherently higher, the scale of energy use means that efficiency can not only impact productivity within firms but can also allow for more efficient allocation of energy across the economy, strengthening both domestic energy markets and Canada's position in global energy markets.

7.5 Labour Productivity, Multifactor Productivity and the National Gap

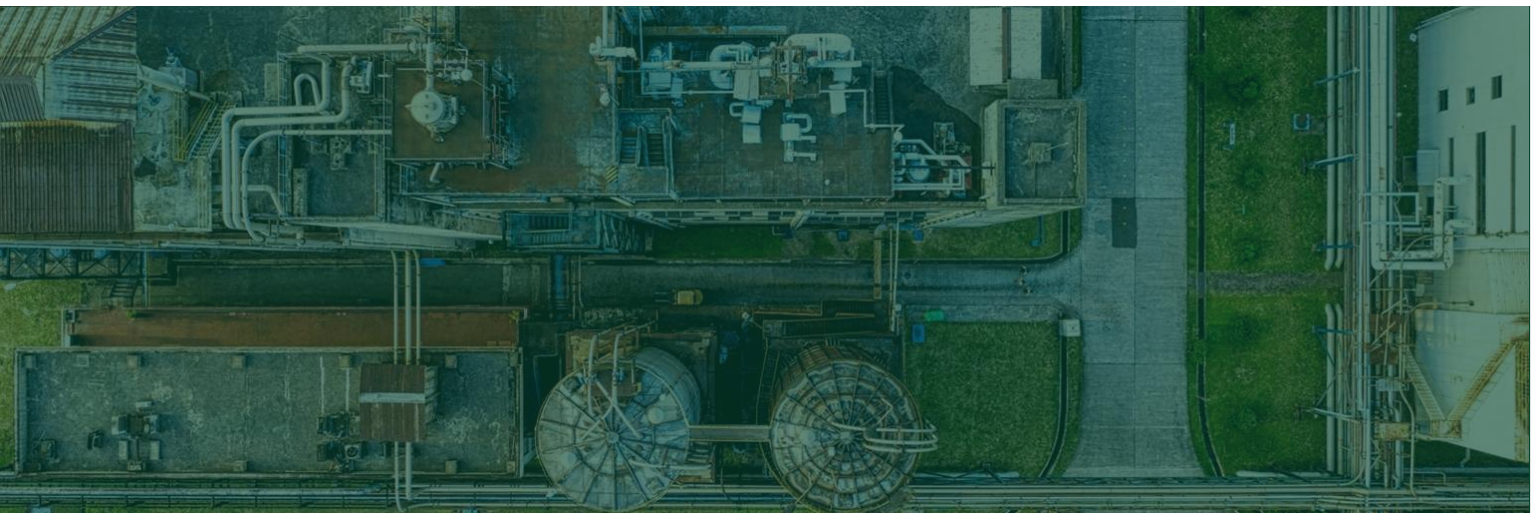
The recent upward trend in energy productivity contrasts with the long-term slowdown in labour productivity growth in Canada, where “the average annual growth in labour productivity in Canada was about 3% in the 1960s and 1970s but fell to 1% between 2000 and 2019”¹⁸ – as noted by the Bank of Canada. As labour and energy are both key inputs to industrial production, their relationship provides a useful lens to assess broader productivity impacts. **Improvements in energy productivity, facilitated through industrial energy efficiency programs, represent a tangible and actionable pathway to help bridge Canada's labour productivity gap.**

Statistics Canada's 2023 productivity performance in the business sector outlined that “multifactor productivity accounted for 1.7 percentage points of the drop in labour productivity, while a decrease in capital intensity contributed an additional 0.6 percentage points”¹⁹. This is a significant relationship that can be quantified in the industrial sector as well, particularly with the use of the Cobb-Douglas, production function where the output at a firm or sector-level can be modelled by their share of input costs and input variables.

For industrial energy efficiency measures, reducing energy input, thereby improving capital performance (i.e. through capital upgrades) and labour utilization (i.e. through automation and other behavioural impacts) can directly impact industrial productivity. This is further explored in the following section.

¹⁸ Source: Nicolas Vincent, “Toward a Virtuous Circle for Productivity,” Bank of Canada, November 19, 2025. <https://www.bankofcanada.ca/2025/11/toward-a-virtuous-circle-for-productivity/>

¹⁹ Source: “Energy Statistics,” *The Daily*, Statistics Canada, 2025. <https://www150.statcan.gc.ca/n1/daily-quotidien/250407/dq250407b-eng.htm>



8 Methodology and Assumptions

There are four key metrics and approaches used in this analysis. First is the energy productivity analysis, which evaluates the contribution of energy savings on GDP relative to a baseline period. Second is the economic impact assessment, where aggregate program spending is used to estimate broader economic activity. Third, energy productivity is linked to labour productivity through the Cobb-Douglas production framework. Fourth, firm-level profitability impacts are assessed to understand competitiveness implications.

8.1 Industrial Energy Efficiency Program Analysis

The study looks at a sample of IEE program data to evaluate how they are currently designed, funded, and delivered across participating provinces, as it relates to industrial productivity. Project-level data was categorized by measure type, sector, and program stream to understand where investments are being directed.

These results are then assessed alongside external economic and energy datasets to provide context on sector-level energy use and economic output. The analysis focuses on identifying patterns in program design, project mix, and funding allocation, and how these factors influence the potential for industrial productivity gains.

The Total Resource Cost (TRC) test and Program Administrator Cost (PAC) test, also known as PACT, are two commonly used metrics to evaluate the cost-effectiveness of energy efficiency programs, but they capture value from different perspectives. The TRC test takes avoided capital costs (i.e. the cost difference between EE and business-as-usual upgrades), accounting for both program costs and participant costs, and compares them against the total benefits, including energy savings and, in some cases, non-energy benefits. A TRC greater than 1.0 indicates that the program delivers net benefits to the economy as a whole.

Similarly, the PAC test reflects the perspective of the program administrator or utility, considering only the costs incurred by the program (such as incentives and administration) relative to the benefits in avoided energy supply costs. As a result, PAC ratios are typically higher than TRC values, as they exclude

participant contributions and broader system benefits. The IESO and EfficiencyOne are transitioning from TRC to PAC analysis while NB Power currently uses PACT for their program evaluation. Enbridge currently uses TRC and ERA has not reported on their new program evaluation at the time of this study. This distinction is important in the context of industrial energy efficiency, where large capital investments are often required. Programs may appear less cost-effective under the TRC test due to high upfront costs, even though they deliver strong long-term economic and productivity benefits.

8.2 Energy Productivity Analysis

Completed projects over the last five years (2021-2025) were provided by the program administrators for analysis. Given that ERA's IEE program began in 2025 and that these projects have not completed a full M&V year, the future potential projects (2025-2027) were included for analysis. The best available data for provincial energy consumption and GDP available for the sector is for the year 2023; therefore, the baseline year is set to 2023 for ERA and 2019 is used for all other programs.

Key Assumptions

- Some programs are focused on one form of energy and the reported energy savings may not account for energy switching. For example, IESO data includes cogeneration projects which may offset electricity savings with increased natural gas use. Energy productivity analysis in this report is based on the energy savings as reported by the programs.
- Electricity-only program data (IESO, Nova Scotia) for energy productivity calculations are analyzed using PJ²⁰ savings against the total industrial GDP.
- Canadian Energy and Emissions Data Centre (CEEDC) data supplements energy use where the Office of Energy Efficiency data is unavailable.
- ERA programs are mostly categorized as capital upgrades due to the Green Industrial Facilities and Manufacturing Program (GIFMP) guidelines. There are some operational improvements that could be filtered; however, program data was not further categorized.
- Future potential projects for 2026-2027 (NB Power and IESO) are not included in this study as there is uncertainty on their implementation timelines and adoption.

To quantify the relationship between energy efficiency and industrial productivity, a set of simplified metrics is used to link changes in energy consumption to changes in value-add or output. These metrics focus on energy productivity improvements, expressed as output per unit of energy input, provide a basis for comparing the relative impact of different projects and program investments. By incorporating both energy savings and financial inputs, such as incentives and total project costs, the framework enables an assessment of how effectively program dollars translate into productivity gains. While simplified, these indicators provide directional insight into how energy efficiency contributes to sector-level performance and can support more informed program design and funding decisions. The following equation is used to calculate the change in energy productivity:

$$\Delta EP = \frac{GDP}{E_{baseline} - \Delta E} - \frac{GDP}{E_{baseline}}$$

²⁰ A petajoule (PJ) is equivalent to 1 million gigajoules (GJ)

8.3 Economic Impact Analysis

The economic impact analysis is designed to estimate the total economic activity generated by industrial energy efficiency programs, rather than focusing on a single year. A 12-year horizon is applied across all programs to reflect a conservative estimate of the average lifetime of energy efficiency measures, given that 95% of projects in the program analysis are capital upgrades (i.e. SEM programs and behavioural efforts from NB Power and EfficiencyOne are minor). Program evaluation findings for IESO indicate that approximately 77%²¹ to 98%²² of industrial firms reinvest their energy cost savings into future projects.

The analysis includes two primary components:

- **Initial capital deployment** – total project spend driven by incentives, represents immediate economic activity (engineering, construction, equipment)
- **Reinvestment of energy savings** – both annual energy cost savings and the non-energy cost benefits are aggregated and identified as freed capital across all projects, accumulated over a 12-year period²³, the average lifetime of energy savings.

Key Assumptions

- An 80% reinvestment rate is applied to freed capital, considering that a portion may be returned to shareholders or retained as profit
- A 1.45 factor is applied to annual energy savings to include NEBs in the total cost savings seen by firms – approximately 45%²⁴ of energy cost savings, a conservative assumption as this number can be higher (discussed in [Section 6.3](#)).
- The total GDP multiplier for Canada's total industrial sector (1.033 at basic prices) is applied to estimate total economic impact, capturing:
 - direct effects (project spending)
 - indirect effects (supply chain activity)
 - induced effects (household spending generated by incomes earned in the value chain)

²¹ Source: "2021–2024 Conservation and Demand Management (CDM) Framework Retrofit Program – PY2021 Evaluation Results," NMR Group, Inc., <https://www.ieso.ca/-/media/Files/IESO/Document-Library/conservation/EMV/2021/PY2021-21-24-CDM-Retrofit-Evaluation-Report.pdf>

²² Source: "Impact and Process Evaluation Report: Interim Framework Process and Systems Upgrades Program (PSUP), PY2021," Ecometric Consulting Inc., <https://www.ieso.ca/-/media/Files/IESO/Document-Library/conservation/EMV/2021/PY2021IF-PSUP-Evaluation-Report.pdf>

²³ This accounts for the mix of capital upgrades that sustain savings over equipment lifetime of 15-20 years and operational projects with low- to no-cost measure that could see 5-15 years. 12-years is taken from a 2015 study across 813 Commercial and Industrial energy efficiency programs. Source: <https://www.osti.gov/servlets/purl/1236443>

²⁴ Source: Reuter, M., Patel, M. K., Eichhammer, W., Lapillonne, B., & Pollier, K., "A Comprehensive Indicator Set for Measuring Multiple Benefits of Energy Efficiency," *Energy Policy*, Vol. 139, 2020. <https://doi.org/10.1016/j.enpol.2020.111284>

8.4 Firm-Level Profitability Impact and Sector-Level Analysis

Energy efficiency measures reduce energy cost which results in lower operating costs, therefore improving the profitability of a firm. The impact of energy cost reductions on profitability varies significantly by sector as a result of two main factors: The baseline margins of the sectors as well the energy cost share of the sectors.

As discussed earlier, Canada's resource-intensive processes make up the sub-sectors that are energy-intensive compared to the finished goods manufacturing that have a smaller energy cost share of input and energy intensity.

Key Assumptions

- Energy costs share data and revenue data is obtained from Statistics Canada for the manufacturing²⁵ and mining²⁶ related NAICS codes. Energy cost share is calculated by dividing the energy expenses by the sum of the salary, energy and material expenses. It is believed this value will be more in line with energy cost shares that are seen in literature.
- The total expense values exclude capital purchases but includes amortization/depreciation of capital goods, overhead costs, bank charges/interest expenses etc. As a result, when the total expense is used to calculate the energy cost share, it is likely the values will be lower than other sources which do not include all operating costs.
- In addition, it is likely that the energy expenses are an underestimation of the real company level energy expenses because of two factors:
 1. Some companies may have included energy types like coal or coke in the material expenses rather than energy expenses when they are being used as a reductant as well as a fuel source.
 2. Contractor usage in mining is quite common and therefore it is possible that the energy usage and therefore costs associated with contractor expenses are not captured under energy expenses but instead under salary or other operating expenses.
- The Oil and Gas sector is excluded from the analysis as the Statistics Canada data did not include expenses broken down into salary, energy and materials.

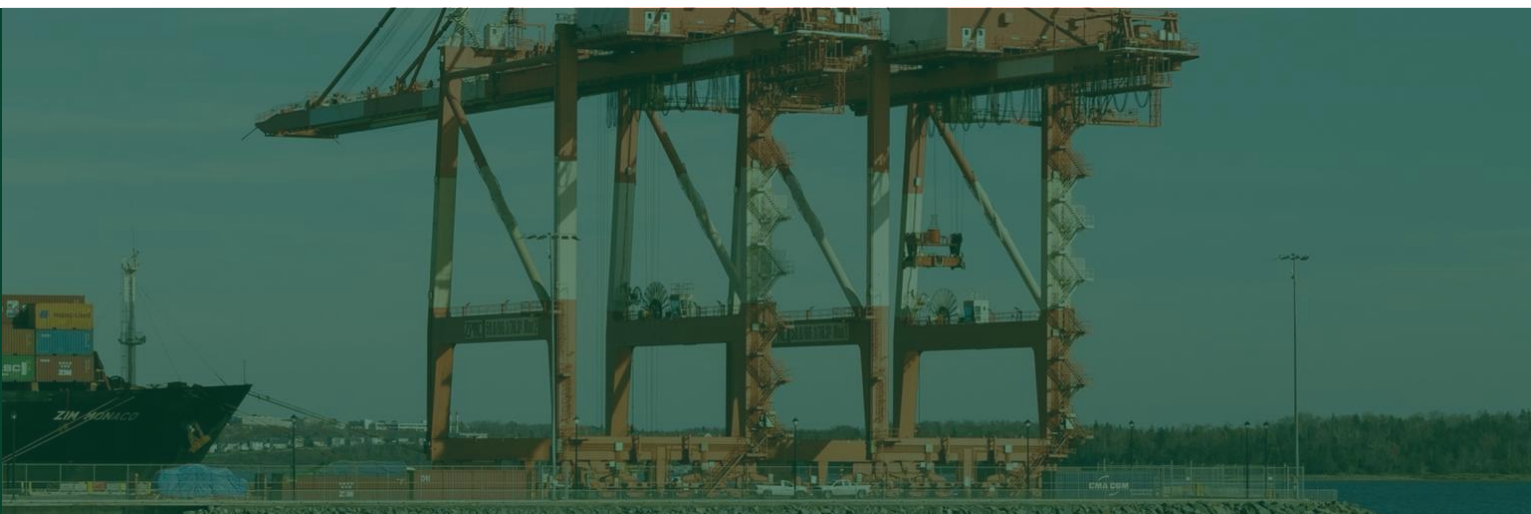
²⁵ Statistics Canada. Table 16-10-0117-01 Principal statistics for manufacturing industries, by North American Industry Classification System (NAICS) (x 1,000)

²⁶ Statistics Canada. Table 16-10-0031-01 Mining industries, principal statistics by industry, Canada

8.5 Key Limitations

There are three key limitations identified during the program analysis. These are referenced throughout the report and include the following:

- **Data comparability across funders** – program savings are not always directly comparable because each funder may use different methodologies, eligible fuels, gross/net savings assumptions, attribution factors, persistence values, and reporting boundaries.
- **Limited project-level detail** – the analysis does not always have visibility into the specific measures implemented, equipment replaced, operational changes made, or whether projects increased output, throughput, reliability, or asset performance.
- **Productivity and NEBs findings are likely understated** – non-energy benefits such as reduced downtime, improved quality, lower maintenance, better process control, and increased asset utilization are not consistently tracked or monetized, so the quantified productivity impact studied in literature is likely conservative. Furthermore, there was no research done on energy efficiency project types and their potentially associated NEBs.



9 IEE Program Data Analysis

9.1 Energy Efficiency Program Overview

Industrial energy efficiency programs prioritize key energy efficiency measures and are delivered through distinct program streams that include Strategic Energy Management programs, capital upgrade streams (custom and prescriptive retrofits) and on some occasions specialized equipment upgrades like IESO's Process and Systems Upgrades (PSU) program. Further analysis of project data by program provider is found in Appendix A-2.

Although programs frameworks can vary by jurisdiction, they generally fall into three categories that are an important distinction for this study:

1. **Strategic Energy Management** where there is a dedicated energy manager at the firm to capture behavioural and operational energy savings through the implementation of an energy management system (such as ISO 50001). In some cases, there are annual energy reduction target obligations for the firm to achieve when participating in this program stream.
2. **Optimization measures** where there is a no- to low-cost to implement (ex: controls tuning, process adjustments, behavioral changes), typically low-cost, fast to implement, and deliver immediate energy reductions with minimal disruption
3. **Capital upgrades**, where a project has an initial investment to deliver energy savings and other benefits, by adding or upgrading assets to increase value and usefulness (ex: equipment replacement, heat recovery systems, electrification)

Measures that fall outside the scope of this analysis include:

- **Demand response and load shifting programs**, where the primary objective is grid interaction rather than efficiency gains
- **Digital transformation initiatives**, including digital twin, advanced analytics, and AI-driven optimization, where impacts are often indirect, cross-cutting, or not consistently captured within traditional EE program frameworks
- **Non-industrial end uses**, such as commercial or residential measures

- **Measures with insufficient or inconsistent data across jurisdictions**, particularly where project-level detail or classification was not available

While these categories provide a structured lens for analysis, it is recognized that many projects can deliver multiple benefits across categories (ex: capital upgrades that also enable process optimization). As such, categorization is based on the primary driver of energy savings and operational impact.

Each program administrator's dataset is summarized in a standardized dashboard below. It is important to note that each program covers specific fuel types. As such, figures such as \$/GJ are not directly comparable. Although electricity and natural gas both support industrial productivity, their impacts vary depending on the technology and industrial application. For example, electricity is commonly used for motors, automation, controls, and refrigeration, while natural gas is often used for process heat, steam, and drying. Improvements in either fuel can support industrial productivity, but their contributions are considered separately given the limitations of the datasets.

9.2 Alberta (ERA): Emerging Industrial Program with High Capital Deployment

The Emissions Reduction Alberta (ERA) industrial program represents a recent program development funded through the Government of Canada's Green Industrial Facilities and Manufacturing Program (GIFMP) and some provincial funding that targets energy efficiency capital upgrades for non-emitting sources (i.e. excludes fossil-fuel systems and any upgrades to existing equipment). This initiative marks the first time a dedicated, structurally defined industrial-only funding stream has been implemented in Alberta, reflecting a more targeted approach to supporting energy efficiency and emissions reduction in their industrial sector.

The current program cycle spans projects in 2025 to 2027, and ERA has allocated \$24.1M of their approved \$70M of incentive funding at the time of the data analysis²⁷. The program includes a comprehensive range of industrial energy efficiency measures, where 96% is for capital upgrades for end-use equipment from non-emitting sources; the program excludes efficiency upgrades to fossil-fuel sourced equipment. Further program analysis is found in the dashboard below and a sensitivity analysis on program energy savings is found in Appendix A-3.

²⁷ As of the report issue date, ERA has fully committed their \$70M of capital projects funding with a waitlist of projects.

ERA Program Overview (2025-2027)



72
Projects



\$24.1M
Incentive Amount



\$54.6M
Total Project Spend

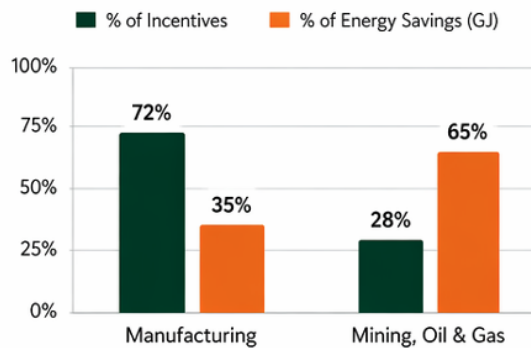


4.6 PJ
Energy Savings



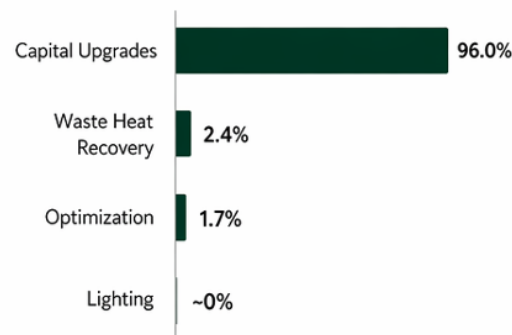
2.3x
Leverage Ratio
(Project Spend / Incentives)

FUNDING VS ENERGY SAVINGS BY SECTOR



Key Insight:
Manufacturing receives the majority of incentives, while resource sectors deliver the majority of energy savings.

ENERGY SAVINGS BY PROJECT TYPE (GJ)



Key Insight:
Program savings are heavily concentrated in capital upgrades, with minimal contribution from optimization and other low-cost measures.

PROGRAM EFFECTIVENESS



Total Resource Cost (TRC) **SEMI: n/a**



Incentive \$ per Energy Savings **\$5.24/GJ**
1.8¢/kWh



Average Incentive per Project **\$335k**



Energy Saved per \$ of Incentive **0.19 GJ/\$**



The average incentive per project is higher than the other program providers.

MARKET REACH & PENETRATION



Total Industrial Firms
8,811



Firms Participating
54



Market Penetration
~1% of firms
6.1% of industrial energy use



Low market penetration suggests significant untapped potential to scale energy efficiency and productivity gains across industry.

Figure 12: ERA (Alberta) Program Overview²⁸

²⁸ TRC for ERA is not available as they are on the first-year of operations.

9.3 Ontario (IESO): Scaled Long Term Programs for a Diverse Industrial Sector

The Independent Electricity System Operator (IESO) delivers industrial energy efficiency programs funded predominantly by ratepayers in Ontario, one of the largest and mature programs in Canada. These programs serve to reduce electrical energy consumption through the IESO's Save on Energy brand and have been active for over fifteen years. Roughly every four years, the programs have evolved under various conservation and demand management frameworks. In 2025, IESO announced their expansion to a longer-term 12-year framework and a \$10.9B commitment for electricity Demand Side Management²⁹.

The programs offered over the last 5 years vary over a wide range of delivery partners by sub-region and program type. These include:

- **Custom Retrofit Program** – Incentivizes capital upgrades and equipment retrofits to drive measurable energy savings across industrial facilities.
- **Process and Systems Upgrades³⁰ (PSU)** – Supports system-level optimization and process improvements to enhance operational efficiency and reduce energy intensity. PSU program widely supported CHP cogeneration projects and some waste heat recovery projects which may offset electricity savings with increased natural gas use. The program was discontinued and did not fund new projects after 2021; however, evaluation measurement and verification (EM&V) for some projects occurred post-2021 that are included in this study.
- **Industrial Energy Efficiency Program (now the XLerate program)** – Enables large, strategic projects through a combination of incentive funding and development support for investment-ready opportunities.
- **Energy Management (EM) Programs** – IESO has had several energy manager programs between 2021-2025 that were delivered through a combined program for both industrial and commercial and institutional (C&I) customers. These incentives broadly covered program activities (includes energy scans, energy champion meetups, and workshops) and incentive firms to adopt energy managers to set energy efficiency targets for their organizations to achieve each year. Additionally, energy manager programs are observed by IESO to generate higher downstream project activities (benefits not captured in the current analysis) which may understate the program's overall impact
- **Expanded Energy Management Program (EEMP)** – Launched in 2025, funded by GIFMP, focuses on continuous operational improvement and energy management practices. A full year of evaluation measurement and verification (EM&V) cycle has not been completed; therefore, results are not included in this study. Further projects to be analyzed in future iterations.

²⁹ Independent Electricity System Operator, "2025–2036 Electricity Demand Side Management Framework," accessed July 17, 2026, <https://www.ieso.ca/Sector-Participants/Energy-Efficiency/2025-2036-Electricity-Demand-Side-Management-Framework>

³⁰ For the industrial programming where incentivized CHP projects historically represented a significant share of program outlays, the impact of the policy directive changes has reduced the role of CHP within the portfolio. The industrial sector is increasingly seeing the emergence of new technologies that could fill this gap, including energy recovery from waste, industrial heat pump technologies, efficient electrification solutions, and other high-efficiency process technologies. While CHP was previously a major driver of incentive spending and energy savings, these newer technologies may provide viable replacement opportunities and help maintain program impact as the industrial market evolves.

IESO Program Overview (2021-2025)



958
Projects



\$111M
Incentive Amount



~\$645M
Total Project Spend

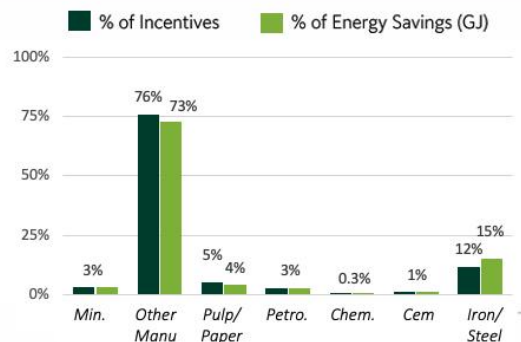


2.98PJ
Energy Savings



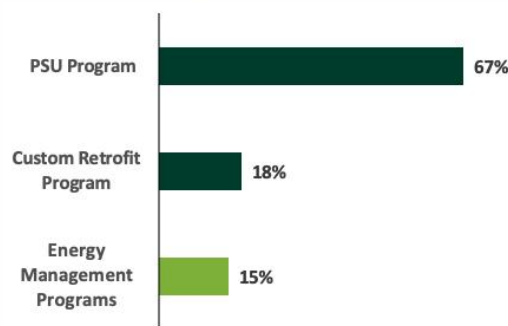
~5.8x³¹
Est. Leverage Ratio
(Project Spend / Incentives)

FUNDING VS ENERGY SAVINGS BY SECTOR



Key Insight:
Manufacturing dominates IEE participation from energy savings and incentives compared to mining and heavy industrial.

ENERGY SAVINGS (GJ) BY PROGRAM TYPE



Key Insight:
PSU program largely supported cogeneration systems contributing to significant energy savings.

PROGRAM EFFECTIVENESS



Total Resource Cost (TRC) **PSUP: 1.28**



Incentive \$ per Energy Savings **\$37.4/GJ**
13.5¢/kWh



Average Incentive per Project **\$116k**



Energy Saved per \$ of Incentive **0.03 GJ/\$**



TRC >1.0 indicates that each program delivers net benefits to the firms.
Note that only PSU has a published TRC value.

MARKET REACH & PENETRATION



Total Industrial Firms
21,199



Firms Participating
236+



Market Penetration
~2% of firms
~25% of industrial electricity use



Low market penetration suggests significant untapped potential to scale energy efficiency and productivity gains across industry.

Figure 13: IESO (Ontario) Program Overview

³¹ The leverage ratio includes project spend estimations for Custom Retrofit program and the EM program as described below and may be higher in reality.

Over the five-year period, IESO has delivered 958 projects through \$111M in incentive funding to achieve 2.98PJ through 12+ programs. The total project spend for custom retrofit stream is estimated to be x2 of the incentive amount as the program rules only allow an incentive of up to 50% of eligible costs. In reality, the project spend will be slightly higher due to the 50% incentive cap. Similarly, for energy manager program data that did not have project spend available, a 1:1 ratio was applied to the incentive amount to estimate project spend based on historical data from 2019-2020.

As observed in the figure above, “Other Manufacturing” continues to be where the most participation in incentives and energy savings are distributed. These include numerous small-to-medium enterprises and is reflective of Ontario’s industrial sectors distribution, where over 80% of total industrial firms are under “Other Manufacturing”. However, there may also be some error in categorization as participants will often self-categorize and choose “Other Manufacturing” during the application process, thereby impacting the accuracy of the sub-sector allocation of projects. Furthermore, the industrial firms share the PSU funding stream with C&I customers based on the local delivery partner (i.e. Local Distribution Companies), and 12% of overall IESO energy savings (representing 0.36PJ of the total 2.98PJ) and 16% of incentive funding are currently categorized under “Other Manufacturing” due to unavailable sub-sector information. In reality, that small subset of PSU participants could contain C&I customers, not fully industrial³².

There is over 21,199³³ employers in the manufacturing (NAICS 31-33) alone in Ontario and IESO manages the complexity of delivering multiple programs to both smaller industrial firms as well as the large energy-intensive firms. Furthermore, there are multiple delivery partners across the province that can drive the program administration costs higher than other provincial programs. Further program analysis is found in the dashboard above.

9.4 Ontario (Enbridge): Utility-led Robust Program Delivery

Enbridge demonstrates the strongest leverage ratio (11.6) across the programs reviewed, with \$25.1M in incentives supporting \$292M in total project spend. The program also delivered the largest number of projects, with 990 projects generating 17.7 PJ of energy savings. This likely reflects the structure of long-standing utility-led Demand-Side Management (DSM) programs, where established customer relationships, a wide advisor network, consistent program delivery and one-on-one support can help move projects from opportunity identification to implementation.

The program appears especially effective for large-volume customers, where the TRC ratio is higher, likely because larger facilities have greater thermal loads. Savings are fairly distributed across manufacturing sectors, including petroleum, chemicals, pulp and paper, food and beverage, and iron and steel. However, mining shows relatively low participation, which is consistent with Ontario’s mining energy profile, where remote operations can rely more on other fuels rather than natural gas. Waste heat recovery also appears to be a meaningful IEE measure for Enbridge, compared to other programs included in the study, that can directly reduce thermal energy demand and deliver large energy savings.

³² The potential inclusion of C&I consists of ~78 projects and attribute 0.36 GJ to the total IESO energy savings.

³³ Innovation Science and Economic Development (ISED) Business – Canadian Industry Statistics

Enbridge Program Overview (2021-2025)



990
Projects



\$25.2M
Incentive Amount



\$292M
Total Project Spend

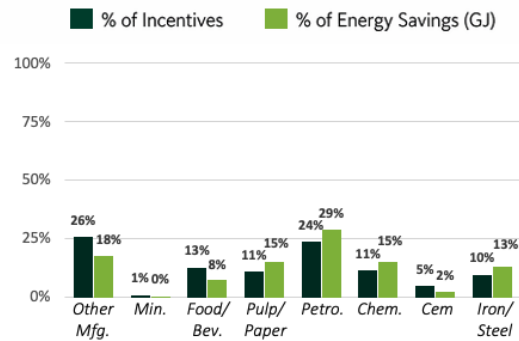


17.7 PJ
Energy Savings



11.6x
Leverage Ratio
(Project Spend / Incentives)

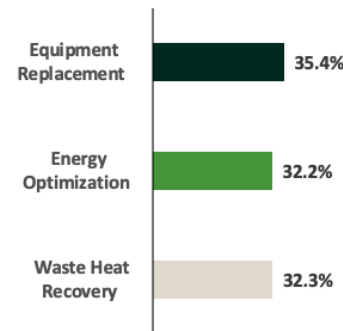
FUNDING VS ENERGY SAVINGS BY SECTOR



Key Insight:

Wide distribution of funds and energy savings across the manufacturing sectors. Lower utilization by the mining industry.

ENERGY SAVINGS BY PROJECT TYPE (GJ)



Key Insight:

Higher utilization for waste heat recovery than the other provinces; almost an equal share of optimization and capital upgrades.

PROGRAM EFFECTIVENESS



Total Resource Cost (TRC) **Industrial: 3.57**
Large-volume: 2.36



Incentive \$ per Energy Savings **\$1.42/GJ**
5.3¢/m³



Average Incentive per Project **\$25.4k**



Energy Saved per \$ of Incentive **0.70 GJ/\$**



TRC > 1.0 indicates that each program delivers net benefits to the firms, where large-volume customers perform better.

MARKET REACH & PENETRATION



Total Industrial Firms
10,971



Firms Participating
408



Market Penetration
3.7% of firms
76% of industrial non-electricity use



Low market penetration suggests significant untapped potential to scale energy efficiency and productivity gains across industry.

Figure 14: Enbridge (Ontario) Program Overview

A fraction of Enbridge's Industrial firms³⁴ are included in the study, accounting for 76% of industrial natural gas use in Ontario. Approximately 91% of energy consumed within the Industrial customer base comes from only 9% of customers; smaller customers are targeted through other types of initiatives like Direct Install and Prescriptive measures, where there is more limited potential per site. Further program analysis is found in the dashboard above.

9.5 Nova Scotia (EfficiencyOne): Mature Model Proves Strong Performance

EfficiencyOne administers industrial energy efficiency programs for Nova Scotia: SEM (supported by GIFMP); and capital upgrade stream, funded by ratepayer contributions through the provincial electric utility, Nova Scotia Power. As a result, program design and delivery are closely aligned with system-level objectives, including demand reduction, grid reliability, and cost management for electricity customers. The program does not include other fuel types in the province.

EfficiencyOne has been delivering some type of efficiency programs since 2010, making it one of the more mature program administrators in Canada, with well-established processes, stakeholder relationships, and program structures. This maturity is reflected in the strong performance of both its SEM program, that began in 2018, as well as the capital upgrade programs, effectively supporting both operational improvements and larger-scale investments across multiple sub-sectors. Market reach seems relatively low (5.3%) for the number of industrial firms with electricity accounts participating in IEE programs; however, these firms account for 28% of the industrial energy use in the province (Figure 15). This means that the larger energy users are participating in the program, however they also consume other types of fuel that are not targeted by EfficiencyOne. Further program analysis is found in the dashboard below.

³⁴ Total industrial firms of 10,971 includes smaller users as well as other sub-sectors such as agriculture.

EfficiencyOne Program Overview (2021-2025)



131
Projects



\$2.8M
Incentive Amount



\$16.1M
Total Project Spend

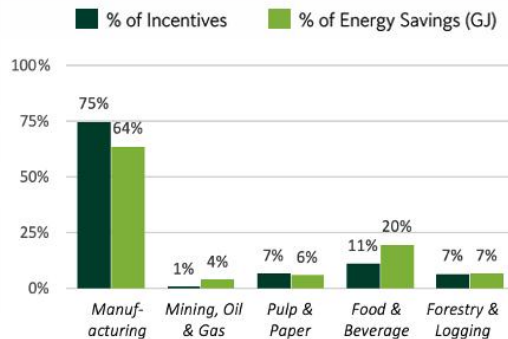


0.14 PJ³⁴
Energy Savings



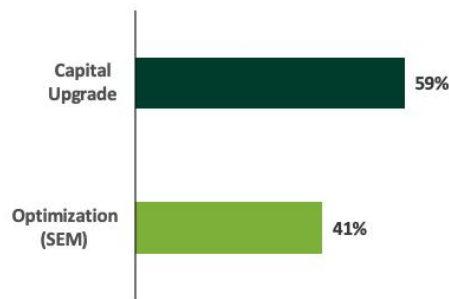
5.8x
Leverage Ratio
(Project Spend / Incentives)

FUNDING VS ENERGY SAVINGS BY SECTOR



Key Insight:
Energy savings and incentives are concentrated in the manufacturing sector.

ENERGY SAVINGS (GJ) BY PROGRAM TYPE



Key Insight:
Program maturity allows for adoption of both the SEM and capital upgrade programs.

PROGRAM EFFECTIVENESS



Total Resource Cost (TRC) **Custom Retrofit: 2.7**
SEM: 5.4



Incentive \$ per Energy Savings **\$20/GJ**
7.2¢/kWh



Average Incentive per Project **\$22.6k**



Energy Saved per \$ of Incentive **0.05 GJ/\$.**



TRC > 1.0 indicates that each program delivers net benefits to the firms. SEM program offers almost double the benefits compared to custom retrofit.

MARKET REACH & PENETRATION



Total Industrial Firms
2,339



Firms Participating
124



Market Penetration
5.3% of firms
28% of industrial energy use



Low market penetration suggests significant untapped potential to scale energy efficiency and productivity gains across industry.

Figure 15: EfficiencyOne (Nova Scotia) Program Overview

³⁵ The program dashboard includes the energy savings for the Forestry and Logging sector, as it falls within the administrative scope of participating industrial programs; however, this sector is excluded from the study analysis.

9.6 New Brunswick (NB Power): Targeted Program with Broad Fuel Coverage

NB Power delivers industrial energy efficiency programs directly as a provincially owned electric utility, meaning funding is primarily derived from ratepayer-supported programs, supplemented in some cases by provincial and federal contributions. The program focuses on SEM and capital upgrade streams for both large and small industrial customers.

NB Power's programs today reflect a relatively mature structure, with established processes for delivering both capital projects and energy management initiatives since 2015. Despite a smaller industrial sector, NB Power appears to achieve relatively strong overall market penetration that accounts for 48% of energy use, likely driven by its targeted delivery model and close utility-customer relationships.

A key strength of NB Power's approach is its fuel-agnostic design, supporting projects across electricity and non-electric energy uses (thermal fuels), enabling broader and more representative industrial participation. This is particularly important in New Brunswick, where the industrial sector accounts for most of the total energy demand. Within the sector, Pulp and Paper is both the largest energy user as well as the sub-sector that participates in the incentive programs the most. Further program analysis is found in the dashboard below.

NB Power Program Overview (2021-2025)



269
Projects



\$12.6M
Incentive Amount



\$60.4M
Total Project Spend

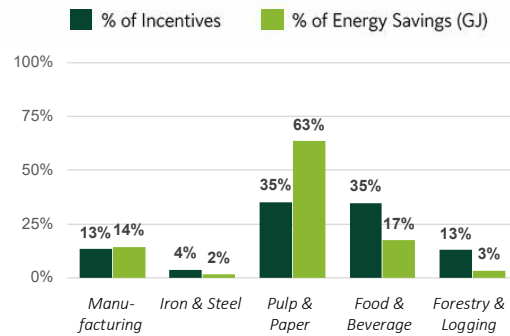


1.07 PJ³⁵
Energy Savings



4.8x
Leverage Ratio
(Project Spend / Incentives)

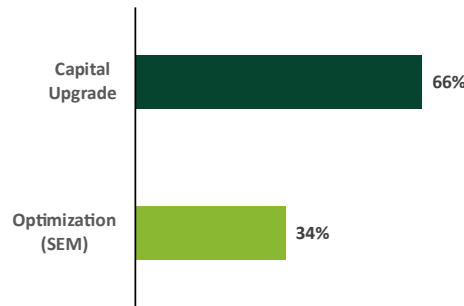
FUNDING VS ENERGY SAVINGS BY SECTOR



Key Insight:

Fair distribution of energy savings and incentives utilized in the prominent industrial sectors.

ENERGY SAVINGS (GJ) BY PROGRAM TYPE



Key Insight:

Program maturity allows for adoption of both the SEM and capital upgrade programs.

PROGRAM EFFECTIVENESS



Program Administrator Cost Test (PACT)

SEM and Custom Retrofit: 15.2

Large customers only



Incentive \$ per Energy Savings

\$11.7/GJ
4.2¢/kWh



Average Incentive per Project

\$46.7k



Energy Saved per \$ of Incentive

0.05 GJ/\$



PACT >1.0 indicates that the programs deliver net benefits for program administrator.

MARKET REACH & PENETRATION



Total Industrial Firms
493



Firms Participating
110

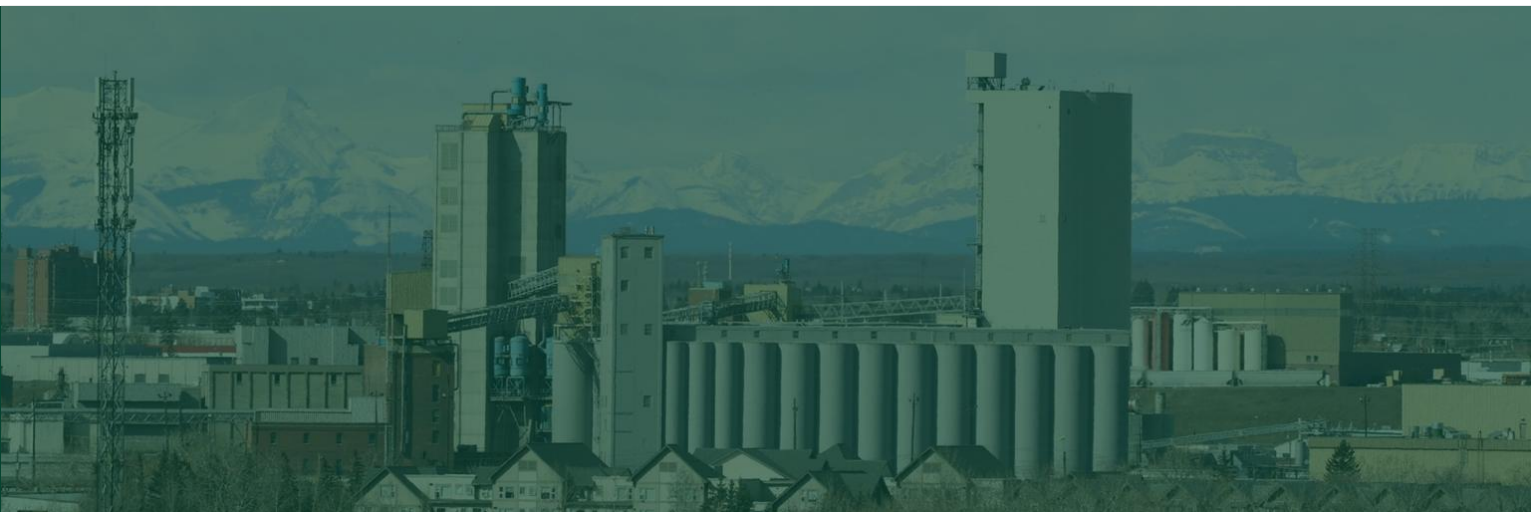


Market Penetration
22.3% of firms
~48% of industrial energy use



Low market penetration suggests significant untapped potential to scale energy efficiency and productivity gains across industry.

Figure 16: NB Power (New Brunswick) Program Overview



10 Key Learnings for IEE Programs

10.1 Market Penetration Remains Variable Across Jurisdictions

Industrial participation in energy efficiency programs varies by the provinces in scope. This indicates a gap between market potential and funding uptake. Variable market penetration highlights the need for improved marketing, outreach, and customer engagement in some jurisdictions, particularly to reach the firms that are less aware of program offerings or lack internal capacity to pursue projects.

Industrial energy efficiency programs across Ontario, New Brunswick³⁶ and Nova Scotia score 1.28 to 5.4 on TRC proving that IEE programs can be cost-effective (score >1). SEM programs appear to perform particularly well, with TRC scores reaching 5.4, while industrial-specific energy efficiency programs tend to score below 4. This reflects the higher participant costs that industrial firms must contribute to receive the capital project funding compared to energy manager programs that will incentive low- to no-cost opportunities.

The program results also suggest that SEM initiatives, and EM programs (i.e. previous IESO programs), can be highly impactful in driving energy savings. Between Ontario, New Brunswick and Nova Scotia, SEM/EM-related savings account for 28% to 41% of total supported energy savings, including both capital project savings and SEM savings, relative to total incentive dollars provided by IESO, NB Power and EfficiencyOne.

Vertically integrated organizations, such as NB Power, EfficiencyOne, and Enbridge, may be well-positioned to administer effective industrial energy efficiency programs directly, given that their programs have achieved TRC scores above 2. Program duration and consistency also appear to be important factors. For example, Enbridge, with their program running for over 30 years, have implemented more than 990 projects, significantly exceeding the number of projects delivered by the other programs reviewed. ACEEE's recent report further recommends that program providers engage directly with firms to build credibility, increase awareness, and encourage greater program participation.

³⁶ NB Power reported on PAC, which does not include the participant costs and some benefits in their assessment; however, a combined SEM and capital upgrade programs score of 15 indicates that the program is performing above average for both streams.

Program delivery structure and the source of funding, whether through federal, provincial, or ratepayer-based utility funding, has a direct influence on program structure, objectives, and market penetration. Utility-driven programs, primarily funded through ratepayer contributions, such as EfficiencyOne, NB Power and Enbridge, demonstrate higher market penetration, reaching approximately 55% of industrial electricity use in Nova Scotia, ~48% in New Brunswick and 76% for natural gas in Ontario. This reflects stronger customer relationships, ongoing engagement, and alignment with system-level objectives inherent in utility-led delivery models. ERA has seen a significant uptake over a short period of time, where 100% of the funds available for IEE over 3 years secured with only less than 100 firms participating in the program – this reflects the appetite for increased funding in Alberta. There may also be other variables beyond delivery structure alone to influence market penetration and the ACEEE study expands on several more of these contributing factors.

10.2 Program Certainty is Critical for Industrial Capital Cycles

Program duration plays a critical role in enabling industrial participation, particularly for large-scale capital projects where firms require certainty³⁷. Industrial firms, especially in sectors such as mining, oil and gas, and energy-intensive manufacturing, operate on long capital planning cycles, often spanning multiple years.

Programs with shorter timelines (i.e. ERA's 2025–2027 window and IESO's historical 4-year turnover of program offerings) may limit participation from these firms. Longer program frameworks (that of NB Power and EfficiencyOne, and IESO's new 12-year framework) may provide predictability and certainty that better align with industrial investment decision-making processes. This would allow firms the time to develop larger, more complex projects, and increase program participation, thereby higher adoption of IEE projects.

The program funders and administrators have observed that participation patterns vary significantly by firm size which may reflect to differences in access to capital, resources, and financial structures. The 2026 ACEEE report also recognizes that the motivations for participating in IEE programs can be characterized by firm-size. Smaller and mid-sized manufacturing firms ("mom-and-pop" operations) can often rely heavily on incentives to advance energy projects which may be observed in the higher participation rates.

Larger industrial firms, particularly those in energy-intensive sectors, may have the internal resources to fund projects independently but still participate selectively for larger or more strategic initiatives. As seen with ERA, participation is concentrated among smaller firms, primarily in the manufacturing sector (74% of incentive amounts committed for only 35% of total energy savings) compared to the larger firms in the mining, oil and gas sector where 26% of the incentive amount contributes to the remaining 65% of program savings. This suggests that when Mining, Oil and Gas firms participate, they implement larger projects than compared to manufacturing firms. If more of these larger firms participated in the IEE programs, many of which are in the mining, oil and gas sector in Alberta, the impact of energy reduction provincially and nationally could be significant.

³⁷ ACEEE: Industrial Capital Investment Decisions: Pathways to Energy Program Engagement, 2026

Sectoral differences seem to strongly influence how energy efficiency is adopted:

- **Mining, oil and gas sector firms typically have longer capital cycles and greater internal funding capacity**, resulting in lower reliance on incentives for standard projects but higher engagement for large, strategic investments.
- **Manufacturing sector firms are driven by tighter margins and greater sensitivity to operating costs** and tend to show higher participation rates.

10.3 Energy Efficiency is Increasingly Linked to Growth and Competitiveness

Industrial firms are increasingly evaluating energy efficiency not only as a cost-saving measure, but as a strategic lever for growth, competitiveness, and long-term resilience. As market conditions evolve, driven by global competition, cost pressures (including the energy crisis and unprecedented tariffs), and decarbonization requirements, firms are prioritizing energy efficiency projects that deliver both operational and strategic value.

From discussion with the program providers in the scope of this study, there is feedback from the industrial firms that suggest senior leadership seek energy projects that can also enable growth, such as:

- Reduce operating costs and improving margins, particularly in energy-intensive processes
- Unlock production increases or enable capacity expansion
- Support technology adoption and process innovation, including automation, controls, and electrification
- Align with corporate sustainability and decarbonization goals – tied to market access and investor expectations

The impact of energy efficiency is particularly pronounced in sectors where energy costs represent a significant share of total operating costs relative to margins, such as pulp and paper, primary metals, and certain upstream industrial processes. In these sectors, even modest improvements in energy intensity can materially improve profitability and competitiveness.

This shift can reframe energy efficiency from a cost-saving exercise to a driver of industrial productivity. Going back to the Cobb-Douglas equation as a reference framework, by reducing energy input, while maintaining or improving output, firms can improve energy productivity. More importantly, energy efficiency investments can also enhance multifactor productivity by improving process reliability, reducing downtime, and enabling better utilization of labour and capital.

The key input to framing industrial productivity is also found through the quantification of NEBs, where the operational impacts drive productivity gains across the business. With that, energy efficiency can also be integrated into core business strategy and capital planning decisions, where the focus is not only on cost savings, but on how energy can be optimized as a controllable input to drive higher output, stronger margins, and sustained competitive advantage.

10.4 Further Data Gathering to Provide Deeper Productivity Insights

While most program administrators track core metrics such as energy savings and incentive spend, there is limited and inconsistent capture of operational outcomes, including production changes, downtime reduction, and other non-energy benefits (NEBs). As a result, the full value of energy efficiency, particularly its contribution to industrial productivity is not systematically measured or captured.

This gap is particularly significant given that firms themselves often report on labour savings, asset utilization, yield improvements, maintenance savings, and production increases when developing internal business cases. However, these same data points are not consistently collected or reported at the program level, limiting the ability to fully evaluate and compare IEE program effectiveness beyond energy savings.

There are trade-offs between data acquisition and the administrative burden, particularly for operational programs such as SEM, where excessive reporting requirements may reduce participation. However, for larger, capital-intensive projects, there is a strong case for more structured data collection, including standardized tracking of key NEBs and productivity-related indicators. As a start, program administrators can work with firms who are willing to provide, to gather available information around these key indicators, to improve the ability to assess holistic program impact on industrial productivity.



11 Energy and Industrial Productivity Outcomes

11.1 Energy Productivity Using Program Data

Funding program administrators often distinguish between gross and net energy savings when evaluating the impact of energy efficiency programs. Gross savings represent the total measured or estimated energy savings from participating projects before adjusting for market or behavioural factors. Net savings reflect the portion of savings that can be attributed directly to the program after accounting for factors such as free ridership, spillover, participant behaviour, and what may have occurred without the incentive or program support.

Furthermore, due to the program scope specifying fuel types and project eligibility, there is also a gross versus net effect to the provincial energy use. For example, IESO is primarily focused on electricity savings, so if a project reduces electricity use but increases natural gas use, IESO may count the total electricity savings but may not fully account for the increase in gas consumption to the province. Similarly, Enbridge focuses on natural gas savings and their programs would look at avoided gas use. If a project saves gas but increases electricity use (i.e. heat pumps), Enbridge would account for the gas savings while the increase in electricity sits outside of their program accounting. Typically, energy productivity would account for the net benefits across all fuel types over the output or value add. Given the differences in the program capture of fuel types and that they are measured against total provincial GDP, the results below should be viewed as an indicative estimates of program contributions on the industrial sector.

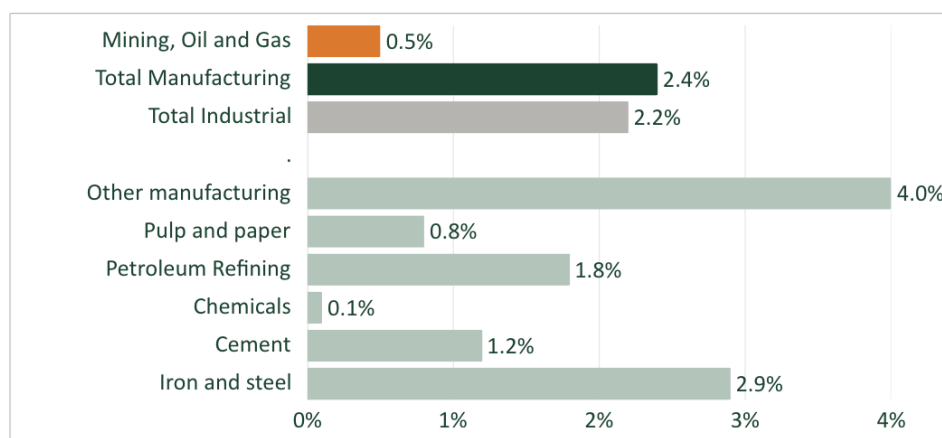
Energy productivity is conducted for programs that have past data with gross savings, using provincial baseline energy data (CEEDC) and provincial GDP by the sub-sector. The analysis includes IESO and Enbridge in Ontario (Figure 17) and NB Power and EfficiencyOne in the Atlantic provinces (Figure 18)³⁸. Aggregated program data from 2021–2025 is used to assess the total impact of incentivized projects on

³⁸ Energy productivity analysis was performed for completed projects and ERA is not included in this as they entail future program savings.

each industrial sub-sector, by program provider. Energy productivity is calculated using 2019 provincial baseline energy consumption and GDP data.

Overall, IESO activity shows a general energy productivity improvement of 0.1%-4% varied by the sub-sector with Mining, Oil and Gas be on the lower side. As Ontario's energy use is only 24% in electricity, an improvement on electricity can be significant for the industrial firms. Enbridge sees a wide variety of results ranging up to energy productivity improvements averaging 23.4% across the manufacturing sectors. Due to gross savings, these numbers do not account for the net impact of savings and can be excluding alternative effects. Enbridge also experiences Mining, Oil and Gas performing weaker than Manufacturing, and may suggest one of two things: that there is a need for large technical improvements in energy efficiency in processes that have stayed traditional in the last decades, or that projects are being funded by the firms without the use of incentive programs.

Ontario, Electricity Energy Productivity Improvement (IESO)



Ontario, Natural Gas Energy Productivity Improvement (Enbridge)

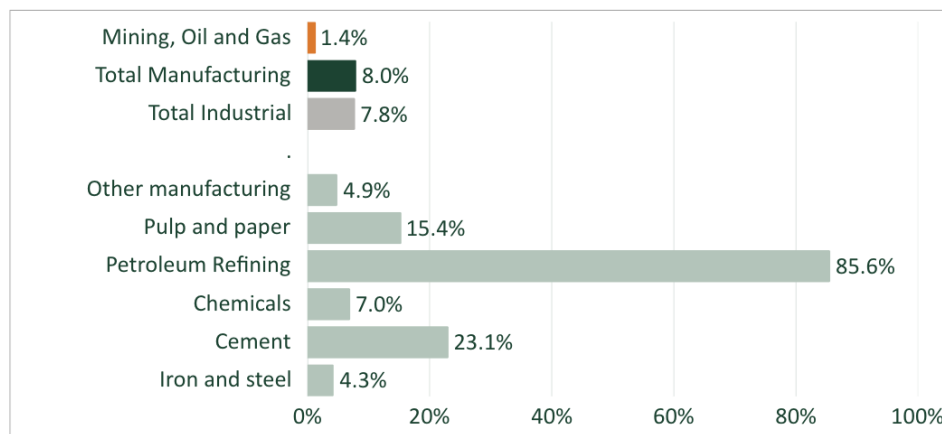
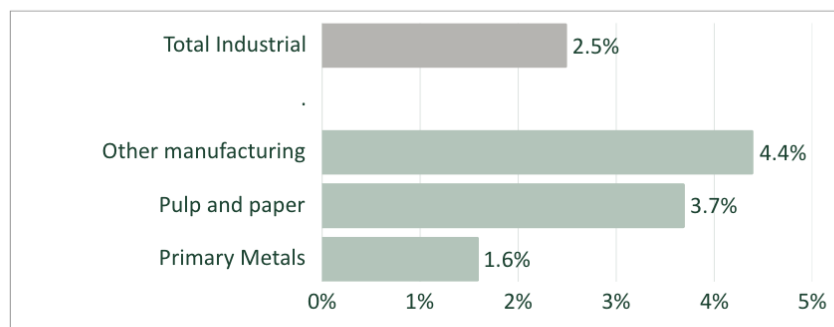


Figure 17: Energy productivity analysis (2021-2025) for Ontario using 2019 baseline data.

In the Atlantic provinces, the funding is allocated for the main industries of pulp and paper, primary metals and a mix of other manufacturing as seen below. For smaller provinces compared to Ontario, there is a mix of energy productivity improvements ranging from 0.6% for Mining, Oil and Gas in Nova

Scotia to 4.4% in NB Power for other manufacturing. The lower results in Nova Scotia might be due to the limitations of their scope on just electricity demand.

New Brunswick, All Fuels Energy Productivity Improvement (NB Power)



Nova Scotia, Electricity Energy Productivity Improvement (Nova Scotia)

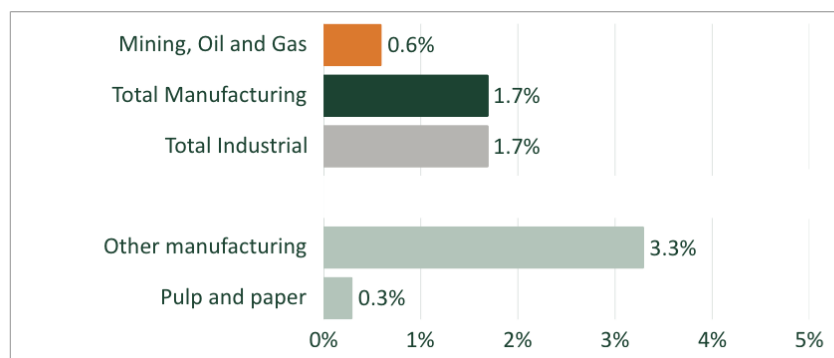


Figure 18: Energy productivity analysis (2021-2025) for Atlantic provinces using 2019 baseline data.

11.2 Sector-level Energy Productivity using Firm Baseline Energy

While industrial energy efficiency programs deliver measurable energy savings, their impact on energy productivity (GDP/GJ) discussed above are considered across the total provincial energy use for the fuel types in scope of each program provider. This section focuses on using firms' baseline energy use to estimate sector-level productivity.

ERA, through their GIFMP data gathering, and Enbridge (Natural Gas only) and EfficiencyOne (Electricity only), through their utility database, were able to provide baseline energy use for the firms participating in the IEE programs and provide considerable results for outlining energy efficiency savings versus energy productivity improvement, where the impact is more pronounced as seen in the figure below. Energy productivity improvements range from 3.5% in Nova Scotia to an average of 19.2% in Alberta, demonstrating the meaningful operational impact of these investments at the firm-level (Figure 19). There may be a significant difference in the type of project ranging from small capital to larger capital upgrades versus behavioural and operational improvements; however, this analysis is limited by the data as there is no visibility into the project specifics (i.e. implications of equipment replacements). Furthermore, this is an illustrative analysis, and these projects may realize output growth that is not captured, limited by data.

ERA - Alberta	2024 Baseline Firms Energy Use (PJ)	Firm Energy Savings, 2025-2027 (PJ)	Energy Reduction	Energy Productivity (GDP/PJ) Improvement
Manufacturing	16.9	1.6	9.5%	10.5%
Mining, Oil, and Gas	11.7	3	25.6%	34.5%
Total Industrial sector	28.6	4.6	16.1%	19.2%
EfficiencyOne - Nova Scotia	Est. Annual Baseline (2021-2025) Firms Energy Use (PJ)	Firm Energy Savings, 2021-2025 (PJ)	Energy Reduction	Energy Productivity (GDP/PJ) Improvement
Total Industrial sector	3.9	0.13	3.3%	3.4%
Enbridge - Ontario	3-year Avg. Baseline Firms Energy Use (PJ)	Firm Energy Savings, 2021-2025 (PJ)	Energy Reduction	Energy Productivity (GDP/PJ) Improvement
Total Industrial sector	213	17.69	8.3%	9.0%

Figure 19: Firm-level Energy Productivity and Energy Reduction for Alberta, Ontario (Enbridge) and Nova Scotia³⁹

The figure below visualizes the non-linear impact on energy productivity when considering the firms' actual baseline energy data (2024) against the past and future project lists (2025-2027).

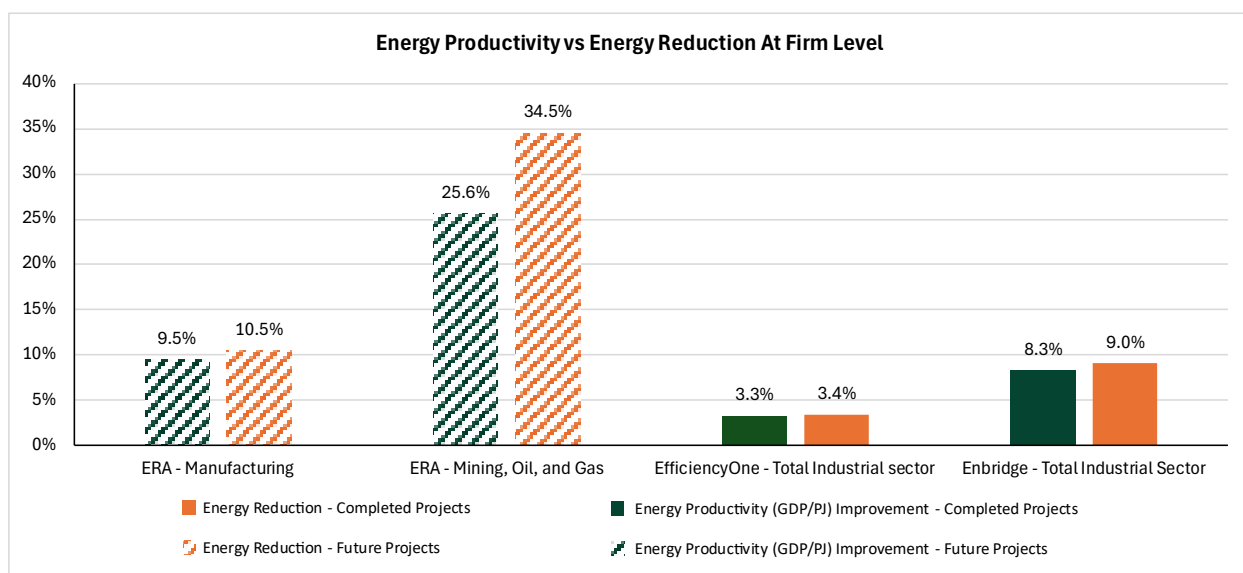


Figure 20: Energy Productivity (2025-2027) Compared to Energy Reduction at the Firm-Level from 2024 baseline.

³⁹ Firm-level energy baseline data varies across program providers due to differences in data availability and confidentiality requirements intended to protect customer information.

11.3 Energy Efficiency to support Labour Productivity Growth

One of the key non-energy benefits of IEE is the impact on the workforce (i.e. reduced hours). This directly impacts labour productivity that is described as GDP/number of workers or GDP/hours worked. Furthermore, labour productivity is often the metric associated with productivity discussions at a macro-economic level and there has been some research exploring this connectivity. Recent discussions have been highlighting the significant labour productivity gap between Canada (\$58.9/hours worked), other G7 countries (\$71.6/hours worked) and the US (\$83.6/hours worked), (USD PPP, 2023)⁴⁰.

On average, a unit increase in energy efficiency is associated with a 0.16–0.21% increase in labor productivity, depending on the measure of energy efficiency adopted.⁴¹ The 2025 International Energy Agency (IEA) report “Multiple Benefits of Energy Efficiency”⁴² also identifies, from an analysis of over 15,000 European firms that those investing in energy efficiency see increases in labour productivity of between 1.4% and 3.6% over firms with no investment in energy efficiency. The range of these two studies can be attributed to several factors including the nature of the project types (i.e. optimization and controls upgrade that may automate manual labour processes to capital upgrades that reduce maintenance hours), the industry type, firm size, firm location (EU versus Canada) and multiple other factors.

Given the Cobb-Douglas relationships⁴³ and multiple research studies, a general relationship can be summarized as 1% reduction in energy demand results in 0.2% impact on labour productivity, the lower end of the results described above. **Inversely, this means that to improve labour productivity by 1%, the sector needs to realize 5% in energy savings.** On a macro level, this relationship can be further applied to extrapolate the funding required to bridge the gap between labour productivity from improvement to energy productivity.

Applying an average funding spend of \$5.16/GJ of energy savings, as found in the cumulative program investment to energy savings realized in the study, this can be combined with a 5% reduction in energy of the total industrial sector in Canada. This implies that close to **\$1B (\$0.94B) in Industrial Energy Efficiency funding could support the improvement of labour productivity by 1%.** Given that Canada’s labour productivity decreased by 0.67 units from 2019 to 2023, investing in energy efficiency may help offset some of the gap. As there is no further analysis conducted within Canada on the industrial sector, there is an increasing need to acknowledge the relationship energy efficiency has on labor productivity and explore the opportunity to quantify the relationships further.

⁴⁰ Source: Nicolas Vincent, “Toward a Virtuous Circle for Productivity,” Bank of Canada, November 19, 2025. <https://www.bankofcanada.ca/2025/11/toward-a-virtuous-circle-for-productivity/>

⁴¹Source: Montalbano, P., Nenci, S., & Vurchio, D., “Energy Efficiency and Productivity: A Worldwide Firm-Level Analysis,” *The Energy Journal*, 2022.

⁴² Source: “Multiple Benefits of Energy Efficiency,” IEA, 2025. <https://www.iea.org/reports/multiple-benefits-of-energy-efficiency&ved=2ahUKEwjB7f2-5Z6UAxXNjSsGHQbpK8wQFnoECB0QAQ&usg=AOvVaw0gDUX2v0L2kRvUDoltYptP>

⁴³ Specific firm-level studies can be conducted to define the wide variety of impacts that can occur when IEE projects are implemented, some of which may include rebound effects (saved energy enabling expanded production), automation substitution (capital deepening from EE projects can reduce labour intensity, not necessarily improve labour productivity), production constraints, and sector heterogeneity.

11.4 Firm-level Profitability and Competitiveness

Industrial energy efficiency has a direct relationship with firm-level profitability because energy is a core production input. For many industrial firms, energy costs may represent a relatively modest share of total operating costs, often in the range of 2% to 10%. However, in energy-intensive sub-sectors such as pulp and paper, chemicals, cement, iron and steel, aluminum, petroleum refining, and mining, energy can represent a much larger share of input costs, reaching in some cases 20%, 30%, and even 45% depending on the specific industrial process, fuel mix, production profile, and market conditions.

The financial value of energy efficiency is highly dependent on how significant energy costs are to the firm's cost structure and it can impact which sub-sectors would benefit more from IEE implementation. Where energy represents a smaller share of total costs, energy efficiency can still improve profitability through avoided utility costs, reduced exposure to price volatility, and incremental margin improvement. However, where energy represents a larger share of input costs, the same percentage reduction in energy use can have a much more material impact.

The analysis of energy as an input cost is critical. It helps identify where industrial energy efficiency has the strongest potential to influence profitability, not just energy consumption. In energy-intensive sectors, avoided energy costs can function similarly to increased revenue because they flow directly to the bottom-line once project costs are recovered. This is particularly important for firms operating with thin margins, where reducing costs may be more achievable than increasing sales in competitive global markets. For these firms, energy efficiency can improve cost competitiveness without requiring additional production volume or business growth. The profitability case becomes even stronger when non-energy benefits are considered.

From a competitiveness perspective, these impacts matter as industrial firms who are exposed to multiple pressures at once – energy price volatility, carbon costs, aging assets, labour constraints, supply chain disruption, and global competition – energy efficiency can reduce exposure by lowering the cost of production and improving operational resilience. Therefore, energy efficiency is not only a cost-reduction measure, but also a profitability and competitiveness strategy.

The figures below identify the energy cost share for the general sub-sectors across Canada⁴⁴. The energy cost share is taken over the total operating expenses of salary, energy and resources. The Mining⁴⁵ sub-sectors have the highest energy cost share followed by the upstream energy intensive manufacturing sectors and then the final goods manufacturing sectors, as seen below.

⁴⁴ Dataset includes all Canadian firms in the sub-sectors analyzed in this section. Source: ISED

⁴⁵ Under NAICS code Mining, Oil and Gas [21], the Oil and Gas sub-sector did not have complete data.

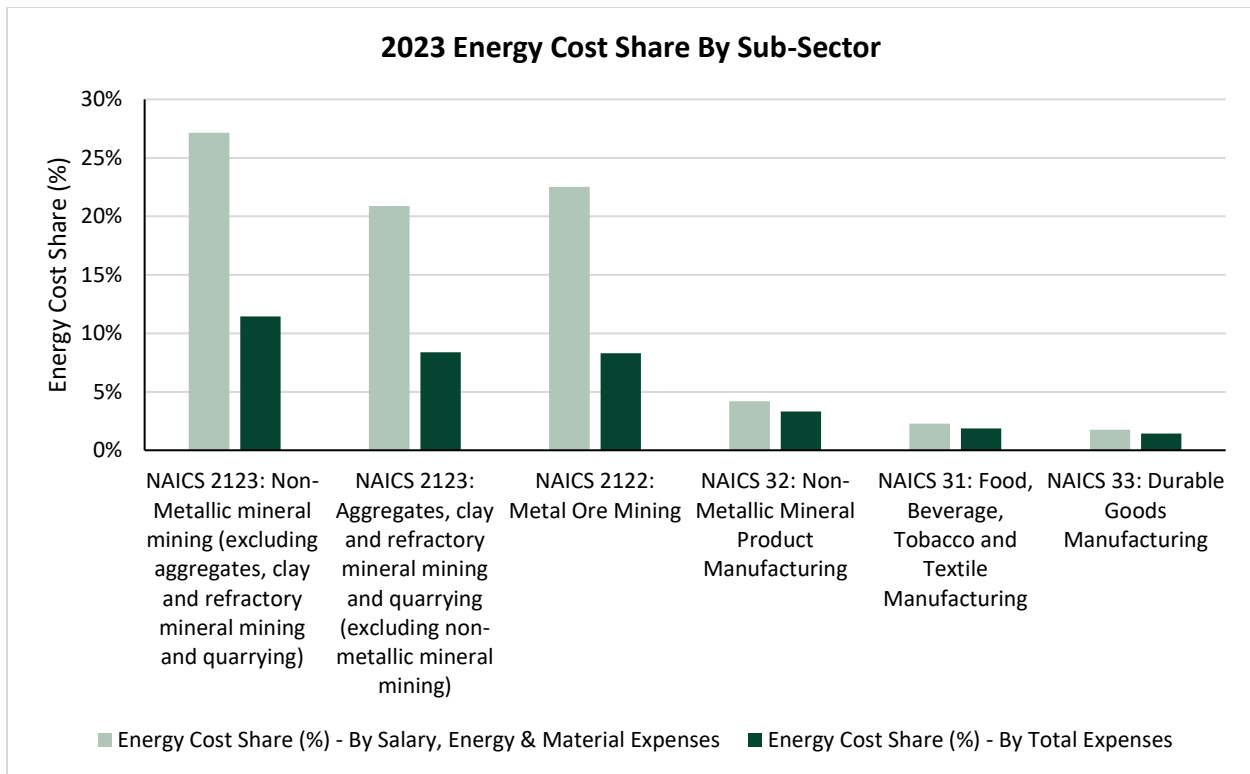


Figure 21: Energy cost share of input expenses by sub-sector.

The graphs below demonstrate the relationship between energy cost reduction, and the impact it has on profit margins and revenue for Canadian industries. Notably, **a 25% energy reduction in resource-extraction, energy-intensive sectors can drive up to 6% increase in margins whereas in industries that have lower margins, they may experience up to 4% increase in margins** as seen below.

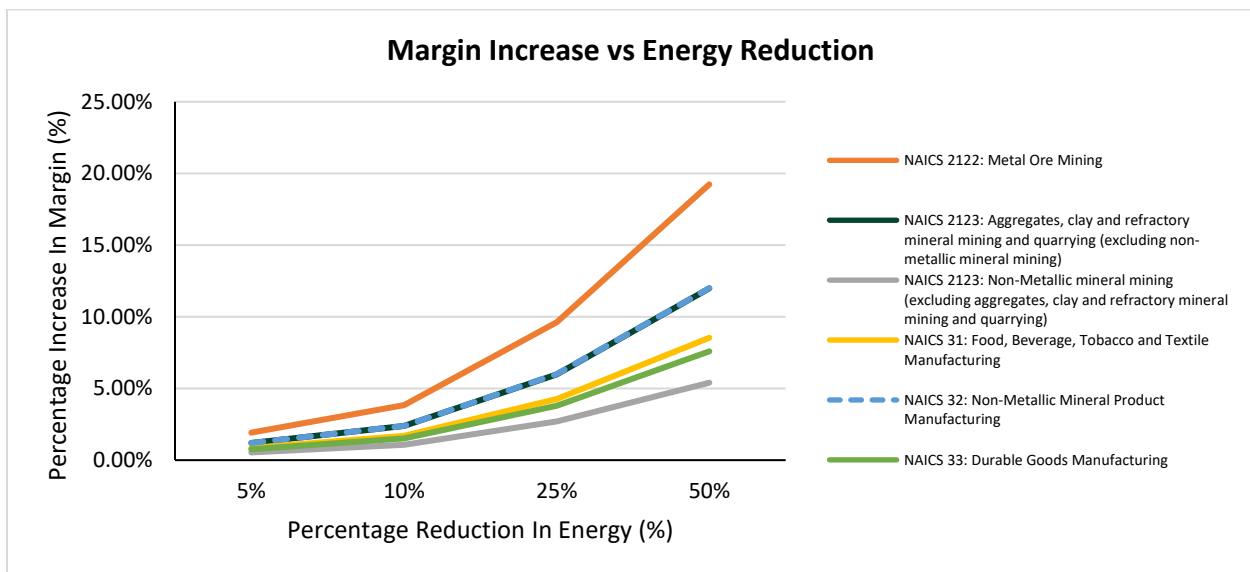


Figure 22: Energy reduction (energy savings) impact on firm profit margins

Further analysis on the specific sub-sectors for both Mining and Manufacturing can be found in Appendix A-3.

Based on the firm's business objectives, IEE programs can influence which sectors to target for the IEE incentives. Therefore, if the objective is:

- **To increase the financial performance of companies**, targeting high energy-intensive sectors such as paper manufacturing, wood manufacturing, primary metal manufacturing companies etc. would be desired as they see the largest margin increases.
- **To reduce energy costs/consumption at an absolute level**, the largest energy cost/consumption sectors should be targeted which are food manufacturing, primary metal manufacturing, chemical manufacturing and paper manufacturing.
- **To reduce the energy costs/consumption for sectors with the highest energy cost share** (i.e. more of an energy intensity basis), the mining sub-sectors should be targeted.
- **To also reduce greenhouse gas (GHG) emissions**, sectors should be targeted that primarily consume fossil fuel as their energy carriers as well as in jurisdictions with high electrical grid emission intensities (ex: Oil and gas in Alberta).

11.5 Incentives Supporting Economic Impact with Lifetime Energy Benefits

Based on the current portfolio of industrial energy efficiency programs across participating jurisdictions, the combined impact of these investments is estimated to deliver approximately a 1.56% impact in Canada's GDP taking lifetime energy savings over 12 years⁴⁶.

Across the programs analyzed, industrial firms in Canada leveraged \$176M in incentives, investing \$1.07B in total project spend inclusive of incentives, to complete 2,420 IEE projects and deliver 26.4 PJ in energy savings. These savings generate approximately \$292M in annual energy cost reductions and non-energy benefits, of which 80% of the freed capital (from both energy cost reduction and NEBs), is taken to be reinvested within the economy⁴⁷. Between 2021 and 2039, this translates to an estimated of \$5.01B in total GDP impact⁴⁸, supporting over 39,000 jobs across the supply chain. The approach is described in the methodology section. The table below summarizes total economic output, including all intermediate inputs in the supply chain, as well as GDP impact, including taxes and subsidies.

⁴⁶This accounts for the mix of capital upgrades that sustain savings over equipment lifetime of 15-20 years and operational projects with low- to no-cost measure that could see 5-15 years. 12-years is taken from a 2015 study across 813 Commercial and Industrial energy efficiency programs. Source: <https://www.osti.gov/servlets/purl/1236443>

⁴⁷ As noted in previous discussions in the study, IEE projects impact GDP (value-add) through a variety of different way from higher throughput to higher quality products (additional value-add). These effects have not been quantified due to data limitations and should be studied further to understand true value and GDP impact.

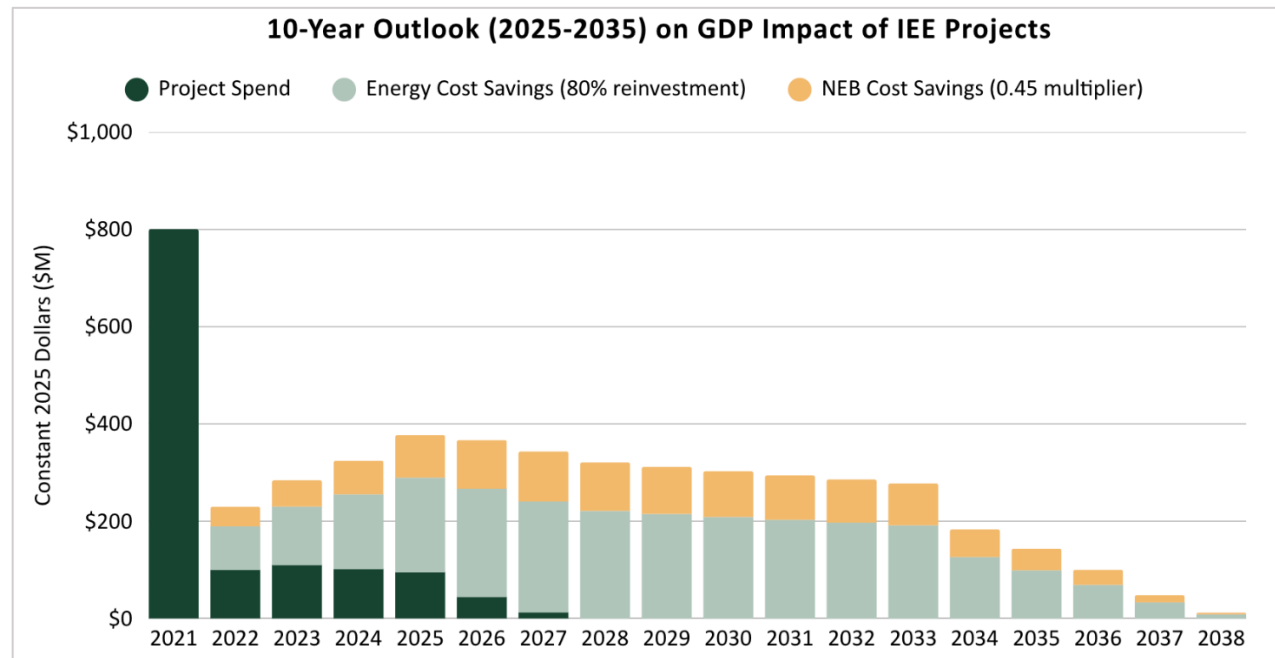
⁴⁸ Includes Total Multiplier (direct, indirect and induced effects) for GDP at basic prices for the Total Industrial sector in Canada. The assumptions and approach is further described in the methodology section.

Table 7: Economic Impact Summary Table

	Total Multiplier (direct + indirect + induced impacts)	% GDP Impact (Constant 2025 Dollars)	GDP Impact (\$)	Economic impact per \$1 of incentive	Economic impact per \$1 in project spend	Jobs created per \$1M of incentive
Output	1.922	2.91%	\$9.31B	\$73	\$8.8	573
GDP Market Prices	1.069	1.62%	\$5.18B	\$41	\$4.9	318
GDP Basic Prices	1.033	1.56%	\$5.01B	\$39	\$4.7	308

Over the lifetime of these energy projects, the total GDP impact can then be summarized against the incentive funding, and the project spend where **each \$1M in incentive funding impacts roughly \$39M in economic activity and 308 jobs and each dollar in project spend impacts GDP by ~\$5.**

Looking 10 years forward (2026–2035), the figure below illustrates the projected ripple effects of IEE program projects across the economy. While energy cost savings and NEB-associated benefits are expected to continue over the lifetimes of the energy projects, freed-up capital reinvested in the economy can make a significant contribution to economic value-added and job creation.


Figure 23: GDP Impact of IEE Projects over the next decade.



12 Future Potential of IEE on Productivity Analysis

Market penetration can be used as a proxy for program scale, assuming that average energy savings per participating firm are maintained as participation increases. The results from this study found that current penetration levels average to 13.9% of the provincial industrial energy use and capture only a small portion of the total potential in the market that is in scope for this study. The largest opportunity is in Alberta, being one of the largest industrial energy users by province (represents over 75% of the energy use of the four provinces studied) and where the current program market participation is low at only 6.1% (due in part to it being a new program). The ERA program provides a significant opportunity for firms who can benefit from a program designed specifically for the industrial sector with a strong delivery partner. The other three provinces have market penetration rates between 25-76% with an average of 56%.

As participation increases, especially for ERA's potential Mining, Oil and Gas sector who is just entering the market with a robust IEE program, the cumulative energy savings can compound overtime, resulting in more meaningful improvements in energy productivity at the sector level. While simplified, this highlights the untapped opportunity to drive productivity gains through increased program engagement among the larger and energy-intensive firms. **If current program participation expanded⁴⁹ to 75% of the industrial energy users in all four provinces, the energy productivity improvement is significant at 16.8%, as seen in the figure below. This could potentially also translate to \$57.4B in economic activity and 448,000 jobs created.**

⁴⁹ This analysis assumes linear extrapolation of current results and does not account for diminishing returns as market penetration increases. Early adopters often capture lower-cost or higher-confidence opportunities first, while remaining opportunities may be more variable, site-specific, or capital-intensive. Ongoing shifts toward electrification, fuel switching, and renewable energy generation may also alter future energy use patterns and affect the magnitude of projected savings and productivity impacts. Furthermore, external factors such as carbon pricing, energy pricing, trade relationships, and business priorities can change how firms prioritize efficiency projects.

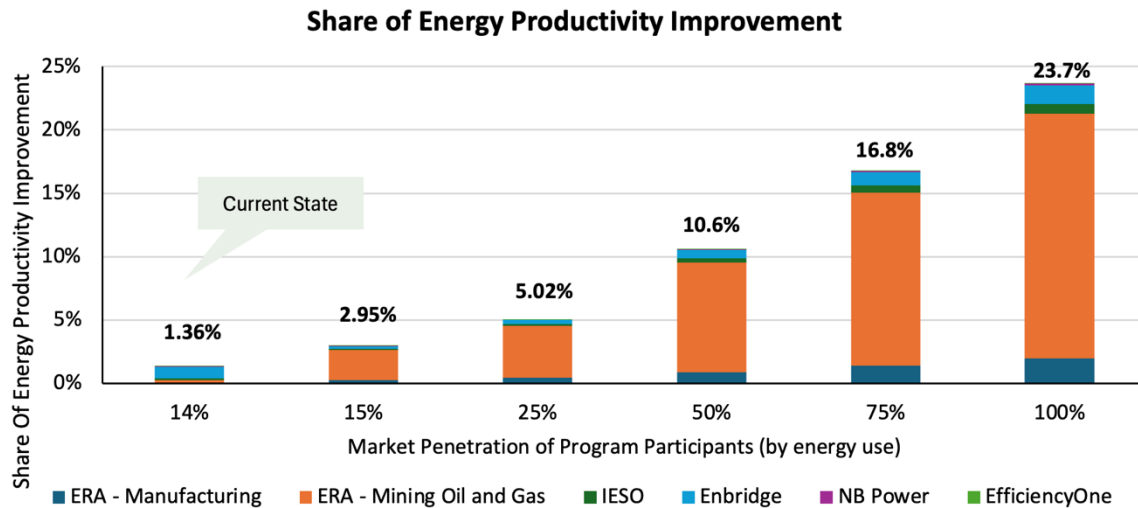


Figure 24: Future Potential of Energy Productivity Impact

Using a simplified Cobb-Douglas framework, reductions in energy input, while holding output constant can translate into gains in productivity through improved input efficiency, although the impact on GDP can increase depending on the type of IEE. The resulting graph below of plotting energy productivity (GDP/GJ) and energy reduction illustrate that even modest reductions in energy consumption at the sector level can generate measurable productivity gains, and does not correlate to a linear relationship. While the values shown are directional and do not account for sector-specific variability, they reinforce that energy efficiency represents a scalable lever for improving industrial productivity.

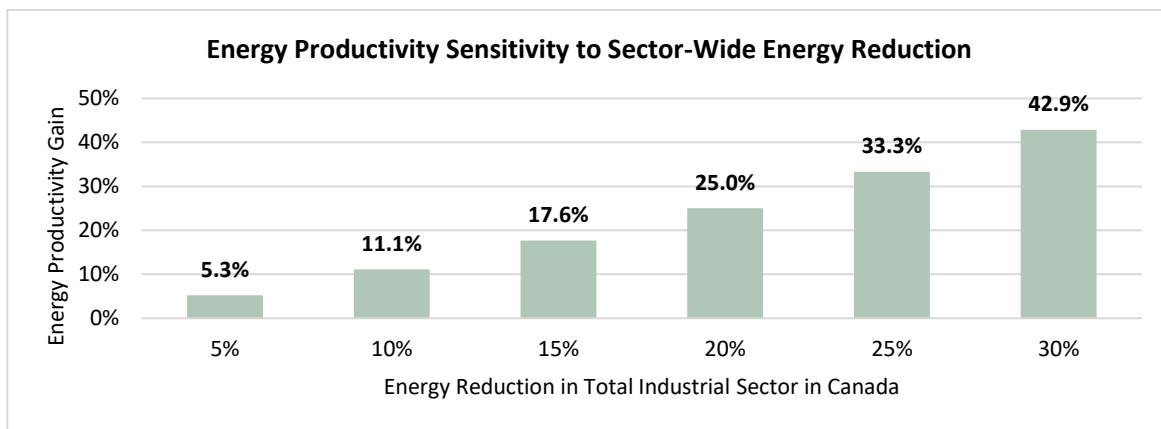


Figure 25: Energy Productivity Sensitivity to Sector-Wide Energy Reduction



13 Recommendations

13.1 Recommendations for Firms

Industrial firms could begin by positioning energy efficiency not just as a cost-reduction initiative, but as a core growth lever embedded within operations and strategy. Energy is one of the few controllable inputs in industrial production, and optimizing its use directly impacts throughput, yield, and reliability.

- **Energy efficiency initiatives as growth and capacity expansion.** Energy savings, especially from capital upgrades, when combined with non-energy benefits (such as reduced maintenance costs, improved reliability, and increased throughput), generate real, recurring cash flow within operations. When further supported by incentives, these projects often require lower upfront capital while delivering immediate financial returns. Rather than evaluating these investments solely against traditional financial thresholds, firms can position them as enablers of growth – freeing up capital to fund new production capacity, process improvements, or strategic initiatives. In doing so, energy efficiency can directly contribute to increasing output and productivity with the existing labour force, improving overall competitiveness.
- **Energy efficiency could also be reframed as a profit maximization tool.** Rather than focusing solely on energy savings, firms can translate these improvements into EBITDA⁵⁰ margins and revenue gains. This framing not only resonates more strongly with executive decision-makers, but it also improves competitiveness amongst peers.
- **Benchmarking against industry peers may be critical to understanding the true opportunity.** IEA and ACEEE consistently show significant efficiency gaps within sectors. For example, in energy-intensive industries like cement, the most efficient facilities can outperform the least efficient by over 50%⁵¹. Firms can set targets based on top-quartile performance rather than internal historical baselines, using benchmarking to highlight potential and drive investment.

⁵⁰ EBITDA (Earnings Before Interest, Taxes, Depreciation, and Amortization) is a financial metric used to evaluate a company's core operating performance and cash flow generation potential.

⁵¹ Source: "Energy Efficiency 2025," International Energy Agency (IEA), 2025.

<https://iea.blob.core.windows.net/assets/ab3e1064-1eb0-49fc-b039-38f6d3749e0a/EnergyEfficiency2025.pdf>

- **Track energy productivity, rather than just energy intensity**, to align efficiency with business outcomes. Metrics such as output per unit of energy (GDP/GJ or revenue/kWh) provide a clearer picture of how effectively energy is contributing to the value creation. Establishing baselines and integrating these metrics into facility and executive dashboards ensures that energy performance is managed alongside other key business indicators.

13.2 Recommendations for Program Administrators

- **Develop a robust and standardized measurement framework** that captures both energy and non-energy impacts at the firm level. This includes establishing clear baselines for energy use and production and systematically tracking energy savings. Where possible, non-energy benefits such as increased throughput, impact on labour hours, reduced downtime, maintenance savings, and improved product quality can also be accounted for. This can be done through project-level or firm-level voluntary surveys. In addition, programs may track participation metrics in a more granular way, including the number of firms participating by sub-sector (i.e. more stringent use of NAICS codes), overall energy consumption levels, and project types. This enables more precise benchmarking, identification of underpenetrated segments, and targeted program design. A well-developed measurement framework not only strengthens program evaluation and funding justification but also provides the data foundation needed to link energy efficiency directly to industrial productivity outcomes that can be rolled up to both the firm and sector level.
- **Simplify and align program structures with industrial decision-making timelines.** Complex application processes, rigid incentive structures, and misalignment with capital planning cycles remain key barriers to uptake. Drawing on ACEEE's recommendations⁴⁶, programs may move toward more flexible, streamlined delivery models that support bundled projects, multi-year engagement, and multi-stage approvals to provide certainty for the firms. Also, providing earlier-stage support, such as feasibility funding, technical assistance, and embedded expertise, can help de-risk projects before firms reach internal approval gates, ultimately increasing adoption and scaling impact.
- **Conduct ongoing internal benchmarking and market research** to identify and prioritize high-impact, high-potential sectors (i.e. firms that are energy-intensive and lower energy productivity than peers), and provide custom marketing strategies to increase overall market penetration. While the 2026 report from ACEEE provide strong guidance on opportunities to expand market penetration and program design, having an internal strategy grounded in program data is critical to maximizing impact. This includes analyzing participation rates, energy consumption profiles, and savings potential across sub-sectors to identify where the largest gaps and opportunities exist. Administrators could also assess which types of measures, such as optimization, process upgrades, or fuel switching, are underutilized relative to their potential. By combining internal data with external benchmarks, programs can proactively target high-impact industries and tailor outreach, incentives, and delivery models accordingly. This approach ensures that resources are directed toward segments with the greatest potential for energy savings, productivity gains, and scalability, ultimately driving deeper and more sustained market penetration.
- **Invest in data infrastructure, transparency, and cross-sector collaboration** to support more effective program design, evaluation and proliferation of IEE projects. The five participating funders across four provinces provided insights into program benefits and identified key success factors for continual improvement. Improved data visibility allows for better benchmarking,

quicker analysis, identification of high-impact opportunities, and more targeted policy interventions. In addition, fostering collaboration between utilities, program administrators, technology providers, and industrial firms helps accelerate innovation, scale best practices, and drive broader market transformation.

13.3 Recommendations for Policy Makers

- **Recognize industrial energy efficiency (IEE) as a strategic lever for economic resilience and competitiveness**, particularly in the context of energy price volatility, supply disruptions, and broader global uncertainty. During periods of energy crisis, reducing demand while maintaining or increasing output becomes a critical advantage. IEE enables this dual outcome by lowering the energy required per unit of production, effectively insulating firms from price shocks while improving cost structures. As a result, countries that prioritize industrial efficiency are better positioned to sustain production, protect margins, and remain globally competitive without increasing resource dependency.
- **Public investment in industrial energy efficiency could be viewed not as a subsidy, but as a high-return economic strategy**. Targeted funding toward improving industrial productivity, has the potential to generate significant direct benefits (energy cost savings, increased output), indirect benefits (supply chain competitiveness for industrial export industries), and broader societal benefits. Importantly, many of these impacts, particularly productivity gains, reinvestment of freed capital, and long-term competitiveness, are not fully captured in traditional program evaluations. This suggests that the true return on public investment in IEE may be materially higher than currently quantified.
- **Explicitly link industrial energy efficiency to national productivity objectives, including closing labour productivity gaps**. By enabling firms to produce more output with the same labour and capital inputs, IEE acts as a multiplier on existing resources. In this context, efficiency investments are not simply about reducing energy use, but about increasing economic output per unit of input, aligning directly with core productivity metrics. Embedding IEE within broader industrial, innovation, and economic development strategies may be critical to unlocking its full value and ensuring long-term competitiveness for Canada.
- **Position industrial energy efficiency as a core pillar of industrial productivity and competitiveness**, rather than solely as a climate or cost-reduction tool. While energy efficiency is often framed within decarbonization objectives, its direct impact on firm-level profitability, output, and cost structures makes it a critical lever for improving national productivity. Furthermore, aligning energy efficiency policy with industrial strategy, particularly in energy-intensive sectors and energy generation sectors, can strengthen global competitiveness and support long-term economic growth. This reframing is essential to securing sustained policy support and investment.
- **Advocate for long-term policy and funding frameworks** that enable industrial firms to make confident capital investment decisions. Industrial projects often have longer planned and payback horizons, and uncertainty around incentives amounts and program continuity can delay or prevent adoption. Providing clear, multi-year signals reduces investment risk and encourages firms to pursue deeper, more transformative efficiency measures rather than incremental improvements.



14 Future Work

14.1 Define an economic model for industrial productivity

Industrial productivity cannot be defined with a template or single formula. There are multiple factors feeding productivity gains and the Cobb-Douglas equation might provide the basis for a broader economic model that quantifies industrial productivity.

After speaking with several economists as part of this study, it is clear that further and more detailed analysis by experts (i.e. economists who can model the connectivity of energy demand, energy use and the energy-intensive sectors in combination with energy efficiency experts) is needed to fully capture the range of variables influencing industrial productivity and economic impact. The dynamics observed specific to Canada's resource-based industrial economy should be carefully considered.

One key consideration is the relationship between the cost of energy generation and the Total Resource Cost (TRC) of delivering industrial energy efficiency programs. In some cases, the cost of supplying new energy, particularly through generation and infrastructure expansion, may exceed the cost of achieving equivalent savings through efficiency. From a utility perspective, reducing demand may be a vehicle to defer or avoid the need for new generation capacity and associated capital investment in the short-term.

As such, there are broader implications to consider when modelling industrial productivity at a macro-level and the modified Cobb-Douglas production function may be a starting point as some of the research studies suggest.

14.2 Dive deeper with Firm-Level Case Studies

To better understand the real-world impact of industrial energy efficiency programs, further analysis should incorporate detailed case studies from the firms, across the different sub-sectors and project types. Project-specific or firm-specific case studies can provide deeper insight into how projects are developed, financed, and implemented at the firm level, including the role of incentives in decision-making.

While firms typically have internal capital and established investment processes, they often require clear, proven examples of project performance before committing to energy efficiency at scale. Case studies provide credibility for large industrial firms by demonstrating how similar firms have successfully implemented projects, achieved operational improvements, and quantified both energy and non-energy benefits and incorporated these into industrial productivity measures.

This is particularly important given that tax-based incentives are often delayed and realized after project completion, making them less attractive from a cash flow and capital planning perspective. In contrast, program incentives are typically applied upfront or during project execution, directly improving project economics and enabling faster decision-making. However, many large firms may not fully recognize or have awareness or prioritize these program-based incentives without clear, tangible examples of impact.

14.3 Expand Analysis to Other Provinces and Program Providers

This analysis can be strengthened by expanding coverage to include additional provinces and program administrators. BC Hydro, Hydro-Québec and Efficiency Manitoba represent some of the most mature and advanced industrial energy efficiency program providers in Canada and are important benchmarks for this analysis in addition to other provincial programs in PEI, Saskatchewan and Newfoundland programs. These utilities have delivered programs over multiple decades, allowing them to develop stable program frameworks, strong customer relationships, and potential data systems that support long-term industrial participation.

Broadening the dataset would enable more robust comparisons across jurisdictions, helping to identify best practices in program delivery, sector engagement, and performance outcomes. It would also support a more comprehensive understanding of national trends in industrial energy efficiency, including variations in market penetration, cost-effectiveness, and productivity impacts.



15 Conclusion

Industrial energy efficiency represents one of the most immediate and underutilized levers to address Canada's productivity challenge while strengthening competitiveness in an increasingly volatile global landscape. There are strong IEE programs being offered to industrial firms from a variety of different funding streams and organizations. Of the four provinces studied, the largest opportunity is in Alberta where ERA is one of the newer program providers in the energy efficiency industry, and has demonstrated a very strong uptake in the Alberta market with a waitlist of projects on \$70M of incentive funding over 3 years. In Alberta, there is currently low market penetration implying a large potential untapped opportunity; however, opportunity remains for all provinces.

There is a clear opportunity to **reposition industrial energy efficiency programs as drivers of industrial productivity and competitiveness**, rather than solely as energy or emissions reduction tools. Program design, evaluation metrics, and stakeholder messaging should better reflect the role of energy efficiency in improving output, operational performance, and profitability.

This study highlights the importance of targeted approaches that recognize the unique structure of Canada's industrial base, where energy-intensive sectors (i.e. mining, refining, primary materials) and final goods processing industries face distinct operational realities, cost structures, and productivity opportunities.

Some of the key findings of this study include the following⁵²:

- \$1B in IEE funding could unlock a 1% labour productivity-equivalent impact
- 30% in energy reduction in the industrial sector could improve energy productivity by 42.9%
- If current program participation expanded to 75% of the industrial energy users in these provinces, the improvement is significant at 16.8%, that would generate \$57.4B in economic impact.

⁵² Note that all of these findings are high level estimates based on many assumptions that are stated in the body of the report.

- At the firm level, a 25% energy reduction could drive a 4-6% average profit margin improvement.
- Current IEE program activity of 930+ firms over the past five years and committed projects for the next two years (ERA), is estimated to contribute \$5.01B in economic activity, representing a 1.56% GDP impact, and supporting over 39,000 jobs over 12 years⁵³.
- Each \$1M in incentive funding impacts roughly \$39M in economic activity and 308 jobs.
- Each \$1 invested by industry in energy projects, the estimated GDP impact is ~ \$5.

The findings also point to significant **untapped potential in IEE programs, where targeted market penetration, strong measurement frameworks, and alignment with firm-level decision-making can unlock a myriad of benefits across the value chain and the broader economy.** One of the most effective tools for increasing market participation and sustaining productivity impacts is **providing firms with long-term program certainty.** Keeping programs available over a longer period allows firms to confidently rely on incentive funding when planning future IEE investment as capital approvals alone can take several years.

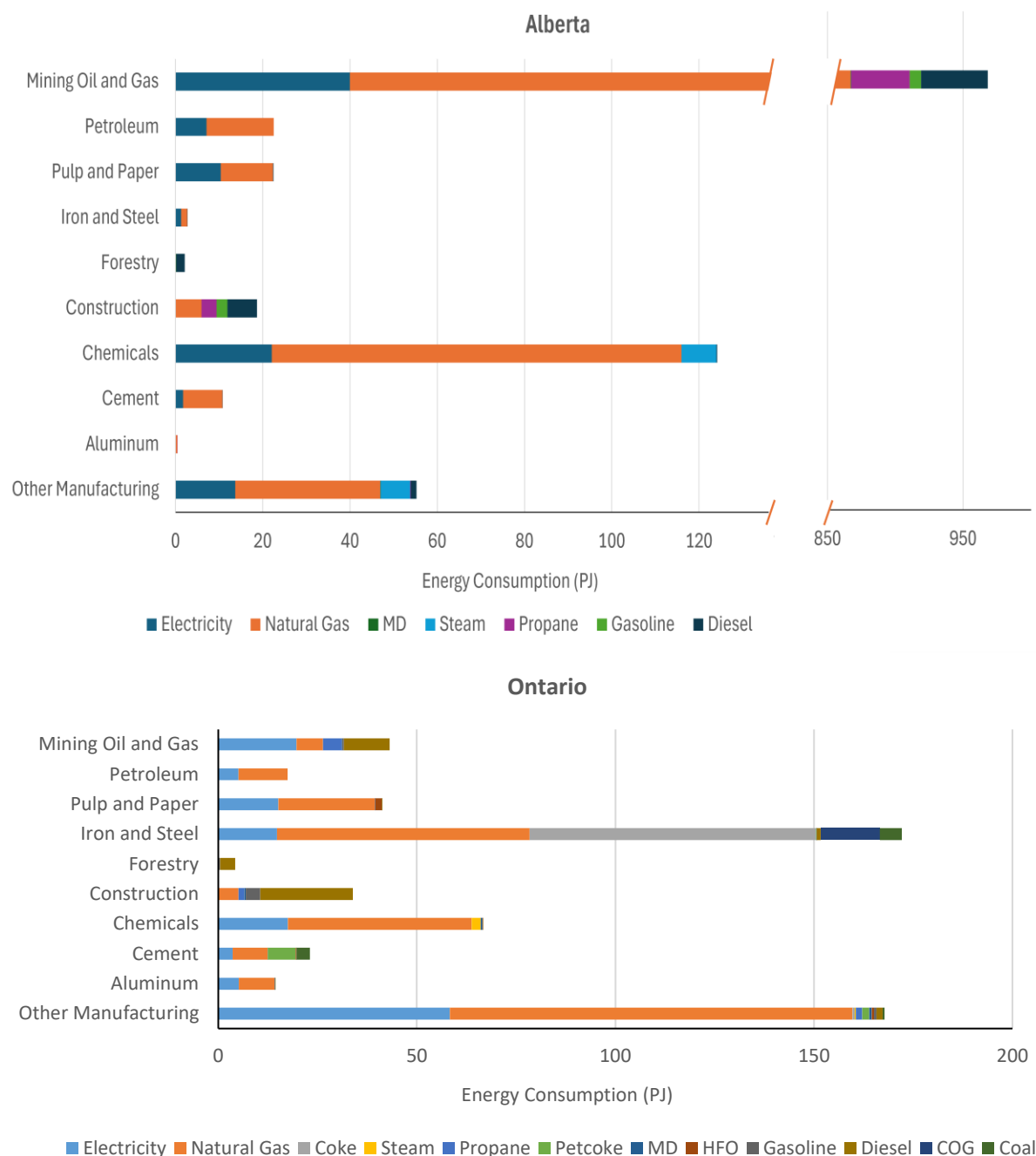
Importantly, the full value of IEE investments, including non-energy benefits, freed capital for reinvestment, and long-term productivity gains, remains under captured in traditional evaluations. **Accelerating IEE adoption is not simply an energy policy objective, but a national strategic economic imperative that can drive sustained growth, resilience, and improved industrial productivity across Canada.**

⁵³ Any total values throughout the report include both completed (2,348) and committed (72) projects.

Appendices

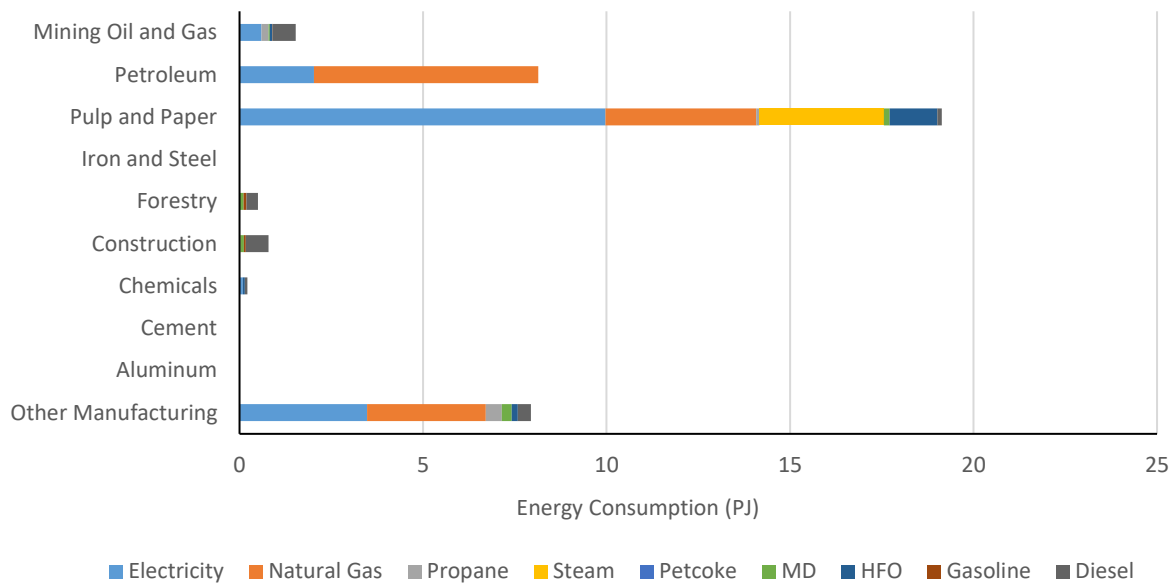
Appendix A-1: Energy Consumption by Fuel Type for Each Province in the Study.

Energy Consumption by fuel type for each province in the study is listed below for 2023.⁵⁴

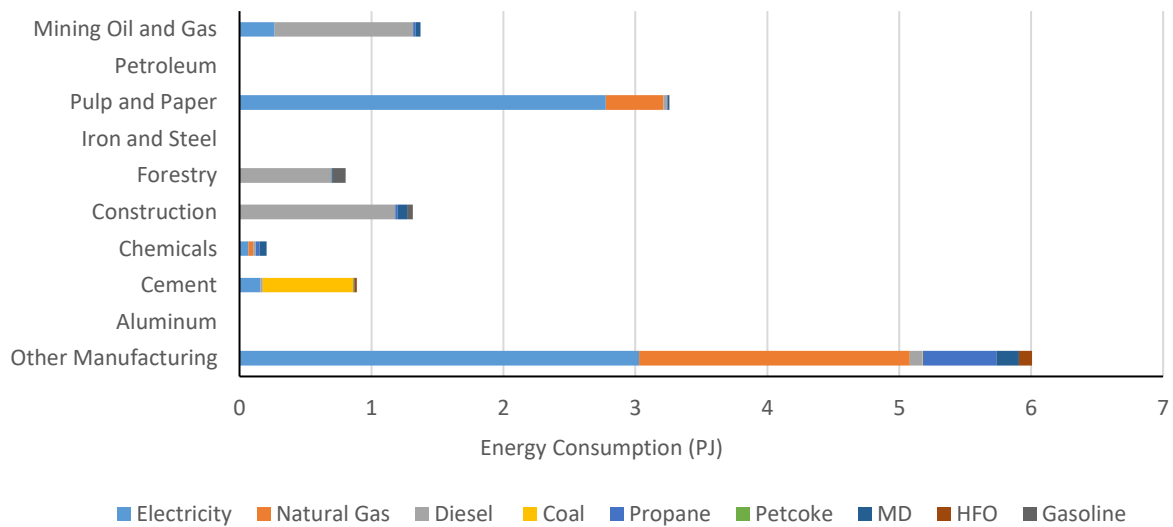


⁵⁴ Source: Centre for Environmental and Energy Data and Analysis (CEEDC), Simon Fraser University, CEEDC Database, <https://ceedc.sfu.ca>

New Brunswick



Nova Scotia



Appendix A-2: ERA Projects Sensitivity Analysis

Since ERA-supported projects are future projects that have not yet been completed, the sensitivity analysis below shows the potential range of program energy savings. A total of 6.8 PJ in energy savings could be achieved if the program delivers 50% more savings than currently expected. This outcome is plausible, as total allocated funding is \$70 million, while only \$24 million in program-supported savings has been included at the time of this study.

Analysis uses firms actual baseline energy data (2024) against the past and future project lists (2025-2027).

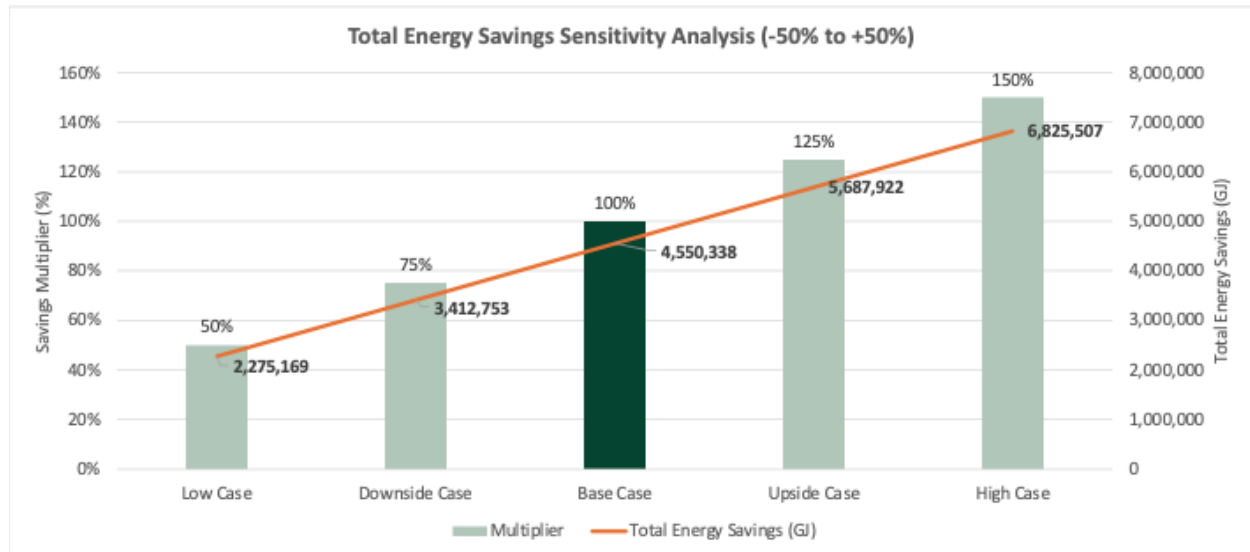


Figure 26: ERA potential program savings - sensitivity analysis

Appendix A-3 IEE Program Data Analysis by Sub-Sector

This appendix contains the IEE Program data analysis by industry sub-sector, by data availability. The analysis includes looking at the following variables by sub-sector: energy savings and cost savings.

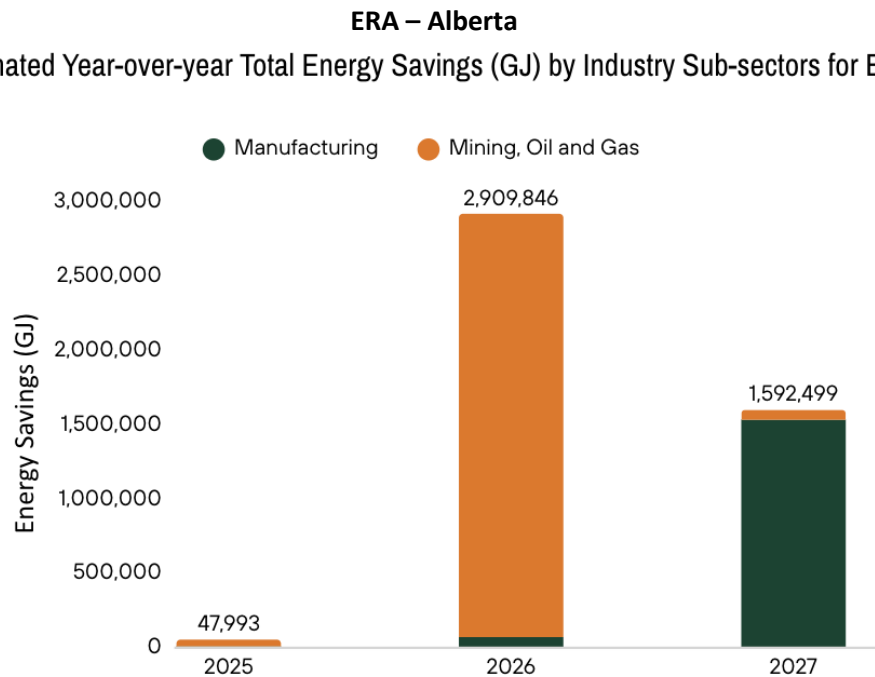


Figure 27: ERA – Estimated Total Energy Savings (GJ) by Industry Sub-sectors

Estimated Year-over-year Total Cost Saving (\$1000s) by Industry Sub-sectors for ERA

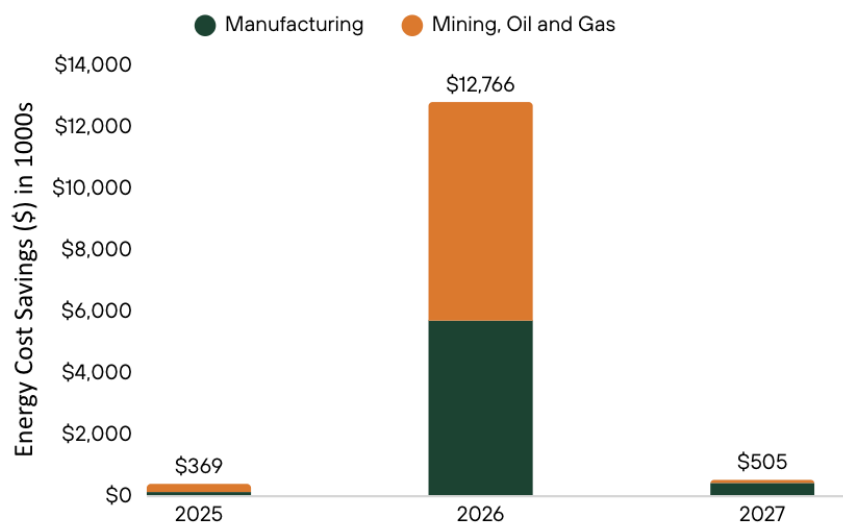


Figure 28: ERA – Estimated Total Cost Savings (\$) by Industry Sub-sectors

Enbridge (Ontario)

Estimated Year-over-year Total Energy Savings (GJ) for Enbridge

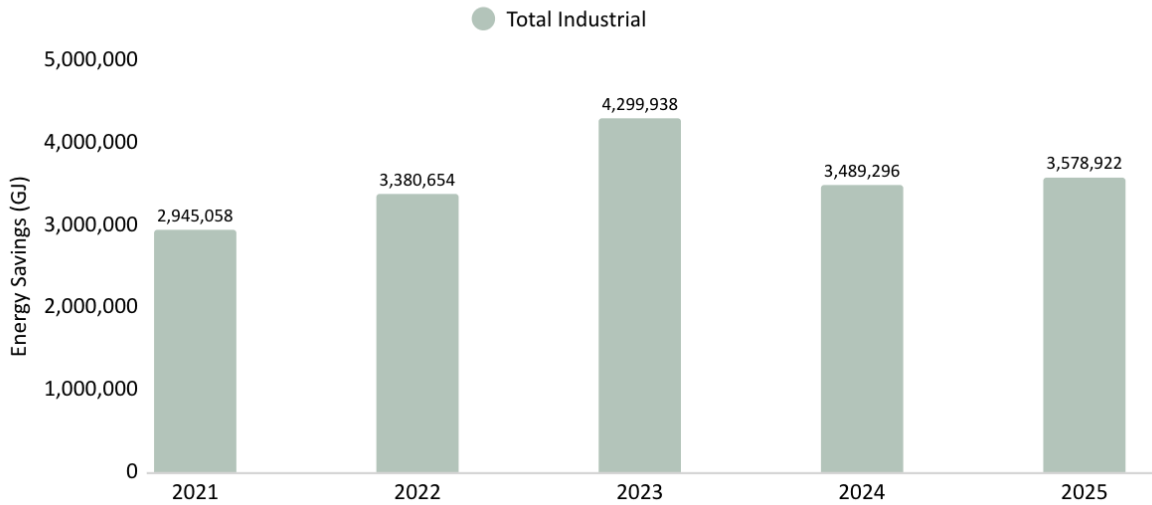


Figure 29: Enbridge – Total Energy Savings (GJ) by Industry Sub-sectors

Estimated Year-over-year Total Cost Saving (\$1000s) for Enbridge

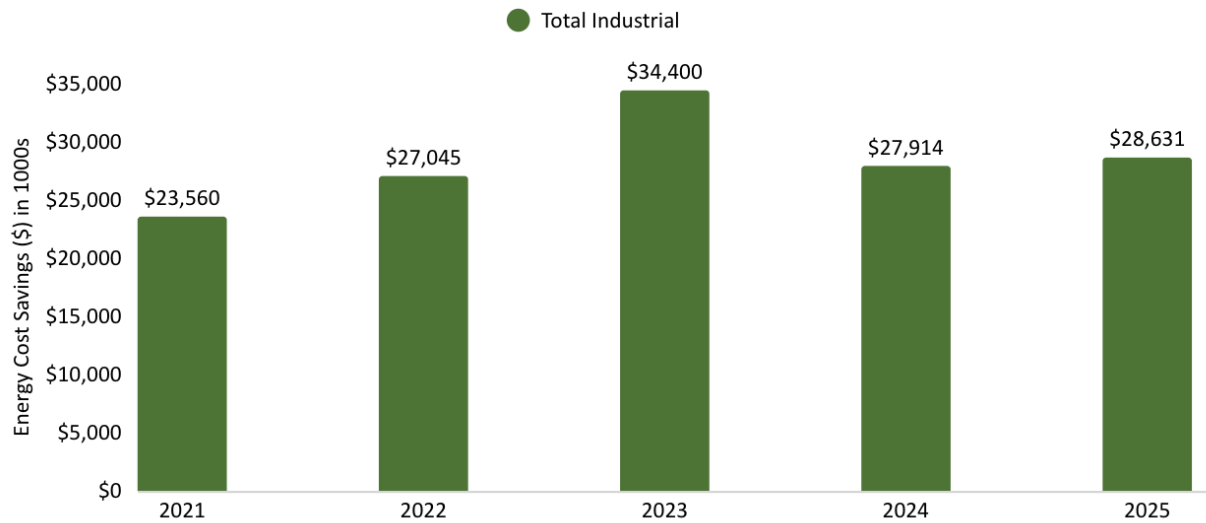


Figure 30: Enbridge – Total Cost Savings (\$) by Industry Sub-sectors

IESO (Ontario)

Estimated Year-over-year Total Energy Savings (GJ) for IESO

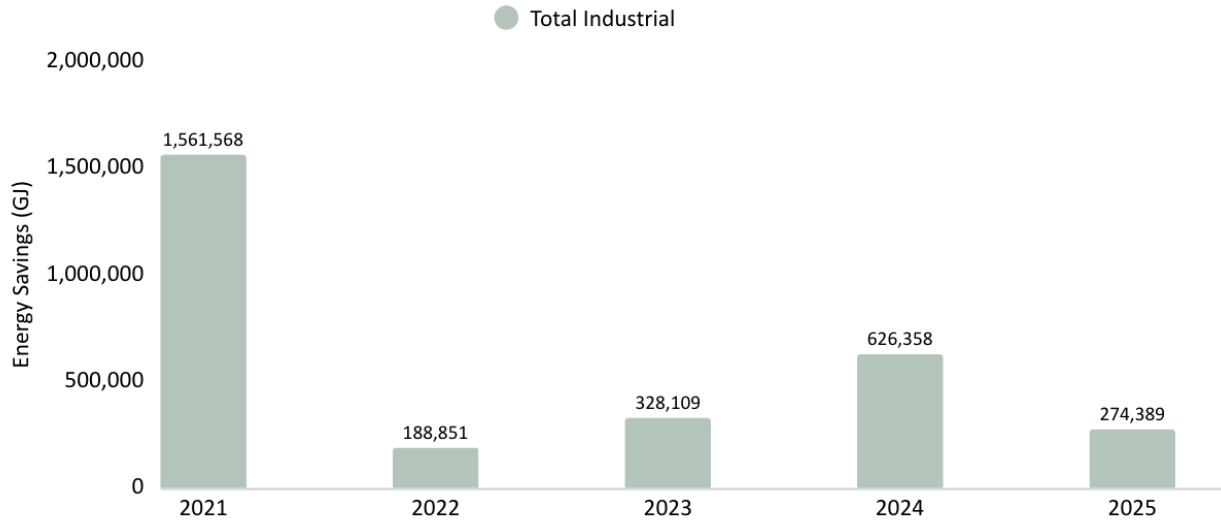


Figure 31: IESO – Total Energy Savings (GJ) by Year

Estimated Year-over-year Total Cost Saving (\$1000s) for IESO

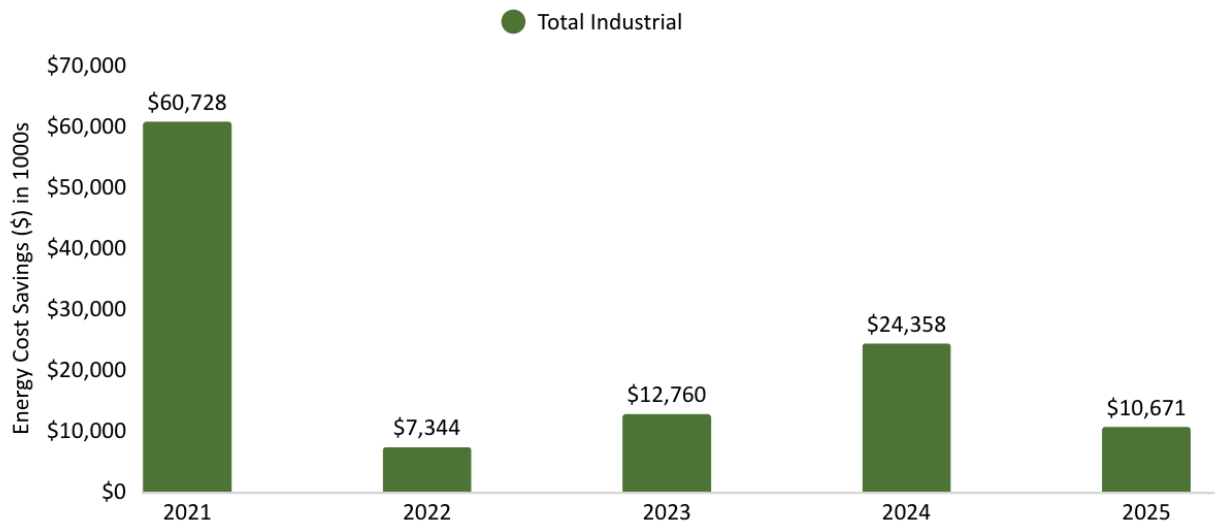


Figure 32: IESO – Total Cost Savings (\$) by Year

NB Power (New Brunswick)

Estimated Year-over-year Total Energy Savings (GJ) for NB Power

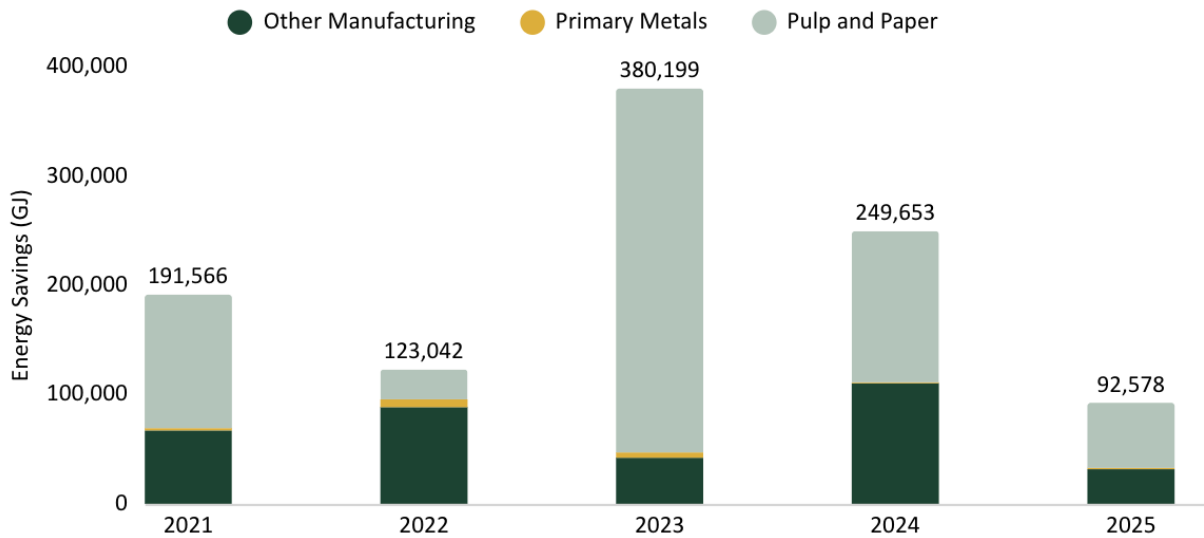


Figure 33: NB Power – Total Energy Savings (GJ) by Industry Sub-sectors

Estimated Year-over-year Total Cost Saving (\$1000s) for NB Power

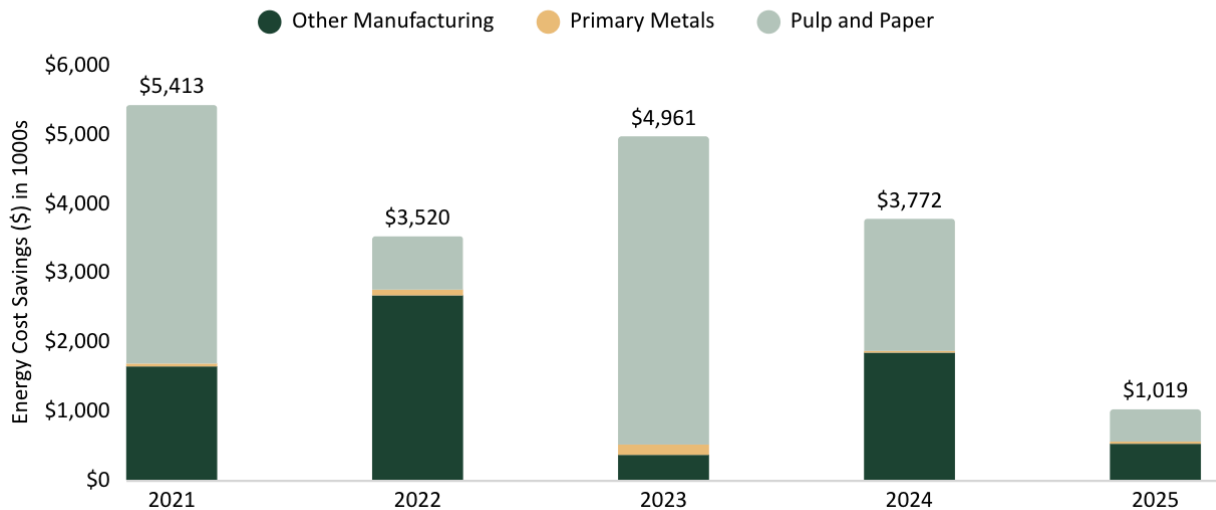


Figure 34: NB Power – Total Cost Savings (\$) by Industry Sub-sectors

Efficiency One (Nova Scotia)

Estimated Year-over-year Total Energy Savings (GJ) for EfficiencyOne

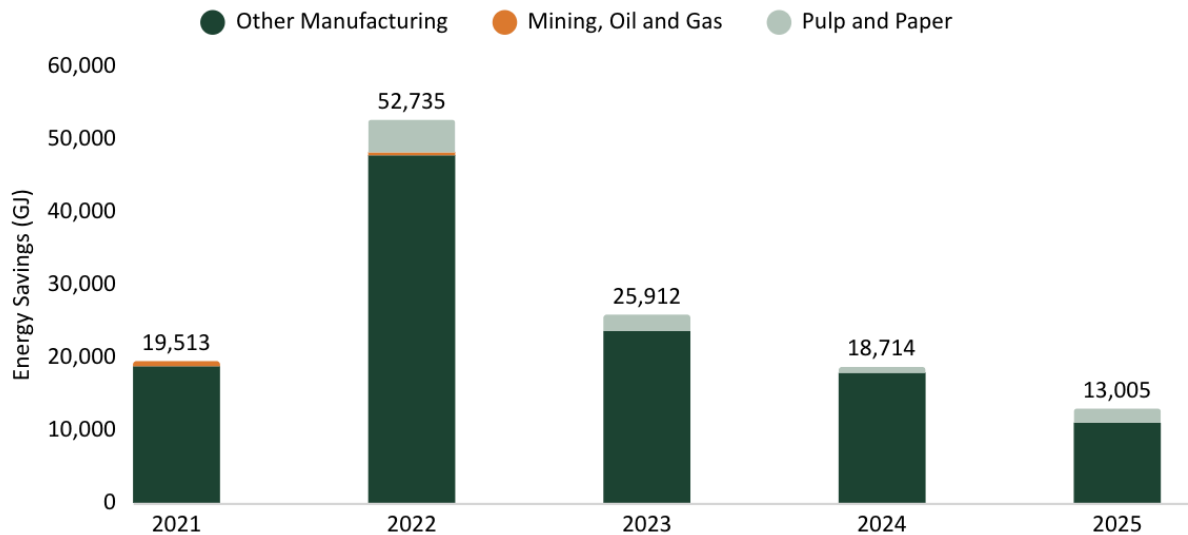


Figure 35: EfficiencyOne – Total Energy Savings (GJ) by Industry Sub-sectors

Estimated Year-over-year Total Cost Saving (\$1000s) for EfficiencyOne

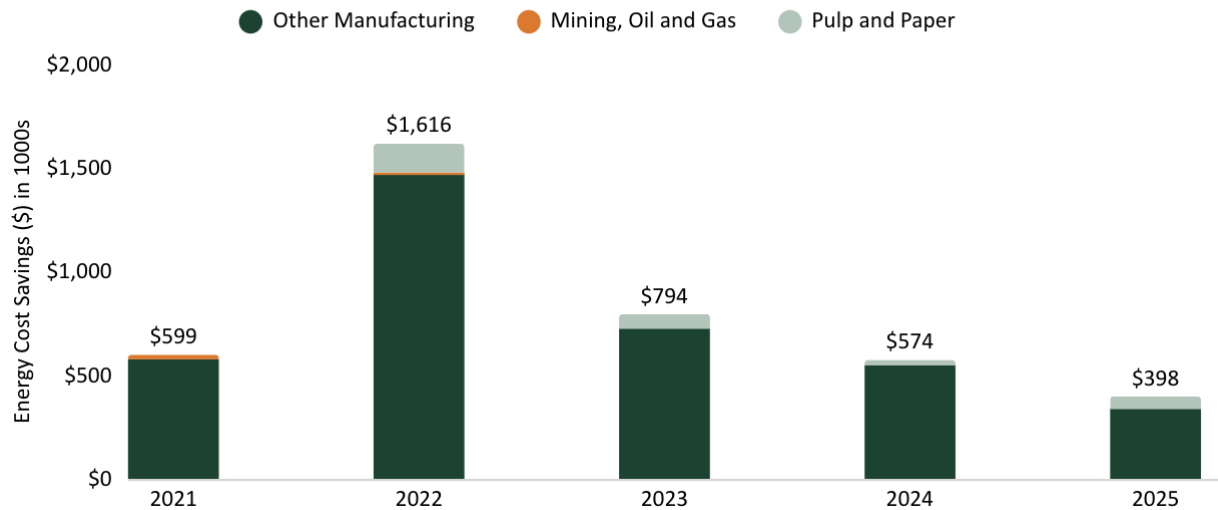


Figure 36: EfficiencyOne – Total Cost Savings (\$) by Industry Sub-sectors

Appendix A-4 Firm competitiveness further analysis by sub-sectors

To understand the magnitude of energy expenses for each sub-sector, the figure below highlights the energy cost share, as a function of the salary + energy + material costs over time for the mining sub-sector by NAICS code for Canada⁵⁵.

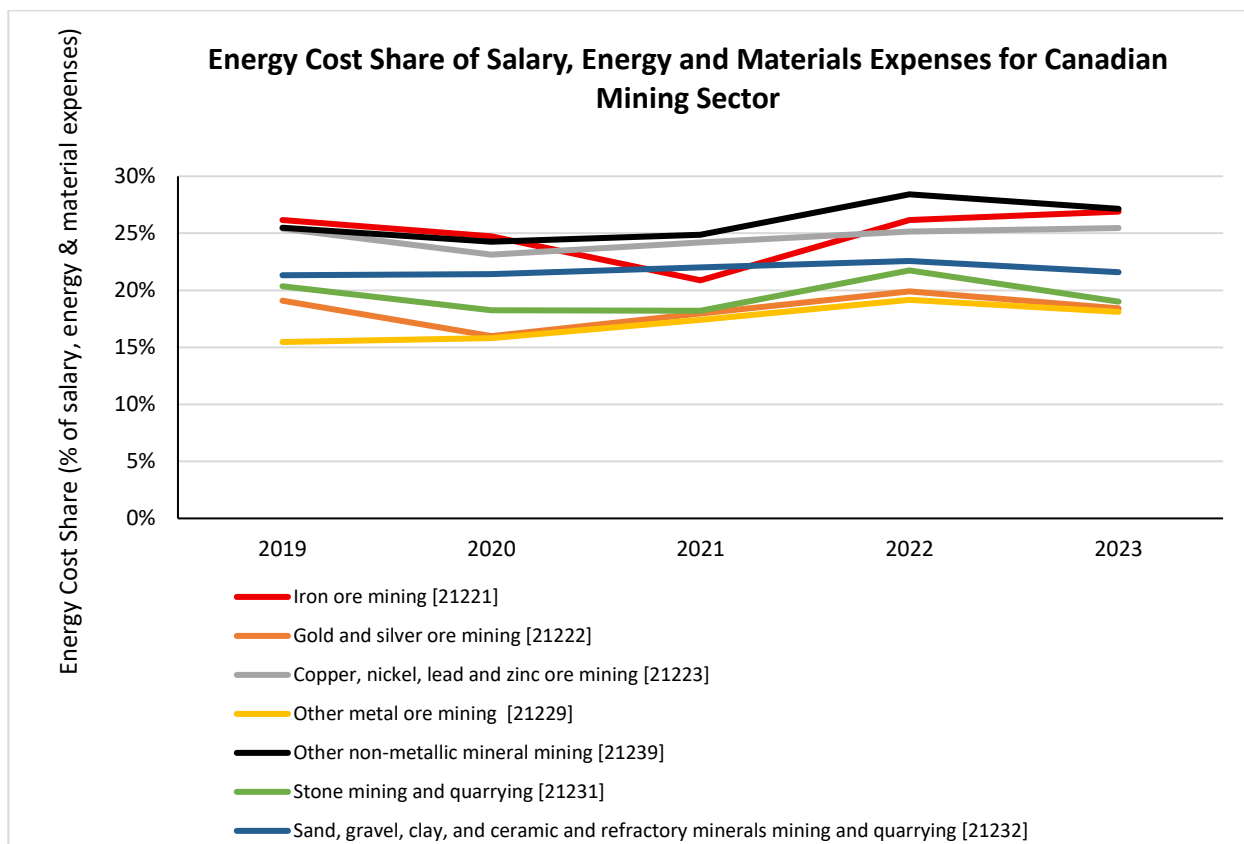


Figure 37: Energy Cost Share by Mining Sub-Sectors (2023)

As can be seen in the figures above, the energy cost share for the mining industry ranges from 15% to 28% when using the salary + energy + material expenses.

The next figure shows the margin by mining NAICS code calculated using the total expenses⁵⁶ and total revenue for each sub-sector. There are high margins for the majority of mining sub-sectors likely driven by relatively high commodity selling prices and Canada's relatively low energy costs compared to G7 and OECD averages. A very large expense increase in the 'Other metal ore mining' in 2023 resulted in negative profit and margins in 2023.

⁵⁵ Data provided by Statistics Canada.

⁵⁶ Total expenses include other expenses outside of energy, salary and materials related expenses.

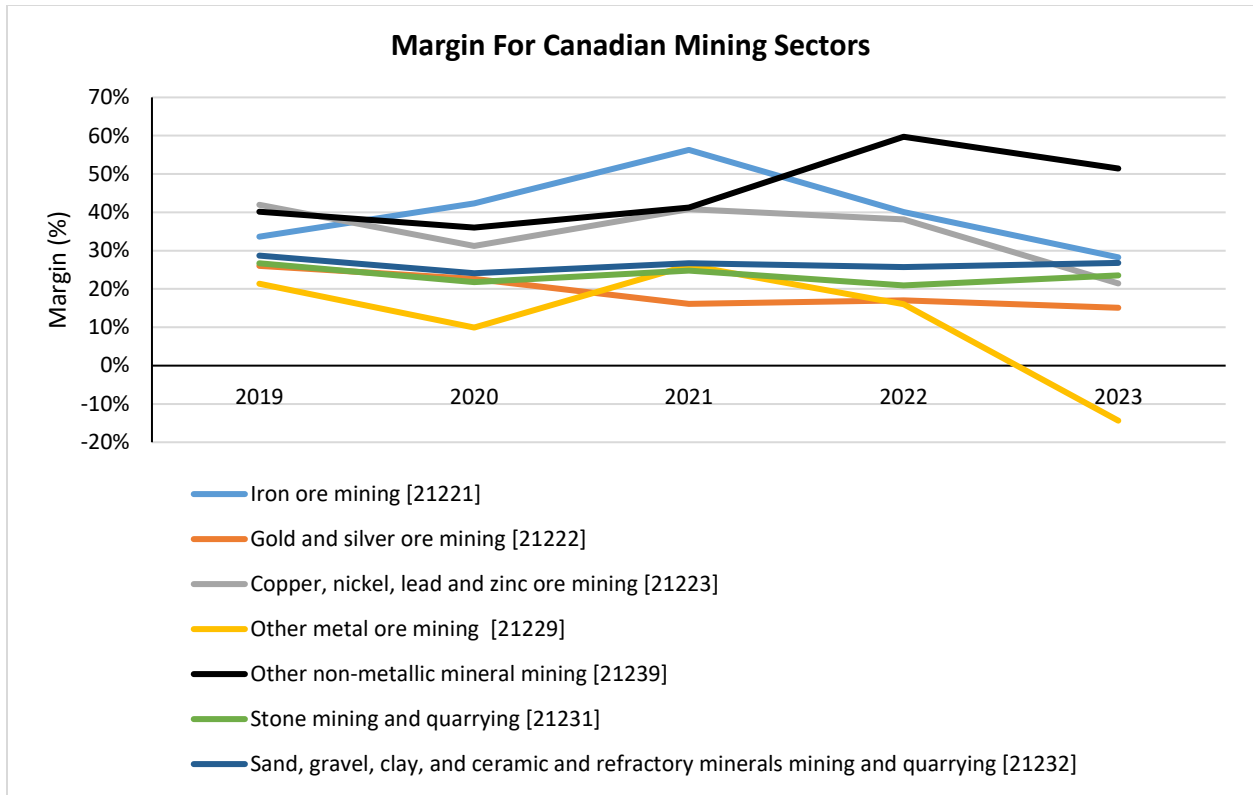


Figure 38: Margins by Mining Sub-Sector (2019-2023)

When the margin for each mining sub-sector was compared to the energy cost share (on a total expenses basis), there is a somewhat linear relationship between the two variables, i.e. an increasing energy cost share was related to businesses with higher margins as seen in the figure below. Therefore, energy intensive mining sub-sectors often see the highest margins.

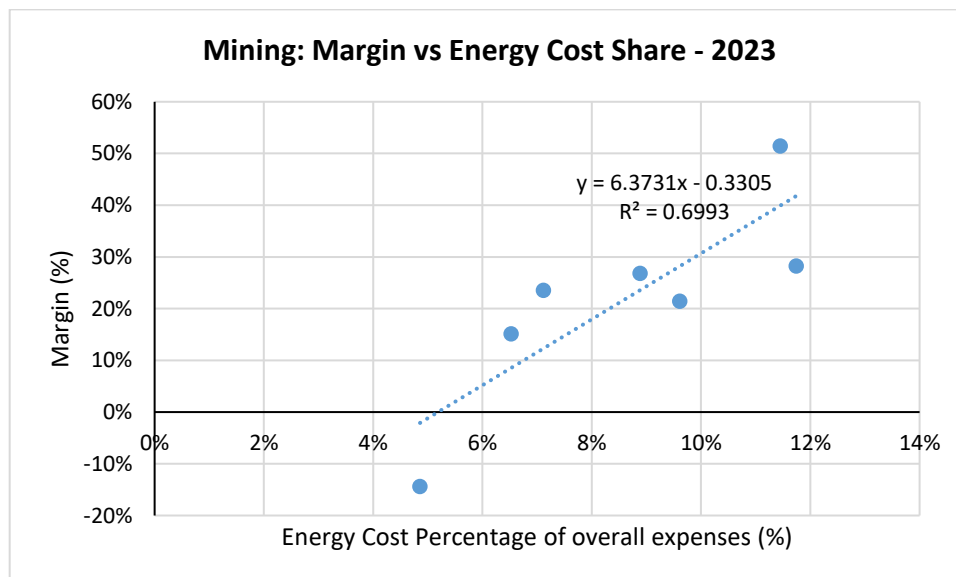


Figure 39: Margin vs. Energy Cost Share for Mining

The energy cost share of salary + energy + materials over time for the manufacturing sub-sector ranges from 0.6% to 12% as seen in the figure below.

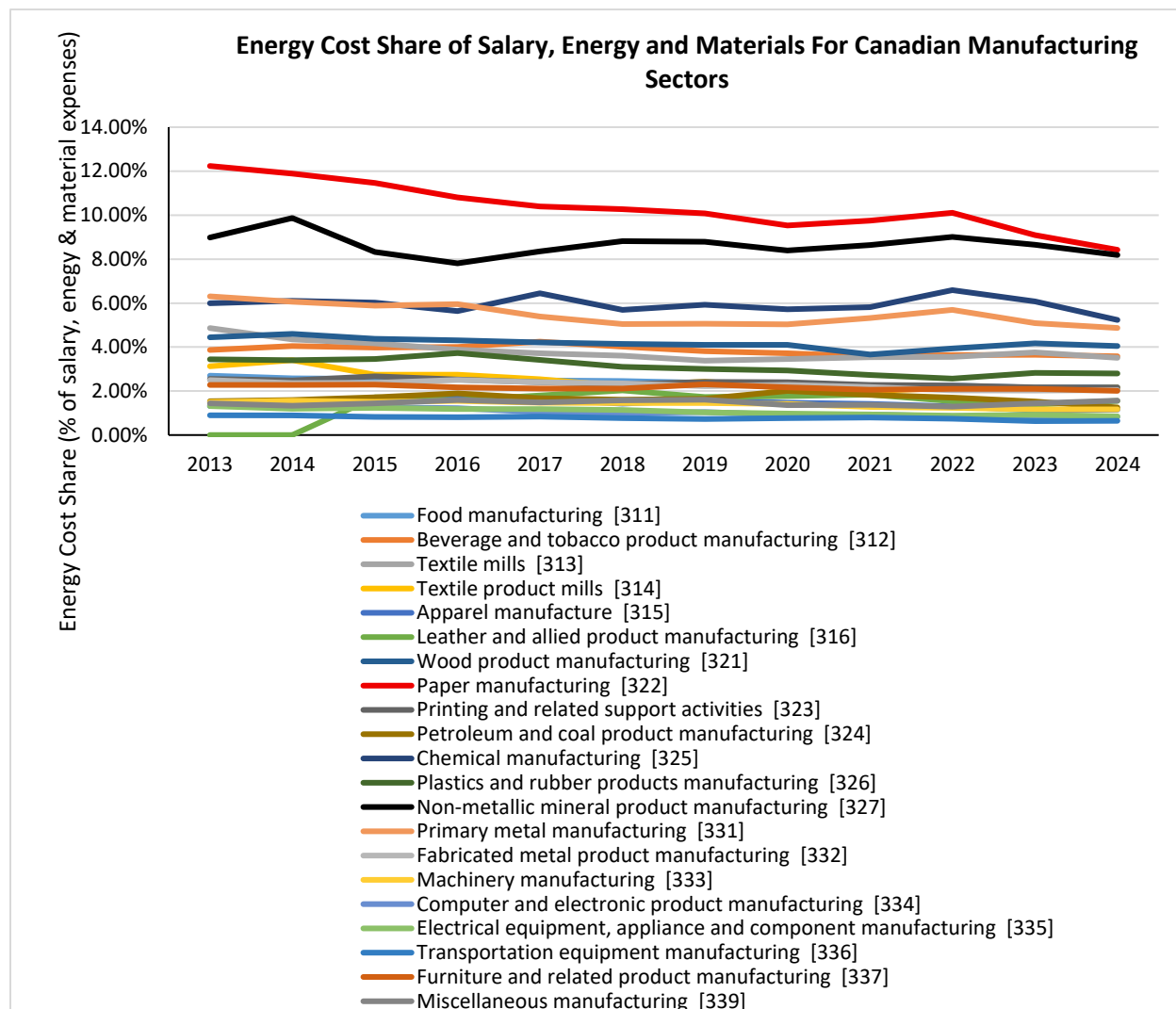


Figure 40: Energy Cost Share of Manufacturing Sub-Sectors (2023)

Three main conclusions can be drawn from these manufacturing sector figures.

- There is a general **decrease in the energy cost share for the majority of manufacturing sub-sectors over time**, possibly as a result of increasing material costs, energy efficiency implementation, increasing salaries etc.
- Manufacturing sub-sectors can be grouped into two: the high energy intensive/high energy cost share sectors (i.e. paper manufacturing, non-metallic mineral product manufacturing, chemical manufacturing and primary metal manufacturing), and the low energy intensity/low energy cost share sector (i.e. Transportation equipment manufacturing, Computer and electronic product manufacturing, Apparel manufacture etc). **The high energy cost share manufacturing sub-sectors are generally located upstream on the value chain and closer to raw resource**

extraction than the low energy cost share manufacturing sub-sectors which contain more final product manufacturing sub-sectors. Note that the energy cost shares of high energy-intensive manufacturing sectors are more in line with the mining sector energy cost shares as seen in the previous figures.

- The energy cost share for the **manufacturing sector is a lot more consistent than the mining sector** as seen in the previous figures. This could suggest that other operating costs can be smaller in the manufacturing sectors possibly due to being less capital intensive; and that material costs are higher in the manufacturing sector as seen in the figure below.

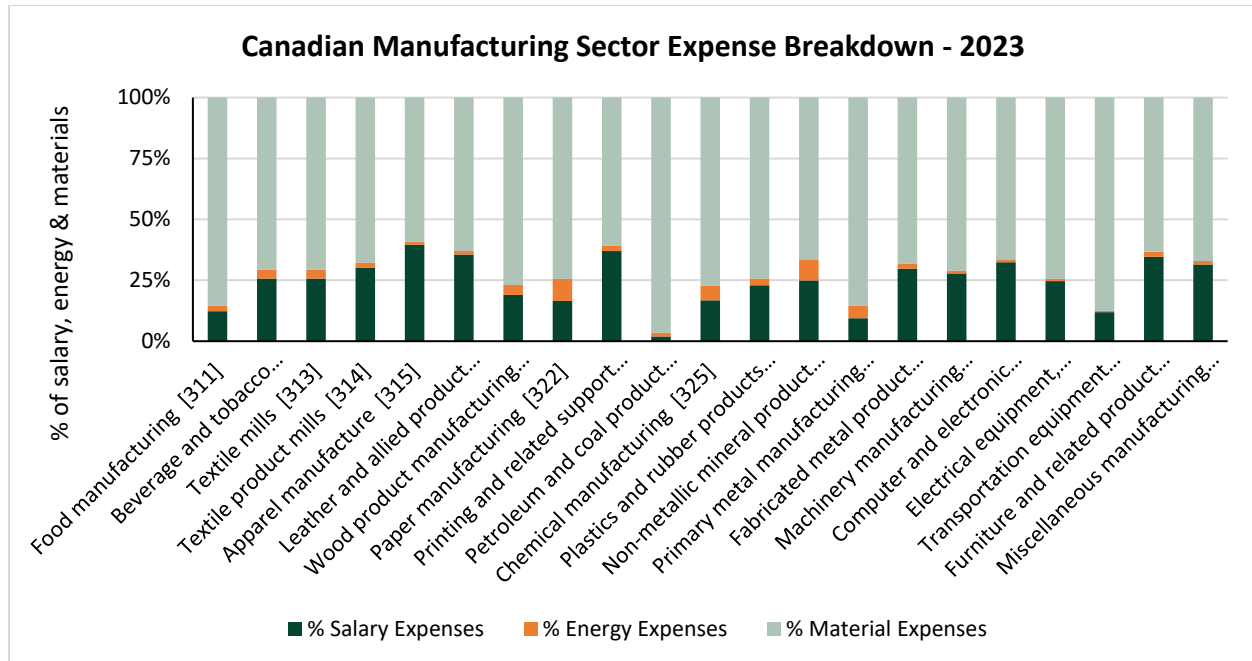


Figure 41: Canadian Manufacturing Sector Expense Breakdown (2023)

The next figure shows the margin by manufacturing NAICS code calculated using the total expenses and total revenue for each sub-sector. As seen in the figure below, the margins are generally lower for the Canadian manufacturing sectors compared to the Canadian mining sectors. The Beverage and tobacco product manufacturing sector were a clear outlier historically in terms of manufacturing sector margins but fell into line with other manufacturing sub-sectors after 2020.

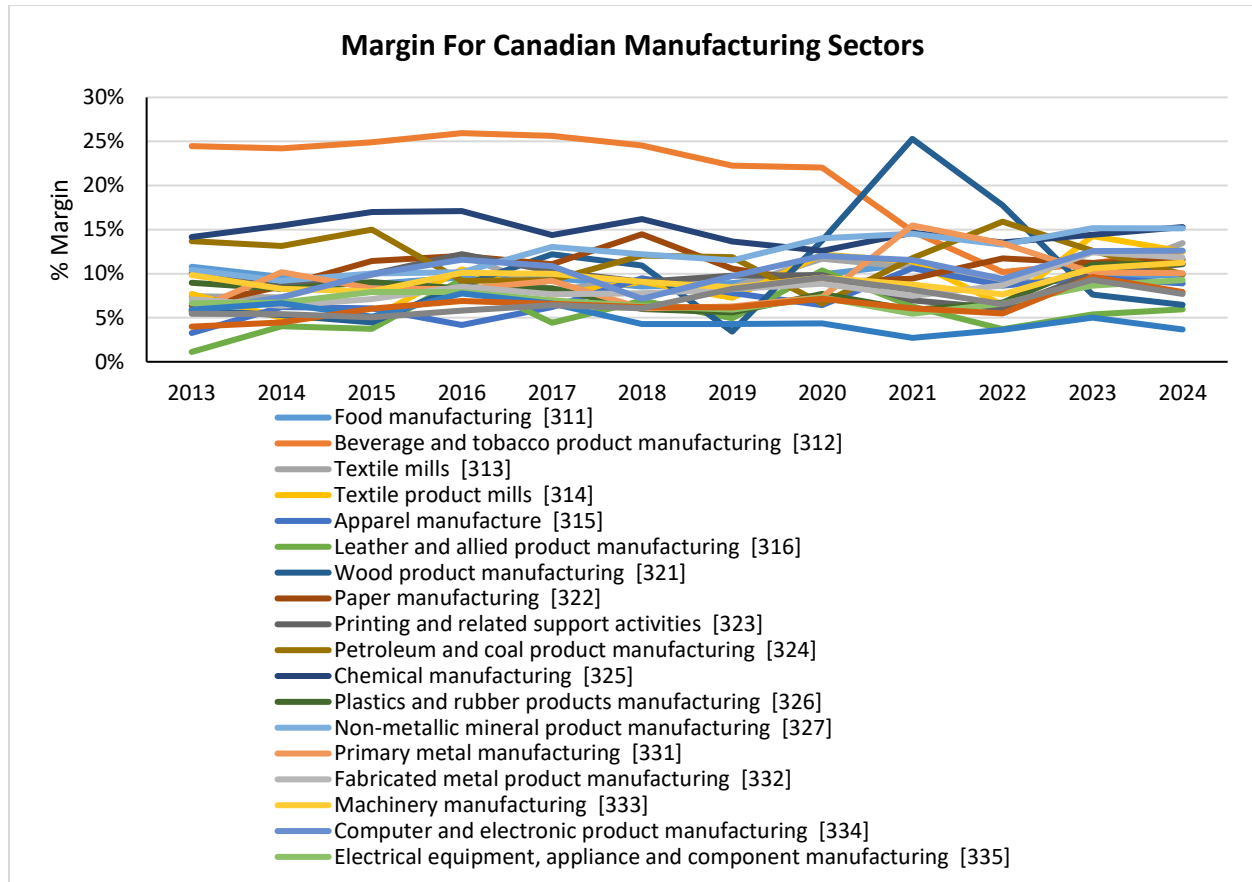


Figure 42: Margin for Manufacturing Sectors (2013-2024)

There was no discernible trend between margin and energy cost share (on a total expenses) basis for the manufacturing sectors as seen in the figure below.

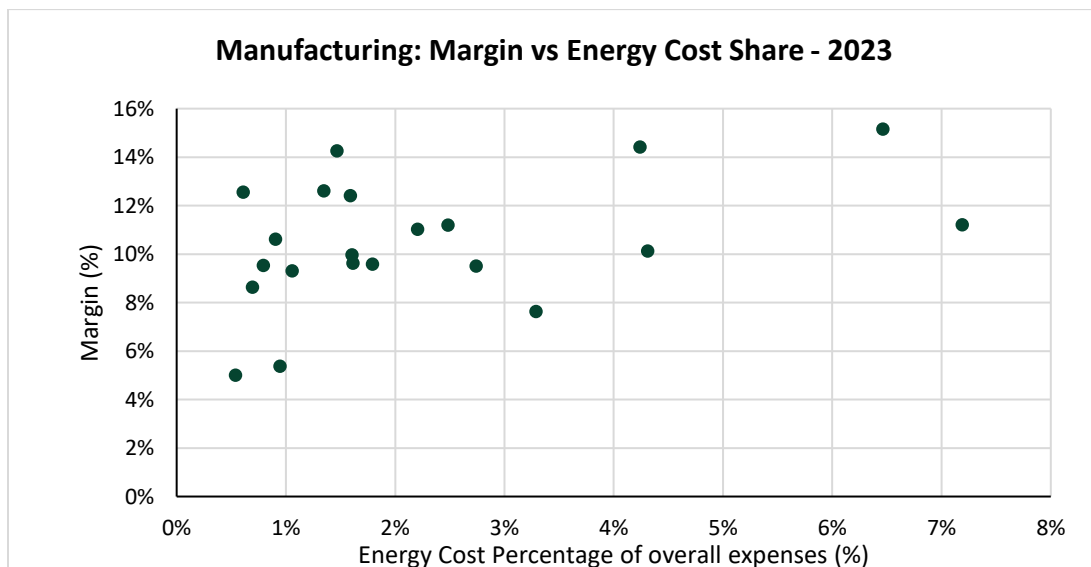


Figure 43: Margin vs. Energy Cost Share for Manufacturing (2023)

The next step in the analysis was to understand the financial impact of energy cost reductions for each sub-sector and determine which sub-sectors will see the biggest benefit from energy efficiency measures vs the sectors that may be better off deploying capital for production increases. This was accomplished by calculating the percentage increase in margins as a function of the energy cost reductions to highlight sectors that see the largest financial benefit from energy reductions.

As seen in the following figure, paper manufacturing had the largest margin increase as a result of energy reductions followed by wood product manufacturing, primary metal manufacturing, gold and silver ore mining, non-metallic metal manufacturing, copper, nickel, lead and zinc ore mining. Paper manufacturing had the largest margin impact because it had the highest energy cost share in the manufacturing sector but also a much lower margin than the high margin and high energy cost share mining sub-sectors. Other high energy intensity manufacturing sub-sectors also saw the largest impacts due to the same reasons as the paper manufacturing sector. In 2023 the gold mining sector had the lowest margin of all mining sub-sectors followed by the copper, nickel, lead and zinc ore mining sub-sector. This resulted in these mining sub-sectors having the largest margin increases in the mining sector due to energy cost reductions.

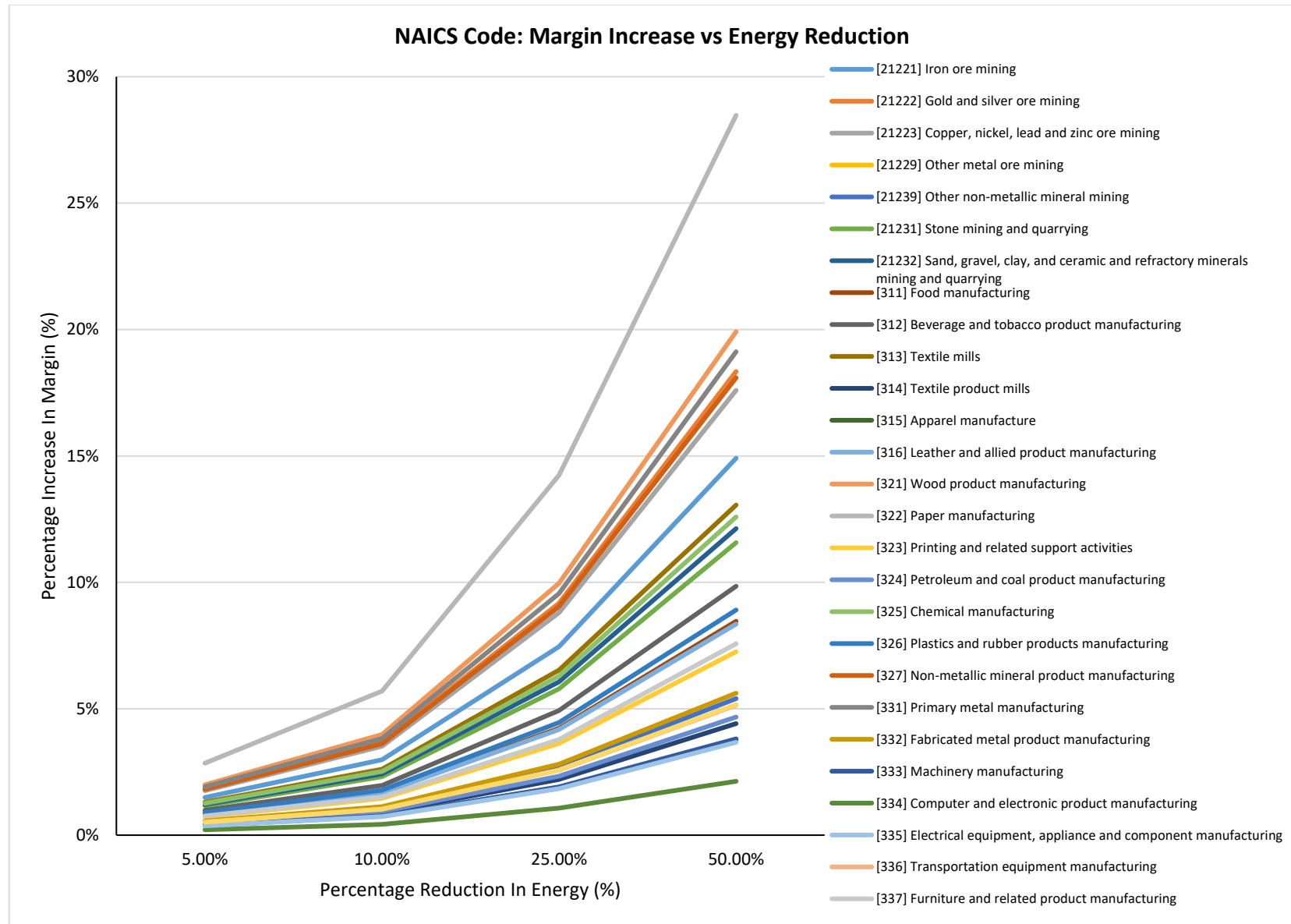


Figure 44: Margin increase vs Energy Reduction for Mining and Manufacturing Sub-Sectors